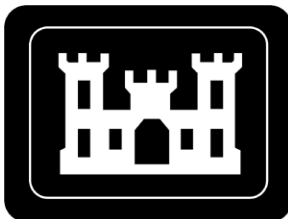

FINAL

SECOND FUSRAP FIVE-YEAR REVIEW REPORT FOR OPERABLE UNIT 8 AT THE IOWA ARMY AMMUNITION PLANT

MIDDLETOWN, IOWA

MARCH 26, 2024



**U.S. Army Corps of Engineers
St. Louis District Office
Formerly Utilized Sites Remedial Action Program**

FINAL

SECOND FUSRAP FIVE-YEAR REVIEW REPORT FOR OPERABLE UNIT 8 AT THE IOWA ARMY AMMUNITION PLANT

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MARCH 26, 2024

prepared by

U.S. Army Corps of Engineers, St. Louis District Office
Formerly Utilized Sites Remedial Action Program

with assistance from

Leidos, Inc.
under Contract No. W912P923C0012



REGION 7

LENEXA, KS 66219

MEMORANDUM

SUBJECT: Second Five-Year Review Report for Operable Unit 8
Iowa Army Ammunition Site
Middletown, Des Moines County, Iowa

FROM: Wesley March, Remedial Project Manager
Federal Facilities and Priority Sites Section

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THRU: Bill Gresham, Supervisor
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Tabatha J. Adkins, Manager
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TO: Robert D. Jurgens, Director
Superfund and Emergency Management Division

Scott D.
Hayes

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Enclosed is the Second Five-Year Review Report, dated February 29, 2024, submitted by the U.S. Army Corps of Engineers (USACE) Formerly Utilized Sites Program (FUSRAP) for the Iowa Army Ammunition Plant (IA7213820445). This site is comprised of 11 operable units (OUs) 10 of which are maintained under the authority of the Department of the Army. The Department of Energy maintains responsibility for OU8 through the USACE FUSRAP St. Louis District. A Federal Facility Agreement between the U.S. Environmental Protection Agency Region 7, USACE St. Louis District, and the state of Iowa was finalized in 2006. Activities within OU8 are primarily related to historical U.S. Atomic Energy Commission (AEC) weapon-assembly and testing operations conducted from 1947 to 1975. The primary contaminants of concern are depleted uranium and explosive materials.

The USACE FUSRAP program provides the following protectiveness statements in the Five-Year Review Report:

Protectiveness Statement(s)

<i>Operable Unit:8</i>	<i>Protectiveness Determination:</i> Will be Protective	<i>Planned Addendum</i> <i>Completion Date:</i> N/A
<i>Protectiveness Statement:</i> The remedy at Iowa Army Ammunition Plant OU8 will be protective of human health for the industrial/commercial and construction worker and the environment upon completion of remediation of soil and structural surfaces with depleted uranium concentrations exceeding the remediation goals. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks to the industrial/commercial and construction workers in these areas. Land use controls will be implemented at OU8 if the criteria for unlimited use and unrestricted exposure are not met following remedial action.		

Region 7 and the Federal Facilities Restoration and Reuse Office have reviewed this document and determined the report satisfies the EPA requirements. We recommend your approval. Your signature on the attached signature page to the subject report will serve to document the EPA's concurrence with the USACE FUSRAP protectiveness statement.

Attachments: Second Five-Year Review Iowa Army Ammunition Plant Site
Signature Page

STATEMENT OF PROTECTIVENESS

Protectiveness Statement

The remedy at Iowa Army Ammunition Plant Operable Unit (OU)-8 will be protective of human health for the industrial/commercial and construction worker and the environment upon completion of remediation of soil and structural surfaces with depleted uranium concentrations exceeding the remediation goals.

In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks to the industrial/commercial and construction workers in these areas.

Land use controls will be implemented at OU-8 if the criteria for unlimited use and unrestricted exposure are not met following remedial action.

For the U.S. Army Corps of Engineers (USACE)

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DY.JOSEPH.1
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Date

Andy J. Pannier
Colonel, U.S. Army
District Commander

For the U. S Environmental Protection Agency (USEPA)

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Bob Jurgens
Director, Superfund Division
USEPA Region 7

For the State of Iowa

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Date

Mindy Uhle
Environmental Services Bureau Chief
Iowa Human and Health Services

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Appendix D	Detailed Responses to Technical Assessment Question B for Operable Unit 8

BACK COVER

The primary distribution format for this document is electronic files. If printed copies are distributed, the following portions will be included on a CD-ROM on the back cover of the report instead of being printed: Appendices B and D.

ACRONYMS AND ABBREVIATIONS

2006 FUSRAP FFA	<i>Iowa Army Ammunition Plant Federal Facility Agreement Under CERCLA Section 120, Administrative Docket Number: CERCLA-07-2005-0378</i>
Ac	actinium
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ARAR	applicable or relevant and appropriate requirement
Army	U.S. Army
ATSDR	Agency for Toxic Substances and Disease Registry
BCG	Biota Concentration Guide
bgs	below ground surface
CC	Compliance Cleanup
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
COC	contaminant of concern
COPEC	contaminant of potential ecological concern
CR	cancer risk
CSF	cancer slope factor
CY	Calendar year
DCF	dose conversion factor
DCGL	derived concentration guideline level
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DSR	dose-to-source ratio
DU	depleted uranium
EDA	Explosive Disposal Area
ELCR	excess lifetime cancer risk
EMC	elevated measurements comparison
EMDAR	Environmental Monitoring and Data Analysis Report
EMP	environmental monitoring program
EPC	exposure point concentration
ESU	East Survey Unit
ESU PRAR	<i>Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area East Survey Units at the Iowa Army Ammunition Plant</i>
ESV	ecological screening value
FFA	Federal Facility Agreement
FGR-11	<i>Federal Guidance Report No. 11: Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion</i>
FGR-12	<i>Federal Guidance Report No. 12: External Exposure to Radionuclides in Air, Water, and Soil</i>
FGR-13	<i>Federal Guidance Report No. 13: Cancer Risk Coefficients for Environmental Exposure to Radionuclides</i>
FGR-15	<i>Federal Guidance Report No. 15: External Exposure to Radionuclides in Air, Water and Soil</i>
First FUSRAP FYRR	<i>Five-Year Review Report for Operable Unit 1 (OU-1) and Operable Unit 8 (OU-8) Iowa Army Ammunition Plant</i>

ACRONYMS AND ABBREVIATIONS (Continued)

FS	firing site
FSA	Firing Sites Area
FSS	final status survey
FSSE	final status survey evaluation
FSSP	<i>Final Status Survey Plan for the FUSRAP Areas at the Iowa Army Ammunition Plant</i>
FUSRAP	Formerly Utilized Sites Remedial Action Program
FUSRAP FS	<i>FUSRAP Feasibility Study Report for the Iowa Army Ammunition Plant</i>
FUSRAP RD/RAWP	<i>Remedial Design/Remedial Action Work Plan, Iowa Army Ammunition Plant, Operable Unit 8, Depleted Uranium Contaminated Soil and Structure Remediation</i>
FUSRAP RI	<i>Iowa Army Ammunition Plant FUSRAP Remedial Investigation Report for Firing Sites Area, Yards C, E, F, G, and L, Warehouse 3-01 and Area West of Line 5B</i>
FUSRAP ROD	<i>FUSRAP Record of Decision for the Iowa Army Ammunition Plant</i>
FYR	five-year review
FYRR	five-year review report
GWS	gamma walkover survey
HI	hazard index
HQ	hazard quotient
HVAC	heating, ventilation, and air conditioning
IAAAP	Iowa Army Ammunition Plant
IC	institutional control
ICRP	International Commission on Radiation Protection
IDA	Inert Disposal Area
IDNR	Iowa Department of Natural Resources
IRP	Installation Restoration Program
iso-U	isotopic uranium
LANL	Los Alamos National Laboratory
LAP	load, assemble, and pack
Leidos	Leidos, Inc.
Line 1 RACR	<i>Remedial Action Completion Report for the FUSRAP Line 1 Structures at the Iowa Army Ammunition Plant</i>
LUC	land use control
LUCIP	land use controls implementation plan
MARSSIM	<i>Multi-Agency Radiation Survey and Site Investigation Manual</i>
MDC	minimum detectable concentration
MMRP	Military Munitions Response Program
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOU	naturally occurring uranium
NRC	U.S. Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
OU	operable unit
Pa	protactinium
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances

ACRONYMS AND ABBREVIATIONS (Continued)

Pilot Study	<i>Soil Sorting Pilot Study Test Report Iowa Army Ammunition Plant Operable Unit 8, Depleted Uranium Contaminated Soil and Structure Remediation</i>
Po	polonium
PPE	personal protective equipment
PRAR	post-remedial action report
Ra	radium
RA	remedial action
RAB	Restoration Advisory Board
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine, also known as royal demolition explosive
RESRAD	RESidual RADioactivity (computer model)
RfC	inhalation reference concentration
RfDo	oral reference dose
RG	remediation goal
RI	remedial investigation
Rn	radon
ROD	record of decision
RSL	regional screening level
RSR	risk-to-source ratio
RUSU	reuse soil survey unit
S3	Soil Sorting System
SL	screening level
SLERA	screening-level ecological risk assessment
SOF	sum of fractions
STSU	structure survey unit
SU	survey unit
TELCR	target excess lifetime cancer risk
TEDE	total effective dose equivalent
TFP	Test Fire Pit
Th	thorium
THQ	target hazard quotient
TM	technical memorandum
U	uranium
UCL ₉₅	95 percent upper confidence limit
USACE	U.S. Army Corps of Engineers
USC	<i>U.S. Code</i>
VQ	validation qualifier
USEPA	U.S. Environmental Protection Agency
UU/UE	unlimited use and unrestricted exposure
WCSU	West-Central Survey Unit
WCSU PRAR	<i>Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area West Central Survey Units at the Iowa Army Ammunition Plant</i>

ACRONYMS AND ABBREVIATIONS (Continued)

WSU	West Survey Unit
WSU PRAR	<i>Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area West Survey Units at the Iowa Army Ammunition Plant</i>

UNIT ABBREVIATIONS

Both English and metric units are used in this report. The units used in a specific situation are based on common unit usage or regulatory language (e.g., depths are given in feet, and areas are given in square meters). Units included in the following list are not defined at first use in this report.

°F	degrees Fahrenheit
Ci	curie(s)
cm ²	square centimeter(s)
dpm	disintegration(s) per minute
ft	foot/feet
g	gram(s)
kg	kilogram(s)
m	meter(s)
m ²	square meter(s)
m ³	cubic meter(s)
mg	milligram(s)
mg/kg	milligram(s) per kilogram
mg/kg/day	milligram(s) per kilogram body weight per day
mrem	millirem
mSv	millisievert(s)
pCi	picocurie(s)
pCi/g	picocurie(s) per gram
pCi/L	picocurie(s) per liter
pCi/m ²	picocurie(s) per square meter(s)
ppb	part(s) per billion
yd ³	cubic yard(s)

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1.0 INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is currently and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports (FYRRs). In addition, FYRRs identify issues found during the review, if any, and document recommendations to address them.

The U.S. Army Corps of Engineers (USACE) St. Louis District prepared this FYRR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 *Code of Federal Regulations [CFR]* Section 300.430(f)(4)(ii)) and considering U.S. Environmental Protection Agency (USEPA) policy. This is the second FYR conducted by USACE for Operable Unit (OU)-8 of the Iowa Army Ammunition Plant (IAAAP) Superfund Site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

IAAAP has 11 OUs. This FYR addresses OU-8 (Formerly Utilized Sites Remedial Action Program [FUSRAP]), which, includes Line 1 structures; the Firing Sites Area (FSA) (soil and structures); Warehouse 3-01 (building interior); and Yard C (soil and structures); Yard G (soil and structures); and Yard L (areas surrounding Warehouses L-37-1, L-37-2, and L-37-3). The 10 OUs that are not addressed in this FYR are OU-1 (Soil), OU-3 (Offsite Groundwater), OU-4 (Inert Disposal Area [IDA]), OU-5 (Military Munitions Response Program [MMRP]), OU-6 (Onsite Groundwater), OU-7 (Installation-Wide), OU-9 (Construction Debris Sites), OU-10 (Explosive Disposal Area [EDA] Groundwater Sites), OU-11 (No Further Action [NFA] Sites), and OU-12 (Compliance Cleanup [CC]/Resource Conservation and Recovery Act [RCRA] Sites). The lead agency responsible for remedial action (RA) at most of these areas is the U.S. Army Joint Munitions Command as part of the Installation Restoration Program (IRP). OUs 1, 3, 4, and 5 are included in the FYR prepared by the IRP. OUs 6, 7, 9, 10, 11, and 12 do not yet have a Record of Decision (ROD). Appendix A contains a summary of these OUs.

This IAAAP OU-8 FYR was led by Mike Kessler from the USACE St. Louis District. Participants included Julie Reitingier, Environmental Scientist; Matthew Bange, Environmental Engineer; Kevin Harris, Environmental Engineer; Steve Passig, Health Physicist; and Patrick Moroney, Risk Assessor. The review began on December 15, 2022.

1.1 SITE BACKGROUND

IAAAP is an active, government-owned, contractor-operated installation under the command of the U.S. Army Joint Munitions Command, Rock Island, Illinois. It occupies approximately 76,890,000 m² (19,000 acres) in Des Moines County near Middletown, Iowa. It is approximately 9 miles northwest of the confluence of the Skunk and Mississippi Rivers (Figure 1). The installation's primary mission since 1941 has been to load, assemble, and pack (LAP) ammunition items, including projectiles, mortar rounds, warheads, demolition charges, and munitions components (e.g., fuses, primers, and boosters) for the U.S. Department of Defense (DoD).

The northern portion of IAAAP consists of gently undulating terrain; the central portion is characterized by rolling terrain dissected by a shallow drainage system, and the southern portion contains drainageways with steep slopes down to creek beds. Elevations within IAAAP range from

730 ft above mean sea level in the northern portion of the installation to 530 ft above mean sea level in the southern portion.

Contamination at IAAAP is primarily attributable to past industrial and laboratory operating practices involving various explosives-laden sludge, wastewater, and solids; lead-contaminated sludge; ashes from incineration and open burning of explosives; and waste solvents. Additional sources of contamination included open burning of explosive materials and munitions and landfilling of waste material (Tetra Tech 2009). Radiological contamination at the OU-8 areas is associated with historical U.S. Atomic Energy Commission (AEC) weapon-assembly operations conducted from 1947 to 1975 (USACE 2011a).

A Federal Facility Agreement (FFA) between the USACE St. Louis District, USEPA Region 7, U.S. Department of Energy (DOE), and State of Iowa was finalized on August 16, 2006, to address the FUSRAP investigatory and cleanup work at IAAAP, as documented in the *Iowa Army Ammunition Plant Federal Facility Agreement Under CERCLA Section 120*, Administrative Docket Number: CERCLA-07-2005-0378 (2006 FUSRAP FFA) (USEPA et al. 2006).

1.2 FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Iowa Army Ammunition Plant		
EPA ID: IA7213820445		
Region: 7	State: IA	City/County: Middletown/Des Moines County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: Other Federal Agency Agency name: U.S. Army Corps of Engineers		
Author name (Federal or State Project Manager): Michael L. Kessler, IAAAP PM		
Author affiliation: Formerly Utilized Sites Remedial Action Program, USACE St. Louis District		
Review period: 12/15/2022 - 3/25/2024		
Date of site inspection: 4/21/2023		
Type of review: Statutory		
Review number: 2		
Triggering action date: 3/25/2019		
Due date (five years after triggering action date): 3/25/2024		

2.0 RESPONSE ACTION SUMMARY

2.1 BASIS FOR TAKING ACTION

The *FUSRAP Record of Decision for the Iowa Army Ammunition Plant* (FUSRAP ROD) states the following basis of the action:

The response actions selected in the ROD are necessary to protect public health or welfare or the environment from actual or threatened releases of DU into the environment at the FSA and Line 1 at the IAAAP (USACE 2011a).

The contaminant of concern (COC) for OU-8 is depleted uranium (DU) (including the isotopes uranium [U]-234, U-235, and U-238) in soil and on structural surfaces. Based on the results of the FUSRAP remedial investigation (RI), soil contamination was expected to be limited to 0 to 2 ft below ground surface (bgs). Per the 2006 FUSRAP FFA, groundwater is outside the authority of FUSRAP. Groundwater at the OU-8 areas is covered by OU-7 (Yard C, Yard G, and the FSA) and OU-11 (Yard L). Any groundwater RAs will be addressed by the OU-7 and OU-11 RODs.

Chemical contaminants, including explosives and metals, were evaluated at Yards C, G, and L. However, based on the evaluated human health and ecological exposure scenarios that assumed current and reasonable/foreseeable future industrial land use, no potential excess lifetime cancer risks (ELCRs) or noncancer hazard indices (HIs) exceeding USEPA target criteria were determined for chemical contamination at Yards C, G, or L. Additionally, no DU or chemical contamination was found at Yards C, G, or L or former Warehouse 3-01 in concentrations exceeding the screening levels (SLs) identified in the *Iowa Army Ammunition Plant FUSRAP Remedial Investigation Report for Firing Sites Area, Yards C, E, F, G, and L, Warehouse 3-01 and Area West of Line 5B* (FUSRAP RI) (USACE 2008). Therefore, no RAs were necessary at these four areas.

The FUSRAP RA at the FSA was limited to the removal of DU fragments and DU-contaminated soil in accordance with the 2006 Dispute Resolution Agreement (U.S. Army 2006). Potential chemical contaminants (e.g., explosives and metals) resulting from site practices are not being addressed under the FUSRAP because the FSA is an operational test range currently being used to test military munitions. Additional response actions will be addressed when the FSA ceases to be operational unless releases from the FSA require an immediate response to protect human health or the environment. If such a condition is determined to exist, response actions will be implemented consistent with the provisions of the 2006 FUSRAP FFA.

During the RA at the Firing Site (FS)-12 Area, potential soil contamination was identified in the former Test Fire Pit (TFP). Soil at the former TFP was excavated to a depth of 18 ft bgs. Saturated soil was encountered during the excavation.

2.2 RESPONSE ACTIONS

Previous response actions conducted at the FSA include a removal action performed in the 1970s. Before returning control of the FSA to the U.S. Army (Army), AEC contracted for soil excavation to remove radiologically contaminated soil from around the firing point at the FS-12 Area. Soil was reportedly excavated to a depth of 15 ft bgs at the firing point and to a depth of 1 to 2 inches bgs from the surrounding area. The volume of soil and debris removed was reported as 112 yd³. The material was placed in drums and shipped offsite for disposal as radioactive waste (Tetra Tech 2006).

No response actions were conducted for Line 1 structures; Yards C, G, or L; or former Warehouse 3-01.

The FUSRAP ROD identified the following remedial action objectives (RAOs), based on current and expected future industrial land use of IAAAP, in conjunction with human health doses and risks estimated for the IAAAP outdoor site worker and construction worker at the FUSRAP areas:

- Prevent ingestion, dust inhalation, and external gamma radiation exposures to isotopes of DU in the FSA soil that could otherwise result in cumulative cancer risks (CRs) exceeding $1.0\text{E-}04$ and radiological doses exceeding 25 mrem per year for receptors under the current (industrial) and expected future (industrial) land use scenarios.
- Prevent radiation exposures from DU particles embedded in and/or adhered to structural surfaces or components of the Line 1 buildings that could otherwise result in cumulative CRs in exceedance of $1.0\text{E-}04$ and a total effective dose equivalent (TEDE) exceeding 25 mrem per year.

To meet the RAOs, soil and structural surface remediation goals (RGs) were defined for DU. All industrial RGs proposed are risk-, or applicable or relevant and appropriate requirement (ARAR)-based concentrations. Both the risk- and dose-based values were derived based on the known activity percentages of the uranium isotopes in DU. Soil and structural surface industrial RGs for DU were derived for the *FUSRAP Feasibility Study Report for the Iowa Army Ammunition Plant, Middletown, Iowa* (FUSRAP FS) (USACE 2011b) and are summarized in Table 2-1.

Table 2-1. Remediation Goals for Soil and Structural Surfaces at OU-8

COC	Soil RG (pCi/g)	Structural Surface RG (dpm/100 cm ²)
DU	150	23,000

Table 2-2 presents a summary of major components of the selected remedy for the soil and structural surfaces in OU-8.

Table 2-2. Remedy Components

Soil	Excavate DU-contaminated soil to meet the industrial RG at Firing Sites 1 and 2; Firing Sites 3, 4, and 5; Firing Site 6 Area; and Firing Site 12 Area.
	No excavation would be conducted at Yards C, G, and L and Firing Site 14.
	Treat DU-contaminated soil from Firing Sites 1 and 2; Firing Sites 3, 4, and 5; Firing Site 6 Area; and Firing Site 12 Area (Physical Method – Soil Sorting).
	Dispose of materials exceeding the DU RG at properly permitted off-site facility. Materials meeting the DU RG may be used as backfill, as appropriate.
	Site restoration including backfilling, grading and re-vegetation.
Structures	Decontaminate structural surfaces and/or replace structural components (e.g., Building 1-11 floor grate and Building 1-63-6 air filters) to achieve the industrial RG for structures.
	Dispose of DU-contaminated materials at properly permitted off-site facilities.
Components Common to Soil and Structures	Continued industrial land use supported by use restrictions and outgrants administered by the Army as part of its land management responsibilities.
	FYRs for all areas exceeding UU/UE, which would verify industrial land use.

2.3 STATUS OF IMPLEMENTATION

The remedial activities conducted at OU-8 are described in the *Remedial Design/Remedial Action Work Plan, Iowa Army Ammunition Plant, Operable Unit 8, Depleted Uranium Contaminated Soil and Structure Remediation* (FUSRAP RD/RAWP) (USACE 2013a).

Soil with DU present at levels exceeding the soil RG is excavated based on the delineation of DU-contaminated material, as presented in the FUSRAP RD/RAWP (USACE 2013a). The RA also includes decontamination of structural surfaces or replacement of structural components to achieve the structural surface RG of 23,000 dpm/100 cm².

The following subsections summarize the primary activities conducted during the remediation of OU-8, including pilot testing; decontamination/replacement of structures/structural components; excavation; and treatment, transport, and disposal of wastes.

2.3.1 Physical Treatment Pilot Test

Prior to the initiation of RA activities at OU-8, a pilot study was implemented to determine the feasibility and cost-effectiveness of physical treatment using a conveyor-assisted radiological scanning and soil sorting system to detect and screen out DU fragments from surrounding soil with sufficient sensitivity to achieve the soil RG.

Results of the pilot study indicated that the *ScanSort*SM system was able to consistently detect and separate soil (i.e., divert to a separate pile) with an average DU activity concentration less than the soil RG of 150 pCi/g. The detailed results of the pilot test are documented in the *Soil Sorting Pilot Study Test Report Iowa Army Ammunition Plant Operable Unit 8, Depleted Uranium Contaminated Soil and Structure Remediation* (Pilot Study) (USACE 2014a).

Beginning in 2019, physical treatment of soil was implemented using the Iso-Pacific Soil Sorting System (S3). The Iso-Pacific S3 was implemented in accordance with the *Soil Sorting Testing/Verification Work Plan Iowa Army Ammunition Plant* (Iso-Pacific 2019).

2.3.2 Decontamination/Replacement of Structures/Structural Components

Remedial activities for OU-8 also included decontamination of structural surfaces and/or replacement of structural components. For Building 1-11, the remediation initially involved decontamination of sections of the steel floor grate as necessary to meet the structural surface RG. A portion of the contaminated floor grate at Building 1-11 could not be decontaminated, so it was removed, and then a replacement floor grate was re-installed. At Building 1-63-6, the remediation involved replacing the heating, ventilation, and air conditioning (HVAC) system air filters that exceeded the structural surface RG. All remediated structural surfaces were surveyed to confirm they met the structural surface RG, as reported in the *Remedial Action Completion Report for the FUSRAP Line 1 Structures at the Iowa Army Ammunition Plant* (Line 1 RACR) (USACE 2020b).

Radiological structural surveys were conducted if structural surfaces were encountered during removal of DU-contaminated soil. The surveys were conducted to determine if structural surfaces (i.e., bunkers, concrete pads, utilities) require decontamination or meet the structural surface RG in compliance with the FUSRAP ROD.

2.3.3 Excavation

The RA for DU fragments and associated contaminated soil at the FSA (the layout of the FSA is shown on Figure 2) was conducted in accordance with the FUSRAP RD/RAWP (USACE 2013a). In general, areas with a low concentration of DU materials were excavated using manual methods

(small hand tools, shovels) and areas with a high concentration of DU materials excavated using mechanical methods (backhoes, excavators).

In 2011, a small volume of soil (less than 1 yd³) was removed from the FS-1 and FS-2 Area and placed in a drum at the FS-12 Area for subsequent offsite disposal. Verification sampling and gamma walkover surveys (GWSs) indicate that the soil RG was met and no additional remediation was required (USACE 2013a).

During August 2013, RA was performed at the FS-3, FS-4, and FS-5 Area (USACE 2014b). A small volume of soil (approximately 1 yd³) was removed and taken to the FS-12 Area for storage and eventual offsite disposal. Verification sampling and GWS conducted in 2013 and 2014 indicate that the soil RG was met and no additional remediation is required.

GWS and soil sampling at the FS-6 Area in 2001 identified a small area associated with a DU fragment near the access road at the FS-6 Area (USACE 2008). A second area of DU-contaminated soil identified in 2000 was further investigated during the 2006 to 2007 RI field activities; however, the soil area with the elevated gamma count rates could not be located. In August 2013, a small volume of contaminated soil (less than 1 yd³) was excavated from the FS-6 Area near the access road. The soil was then taken to the FS-12 Area to be disposed of with the FS-12 Area soil. In 2019, an FSS attempt for the FS-6 Area (FS-6, FS-7, FS-8, FS-15) was conducted to demonstrate that the soil at the FS-6 Area meets the soil RG. During the GWS, additional locations of potentially DU-contaminated soil were located, and additional soil samples were collected. Several soil sample results exceeded the soil RG. Additional RA at the FS-6 Area is pending.

Remediation of DU-contaminated soil at the FS-12 Area is the major portion of the RA under OU-8. Preliminary excavation activities at the FS-12 Area began August 6, 2013. Full-scale excavation activities at the FS-12 Area began April 14, 2014, and are ongoing. Mechanical remediation was conducted using large-scale excavation methods (e.g., excavator) with removal of soil in nominal lifts of 10 to 12 inches. After the DU-contaminated soil was excavated, real-time performance monitoring (including GWS) was conducted within the excavated areas to determine the measurable extent of any remaining contamination. If necessary, additional soil lifts were excavated until the remaining contamination was removed. As remediation activities moved beyond the 175-to-200-m radius of the firing pad, the extent of soil contamination was found to be isolated and manual excavation methods (e.g., hand tools) were employed. All excavated soil was transported to a stockpile area at the FS-12 Area for physical treatment using radiological soil sorting. If individual DU fragments were recovered, the materials were added directly to the contaminated soil pile for offsite disposal.

Upon completion of excavation activities, an FSS is conducted (including collection of post-excavation soil samples and performance of a GWS) following *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* guidance (DoD 2000). FSSs have been completed for three sections of the FS-12 Area; the West Survey Units (WSU), the West-Central Survey Units (WCSU), and the East Survey Units (ESU) (USACE 2019a, 2020a, 2021a).

2.3.4 Treatment, Transport, and Disposal

Wastes from the FS-12 Area were transported to the onsite processing area at the FS-12 Area, where the soil and debris are segregated and processed using the Orion *ScanSort*SM system or Iso-Pacific S3. Radiological scanning and soil sorting was conducted using the Orion *ScanSort*SM from 2013 to 2018 and has been conducted using the Iso-Pacific S3 from 2019 through 2022. The reuse soil stockpile was verified as meeting the soil RG prior to use as backfill material at the FSA.

Approximately 129,680 yd³ of soil from the FSA was processed through the Orion *ScanSort*SM system and Iso-Pacific S3 systems from 2013 through 2022. Physical treatment of soil has resulted in a significant reduction in the amount of contaminated soil that required offsite disposal. The sorting process was able to produce a contaminated soil (i.e., soil with DU concentrations exceeding the soil RG) volume reduction of 88 percent, resulting in disposal of approximately 15,328 yd³ of contaminated soil for the 2013 through 2022 period (USACE 2023a).

The contaminated soil was transported by trucks to a staging area near M-Yard (Figure 1). Additional waste materials, including contaminated non-soil materials, personal protective equipment (PPE), asbestos containing tiles, and a portion of the grate from Building 1-11, were hauled to M-Yard for disposal with the soil. To facilitate the stockpiling of contaminated material from the FSA at M-Yard for waste shipment, M-Yard was surveyed, mowed, and roto-tilled in July 2015. A retaining wall was built on the southern end of the stockpile area for storm-water retention and elevated access for loading railcars. A polyethylene liner was installed in the stockpile area. Between 2014 and 2018, waste material was shipped to Energy Solutions in Clive, Utah, for disposal. Between 2019 and 2022, waste materials were shipped to US Ecology in Grand View, Idaho. Waste materials were stored and transported in accordance with the FUSRAP RD/RAWP (USACE 2013a).

2.3.5 Land Use Controls

Installation-wide institutional controls (ICs) include continued industrial land use supported by use restrictions and outgrants administered by the Army as part of its land management responsibilities as documented in the FUSRAP ROD (USACE 2011a). The land use restrictions at OU-8 are maintained by the Army subject to contractual arrangements between the Army and the IAAAP operating contractor.

IAAAP procedures that are currently in place provide the necessary site controls to protect plant workers, contractors, and other site visitors from residual contamination at OU-8. Currently, coordination of digging permits, utility repairs, maintenance, or other site work is accomplished through project review and approval procedures for the Environmental Work Instruction E01-012, *Incorporating Land Use Controls in Project Planning* (AO 2021). Engineering controls are in place at OU-8, including security fences and signs. No additional site-specific engineering controls are being implemented at this time.

At the completion of RA for OU-8, risk and dose assessments will be performed to determine if OU-8 meets the criteria for UU/UE. A land use controls implementation plan (LUCIP) for OU-8 will be developed if the criteria for UU/UE are not met.

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3.0 PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the *Five-Year Review Report for Operable Unit 1 (OU-1) and Operable Unit 8 (OU-8) Iowa Army Ammunition Plant* (USACE 2019b) (First FUSRAP FYRR) as well as the recommendations from the First FUSRAP FYRR and the current status of those recommendations.

Table 3-1. Protectiveness Determinations/Statements from the First FUSRAP FYRR

OU	Protectiveness Determination	Protectiveness Statement
8	Will be Protective	The remedy at OU-8 will be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

Table 3-2. Status of Recommendations from the First FUSRAP FYRR

OU	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
8	An evaluation is required to determine the need for ICs.	An evaluation of long-term protectiveness needs to be conducted through either (1) a post-construction risk assessment or (2) a review of remedy protectiveness following the closure of the operational range.	Ongoing	Continued industrial land use would be supported by use restrictions and outgrants administered by the Army as part of its land management responsibilities while RA is ongoing. Following completion of RA, risk and dose assessments will be performed to determine if OU-8 meets the criteria for UU/UE. A LUCIP for OU-8 will be developed if the criteria for UU/UE are not met.	18 months following acceptance of the Remedial Action Completion Report for the FSA

NA – not applicable

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4.0 FIVE-YEAR REVIEW PROCESS

4.1 COMMUNITY NOTIFICATION AND INVOLVEMENT AND SITE INTERVIEWS

A public announcement of the FYR was made on January 10, 2023, at the January Restoration Advisory Board (RAB) Meeting. A public notice of the FYR was printed in Burlington's The Hawk Eye newspaper on February 11, 2023, and in the Ft. Madison Daily Democrat on February 17, 2023; posted on the USACE St. Louis District FUSRAP website on January 19, 2023, and on the IAAAP website on January 17, 2023; and displayed at the Burlington Public Library from February 2 through March 3, 2023. The results of the FYR will be made available at the IAAAP information repository located at the IAAAP Visitor Reception Area in IAAAP Administrative Building 100-101, 17571 DMC Highway 79, Middletown, IA 52638-5000; the Burlington Public Library, 501 North Fourth Street, Burlington, IA 52601; and the FUSRAP Project Office, 114 James S McDonnell Boulevard, Hazelwood, MO 63042.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of these interviews are summarized below. A complete list of interview questions and the responses are provided on the individual review forms included in Appendix B.

In general, the interviewees expressed a positive overall impression of the project. While acknowledging remediation at OU-8 has been a lengthy process, most interviewees stated they believe progress has been made. Respondents indicated they felt the measures taken have been appropriate and have been conducted safely. Respondents were not aware of any vandalism incidents or negative effects of the site operations on the surrounding community. Respondents noted good communication between members of the environmental restoration team and indicated the information provided by the RAB meetings has kept them well informed of the site activities and progress.

4.2 DATA REVIEW

FSS data generated by RAs that are not complete were not reviewed. These data will be reviewed in a subsequent FYRR once the RA is complete.

The data review component of this FYR consisted of examining datasets for areas where RA has been completed since the last FYR:

- Soil radiological survey data for FS-12 Area WSU, WCSU, and ESU;
- Soil radiological survey data for post-treatment reuse soil identified as reuse soil survey unit (RUSU)-1 through RUSU-198;
- Structural surface radiological survey data for Line 1 structures; and
- Environmental monitoring program (EMP) data collected as part of RA conducted at OU-8.

4.2.1 Radiological Soil Data for FS-12 Area West, West-Central, and East Survey Units

FSSs were conducted using post-excavation soil sampling and GWSs to demonstrate that the FSA soil meets the FUSRAP ROD soil RG. All FSS activities were conducted using a MARSSIM-based approach documented in the *Final Status Survey Plan for the FUSRAP Areas at the Iowa Army Ammunition Plant* (FSSP) (USACE 2013b). FSS has been completed for 84 survey units (SUs) in three areas at the FS-12 Area: the WSU, WCSU, and ESU (Figure 3). The individual survey unit (SU) numbering was assigned based on the entire FS-12 Area; therefore, the SU numbering is not continuous for each geographical SU.

The FSS was conducted for each individual SU. Systematic and biased (as necessary) soil samples are collected from the excavation surface (or grade) to 0.5 ft bgs. In addition, one subsurface soil sample is collected at the same location as each systematic sample to confirm no unexpected subsurface contamination was present. Soil samples were analyzed for isotopic uranium (iso-U).

For each soil sample, the sum of the U-234, U-235, and U-238 concentrations is compared to the soil RG. If the DU result exceeds 150 pCi/g, then either additional remediation is conducted and the SU is resampled, or additional evaluation is conducted in accordance with MARSSIM guidance (DoD 2000). For a SU with sample exceedances of the soil RG, the elevated measurements comparison (EMC) unity rule is used to determine if the affected area is small in comparison to the SU. For the EMC unity rule, the fractional contribution from the small area of elevated activity is summed with the average fractional contribution based on the systematic samples from the entire SU. An EMC result less than 1 is acceptable.

The results of the final status survey evaluations (FSSEs) presented in three Post-Remedial Action Report-Final Status Survey Evaluations (PRAR-FSSEs) demonstrate that the in-situ soil meets the FUSRAP ROD criteria for industrial use and no further RA is required. A summary of the FSSE results is presented in Table 4-1.

Table 4-1. FS-12 Area Maximum Depleted Uranium Final Status Survey Result

PRAR-FSSE ^a Grouping	Maximum DU Result (pCi/g)	Average DU Result (pCi/g)	EMC Result (unitless)
WSU	4.21	2.24	NA
WCSU	6.01	2.12	NA
ESU	909.96	7.73	0.57

^a USACE 2019a, 2020a, 2021a

4.2.2 Radiological Soil Data for Reuse Soil Survey Units 1 through 198

Physical treatment (radiological scanning and soil sorting) was defined as a component of the selected remedy to provide a reduction in the overall volume of soil requiring disposal. A MARSSIM-based approach was developed in the FSSP (USACE 2013b) to demonstrate that the reuse soil from the physical treatment process complied with the soil RG to allow for use as backfill material (reuse soil) at the FS-12 Area.

Soil samples were collected intermittently from soil diverted to the reuse soil pile and then analyzed for iso-U. Reuse soil was grouped into RUSUs defined in chronological order.

The FSSE for RUSU-1 through RUSU-142 is presented in the *Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area West-Central Survey Units at the Iowa Army Ammunition Plant* (WCSU PRAR) (USACE 2020a). The FSSE for RUSU-143 through RUSU-198 is presented in the *Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area East Survey Units at the Iowa Army Ammunition Plant* (ESU PRAR) (USACE 2021a).

Based on the results from the FSSE, the treated soil identified as RUSU-1 through RUSU-198 met the requirements of the FUSRAP ROD and was acceptable for use as backfill material at the FS-12 Area. A summary of the FSSE results is presented in Table 4-2.

Table 4-2. FS-12 Area Reuse Soil Maximum Depleted Uranium Final Status Survey Result

RUSU Grouping	Maximum DU Result (pCi/g)	Average DU Result (pCi/g)
1-142	146.59	6.00
143-198	19.82	2.76

4.2.3 Radiological Structural Surface Data for Line 1 Structures

FSSs were conducted using post-remediation survey data to demonstrate that the Line 1 structural surfaces meet the FUSRAP ROD structural surface RG. All FSS activities were conducted using a MARSSIM-based approach documented in the FSSP (USACE 2013b). FSS has been completed for nine structure survey units (STSUs) at Line 1.

The results of the FSSE are presented in the Line 1 RACR (USACE 2020b) and demonstrate that the structural surfaces meet the FUSRAP ROD criteria for industrial use and no further RA is required.

The RA taken for AEC-related radiological contamination at the Line 1 structures is protective for an industrial receptor as well as a hypothetical residential receptor. Future statutory reviews of the Line 1 structures component of the OU-8 remedy are not required.

4.2.4 Environmental Monitoring Program

The EMP for OU-8 includes the preparation of an annual Environmental Monitoring and Data Analysis Report (EMDAR) that consolidates and evaluates the environmental monitoring data collected for a single calendar year (CY). The EMDARs for OU-8 assess compliance with ARARs and the potential for contaminant migration from RA at the FSA.

This EMP review is based on data collected between CY 2017 and CY 2021 (USACE 2018, 2019c, 2020c, 2021b, 2022, and 2023b). The First FUSRAP FYRR previously evaluated EMP data from CY 2013 through CY 2016 (USACE 2019b). Only summaries of the EMDAR data evaluations are presented here. For a complete presentation and evaluation of the data reviewed, please refer to the annual EMDARs for each CY.

General area air samples were collected at the boundary of remediation area with the results used to determine the site emissions. Particulate air samples were collected from the perimeter of the FS-12 Area excavation, soil sorting area, soil stockpile areas, and the M-Yard loadout area. The sampling was conducted using an air pump and a Ludlum Model 2929 Radiation Monitor. Air emissions from inactive areas of IAAAP OU-8 were not calculated because the surface soil at IAAAP is generally covered with vegetation that limits the potential for material to become airborne.

Radiological air data were used as inputs to calculate the TEDE to the hypothetical maximally exposed individual at OU-8 to evaluate compliance with two ARARs: 10 *CFR* 20.1403(b), and 10 *CFR* 20.1101(d):

- 10 *CFR* 20.1101(d): requires that emissions of radioactive material to the environment, excluding radium (Ra)-222 and its daughters, are maintained so the highest individual dose to the public will not exceed 10 mrem per year. The evaluation for compliance with the 10 *CFR* 20.1101(d) ARAR is accomplished using the USEPA computer code CAP88-PC to determine dose from radioactive airborne emissions to members of the public located at specific distances and directions from the site.
- 10 *CFR* 20.1403(b): requires that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem per year. The evaluation for compliance with the 10 *CFR* 20.1403(b) ARAR is accomplished by calculating the total dose from contaminant exposures, resulting from soil excavation, sorting, and loadout activities at the FS-12 Area, to the closest onsite worker at the FS-1 and FS-2 area, via the most significant migration pathway, which is airborne emissions. Consequently, both ARARs were evaluated against only the total dose from airborne emissions and all of the

radiological exposure routes (i.e., ingestion, inhalation, air immersion, ground surface, internal and external radiation) associated with airborne emissions.

Compliance with 10 *CFR* 20.1101(d) automatically ensures compliance with 10 *CFR* 20.1403(b), because both are dose-based limits of 10 and 25 mrem per year, respectively, to the average member of the critical group (USACE 2021b).

The average member of the critical group (i.e., “Potential Human Receptor”) for the site is the current and future site worker and the future construction worker. For the purposes of this evaluation, the current and future site worker is an IAAAP employee working at the FS-1 and FS-2 Area, located approximately 521 m northwest of M-Yard or an IAAAP employee working at the IDA location approximately 613 m east of the FS-12 Area.

The evaluation for compliance with the 10 *CFR* 20.1101(d) ARAR is accomplished using the USEPA computer code CAP88-PC to determine dose from radioactive airborne emissions to members of the public located at specific distances and directions from the site. The evaluation for compliance with the 10 *CFR* 20.1403(b) ARAR is typically accomplished by calculating dose from all pathways, including radioactive airborne emissions (inhalation), ingestion, dermal contact, external gamma radiation, and radon; however, based on the location of the current and future site worker at the FS-1 and FS-2 Area and the IDA, the FUSRAP ROD considers exposure from all pathways except airborne emissions to be insignificant. Therefore, both ARARs were evaluated using only the dose from airborne emissions.

Exposures to potential trespassers and recreational users (e.g., hunters) are considered infrequent and insignificant, because of access restrictions to the IAAAP property as well as the physical characteristics of each area therein.

As shown in Table 4-3, the CAP88-PC results for CY 2017 through CY 2022 demonstrate that all OU-8 receptors, including the hypothetical maximally exposed individual at OU-8 (i.e., the business receptor, an IAAAP employee at the FS-1 and FS-2 Area or the IDA, who is an average member of the critical group), receive less than the dose standards prescribed in 10 *CFR* 20.1101(d) (10 mrem per year) and 10 *CFR* 20.1403(b) (25 mrem per year). The annual dose rates calculated for all IAAAP OU-8 receptors, including the hypothetical maximally exposed individual at OU-8, were less than 0.1 mrem per year.

Table 4-3. OU-8 CAP88-PC Results for Receptors

CY	Source	Annual Dose Rate ^a (mrem/year)			
		Resident ^b	School ^c	Business ^d	Farm ^b
2017	FS-12 Area	<0.1	<0.1	<0.1	<0.1
2018	FS-12 Area	<0.1	<0.1	<0.1	<0.1
2019	FS-12 Area and M-Yard ^e	<0.1	<0.1	<0.1	<0.1
2020	FS-12 Area and M-Yard ^e	<0.1	<0.1	<0.1	<0.1
2021	FS-12 Area and M-Yard ^e	<0.1	<0.1	<0.1	<0.1
2022	FS-12 Area and M-Yard ^e	<0.1	<0.1	<0.1	<0.1

^a As reported in USACE 2018, 2019b, 2020c, 2021b, 2022 and 2023b.

^b 100 percent occupancy factor.

^c Corrected for the 23 percent occupancy factor (40 hours per week for 50 weeks per year).

^d The business receptors, an IAAAP employee at the IDA and at the FS-1 FS-2 Area, are average members of the critical group.

^e The individual dose results for the FS-12 Area and the M-Yard were summed.

4.3 SITE INSPECTION

The site inspection was conducted on April 21, 2023. Attendees included Mike Kessler, David Rose, and Greg Rakers, USACE St. Louis District; Kellie Crist, public; and Matthew Bange, Leidos (USACE contractor). The purpose of the inspection was to assess the protectiveness of the remedy.

The OU-8 sites inspected were the FSA, specifically the FS-12 Area and M-Yard. The OU-8 areas designated for industrial land use (i.e., Yard C, Yard G, and Yard L) were assessed visually from a vehicle. No change in the land use was identified.

No issues were identified as part of the site inspection. The general site conditions were good, and the sites are well maintained. Site access appeared to be sufficiently restricted where necessary.

A detailed summary of the inspection results is provided in Appendix C.

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5.0 TECHNICAL ASSESSMENT

5.1 QUESTION A: Is the remedy functioning as intended by the decision documents?

Based upon a review of the post-remediation data and documents; ARARs; exposure assumptions; and the results of the onsite inspection, it has been determined that the actions taken to date have been implemented as intended by the FUSRAP ROD. Post-remedial action verification documents finalized to date for excavated portions of the FS-12 Area demonstrate that the RAOs for soil and the soil RG established in the FUSRAP ROD are being met. Environmental monitoring data demonstrate compliance with the ARARs. For ongoing actions, the RA continues to operate as designed in meeting FUSRAP ROD requirements.

Continued industrial land use of the OU-8 areas is supported by use restrictions and outgrants administered by the Army as part of its land management responsibilities as documented in the FUSRAP ROD (USACE 2011a).

Groundwater at the FSA is outside the authority of FUSRAP: therefore, risk from DU in groundwater will be addressed under OU-7.

5.2 QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid, and any changes in these values have no impact on health protectiveness. Discussions and evaluations performed relative to Question B that support this finding are summarized below and presented in detail in Appendix D.

5.2.1 Changes in Standards and To Be Considered

During soil RAs, which are ongoing at the FSA, location-specific, chemical-specific, and action-specific ARARs established in the FUSRAP ROD (USACE 2011a) have been met. Appendix D, Table D-1, presents a list and analysis of the three ARARs for OU-8. The analysis shows that all three standards continue to be relevant and appropriate, in the context of current site conditions and the remedies being implemented.

5.2.2 Changes in Toxicity and Other Contaminant Characteristics

No changes have occurred in the known chemical/physical characteristics of DU or the radiological components of DU (U-234, U-235, and U-238) since publication of the FUSRAP ROD. The cancer slope factors (CSFs), internal dose conversion factors (DCFs), and nuclear decay data for the DU isotopes, along with the noncancer chemical toxicity for elemental uranium, have been updated once since publication of the FUSRAP ROD. The external DCFs for the DU isotopes have been updated twice. The combined updates relative to radioactivity of the DU isotopes and decay chain progeny were used to evaluate the continued health protectiveness of the risk-based soil and structural surface RGs for DU radioactivity (see Appendix D and Attachments D-1 and D-2, respectively, of this FYRR). The latest radiological toxicity and decay chain data result in no net change in health conservatism for soil, though they result in slightly less health conservatism for structures. Therefore, the remedies for these media continue to be health protective.

Aside from radioactivity, the noncancer, chemical toxicity of elemental uranium in soil is also evaluated in Appendix D relative to the USEPA's current industrial soil regional screening level

(RSL) for elemental uranium (i.e., as soluble salts) (USEPA 2023). Evaluations performed during the first FYR and this FYR (Appendix D) demonstrate that average elemental uranium in soil following remediation is less than 10 percent of the activity equivalent of the industrial soil RSL (see Appendix D and Table D-6 of this FYRR). Therefore, the remedy for DU in soil continues to be health protective.

5.2.3 Changes in Risk Assessment Methods

No changes in USEPA's standardized chemical or radiological risk assessment methods have occurred, though DOE updates to RESidual RADioactivity (RESRAD)-ONSITE and RESRAD-BUILD models have occurred since publication of the FUSRAP ROD in 2011. The RESRAD-ONSITE and RESRAD-BUILD models are used to evaluate ELCRs and doses associated with exposures to DU in soil and DU in soil on structural surfaces, respectively. There have been two updates to the RESRAD-ONSITE model since publication of the FUSRAP ROD, with the latest update, Version 7.2, having been released by DOE in July 2016. There was only one update to the RESRAD-BUILD model since publication of the FUSRAP ROD, Version 4.0, which was released in December 2022. Aside from the updates to radiological toxicity criteria and nuclear decay chain data discussed in Section 5.2.2, these updates include model input factors and calculations that do not result in any net change in the health-conservatism of risk and dose assessments performed for OU-8 areas of IAAAP. Evaluations of DU in soil performed during both the first FYR and this FYR (see Appendix D and Attachments D-1 and D-3) have demonstrated that the soil RG, as well as the selected remedy for soil, continues to be health protective. Evaluations of DU in soil on structural surfaces performed during this FYR (see Appendix D and Attachments D-2 and D-4) have demonstrated that the structural surface RG, as well as the selected remedy for structural surfaces, continues to be health protective.

5.2.4 Changes in Exposure Pathways

No changes to the exposure pathways have occurred since publication of the FUSRAP ROD that would impact the ability of the remedy to meet the FUSRAP ROD RGs and RAOs. However, as discussed in detail in Appendix D, two exposure assumptions have been updated for reasons other than land use or physical characteristics. These include (1) the soil ingestion rate for a site worker (i.e., for use in the RESRAD-ONSITE model), due to a comment from USEPA during review of the ESU PRAR; and (2) the assumption of deposition velocity used in the RESRAD-BUILD model, due to DOE's update of the default value for this parameter. The updated soil ingestion rate results in slightly more health-conservative risk and dose calculations. However, the updated deposition velocity, which is the default value used in RESRAD-BUILD Version 4.0, is less conservative than the corresponding default value used from the previous model version. As discussed in Appendix D and presented in Attachments D-1 through D-5, evaluations of these updated exposure assumptions demonstrate the continued validity of the soil and structural surface RGs and health protectiveness of the remedy.

The approved FUSRAP RI (USACE 2008) and FUSRAP FS (USACE 2011b) established that no ecological risks to the Indiana bat (*Myotis sodalis*) exist. In addition, a screening level ecological risk assessment (SLERA) has been conducted to assess remedy protectiveness of various types of sensitive terrestrial receptors beyond those with protected species status (i.e., the Indiana bat) from potential exposures to post-remedy soil concentrations of DU at the portions of the FS-12 Area for which PRAR-FSSE documentation has been finalized since the First FUSRAP FYRR. The details of the SLERA, including statistical summary and comparisons to ecological screening values established for various types of terrestrial receptors, is presented in Appendix D, Attachment D-1.

The results of the FUSRAP RI, FUSRAP FS, and SLERA indicate that the remedy is protective of all terrestrial receptor types.

5.2.5 Expected Progress Towards Meeting RAOs

The selected remedy for DU in soil and DU in soil on structural surfaces is progressing as expected toward meeting RAOs established in the FUSRAP ROD. No changes in site conditions (i.e., physical, radiological, or chemical) that impact or are expected to impact achievement of the RAOs and health-protectiveness of the remedy have been discovered since publication of the FUSRAP ROD.

5.3 QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No impacts from natural disasters have occurred. No site changes or vulnerabilities related to climate change impacts have become apparent since remedy selection.

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a group of emerging contaminants, consisting of more than 5,000 man-made fluorinated organic chemicals known for their water, oil, and stain repellency. PFAS chemistry was discovered in the late 1930s and widespread use began in the 1950s. An evaluation of current and past IAAAP activities was conducted to determine whether PFAS may have been used at IAAAP. This evaluation did not identify uses of PFAS at the OU-8 Areas (Arcadis 2020).

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6.0 ISSUES/RECOMMENDATIONS

OU: 8	Issue Category: Institutional Controls			
	Issue: Land use controls (LUCs), including ICs (if needed), have yet to be formally documented and implemented.			
	Recommendation: If required, the need for LUCs/ICs will be formally documented in an explanation of significant differences. The process for formally documenting LUCs, including ICs, will be established in a LUCIP.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	USACE	EPA/State	18 months following acceptance of the Remedial Action Completion Report for the FSA

6.1 OTHER FINDINGS

The following are recommendations that were identified during the FYR, but do not affect current and/or future protectiveness:

- Provide more details on the progress of RA at OU-8 to the RAB based on FYR site interviews.
- PFAS are a family of thousands of chemicals that vary widely in their chemical and physical properties, as well as their potential risks to human health and the environment. There is no known use of PFAS at the OU-8 areas (Arcadis 2020); therefore, PFAS contamination of environmental media has not been tested.

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7.0 PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
<i>Operable Unit:</i> 8	<i>Protectiveness Determination:</i> Will be Protective
<i>Protectiveness Statement:</i> The remedy at OU-8 will be protective of human health for the industrial/commercial and construction worker and the environment upon completion of remediation of soil and structural surfaces with DU concentrations exceeding the RGs. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks to the industrial/commercial and construction workers in these areas. LUCs will be implemented at OU-8 if the criteria for UU/UE are not met following RA.	

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8.0 NEXT REVIEW

The next FYR for IAAAP OU-8 is scheduled for completion no later than 5 years from the signature date of this report.

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9.0 REFERENCES

- 40 *CFR* 300, 2000, *Code of Federal Regulations*, Title 40, “Protection of Environment,” Part 300, “National Oil and Hazardous Substances Pollution Contingency Plan,” Office of the Federal Register.
- 42 USC § 9601 et seq., 1980, “Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund),” United States Code, December 11, 1980.
- AO 2021. American Ordnance LLC. *Environmental Work Instruction (EWI) E01-012 Incorporating Land Use Controls in Project Planning*. Iowa Army Ammunition Plant. September 12, 2021
- Arcadis 2020. *Final Preliminary Assessment of Per- and Polyfluoroalkyl Substances Iowa Army Ammunition Plant, Iowa*. October.
- ATSDR 2013. Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, Atlanta, Georgia. *Toxicological Profile for Uranium*. February.
- ANL 1993. Argonne National Laboratory. *Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil*, Environmental Assessment and Information Sciences Division, Argonne National Laboratory.
- ANL 2002. Argonne National Laboratory. *Technical Basis for Calculating Radiation Doses for the Building Occupancy Scenario Using Probabilistic RESRAD-BUILD 3.0 Code*, ANL/EAD/TM/02-1, NUREG/CR-6755, prepared for the U.S. Nuclear Regulatory Commission. February.
- DoD 2000. U.S. Department of Defense, U.S. Department of Energy, U.S. Environmental Protection Agency, and U.S. Nuclear Regulatory Commission. *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*. NUREG 1575. USEPA 402-R-97-016. August 2000.
- DOE 2000. U.S. Department of Energy. *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities*, DOE-510-1136-2000.
- ICRP 1983. International Commission on Radiological Protection. *Annals of the ICRP, Publication 38, Radionuclide Transformations – Energy and Intensity of Emissions*.
- ICRP 2008. International Commission on Radiological Protection. *Annals of the ICRP, Publication 107, Nuclear Decay Data for Dosimetric Calculations*.
- Iso-Pacific 2019. Iso-Pacific Remediation Technologies, Inc. *Soil Sorting Testing/Verification Work Plan Iowa Army Ammunition Plant*. March.
- ORNL 2014. Oak Ridge National Laboratory. Center for Radiation Protection Knowledge. *Calculation of Slope Factors and Dose Coefficients*. September.
- ORNL 2023a. Oak Ridge National Laboratory. Risk Assessment Information System Ecological Benchmark Tool for Radionuclides. Available online at https://rais.ornl.gov/tools/eco_search.php?select=rad. Accessed November 2023.
- ORNL 2023b. Oak Ridge National Laboratory. Risk Assessment Information System Ecological Benchmark Tool for Chemicals. Available online at https://rais.ornl.gov/tools/eco_search.php?select=chem. Accessed November 2023.

- PNNL 1994. Pacific Northwest National Laboratory. *Residual Radioactive Contamination from Decommissioning*. PNL-7994, NUREG/CR-5512 Volume 1, prepared for the U.S Nuclear Regulatory Commission. June.
- SNL 1999. Sandia National Laboratories. *Residual Radioactive Contamination from Decommissioning*, SAND99-2148, NUREG/CR-5512 Volume 3, prepared for the U.S. Nuclear Regulatory Commission, June.
- Tetra Tech 2006. Tetra Tech, Inc. *Comprehensive (Brush Creek, Spring Creek, Long Creek, and Skunk River) Watersheds Evaluation and Supplemental Data Collection Work Plan for the Iowa Army Ammunition Plant, Middletown, Iowa*. Final. December.
- Tetra Tech 2009. Tetra Tech, Inc. *Explanation of Significant Differences for the Final Record of Decision (ROD) Soils Operable Unit 1 (OU-1) Change of Primary Treatment Technology from Biological to Alkaline Hydrolysis Chemical Treatment for Iowa Army Ammunition Plant, Middletown, Iowa*. Final. September.
- U.S. Army 2006. Letter from Addison D. Davis, Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health) to John B. Askew, Regional Administrator, U.S. EPA Region VII, Regarding *Statement of Dispute Resolution between USEPA Region 7 and the U.S. Army for Operable Unit 4 (OU-4) Work Plan for Supplemental Remedial Investigation*. December.
- USACE 2001. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Preliminary Assessment, Iowa Army Ammunition Plant, Middletown, Iowa*. Final. December.
- USACE 2004. U.S. Army Corps of Engineers, Omaha District. *Baseline Ecological Risk Assessment (BERA), Iowa Army Ammunition Plant, Middletown, Iowa*. Draft Final. October.
- USACE 2008. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant FUSRAP Remedial Investigation Report for Firing Sites Area, Yards C, E, F, G, and L, Warehouse 3-01, and Area West of Line 5B*. Middletown, Iowa. Final. October 8.
- USACE 2011a. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *FUSRAP Record of Decision for the Iowa Army Ammunition Plant*. Middletown, Iowa. Final. September.
- USACE 2011b. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *FUSRAP Feasibility Study Report for the Iowa Army Ammunition Plant*. Middletown, Iowa. Final. April 22.
- USACE 2011c. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *FUSRAP Proposed Plan for the Iowa Army Ammunition Plant*, Middletown, Iowa. Final, April 22.
- USACE 2013a. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Remedial Design/Remedial Action Work Plan, Iowa Army Ammunition Plant, Operable Unit 8, Depleted Uranium Contaminated Soil and Structure Remediation*. Middletown, Iowa. Final. February.
- USACE 2013b. U.S. Army Corps of Engineers St. Louis District. *Final Status Survey Plan for the FUSRAP Areas at the Iowa Army Ammunition Plant*. Middletown, IA. Final. February 2013.

- USACE 2014a. U.S. Army Corps of Engineers, St. Louis District. *Soil Sorting Pilot Study Test Report, Iowa Army Ammunition Plant, Operable Unit 8, Depleted Uranium Contaminated Soil and Structure Remediation*. Middletown, Iowa. Final. October.
- USACE 2014b. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2013*. Middletown, Iowa. Revision 0. December 5.
- USACE 2014c. U.S. Army Corps of Engineers, Omaha District. *Record of Decision Operable Unit 5, Military Munitions Response Program, Iowa Army Ammunition Plant, Middletown, Iowa*. Final. September.
- USACE 2018. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2017*. Middletown, Iowa. Revision 0. September 21.
- USACE 2019a. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area West Survey Units at the Iowa Army Ammunition Plant*. Middletown, Iowa. Revision 0. September 6.
- USACE 2019b. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Five-Year Review Report for Operable Unit 1 (OU-1) and Operable Unit 8 (OU-8) Iowa Army Ammunition Plant*. Middletown, Iowa. Revision 0. January 18.
- USACE 2019c. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2018*. Middletown, Iowa. Revision 0. August 7.
- USACE 2020a. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area West-Central Survey Units at the Iowa Army Ammunition Plant*. Middletown, Iowa. Revision 0. October 23.
- USACE 2020b. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Remedial Action Completion Report for the FUSRAP Line 1 Structures at the Iowa Army Ammunition Plant*. Rev. 0 August 26.
- USACE 2020c. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2019*. Middletown, Iowa. Revision 0. August 3.
- USACE 2021a. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area East Survey Units at the Iowa Army Ammunition Plant*. Middletown, Iowa. Revision 0. August 18.

- USACE 2021b. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2020*. Middletown, Iowa. Revision 0. July 8.
- USACE 2021c. U.S. Army Corps of Engineers, Kansas City District, *Fourth Five-Year Review, Iowa Army Ammunition Plant*. Middletown, Iowa. Revision 0. March.
- USACE 2022. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2021*. Middletown, Iowa. Revision 0. December 16.
- USACE 2023a. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *2022 Remedial Action Field Activities Summary Report Iowa Army Ammunition Plant Operable Unit 8*. Final. February.
- USACE 2023b. U.S. Army Corps of Engineers, St. Louis District, Formerly Utilized Sites Remedial Action Program. *Iowa Army Ammunition Plant Operable Unit 8 Annual Environmental Monitoring Data and Analysis Report for Calendar Year 2022*. Middletown, Iowa. Revision A. June 6.
- USEPA 1988. U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, D.C. *Federal Guidance Report No. 11: Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*. EPA-520/1-88-020. September.
- USEPA 1993. U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C. *Federal Guidance Report No. 12: External Exposure to Radionuclides in Air, Water, and Soil*. EPA-402-R-93-081. September.
- USEPA 1997. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*. OSWER Publication No. 9200.4-18. August.
- USEPA 1999. U.S. Environmental Protection Agency, Office of Air and Radiation, Washington, D.C. *Federal Guidance Report No. 13: Cancer Risk Coefficients for Environmental Exposure to Radionuclides*. EPA 402-R-99-001. September.
- USEPA 2000. U.S. Environmental Protection Agency, Office of Radiation and Indoor Air/Office of Solid Waste and Emergency Response, Washington, D.C. *Soil Screening Guidance for Radionuclides: User's Guide*. EPA/540-R-00-007. October.
- USEPA 2011. U.S. Environmental Protection Agency. *Exposure Factors Handbook: 2011 Edition*. National Center for Environmental Assessment, Office of Research and Development, Washington, D.C. EPA/600/R-09/052F. 2011.
- USEPA 2014. U.S. Environmental Protection Agency. *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors*. OSWER Directive 9200.1-120, Washington, D.C. February 6.
- USEPA 2016. U.S. Environmental Protection Agency, Office of Land and Emergency Management, Washington, D.C. *Memorandum: Considering a Noncancer Oral Reference Dose for Uranium for Superfund Human Health Risk Assessments*. December 21.

- USEPA 2018. U.S. Environmental Protection Agency. *Region 4 Ecological Risk Assessment Supplemental Guidance*. Scientific Support Section, Superfund Division, USEPA Region 4. Originally published November 1995 and updated March 2018. Also available online at <https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance>.
- USEPA 2019. U.S. Environmental Protection Agency, Office of Radiation and Indoor Air. *Federal Guidance Report No. 15*. “External Exposure to Radionuclides in Air, Water and Soil.” EPA 402-R-19-002. Revised August 2019.
- USEPA 2022a. U.S. Environmental Protection Agency. *ProUCL: Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations*. Version 5.2. <https://www.epa.gov/land-research/proucl-software>. June 14.
- USEPA 2022b. U.S. Environmental Protection Agency. *Technical Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations*. Office of Research and Development. Washington, D.C. June 14.
- USEPA 2023. U.S. Environmental Protection Agency. *Regional Screening Levels*, “RSL Tables.” <https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables>. May. Accessed July 2023.
- USEPA et al. 2006. U.S. Environmental Protection Agency, Region 7, State of Iowa, and the U.S. Army Corps of Engineers. *Iowa Army Ammunition Plant Federal Facility Agreement Under CERCLA Section 120*. Administrative Docket Number: CERCLA-07-2005-0378.

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FIGURES

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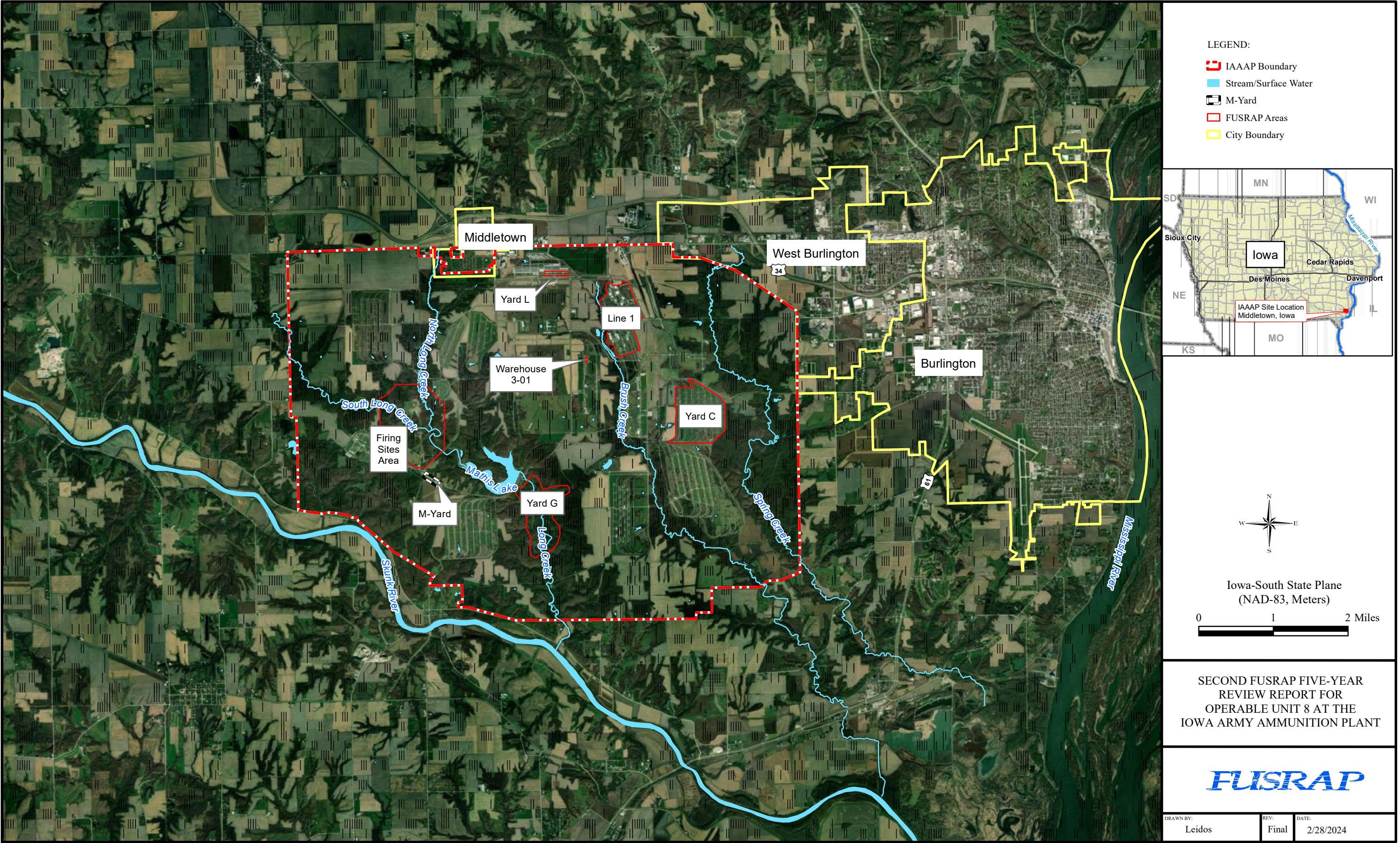


Figure 1. Location of IAAAP

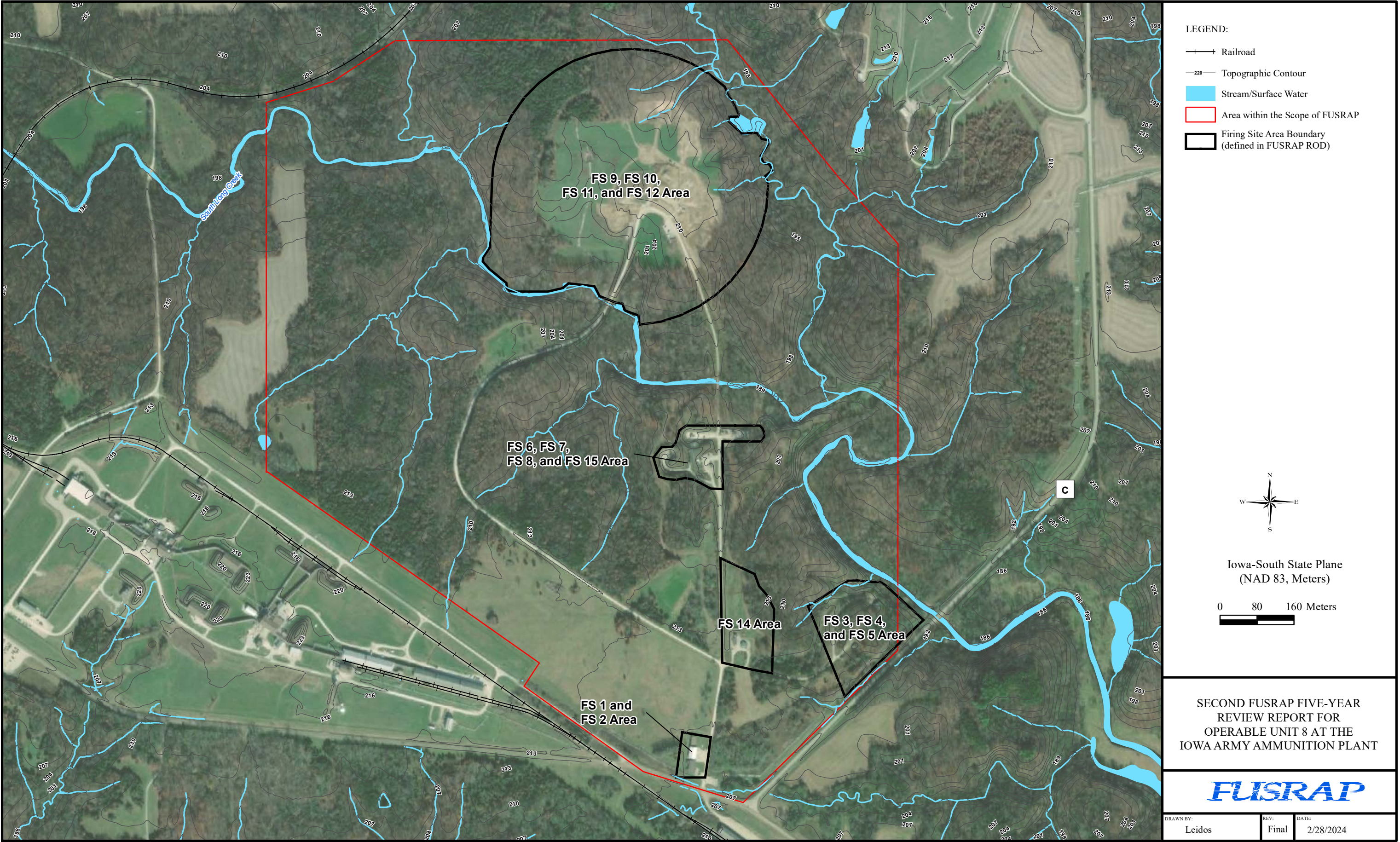


Figure 2. Layout and Topography of the Firing Sites Area

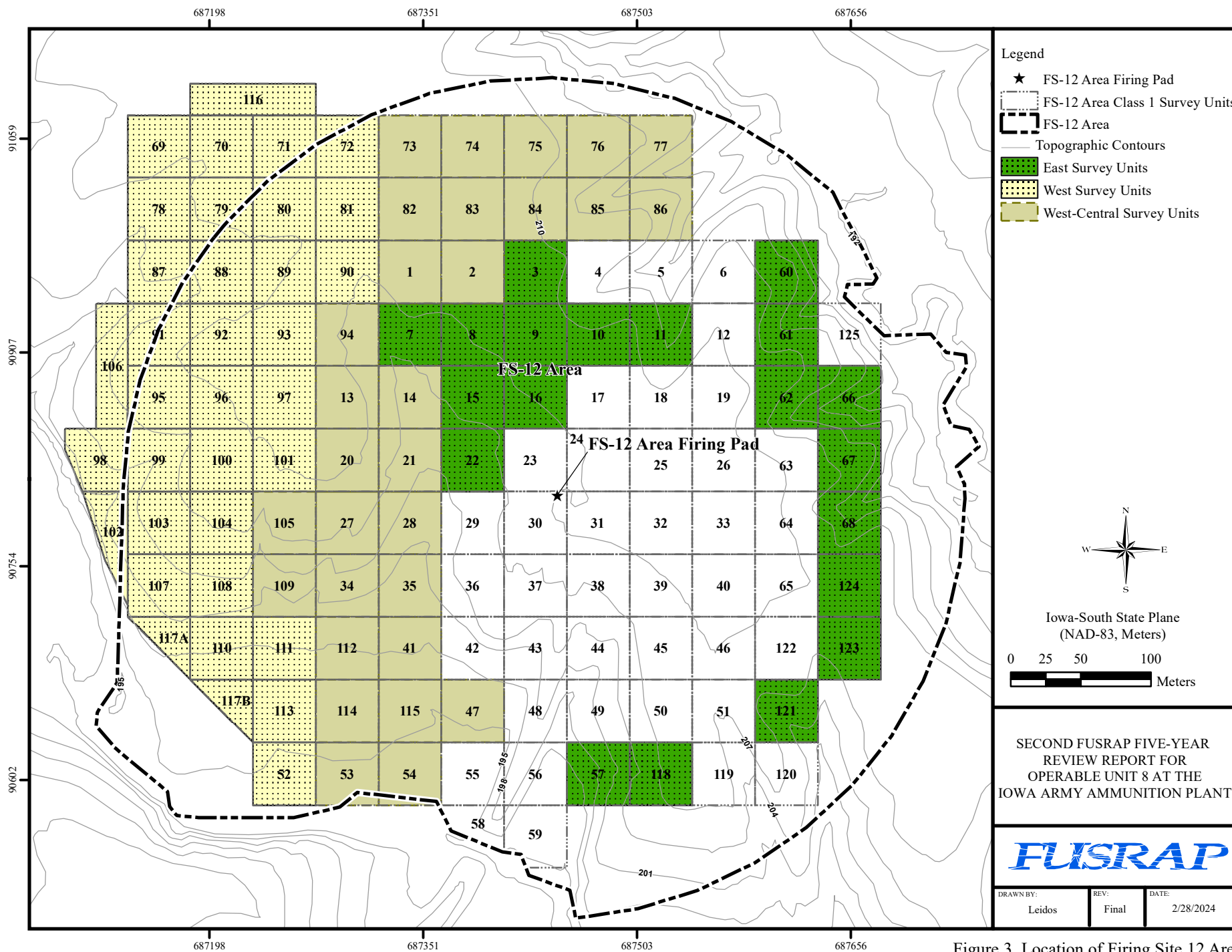


Figure 3. Location of Firing Site 12 Area Survey Units

APPENDIX A

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT PHASE OF IOWA ARMY AMMUNITION PLANT OPERABLE UNITS

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COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT PHASE OF IOWA ARMY AMMUNITION PLANT OPERABLE UNITS

Operable Unit	Current CERCLA Phase	Five-Year Review Protectiveness Statement ^a
OU-1: Soils	ROD	A protectiveness determination of the remedy at OU-1 cannot be made until further information is obtained. Further information will be obtained by collecting samples for PFAS analysis at the Fire Training Pit. It is expected that this action will take approximately 2 years to complete, at which time a protectiveness determination will be made.
OU-3: Offsite Groundwater	ROD	The remedy at OU-3 currently protects human health and the environment because alternative drinking water has been offered and supplied to impacted residences. However, for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: • Complete a thorough review of the remedy and determine necessary actions (if this remedy can be augmented or if another remedy should be evaluated) to restore groundwater within a reasonable timeframe. • Review and optimize the remedial design (RD) to determine if the RD is technically suitable to achieve the anaerobic conditions necessary to support degradation of hexahydro-1,3,5-trinitro-1,3,5-triazine, also known as royal demolition explosive (RDX). Augmentation of the current remedy or consideration of other remedial approaches and technologies should be considered. • Continue coordination with Iowa Department of Natural Resources (IDNR) and other Iowa state and local agencies to facilitate execution of the Iowa state groundwater protection designation.
OU-4: IDA	ROD	A protectiveness determination of the remedy at OU-4 cannot be made until further information is obtained. Further information will be obtained by collecting samples for PFAS analysis. It is expected that this action will take approximately 2 years to complete, at which time a protectiveness determination will be made.
OU-5: MMRP Sites	ROD	The remedy at OU-5 currently protects human health and the environment because engineering controls have been constructed and are effective. However, for the remedy to be protective in the long-term, a Base Master Plan must be implemented to act as an institutional control (IC), per the <i>Record of Decision Operable Unit 5, Military Munitions Response Program, Iowa Army Ammunition Plant, Middletown, Iowa</i> (USACE 2014c).
OU-6: Onsite Groundwater	RI	NA
OU-7: Installation-wide Sites	RI	NA
OU-9: Construction Debris Areas	FS	NA
OU-10: EDA Groundwater Sites	RI	NA
OU-11: NFA Sites	RI	NA
OU-12: Former RCRA/CC Sites	RI	NA

^a From *Fourth Five-Year Review, Iowa Army Ammunition Plant, Middletown, Iowa* (USACE 2021c)

NA- Not Applicable

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APPENDIX B
COMMUNITY INTERVIEWS

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LIST OF INDIVIDUALS INTERVIEWED (NAME/AFFILIATION)

RAB member #1

Citizen #1

RAB member #2

RAB member #3

RAB member #4

RAB member #5

RAB member #6

RAB member #7

RAB member #8

Jennifer Busard – Environmental Restoration Manager, IAAAP

Milton “Butch” Hicks – Fire Marshal, IAAAP

Shelly Nellesen – Environmental Specialist, IA DNR, RAB member

Wes March – Remedial Project Manager, EPA, RAB member

Joe Hafner – Environmental Office, IAAAP

David Rose – Firing Sites UXO/Safety/QA Representative, USACE St. Louis District

Greg Bright – Construction Contractor, Cabrera

Citizen #2

Steven J. Bellrichard – Chief, Operations Support Division, IAAAP

Matthew Bange, PE – Environmental Engineer, Leidos

Jon Rankins – Health Physicist, USACE

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INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 7:45 a.m. Date: 3/24/2023
Type: ☐ Telephone ☐ Visit ☒ Email Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #1		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Any cleanup efforts at the facility are good.		
2. What effects have site operations had on the surrounding community? A. None to my knowledge.		
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. None.		
4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. None.		
5. Do you feel well-informed about the site's activities and progress? A. Yes.		
6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. As a member of the RAB, I feel we are well informed.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 9:54 a.m. Date: 3/23/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: Citizen #1		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. This project seems to me to be a thorough well-organized endeavor. 2. What effects have site operations had on the surrounding community? A. Other than providing jobs for local workers, contractors and additional business for the local service industries none that I am aware of. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. None that I am aware of. The site is isolated from the general population. 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. No instances that I am aware of. The facility is secured by armed guards and sectioned off by high security fencing. 5. Do you feel well-informed about the site's activities and progress? A. I feel that both the COE reps and on-site contractors have done an excellent job of keeping us informed of the project's events and status. 6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. I have no current issues or concerns with the management of this site. I feel the management of this project has been handled in an efficient and professional manner by all parties involved.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 2:52 p.m. Date: 4/4/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #2		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. It appears to be fine. The environment team seems to be following all recommended guidelines. 2. What effects have site operations had on the surrounding community? A. Nothing negative that I have been made aware of. The plant/site operation employs many people. I think that has a positive impact on the surrounding community. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. No. I am amazed at how many people in the community that I have met that do not know that work is completed at the plant or that the RAP/RAB exists even though the meetings are announced in the paper and all of the information from past meetings is available online. 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. No. 5. Do you feel well-informed about the site's activities and progress? A. Yes. I think the RAB does an excellent job of providing information about what is currently being done for each project. The meeting date/location/time is published in the local paper. The information about the meeting and all of the notes from past meetings can also be located online. 6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. No.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 9:00 a.m. Date: 4/4/2023
Type: ☐ Telephone ☒ Visit ☐ Email		☐ Incoming ☐ Outgoing
Location of visit: Hwy 34 Truck Stop near IAAAP		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #3		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Still a lot of 'stuff' to address that has not been addressed (i.e., Bldg. 300-148, DA/DF, east BG; WBPB; and pistol range). 2. What effects have site operations had on the surrounding community? A. Past work practices hurt the community. My wife is dead and my two kids have health issues. But the damage has been done. The remedial work at the site has had no negative impacts. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. No. The 'community' don't come to the RAB meetings anymore since it's about the cleanup and not health issues. 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. No. 5. Do you feel well-informed about the site's activities and progress? A. Yes, at least what they want to tell us. 6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. Listen to what people tell you. Additional notes: The interview lasted 5 hours from approximately 0900 until 1400. In addition to addressing the specific interview questions, much of the time was spent educating the interviewer on general operations at IAAAP such as how AEC used WH 3-01, Yard G, etc.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 12:32 p.m. Date: 3/7/2023
Type: ☐ Telephone ☐ Visit ☒ Email (handwritten letter attached) Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #4		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Very impressive undertaking to restore the 19 acres to a safe and useable environment resource. 2. What effects have site operations had on the surrounding community? A. It has provided jobs for many. It has provided usable land for private companies to operate and for added farming. New joint building for Army Reserve and National Guard. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. Still have contamination on and off site fenced in areas that has not been cleaned up properly. (May be future plans.) 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. Only thing I have noticed this year is that there has been 2 bright satellites above or a little west of plant site. 5. Do you feel well-informed about the site's activities and progress? A. Yes, see #6 also. 6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. The details on agenda items are not given to committee (RAB) in detail. Presenter reads details from his notes and all we get is bullet points. We have in past received the details.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 9:40 a.m. Date: 3/13/2023
Type: ☐ Telephone ☐ Visit ☒ Email Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #5		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Making progress.		
2. What effects have site operations had on the surrounding community? A. Difficult to ascertain. Community seems to be mostly concerned with off site explosive contamination, not radiation.		
3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. No.		
4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. No.		
5. Do you feel well-informed about the site's activities and progress? A. Yes.		
6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. Keep progressing!		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 8:38 p.m. Date: 5/4/2023
Type: ☐ Telephone ☐ Visit ☒ Email Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #6		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Overall positive. As with any cleanup the timeframes to complete seem too long. 2. What effects have site operations had on the surrounding community? A. The plume of contamination from Line 1 continues to effect groundwater off the plant. The full extent from past operations may never be truly known. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. Timeframe for sampling under demolished bldgs. Seems to be taking a long time. 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. No 5. Do you feel well-informed about the site's activities and progress? A. Yes thru the RAB 6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. No		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 4:25 p.m. Date: 4/4/2023
Type: ☐ Telephone ☐ Visit ☒ Email Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #7		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. The information is much more informative than in the earlier years of the RAB. I feel in the earlier years, the information we received was less than reliable and somewhat misleading. I feel in the earlier years there was an attempt to create a narrative that was somewhat misleading. 2. What effects have site operations had on the surrounding community? A. N/A. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. There is still much wait and see before there is complete confidence in the operation and information about process. 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. I am not aware of any of the above activities. 5. Do you feel well-informed about the site's activities and progress? A. The information about the site's activities and progress has improved with each of the changes of command. 6. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. Continue to listen with former and present members of the plant family. Continue to provide information on both the successes and problems of continuing to rehab the site as well as, protect the surrounding area.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 7:20 a.m. Date: 3/4/2023
Type: ☐ Telephone ☐ Visit ☒ Email Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: RAB member #8		
Summary of conversation (Group 1 questions)		
1. What is your overall impression of the project? (General sentiment.) A. I believe the project is working as intended and operates under good stewardship. Results are not immediate and gratifying successes come over decades, not months or even years sometimes. However, that is the nature of such an extensive effort. One of the things I've noticed over the years is the behemoth-like grinding interaction between federal agencies. That is probably one of the most frustrating aspects of a project such as this. It's like galaxies colliding. 2. What effects have site operations had on the surrounding community? A. One of my concerns is, despite efforts to let the public know about ongoing remedial activities, it seems we don't have a news reporter regularly coming to our RAB meetings, as they have in the past. Our community recently has the benefit of two local police papers covering the area, instead of one. I'd like to see reporters covering our meetings again. I know invitations are extended and public notices posted. Perhaps a little encouragement from plant and RAB members directed towards the newspaper to attend would assist. Besides public notices, is there a Marketing budget that is intended to broadcast or advertise the ongoing efforts of the IAAP remedial project? 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, give details. A. No 4. Are you aware of any events, incidents or activities at the site, such as vandalism, trespassing or emergency responses from local authorities? If so, give details. A. No		

5. Do you feel well-informed about the site's activities and progress?

A. I do. The RAB members are well briefed and efforts are made to answer any questions and follow-up with any concerns. We always have a snapshot of current activities. I think we sometimes we forget the big picture, as in, what has been accomplished she the project began over three decades ago. I'd love to see a big graphic or chart (something visual) laying out the remedial accomplishments over the years along with the astounding numbers that would accompany the visual.

6. Do you have any comments, suggestions or recommendations regarding the site's management or operation?

A. I do believe work has been done and continues to be done through purposeful and thoughtful practices. Project managers plan and contractors perform their work as directed. Projects are carefully thought out and plans in place before work begins. One thing I maybe have missed: Has a plan ever been implemented and then a major revision needed due to unexpected or unanticipated problems? What happens when a Plan B is called for?

Page 2 of 2

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 9:44 a.m. Date: 4/4/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Jen Busard	Title: Environmental Restoration Manager	Organization: IAAAP, RAB
Summary of conversation (Group 2 questions)		
1. What is your overall impression of the project? (General sentiment.) A. The IAAAP FUSRAP is a very well managed and planned project. 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results. A. Yes, there is weekly communication with the FUSRAP project manager. I have gone on site visits over the years, and I'm present for reporting at monthly program manager meetings. 3. Have there been any complaints, violations or other incidents related to the site requiring a response by your office? If so, give details of the events and results of the responses. A. Not that I'm aware of. 4. Do you feel well-informed about the site's activities and progress? A. I feel very informed, Mike Kessler does a great job at keeping the team aware. 5. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. I'd like to add that Mike Kessler does an amazing job. No recommendations, great program. 6. Is the use of Land Use Controls consistent with the Remedy? A. Yes, the Institutional Controls are being communicated through quarterly RAB meetings.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 12:52 p.m. Date: 3/21/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Milton "Butch" Hicks	Title: Local Authority, Fire	Organization: IAAAP
Summary of conversation (Group 2 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Overall safety/fire assessment/impression – minimal impact on IAAAP operations. In the past 5 years, no safety or fire responses due to COE operations. One response that required EOD support - inert MEC (75mm). 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results. A. Yes – several firing site locations have been demolished at FS that required coordination between AO LLC FS operations and COE activities. COE representatives communicate on a routine basis if support from US Army or operating contractor is required. 3. Have there been any complaints, violations or other incidents related to the site requiring a response by your office? If so, give details of the events and results of the responses. A. No 4. Do you feel well-informed about the site's activities and progress? A. Yes 5. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. No comment. Good safety program 6. Is the use of Land Use Controls consistent with the Remedy? A. Yes		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 1:08 p.m. Date: 3/14/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Shelly Nellesen	Title: Environmental Specialist	Organization: IA DNR, RAB
Summary of conversation (Group 2 questions)		
1. What is your overall impression of the project? (General sentiment.) A. A generally positive impression. Things continue to move forward at OU-8. 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results. A. The Iowa DNR attends a quarterly RAB meeting. 3. Have there been any complaints, violations or other incidents related to the site requiring a response by your office? If so, give details of the events and results of the responses. A. None that I know of. 4. Do you feel well-informed about the site's activities and progress? A. Yes, a quarterly report is provided in addition to the discussion during the RAB meeting. 5. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. No. 6. Is the use of Land Use Controls consistent with the Remedy? A. Yes but to my knowledge the Land Use Controls have not been finalized.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 4:12 p.m. Date: 4/7/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Wes March	Title: Remedial Project Manager	Organization: EPA, RAB
Summary of conversation (Group 2 questions)		
1. What is your overall impression of the project? (General sentiment.) A. This is a complex site due to the large area and decades of various use. It is also of critical economic and historic significance to the local community. Both regulators and operators communicate and work together effectively to adequately address environmental concerns while maintaining facility operations. 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results. A. The EPA has regular meetings with the facility employees and consultants. We frequently discuss current and future activities along with addressing any critical issues that may arise. The EPA is provided all reports and is included in the comment and review processes. 3. Have there been any complaints, violations or other incidents related to the site requiring a response by your office? If so, give details of the events and results of the responses. A. No 4. Do you feel well-informed about the site's activities and progress? A. Yes 5. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. The site team communicates and operates effectively. The EPA has a very amical relationship with all stakeholders that facilitates excellent site management. 6. Is the use of Land Use Controls consistent with the Remedy? A. The land use controls are consistent with the remedy. On occasion, controls may be substituted for other alternatives that are consistent with the remedy.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 9:20 a.m. Date: 3/6/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Joe Haffner	Title: Local Authority, Environmental Office	Organization: IAAAP
Summary of conversation (Group 2 questions)		
1. What is your overall impression of the project? (General sentiment.) A. Local position manager is overwhelmed (stuck behind the desk). Inter-staff communication is suffering as well as field inspection/visits. 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, give purpose and results. A. No. 3. Have there been any complaints, violations or other incidents related to the site requiring a response by your office? If so, give details of the events and results of the responses. A. No. 4. Do you feel well-informed about the site's activities and progress? A. I feel better informed than in the past. I don't feel well-informed. 5. Do you have any comments, suggestions or recommendations regarding the site's management or operation? A. See Question 1. 6. Is the use of Land Use Controls consistent with the Remedy? A. I believe so. I'm not current on what the remedy is for each site.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 1:11 p.m. Date: 3/8/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: David Rose	Title: RA Contractor, QAR	Organization: USACE
Summary of conversation (Group 3 questions)		
1. What is your overall impression of the project? (General sentiment.) A. The project was progressing well for completion of Firing Site 12 in 2022. The prime contractor made every effort to complete environmental restoration but fell short of expectations due to mechanical delays with soil sorting equipment and continued external challenges with test firing and weather. 2. What is the current status of construction (e.g., budget and schedule)? A. Additional remedial action, sampling, and gamma walk over surveys are required to complete restoration of the firing sites. The previous contractor was not able to complete prior to their contract expiring, so a new contract for remedial restoration will be needed to complete. 3. Have any problems been encountered that required, or will require, changes to this remedial design or this Record of Decision (ROD)? A. I have not encountered any problems that would require a change to the ROD. 4. Have any problems or difficulties been encountered that have had an impact on construction progress or implementability? A. Mechanical delays, test firing, weather, and Pandemic slowed the project the last couple of years. In 2022, the majority of delays came from mechanical failures associated with the soil sorting equipment used by the contractor. 5. Do you have any comments, suggestions or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)? A. A suggested recommendation would be for the next remedial action contractor to rent soil sorting equipment closer to the work site. That would make repairs faster and prevent long delays. If that is not possible, ensure there are spare parts on hand to quickly repair equipment and prevent long delays of productivity. 6. Is the use of Land Use Controls consistent with the Remedy? A. All Land Use Controls we are responsible for are consistent with the remedy.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 2:21 p.m. Date: 3/7/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Greg Bright	Title: Construction Contractor	Organization: Cabrera
Summary of conversation (Group 3 questions)		
1. What is your overall impression of the project? (General sentiment.) A. As the Project Manager of R8I-Cabrera Remediation & Construction LLC (RCRC), I was responsible for managing the remedial action at OU-8, and specifically, at Firing Site (FS)-12. My overall impression of the project was that it was a great success. Our subcontractor, ISO-Pacific Remediation Technologies (ISO-Pacific), was responsible for processing soil and debris to separate depleted uranium from the overall excavated volume. Our team exceeded USACE soil processing goals each field season from 2019-2022, and far exceeded the soil processing productivity of the previous contractor, who was on-site from 2013-2018. 2. What is the current status of construction (e.g., budget and schedule)? A. We have expended nearly 99% of our budget under our contract W912P918D0023, and our period of performance ends on 28 March 2023. We have been demobilized from the Site since November 2022. There are two stockpiles of above Remedial Goal (RG) soil and debris stockpiled at the Site, along with a stockpile of excavated soils requiring processing. Two survey units still require remediation, along with areas under the FS-12 road, and additional areas will require final grading and restoration. RA is complete in the remainder of the FS-12 site. 3. Have any problems been encountered that required, or will require, changes to this remedial design or this Record of Decision (ROD)? A. There are no problems that I'm aware of that required changes to the overall remedial design or the ROD. In Area E, we encountered a former projectile test firing pit with subsurface contamination to an approximate depth of 18 feet below ground surface. This contamination is deeper than what was stated in the ROD. A Remedial Action Work Plan was developed for this specific area and reviewed by USACE, EPA, and IDNR prior to implementation. Throughout the process we encountered areas that required either more or less excavation, processing, and restoration than was anticipated in order to meet the ROD RGs, but overall these changes were minor and consistent with the remedial design for the Site.		

4. Have any problems or difficulties been encountered that have had an impact on construction progress or implementability?

A. There were some issues that delayed construction progress. Test firing activities taking place at nearby firing site locations forced us to stand down for several hours at a time. Inclement weather conditions included lightning, rain, wind, and saturated soil conditions that delayed the processing and/or excavation of soils. Mechanical issues with specialty equipment related to soil processing activities caused delays. These issues included unscheduled maintenance on the shaker screen plant, stacker conveyors, and operational or mechanical issues with the S3. We also had lost hours/days due to the COVID-19 pandemic (i.e., employees getting sick themselves, quarantining after close contact with others, or waiting for testing results).

5. Do you have any comments, suggestions or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

A. I do not have any comments, suggestions, or recommendations related to the 5-year review.

6. Is the use of Land Use Controls consistent with the Remedy?

A. Yes.

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 9:05 a.m. Date: 3/20/2023
Type: ☐ Telephone ☐ Visit ☒ Email Location of visit: FUSRAP Project Office, Berkeley, MO		☒ Incoming ☐ Outgoing Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted: Citizen #2		
Summary of conversation (Group 3 questions)		
1. What is your overall impression of the project? (General sentiment.) A. OU-8 should be straight forward easy project; locate the contamination, determine the level contamination, and reduce the level below the RG. The actual implementation and oversight; however, has been the complete opposite. The hardest part of the project should be finding the contamination, but hardest part has been getting everyone to agree on the implementation and path forward. 2. What is the current status of construction (e.g., budget and schedule)? A. Current status of construction is incomplete and over budget. Due to the limited understanding by members of management, site records, and construction design input, the project did not meet its original budget or schedule. Since construction allowed the RAC to start before nature, extent, and method of remediation was determined the project ran into many scheduling and construction issues. To this day the actual extent at both the north and south test fire sites has not been determined. The contamination at the south site was only recently found. By allowing the RAC to so early many times the PDI and remediation was driven by schedule and budget instead of data and results leading. As for the budget and schedule going forward, that depends how the issues and questions are answered. My best guess is that there could be another 3 to 6 years left in the projects field work and up to another \$25,000,000. 3. Have any problems been encountered that required, or will require, changes to this remedial design or this Record of Decision (ROD)? A. Yes, there are several problems that require changes to both the design and ROD. Three of these problems are: the original design doesn't include the South Test Fire Site, the original GEA does not include all of what has been remediated, and the RG does not cover point sources. The first two of the listed problems are easy correction, but the last one requires more thought and discussion.		

4. Have any problems or difficulties been encountered that have had an impact on construction progress or implement ability?

A. Yes, for example changing technique/equipment during the project without verifying it meeting the design or ROD. This project is a three step process and not knowing how each step is working and related causes wasted time when issues arise between the steps. Changing one step and forcing the other two to change does not make sense unless the initial change is verified. Also, making a change in technique/equipment during a project brings into question whether the original technique/equipment was adequate.

5. Do you have any comments, suggestions or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

A. Reevaluate the ROD, RGs, and the overall goal for the project. Make sure that everyone at each level of management is on the same page and has an understanding of radiation, technique, and instrumentation/equipment before moving forward. The next thing is that all contamination controls should be handled by an approved radiation contractor, the RAC should not be in charge of the site controls. Finally, make sure someone with an understanding radiation, radiation equipment, and construction are on site or at least a few times a month evaluate the processes and in the field information/data to have a better handle when issues arise.

6. Is the use of Land Use Controls consistent with the Remedy?

A. No, the land use controls are for the most part not existent. Since the south test fire site was only recently found to be contaminated, controls have not been put in place. Multiple times vehicles are driven into areas with contamination and back onto non-contaminated roadways. Just because areas have been remediated and meet RG does not mean they meet free release. The RG is industrial release not free release.

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 8:33 a.m. Date: 3/8/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Steve Bellrichard	Title: Deputy to the Commander	Organization: IAAAP
Summary of conversation (Group 4 questions)		
There are five questions: 1. What is your overall impression of the project? (General sentiment.) A. The project is larger than projected and the USACE has made the correct adjustments to its remediation strategy. 2. Is the remedy functioning as expected? How well is the remedy performing? A. I do not know the data, but from all reports remedy is functioning well and as expected. 3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing? A. Again, I do not know the data, but from all reports the USACE is making steady progress towards decreasing contamination such that land will be returned to the army for industrial use purposes. 4. Is there a continual on-site Operations and Maintenance (O&M) presence? If so, describe staff and activities. If there isn't a continual on-site presence, describe staff and frequency of site inspections and activities. A. I do not know the details of O&M nor frequency of inspections and activities. I do know that they shut down for the winter and return in the spring to start again. I have not received any reports of insufficient O&M, or USACE oversight. 5. Have there been any significant changes in the O&M requirements, maintenance schedules or sampling routines since startup or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Describe changes and impacts. A. I know of no significant changes in O&M requirements. I do know that any such changes would trigger EPA and state of Iowa review and if there were issues, they were not brought to my attention.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 2:22 p.m. Date: 3/28/223
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Matthew Bange	Title: Environmental Engineer	Organization: Leidos
Summary of conversation (Group 4 questions)		
1. What is your overall impression of the project? (General sentiment.) A. The project is going well. The project continues to implement lessons learned to try to make each field season better than the last. 2. Is the remedy functioning as expected? How well is the remedy performing? A. Excavation with soil sorting and offsite disposal is functioning well. Land Use Controls will be required. 3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing? A. The air monitoring data, and surface water and sediment data from Long Creek is not indicating any issues. The surface water and sediment values are consistent with samples collected before implementation of the remedy. 4. Is there a continual on-site Operations and Maintenance (O&M) presence? If so, describe staff and activities. If there isn't a continual on-site presence, describe staff and frequency of site inspections and activities. A. The remedy for OU-8 does not require a continual O&M presence. I am not sure of the frequency of the site inspections. 5. Have there been any significant changes in the O&M requirements, maintenance schedules or sampling routines since startup or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Describe changes and impacts. A. There have not been any significant changes in the O&M requirements, maintenance schedules or sampling routines since startup or in the last five years.		

INTERVIEW RECORD		
Site name: Iowa Army Ammunition Plant		EPA ID No.: IA7213820445
Subject: Second FUSRAP Five-Year Review, IAAAP OU-8		Time: 1:14 p.m. Date: 4/7/2023
Type: ☐ Telephone ☐ Visit ☒ Email		☒ Incoming ☐ Outgoing
Location of visit: FUSRAP Project Office, Berkeley, MO		Response to phone and email.
Contact made by:		
Name: Mike Kessler	Title: Project Manager	Organization: MVSFUSRAP
Individual contacted:		
Name: Jonathan Rankins	Title: Health Physicist	Organization: USACE
Summary of conversation (Group 4 questions)		
1. What is your overall impression of the project? (General sentiment.) <i>A. Project is moving towards closeout a lot slower than expected. Too many issues within USACE MVS Contracting.</i> 2. Is the remedy functioning as expected? How well is the remedy performing? <i>A. Selected Remedy for OU-8 is working extremely well and remains protective of human health and the environment.</i> 3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing? <i>A. Yes, uranium levels at the OU-8 sites are trending towards zero.</i> 4. Is there a continual on-site Operations and Maintenance (O&M) presence? If so, describe staff and activities. If there isn't a continual on-site presence, describe staff and frequency of site inspections and activities. <i>A. No, would have to check with Construction and field engineers (other PDT members).</i> 5. Have there been any significant changes in the O&M requirements, maintenance schedules or sampling routines since startup or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Describe changes and impacts. <i>A. No significant changes.</i>		

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APPENDIX C

FIVE-YEAR REVIEW SITE INSPECTIONS

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SITE INSPECTIONS

GENERAL SITE INFORMATION

Site Name: IAAAP

Location and Region: Middletown, Iowa; USEPA Region 7

USEPA ID: IA7213820445

Agency Leading the Five-Year Review: USACE St. Louis District

Weather/Temperature: Overcast/53°F.

Table C-1. Site Inspection Team Roster

Name	Agency	Title
Michael L. Kessler	USACE St. Louis District	FUSRAP IAAAP Project Manager
Greg Rakers	USACE St. Louis District	FUSRAP Safety
David Rose	USACE St. Louis District	FUSRAP UXO/Construction Quality Assurance
Kellie Crist	IAAAP RAB	NA
Matthew Bange	Leidos	Environmental Engineer

NA – not applicable

OU-8: FIRING SITES AREA – FIRING SITE 12 AREA

The remedy for the FSA includes remediation of DU-contaminated soil and continued industrial land use. The remedy is designed to prevent exposures to DU isotopes in soil that could otherwise result in cumulative carcinogenic risk exceeding $10E-4$ and radiological doses exceeding 25 mrem per year for receptors under an industrial land use scenario.

The remedy for the FSA includes excavation of surface and subsurface soil for soil concentrations exceeding the soil RG. Physical treatment technologies (i.e., soil sorting) are used to reduce the volume of soil requiring offsite disposal. Soil exceeding the soil RG is disposed of by transfer to a properly permitted offsite disposal facility. Below-grade structural surfaces exposed during soil excavation at the FSA are also surveyed for the presence of DU-contaminated soil. If DU-contaminated soil is found adhered to these surfaces, the structural surface is decontaminated. If the structural surface cannot be decontaminated, the surface would be sealed and abandoned with LUCs or demolished and removed without replacement. Continued industrial land use would be supported by use restrictions and outgrants administered by the Army as part of its land management responsibilities.

Access to the FSA required signing a daily access/security log and then passing through a chain-link gate near Building FS-1. The road from the gate to the FS-12 Area is gravel and well maintained. No signs of vandalism or trespassing at the site were observed. Excavation and site drainage plans are available and current. The site safety plan is also available and current. Personnel are required to wear the appropriate PPE when excavation is ongoing.

In most of the previously excavated areas, the land was backfilled and had a vegetation cover established. In the excavated areas east of the former FS-12 bunker, soil is stockpiled for later use. A stockpile of greater-than-RG soil awaiting shipment was located northeast of the former FS-12 bunker location. Soilworks® Soiltac soil stabilization product was used to reduce wind and water erosion of stockpiled greater-than-RG soil. Silt fencing and earthen berms are used to slow and contain sediment and thus minimize erosion in all areas without re-established vegetation. These drainage controls are in satisfactory condition.

The field team concluded implementation of the remedy was effective in those areas that had been remediated, either by hand or mechanical means, and verified.

Site Map



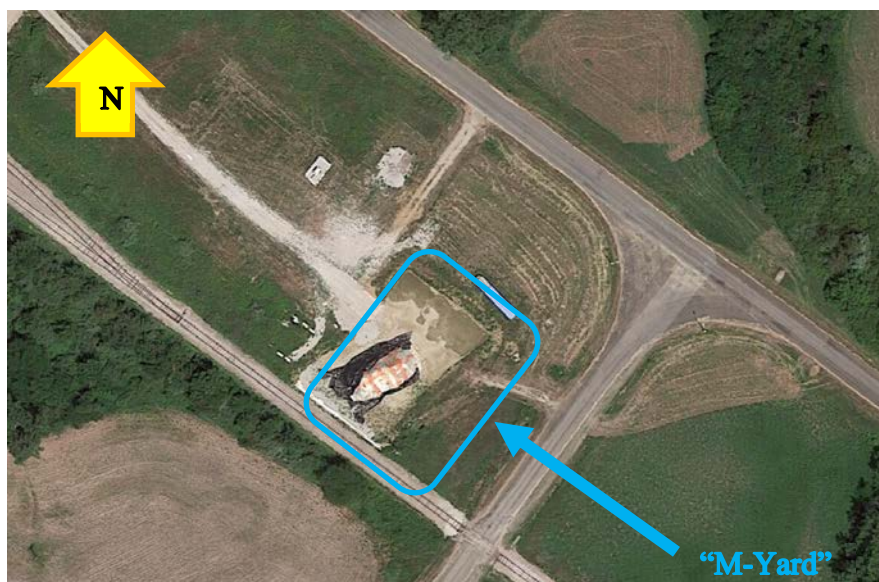
Firing Site Area

OU-8: M-YARD

The field team also inspected the M-Yard. The M-Yard, which did not require remediation, is the location from which greater-than-RG soil is loaded onto rail cars for transportation to a properly permitted offsite disposal facility. The location is active only during loading operations. The road, loading ramp, and containment berm were well maintained. No signs of vandalism or trespassing at the site were observed.

A stockpile of greater-than-RG soil awaiting shipment was in the containment berm. Soilworks® Soiltac soil stabilization product was used to reduce wind and water erosion of stockpiled greater-than-RG soil at the M-Yard.

Site Map



M-Yard

Yards C, G, and L

The remedy at Yards C, G, and L includes continued industrial land use. The land use at each of the Yards is still industrial. No new construction was noted at any of the Yards.



Yard C



Yard G



Yard L

APPENDIX D

**DETAILED RESPONSES TO TECHNICAL ASSESSMENT QUESTION B FOR
OPERABLE UNIT 8**

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QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection still valid?

Yes.

The exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of remedy selection are still valid, and any changes in these values have no impact on health protectiveness. As of the writing of this FYRR, remediation of DU-contaminated soil to meet the soil RG is still ongoing at the FSA; however, evaluations of soil in portions of the FS-12 Area where remediation is complete (i.e., WSU, WCSU, ESU, and associated RUSUs), using updated toxicity data, demonstrate the continued health protectiveness of the remedy as applied to the FUSRAP ROD receptor (i.e., a site worker) in those areas.

An evaluation of the structural surface RG using updated toxicity data in this FYRR has confirmed the continued health protectiveness of the remedy relative to the FUSRAP ROD receptor, (i.e., a site worker). The results of the site worker structural surface RG analysis in this FYRR demonstrate that the original RG is more health protective than derived concentration guideline levels (DCGLs) calculated using updated toxicity data.

CHANGES IN STANDARDS AND TO BE CONSIDERED

During soil RAs, which are ongoing at the FSA, location-specific, chemical-specific, and action-specific ARARs established in the FUSRAP ROD have been met. A list and analyses of the three ARARs identified for OU-8 in the FUSRAP ROD are presented in Table D-1 (USACE 2011a). The analysis shows that all three standards continue to be relevant and appropriate, in the context of current site conditions and the remedies being implemented.

Table D-1. Analysis of Location-, Chemical-, and Action-Specific ARARs for OU-8 FUSRAP Remediation of DU-Contaminated Soil and Soil on Structural Surfaces

ARAR Citation	Excavation of DU-Contaminated Soil with Physical Treatment and Offsite Disposal
	Decontamination/Replacement of Structures
Endangered Species Act 16 <i>U.S. Code (USC)</i> §1538(a)(1)	Location-specific ARAR from the FUSRAP ROD (USACE 2011a). These provisions prohibit the illegal taking of a federally listed endangered species. Federal agencies are required to ensure their actions do not jeopardize the continued existence of a listed species or result in destruction of or adverse modification of its critical habitat. A federally listed endangered species, the Indiana bat, may be found as a transient species within the FUSRAP areas of IAAAP. Therefore, these requirements continue to be relevant and appropriate for RAs conducted within OU-8. The selected remedy will comply with these provisions.

**Table D-1. Analysis of Location-, Chemical-, and Action-Specific ARARs for OU-8
FUSRAP Remediation of DU-Contaminated Soil and Soil on Structural Surfaces
(Continued)**

ARAR Citation	Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal
	Decontamination/Replacement of Structures
10 <i>CFR</i> 20 Subpart E, 10 <i>CFR</i> 20.1403(b) and (e) (U.S. Nuclear Regulatory Commission [NRC] Radiological Criteria for License Termination)	Chemical-specific ARAR from the FUSRAP ROD (USACE 2011a). These provisions identify the criteria under which a site is acceptable for license termination under restricted conditions. Title 10 <i>CFR</i> 20.1403(b) requires provisions for legally enforceable ICs that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem per year. Title 10 <i>CFR</i> 20.1403(e) requires that the annual dose to an average member of the critical group is as low as reasonably achievable (ALARA) and would not exceed 100 mrem per year if LUCs are no longer present. These criteria continue to be relevant and appropriate to the cleanup of DU-contaminated soil and structures at the FSA under the FUSRAP. They were used to develop the industrial RGs for soil and structures. The selected remedy will comply with these criteria through the excavation and offsite disposal of soil and structural material that exceed the industrial RGs.
10 <i>CFR</i> 20 Subpart B, 10 <i>CFR</i> 20.1101(d) (Radiation Protection Program)	Action-specific ARAR from the FUSRAP ROD (USACE 2011a). These provisions impose a constraint on air emissions of radioactive material to the environment, excluding radon (Rn)-222 and its daughters, such that the highest individual dose to the public will not exceed 10 mrem per year. These requirements continue to be relevant and appropriate to actions involving releases of airborne radioactive materials during remediation. The selected remedy will comply with these provisions.

CHANGES IN EXPOSURE PATHWAYS, EXPOSURE ASSUMPTIONS, AND RISK ASSESSMENT METHODS

No changes in land use or physical characteristics at OU-8 have occurred that would lead to a change in the COCs, potential receptors, exposure pathways, or exposure assumptions that were applied during remedy selection and the development of the FUSRAP ROD RGs for both soil and structural surfaces. Additionally, no changes in the radiological risk assessment methods or the RESRAD-ONSITE Version 7.2 model, which is used to evaluate ELCR risks and doses associated with exposures to DU in soil, have occurred. However, one change has been made to an exposure assumption, the site worker soil ingestion rate, which is applied to the risk and doses assessments being conducted to verify remediation of the FSA. The soil RG assumes that during a typical working day, the worker is assumed to spend 8 hours outdoors and will ingest 50 mg of soil (i.e., 18.25 g/year). However, since the first FUSRAP FYR, and due to a comment from USEPA during preparation of the WCSU PRAR (USACE 2020a), the soil ingestion rate for the site worker has been increased from 50 mg/day to 100 mg/day. This results in an updated RESRAD-ONSITE model input value of 25 g/year for soil ingestion.

Another change occurred since the first FUSRAP FYR. In December 2022, an updated version of the RESRAD-BUILD model, which is used to evaluate DU in soil on structures at OU-8, was released. The current model version, Version 4.0, provides for a new default value of 0.00039 m/sec for deposition velocity, which represents the mean of the uncertainty distribution. The deposition velocity contributes to calculations of risk and dose for two pathways in the RESRAD-BUILD Version 4.0 model: external radiation exposures to surface deposition (i.e., onto floors) and ingestion of deposition. Prior to Version 4.0, the default value for deposition velocity had been 0.01 m/sec. The structural surface RG was derived in the FUSRAP FS (USACE 2011b) using the deposition velocity of 0.01 m/sec.

Evaluations of Depleted Uranium in Soil

Human Health Risk and Dose

During the FUSRAP RI, a human health risk and dose assessment of the DU isotopes (i.e., U-234, U-235, and U-238) in soil was performed using RESRAD Version 6.3 that was developed at Argonne National Laboratory (ANL) for the DOE and released in December 2007. The RESRAD model, which is part of a family of RESRAD codes developed for the DOE for modeling ELCR and dose, was designed to assess radiation exposures to a human receptor located on top of radiologically contaminated soil. Modeling ELCR and dose using the RESRAD codes is an acceptable standard industry practice which has been applied by the USACE St. Louis FUSRAP for nearly 20 years. For USACE St. Louis FUSRAP Sites, including IAAAP OU-8, the RESRAD models are used to calculate the maximum ELCR and dose to a receptor(s) that could occur over a 1,000-year evaluation period.

Following the completion of the FUSRAP RI (USACE 2008), RESRAD Version 6.4, an update to RESRAD Version 6.3, was used during the preparation of the FUSRAP FS (USACE 2011b) to calculate risk- and dose-based DCGLs for the individual isotopes of DU (i.e., U-234, U-235, and U-238) that were ultimately used as the basis for determining the FUSRAP ROD soil RG of 150 pCi/g for a site (industrial) worker. The DCGLs that were used to calculate the RG are the minimum levels corresponding to the time of maximum dose or ELCR over a 1,000-year period. The soil RG was derived based on a 1E-04 ELCR to a site worker hypothetically exposed to DU via soil ingestion, dust inhalation, and external ground radiation. Since selection of the remedy and establishment of the soil RG, the DOE has released three updates to the RESRAD model: RESRAD Version 6.5 (October 2009), RESRAD Version 7.0 (April 2014), and the current version, RESRAD-ONSITE Version 7.2 (July 2016). None of these updates include changes in the model that would have resulted in changes to the exposure assumptions or to the methods used in calculating pathway-specific and total ELCRs and doses that were used to derive the soil RG for the FUSRAP ROD.

Ecological Risk to Terrestrial Biota

Regarding ecological risks associated with DU in soil, the FUSRAP ROD (USACE 2011a) focused on protection of an endangered species, the Indiana bat, in a manner consistent with Appendix M of the *Baseline Ecological Risk Assessment (BERA), Iowa Army Ammunition Plant, Middletown, Iowa* (USACE 2004) and the *Explanation of Significant Differences for the Interim Action Record of Decision (Irod) Soils Operable Unit (OU-1) Addition of Environmental Protectiveness to the Remedy and Transfer of Sites from OU-4 to OU-1 for Iowa Army Ammunition Plant, Middletown, Iowa* (Tetra Tech 2008). The approved FUSRAP RI (USACE 2008) and FUSRAP FS (USACE 2011b) established that no ecological risks to the Indiana bat exist, thus no ecological RAOs were established in the FUSRAP ROD. The ecological risk evaluations performed included evaluations of soil and sediment. Because Indiana bats tend to inhabit exfoliating trees and have very little potential for direct or indirect contact with DU in soil, the soil

RG is protective of the bat. This is reinforced by the fact that the soil RG was derived based on direct contact exposures to soil for the most likely receptor (i.e., a site worker). Evaluations of the Indiana bat in the FUSRAP RI indicated that exposures to soil would likely be indirect in nature via the ingestion of insects that emanate from larvae in the soil. However, with most of the DU contamination in soil at the FSA being present in the form of solid fragments, an insignificant potential exists for bioavailability to bats foraging on insects exposed to area soil.

Additionally, since finalization of the FUSRAP ROD, the soil RG has been applied to ongoing soil and DU fragment removals that have resulted thus far in the excavation and removal of soil and DU fragments from portions of the FSA. These removal actions have further reduced the chances for ecological exposures to DU, as well as the potential for environmental migration of DU to sediments in Long Creek. The potential for ecological exposures will continue to decline as remediation progresses.

As an additional evaluation of potential ecological risks to terrestrial receptors in this FYR, a post-remedy SLERA was conducted for FS-12 Area land area SUs and RUSUs for which PRAR-FSSE documentation has been finalized since the first FUSRAP FYR (i.e., WSU, WCSU, and ESU). The RUSUs were evaluated as part of the WCSU PRAR, which included RUSUs 1 through 142, and the ESU PRAR, which included RUSUs 143 through 198. As was the case in the human health evaluations in the respective PRAR-FSSEs, the land area SUs and the RUSUs were evaluated separately for ecological risks. For the SLERA, analytical data have been combined across the WSU, WCSU, and ESU and evaluated collectively for potential post-remedy risks to sensitive terrestrial receptors, beyond those with protected species status (e.g., the Indiana bat that was evaluated under the FUSRAP ROD), assumed to be exposed to residual soil concentrations of the DU isotopes (i.e., U-234, U-235, U-238), as well as elemental uranium. Similarly, the data for all RUSUs (i.e., 1 through 198) have also been combined to assess potential ecological risks from U-234, U-235, U-238, and elemental uranium concentrations in backfill soil applied across all mechanically excavated land area SUs. The intent of this SLERA is to provide supplemental information regarding protectiveness of the remedy for sensitive terrestrial receptors to determine if NFA for terrestrial receptors is appropriate.

Table D-1-1 in Attachment D-1 presents statistical U-234, U-235, and U-238 data summaries for the combined land area SUs (i.e., WSU, WCSU, and ESU) and the combined RUSUs (i.e., 1 through 198). Not including field QC samples, a total of 1,769 samples were collected across the land area SUs and 2,229 samples were collected from RUSUs 1 through 198. It is worth noting that Table D-1-1 presents a maximum land area U-238 concentration of 903 pCi/g, which was detected in the sample collected from SU 7 (in the ESUs), location IHTZ211553. According to the field logs, this elevated activity is due to the presence of a DU fragment observed in the soil sample. Because the sampling process has resulted in the removal of the fragment from the ESU, this outlier result is not representative of the post-remedy concentrations that remain throughout the remaining WSU, WCSU, and ESU, which equates to an area of 167,258 m². However, to provide a conservative assessment of potential risks to sensitive terrestrial receptors, the maximum U-238 result was retained in the data set for this analysis.

Through side-by-side presentation of summary statistics calculated for the land area SUs and the RUSUs Table D-1-1 also shows that some overlap exists in the data between the SUs and RUSUs. Although the maximum and maximum detected concentrations in the land area SUs are slightly greater for all three DU isotopes than the corresponding maximums in the RUSUs, the mean concentrations for all three isotopes determined for the land area SUs are slightly less than the corresponding RUSU mean concentrations. The 95 percent upper confidence limit (UCL₉₅) of the arithmetic mean values for U-234 and U-235 in the land area SUs are slightly greater than the

corresponding UCL₉₅ values calculated for the RUSUs. However, the U-238 UCL₉₅ in the land area SUs is slightly greater than the RUSUs UCL₉₅ for U-238. The overlap in the statistics suggests possible differences exist in the skewness between the land area SU and RUSU data sets, all of which were determined to be nonparametric. Another explanation for the overlap is that the reuse soil is soil that was excavated from the land area SUs and that had DU concentrations less than the soil RG. During the physical treatment process (via a mechanical radiological scanning and soil sorting system), 100 percent of the mechanically excavated soil from land area SUs was scanned using the soil sorting system. When DU concentrations were detected below the set point, those soil sections were diverted to the reuse soil pile. Therefore, it is not unexpected that there could be statistical overlaps between the land area SU and RUSU data sets.

Next, U-234, U-235, U-238, and elemental uranium were evaluated to determine if they should be retained as contaminants of potential ecological concern (COPECs) for the land area SUs and the RUSUs. To facilitate this in a manner that is considered representative of the large, combined area of the WSU, WCSU, and ESU, and the large, combined volume of reuse soil, exposure point concentrations (EPCs) were calculated for the DU isotopes at the land area SUs and the RUSUs. An EPC was determined to be the lesser of the UCL₉₅ and the maximum concentration, minus the mean background concentration. The mean background values are those presented in Table 8-2 of the FUSRAP RI (USACE 2008). The UCL₉₅ results were calculated using the ProUCL Version 5.2 *Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations* (USEPA 2022a). Data censoring of radionuclides (i.e., between detects and nondetects) was not performed, so all results were entered into ProUCL as detections, for consistency with St. Louis FUSRAP standard practice and USEPA's *Technical Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations* (USEPA 2022b). Because the UCL₉₅ values were less than the corresponding maximum concentrations for all land area SUs and RUSUs, the EPCs above background for the DU isotopes were determined based on the UCL₉₅ minus the corresponding mean background concentration. EPC and UCL₉₅ calculations for the land area SUs are presented in Attachment D-1, Tables D-1-2 and D-1-3, respectively. EPC and UCL₉₅ calculations for the RUSUs are presented in Attachment D-1, Tables D-1-4 and D-1-5, respectively.

Although verification sampling at the land area SUs and RUSUs included analyses of uranium isotopes, elemental uranium was not included in the laboratory analyte list. Therefore, elemental uranium concentrations were calculated as mass concentration equivalents corresponding to selected statistical values for U-238 concentrations presented in Table D-1-1. U-238 was used as the basis for the activity-to-mass conversions because DU is 99.8 percent comprised of U-238 by weight. The calculations of elemental uranium concentrations for the combined land area SUs and combined RUSUs 1 through 198 are presented in Attachment D-1, Tables D-1-6 and D-1-7, respectively. It should be noted that the EPCs for elemental uranium were calculated from the UCL₉₅ values for U-238, without background subtraction.

The EPCs for the DU isotopes and elemental uranium were compared to ecological screening values (ESVs) that were obtained from Oak Ridge National Laboratory's (ORNL's) online *Ecological Benchmark Tools for Radionuclides and Chemicals* (ORNL 2023) to determine if they should be retained as COPECs for further evaluations. The ESVs include USEPA Region 6 Biota Concentration Guide (BCG) values and Los Alamos National Laboratory (LANL) low-effect and no-effect ECORISK values. For the DU isotopes, the comparisons were performed using a sum of fractions (SOF) approach, for each terrestrial receptor, across all radionuclides, using the equation below.

$$SOF_{TR} = \left(\frac{EPC_{U-234}}{ESV_{U-234}} \right) + \left(\frac{EPC_{U-235}}{ESV_{U-235}} \right) + \left(\frac{EPC_{U-238}}{ESV_{U-238}} \right)$$

Where:

SOR_{TR} = Sum of fractions for terrestrial receptor, unitless

EPC_{U-234} = EPC for U-234, pCi/g

EPC_{U-235} = EPC for U-235, pCi/g

EPC_{U-238} = EPC for U-238, pCi/g

ESV_{U-234} = Receptor-specific ESV for U-234, pCi/g

ESV_{U-235} = Receptor-specific ESV for U-235, pCi/g

ESV_{U-238} = Receptor-specific ESV for U-238, pCi/g

In this equation, if the SOF for a receptor is less than or equal to 1.0, then the site concentration is less than the receptor-specific ESVs across all DU isotopes and no further evaluation is required. However, if the SOF exceeds 1.0, then at least one of the ESVs is exceeded and further actions are required. Exceedance of an ESV results in the DU isotope(s) being retained as a COPEC.

For determination of elemental uranium as a COPEC, the EPC was compared to each receptor-specific ESV as a ratio of the EPC to the ESV. The quotient of this ratio is the receptor hazard quotient (HQ). If an HQ is less than 1 for a receptor, then elemental uranium is not retained as a COPEC for the receptor and no further evaluation is required. However, if an HQ exceeds 1 for a receptor, then elemental uranium is identified as a COPEC for the receptor and further action is required.

For the combined land area SUs, the SOF calculation for DU isotopes and HQ calculations for elemental uranium are presented in Attachment D-1, Tables D-1-8 and D-1-9, respectively. Based on the SOF calculations presented in Table D-1-8, no ESV exceedances occur for the DU isotopes. Therefore, no radiological COPECs are identified for the land area SUs. However, Table D-1-9 shows an ESV exceedance of the USEPA Region 6 BCG for plants (5 mg/kg) by the elemental uranium EPC (15.35 mg/kg) in the combined land area SUs, which resulted in a HQ of 3.1. None of the other LANL low-effect or no-effect ESVs were exceeded by the EPC in the land area SUs. Despite the exceedance, elemental uranium is not being retained as a COPEC in the land area SUs for the following reasons.

- The Region 6 BCG represents the lowest value presented in Table D-1-8 and is five times less than the next higher ESV of 25 mg/kg (i.e., for LANL No Effect level for Generic Plant).
- USEPA Region 6 generally recommends the use of 25 mg/kg as the ESV, which is consistent with the LANL No Effect level for Generic Plant (USEPA 2018). The EPC for the land area SUs is less than the 25 mg/kg ESV.
- The EPC is less than all of the avian and mammalian ESVs applied to the analysis.

For the combined RUSUs 1 through 198, the SOF calculation for DU isotopes and HQ calculations for elemental uranium are presented in Attachment D-1, Tables D-1-10 and D-1-11, respectively. Based on the SOF calculations presented in Table D-1-10, no ESV exceedances occur for the DU isotopes. Therefore, no radiological COPECs are identified. However, Table D-1-11 shows an ESV exceedance of the USEPA Region 6 BCG for plants (5 mg/kg) by the elemental uranium EPC

(12.41 mg/kg) in RUSUs 1 through 198, which resulted in a HQ of 2.5. None of the other LANL low-effect or no-effect ESVs were exceeded by the EPC in RUSUs 1 through 198. Despite the exceedance, elemental uranium is not being retained as a COPEC in the land area SUs for the following reasons.

- The Region 6 BCG represents the lowest value presented in Table D-1-11 and is five times less than the next higher ESV of 25 mg/kg (i.e., for LANL No Effect level for Generic Plant).
- USEPA Region 6 generally recommends the use of 25 mg/kg as the ESV, which is consistent with the LANL No Effect level for Generic Plant (USEPA 2018). The EPC for the land area SUs is below the 25 mg/kg ESV.
- The EPC is less than all of the avian and mammalian ESVs applied to the analysis.

In summary, because the post-remedy concentrations of the DU isotopes and elemental uranium do not warrant further evaluations of either the combined land area SUs or RUSUs 1 through 198, they are not likely to be harmful to populations of ecological receptors. Therefore, the results of the SLERA indicate that the remedy is protective of all terrestrial receptor types.

Evaluations of Depleted Uranium in Soil on Structural Surfaces

Similarly, during the FUSRAP FS (USACE 2011b), a structural surface RG (i.e., 23,000 dpm/100 cm²) was derived for the FUSRAP ROD to determine the need for remediation of interior/exterior building surfaces and components at OU-8. This determination was made through RG comparisons with total and removable gross alpha and beta survey results for interior and exterior building surfaces and components. The structural surface RG was derived using the DOE RESRAD-BUILD model Version 3.4 (i.e., RESRAD-BUILD 3.4), which was developed for assessing radiation exposures to a human receptor inside of a contaminated building or a building containing contaminated surfaces (e.g., walls, floors, furniture, equipment, etc.). The structural surface RG was derived for the FUSRAP ROD based on a 1E-04 ELCR to a site worker hypothetically exposed in a hypothetical room, measuring 10-m by 10-m, and with a ceiling height of 2.5 m. The modeled scenario assumes that DU-contaminated soil in the room is present on the floor and all four walls of the room. Receptor exposures are assumed to occur via ingestion, dust inhalation, and external radiation (i.e., external radiation exposures to sources of infinite volume, planar surface sources, and air submersion). The modeled source term assumed unit concentrations (pCi/m²) of DU isotopes present at site DU activity fractions of 90.14 percent, 1.45 percent, and 8.4 percent for U-238, U-235, and U-234, respectively. The activity fractions were applied to dose-to-source ratios (DSRs) and risk-to-source ratios (RSRs) determined from model outputs to calculate the DCGLs for each isotope, based on the apportioned target dose and ELCR of 25 mrem per year and 1E-04, respectively. The isotope-specific DCGLs were then converted to units of dpm/100 cm² and summed over the three isotopes to produce the dose-based and risk-based DCGLs for DU in soil on structural surfaces. The more health-conservative of these DCGLs, (i.e., 23,000 dpm/100 cm²) was selected as the structural surface RG for the FUSRAP ROD.

In October 2009, RESRAD-BUILD Version 3.5 was released and was used in FUSRAP risk and dose assessments until December 2022, when RESRAD-BUILD Version 4.0 was released. The update to Version 4.0 has not resulted in any significant changes in exposure assumptions or methods but does include recent updates in CSF and DCF model libraries, as discussed in greater detail in the following section.

CHANGES IN TOXICITY OR CONTAMINANT CHARACTERISTICS

No changes have occurred in the known chemical/physical characteristics of DU or the radiological components of DU (U-234, U-235, and U-238) since publication of the FUSRAP ROD (USACE 2011a). Additionally, since the first FUSRAP FYR, there have been no updates to toxicity data relating to the noncancer effects attributable to elemental uranium. During the first FUSRAP FYR, a health protectiveness evaluation concluded that the remedy, as it is applied to meet the soil RG, is health protective of a site worker from potential noncancer effects. Therefore, no further evaluation of noncancer toxicity of uranium is necessary for this FYR.

However, since publication of the FUSRAP ROD, radionuclide-and pathway-specific DCFs and CSFs, used to calculate doses and ELCRs, respectively, have been updated, as documented in the technical memorandum (TM) *Calculation of Slope Factors and Dose Coefficients* (ORNL 2014). According to this document, the recalculations of CSFs and DCFs incorporate the latest energy and decay chain information that is currently available in the International Commission on Radiological Protection (ICRP) Publication 107 (ICRP 2008). ICRP-107 contains a revised database of nuclear decay data (energies and intensities of emitted radiations, physical half-lives, and decay models) for 1,252 naturally occurring and manmade radionuclides and supersedes the previous database, ICRP-38, which was published in 1983 (ICRP 1983). ORNL presents tables that include the contribution of daughter products in secular equilibrium with their longer-lived parents (ORNL 2014). Information for progeny nuclides associated with a 100- and 1,000-year period of ingrowth, are available. The USACE St. Louis FUSRAP assessed ELCR and dose contributions from decay ingrowths occurring over a 1,000-year period of evaluation for DU in soil and DU in soil on structures at OU-8 during the FUSRAP RI. The 1,000-year period of evaluation was also later applied to RG development and remedy selection in the FUSRAP FS (USACE 2011b), *FUSRAP Proposed Plan for the Iowa Army Ammunition Plant* (USACE 2011c), and FUSRAP ROD (USACE 2011a).

The ORNL 2014 CSF and DCF updates were discussed extensively in the First FUSRAP FYRR (USACE 2019b) relative to their incorporation into the RESRAD-ONSITE Version 7.2 Model for soil evaluations. These same factors, which do not differ between evaluations for soil and structural surfaces, are now included in the RESRAD-BUILD Version 4.0 model. In the First FUSRAP FYRR, the ORNL 2014 CSFs and DCFs for all internal and external pathways were compared with those used in the past, particularly those used to derive the risk-based soil RG in the FUSRAP FS (USACE 2011b). The same CSFs and DCFs used to derive the soil RG were also used to derive the structural surface RG in the FUSRAP FS (USACE 2011b). Therefore, the same presentations of the ORNL 2014 CSFs and DCFs made in the First FUSRAP FYRR (USACE 2019b) are not repeated in this FYRR.

In August 2019, after finalization of the First FUSRAP FYRR, USEPA released updated, age-specific external radiation DCFs in *Federal Guidance Report No. 15: External Exposure to Radionuclides in Air, Water and Soil* (FGR 15) (USEPA 2019). In FGR 15, age-specific external radiation DCFs are now available for the following pathways: external radiation from surface and depth-specific sources (i.e., including ground surface, 1 cm, 5 cm, 15 cm, and infinite depth), air submersion, and water immersion. Receptor ages include newborn, 1-year-old, 5-year-old, 10-year-old, 15-year-old, and adult. The FGR 15 external radiation DCFs are not currently available in the DCFPAK3.02 library of either the RESRAD-ONSITE Version 7.2 or RESRAD-BUILD Version 4.0 model libraries. Of the available external radiation DCFs historically used in FUSRAP evaluations, the external radiation DCFs for infinite depth have the greatest significance and contribution to total receptor dose. Table D-2 below presents a comparison between the ORNL

2014 external radiation DCFs that are currently available for the DU isotopes in the latest RESRAD-ONSITE and RESRAD-BUILD models, versus those in FGR 15 for an Adult (i.e., worker) that are not available in the model. DCFs for decay chain radionuclides of U-234, U-235 and U-238 are also presented for 1,000-year decay chain radionuclides (ORNL 2014) and decay chain radionuclides for which dose and risk results are presented in the RESRAD-ONSITE Version 7.2 and/or the RESRAD-BUILD Version 4.0 models. Table D-2 shows that most of the FGR 15 DCFs are greater than the corresponding DCFs calculated by ORNL.

Table D-2. External Radiation (Infinite Depth) DCFs for DU Isotopes

Radionuclides Associated with DU	External Radiation DCFs Infinite Depth (mrem/yr per pCi/g)	
	ORNL 2014	USEPA FGR 15 (Adult) ^a
Ac-227 ^b	2.62E-04	4.33E-04
Pa-231 ^b	1.61E-01	1.59E-01
Pa-234 ^c	8.28E+00	8.29E+00
Pa-234m ^c	1.26E-01	4.46E-01
Pb-210 ^b	2.09E-03	2.35E-03
Po-210 ^{b,d}	5.64E-05	5.60E-05
Ra-226 ^b	3.18E-02	3.21E-02
Th-230 ^b	1.11E-03	1.16E-03
Th-231 ^c	3.25E-02	4.69E-02
Th-234 ^c	2.32E-02	2.99E-02
U-234	3.46E-04	3.51E-04
U-235	7.01E-01	7.06E-01
U-238	1.71E-04	1.72E-04

^a FGR-15 DCFs were converted from SI Units of Sv/s per Bq/m³

^b Decay chain progeny for which results are provided by RESRAD-ONSITE 7.2 and/or RESRAD-BUILD 4.0

^c Identified as a 1,000-year decay chain isotope (ORNL 2014).

^d The organic form of Po-210 is assumed for soil ingestion and ingestion of soil (dust) on structural surfaces (USEPA 2019)

Note:

Ac – actinium; Pa – protactinium; Pb – lead; Po – polonium; Ra – radium; Th – thorium

Because the FGR-15 DCFs are not available in either model, evaluations are necessary to (1) determine the continued validity and health protectiveness of the current FUSRAP ROD soil and structural surface RGs, and (2) determine the impacts of applying the FGR 15 external radiation DCFs to soil and structural risk and dose assessments that have been recently completed for OU-8. Therefore, for this evaluation, the CSFs and DCFs that are currently not included in the RESRAD-ONSITE Version 7.2 and RESRAD-BUILD Version 4.0 model base libraries and that were not evaluated during the first FUSRAP FYR have been included into modified model libraries for the purpose of assessing the continued validity and health protectiveness of the site worker soil and structural surface RGs. The FGR 15 external radiation DCFs used in this evaluation are the infinite depth DCFs for consistency with past use of external radiation DCFs at IAAAP. Also, the infinite depth DCFs result in the most health-conservative estimates of dose relative to the other depth-specific DCFs. Additionally, the ORNL 2014 soil ingestion CSFs for the “Soil Worker” have also been used in the modified libraries to replace the model default dietary CSFs. The use of dietary CSFs as default values in the DCFPAK3.02 RESRAD model libraries was discussed in the First FUSRAP FYRR (USACE 2019b).

The detailed analyses of the validity of the soil and structural surface RGs for the site worker are presented in Attachments D-1 and D-2, respectively. Following evaluations of the RGs, the impacts

of using the default DCFPAK3.02 model libraries versus the modified libraries are evaluated using soil EPCs from the *Post-Remedial Action Report and Final Status Survey Evaluation for the Firing Site 12 Area West Survey Units at the Iowa Army Ammunition Plant* (WSU PRAR) (USACE 2019a), WCSU PRAR (USACE 2020a), and ESU PRAR (USACE 2021a), as well as EPCs from the Line 1 RACR) (USACE 2020b). The detailed evaluations for the FS-12 Area soil and the Line 1 structures are presented in Attachments D-3 and D-4, respectively.

Verification of the Site Worker Remediation Goal for Depleted Uranium in Soil

Because of the release of updated external radiation DCFs for infinite volume in USEPA's FGR 15 (USEPA 2019) since the First FUSRAP FYR, this evaluation verifies the continued validity health-protectiveness of the site worker soil RG that was derived in the FUSRAP FS (USACE 2011b). Verification is performed by incorporating the FGR 15 adult DCFs into a modified DCFPAK3.02 (Adult) dose library of the RESRAD-ONSITE Version 7.2 model and calculating risk- and dose-based DCGLs for the site worker that are compared to the RG (i.e., as hypothetical recalculations of the RG). Like derivation of the RG, the DCGLs target an ELCR of 1E-04 (corresponding to the upper limit of the USEPA's risk range) and the dose limit of 25 mrem/yr. The RG was established in the FUSRAP ROD (USACE 2011a) based on the target excess lifetime cancer risk (TELCR) of 1E-04. Also, for the DCGL calculations, dietary CSFs incorporated as model default values in the DCFPAK3.02 Morbidity risk library are replaced with ORNL 2014 worker soil ingestion CSFs. Most of the exposure factors and all other model input values that were used in the RG derivation are not changed in this evaluation, except for the soil ingestion rate, which has been updated from 18.25 g/year to 25 g/year, which corresponds to USEPA's default value of 100 mg/day (USEPA 2014a). Details regarding this evaluation, along with the model outputs, are presented in Attachment D-1.

Following calculations of the risk- and dose-based DCGLs, the risk-based DCGL of 148 pCi/g for U-238 was selected as being the most health protective value for comparison with the soil RG. The evaluation concludes that use of the RESRAD-ONSITE Version 7.2 model with the updated ORNL 2014 DCFs and CSFs, along with the more recent FGR 15 external radiation DCFs and the modified soil ingestion rate for the site worker, results in a U-238 DCGL (148 pCi/g) that approximates the RG (150 pCi/g). Therefore, the soil RG established in the FUSRAP ROD (USACE 2011a) is still valid and the remedy being applied to the DU-contaminated soil at OU-8 remains health-protective.

Verification of the Site Worker Remediation Goal for Depleted Uranium in Soil on Structural Surfaces

The December 2022 release of the RESRAD-BUILD Version 4.0 has prompted a review of the structural surface RG of 23,000 dpm/cm² established for the site worker in the FUSRAP ROD (USACE 2011a). The structural surface RG for the site worker was determined in the FUSRAP FS (USACE 2011b) from among risk- and dose-based DCGLs calculated for the site worker using RESRAD-BUILD Version 3.4, which was released in December 2007. CSFs and DCFs utilized during the original DCGL calculations were available in the *Federal Guidance Report No. 13: Cancer Risk Coefficients for Environmental Exposure to Radionuclides* (FGR-13) (USEPA 1999) Morbidity library of the RESRAD-BUILD Version 3.4 model. The DCFs in the FGR-13 Morbidity library were obtained from *Federal Guidance Report No. 11: Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion* (FGR-11) for ingestion and inhalation (USEPA 1988), and from *Federal Guidance Report No. 12: External Exposure to Radionuclides in Air, Water, and Soil* (FGR-12) for external radiation DCFs (USEPA 1993). The morbidity CSFs in the FGR-13 Morbidity library were

obtained from FGR-13 for all pathways (USEPA 1999). The FGR-13 Morbidity library incorporated ICRP-38 data for nuclide energies and decay chains (USEPA 1999).

Subsequently, Version 3.5 was released in October 2009, but with no updates to the CSF and DCF model libraries. After the 2009 release of the Version 3.5 model, updated CSFs and DCFs were published in a September 2014 ORNL TM (ORNL 2014). The ORNL 2014 CSFs and DCFs are based on updated data for nuclide energy and decay chain information from ICRP-107 (ICRP 2008). The ORNL updates were not available in the RESRAD-BUILD Version 3.5 at the time of the First FYR; however, a comparative evaluation between the updated ORNL factors versus those in the FGR 13 Morbidity library of RESRAD-BUILD Version 3.5 showed that there would be no significant difference in model results generated if either the ORNL or FGR 13 Morbidity library CSFs and DCFs were used. In August 2019, after finalization of the First FUSRAP FYRR, USEPA released updated, age-specific external radiation DCFs in FGR 15 (USEPA 2019).

Therefore, as part of this second FYR, verification of the site worker structural surface RG is conducted utilizing the latest DCFs and CSFs from ORNL that are currently available in the DCFPAK 3.02 (Adult) library of the RESRAD-BUILD Version 4.0 model (ORNL 2014). One difference between the DCFPAK3.02 library and the ORNL TM is that the model library applies dietary CSFs by default to the ingestion pathway, rather than the soil ingestion CSFs available in the TM. Additionally, the FGR 15 external radiation DCFs are not currently available in the DCFPAK3.02 library. Therefore, this evaluation incorporates all of the most recent CSF and DCF updates. Aside from the CSF and DCF updates, all other model input values that were used in the RG derivation are not changed in this evaluation to provide consistency with the original RG calculations. Details regarding this evaluation, along with the model outputs, are presented in Attachment D-2.

Following calculations of the risk- and dose-based DCGLs, and considering only the DCGLs for U-238, the selected DCGL for use as an RG (hypothetically) from this evaluation would be the lower and more health protective of the two risk-based DCGLs of 25,710 dpm/100 cm². The risk-based DCGL for DU determined during the FS was 23,033 dpm/100 cm², which remains more health-protective than the current DCGL of 25,710 dpm/100 cm² calculated in this second FYR RG evaluation. This evaluation also demonstrates that the inhalation pathway continues to be the predominantly contributing exposure pathway when considering total dose to the site worker.

In conclusion, the DU structural surface DCGL recalculations in this FYR using the recently released RESRAD-BUILD Version 4.0 model with the updated ORNL (2014) DCFs and CSFs, along with the more recent FGR 15 external radiation DCFs and modified soil ingestion rate for the site worker, demonstrates that the DU structural surface RG (23,000 dpm/100 cm²) established in the FUSRAP ROD (USACE 2011a) is still valid and health-protective.

Verification of Soil Risk and Dose Results for Remediated Firing Site 12 Areas

Since the first FUSRAP FYR, soil remediation has been conducted and documentation completed for the following portions of the FS-12 Area: WSU (USACE 2019ba), WCSU (USACE 2020a) and ESU (USACE 2021a). The soil risk and dose assessments completed for these areas were conducted using the RESRAD-ONSITE Version 7.2 model. The CSFs and DCFs used are those currently in the DCFPAK3.02 library, which were calculated and published in the ORNL 2014 TM (ORNL 2014). Because the FGR 15 external radiation DCFs and 2014 worker soil ingestion CSFs were not included and utilized for these assessments, this evaluation repeats those assessments, but with the FGR 15 DCFs and worker soil ingestion CSFs incorporated into modified DCFPAK3.02 libraries. Additionally, this evaluation includes the updated worker soil ingestion rate of 25 g/year. Aside from inclusion of all updated CSFs and DCFs and the worker

soil ingestion rate, all other RESRAD-ONSITE model inputs for this evaluation remain unchanged, including the EPCs.

Both the land area SUs and RUSUs (i.e., used as backfill for the remediated land area SUs) are the subject of this evaluation. However, rather than reassessing all land SU areas and all RUSUs, only the land SU area receptor scenario and RUSU receptor scenario that resulted in the maximum risk and dose in the respective PRAR-FSSEs are evaluated. Supporting tables for this evaluation are presented in Attachment D-3 (i.e., Tables D-3-1 through D-3-4). PRAR-FSSE EPCs for land area SUs and RUSUs are presented in Attachment D-3, Tables D-3-1 and D-3-3, respectively. The corresponding PRAR-FSSE risk and dose results for the land area SUs and RUSUs are presented in Attachment D-3, Tables D-3-2 and D-3-4, respectively. Based on the most elevated risk and dose results presented in Attachment D-3, the ESU site worker (soil at 0 to 1 ft bgs depth) scenario and the RUSUs 1 to 142 site worker (deep backfill) scenario were selected for the evaluations.

Table D-3 shows the results of the risk evaluations for the site worker exposed to soil (0 to 1 ft bgs) at the ESU using the modified DCFPAK3.02 library in the RESRAD-ONSITE Version 7.2 model. These results are compared with the results obtained from the ESU PRAR (USACE 2021a) that were calculated using the default DCFPAK3.02 library. Table C-3 shows that there is no change in the risk result obtained from both evaluations (i.e., $4.2\text{E-}07$). The dose result more than doubled from 0.03 mrem per year to 0.07 mrem per year when the modified CSF/DCF library is used. Given that both the risk and dose results are well below the respective target limits of $1\text{E-}04$ and 25 mrem per year, respectively, the evaluation shows that the results outcome of the ESU risk and dose assessment is not impacted using the FGR 15 DCFs and the ORNL 2014 worker soil ingestion CSFs.

Table D-3. Risk and Dose Comparisons between Use of Default Versus Modified DCFPAK3.02 Libraries, East Survey Units

Area	Receptor Scenario	Depth	Default DCFPAK3.02 Library (PRAR-FSSE) ^{a,b}		Modified DCFPAK3.02 Library (PRAR-FSSE) ^{c,d}	
			Risk	Dose (mrem/year)	Risk	Dose (mrem/year)
ESU	Site Worker	0 to 1 ft bgs	$4.2\text{E-}07$	0.03	$4.2\text{E-}07$	0.07

^a The RESRAD-ONSITE 7.2 model default base risk “DCFPAK3.02 Morbidity” library is used for all CSFs

^b The RESRAD-ONSITE 7.2 model default base dose libraries are used. The base internal dose library is “DCFPAK3.02 (Adult)”, which includes all 2014 DCFs (ORNL 2014). The base external dose library is “DCFPAK3.02”, which includes ORNL 2014 external radiation DCFs.

^c The RESRAD-ONSITE 7.2 model base risk “DCFPAK3.02 Morbidity” library is modified to replace ORNL 2014 dietary CSFs for the ingestion pathway with the ORNL worker soil ingestion CSFs.

^d The RESRAD-ONSITE 7.2 external dose library “DCFPAK3.02” is modified to replace the 2014 external radiation DCFs for infinite depth (ORNL 2014) with the corresponding USEPA FGR 15 DCFs for infinite depth (USEPA 2019).

Table D-4 shows the results of the risk evaluations for site worker exposures to soil in RUSUs 1 to 142 (assuming the deep backfill scenario) using the modified DCFPAK3.02 library in the RESRAD-ONSITE Version 7.2 model. These results are compared with the results obtained from the WCSU PRAR (USACE 2020a) that were calculated using the default DCFPAK3.02 library. Table D-4 shows that there is no change in the risk result obtained from both evaluations (i.e., $2.8\text{E-}06$). However, the dose result doubled from 0.2 mrem per year to 0.4 mrem per year when the modified CSF/DCF library is used. Given that both the risk and dose results are well below the respective target limits of $1\text{E-}04$ and 25 mrem per year, respectively, the evaluation shows that the results outcome of the RUSUs 1 to 142 risk and dose assessment is not impacted by using the FGR 15 DCFs and the ORNL 2014 worker soil ingestion CSFs.

Both the RESRAD-ONSITE risk and dose outputs for ESU and RUSUs 1 to 142 evaluations are shown in Attachments D-3-1 and D-3-2, respectively. Both outputs indicate that the external

radiation (infinite depth) pathway is the predominant pathway, contributing greater than 96 percent of the total risk and dose, which is the explanation for the increase in dose in the ESU and RUSU evaluations, when the modified library is used. There is no change in risk because 1) the ORNL worker soil ingestion CSFs used in the modified DCFPAK3.02 library are somewhat less health-conservative than the model default ORNL dietary CSFs, and 2), soil ingestion contributes to approximately 1 percent of the total receptor risk.

Table D-4. Risk and Dose Comparisons between Use of Default Versus Modified DCFPAK3.02 Libraries, Reuse Soil Survey Units 1 to 142

RUSUs	Land SU Area Backfilled	Receptor Scenario	Default DCFPAK3.02 Library (PRAR-FSSE) ^{a,b}		Modified DCFPAK3.02 Library (PRAR-FSSE) ^{c,d}	
			Risk	Dose (mrem/year)	Risk	Dose (mrem/year)
1 - 142	WSCU	Site Worker, Deep Backfill	2.8E-06	0.2	2.8E-06	0.4

^a The RESRAD-ONSITE 7.2 model default base risk "DCFPAK3.02 Morbidity" library is used for all CSFs.

^b The RESRAD-ONSITE 7.2 model default base dose libraries are used. The base internal dose library is "DCFPAK3.02 (Adult)", which includes all 2014 DCFs (ORNL 2014). The base external dose library is "DCFPAK3.02", which includes ORNL 2014 external radiation DCFs.

^c The RESRAD-ONSITE 7.2 model base risk "DCFPAK3.02 Morbidity" library is modified to replace ORNL 2014 dietary CSFs for the ingestion pathway with the ORNL worker soil ingestion CSFs.

^d The RESRAD-ONSITE 7.2 external dose library "DCFPAK3.02" is modified to replace the 2014 external radiation DCFs for infinite depth (ORNL 2014) with the corresponding USEPA FGR 15 DCFs for infinite depth (USEPA 2019).

Verification of Soil Risk and Dose Results for the Line 1 Structural Surfaces

Site worker risk and dose were evaluated for Line 1 structural surfaces in the Line 1 RACR (USACE 2020b). The risk and dose were calculated using the RESRAD-BUILD Version 3.5 and the default CSFs and DCFs in the currently outdated FGR 13 Morbidity library. Therefore, in this evaluation, the EPCs calculated in the Line 1 RACR are used to recalculate site worker risk and dose using the RESRAD-BUILD Version 4.0 model to verify that the latest CSFs and DCFs available do not impact the results outcome of the original risk and dose assessment. Evaluations are performed using 1) the default DCFPAK3.02 libraries in the Version 4.0 model that include CSFs and DCFs from the ORNL TM (ORNL 2014), and 2) the DCFPAK3.02 libraries modified to include the USEPA's FGR 15 external radiation DCFs for infinite depth, while replacing ORNL's 2014 dietary CSFs with ORNL's 2014 worker soil ingestion CSFs for the soil ingestion pathway. All other RESRAD-BUILD model inputs for this evaluation remain unchanged, including the EPCs, the latter of which are presented in Attachment D-4, Table D-4-1. Both the RESRAD-BUILD Version 4.0 risk and dose outputs for the default and modified CSF/DCF libraries are shown in Attachments D-4-1 and D-4-2, respectively.

Table D-5 shows the results of the evaluations from using the default DCFPAK3.02 CSF/DCF library and the modified library results in RESRAD-BUILD Version 4.0, compared to the original results obtained in the Line 1 RACR using the FGR 13 Morbidity library in the Version 3.5 model. Based on the results, use of the CSFs and DCFs in the FGR 13 Morbidity library in the Version 3.5 model produced the most health-conservative estimates of risk (6.9E-05) and dose (13 mrem per year) of the three evaluations conducted. Use of the default and modified (updated) CSFs and DCFs in the DCPAK3.02 library of the Version 4.0 model produces the same cancer risk (i.e., 2.3E-06). However, the dose result increased from 3 mrem per year to 5 mrem per year when the modified CSF/DCF library is used in the Version 4.0 model.

Given that both the risk and dose results are well below the respective target limits of 1E-04 and 25 mrem per year, respectively, for all evaluations, it is demonstrated that the results outcome of

the risk and dose assessment for the Line 1 structural surfaces performed in the Line 1 RACR is not impacted using the FGR 15 DCFs and the ORNL 2014 worker soil ingestion CSFs.

Table D-5. Risk and Dose Comparisons Among RESRAD-BUILD Model and CSF/DCF Library Versions, Line 1 Structures

Receptor Scenario	RESRAD-BUILD 3.5 FGR 13 Morbidity Library (Line 1 RACR) ^{a,b}		RESRAD-BUILD 4.0 Default DCFPAK3.02 Library (PRAR-FSSE) ^{c,d}		RESRAD-BUILD 4.0 Modified DCFPAK3.02 Library (PRAR-FSSE) ^{e,f}	
	Risk	Dose (mrem/year)	Risk	Dose (mrem/year)	Risk	Dose (mrem/year)
Site Worker	6.9E-05	13	2.3E-06	3	2.3E-06	5

^a The RESRAD-BUILD 3.5 model default CSFs in the FGR 13 Morbidity library are from FGR 13.

^b The RESRAD-BUILD 3.5 model default internal and external DCFs in the FGR 13 Morbidity library are from FGR 11 and FGR 12, respectively.

^c The RESRAD-BUILD 4.0 model default base risk "DCFPAK3.02 Morbidity" library is used for all CSFs.

^d The RESRAD-BUILD 4.0 model default base dose libraries are used. The base internal dose library is "DCFPAK3.02 (Adult)", which includes all 2014 DCFs (ORNL 2014). The base external dose library is "DCFPAK3.02", which includes ORNL 2014 external radiation DCFs

^e The RESRAD-BUILD 4.0 model base risk "DCFPAK3.02 Morbidity" library is modified to replace ORNL 2014 dietary CSFs for the ingestion pathway with the ORNL worker soil ingestion CSFs.

^f The RESRAD-BUILD 4.0 external dose library "DCFPAK3.02" is modified to replace the 2014 external radiation DCFs for infinite depth (ORNL 2014) with the corresponding USEPA FGR 15 DCFs for infinite depth (USEPA 2019).

Health Protectiveness Evaluation of the Soil Remediation Goal for DU Relative to Noncancer Effects

As stated previously, the soil RG was derived based on health protection of a site worker so that potential cancer risks from radiological exposures do not exceed the TELCR of 1E-04. The evaluations discussed in the previous section demonstrate that the soil RG is still health-protective of a site worker from potential cancer risks that could otherwise result from radiological exposures to DU in soil. This evaluation addresses the health protectiveness of the soil RG from noncancer effects that could result from exposures to the elemental or metallic form of the uranium comprising the DU at the FSA. More specifically, evaluations of health protectiveness from noncancer effects are performed for the WSU, WCSU and ESU, as well as for the associated RUSUs, for which risk and dose assessments have been previously completed in respective PRAR-FSSE documents.

Generally, to calculate noncancer HIs and risk-based concentrations for elemental uranium in soil, the USEPA currently recommends the use of a recently published, intermediate-term minimal risk level (MRL) of 0.0002 mg/kg-day as the oral reference dose (RfDo), in conjunction with an inhalation reference concentration (RfC) of 4.0E-05 mg/m³. As stated previously, these values have not been updated since the first FUSRAP FYR. An MRL is as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse noncancer effects over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) and critical effects that could results from exposures, via a given route (e.g., ingestion, dermal, or inhalation), for a specific duration of time. MRLs are based on noncancer health effects only and do not consider carcinogenic effects. Excluding radiological properties, elemental uranium exposures primarily lead to noncancer effects targeting the kidneys. The noncancer MRL, along with the supporting toxicological studies upon which the MRL is based, was published by the Agency for Toxic Substances and Disease Registry (ATSDR) in the *"Toxicological Profile for Uranium"* (ATSDR 2013). The MRL was subsequently adopted by the USEPA as described in a Memorandum entitled *"Considering a Noncancer Oral Reference Dose for Uranium for Superfund Human Health Risk Assessments"* (USEPA 2016). As a result of the adoption of the ATSDR MRL, the USEPA has derived and established the current RSL of 230 mg/kg for elemental uranium (i.e., as soluble salts) in soil under industrial land use assumptions (USEPA 2023). The USEPA RSL was

calculated based on a target hazard quotient (THQ) of 1 and includes route-specific HQ contributions from ingestion and dust inhalation (no dermal contributions were assessed due to no absorption fraction available for uranium).

The soil RG, which was derived based on U-238, converts to a mass concentration of 446 mg/kg, using the specific activity for U-238, based on the assumption that DU is 99.8 percent by weight U-238. The calculation of the RG mass equivalent is shown below. The RG mass equivalent of 446 mg/kg exceeds the RSL and would result in a HI of 2 for the site worker.

$$RG_M = RG_A \times SA^{-1} \times CF_U \times CF_S$$

Where:

RG_M = mass equivalent to the activity-based RG, 446 mg/kg

RG_A = activity-based RG (based on U-238), 150 pCi/g

SA^{-1} = inverse of specific activity for U-238, 3.00E-06 g uranium per pCi U-238

CF_U = conversion factor for mass of uranium, 1,000 mg uranium per g uranium

CF_S = conversion factor for mass of soil, 1,000 g soil per kg soil

The RG mass equivalent of 446 mg/kg calculated using the above equation exceeds the RSL of 230 mg/kg and would result in a HI of 2 for the site worker. Therefore, to evaluate health protectiveness from noncancer effects for site workers exposed to uranium in post-remedy soil at the land area SUs (i.e., WSU, WCSU and ESU), as well as in the RUSUs (i.e., RUSU-1 through 142 and RUSU-143 through 198), the USEPA RSL of 230 mg/kg is converted to the activity-based equivalent for U-238 of 77 pCi/g and compared to the EPCs calculated for U-238 in the land area SUs and RUSUs. Again, this calculation assumes that DU is 99.8 percent by weight U-238. The calculation of the RSL activity-based equivalent is shown below.

$$RSL_A = RSL_M \times CF_U \times SA \times CF_S$$

Where:

RSL_A = activity-based U-238 equivalent to the mass-based RSL for soluble uranium, 77 pCi/g

RSL_M = USEPA mass-based RSL, 230 mg/kg

CF_U = conversion factor for mass of uranium, 1 g uranium per 1,000 mg uranium

SA = specific activity for U-238, 3.36E+05 pCi U-238 per g uranium

CF_S = conversion factor for mass of soil, 1 kg soil per 1,000 g soil

Based on the comparisons shown in Table D-6 below, all EPCs calculated for land area SUs and RUSUs are less than the RSL activity-based U-238 equivalent of 77 pCi/g. This demonstrates that remediation of soil to meet the soil RG is protective of site workers from adverse non-cancer effects from exposures to uranium.

Table D-6. U-238 EPC Comparisons with the U-238 Activity-Based Equivalent to USEPA's RSL for Uranium

Land Area and Reuse Soil SUs	U-238 EPC for Site Worker (pCi/g)	Industrial Worker RSL (U-238 Equivalent) (pCi/g)
WSU	0.00	77
WCSU	0.00	77
ESU	0.61	77
RUSUs 1-142	3.88	77
RUSUs 143-198	0.32	77

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ATTACHMENT D-1

**SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT FOR FIRING SITE 12
AREA LAND AREA AND RESUSE SOIL SURVEY UNITS**

SUPPORTING TABLES AND CALCULATIONS

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Table D-1-1. Statistical Summary for Firing Site 12 Area Combined Land Area Survey Units (WSU, WCSU, and ESU)

Summary Statistic/Parameter ^a	Combined Land Area SUs			Combined RUSUs 1 to 198		
	U-234 ^b (pCi/g)	U-235 ^b (pCi/g)	U-238 ^b (pCi/g)	U-234 ^b (pCi/g)	U-235 ^b (pCi/g)	U-238 ^b (pCi/g)
Minimum Concentration ^c	3.0E-01 J	-6.0E-02 UJ	4.0E-02 UJ	2.7E-01 J	-9.4E-02 UJ	2.7E-02 UJ
Maximum Concentration ^c	4.4E+01 =	7.0E+00 J	9.0E+02 J	1.3E+01 J	2.7E+00 =	1.3E+02 J
SU of Maximum Concentration	62	7	7	136	136	136
Location of Maximum Concentration	IHTZ211568	IHTZ211553	IHTZ211553	IAAP217378	IAAP217378	IAAP217378
Minimum Detection	3.0E-01 J	5.0E-02 J	3.2E-01 J	2.7E-01 J	5.9E-02 J	4.4E-01 J
Maximum Detection	4.4E+01 =	7.0E+00 J	9.0E+02 J	1.3E+01 J	2.7E+00 =	1.3E+02 J
Number of Detections	1764	78	1765	2227 *	291	2228
Total Number of Samples	1764	1769	1769	2229 *	2229	2229
Minimum Nondetect	NA	-5.0E-02 UJ	4.0E-02 UJ	1.2E+00 U	-9.4E-02 UJ	2.7E-02 UJ
Maximum Nondetect	NA	4.0E-01 UJ	3.9E-01 U	2.0E+00 U	4.8E-01 UJ	2.7E-02 UJ
Minimum MDC	3.0E-02	3.0E-02	3.0E-02	3.6E-02	4.3E-02	3.5E-02
Maximum MDC	5.7E-01	8.9E-01	2.9E+00	6.1E-01	6.6E-01	5.7E-01
Data Distribution ^d	X	X	X	X	X	X
Mean ^c	1.1E+00	7.5E-02	2.6E+00	1.3E+00	9.8E-02	3.7E+00
UCL ₉₅ ^c	1.2E+00	1.0E-01	5.2E+00	1.4E+00	1.1E-01	4.2E+00
EPC ^{c,e}	0.0E+00	6.4E-02	3.8E+00	1.2E-01	7.0E-02	2.8E+00

^a All statistical calculations were performed based on data from the combined WSU, WCSU, and ESU data set. The results for field duplicates and splits are not included in the statistical calculations for consistency with St. Louis FUSRAP standard practice in post-remedy documents.

^b Validation qualifier (VQ) symbols indicate: “=” for positive results, “U” for not detected above this value, “J” for estimated quantity, and “UJ” for not detected above estimated value.

^c Statistical calculations include all detect and nondetect results from the combined WSU, WCSU, and ESU data set.

^d X – Non parametric distribution.

^e The EPC was calculated above the mean background presented in Table 8-2 of the FUSRAP RI (USACE 2008).

Note:

MDC - minimum detectable concentration

Table D-1-2. EPC Calculations for FS-12 Area Combined Land Area SUs (WSU, WCSU, and ESU)

Area	Statistic	U-234	U-235	U-238
Background^a	Mean	1.27	0.04	1.42
Combined Land Area SUs (WSUs, WCSUs, and ESUs)	Maximum	44.40	6.96	903.00
	Distribution ^b	X	X	X
	UCL ₉₅	1.21	0.10	5.21
	EPC	0.00	0.06	3.79

^a Background values were obtained from Table 8-2 of the FUSRAP RI (USACE 2008).

Note:

^b X – Non parametric

Reproduction of FUSRAP RI Table 8-2. Background Soil Concentrations for IAAAP Sites

Property	Sample ID	Statistic	U-234	U-235	U-238
			(pCi/g)	(pCi/g)	(pCi/g)
Background	IAAP25025		0.96	0.04	1.62
	IAAP25026		1.40	0.00	1.73
	IAAP25027		1.35	0.11	1.50
	IAAP25028		1.35	-0.02	1.27
	IAAP25029		0.84	0.02	0.91
	IAAP25030		1.46	0.03	1.42
	IAAP25031		1.50	0.13	1.49
		Maximum	1.50	0.13	1.73
		Mean	1.27	0.04	1.42

**Table D-1-3. IAAAP Firing Site 12 Combined Land Area SUs (WSUs, WCSUs, and ESUs)
UCL Statistics for Uncensored Full Data Sets, Post-Remedy Soil**

User Selected Options

Date/Time of Computation ProUCL 5.2 11/17/2023 9:38:28 AM
 From File Summary Stat Calcs_FS12 Land Area and Soil Reuse SUs_2nd FYR_Working File_d.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

U-234 (pCi/g)

General Statistics

Total Number of Observations	1764	Number of Distinct Observations	341
		Number of Missing Observations	5
Minimum	0.3	Mean	1.082
Maximum	44.4	Median	1
SD	1.266	Std. Error of Mean	0.0302
Coefficient of Variation	1.171	Skewness	25.48

Normal GOF Test

Shapiro Wilk Test Statistic 0.182
 1% Shapiro Wilk P Value 0
 Lilliefors Test Statistic 0.33
 1% Lilliefors Critical Value 0.0246

Shapiro Wilk GOF Test

Data Not Normal at 1% Significance Level

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 1.132

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 1.151

95% Modified-t UCL (Johnson-1978) 1.135

Gamma GOF Test

A-D Test Statistic 5.669E+27
 5% A-D Critical Value 0.757
 K-S Test Statistic 0.155
 5% K-S Critical Value 0.0234

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.773	k star (bias corrected MLE)	5.764
Theta hat (MLE)	0.187	Theta star (bias corrected MLE)	0.188
nu hat (MLE)	20368	nu star (bias corrected)	20335
MLE Mean (bias corrected)	1.082	MLE Sd (bias corrected)	0.451
		Approximate Chi Square Value (0.05)	20004
Adjusted Level of Significance	0.0499	Adjusted Chi Square Value	20004

Assuming Gamma Distribution

95% Approximate Gamma UCL 1.1

95% Adjusted Gamma UCL 1.1

**Table D-1-3. IAAAP Firing Site 12 Combined Land Area SUs (WSUs, WCSUs, and ESUs)
UCL Statistics for Uncensored Full Data Sets, Post-Remedy Soil (Continued)**

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.871	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0842	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.0195	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-1.204	Mean of logged Data	-0.0104
Maximum of Logged Data	3.793	SD of logged Data	0.331
Assuming Lognormal Distribution			
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	1.071
95% Chebyshev (MVUE) UCL	1.082	97.5% Chebyshev (MVUE) UCL	1.098
99% Chebyshev (MVUE) UCL	1.13		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1.131	95% BCA Bootstrap UCL	1.154
95% Standard Bootstrap UCL	1.132	95% Bootstrap-t UCL	1.18
95% Hall's Bootstrap UCL	1.333	95% Percentile Bootstrap UCL	1.136
90% Chebyshev(Mean, Sd) UCL	1.172	95% Chebyshev(Mean, Sd) UCL	1.213
97.5% Chebyshev(Mean, Sd) UCL	1.27	99% Chebyshev(Mean, Sd) UCL	1.382
Suggested UCL to Use			
95% Student's-t UCL	1.132		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Table D-1-3. IAAAP Firing Site 12 Combined Land Area SUs (WSUs, WCSUs, and ESUs)
UCL Statistics for Uncensored Full Data Sets, Post-Remedy Soil (Continued)**

U-235 (pCi/g)

General Statistics			
Total Number of Observations	1769	Number of Distinct Observations	380
		Number of Missing Observations	0
Minimum	-0.06	Mean	0.0748
Maximum	6.96	Median	0.047
SD	0.28	Std. Error of Mean	0.00666
Coefficient of Variation	3.743	Skewness	18.03
Normal GOF Test			
Shapiro Wilk Test Statistic	0.182	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.352	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.0246	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.0858	95% Adjusted-CLT UCL (Chen-1995)	0.0888
		95% Modified-t UCL (Johnson-1978)	0.0863
Gamma Statistics Not Available			
Lognormal Statistics Not Available			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	0.0858	95% BCA Bootstrap UCL	0.0898
95% Standard Bootstrap UCL	0.0856	95% Bootstrap-t UCL	0.0915
95% Hall's Bootstrap UCL	0.0939	95% Percentile Bootstrap UCL	0.0861
90% Chebyshev(Mean, Sd) UCL	0.0948	95% Chebyshev(Mean, Sd) UCL	0.104
97.5% Chebyshev(Mean, Sd) UCL	0.116	99% Chebyshev(Mean, Sd) UCL	0.141
Suggested UCL to Use			
95% Student's-t UCL	0.0858		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Table D-1-3. IAAAP Firing Site 12 Combined Land Area SUs (WSUs, WCSUs, and ESUs)
UCL Statistics for Uncensored Full Data Sets, Post-Remedy Soil (Continued)**

U-238 (pCi/g)

General Statistics			
Total Number of Observations	1769	Number of Distinct Observations	333
		Number of Missing Observations	0
Minimum	0.04	Mean	2.618
Maximum	903	Median	1.1
SD	25	Std. Error of Mean	0.594
Coefficient of Variation	9.55	Skewness	28.97
Normal GOF Test			
Shapiro Wilk Test Statistic	0.0629	Shapiro Wilk GOF Test	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.483	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.0246	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	3.596	95% Adjusted-CLT UCL (Chen-1995)	4.033
		95% Modified-t UCL (Johnson-1978)	3.665
Gamma GOF Test			
A-D Test Statistic	5.653E+27	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.8	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.424	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.0243	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.723	k star (bias corrected MLE)	0.722
Theta hat (MLE)	3.623	Theta star (bias corrected MLE)	3.628
nu hat (MLE)	2556	nu star (bias corrected)	2553
MLE Mean (bias corrected)	2.618	MLE Sd (bias corrected)	3.082
		Approximate Chi Square Value (0.05)	2437
Adjusted Level of Significance	0.0499	Adjusted Chi Square Value	2437
Assuming Gamma Distribution			
95% Approximate Gamma UCL	2.743	95% Adjusted Gamma UCL	2.743
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.57	Shapiro Wilk Lognormal GOF Test	
10% Shapiro Wilk P Value	0	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.203	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.0195	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-3.219	Mean of logged Data	0.13
Maximum of Logged Data	6.806	SD of logged Data	0.546

**Table D-1-3. IAAAP Firing Site 12 Combined Land Area SUs (WSUs, WCSUs, and ESUs)
UCL Statistics for Uncensored Full Data Sets, Post-Remedy Soil (Continued)**

Assuming Lognormal Distribution			
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	1.376
95% Chebyshev (MVUE) UCL	1.401	97.5% Chebyshev (MVUE) UCL	1.436
99% Chebyshev (MVUE) UCL	1.504		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	3.596	95% BCA Bootstrap UCL	4.437
95% Standard Bootstrap UCL	3.588	95% Bootstrap-t UCL	4.889
95% Hall's Bootstrap UCL	7.215	95% Percentile Bootstrap UCL	3.645
90% Chebyshev(Mean, Sd) UCL	4.402	95% Chebyshev(Mean, Sd) UCL	5.209
97.5% Chebyshev(Mean, Sd) UCL	6.331	99% Chebyshev(Mean, Sd) UCL	8.533
Suggested UCL to Use			
95% Student's-t UCL	3.596		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table D-1-4. EPC Calculations for Combined RUSUs 1 to 198

Area	Statistic	U-234	U-235	U-238
Background^a	Mean	1.27	0.04	1.42
RUSUs 1 to 198	Maximum	12.90	2.69	131.00
	Distribution ^b	X	X	X
	UCL ₉₅	1.39	0.11	4.21
	EPC	0.12	0.07	2.79

^a Background values were obtained from Table 8-2 of the FUSRAP RI (USACE 2008).

Note:

X – Non parametric

Reproduction of FUSRAP RI Table 8-2. Background Soil Concentrations for IAAAP Sites

Property	Sample ID	Statistic	U-234	U-235	U-238
			(pCi/g)	(pCi/g)	(pCi/g)
Background	IAAP25025		0.96	0.04	1.62
	IAAP25026		1.40	0.00	1.73
	IAAP25027		1.35	0.11	1.50
	IAAP25028		1.35	-0.02	1.27
	IAAP25029		0.84	0.02	0.91
	IAAP25030		1.46	0.03	1.42
	IAAP25031		1.50	0.13	1.49
		Maximum	1.50	0.13	1.73
		Mean	1.27	0.04	1.42

Table D-1-5. IAAAP Firing Site 12 Combined Reuse Soil SUs (RUSUs 1 to 198)
UCL Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation ProUCL 5.2 11/17/2023 9:39:49 AM
 From File Summary Stat Calcs_FS12 Land Area and Soil Reuse SUs_2nd FYR_Working File_e.xls
 Full Precision OFF
 Confidence Coefficient 95%
 Number of Bootstrap Operations 2000

U-234 (pCi/g)**General Statistics**

Total Number of Observations	2229	Number of Distinct Observations	513
		Number of Missing Observations	0
Minimum	0.267	Mean	1.316
Maximum	12.9	Median	1.16
SD	0.74	Std. Error of Mean	0.0157
Coefficient of Variation	0.562	Skewness	5.439

Normal GOF Test

Lilliefors Test Statistic 0.227
 1% Lilliefors Critical Value 0.0219

Lilliefors GOF Test

Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution**95% Normal UCL**

95% Student's-t UCL 1.342

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 1.344
 95% Modified-t UCL (Johnson-1978) 1.342

Gamma GOF Test

A-D Test Statistic 4.486E+27
 5% A-D Critical Value 0.756
 K-S Test Statistic 0.157
 5% K-S Critical Value 0.0201

Anderson-Darling Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Kolmogorov-Smirnov Gamma GOF Test

Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.229	k star (bias corrected MLE)	6.221
Theta hat (MLE)	0.211	Theta star (bias corrected MLE)	0.212
nu hat (MLE)	27770	nu star (bias corrected)	27734
MLE Mean (bias corrected)	1.316	MLE Sd (bias corrected)	0.528
		Approximate Chi Square Value (0.05)	27348
Adjusted Level of Significance	0.0499	Adjusted Chi Square Value	27347

Assuming Gamma Distribution

95% Approximate Gamma UCL 1.335 95% Adjusted Gamma UCL 1.335

Table D-1-5. IAAAP Firing Site 12 Combined Reuse Soil SUs (RUSUs 1 to 198)
UCL Statistics for Uncensored Full Data Sets (Continued)

Lognormal GOF Test			
Lilliefors Test Statistic	0.118	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.0173	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-1.321	Mean of logged Data	0.192
Maximum of Logged Data	2.557	SD of logged Data	0.365
Assuming Lognormal Distribution			
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	1.326
95% Chebyshev (MVUE) UCL	1.341	97.5% Chebyshev (MVUE) UCL	1.36
99% Chebyshev (MVUE) UCL	1.398		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1.342	95% BCA Bootstrap UCL	1.343
95% Standard Bootstrap UCL	1.342	95% Bootstrap-t UCL	1.344
95% Hall's Bootstrap UCL	1.344	95% Percentile Bootstrap UCL	1.342
90% Chebyshev(Mean, Sd) UCL	1.363	95% Chebyshev(Mean, Sd) UCL	1.385
97.5% Chebyshev(Mean, Sd) UCL	1.414	99% Chebyshev(Mean, Sd) UCL	1.472
Suggested UCL to Use			
95% Student's-t UCL	1.342		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table D-1-5. IAAAP Firing Site 12 Combined Reuse Soil SUs (RUSUs 1 to 198)
UCL Statistics for Uncensored Full Data Sets (Continued)

U-235 (pCi/g)

General Statistics			
Total Number of Observations	2229	Number of Distinct Observations	1026
		Number of Missing Observations	0
Minimum	-0.0936	Mean	0.0983
Maximum	2.69	Median	0.0724
SD	0.128	Std. Error of Mean	0.00271
Coefficient of Variation	1.303	Skewness	6.392
Normal GOF Test			
Lilliefors Test Statistic	0.175	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.0219	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	0.103	95% Adjusted-CLT UCL (Chen-1995)	0.103
		95% Modified-t UCL (Johnson-1978)	0.103
Gamma Statistics Not Available			
Lognormal Statistics Not Available			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	0.103	95% BCA Bootstrap UCL	0.103
95% Standard Bootstrap UCL	0.103	95% Bootstrap-t UCL	0.103
95% Hall's Bootstrap UCL	0.103	95% Percentile Bootstrap UCL	0.103
90% Chebyshev(Mean, Sd) UCL	0.106	95% Chebyshev(Mean, Sd) UCL	0.11
97.5% Chebyshev(Mean, Sd) UCL	0.115	99% Chebyshev(Mean, Sd) UCL	0.125
Suggested UCL to Use			
95% Student's-t UCL	0.103		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table D-1-5. IAAAP Firing Site 12 Combined Reuse Soil SUs (RUSUs 1 to 198)
UCL Statistics for Uncensored Full Data Sets (Continued)

U-238 (pCi/g)

General Statistics			
Total Number of Observations	2229	Number of Distinct Observations	657
		Number of Missing Observations	0
Minimum	0.0266	Mean	3.654
Maximum	131	Median	1.91
SD	6.03	Std. Error of Mean	0.128
Coefficient of Variation	1.65	Skewness	7.826
Normal GOF Test			
Lilliefors Test Statistic	0.312	Lilliefors GOF Test	
1% Lilliefors Critical Value	0.0219	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	3.864	95% Adjusted-CLT UCL (Chen-1995)	3.886
		95% Modified-t UCL (Johnson-1978)	3.867
Gamma GOF Test			
A-D Test Statistic	4.486E+27	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.777	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.194	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.0205	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.324	k star (bias corrected MLE)	1.322
Theta hat (MLE)	2.76	Theta star (bias corrected MLE)	2.763
nu hat (MLE)	5901	nu star (bias corrected)	5894
MLE Mean (bias corrected)	3.654	MLE Sd (bias corrected)	3.178
		Approximate Chi Square Value (0.05)	5717
Adjusted Level of Significance	0.0499	Adjusted Chi Square Value	5717
Assuming Gamma Distribution			
95% Approximate Gamma UCL	3.767	95% Adjusted Gamma UCL	3.767
Lognormal GOF Test			
Lilliefors Test Statistic	0.132	Lilliefors Lognormal GOF Test	
10% Lilliefors Critical Value	0.0173	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-3.627	Mean of logged Data	0.873
Maximum of Logged Data	4.875	SD of logged Data	0.765

Table D-1-5. IAAAP Firing Site 12 Combined Reuse Soil SUs (RUSUs 1 to 198)
UCL Statistics for Uncensored Full Data Sets (Continued)

Assuming Lognormal Distribution				
95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	3.383	
95% Chebyshev (MVUE) UCL	3.463	97.5% Chebyshev (MVUE) UCL	3.575	
99% Chebyshev (MVUE) UCL	3.793			
Nonparametric Distribution Free UCL Statistics				
Data do not follow a Discernible Distribution				
Nonparametric Distribution Free UCLs				
95% CLT UCL	3.864	95% BCA Bootstrap UCL	3.876	
95% Standard Bootstrap UCL	3.859	95% Bootstrap-t UCL	3.885	
95% Hall's Bootstrap UCL	3.893	95% Percentile Bootstrap UCL	3.865	
90% Chebyshev(Mean, Sd) UCL	4.037	95% Chebyshev(Mean, Sd) UCL	4.21	
97.5% Chebyshev(Mean, Sd) UCL	4.451	99% Chebyshev(Mean, Sd) UCL	4.925	
Suggested UCL to Use				
95% Student's-t UCL	3.864			

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.

Please verify the data were collected from random locations.

**If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table D-1-6. Calculations of Total Uranium Mass Concentrations (mg/kg) from Isotopic Activity Concentrations in Soil (pCi/g) Reported for Firing Site 12 Area Combined Land Area Survey Units

Calculations of total U mass concentrations from iso-U activity concentrations in soil are calculated for combined Land Area SUs (i.e., WSUs, WCSUs, and ESUs) to facilitate ecological assessment of the elemental U toxicity to terrestrial receptors. The weight fraction of U-238 in DU (99.8%) is assumed in the conversions. The following general equation is used to calculate total U mass concentrations from corresponding summary statistics of iso-U activity concentrations of DU calculated from the combined land area SUs data set:

$$C_{S,U} = C_{S,isoU} \times CF1 \times (SA)^{-1} \times CF2 \times CF3 \times (F_{wt-isoU})^{-1}$$

Where:

$C_{S,DU}$ = Soil mass concentration of total uranium as DU in mg D_U/kg_{soil}

$C_{S,U238}$ = Soil activity concentration of isotopic uranium as U-238 (i.e., $C_{S,U238}$), pCi/g_{soil}

$CF1$ = Conversion factor, curies (Ci) to picocuries (pCi), 1E-12 Ci/pCi

SA = Specific activity for isotope, curies of activity per gram of U-238, 3.4E-07 Ci/g_{U238} for U-238

$CF2$ = Conversion factor, milligrams of uranium isotope per gram of uranium isotope, 1E+03 mg_{U238}/g_U

$CF3$ = Conversion factor, grams of soil per kilogram of soil, 1E+03 g_{soil}/kg_{soil}

$F_{wt-U238}$ = U-238 weight fraction, 0.998 for U-238 in DU

U-238 Statistic for Combined Land Area SUs ^a	$C_{S,U238}$ (pCi/g _{soil})	CF1 (Ci/pCi)	$(SA)^{-1}$ (g _{U238} /Ci)	CF2 (mg _{U238} /g _{U238})	CF3 (g _{soil} /kg _{soil})	$(F_{wt-U238})^{-1}$ (unitless)	$C_{S,DU}$ (mg _{DU} /kg _{soil})
Minimum ^b	0.04 UJ	1E-12	2,941,176	1,000	1,000	1.00	0.12
Maximum ^b	903.00 J	1E-12	2,941,176	1,000	1,000	1.00	2,661.20
Minimum Detect	0.32 J	1E-12	2,941,176	1,000	1,000	1.00	0.94
Maximum Detect	903.00 J	1E-12	2,941,176	1,000	1,000	1.00	2,661.20
Mean ^b	2.62	1E-12	2,941,176	1,000	1,000	1.00	7.72
UCL ₉₅ ^b	5.21	1E-12	2,941,176	1,000	1,000	1.00	15.35
EPC ^{b,c}	3.79	1E-12	2,941,176	1,000	1,000	1.00	11.17

^a All statistical calculations were performed based on U-238 data from the combined WSU, WCSU, and ESU data set. The U-238 results for field duplicates and splits are not included in the statistical calculations for consistency with St. Louis FUSRAP standard practice in post-remedy documents.

^b Statistical calculations include all detect and nondetect U-238 results from the combined WSU, WCSU, and ESU data set.

^c The EPC for U-238 was calculated above the mean background presented in Table 8-2 of the FUSRAP RI (USACE 2008).

Note:

NOU - naturally occurring uranium

Table D-1-7. Calculations of Total Uranium Mass Concentrations (mg/kg) from Isotopic Activity Concentrations (pCi/g) in Firing Site 12 Area Reuse Soil Survey Units 1 to 198

Calculations of total U mass concentrations from iso-U activity concentrations in soil are calculated for RUSUs 1 to 198 to facilitate ecological assessment of the elemental U toxicity to terrestrial receptors. The weight fraction of U-238 in DU (99.8%) is assumed in the conversions. The following general equation is used to calculate total U mass concentrations from corresponding summary statistics of iso-U activity concentrations of DU calculated from the combined land area SUs data set:

$$C_{S,U} = C_{S,isoU} \times CF1 \times (SA)^{-1} \times CF2 \times CF3 \times (F_{wt-isoU})^{-1}$$

Where:

$C_{S,DU}$ = Soil mass concentration of total uranium as DU in mg DU/kg soil

$C_{S,U238}$ = Soil activity concentration of isotopic uranium as U-238 (i.e., $C_{S,U238}$), pCi/g soil

$CF1$ = Conversion factor, curies (Ci) to picocuries (pCi), $1E-12$ Ci/pCi

SA = Specific activity for isotope, curies of activity per gram of U-238, $3.4E-07$ Ci/g_{U238} for U-238

$CF2$ = Conversion factor, milligrams of uranium isotope per gram of uranium isotope, $1E+03$ mg_{U238}/g_U

$CF3$ = Conversion factor, grams of soil per kilogram of soil, $1E+03$ g_{soil}/kg_{soil}

$F_{wt-U238}$ = U-238 weight fraction, 0.998 for U-238 in DU

U-238 Statistic for Combined Land Area SUs ^a	$C_{S,U238}$ (pCi/g _{soil})	CF1 (Ci/pCi)	$(SA)^{-1}$ (g _{U238} /Ci)	CF2 (mg _{U238} /g _{U238})	CF3 (g _{soil} /kg _{soil})	$(F_{wt-U238})^{-1}$ (unitless)	$C_{S,DU}$ (mg _{DU} /kg _{soil})
Minimum ^b	0.03 UJ	1E-12	2,941,176	1,000	1,000	1.00	0.08
Maximum ^b	131.00 J	1E-12	2,941,176	1,000	1,000	1.00	386.07
Minimum Detect	0.44 J	1E-12	2,941,176	1,000	1,000	1.00	1.31
Maximum Detect	131.00 J	1E-12	2,941,176	1,000	1,000	1.00	386.07
Mean ^b	3.65	1E-12	2,941,176	1,000	1,000	1.00	10.77
UCL ₉₅ ^b	4.21	1E-12	2,941,176	1,000	1,000	1.00	12.41
EPC ^{b,c}	2.79	1E-12	2,941,176	1,000	1,000	1.00	8.22

^a All statistical calculations were performed based on U-238 data from the combined RUSU 1 to 198 data set. The U-238 results for field duplicates and splits are not included in the statistical calculations for consistency with St. Louis FUSRAP standard practice in post-remedy documents.

^b Statistical calculations include all detect and nondetect U-238 results from the combined RUSU 1 to 198 data set.

^c The EPC for U-238 was calculated above the mean background presented in Table 8-2 of the FUSRAP RI (USACE 2008).

Note:

NOU - naturally occurring uranium

Table D-1-8. Selection of Radiological Contaminants of Potential Ecological Concern in Soil for Firing Site 12 Area Combined Land Area Survey Units (WSU, WCSU, and ESU)

Value Source	Value Description	U-234		U-235		U-238		SOF ^a (unitless)
		Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	
FS-12 Area Concentrations Used for Screening	Mean IAAAP Soil Background Concentration	1.3E+00	NA	4.0E-02	NA	1.4E+00	NA	NA
	FS-12 UCL ₉₅ for Combined Land Area SUs	1.2E+00	NA	1.0E-01	NA	5.2E+00	NA	NA
	EPC above Background for FS-12 Area Combined Land Area SUs ^b	<Bkgd	NA	6.4E-02	NA	3.8E+00	NA	NA
<i>Soil ESVs - Terrestrial Receptors^c</i>								
USEPA Region 6 BCG (August 2020)	Terrestrial Soil	5.0E+03	NA	3.0E+03	2.1E-05	2.0E+03	1.9E-03	1.9E-03
LANL ECORISK - Low Effect (2022)	American kestrel (Avian top carnivore)	2.6E+06	NA	1.0E+05	6.4E-07	4.2E+04	9.0E-05	9.1E-05
	American kestrel (insectivore / carnivore)	2.6E+06	NA	1.0E+05	6.4E-07	3.3E+04	1.1E-04	1.2E-04
	American robin (Avian herbivore)	1.4E+05	NA	6.3E+04	1.0E-06	4.0E+04	9.5E-05	9.6E-05
	American robin (Avian insectivore)	6.9E+05	NA	9.5E+04	6.7E-07	3.7E+04	1.0E-04	1.0E-04
	American robin (Avian omnivore)	2.7E+05	NA	7.9E+04	8.1E-07	2.1E+04	1.8E-04	1.8E-04
	Deer mouse (Mammalian omnivore)	1.2E+06	NA	5.2E+04	1.2E-06	1.1E+04	3.4E-04	3.5E-04
	Earthworm (Soil-dwelling invertebrate)	2.2E+04	NA	1.6E+04	4.0E-06	4.0E+03	9.5E-04	9.5E-04
	Generic plant (Terrestrial autotroph - producer)	4.4E+03	NA	4.4E+03	1.5E-05	2.1E+04	1.8E-04	1.9E-04
	Gray fox (Mammalian top carnivore)	1.1E+06	NA	5.2E+04	1.2E-06	2.1E+04	1.8E-04	1.8E-04
	Montane shrew (Mammalian insectivore)	1.5E+06	NA	5.2E+04	1.2E-06	1.8E+04	2.1E-04	2.1E-04
	Mountain cottontail (Mammalian herbivore)	1.2E+05	NA	3.8E+04	1.7E-06	4.2E+04	9.0E-05	9.2E-05

Table D-1-8. Selection of Radiological Contaminants of Potential Ecological Concern in Soil for Firing Site 12 Area Combined Land Area Survey Units (WSU, WCSU, and ESU) (Continued)

Value Source	Value Description	U-234		U-235		U-238		SOF ^a (unitless)
		Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	
LANL ECORISK - No Effect (2022)	American kestrel (Avian top carnivore)	2.6E+05	NA	1.0E+04	6.4E-06	4.2E+03	9.0E-04	9.1E-04
	American kestrel (insectivore / carnivore)	2.6E+05	NA	1.0E+04	6.4E-06	4.2E+03	9.0E-04	9.1E-04
	American robin (Avian herbivore)	1.4E+04	NA	6.3E+03	1.0E-05	3.3E+03	1.1E-03	1.2E-03
	American robin (Avian insectivore)	6.9E+04	NA	9.5E+03	6.7E-06	4.0E+03	9.5E-04	9.5E-04
	American robin (Avian omnivore)	2.7E+04	NA	7.9E+03	8.1E-06	3.7E+03	1.0E-03	1.0E-03
	Deer mouse (Mammalian omnivore)	1.2E+05	NA	5.2E+03	1.2E-05	2.1E+03	1.8E-03	1.8E-03
	Earthworm (Soil-dwelling invertebrate)	2.2E+03	NA	1.6E+03	4.0E-05	1.1E+03	3.4E-03	3.5E-03
	Generic plant (Terrestrial autotroph - producer)	4.4E+02	NA	4.4E+02	1.5E-04	4.0E+02	9.5E-03	9.6E-03
	Gray fox (Mammalian top carnivore)	1.1E+05	NA	5.2E+03	1.2E-05	2.1E+03	1.8E-03	1.8E-03
	Montane shrew (Mammalian insectivore)	1.5E+05	NA	5.2E+03	1.2E-05	2.1E+03	1.8E-03	1.8E-03
	Mountain cottontail (Mammalian herbivore)	1.2E+04	NA	3.8E+03	1.7E-05	1.8E+03	2.1E-03	2.1E-03
COPEC Flag (Yes/No):		No		No		No		NA
Rationale:		U-234 EPC < Bkgd		U-235 EPC < All ESLs		U-238 EPC < All ESLs		NA

^a The SOF approach is applied per DOE (i.e., DOE 2019) by calculating the fraction of the "concentration used for screening" for each radionuclide to the corresponding BCG or ESV, then summing the fractions over all radionuclides. If the SOF for a receptor is less than or equal to 1.0, then the site concentration is less than the receptor-specific ESVs across all DU isotopes and no further evaluation is required. However, if the SOF exceeds 1.0, then at least one of the ESVs is exceeded and further actions are required. Exceedance of an ESV results in the DU isotope(s) as being retained as a COPEC.

^b The EPC for each isotope, calculated over the entire combined WSU, WCSU, and ESU area (167,258 m²), is applied toward comparison with the ESV. The EPC for each isotope is calculated as the lesser of the UCL₉₅ and the maximum concentration, minus the corresponding mean IAAAP soil background concentration reported in Table 8-2 of the FUSRAP RI (USACE 2008).

^c ESVs were selected from ORNL's online Ecological Benchmark Tool for Radionuclides (ORNL 2023a).

Notes:

<Bkgd - The UCL₉₅ is less than background (i.e., the EPC is a negative value)

NA - Not applicable

Table D-1-9. Evaluation of Elemental Uranium as a Contaminant of Potential Ecological Concern in Soil for Firing Site 12 Area Combined Land Area Survey Units (WSU, WCSU, and ESU)

Value Source	Value Description	Uranium	
		Value (mg/kg)	HQ ^a (unitless)
FS-12 Area Soil Concentrations Used for Screening	Mean IAAAP Soil Background Concentration	NA	NA
	EPC for FS-12 Area Combined Land Area SUs ^b	1.5E+01	NA
<i>Soil ESVs - Terrestrial Receptors^c</i>			
USEPA Region 6 (August 2020)	Plants (Not Specified)	5.0E+00	3.1E+00
LANL ECORISK - Low Effect (2022)	Avian herbivore	1.5E+04	1.0E-03
	Avian insectivore	1.1E+04	1.4E-03
	Avian omnivore	1.2E+04	1.3E-03
	Avian top carnivore	2.6E+05	5.9E-05
	Generic Plant	2.5E+02	6.1E-02
	Insectivore / carnivore	1.4E+05	1.1E-04
	Mammalian herbivore	2.6E+03	5.9E-03
	Mammalian insectivore	1.2E+03	1.3E-02
	Mammalian omnivore	1.8E+03	8.5E-03
	Mammalian top carnivore	1.2E+04	1.3E-03
LANL ECORISK - No Effect (2022)	Avian herbivore	1.5E+03	1.0E-02
	Avian insectivore	1.1E+03	1.4E-02
	Avian omnivore	1.2E+03	1.3E-02
	Avian top carnivore	2.6E+04	5.9E-04
	Generic Plant	2.5E+01	6.1E-01
	Insectivore / carnivore	1.4E+04	1.1E-03
	Mammalian herbivore	1.0E+03	1.5E-02
	Mammalian insectivore	4.8E+02	3.2E-02
	Mammalian omnivore	7.4E+02	2.1E-02
	Mammalian top carnivore	4.8E+03	3.2E-03
COPEC Flag (Yes/No):		No	
Rationale:		See Footnote <i>d</i>	

^a The HQ is calculated as the ratio between the EPC to the BCG or ESV. If an HQ is less than 1 for a receptor, then elemental uranium is not retained as a COPEC for the receptor and no further evaluation is required. However, if an HQ exceeds 1 for a receptor, then elemental uranium is identified as a COPEC for the receptor and further action is required. HQs exceeding 1 are presented in bold font.

^b The EPC for elemental uranium was calculated from the U-238 isotopic concentration (see Table D-1-6) the lesser of the UCL₉₅ and the maximum concentration determined over the combined land area SUs (WSU, WCSU, and ESU) that encompass 167,258 m². The EPC is therefore based on the UCL₉₅. No background levels are available for elemental uranium at IAAAP.

^c ESVs were selected from ORNL's online Ecological Benchmark Tool for Chemicals (ORNL 2023b).

^d The EPC for elemental uranium exceeds only ESV, which is the USEPA Region 6 ESV for plants (5 mg/kg). This ESV represents the lowest value presented in the table above and is 5 times less than the next higher ESV of 25 mg/kg (i.e., for LANL No Effect level for Generic Plant). USEPA Region 6 recommends the use of 25 mg/kg as the ESV which is consistent with the LANL No Effect level for Generic Plant (USEPA 2018). Additionally, none of the LANL Low Effect or No Effect levels are exceeded by the EPC. Therefore, elemental uranium is not identified as a COPEC in soil at the combined land area SUs.

Note:

NA - Not applicable

Table D-1-10. Selection of Radiological Contaminants of Potential Ecological Concern in for Reuse Soil Survey Units 1 to 198

Value Source	Value Description	U-234		U-235		U-238		SOF ^a (unitless)
		Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	
RUSUs 1 to 198 Soil Concentrations Used for Screening	Mean IAAAP Soil Background Concentration	1.3E+00	NA	4.0E-02	NA	1.4E+00	NA	NA
	UCL ₉₅ for RUSUs 1 to 198	1.4E+00	NA	1.1E-01	NA	4.2E+00	NA	NA
	EPC above Background for RUSUs 1 to 198 ^b	1.2E-01	NA	7.0E-02	NA	2.8E+00	NA	NA
<i>Soil ESVs - Terrestrial Receptors^c</i>								
USEPA Region 6 BCG (August 2020)	Terrestrial Soil	5.0E+03	2.3E-05	3.0E+03	2.3E-05	2.0E+03	1.4E-03	1.4E-03
LANL ECORISK - Low Effect (2022)	American kestrel (Avian top carnivore)	2.6E+06	4.4E-08	1.0E+05	7.0E-07	4.2E+04	6.6E-05	6.7E-05
	American kestrel (insectivore / carnivore)	2.6E+06	4.4E-08	1.0E+05	7.0E-07	3.3E+04	8.5E-05	8.5E-05
	American robin (Avian herbivore)	1.4E+05	8.2E-07	6.3E+04	1.1E-06	4.0E+04	7.0E-05	7.1E-05
	American robin (Avian insectivore)	6.9E+05	1.7E-07	9.5E+04	7.4E-07	3.7E+04	7.5E-05	7.6E-05
	American robin (Avian omnivore)	2.7E+05	4.3E-07	7.9E+04	8.9E-07	2.1E+04	1.3E-04	1.3E-04
	Deer mouse (Mammalian omnivore)	1.2E+06	9.6E-08	5.2E+04	1.3E-06	1.1E+04	2.5E-04	2.5E-04
	Earthworm (Soil-dwelling invertebrate)	2.2E+04	5.2E-06	1.6E+04	4.4E-06	4.0E+03	7.0E-04	7.0E-04
	Generic plant (Terrestrial autotroph - producer)	4.4E+03	2.6E-05	4.4E+03	1.6E-05	2.1E+04	1.3E-04	1.5E-04
	Gray fox (Mammalian top carnivore)	1.1E+06	1.0E-07	5.2E+04	1.3E-06	2.1E+04	1.3E-04	1.3E-04
	Montane shrew (Mammalian insectivore)	1.5E+06	7.7E-08	5.2E+04	1.3E-06	1.8E+04	1.6E-04	1.6E-04
	Mountain cottontail (Mammalian herbivore)	1.2E+05	9.6E-07	3.8E+04	1.8E-06	4.2E+04	6.6E-05	6.8E-05

Table D-1-10. Selection of Radiological Contaminants of Potential Ecological Concern in for Reuse Soil Survey Units 1 to 198 (Continued)

Value Source	Value Description	U-234		U-235		U-238		SOF ^a (unitless)
		Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	Value (pCi/g)	Fraction of ESL (unitless)	
LANL ECORISK - No Effect (2022)	American kestrel (Avian top carnivore)	2.6E+05	4.4E-07	1.0E+04	7.0E-06	4.2E+03	6.6E-04	6.7E-04
	American kestrel (insectivore / carnivore)	2.6E+05	4.4E-07	1.0E+04	7.0E-06	4.2E+03	6.6E-04	6.7E-04
	American robin (Avian herbivore)	1.4E+04	8.2E-06	6.3E+03	1.1E-05	3.3E+03	8.5E-04	8.6E-04
	American robin (Avian insectivore)	6.9E+04	1.7E-06	9.5E+03	7.4E-06	4.0E+03	7.0E-04	7.0E-04
	American robin (Avian omnivore)	2.7E+04	4.3E-06	7.9E+03	8.9E-06	3.7E+03	7.5E-04	7.6E-04
	Deer mouse (Mammalian omnivore)	1.2E+05	9.6E-07	5.2E+03	1.3E-05	2.1E+03	1.3E-03	1.3E-03
	Earthworm (Soil-dwelling invertebrate)	2.2E+03	5.2E-05	1.6E+03	4.4E-05	1.1E+03	2.5E-03	2.6E-03
	Generic plant (Terrestrial autotroph - producer)	4.4E+02	2.6E-04	4.4E+02	1.6E-04	4.0E+02	7.0E-03	7.1E-03
	Gray fox (Mammalian top carnivore)	1.1E+05	1.0E-06	5.2E+03	1.3E-05	2.1E+03	1.3E-03	1.3E-03
	Montane shrew (Mammalian insectivore)	1.5E+05	7.7E-07	5.2E+03	1.3E-05	2.1E+03	1.3E-03	1.3E-03
	Mountain cottontail (Mammalian herbivore)	1.2E+04	9.6E-06	3.8E+03	1.8E-05	1.8E+03	1.6E-03	1.6E-03
COPEC Flag (Yes/No):		No		No		No		NA
Rationale:		U-234 < Bkgd		U-235 EPC < All ESLs		U-238 EPC < All ESLs		NA

^a The SOF approach is applied per DOE (i.e., DOE 2019) by calculating the fraction of the "concentration used for screening" for each radionuclide to the corresponding BCG or ESV, then summing the fractions over all radionuclides. If the SOF for a receptor is less than or equal to 1.0, then the site concentration is less than the receptor-specific ESVs across all DU isotopes and no further evaluation is required. However, if the SOF exceeds 1.0, then at least one of the ESVs is exceeded and further actions are required. Exceedance of an ESV results in the DU isotope(s) as being retained as a COPEC.

^b The EPC for each isotope, calculated over RUSUs 1 to 198, is applied toward comparison with the ESV. The EPC for each isotope is calculated as the lesser of the UCL₉₅ and the maximum concentration, minus the corresponding mean IAAAP soil background concentration reported in Table 8-2 of the FUSRAP RI (USACE 2008).

^c ESVs were selected from ORNL's online Ecological Benchmark Tool for Radionuclides (ORNL 2023a)).

Note:

NA - Not applicable

Table D-1-11. Evaluation of Elemental Uranium as a Contaminant of Potential Ecological Concern in Soil for Reuse Soil Survey Units 1 to 198

Value Source	Value Description	Uranium	
		Value (mg/kg)	HQ ^a (unitless)
RUSUs 1 to 198 Soil Concentration Used for Screening	Mean IAAAP Soil Background Concentration	NA	NA
	EPC above Background for RUSUs 1 to 198 ^b	1.2E+01	NA
<i>Soil ESVs - Terrestrial Receptors^c</i>			
USEPA Region 6 (August 2020)	Plants (Not Specified)	5.0E+00	2.5E+00
LANL ECORISK - Low Effect (2022)	Avian herbivore	1.5E+04	8.3E-04
	Avian insectivore	1.1E+04	1.1E-03
	Avian omnivore	1.2E+04	1.0E-03
	Avian top carnivore	2.6E+05	4.8E-05
	Generic Plant	2.5E+02	5.0E-02
	Insectivore / carnivore	1.4E+05	8.9E-05
	Mammalian herbivore	2.6E+03	4.8E-03
	Mammalian insectivore	1.2E+03	1.0E-02
	Mammalian omnivore	1.8E+03	6.9E-03
LANL ECORISK - No Effect (2022)	Mammalian top carnivore	1.2E+04	1.0E-03
	Avian herbivore	1.5E+03	8.3E-03
	Avian insectivore	1.1E+03	1.1E-02
	Avian omnivore	1.2E+03	1.0E-02
	Avian top carnivore	2.6E+04	4.8E-04
	Generic Plant	2.5E+01	5.0E-01
	Insectivore / carnivore	1.4E+04	8.9E-04
	Mammalian herbivore	1.0E+03	1.2E-02
	Mammalian insectivore	4.8E+02	2.6E-02
	Mammalian omnivore	7.4E+02	1.7E-02
	Mammalian top carnivore	4.8E+03	2.6E-03
COPEC Flag (Yes/No):		No	
Rationale:		See Footnote <i>d</i>	

^a The HQ is calculated as the ratio between the EPC to the BCG or ESV. If an HQ is less than 1.0 for a receptor, then elemental uranium is not retained as a COPEC for the receptor and no further evaluation is required. However, if an HQ exceeds 1.0 for a receptor, then elemental uranium is identified as a COPEC for the receptor and further action is required. HQs exceeding 1.0 are presented in bold font.

^b The EPC for elemental uranium was calculated from the U-238 isotopic concentration (See Attachment D-1, Table D-1-7) the lesser of the UCL₉₅ and the maximum concentration determined over the combined RUSUs 1 to 198. The EPC is therefore based on the UCL₉₅. No background levels are available for elemental uranium at the IAAAP.

^c ESVs were obtained from ORNL's online Ecological Benchmark Tool for Chemicals (ORNL 2023b).

^d The EPC for elemental uranium exceeds only one ESV, which is the USEPA Region 6 ESV for plants (5 mg/kg). This ESV represents the lowest value presented in the table above and is 5 times less than the next higher ESV of 25 mg/kg (i.e., for LANL No Effect level for Generic Plant). USEPA Region IV recommends the use of 25 mg/kg as the ESV which is consistent with the LANL No Effect level for Generic Plant (USEPA 2018). Additionally, none of the LANL Low Effect or No Effect levels are exceeded by the EPC. Therefore, elemental uranium is not identified as a COPEC in soil at the combined land area SUs.

Note:

NA - Not applicable

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ATTACHMENT D-2

**SECOND FIVE-YEAR REVIEW VERIFICATION OF THE SITE WORKER
REMEDiation GOAL FOR DEPLETED URANIUM IN SOIL AT OPERABLE UNIT 8**

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INTRODUCTION

As part of this second FUSRAP FYR for OU-8, this attachment documents verification of the validity of the DCGL calculations originally performed during preparation of the FUSRAP FS (USACE 2011b) using the RESRAD-ONSITE Version 7.2 model. RESRAD Version 6.4 was used during the FUSRAP FS to calculate risk- and dose-based DCGLs for the individual isotopes of DU (i.e., U-234, U-235, and U-238) that were ultimately used as the basis for determining the soil RG for a site (industrial) worker at the FSA. The DCGLs used to calculate the soil RG are the minimum levels corresponding to the time of maximum dose or ELCR over a 1,000-year period. The soil RG was derived based on a $1\text{E-}04$ ELCR to a site worker hypothetically exposed to DU via soil ingestion, dust inhalation, and external ground radiation. Generally, the RESRAD-ONSITE computer code is used to determine DSRs and RSRs for DU-contaminated soil. The DSR and RSR are then used to calculate individual radionuclide DCGLs as dose and ELCR limit equivalents that collectively do not exceed the total dose and ELCR limits of 25 mrem per year and $1\text{E-}04$, respectively.

In order to assess the validity and continued health protectiveness of the site worker DCGL calculations used to support determination and establishment of the soil RG for the site worker, the DCGL calculations are repeated in this evaluation by incorporating updated CSFs and DCFs. As discussed in more detail in the following pages of this evaluation, most of the updates are currently available in the RESRAD-ONSITE Version 7.2 model base CSF and DCF libraries. Updates not included in the base libraries have been incorporated and saved into modified libraries to facilitate the assessment of the continued validity and health protectiveness of the DCGL calculations performed during the FUSRAP FS.

The DCGLs presented in this document are based on the following:

- release under restricted conditions set forth by U.S. Nuclear Regulatory Commission (NRC) in 10 *CFR* 20.1403(b), which states: “The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem [0.25 mSv] per year.”
- USEPA defines the CERCLA ELCR range as 10^{-6} to 10^{-4} where “the upper boundary of the risk range is not a discrete line at 1×10^{-4} . A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions” (USEPA 1997).

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METHODOLOGY

The principal radiological contaminant in soil at the FSA is DU. DU is the byproduct remaining after the extraction of U-235 from naturally occurring uranium. DU typically contains approximately 99.799 percent by weight U-238; 0.200 percent by weight U-235; and 0.001 percent by weight U-234, respectively, with corresponding activity percentages of 90.14; 1.45; and 8.40. Natural U, by comparison, consists of about 99.284; 0.711; and 0.005 percent by weight U-238, U-235, and U-234, respectively, with corresponding activity percentages of 48.6; 2.2; and 49.2.

The DCGL and ultimately, the RG, for DU is actually determined using U-238 because the activity fraction (i.e., as a percentage) is 90.14 percent of the total DU activity.

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DETERMINATION OF THE DERIVED CONCENTRATION GUIDELINE LEVEL FOR DEPLETED URANIUM IN SOIL

RISK AND DOSE ASSESSMENT MODEL

RESRAD-ONSITE Version 7.2 (released July 2016), is being used to re-derive and verify the DCGLs and soil RG originally derived using RESRAD Version 6.4 (released December 2007). Generally, RESRAD (now RESRAD-ONSITE) is a computer code developed at the ANL for the DOE to assess radiation exposures (i.e., doses and ELCRs) to a human receptor located on top of radiologically contaminated soils. Modeling dose and ELCR using the RESRAD codes is an acceptable standard industry practice that has been applied to the USACE St. Louis FUSRAP Sites for nearly 2 decades. For OU-8, these RESRAD models are used to calculate the maximum ELCR and dose to a receptor(s) that could occur over a 1,000-year evaluation period. Additionally, the RESRAD models are used to determine site-specific residual radiation guidelines and dose to an on-site receptor at sites that are contaminated with residual radioactive materials.

CANCER SLOPE AND DOSE CONVERSION FACTORS

The soil RG for the site worker was determined in the FUSRAP FS (USACE 2011b) from among site worker and construction DCGLs that were calculated using RESRAD Version 6.4. CSFs and DCFs utilized during the original DCGL calculations were available in the FGR-11 library of the RESRAD Version 6.4 model. The DCFs in the FGR-11 library of RESRAD Version 6.4 were obtained from FGR-11 for ingestion and inhalation (USEPA 1988), and from FGR-12 for external radiation DCFs (USEPA 1993). The CSFs in the FGR-11 library of RESRAD Version 6.4 were obtained from FGR-13 for all pathways (USEPA 1999). The FGR-11 library of RESRAD Version 6.4 incorporated ICRP-38 data for nuclide energies and decay chains (USEPA 1999).

During the first FUSRAP FYR (USACE 2019b), verification of the soil RG was performed using default CSFs and DCFs in the DCFPAK3.02 (Adult) library of RESRAD-ONSITE Version 7.2. All CSFs and DCFs in that library are the values presented in ORNL's 2014 TM (ORNL 2014) and are based on updated data for nuclide energy and decay chain information from ICRP-107 (ICRP 2008). One difference between the DCFPAK3.02 library and the ORNL 2104 TM is that the model library applies dietary CSFs by default to the soil ingestion pathway, rather than the soil ingestion CSFs available in the TM. During the first FUSRAP FYR, all DCFPAK3.02 library default factors were used in the site worker soil RG verification, including the dietary factors for the soil ingestion pathway.

As part of this second FYR, verification of the site worker soil RG is conducted utilizing the latest DCFs and CSFs from ORNL 2014 that are available in the DCFPAK 3.02 (Adult) library of the RESRAD-ONSITE Version 7.2 model. The default values in the model library have not changed since the first FUSRAP YR; however, in August 2019 (subsequent to completion of the first FUSRAP FYR), USEPA released updated, age-specific external radiation DCFs in FGR 15 (USEPA 2019). In FGR 15, age-specific external radiation DCFs are now available for the following pathways: external radiation from surface and depth-specific sources (i.e., including ground surface, 1 cm, 5 cm, 15 cm, and infinite depth), air submersion, and water immersion. Receptor ages include newborn, 1-year old, 5-year old, 10-year old, 15-year old, and adult. The FGR 15 external radiation DCFs are not currently available in the DCFPAK3.02 library, nor are the soil ingestion CSFs from ORNL's 2014 TM (i.e., the dietary CSFs are still the library default values for the soil ingestion pathway). Both the ORNL 2014 soil ingestion CSFs and the FGR 15 external dose factors were also not included in the DU soil RG evaluations performed during the

first FUSRAP FYR (USACE 2019b). Therefore, for this evaluation, the CSFs and DCFs that are currently not included in the RESRAD-ONSITE Version 7.2 model base libraries and that were not evaluated during the first FUSRAP FYR have been included into modified libraries for the purpose of assessing the continued validity and health protectiveness of the soil RG established in the FUSRAP ROD. The ORNL soil ingestion CSFs being used in this evaluation are the “Soil Worker” ingestion CSFs. The FGR 15 external radiation DCFs used in this evaluation are the infinite depth DCFs for consistency with past use of external radiation DCFs at IAAAP. Also the infinite depth DCFs result in the most health-conservative estimates of dose relative to the other depth-specific DCFs.

SOURCE TERM

Based on Table 2-1 of *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities* (DOE 2000), DU is the sum of 99.8 percent by weight of U-238; 0.0007 percent by weight of U-234; and 0.2 percent by weight of U-235 with corresponding activity percentages of 90.14; 1.45; and 8.40. Because U-238 accounts for more than 90 percent of the DU activity, only U-238 DCGLs equivalent to the relative dose/ELCR limit were developed (i.e., the U-238 DCGLs will be based on relative dose/ELCR values that are less than the limit to account for dose/ELCR from U-234 and U-235) and will be protective considering associated U-234 and U-235. Therefore, soil analysis needs only account for U-238 to compare to the DCGL.

SITE PHYSICAL PARAMETERS

For this evaluation, the RESRAD parameters selected are the same as those used in the FUSRAP FS (USACE 2011b), which are consistent with USEPA’s *Human Health Evaluation Manual, Supplemental Guidance: Update of Superfund Default Exposure Factors* (USEPA 2014), USEPA’s *Exposure Factors Handbook, 2011 Edition*, which includes subsequent chapter updates (USEPA 2011), USEPA’s *Soil Screening Guidance for Radionuclides* (USEPA 2000), and ANL’s *Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil* (ANL 1993). Site-specific information is given the first preference for selection of site physical parameter values for RESRAD input parameters.

RECEPTOR SCENARIOS

Based on the current and future land use, the site worker and construction worker receptors were modeled in the original assessment performed during the RG development in the FUSRAP FS (USACE 2011b). During that evaluation, it was determined that the site worker is the critical receptor for RG development because DCGLs calculated for the site worker were more health-conservative than those calculated for the construction worker. This is because of the longer exposure duration assumed for the site worker (25 years) versus the construction worker (1 year). Therefore, for the purposes of the FYR, this evaluation focuses only on the critical receptor, the site worker.

The site worker scenario assumes that the critical receptor is a typical site worker who works 250 days per year for 25 years (USEPA 2014). The soil RG assumes that during a typical working day, the worker will spend 8 hours outdoors and will ingest 50 mg of soil (i.e., 18.25 g/year). However, since the first FUSRAP FYR, and due to a comment from USEPA during preparation of the WCSU PRAR (USACE 2020a), the soil ingestion rate for the site worker has been increased from 50 mg/day to 100 mg/day. This results in an updated RESRAD-ONSITE model input value of 25 g/year for soil ingestion. The site worker may be exposed to radioactive contamination

through several exposure pathways relative to site soil. Members of the site worker critical group can incur a radiation dose via the following pathways:

- Direct radiation from radionuclides in the soil,
- Inhalation of re-suspended dust present on contaminated soil, and
- Direct ingestion of contaminated soil.

The input parameters selected for the site worker scenario are the default RESRAD-ONSITE Version 7.2 input parameters, with the exception of inhalation and ingestion rates, exposure durations, and indoor/outdoor time fractions. The non-default RESRAD input parameters for the receptor scenarios are presented below in Table D-2-1.

Table D-2-1. RESRAD-ONSITE Version 7.2 Input Parameters for Risk and Dose Assessments

Category	Parameter	Input Value
Physical Parameters	Area of contaminated zone (m ²) of FSA	354,695
	Thickness of the contaminated zone (m) of the FSA	0.9
	Inhalation rate ^a (m ³ /year)	7,300
	Exposure duration (year)	25
	Indoor time fraction	0
	Outdoor time fraction ^b	0.2283
	Soil ingestion (g/year) ^c	25

^a Inhalation rate is based upon 20 m³/day * 365 day/year = 7,300 m³/year.

^b Fraction of time outdoor per year = (8 hours/day x 250 days/year) / (24 hours/day x 365 day/year) = 0.2283.

^c Site worker soil ingestion = 100 mg/day x 250 day/year x g/1000 mg = 25 g/year.

VERIFICATION OF THE SOIL REMEDIATION GOAL

Using the RESRAD-ONSITE Version 7.2 model, site-specific, risk-based and dose-based DCGLs for DU in soil were developed for the site worker. These DCGLs, which are generally the basis for determining the RG, are based on the known activity fractions of each of the uranium isotopes. However, with an activity fraction of 0.9014 (i.e., 90.14 percent), the ELCR and dose contributions from U-238 essentially drive the DCGLs, and ultimately, the soil RG.

Additionally, in the FUSRAP FS (USACE 2011b), dose- and risk-based DCGLs were calculated to comply with the 10 *CFR* 20.1403(b) dose limit of 25 mrem per year and the CERCLA ELCR range of 1E-06 to 1E-04. Compliance with the CERCLA ELCR range was achieved by targeting CRs of 1E-06, 1E-05, and 1E-04. However, because the RG selected from the DCGLs was based on the TELCR of 1E-04, this evaluation will focus development of the risk-based DCGLs only on the TELCR of 1E-04. To be health-protective of U-234 and U-235, both the dose- and risk-based soil DCGLs also consider the activity percent contribution of U-238.

Dose-Based Derived Concentration Guideline Level Calculations

Table D-2-2 presents the RESRAD-ONSITE Version 7.2 calculations of the dose-based soil DCGLs for all DU isotopes, as well as the total DCGL for DU. From the model output, DSRs were developed for each radionuclide. A relative DSR for each isotope was then calculated by multiplying the DSR by the corresponding activity fraction in DU. An isotopic fraction of the total relative DSR for DU was calculated for each isotope by dividing the relative DSR by the total relative DSR for DU. The target equivalent dose for each isotope was calculated by multiplying the target dose limit of 25 mrem per year by the isotopic fraction of the relative DU DSR. The isotopic DCGL was calculated by the dividing the isotopic target equivalent dose by the total

relative DSR for DU. The individual isotopic DCGLs were calculated such that the DCGL-equivalent doses and ELCRs collectively do not exceed the total dose and ELCR limits of 25 mrem per year and 1E-04, respectively. The total DU dose-based DCGL (241 pCi/g) was finally determined by summing the isotopic DCGLs. Given the predominant dose contribution from U-238, the U-238 DCGL (234 pCi/g) was selected for comparison with the corresponding risk-based DCGL determined in Table D-2-3.

Table D-2-2. Site Worker Dose-Based Derived Concentration Guideline Levels, RESRAD-ONSITE 7.2 Base Internal Dose Library: DCFPAK3.02 (Adult) Modified External Dose Library: DCFPAK3.02 with FGR 15 DCFs for Infinite Depth (Adult)

Isotope ^a	DSR ^b (mrem-g/pCi-yr)	DU Activity Fraction	Relative DSR (mrem-g/pCi-yr)	Isotopic Fraction of DU DSR (Unitless)	Target Dose (25 mrem/year Isotopic Equivalent)	DCGL (pCi/g)
U-238	1.12E-01	9.01E-01	1.01E-01	9.74E-01	2.43E+01	234
U-235	1.73E-01	1.45E-02	2.50E-03	2.41E-02	6.02E-01	6
U-234	2.52E-03	8.40E-02	2.12E-04	2.04E-03	5.09E-02	0.5
Total for DU:		1.00E+00	1.04E-01	1.00E+00	2.50E+01	241

^a Nuclide energies and decay chain data for DU isotopes were incorporated from ICRP-107 (ICRP 2008).

^b DSR = Maximum dose over 1,000-year evaluation period divided by the source concentration (1 pCi/g).

Risk-Based Derived Concentration Guideline Level Calculations

The risk-based DCGL for U-238 is calculated using the same methodology used for the dose-based DCGL, except RSRs, rather than DSRs, are the basis of the calculation. The risk-based DCGLs for the individual isotopes target equivalent ELCR levels that collectively do not exceed a total ELCR of 1E-04. Table D-2-3 shows these calculations. The total DU risk-based DCGL (160 pCi/g) in Table D-2-3 was finally determined by summing the isotopic DCGLs. Given the predominant ELCR contribution from U-238, the U-238 risk-based DCGL (148 pCi/g) was selected for comparison with the corresponding dose-based DCGL determined in Table D-2-2.

Table D-2-3. Site Worker Risk-Based Derived Concentration Guideline Levels, RESRAD-ONSITE 7.2 Modified Risk Library: DCFPAK3.02 Morbidity with Worker Soil Ingestion CSFs (ORNL 2014)

Isotope ^a	RSR ^b (Risk-g/pCi)	DU Activity Fraction	Relative RSR (Risk-g/pCi)	Isotopic Fraction of DU RSR (Unitless)	Target Cancer Risk (1E-04 Isotopic Equivalent)	DCGL (pCi/g)
U-238	6.44E-07	9.01E-01	5.80E-07	9.26E-01	9.26E-05	148
U-235	3.02E-06	1.45E-02	4.37E-08	6.98E-02	6.98E-06	11
U-234	3.36E-08	8.40E-02	2.82E-09	4.50E-03	4.50E-07	0.72
Total for DU:		1.00E+00	6.27E-07	1.00E+00	1.00E-04	160

^a Nuclide energies and decay chain data for DU isotopes were incorporated from ICRP-107 (ICRP 2008).

^b RSR = Maximum cancer risk over 1,000-year evaluation period divided by the source concentration (1 pCi/g).

CONCLUSION

Following a review of the dose- and risk-based soil DCGLs calculated for U-238 in Tables D-2-2 and D-2-3, respectively, the selected RG would be the lower and more health conservative of the two values (i.e., the risk-based DCGL of 148 pCi/g). The risk-based DCGL for U-238 determined during in FUSRAP FS was 154 pCi/g. Both the current and FS-derived DCGLs for U-238 values round to 150 pCi/g, which is the soil RG established in the FUSRAP ROD (USACE 2011a).

In conclusion, the RG recalculation using the RESRAD-ONSITE Version 7.2 model, with the updated ORNL 2014 DCFs and CSFs, along with the FGR 15 external radiation DCFs and the modified soil ingestion rate for the site worker, results in a U-238 DCGL (148 pCi/g) that approximates the soil RG (150 pCi/g). Therefore, the soil RG established in the FUSRAP ROD (USACE 2011a) is still valid and the remedy being applied to the DU-contaminated soil at the FSA remains health-protective.

The RESRAD-ONSITE Version 7.2 output files for the dose and ELCR calculations are included as Attachments D-2-1 and D-2-2, respectively.

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ATTACHMENT D-2-1

**SITE WORKER RESRAD-ONSITE VERSION 7.2 DOSE OUTPUT REPORT
BASE INTERNAL DOSE LIBRARY: DCFPAK3.02 (ADULT)
MODIFIED EXTERNAL DOSE LIBRARY: DCFPAK3.02 WITH FGR 15 DCFs FOR
INFINITE DEPTH (ADULT)**

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RESRAD Version 7.2 Dose Output, DCGL Calculation Check of Soil RG for Depleted Uranium, Site Worker
2014 ORNL Adult Internal DCFs
USEPA FGR No. 15 Adult External DCFs
Iowa Army Ammunition Plant, Operable Unit 8

Part I: Mixture Sums and Single Radionuclide Guidelines	
Dose Conversion Factor (and Related) Parameter Summary ...	2
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Contaminated Zone and Total Dose Summary	11
Total Dose Components	12
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Time = 0.000E+00	16
Time = 1.000E+00	17
Time = 3.000E+00	18
Time = 1.000E+01	19
Time = 7.000E+01	20
Time = 1.000E+02	20
Dose/Source Ratios Summed Over All Pathways	21
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Summary : IAAAP_OH8 Soil DU DCIGs Site Wkr 2014 ORNL Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: Worker Updates_Soil)	4.330E-04	2.615E-04	DCF1(1)
A-1	At-218 (Source: Worker Updates_Soil)	5.260E-04	5.567E-05	DCF1(2)
A-1	At-219 (Source: DCFPAK3.02)	0.000E+00	0.000E+00	DCF1(3)
A-1	Bi-210 (Source: Worker Updates_Soil)	1.280E-01	5.474E-03	DCF1(4)
A-1	Bi-211 (Source: Worker Updates_Soil)	2.370E-01	2.410E-01	DCF1(5)
A-1	Bi-214 (Source: Worker Updates_Soil)	9.370E+00	9.136E+00	DCF1(6)
A-1	Bi-215 (Source: Worker Updates_Soil)	1.590E+00	1.369E+00	DCF1(7)
A-1	Fr-223 (Source: Worker Updates_Soil)	2.860E-01	1.758E-01	DCF1(8)
A-1	Hg-206 (Source: Worker Updates_Soil)	7.300E-01	6.128E-01	DCF1(9)
A-1	Pa-231 (Source: Worker Updates_Soil)	1.590E-01	1.609E-01	DCF1(10)
A-1	Pa-234 (Source: Worker Updates_Soil)	8.290E+00	8.276E+00	DCF1(11)
A-1	Pa-234m (Source: Worker Updates_Soil)	4.460E-01	1.257E-01	DCF1(12)
A-1	Pb-210 (Source: Worker Updates_Soil)	2.350E-03	2.092E-03	DCF1(13)
A-1	Pb-211 (Source: Worker Updates_Soil)	5.150E-01	3.680E-01	DCF1(14)
A-1	Pb-214 (Source: Worker Updates_Soil)	1.300E+00	1.257E+00	DCF1(15)
A-1	Po-210 (Source: Worker Updates_Soil)	5.600E-05	5.642E-05	DCF1(16)
A-1	Po-211 (Source: Worker Updates_Soil)	4.670E-02	4.708E-02	DCF1(17)
A-1	Po-214 (Source: Worker Updates_Soil)	4.780E-04	4.801E-04	DCF1(18)
A-1	Po-215 (Source: Worker Updates_Soil)	9.330E-04	9.453E-04	DCF1(19)
A-1	Po-218 (Source: Worker Updates_Soil)	2.260E-06	9.229E-09	DCF1(20)
A-1	Ra-223 (Source: Worker Updates_Soil)	5.820E-01	5.791E-01	DCF1(21)
A-1	Ra-226 (Source: Worker Updates_Soil)	3.210E-02	3.176E-02	DCF1(22)
A-1	Rn-218 (Source: Worker Updates_Soil)	4.200E-03	4.260E-03	DCF1(23)
A-1	Rn-219 (Source: Worker Updates_Soil)	2.930E-01	2.970E-01	DCF1(24)
A-1	Rn-222 (Source: Worker Updates_Soil)	2.110E-03	2.130E-03	DCF1(25)
A-1	Th-227 (Source: Worker Updates_Soil)	5.600E-01	5.642E-01	DCF1(26)
A-1	Th-230 (Source: Worker Updates_Soil)	1.160E-03	1.106E-03	DCF1(27)
A-1	Th-231 (Source: Worker Updates_Soil)	4.690E-02	3.251E-02	DCF1(28)
A-1	Th-234 (Source: Worker Updates_Soil)	2.990E-02	2.317E-02	DCF1(29)
A-1	Tl-206 (Source: Worker Updates_Soil)	2.000E-01	1.278E-02	DCF1(30)
A-1	Tl-207 (Source: Worker Updates_Soil)	1.920E-01	2.391E-02	DCF1(31)
A-1	Tl-210 (Source: Worker Updates_Soil)	1.730E+01	1.678E+01	DCF1(32)
A-1	U-234 (Source: Worker Updates_Soil)	3.510E-04	3.456E-04	DCF1(33)
A-1	U-235 (Source: Worker Updates_Soil)	7.060E-01	7.006E-01	DCF1(34)
A-1	U-238 (Source: Worker Updates_Soil)	1.720E-04	1.713E-04	DCF1(35)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.459E-01	5.760E-01	DCF2(1)
B-1	Pa-231	8.505E-01	8.505E-01	DCF2(2)
B-1	Pb-210+D	3.708E-02	2.077E-02	DCF2(3)
B-1	Ra-226+D	3.541E-02	3.517E-02	DCF2(4)
B-1	Th-230	3.759E-01	3.759E-01	DCF2(5)
B-1	U-234	3.479E-02	3.479E-02	DCF2(6)
B-1	U-235+D	3.132E-02	3.132E-02	DCF2(7)
B-1	U-238	2.973E-02	2.973E-02	DCF2(8)
B-1	U-238+D	2.976E-02	2.973E-02	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.607E-03	1.191E-03	DCF3(1)

Summary : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
D-1	Pa-231	1.772E-03	1.772E-03	DCF3(2)
D-1	Pb-210+D	7.057E-03	2.575E-03	DCF3(3)
D-1	Ra-226+D	1.037E-03	1.036E-03	DCF3(4)
D-1	Th-230	7.918E-04	7.918E-04	DCF3(5)
D-1	U-234	1.831E-04	1.831E-04	DCF3(6)
D-1	U-235+D	1.740E-04	1.728E-04	DCF3(7)
D-1	U-238	1.650E-04	1.650E-04	DCF3(8)
D-1	U-238+D	1.776E-04	1.650E-04	DCF3(9)
Dose Conversion Factor (and Related) Parameter Summary (continued)				
D-34	Food transfer factors, Soil Plus DCFPAK3.02 (Adult)			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)

Summary : IAAAP_OH8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors_&_FGR15_DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC (2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC (2,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC (3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC (3,2)
D-5	Per-226+D , fish	5.000E+01	5.000E+01	BIOFAC (4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC (4,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC (5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC (5,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC (6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (6,2)
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC (7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (7,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC (8,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (8,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC (9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (9,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : IAAAP_OH8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			
R011	Area of contaminated zone (m**2)	3.547E+05	1.000E+04		AREA
R011	Thickness of contaminated zone (m)	9.000E-01	2.000E+00	Used by RESRAD	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00		SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02		LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01		BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00		TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00		T (2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00		T (3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T (4)
R011	Times for calculations (yr)	7.000E+01	3.000E+01	---	T (5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T (6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T (7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T (8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T (9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1 (6)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+00	0.000E+00	---	S1 (7)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+00	0.000E+00	---	S1 (8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1 (6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1 (7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1 (8)
Site-Specific Parameter Summary					
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	V CZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
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0 Menu		User Input	Default	(If different from user input)	Parameter
R014	Well pump intake depth (m below water table)	not used	1.000E+01		DATEWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	Used by RESRAD	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02		UW
R015	Number of unsaturated zone strata	not used	1		NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00		H (1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00		DENSUZ (1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ (1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ (1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ (1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00		BUZ (1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ (1)
R016	Distribution coefficients for U-234			---	
R016		5.000E+01	5.000E+01	---	DCNUCC (6)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	---	DCNUCU (6,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCS (6)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	ALEACH (6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	---	SOLUBK (6)
Site-Specific Parameters Summary (continued)					
R016	Distribution coefficients for U-235				
R016		5.000E+01	5.000E+01	---	DCNUCC (7)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	7.376E-03	DCNUCU (7,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (7)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (7)
R016	Solubility constant				
R016	Distribution coefficients for U-238				
R016		5.000E+01	5.000E+01	---	DCNUCC (8)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	7.376E-03	DCNUCU (8,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (8)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (8)
R016	Solubility constant				
R016	Distribution coefficients for daughter Ac-227				
R016		2.000E+01	2.000E+01	---	DCNUCC (1)
R016	Contaminated zone (cm**3/g)	not used	2.000E+01	7.376E-03	DCNUCU (1,1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	not used	DCNUCS (1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (1)
R016	Solubility constant				
R016	Distribution coefficients for daughter Pa-231				
R016		5.000E+01	5.000E+01	---	DCNUCC (2)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	1.832E-02	DCNUCU (2,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (2)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (2)
R016	Solubility constant				

7.376E-03

not used

Summary : IAAAP_OUG Soils DU DCIGs Site Wkr 2014 ORNL Factors & FGR15.DCFs
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0 Menu		User Input	Default	(If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210	1.000E+02	1.000E+02	Used by RESRAD	DCNUCC (3)
R016	Contaminated zone (cm**3/g)	not used	1.000E+02		DCNUCU (3,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02		DCNUCS (3)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (3)
R016	Solubility constant				
R016	Distribution coefficients for daughter Ra-226	7.000E+01	7.000E+01	---	DCNUCC (4)
R016	Contaminated zone (cm**3/g)	not used	7.000E+01	3.696E-03	DCNUCU (4,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	not used	DCNUCS (4)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (4)
R016	Solubility constant				
R016	Distribution coefficients for daughter Th-230	6.000E+04	6.000E+04	---	DCNUCC (5)
R016	Contaminated zone (cm**3/g)	not used	6.000E+04	5.275E-03	DCNUCU (5,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	not used	DCNUCS (5)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (5)
R016	Solubility constant				
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03		INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	6.173E-06	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	not used	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01		SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01		FIND
R017	Fraction of time spent outdoors (on site)	2.283E-01	2.500E-01		FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	---	FS
R017	Radii of shape factor array (used if FS = -1):			---	
R017	1:	not used	5.000E+01	>0_shows circular AREA.	RAD_SHAPE (1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE (2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE (3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE (4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE (5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00		RAD_SHAPE (6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00		RAD_SHAPE (7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE (8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE (9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE (10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE (11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE (12)

Summary : IAAAP OH8 Soil DU DCIGs Site Wkr 2014 ORNL Factors & FGR15.DCFs
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0		User	Default	(If different from user input)	Parameter
Menu		Input			Name
R017	Fractions of annular areas within AREA:				
R017	1	not used	1.000E+00	Used by RESRAD	FRACA (1)
R017	2	not used	2.732E-01		FRACA (2)
R017	3	not used	0.000E+00		FRACA (3)
R017	4	not used	0.000E+00		FRACA (4)
R017	5	not used	0.000E+00		FRACA (5)
R017	6	not used	0.000E+00		FRACA (6)
R017	7	not used	0.000E+00		FRACA (7)
R017	8	not used	0.000E+00	---	FRACA (8)
R017	Parameter 9	not used	0.000E+00	---	FRACA (9)
R017	10	not used	0.000E+00	---	FRACA (10)
R017	11	not used	0.000E+00	---	FRACA (11)
R017	12	not used	0.000E+00	---	FRACA (12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET (1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET (2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET (3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET (4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET (5)
R018	Site-Specific Seasonal Consumption (kg/yr)	not used	9.000E-01	---	DIET (6)
R018	Soil ingestion rate (g/yr)	2.500E+01	3.650E+01		SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01		DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE (1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE (2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE (3)

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15.DCFs
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0 Menu		User Input	Default	(If different from user input)	Parameter
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01		TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	Used by RESRAD	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00		TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01		RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01		RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (l/sec)	not used	7.000E-07	---	EVSIN
C14	C-12 evasion flux rate from soil (l/sec)	not used	1.000E-10	---	REVSIN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in swine feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):			---	
STOR		1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Fruits, non-leafy vegetables, and grain	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Milk	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Meat and poultry	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Crustacea and mollusks	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Surface water	4.500E+01	4.500E+01	---	STOR_T(9)
STOR	Livestock fodder			---	
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):			---	
R021		not used	2.000E-06	---	DIFCV
R021	in cover material	not used	3.000E-07	---	DIFFL
R021	in foundation material	not used	2.000E-06	---	DIFCZ
R021	Radon emanation coefficient	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points			---	NPTS

0		User	Default	(If different from user input)	Parameter
Menu		Input			
TITL	Maximum number of integration points for dose				NAME
TITL	Maximum number of integration points for risk		---	Used by RESRAD	LYMAX
		17	---		
		257	---		

	Parameter	User Selection	---

		active	
		suppressed	
		suppressed	
		suppressed	
		suppressed	
		suppressed	
1	Summary of External gamma		
2	-- inhalation (w/o radon)		
3	Site-Specific Parameter Summary (continued)		
3	Plant ingestion	suppressed	
4	-- meat ingestion	suppressed	
5	-- milk ingestion		
6	-- aquatic foods	active	
7	-- drinking water		
8	-- soil ingestion		
9	-- radon		
	Find peak pathway doses		

Summary : IAAAP_OH8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors_&_FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Initial Soil Concentrations, pCi/g

		U-234	1.000E+00
Contaminated Zone Dimensions:		U-235	1.000E+00
Length:	0.00 meters	U-238	1.000E+00
Width:	0.00 meters		
Depth:	0.00 meters		
Area:	354695.00 square meters		

	0.000E+00	1.000E+00	3.000E+00	1.000E+01	7.000E+01	1.000E+02	3.000E+02	1.000E+03
t (years):	2.874E-01	2.852E-01	2.811E-01	2.670E-01	1.718E-01	1.379E-01	3.192E-02	0.000E+00
	1.149E-02	1.141E-02	1.124E-02	1.068E-02	6.873E-03	5.516E-03	1.277E-03	0.000E+00

Maximum TDOSE(t): 2.874E-01 mrem/yr at t = 0.000E+00 years
 TDOSE(t):

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
 M(t):

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Dose TDOSE(t), mrem/yr

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.982E-05	0.0003	1.398E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.042E-03	0.0036
U-235	1.703E-01	0.5927	1.259E-03	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.897E-04	0.0034
U-238	1.101E-01	0.3831	1.196E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.010E-03	0.0035
Total	2.805E-01	0.9760	3.853E-03	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.041E-03	0.0106

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.519E-03	0.0088
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.726E-01	0.6005
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.123E-01	0.3907
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.874E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.874E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	mrem/yr	fract.	mrem/yr	fract.
U-234	7.925E-05	0.0003	1.388E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.691E-01	0.5927	1.250E-03	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.093E-01	0.3831	1.187E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.784E-01	0.9760	3.825E-03	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Water Dependent Pathways														
Water		Fish		Radon		Plant		Meat		Milk		All Pathways*		
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.501E-03	0.0088
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.713E-01	0.6005
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.115E-01	0.3907
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.852E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.852E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.814E-05	0.0003	1.368E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.019E-03	0.0036
U-235	1.666E-01	0.5927	1.234E-03	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.687E-04	0.0034
U-238	1.077E-01	0.3830	1.170E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.876E-04	0.0035
Total	2.743E-01	0.9760	3.771E-03	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.975E-03	0.0106

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.465E-03	0.0088
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.688E-01	0.6005
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.098E-01	0.3907
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.811E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.811E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.467E-05	0.0003	1.300E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.678E-04	0.0036
U-235	1.582E-01	0.5927	1.177E-03	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.216E-04	0.0035
U-238	1.022E-01	0.3830	1.111E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.380E-04	0.0035
Total	2.605E-01	0.9760	3.587E-03	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.827E-03	0.0106

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.342E-03	0.0088
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.603E-01	0.6005
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.043E-01	0.3907
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.670E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.670E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	6.554E-05	0.0004	8.417E-04	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.238E-04	0.0036
U-235	1.019E-01	0.5930	7.931E-04	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.036E-04	0.0035
U-238	6.568E-02	0.3823	7.137E-04	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.026E-04	0.0035
Total	1.676E-01	0.9757	2.348E-03	0.0137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.830E-03	0.0107

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.531E-03	0.0089
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.033E-01	0.6012
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.700E-02	0.3899
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.718E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.718E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 7.000E+01 years

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	mrem/yr	fract.	mrem/yr	fract.
U-234	7.028E-05	0.0005	6.783E-04	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.180E-02	0.5932	6.518E-04	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	5.264E-02	0.3818	5.721E-04	0.0041	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.345E-01	0.9755	1.902E-03	0.0138	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

0		Water Dependent Pathways													
0		Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234		0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.250E-03	0.0091
As mrem/yr		0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.294E-02	0.6015
U-235		0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.370E-02	0.3894
U-238		0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.379E-01	1.0000
Total		0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.379E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Summary : IAAAP OH8 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15 DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.418E-04	0.0044	1.697E-04	0.0053	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.209E-04	0.0038
U-235	1.891E-02	0.5925	1.737E-04	0.0054	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.196E-04	0.0037
U-238	1.204E-02	0.3772	1.309E-04	0.0041	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.106E-04	0.0035
Total	3.109E-02	0.9741	4.744E-04	0.0149	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.511E-04	0.0110

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.325E-04	0.0135
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-02	0.6017
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.228E-02	0.3847
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.192E-02	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.192E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Summary : IAAAP_OH8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15_DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Summary : IAAAP-008 Soil DU DCGLs Site Wkr 2014 ORNL Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\008_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0	Parent	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
				0.000E+00	1.000E+00	3.000E+00	1.000E+01	7.000E+01	1.000E+02	3.000E+02	1.000E+03
	U-234	U-234	1.000E+00	2.519E-03	2.501E-03	2.464E-03	2.340E-03	1.503E-03	1.205E-03	2.754E-04	0.000E+00
	U-234	Th-230	1.000E+00	9.147E-08	2.735E-07	6.336E-07	1.853E-06	1.007E-05	1.300E-05	2.208E-05	0.000E+00
	U-234	Ra-226+D	1.000E+00	1.603E-09	1.118E-08	5.859E-08	5.085E-07	1.774E-05	3.182E-05	1.319E-04	0.000E+00
	U-234	Pb-210+D	1.000E+00	3.660E-13	5.434E-12	6.197E-11	1.514E-09	2.410E-07	5.256E-07	3.141E-06	0.000E+00
	U-234	ΣDSR(j)		2.519E-03	2.501E-03	2.465E-03	2.342E-03	1.531E-03	1.250E-03	4.325E-04	0.000E+00
	U-235	U-235+D	1.000E+00	1.726E-01	1.713E-01	1.688E-01	1.603E-01	1.030E-01	8.253E-02	1.888E-02	0.000E+00
	U-235	Pa-231	1.000E+00	8.472E-07	2.525E-06	5.807E-06	1.654E-05	7.132E-05	8.146E-05	5.560E-05	0.000E+00
	U-235	Ac-227+D	1.000E+00	6.336E-08	4.354E-07	2.208E-06	1.707E-05	2.590E-04	3.330E-04	2.720E-04	0.000E+00
	U-235	ΣDSR(j)		1.726E-01	1.713E-01	1.688E-01	1.603E-01	1.033E-01	8.294E-02	1.920E-02	0.000E+00
	U-238	U-238	1.000E+00	1.123E-01	1.115E-01	1.098E-01	1.043E-01	6.700E-02	5.370E-02	1.228E-02	0.000E+00
	U-238	U-238+D	1.000E+00	1.123E-01	1.115E-01	1.098E-01	1.043E-01	6.700E-02	5.370E-02	1.228E-02	0.000E+00
	U-238	Th-230	1.000E+00	8.598E-14	5.993E-13	3.138E-12	2.713E-11	9.164E-10	1.619E-09	6.166E-09	0.000E+00
	U-238	Ra-226+D	1.000E+00	1.131E-15	1.689E-14	1.951E-13	4.993E-12	1.114E-09	2.782E-09	2.893E-08	0.000E+00
	U-238	Pb-210+D	1.000E+00	2.068E-19	6.349E-18	1.566E-16	1.135E-14	1.248E-11	3.895E-11	6.446E-10	0.000E+00
	U-238	ΣDSR(j)		1.123E-01	1.115E-01	1.098E-01	1.043E-01	6.700E-02	5.370E-02	1.228E-02	0.000E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

0Nuclide	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	7.000E+01	1.000E+02	3.000E+02	1.000E+03
(j) U-234	9.923E+03	9.996E+03	1.014E+04	1.067E+04	1.633E+04	2.000E+04	5.781E+04	*6.222E+09	
U-235	1.449E+02	1.460E+02	1.481E+02	1.559E+02	2.420E+02	3.014E+02	1.302E+03	*2.160E+06	
U-238	2.227E+02	2.243E+02	2.276E+02	2.397E+02	3.731E+02	4.656E+02	2.036E+03	*3.361E+05	

*At specific activity limit

0Nuclide	Soil Guidelines G(i,tmin)	DSR(i,tmin)	DSR(i,tmax)	G(i,tmax)
	(pCi/g)	(years)	(pCi/g)	(pCi/g)
U-234	2.519E-03	9.923E+03	1.726E-01	1.449E+02
U-235	1.726E-01	1.449E+02	1.123E-01	2.227E+02
U-238	1.123E-01	2.227E+02	1.123E-01	2.227E+02

Summary : IAAAP_OH8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0Nuclide	Parent	THF(i)	DOSE(j,t), mrem/yr							
	(i)		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	7.000E+01	1.000E+02	3.000E+02	1.000E+03
(j)										
U-234	U-234	1.000E+00	2.519E-03	2.501E-03	2.464E-03	2.340E-03	1.503E-03	1.205E-03	2.754E-04	0.000E+00
U-234	U-238	1.000E+00	3.552E-09	1.059E-08	2.435E-08	6.937E-08	2.992E-07	3.418E-07	2.337E-07	0.000E+00
U-234	ΣDOSE(j)		2.519E-03	2.501E-03	2.464E-03	2.340E-03	1.503E-03	1.205E-03	2.756E-04	0.000E+00
Th-230	U-234	1.000E+00	9.147E-08	2.735E-07	6.336E-07	1.853E-06	1.007E-05	1.300E-05	2.208E-05	0.000E+00
Th-230	U-238	1.000E+00	8.598E-14	5.993E-13	3.138E-12	2.713E-11	9.164E-10	1.619E-09	6.166E-09	0.000E+00
Th-230	ΣDOSE(j)		9.147E-08	2.735E-07	6.336E-07	1.853E-06	1.008E-05	1.300E-05	2.208E-05	0.000E+00
Ra-226	U-234	1.000E+00	1.603E-09	1.118E-08	5.859E-08	5.085E-07	1.774E-05	3.182E-05	1.319E-04	0.000E+00
Ra-226	U-238	1.000E+00	1.131E-15	1.689E-14	1.951E-13	4.993E-12	1.114E-09	2.782E-09	2.893E-08	0.000E+00
Ra-226	ΣDOSE(j)		1.603E-09	1.118E-08	5.859E-08	5.085E-07	1.774E-05	3.183E-05	1.319E-04	0.000E+00
Pb-210	U-234	1.000E+00	3.660E-13	5.434E-12	6.197E-11	1.514E-09	2.410E-07	5.256E-07	3.141E-06	0.000E+00
Pb-210	U-238	1.000E+00	2.068E-19	6.349E-18	1.566E-16	1.135E-14	1.248E-11	3.895E-11	6.446E-10	0.000E+00
Pb-210	ΣDOSE(j)		3.660E-13	5.434E-12	6.197E-11	1.514E-09	2.410E-07	5.256E-07	3.142E-06	0.000E+00
Pa-231	U-235	1.000E+00	1.726E-01	1.713E-01	1.688E-01	1.603E-01	1.030E-01	8.253E-02	1.888E-02	0.000E+00
Pa-231	U-235	1.000E+00	8.472E-07	2.525E-06	5.807E-06	1.654E-05	7.132E-05	8.146E-05	5.560E-05	0.000E+00
Pa-231	ΣDOSE(j)		8.472E-07	2.525E-06	5.807E-06	1.654E-05	7.132E-05	8.146E-05	5.560E-05	0.000E+00
Ac-227	U-235	1.000E+00	6.336E-08	4.354E-07	2.208E-06	1.707E-05	2.590E-04	3.330E-04	2.720E-04	0.000E+00
U-238	U-238	5.450E-07	1.184E-09	1.175E-09	1.158E-09	1.099E-09	7.063E-10	5.661E-10	1.295E-10	0.000E+00
U-238	U-238	1.000E+00	1.123E-01	1.115E-01	1.098E-01	1.043E-01	6.700E-02	5.370E-02	1.228E-02	0.000E+00
U-238	ΣDOSE(j)		1.123E-01	1.115E-01	1.098E-01	1.043E-01	6.700E-02	5.370E-02	1.228E-02	0.000E+00

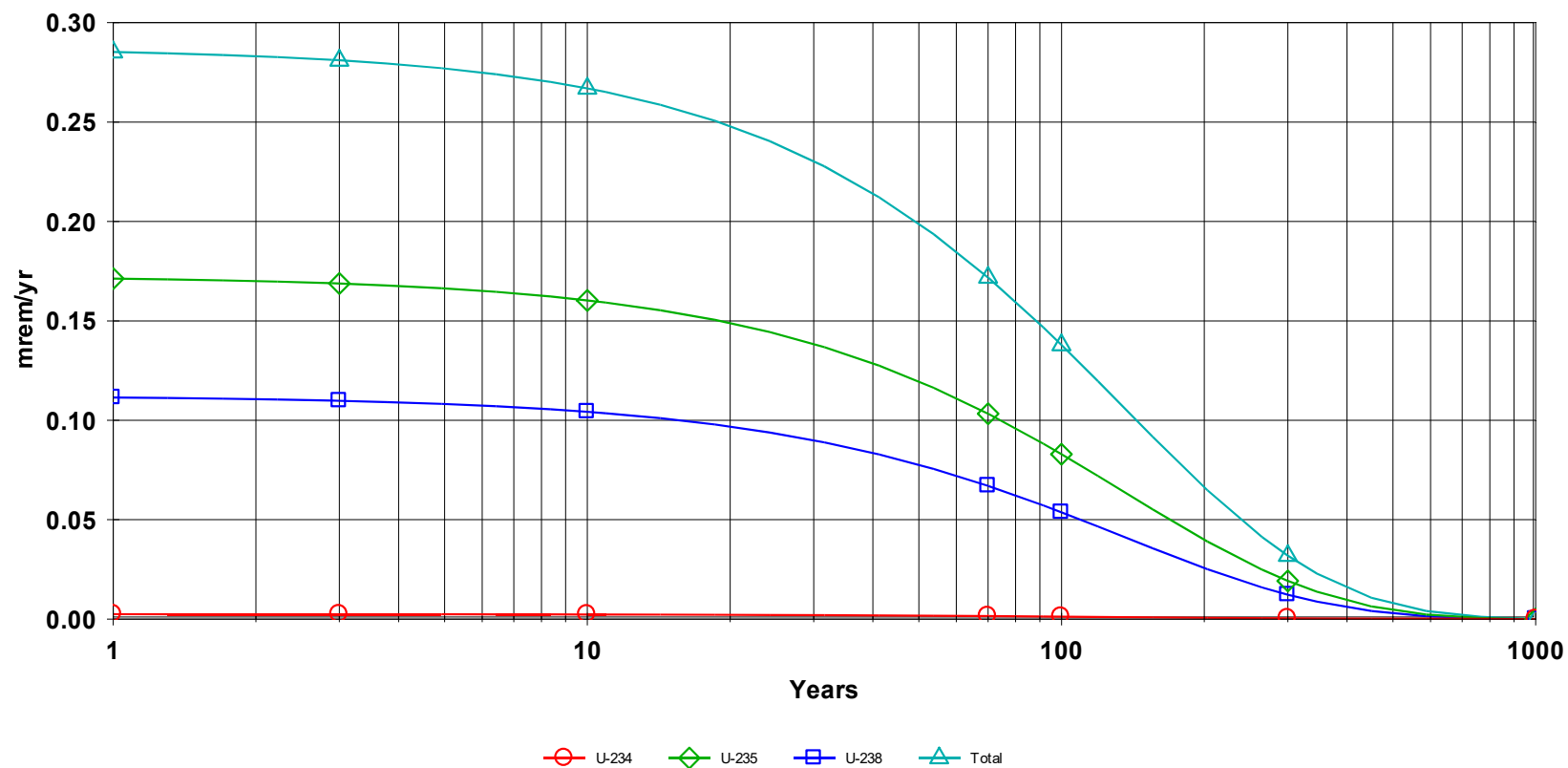
THF(i) is the thread fraction of the parent nuclide.

Summary : IAAAP_OH8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0Nuclide	Parent (i)	THF(i)	S(j,t), pCi/g							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	7.000E+01	1.000E+02	3.000E+02	1.000E+03
(j)										
U-234	U-234	1.000E+00	1.000E+00	9.926E-01	9.781E-01	9.289E-01	5.966E-01	4.781E-01	1.093E-01	6.244E-04
U-234	U-238	1.000E+00	0.000E+00	2.803E-06	8.285E-06	2.623E-05	1.179E-04	1.350E-04	9.262E-05	1.766E-06
U-234	ΣS(j):		1.000E+00	9.927E-01	9.781E-01	9.289E-01	5.967E-01	4.783E-01	1.094E-01	6.262E-04
Th-230	U-234	1.000E+00	0.000E+00	9.161E-06	2.728E-05	8.864E-05	5.024E-04	6.498E-04	1.107E-03	1.229E-03
Th-230	U-238	1.000E+00	0.000E+00	1.292E-11	1.151E-10	1.236E-09	4.541E-08	8.058E-08	3.088E-07	4.692E-07
Th-230	ΣS(j):		0.000E+00	9.161E-06	2.728E-05	8.864E-05	5.025E-04	6.499E-04	1.107E-03	1.229E-03
Ra-226	U-234	1.000E+00	0.000E+00	1.983E-09	1.769E-08	1.907E-07	7.234E-06	1.303E-05	5.442E-05	9.240E-05
Ra-226	U-238	1.000E+00	0.000E+00	1.865E-15	4.984E-14	1.781E-12	4.514E-10	1.134E-09	1.193E-08	3.454E-08
Ra-226	ΣS(j):		0.000E+00	1.983E-09	1.769E-08	1.907E-07	7.234E-06	1.304E-05	5.443E-05	9.243E-05
Pb-210	U-234	1.000E+00	0.000E+00	2.048E-11	5.400E-10	1.842E-08	3.325E-06	7.294E-06	4.397E-05	8.246E-05
Pb-210	U-238	1.000E+00	0.000E+00	1.447E-17	1.147E-15	1.311E-13	1.709E-10	5.379E-10	9.012E-09	3.070E-08
Pb-210	ΣS(j):		0.000E+00	2.048E-11	5.400E-10	1.842E-08	3.325E-06	7.295E-06	4.398E-05	8.249E-05
Pb-210	U-235	1.000E+00	1.000E+00	9.927E-01	9.781E-01	9.289E-01	5.967E-01	4.783E-01	1.094E-01	6.262E-04
OPa-231	U-235	1.000E+00	0.000E+00	2.100E-05	6.208E-05	1.965E-04	8.831E-04	1.011E-03	6.922E-04	1.311E-05
Parent Nuclide and Branch Fraction Indicated										
OPa-231	U-235	1.000E+00	0.000E+00	3.296E-07	2.842E-06	2.726E-05	4.488E-04	5.789E-04	4.751E-04	9.530E-06
OU-238	U-238	5.450E-07	5.450E-07	5.410E-07	5.331E-07	5.062E-07	3.252E-07	2.607E-07	5.962E-08	3.413E-10
U-238	U-238	1.000E+00	1.000E+00	9.927E-01	9.781E-01	9.289E-01	5.967E-01	4.783E-01	1.094E-01	6.262E-04
U-238	ΣS(j):		1.000E+00	9.927E-01	9.781E-01	9.289E-01	5.967E-01	4.783E-01	1.094E-01	6.262E-04

THF(i) is the thread fraction of the parent nuclide.
 ORESRAD.EXE execution time = 8.14 seconds

DOSE: All Nuclides Summed, All Pathways Summed



\\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE WKR_SOIL DU DCGL_2014 ORNL_FGR15.RAD 04/21/2023 14:42 GRAPHICS.ASC Includes All Pathwa

ATTACHMENT D-2-2

**SITE WORKER RESRAD-ONSITE 7.2 RISK OUTPUT REPORT
MODIFIED RISK LIBRARY: DCFPAK3.02 MORBIDITY WITH WORKER SOIL
INGESTION CSFs (ORNL 2014)**

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RESRAD Version 7.2 Risk Output, DCGL Calculation Check of Soil RG for Depleted Uranium, Site Worker
2014 ORNL Internal & External CSFs (Soil Ingestion CSFs Used Rather than Dietary CSFs
Iowa Army Ammunition Plant, Operable Unit 8

Part III: Intake Quantities and Health Risk Factors	
Cancer Risk Slope Factors	2
Risk Slope and ETFG for the Ground Pathway	4
Amount of Intake Quantities and Excess Cancer Risks	5
.....	8
.....	11
Time= 0.000E+00	14
Time= 0.000E+00	17
Time= 3.000E+00	20
Time= 1.000E+01	23
Time= 7.000E+01	26
Time= 1.000E+02	
Time= 3.000E+02	
Time= 1.000E+03	

Intrisk : IAAAP_OH8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors_&_FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0		Current	Base	Parameter
Menu		Value	Case*	Name
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	Ac-227+D	1.44E-06	1.98E-10	SLPF(1,1)
Sf-1	Pa-231	1.27E-07	1.27E-07	SLPF(2,1)
Sf-1	Pb-210+D	4.30E-09	1.48E-09	SLPF(3,1)
Sf-1	Ra-226+D	8.37E-06	2.50E-08	SLPF(4,1)
Sf-1	Th-230	8.45E-10	8.45E-10	SLPF(5,1)
Sf-1	U-234	2.53E-10	2.53E-10	SLPF(6,1)
Sf-1	U-235+D	5.76E-07	5.51E-07	SLPF(7,1)
Sf-1	U-238	1.24E-10	1.24E-10	SLPF(8,1)
Risk Library	Worker Updates_Soil Plus DCFPAK3.02 Morbidity	1.19E-07	1.24E-10	SLPF(9,1)
Sf-1				
Sf-2	Inhalation, slope factors, 1/(pCi):			
Sf-2	Ac-227+D	2.13E-07	1.49E-07	SLPF(1,2)
Sf-2	Pa-231	7.62E-08	7.62E-08	SLPF(2,2)
Sf-2	Pb-210+D	3.08E-08	1.59E-08	SLPF(3,2)
Sf-2	Ra-226+D	2.83E-08	2.81E-08	SLPF(4,2)
Sf-2	Th-230	3.41E-08	3.41E-08	SLPF(5,2)
Sf-2	U-234	2.78E-08	2.78E-08	SLPF(6,2)
Sf-2	U-235+D	2.50E-08	2.50E-08	SLPF(7,2)
Sf-2	U-238	2.36E-08	2.36E-08	SLPF(8,2)
Sf-2	U-238+D	2.37E-08	2.36E-08	SLPF(9,2)
Sf-2				
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	6.54E-10	2.45E-10	SLPF(1,3)
Sf-3	Pa-231	2.26E-10	2.26E-10	SLPF(2,3)
Sf-3	Pb-210+D	3.44E-09	1.18E-09	SLPF(3,3)
Sf-3	Ra-226+D	5.15E-10	5.14E-10	SLPF(4,3)
Sf-3	Th-230	1.19E-10	1.19E-10	SLPF(5,3)
Sf-3	U-234	9.55E-11	9.55E-11	SLPF(6,3)
Sf-3	U-235+D	9.76E-11	9.43E-11	SLPF(7,3)
Sf-3	U-238	8.66E-11	8.66E-11	SLPF(8,3)
Sf-3	U-238+D	1.21E-10	8.66E-11	SLPF(9,3)
Sf-3				
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	4.87E-10	2.01E-10	SLPF(1,4)
Sf-3	Pa-231	1.72E-10	1.72E-10	SLPF(2,4)
Sf-3	Pb-210+D	2.67E-09	8.84E-10	SLPF(3,4)
Sf-3	Ra-226+D	3.85E-10	3.85E-10	SLPF(4,4)
Sf-3	Th-230	9.14E-11	9.14E-11	SLPF(5,4)
Sf-3	U-234	7.07E-11	7.07E-11	SLPF(6,4)
Sf-3	U-235+D	7.17E-11	6.95E-11	SLPF(7,4)
Sf-3	U-238	6.40E-11	6.40E-11	SLPF(8,4)
Sf-3	U-238+D	8.71E-11	6.40E-11	SLPF(9,4)
Sf-3				
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	3.45E-10	2.45E-10	SLPF(1,5)
Sf-3	Pa-231	1.54E-10	2.26E-10	SLPF(2,5)
Sf-3	Pb-210+D	2.04E-09	1.18E-09	SLPF(3,5)
Sf-3	Ra-226+D	2.95E-10	5.14E-10	SLPF(4,5)
Sf-3	Th-230	7.73E-11	1.19E-10	SLPF(5,5)

Intrisk : IAAAP_OH8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors_&_FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0		Current	Base	Parameter
Menu		Value	Case*	Name
Sf-3	U-234	5.11E-11	9.55E-11	SLPF(6,5)
Sf-3	U-235+D	5.01E-11	9.43E-11	SLPF(7,5)
Sf-3	U-238	4.66E-11	8.66E-11	SLPF(8,5)
Sf-3	U-238+D	5.61E-11	8.66E-11	SLPF(9,5)
Sf-Rn	Radon Inhalation slope factors, 1/(pCi):			
Sf-Rn	Rn-222	1.80E-12	1.80E-12	SLPFRN(1,1)
Sf-Rn	Po-218	3.70E-12	3.70E-12	SLPFRN(1,2)
Sf-Rn	Pb-214	6.20E-12	6.20E-12	SLPFRN(1,3)
Sf-Rn	Bi-214	1.50E-11	1.50E-11	SLPFRN(1,4)
Risk Library	Worker Updates_Soil Plus DCFPAK3.02 Morbidity			
Cancer Risk	Slope Factors Summary Table (continued)			
Sf-Rn	Radon R-factors, (mrem/WLM):			
Sf-Rn	Rn-222 Indoor	3.88E+02	3.88E+02	KFACTR(1,1)
Sf-Rn	Rn-222 Outdoor	3.88E+02	3.88E+02	KFACTR(1,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

0Nuclide	Slope(i) *	ETFG(i,t) At Time in Years (dimensionless)							
		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	7.000E+01	1.000E+02	3.000E+02	1.000E+03
(i)									
Ac-227	1.990E-10	2.277E-01	2.277E-01	2.277E-01	2.277E-01	2.277E-01	2.277E-01	2.277E-01	0.000E+00
At-218	2.740E-11	2.254E-01	2.254E-01	2.254E-01	2.254E-01	2.254E-01	2.254E-01	2.254E-01	0.000E+00
At-219	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Bi-210	2.770E-09	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	0.000E+00
Bi-211	0.000E+00	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	0.000E+00
Bi-214	7.340E-06	2.254E-01	2.254E-01	2.254E-01	2.254E-01	2.253E-01	2.253E-01	2.250E-01	0.000E+00
Bi-215	1.080E-06	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	0.000E+00
Bi-215	1.080E-06	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	2.264E-01	0.000E+00
Fr-223	4.830E-07	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	0.000E+00
Hg-206	1.270E-07	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	0.000E+00
Pa-231	6.620E-06	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.258E-01	0.000E+00
Pa-234	9.060E-08	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.255E-01	0.000E+00
Pa-234m	1.480E-09	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	0.000E+00
Pb-210	2.910E-07	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.258E-01	0.000E+00
Pb-211	9.940E-07	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	0.000E+00
Pb-214	4.510E-11	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.255E-01	0.000E+00
Po-210	3.760E-08	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.254E-01	0.000E+00
Po-211	3.850E-10	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.254E-01	0.000E+00
Po-214	7.480E-10	2.260E-01	2.260E-01	2.260E-01	2.260E-01	2.260E-01	2.260E-01	2.260E-01	0.000E+00
Po-215	6.840E-15	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	0.000E+00
Po-218	4.550E-07	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.269E-01	0.000E+00
Ra-223	2.500E-08	2.269E-01	2.269E-01	2.269E-01	2.269E-01	2.269E-01	2.269E-01	2.269E-01	0.000E+00
Ra-226	3.390E-09	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.255E-01	2.254E-01	0.000E+00
Rn-218	2.350E-07	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	0.000E+00
Rn-219	1.690E-09	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.258E-01	0.000E+00
Rn-222	4.450E-07	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.269E-01	0.000E+00
Th-227	8.450E-10	2.278E-01	2.278E-01	2.278E-01	2.278E-01	2.278E-01	2.278E-01	2.278E-01	0.000E+00
Th-230	2.490E-08	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	0.000E+00
Th-231	1.780E-08	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	0.000E+00
Th-234	6.110E-09	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	0.000E+00
Tl-206	1.590E-08	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.259E-01	2.258E-01	0.000E+00
Tl-207	1.340E-05	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.256E-01	2.253E-01	0.000E+00
Tl-210	2.530E-10	2.282E-01	2.282E-01	2.282E-01	2.282E-01	2.282E-01	2.282E-01	2.282E-01	0.000E+00
U-234	5.510E-07	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.270E-01	2.269E-01	0.000E+00
U-235	1.240E-10	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	0.000E+00
U-238	1.240E-10	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	2.268E-01	0.000E+00

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Intrisk : IAAAP_OU8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors_&_FGR15_DCFA
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio-Nuclide	Water Dependent Pathways											Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*	
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-Indep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sum of Intake Quantities	4.033E-02	0.000E+00	0.000E+00	0.000E+00	5.707E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.707E+00
U-235	4.033E-02	0.000E+00	0.000E+00	0.000E+00	5.708E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.708E+00
U-238	4.033E-02	0.000E+00	0.000E+00	0.000E+00	5.708E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.708E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 0.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 0.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	3.902E-10	0.0001	1.029E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.353E-12	0.0000
Pa-231	1.686E-10	0.0000	1.799E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.143E-12	0.0000
Excl. Cancer Risks	1.566E-15	0.0000	1.996E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.872E-14	0.0000
Ra-226	1.804E-11	0.0000	1.090E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.612E-14	0.0000
Th-230	5.205E-13	0.0000	3.716E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.193E-12	0.0000
U-234	1.318E-09	0.0004	2.562E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.659E-09	0.0018
U-235	2.985E-06	0.8084	2.303E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.529E-09	0.0018
U-238	6.146E-07	0.1665	2.179E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.312E-09	0.0020
Total	3.601E-06	0.9754	7.047E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.051E-08	0.0056

and Fraction of Total Risk at t= 0.000E+00 years

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.028E-10	0.0001
Excess Cancer Risks CNRS (i, P, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.917E-10	0.0001
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.228E-14	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.807E-11	0.0000
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.430E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.359E-08	0.0091
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.014E-06	0.8164
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.437E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.692E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 0.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, P, t) and CNRS (i, P, t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 0.000E+00 years														Water Independent Pathways (Inhalation excludes radon)	
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil			
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	
U-234	1.337E-09	0.0004	2.562E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.660E-09	0.0018	
U-235	2.985E-06	0.8085	2.306E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.537E-09	0.0018	
	6.146E-07	0.1665	2.180E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.312E-09	0.0020	
Water Ind. Excess Cancer Risk CNRS (i, P, t) *** for															
Total	3.601E-06	0.9754	7.047E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.051E-08	0.0056	

Intrisk : IAAAP_OH8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCL_2014_ORNL_FGR15.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.361E-08	0.0091
Total Excess Cancer Risk CNRSI (p,t) **	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.015E-06	0.8166
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.437E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.692E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.329E-08	0.000E+00	0.000E+00	0.000E+00	1.881E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.881E-06
Pa-231	8.470E-07	0.000E+00	0.000E+00	0.000E+00	1.199E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.199E-04
Water-Indep.	8.261E-13	0.000E+00	0.000E+00	0.000E+00	1.169E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.169E-10
Ra-226	7.998E-11	0.000E+00	0.000E+00	0.000E+00	1.132E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.132E-08
Th-230	3.695E-07	0.000E+00	0.000E+00	0.000E+00	5.229E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.229E-05
Sum of Ingestion Pathways	4.003E-02	0.000E+00	0.000E+00	0.000E+00	5.666E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.666E+00
U-235	4.003E-02	0.000E+00	0.000E+00	0.000E+00	5.666E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.666E+00
U-238	4.003E-02	0.000E+00	0.000E+00	0.000E+00	5.666E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.666E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	4.326E-10	0.0001	1.141E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.609E-12	0.0000
Pa-231	1.811E-10	0.0000	1.933E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.527E-12	0.0000
Excels Cancer Risks	1.816E-15	0.0000	2.315E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.171E-14	0.0000
Ra-226	2.023E-11	0.0000	1.222E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.808E-14	0.0000
Th-230	5.608E-13	0.0000	4.003E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.285E-12	0.0000
U-234	1.309E-09	0.0004	2.543E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.610E-09	0.0018
U-235	2.963E-06	0.8084	2.286E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.481E-09	0.0018
U-238	6.101E-07	0.1665	2.163E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.258E-09	0.0020
Total	3.575E-06	0.9754	6.996E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.036E-08	0.0056

and Fraction of Total Risk at t= 1.000E+00 years

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.466E-10	0.0001
Excess Cancer Risks CNRS (i, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.060E-10	0.0001
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.584E-14	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.026E-11	0.0000
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.850E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.335E-08	0.0091
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.992E-06	0.8164
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.390E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.665E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, t) and CNRS (i, t) for Inhalation of								
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+00 years Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	1.329E-09	0.0004	2.543E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.611E-09	0.0018
U-235	2.963E-06	0.8085	2.289E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.489E-09	0.0018
U-238	6.101E-07	0.1665	2.164E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.258E-09	0.0020
Water Ind. Excess Cancer Risk CNRS (i, p, t) *** for														
Total	3.575E-06	0.9754	6.996E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.036E-08	0.0056

Intrisk : IAAAP_OH8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.337E-08	0.0091
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.993E-06	0.8166
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.390E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.665E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Radio-Nuclide	Water Dependent Pathways										Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.146E-07	0.000E+00	0.000E+00	0.000E+00	1.622E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.622E-05
Pa-231	2.504E-06	0.000E+00	0.000E+00	0.000E+00	3.543E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.543E-04
Water-Indep.	2.178E-11	0.000E+00	0.000E+00	0.000E+00	3.082E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.082E-09
Ra-226	7.136E-10	0.000E+00	0.000E+00	0.000E+00	1.010E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.010E-07
Th-230	1.100E-06	0.000E+00	0.000E+00	0.000E+00	1.557E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.557E-04
Sum of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	3.945E-02	0.000E+00	0.000E+00	0.000E+00	5.583E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.583E+00
U-235	3.945E-02	0.000E+00	0.000E+00	0.000E+00	5.583E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.583E+00
U-238	3.945E-02	0.000E+00	0.000E+00	0.000E+00	5.583E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.583E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	5.241E-10	0.0001	1.382E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.161E-12	0.0000
Pa-231	2.057E-10	0.0001	2.195E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.276E-12	0.0000
Ra-226	2.399E-15	0.0000	3.058E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.868E-14	0.0000
Th-230	2.507E-11	0.0000	1.514E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.241E-14	0.0000
U-234	6.404E-13	0.0000	4.572E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.468E-12	0.0000
U-235	1.290E-09	0.0004	2.505E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.513E-09	0.0018
U-238	2.919E-06	0.8083	2.253E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.386E-09	0.0018
U-238	6.012E-07	0.1665	2.132E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.152E-09	0.0020
Total	3.523E-06	0.9754	6.894E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.006E-08	0.0056

and Fraction of Total Risk at t= 3.000E+00 years

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.411E-10	0.0001
Excess Cancer Risks CNRS (i, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.339E-10	0.0001
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.413E-14	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.511E-11	0.0000
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.680E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.286E-08	0.0091
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.948E-06	0.8163
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.296E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.612E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, t) and CNRS (i, t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+00 years														Water Independent Pathways (Inhalation excludes radon)	
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil			
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	
U-234	1.315E-09	0.0004	2.506E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.514E-09	0.0018	
U-235	2.920E-06	0.8085	2.256E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.396E-09	0.0018	
U-238	6.012E-07	0.1665	2.132E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.152E-09	0.0020	
Water Ind. Excess Cancer Risk CNRS (i, p, t) *** for															
Total	3.523E-06	0.9754	6.894E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.006E-08	0.0056	

Intrisk : IAAAP_OH8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.289E-08	0.0091
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.949E-06	0.8166
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.296E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.612E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors_&_FGR15_DCFA
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Radio-Nuclide	Water Dependent Pathways										Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.099E-06	0.000E+00	0.000E+00	0.000E+00	1.556E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.556E-04
Pa-231	7.925E-06	0.000E+00	0.000E+00	0.000E+00	1.122E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.122E-03
Water-Indep.	2.428E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	7.691E-09	0.000E+00	0.000E+00	0.000E+00	1.088E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.088E-06
Th-230	3.575E-06	0.000E+00	0.000E+00	0.000E+00	5.059E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.059E-04
Sum of Intake Quantities (i, p, t) for Individual Radionuclides (i) and Pathways (p)	3.746E-02	0.000E+00	0.000E+00	0.000E+00	5.302E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.302E+00
U-235	3.746E-02	0.000E+00	0.000E+00	0.000E+00	5.302E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.302E+00
U-238	3.746E-02	0.000E+00	0.000E+00	0.000E+00	5.302E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.302E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake Quantities (i, p, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+01 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+01 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	8.984E-10	0.0003	2.369E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.419E-12	0.0000
Pa-231	2.858E-10	0.0001	3.049E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.720E-12	0.0000
Excels Cancer Risks CNRS (i, p, t) for Individual Radionuclides (i) and Pathways (p)	5.462E-15	0.0000	6.962E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.530E-14	0.0000
Ra-226	4.673E-11	0.0000	2.823E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.177E-14	0.0000
Th-230	9.100E-13	0.0000	6.496E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.086E-12	0.0000
U-234	1.225E-09	0.0004	2.379E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.185E-09	0.0018
U-235	2.772E-06	0.8082	2.139E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.065E-09	0.0018
U-238	5.709E-07	0.1664	2.024E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.792E-09	0.0020
Total	3.346E-06	0.9754	6.549E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.906E-08	0.0056

and Fraction of Total Risk at t= 1.000E+01 years

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Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.275E-10	0.0003
Excess Cancer Risks CNRS (i, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.250E-10	0.0001
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.772E-14	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.680E-11	0.0000
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.492E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.120E-08	0.0091
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.800E-06	0.8162
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.979E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.430E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+01 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, t) and CNRS (i, t) for Inhalation of								
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+01 years														Water Independent Pathways (Inhalation excludes radon)									
Ground				Inhalation		Radon		Plant		Meat		Milk		Soil									
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.									
U-234	1.272E-09	0.0004	2.380E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.187E-09	0.0018									
U-235	2.774E-06	0.8086	2.145E-08	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.079E-09	0.0018									
U-238	5.709E-07	0.1664	2.025E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.792E-09	0.0020									
Total Excess Cancer Risk CNRS (i, p, t) *** for																							
Total	3.346E-06	0.9754	6.549E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.906E-08	0.0056									

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Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.126E-08	0.0091
Total Excess Cancer Risk CNRSI (p,t) **	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.801E-06	0.8166
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.979E-07	0.1743
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.430E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Radio-Nuclide	Water Dependent Pathways										Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.810E-05	0.000E+00	0.000E+00	0.000E+00	2.561E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.561E-03
Pa-231	3.562E-05	0.000E+00	0.000E+00	0.000E+00	5.041E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.041E-03
Water-Indep. Pathways	1.810E-05	0.000E+00	0.000E+00	0.000E+00	2.561E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.561E-03
Ra-226	2.917E-07	0.000E+00	0.000E+00	0.000E+00	4.129E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.129E-05
Th-230	2.026E-05	0.000E+00	0.000E+00	0.000E+00	2.868E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.868E-03
Sum of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	2.407E-02	0.000E+00	0.000E+00	0.000E+00	3.406E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.406E+00
U-235	2.407E-02	0.000E+00	0.000E+00	0.000E+00	3.406E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.406E+00
U-238	2.407E-02	0.000E+00	0.000E+00	0.000E+00	3.406E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.406E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 7.000E+01 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 7.000E+01 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	4.157E-09	0.0019	1.096E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.508E-11	0.0000
Pa-231	6.812E-10	0.0003	7.269E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.079E-11	0.0000
Ra-226	1.185E-13	0.0000	1.511E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.417E-12	0.0000
Th-230	4.511E-10	0.0002	2.725E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.031E-13	0.0000
U-234	2.728E-12	0.0000	1.947E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.253E-12	0.0000
U-235	7.867E-10	0.0004	1.528E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.973E-09	0.0018
U-238	1.781E-06	0.8065	1.374E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.896E-09	0.0018
U-238	3.667E-07	0.1661	1.301E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.363E-09	0.0020
Total	2.154E-06	0.9753	4.223E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.229E-08	0.0056

and Fraction of Total Risk at t= 7.000E+01 years

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Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.292E-09	0.0019
Excess Cancer Risks	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.747E-10	0.0004
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.686E-12	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.517E-10	0.0002
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.846E-11	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.004E-08	0.0091
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.799E-06	0.8145
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.841E-07	0.1739
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.208E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 7.000E+01 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 7.000E+01 years Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	1.240E-09	0.0006	1.530E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.980E-09	0.0018
U-235	1.786E-06	0.8087	1.392E-08	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.942E-09	0.0018
U-238	3.667E-07	0.1661	1.301E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.364E-09	0.0020
Water Ind. Excess Cancer Risks	2.154E-06	0.9753	4.223E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.229E-08	0.0056

Intrisk : IAAAP_OH8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.052E-08	0.0093
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.804E-06	0.8168
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.841E-07	0.1739
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.208E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 7.000E+01 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors_&_FGR15_DCFA
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Radio- Nuclide	Water Dependent Pathways										Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	2.335E-05	0.000E+00	0.000E+00	0.000E+00	3.304E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.304E-03
Pa-231	4.077E-05	0.000E+00	0.000E+00	0.000E+00	5.770E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.770E-03
Water-Indep.	2.942E-07	0.000E+00	0.000E+00	0.000E+00	4.164E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.164E-05
Ra-226	5.257E-07	0.000E+00	0.000E+00	0.000E+00	7.440E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.440E-05
Th-230	2.621E-05	0.000E+00	0.000E+00	0.000E+00	3.709E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.709E-03
Sum of Ingestion Pathways (p)	1.929E-02	0.000E+00	0.000E+00	0.000E+00	2.730E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.730E+00
U-235	1.929E-02	0.000E+00	0.000E+00	0.000E+00	2.730E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.730E+00
U-238	1.929E-02	0.000E+00	0.000E+00	0.000E+00	2.730E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.730E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+02 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	4.982E-09	0.0028	1.314E-10	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.005E-11	0.0000
Pa-231	7.452E-10	0.0004	7.952E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.274E-11	0.0000
Ra-226	2.269E-13	0.0000	2.892E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.713E-12	0.0000
Th-230	7.357E-10	0.0004	4.469E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.612E-13	0.0000
U-234	3.376E-12	0.0000	2.410E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.737E-12	0.0000
U-235	6.305E-10	0.0004	1.225E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.185E-09	0.0018
U-238	1.427E-06	0.8054	1.101E-08	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.123E-09	0.0018
U-238	2.939E-07	0.1658	1.042E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.497E-09	0.0020
Total	1.729E-06	0.9753	3.392E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.868E-09	0.0056

and Fraction of Total Risk at t= 1.000E+02 years

Intrisk : IAAAP_OU8_Soil_DU_DCIGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.143E-09	0.0029
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.475E-10	0.0005
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.229E-12	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.408E-10	0.0004
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.521E-11	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.607E-08	0.0091
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.442E-06	0.8134
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.079E-07	0.1737
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.772E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+02 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+02 years Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	1.374E-09	0.0008	1.227E-08	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.195E-09	0.0018
U-235	1.433E-06	0.8087	1.122E-08	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.175E-09	0.0018
U-238	2.939E-07	0.1659	1.043E-08	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.498E-09	0.0020
Water Ind. Excess Cancer Risk CNRS (i, p) for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.729E-06	0.9753	3.392E-08	0.0191	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.868E-09	0.0056

Intrisk : IAAAP_OH8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
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Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.684E-08	0.0095
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.448E-06	0.8168
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.079E-07	0.1737
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.772E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors_&_FGR15_DCFA
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Radio-Nuclide	Water Dependent Pathways										Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.916E-05	0.000E+00	0.000E+00	0.000E+00	2.711E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.711E-03
Pa-231	2.792E-05	0.000E+00	0.000E+00	0.000E+00	3.951E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.951E-03
Water-Indep.	1.774E-06	0.000E+00	0.000E+00	0.000E+00	2.510E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.510E-04
Ra-226	2.195E-06	0.000E+00	0.000E+00	0.000E+00	3.107E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.107E-04
Th-230	4.464E-05	0.000E+00	0.000E+00	0.000E+00	6.317E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.317E-03
Sum of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	4.412E-03	0.000E+00	0.000E+00	0.000E+00	6.244E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.244E-01
U-235	4.412E-03	0.000E+00	0.000E+00	0.000E+00	6.244E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.244E-01
U-238	4.412E-03	0.000E+00	0.000E+00	0.000E+00	6.244E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.244E-01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Inhaled Radon, 0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+02 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+02 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	3.692E-09	0.0090	9.735E-11	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.227E-11	0.0001
Pa-231	4.735E-10	0.0012	5.053E-11	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.445E-11	0.0000
Excess Cancer Risks (i, p) for Individual Radionuclides (i) and Pathways (p)	1.121E-12	0.0000	1.429E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.340E-11	0.0000
Ra-226	2.660E-09	0.0065	1.609E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.381E-12	0.0000
Th-230	5.382E-12	0.0000	3.842E-11	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.234E-11	0.0000
U-234	1.442E-10	0.0004	2.802E-09	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.284E-10	0.0018
U-235	3.265E-07	0.7946	2.519E-09	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.143E-10	0.0017
U-238	6.722E-08	0.1636	2.384E-09	0.0058	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.999E-10	0.0019
Total	4.007E-07	0.9752	7.895E-09	0.0192	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.307E-09	0.0056

and Fraction of Total Risk at t= 3.000E+02 years

Intrisk : IAAAP_OU8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.811E-09	0.0093
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.385E-10	0.0013
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.595E-11	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.664E-09	0.0065
At-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.614E-11	0.0001
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.675E-09	0.0089
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.298E-07	0.8025
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.040E-08	0.1713
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.109E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+02 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+02 years														Water Independent Pathways (Inhalation excludes radon)	
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil			
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	
U-234	2.810E-09	0.0068	2.841E-09	0.0069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.559E-10	0.0018	
U-235	3.307E-07	0.8048	2.667E-09	0.0065	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.510E-10	0.0018	
U-238	6.722E-08	0.1636	2.387E-09	0.0058	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.005E-10	0.0019	
Total Excess Cancer Risk CNRS (1,p,t) ** for															
Total	4.007E-07	0.9752	7.895E-09	0.0192	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.307E-09	0.0056	

Intrisk : IAAAP_OH8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCL_2014_ORNL_FGR15.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.407E-09	0.0156
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.341E-07	0.8131
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.040E-08	0.1713
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.109E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Intrisk : IAAAP_OU8_Soil_DU_DCGLs_Site_Wkr_2014_ORNL_Factors_&_FGR15_DCFA
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD

Radio- Nuclide	Water Dependent Pathways											Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*	
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-Indep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sum of Intake Quantities (i, p, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake Quantities (i, p, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+03 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Excels Cancer Risks (i, p, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

and Fraction of Total Risk at t= 1.000E+03 years

[illegible]

Intrisk : IAAAP_OH8_Soil_DU_DCLGs_Site_Wkr_2014_ORNL_Factors & FGR15.DCFs
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OH8_SITE_WKR_SOIL_DU_DCL_2014_ORNL_FGR15.RAD

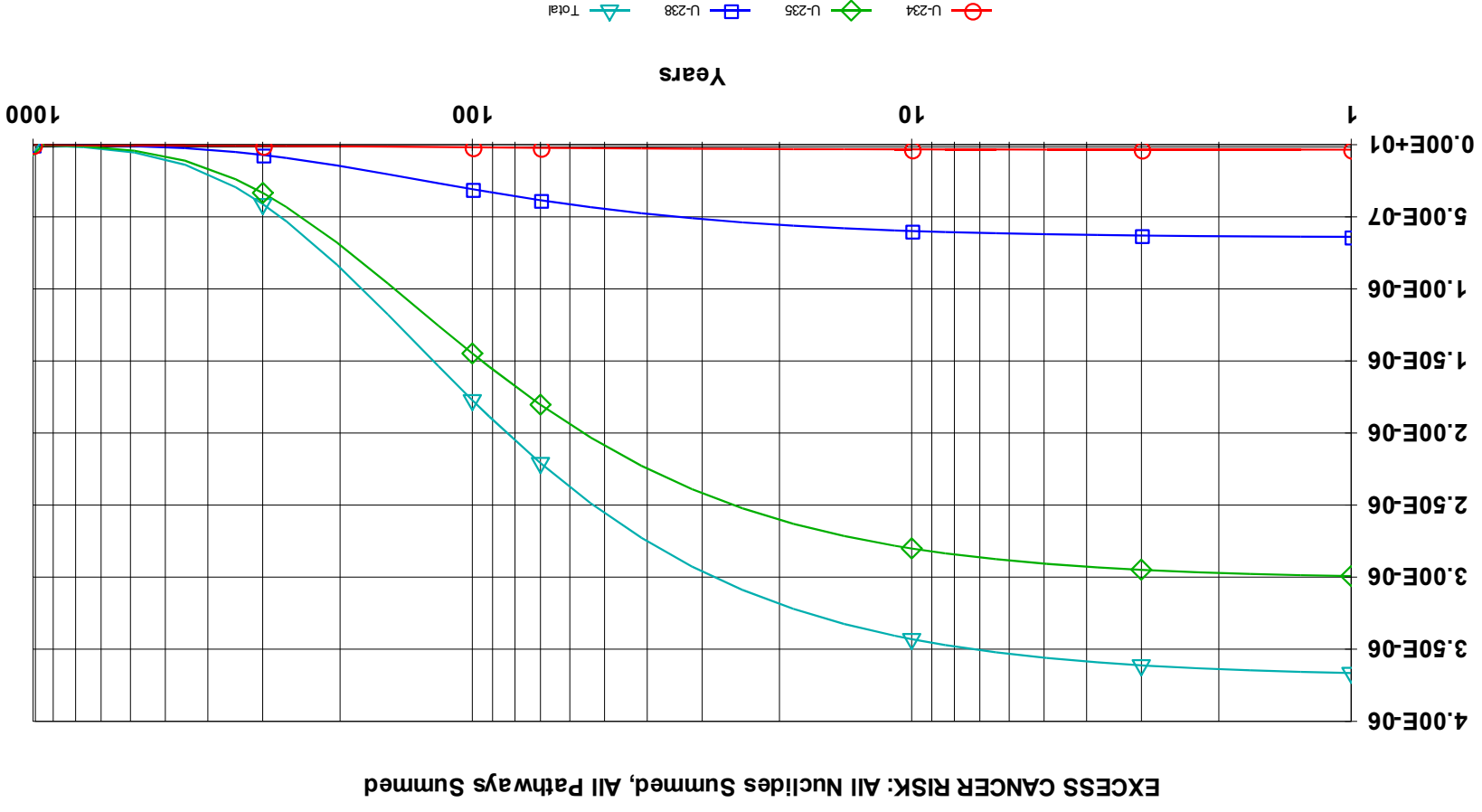
Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total Excess Cancer Risk CNRSI (p,t) **	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways



\\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OU8_SITE_WKR_SOIL_DU_DCGL_2014_ORNL_FGR15.RAD 04/21/2023 14:42 GRAPHICS.ASC Includes All Pathway

ATTACHMENT D-3

**SECOND FUSRAP FIVE-YEAR REVIEW VERIFICATION OF THE SITE WORKER
REMEDIATION GOAL FOR DEPLETED URANIUM IN SOIL ON OU-8
STRUCTURAL SURFACES**

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INTRODUCTION

As part of this second FUSRAP FYR, this attachment documents verification of the validity of the DCGL calculations originally performed during preparation of the FUSRAP FS (USACE 2011b) using the recently released RESRAD-BUILD Version 4.0 model and updated model CSF and DCF libraries. RESRAD-BUILD Version 3.4 was used during the FUSRAP FS to calculate risk- and dose-based DCGLs for the individual isotopes of DU (i.e., U-234, U-235, and U-238) that were ultimately used as the basis for determining the structural surface RG for a site (industrial) worker at Line 1 and the FSA. The DCGLs used to calculate the structural surface RG are the minimum levels corresponding to the time of maximum dose or ELCR over a 1,000-year period. The structural surface RG was derived based on a $1\text{E-}04$ ELCR to be protective of a site worker hypothetically exposed to DU in soil on building surfaces and components via soil ingestion, dust inhalation, and external ground radiation. Generally, the RESRAD-BUILD computer code is used to determine DSR and RSR for DU-contaminated soil on structural surfaces. The DSR and RSR are then used to calculate individual radionuclide DCGLs that were equivalent to 25 mrem per year or $1\text{E-}4$ ELCR (the maximum allowable protective ELCR in CERCLA).

To assess the validity and continued health protectiveness of the site worker DCGL calculations used to support determination and establishment of the structural surface RG for the site worker, the DCGL calculations are repeated in this evaluation by incorporating updated CSFs and DCFs. As discussed in more detail in the following pages of this evaluation, most of the updates are currently available in the RESRAD-BUILD Version 4.0 model base CSF and DCF libraries. Updates not included in the base libraries have been incorporated and saved into modified libraries to facilitate the assessment of the continued validity and health protectiveness of the DCGL calculations performed during FUSRAP FS.

The DCGLs presented in this document are based on the following:

- release under restricted conditions set forth by NRC in 10 *CFR* 20.1403(b), which states: “The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem [0.25 mSv] per year.”
- USEPA defines the CERCLA ELCR range as 10^{-6} to 10^{-4} where “the upper boundary of the risk range is not a discrete line at 1×10^{-4} . A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions” (USEPA 1997).

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METHODOLOGY

The principal radiological contaminant on structure surfaces at OU-8 sites is DU. DU is the byproduct remaining after the extraction of U-235 from naturally occurring uranium. DU typically contains about 99.799 percent by weight U-238; 0.200 percent by weight U-235, and 0.001 percent by weight U-234, respectively, with corresponding activity percentages of 90.14; 1.45; and 8.40. Natural U, by comparison, consists of about 99.284; 0.711; and 0.005 percent by weight U-238, U-235, and U-234, respectively, with corresponding activity percentages of 48.6; 2.2; and 49.2.

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DETERMINATION OF THE DERIVED CONCENTRATION GUIDELINE LEVEL FOR DEPLETED URANIUM

RISK AND DOSE ASSESSMENT MODEL

RESRAD-BUILD Version 4.0 (released December 2022) is being used to re-derive and verify the risk- and dose-based DU structural surface DCGLs originally calculated during the FUSRAP FS (USACE 2011b) using RESRAD-BUILD 3.4 (released December 2007). The DCGL calculations supported the selection and establishment of the risk-based DCGL (i.e., 23,000 dpm/100 cm²) as the structural surface RG for OU-8 in the FUSRAP ROD (USACE 2011a). Generally, RESRAD-BUILD is a computer code developed at the ANL for the DOE to assess radiation exposures (i.e., doses and ELCRs) to a human receptor inside of a contaminated building or a building containing contaminated surfaces (e.g., walls, floors, furniture, equipment, etc.).

CANCER SLOPE AND DOSE CONVERSION FACTORS

The structural surface RG for the site worker was determined in the FUSRAP FS (USACE 2011b) from among risk- and dose-based DCGLs calculated for the site worker using RESRAD-BUILD Version 3.4. CSFs and DCFs utilized during the original DCGL calculations were available in the FGR-13 Morbidity library of the RESRAD-BUILD Version 3.4 model. The DCFs in the FGR-13 Morbidity library were obtained from FGR-11 for ingestion and inhalation (USEPA 1988), and from FGR-12 for external radiation DCFs (USEPA 1993). The morbidity CSFs in the FGR-13 Morbidity library were obtained from FGR-13 for all pathways (USEPA 1999). The FGR-13 Morbidity library incorporated ICRP-38 data for nuclide energies and decay chains (USEPA 1999).

During the first FUSRAP FYR (USACE 2019b), the structural surface RG was verified and duplicated using the RESRAD-BUILD Version 3.5 model (released October 2009). The model default CSFs and DCFs used in the Version 3.5 model were the same as those used during RG derivation in the Version 3.4 model (i.e., the FGR 13 Morbidity library). After the 2009 release of the Version 3.5 model, updated CSFs and DCFs were published in the ORNL 2014 TM (ORNL 2014). The ORNL 2014 CSFs and DCFs are based on updated data for nuclide energy and decay chain information from ICRP-107 (ICRP 2008). The ORNL updates were not available in the RESRAD-BUILD Version 3.5 at the time of the first FUSRAP FYR; however, a comparative evaluation between the updated ORNL factors versus those in the FGR 13 Morbidity library of RESRAD-BUILD Version 3.5 showed that there would be no significant difference in model results generated if either the ORNL or FGR 13 Morbidity library CSFs and DCFs were used.

In August 2019, subsequent to completion of the first FUSRAP FYR, USEPA released updated, age-specific external radiation DCFs in FGR 15 (USEPA 2019). In FGR 15, age-specific external radiation DCFs are now available for the following pathways: external radiation from surface and depth-specific sources (i.e., including ground surface, 1 cm, 5 cm, 15 cm, and infinite depth), air submersion, and water immersion. Receptor ages include newborn, 1-year-old, 5-year-old, 10-year-old, 15-year-old, and adult.

As part of this second FYR, verification of the site worker structural surface RG is conducted utilizing the latest DCFs and CSFs from ORNL that are currently available in the DCFPAK 3.02 (Adult) library of the RESRAD-BUILD Version 4.0 model (ORNL 2014). One difference between the DCFPAK3.02 library and the ORNL 2014 TM is that the model library applies dietary CSFs by default to the ingestion pathway, rather than the soil ingestion CSFs available in the TM. Additionally, the FGR 15 external radiation DCFs are not currently available in the DCFPAK3.02

library. Therefore, this evaluation incorporates all the most recent CSF and DCF updates, as described in greater detail in the “Verification of the Structural Surface Remediation Goal” section.

SOURCE TERM

DU is the sum of 99.8 percent by weight U-238; 0.0007 percent by weight U-234, and 0.2 percent by weight U-235. Because structure survey instruments cannot differentiate between alpha/beta contamination from independent isotopes, the instrument detects radioactive decays from all three uranium isotopes. Therefore, the DCGL is based on all three isotopes at their assumed activity percentages.

A unit source concentration (1.0 pCi/m²) was input into RESRAD-BUILD Version 4.0 model to determine DSRs and RSRs for U-234, U-235, and U-238. The DSRs and RSRs were then used to calculate a DU DCGL based upon DU activity concentrations and the applicable dose- or risk-based target limit.

For this assessment, both receptors are assumed to work in the same facility where the entire floor (model default area = 100 m²) and walls up to a height of 2 m (model default height) are uniformly contaminated with DU. The assumptions regarding room dimensions and contamination represent default model inputs per NUREG-5512 and NUREG-6697 (PNNL 1994; SNL 1999; ANL 2002). The default room size is being used because it represents a room size that is likely to be smaller than rooms typically found at a large production facility such as IAAAP. Because the distances between the walls and receptor located in the center of a smaller room are less than those in a larger room in a production facility, it is assumed that the smaller room results in a higher delivery of radioactive dose to a receptor than a larger room of similar surface concentrations. Therefore, model inputs for the default room are likely to represent a health-conservative exposure scenario.

RECEPTOR SCENARIOS

Based on the current and future land use, the site worker and construction worker receptors were modeled in the original assessment performed during the RG development in the FUSRAP FS (USACE 2011b). During that evaluation, it was determined that the site worker was the critical receptor for RG development because DCGLs calculated for the site worker were more health-conservative than those calculated for the construction worker. Although it is plausible for a construction worker to become exposed during renovation and other construction-related activities, the exposures to a site worker bound those of the construction worker primarily because of the longer exposure duration assumed for the site worker (25 years) versus the construction worker (1 year). Therefore, for the FYR, this evaluation focuses only on the critical receptor, the site worker.

The site worker scenario assumes that the critical receptor is a typical site worker who works 250 days per year for 25 years (USEPA 2014). The individual works in the building structure that is contaminated with surficial radioactive material. The radioactive material can be released into the indoor air by mechanisms such as mechanical removal (decontamination activities) or erosion (removal of surface contamination). The applicable pathways for the site worker include the following:

- External exposure to penetrating radiation,
- Inhalation of airborne radioactive particulates, and
- Direct ingestion of surface contamination.

The RESRAD-BUILD parameters and model input values for the site worker scenario are presented in Table D-3-1. Of the parameters presented, the only change that has occurred in the

RESRAD-BUILD Version 4.0 model is a new default value of 0.00039 m/sec for deposition velocity, which represents the mean of the uncertainty distribution. The deposition velocity contributes to calculations of risk and dose for two pathways in the RESRAD BUILD Version 4.0 model: external radiation exposures to surface deposition (i.e., deposition on floors) and ingestion of deposition. Prior to Version 4.0, the default value for deposition velocity had been 0.01 m/sec. The structural surface RG was derived during the FUSRAP FS (USACE 2011b) using the deposition velocity of 0.01 m/sec.

Table D-3-1. Parameters for RESRAD-BUILD Building Occupancy Scenario (Site Worker)

Parameter	Description	Value	Justification
<i>Time Parameters</i>			
Exposure Duration	Amount of time that exposure occurs	365 days	NUREG/CR-5512, Volume 1, Section 3.2.1
Indoor Fraction	Fraction of the exposure duration that is spent inside the building	0.23	8 hour/day; 250 days/year
Evaluation Time	Times at which doses are calculated	0 year	RESRAD-BUILD Default
<i>Building Parameters</i>			
Number of Rooms	Number of compartments in the building	1	RESRAD-BUILD Default
Deposition Velocity	Velocity at which airborne particles are deposited onto the floor surfaces	0.01 m/second	RESRAD-BUILD Default (A sensitivity test resulted in no significant difference between the default value and the minimum and maximum values listed in NUREG/CR-6697)
Re-suspension Rate	Rate at which deposited material is re-suspended into the air	5.0 E-07 second ⁻¹	RESRAD-BUILD Default (approximate midpoint between NUREG/CR-6697 minimum and maximum values)
Building Exchange Rate	Total volume of air going out of the building per unit time divided by the total volume of the building	0.8 hour ⁻¹	RESRAD-BUILD Default Consistent with value of 0.75 hour ⁻¹ for conditioned spaces (cited by American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.)
Room Area	Floor area of the room	100 m ²	NUREG/CR-5512, Volume 1, Section 6.2.1
Room Height	Height of the room	2.5 m	RESRAD-BUILD Default Consistent with NUREG/CR-6697 most likely value of 2.4 m
Room Exchange Rate	Total volume of air going out of the room per unit time divided by the total volume of the room	0.8 hour ⁻¹	RESRAD-BUILD Default Same as building exchange rate due to single room
In/Out Flow Rate	Flow rates of air into and out of the room	200 m ³ /hour	Room volume (250 m ³) * Room exchange rate (0.8 hour ⁻¹)
<i>Receptor Parameters</i>			
Number of Receptors		1	RESRAD-BUILD Default
Room # Location	Room in which the receptor is located	1	RESRAD-BUILD Default
Time Fraction	Fraction of time within the building that the exposed individual spends at his receptor location	1	RESRAD-BUILD Default
Breathing Rate	Inhalation rate of airborne material at this location	33.6 m ³ /day	NUREG/CR-6697 most likely value (Breathing rate = 1.4 m ³ /hr)
Ingestion Rate	Ingestion rate of deposited dust for this location	1 E-04 m ² /hr	RESRAD-BUILD Default (approximate midpoint between NUREG/CR-6697 minimum and maximum values)
Receptor Location	Coordinates of the receptor	5 m, 5 m, 1 m	Located in center of room at height of 1m

Table D-3-1. Parameters for RESRAD-BUILD Building Occupancy Scenario (Site Worker) (Continued)

Parameter	Description	Value	Justification
<i>Shielding Parameters</i>			
Thickness	Thickness of the shielding between the contamination source and the receptor location	0	RESRAD-BUILD Default
Density	Density of the shielding material	Not applicable	No shielding is assumed.
Material	Identification of the shielding material	Not applicable	No shielding is assumed.
<i>Source Parameters</i>			
Number of Sources		5	Floor and four walls
Room # location	All sources are located in Room # 1	1	
Source Type		Area	Surface contamination only; volume source is not likely due to historical assessment of the IAAAP buildings. (No processing of materials or activation of building materials)
Direction	Axis perpendicular to the exposed area	Floor (z), Ceiling (z), 4 walls (x,y,x,y)	NUREG/CR-5512, Volume 1, Section 6.2.1
Location	Center point of the source in the x, y, z direction	Floor: 5 m, 5 m, 0 m; Walls: 10 m, 5 m, 1 m; 5 m, 10 m, 1 m; 0 m, 5 m, 1 m; and 5 m, 0 m, 1 m	Entire floor and bottom 2 m of each wall are uniformly contaminated
Geometry: Area	Area of the exposed surface over which the contamination is evenly distributed	100 m ² , 20 m ² , 20 m ² , 20 m ² , 20 m ²	
Air Release Fraction	Fraction of the eroded material that is released into the air	0.07	Most likely value. NUREG/CR-6697
Direct Ingestion	Direct ingestion rate of the source by any receptor in the room	0 / hour	RESRAD-BUILD Default
Removable Fraction	Fraction of the source that can be linearly removed between t = 0 and lifetime	0.2	Most likely value NUREG/CR-6697
Lifetime	Amount of time in which all of the removable fraction of the source is linearly eroded	10,000 days	Most likely value NUREG/CR-6697
Radionuclides Concentration	Unit concentration is initially run; results are normalized to 25 mrem/year and 1E-04 ELCR to determine each isotopic DCGL	1 pCi/m ²	A concentration is required for entry into the model for calculation of DCGLs. A unit concentration of 1 pCi/m ² was used, though any concentration value would suffice.

Note:

The construction worker is exposed for only 1 year whereas the site worker is exposed for 25 years.

VERIFICATION OF THE STRUCTURAL SURFACE REMEDIATION GOAL

To assess the validity and continued health protectiveness of the site worker structural surface RG, risk-and dose-based site worker DCGLs are calculated in two separate analyses using the RESRAD-BUILD Version 4.0 model. The first analysis incorporates only the model default CSFs and DCFs that currently exist in the DCFPAK3.02 library (i.e., the ORNL 2014 factors, including the dietary CSFs for ingestion). The second analysis incorporates modified DCFPAK3.02 base libraries developed to utilize the ORNL “Soil Worker” CSFs for soil ingestion (i.e., replacing the default dietary CSFs for the ingestion pathway), as well as the FGR 15 external radiation DCFs. The external radiation DCFs used in this evaluation are the infinite depth DCFs, for consistency with past use of external radiation DCFs at IAAAP. The infinite depth DCFs result in the most health-conservative estimates of dose relative to the other available depth-specific DCFs.

To derive the surficial contamination DCGL value that would be equivalent to the dose limit of 25 mrem per year, the IAAAP DU COCs (U-238, U-235, and U-234) were entered into the RESRAD-BUILD 4.0 model using the source concentration term of 1 pCi/m² to determine a DSR and RSR over all of the five surficial exposure sources (i.e., with source one being the floor and sources two through five being each of the four walls) assumed for the hypothetically contaminated compartment (i.e., interior room of a structure). The DSR is a derived value based upon the RESRAD-BUILD modeling output that can be used to convert the dose limit to an equivalent unit of surficial concentration (pCi/m²). Likewise, the RSR is a derived value based upon the RESRAD-BUILD modeling output that can be used to convert a TELCR to an equivalent unit of surficial concentration (pCi/m²). The total room DSRs and RSRs for DU were then calculated by summing the individual surface DSRs and RSRs, respectively.

Dose-Based DCGL Calculations

Table D-3-2 shows the DSRs calculated using RESRAD-BUILD Version 4.0 for each of the DU isotopes on each of the five sources (the floor and four walls), along with the total DSR for each isotope over all sources combined. The DSRs are presented from use of both the default and modified DCFPAK3.02 (Adult) dose libraries.

Table D-3-2. Site Worker Dose-to-Source Ratio Values, RESRAD-BUILD 4.0

Isotope	Default DCFPAK3.02 (Adult) Library ^a					
	DSR ([mrem/yr]/[pCi/m ²])					
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
U-238	2.85E-06	4.13E-07	4.13E-07	4.13E-07	4.13E-07	4.50E-06
U-235	3.45E-06	4.46E-07	4.46E-07	4.46E-07	4.46E-07	5.24E-06
U-234	2.09E-06	4.15E-07	4.15E-07	4.15E-07	4.15E-07	3.75E-06
Isotope	Modified DCFPAK3.02 (Adult) Library ^b					
	DSR ([mrem/yr]/[pCi/m ²])					
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
U-238	5.32E-06	5.51E-07	5.51E-07	5.51E-07	5.51E-07	7.52E-06
U-235	3.60E-06	4.50E-07	4.50E-07	4.50E-07	4.50E-07	5.40E-06
U-234	2.09E-06	4.15E-07	4.15E-07	4.15E-07	4.15E-07	3.75E-06

^a The RESRAD-BUILD 4.0 model default base dose libraries are used. The base internal dose library is "DCFPAK3.02 (Adult)", which includes all 2014 DCFs (ORNL 2014). The base external dose library is "DCFPAK3.02", which includes ORNL 2014 external radiation DCFs.

^b The RESRAD-BUILD 4.0 external dose library "DCFPAK3.02" is modified to replace the 2014 external radiation DCFs for infinite depth (ORNL 2014) with the corresponding FGR 15 DCFs for infinite depth (USEPA 2019).

Table D-3-3 shows that by using the total DSR for each isotope from Table D-3-2, a relative DSR for each isotope was then calculated by multiplying the total DSR by the corresponding activity

fraction for that isotope in DU. An isotopic fraction of the total relative DSR for DU was calculated for each isotope by dividing the relative DSR by the total relative DSR for DU. The target equivalent dose for each isotope was calculated by multiplying the target dose limit of 25 mrem per year by the isotopic fraction of the relative DU DSR. The isotopic DCGL was calculated by dividing the isotopic target equivalent dose by the total relative DSR for DU. The individual isotopic DCGLs were calculated such that the DCGL-equivalent doses and ELCRs collectively do not exceed the total dose and ELCR limits of 25 mrem per year and 1E-04, respectively. The sum of the isotope-specific DCGLs yields a total DU DCGL equivalent to 25 mrem per year. Table D-3-3 shows these calculations and the results when using the default and modified DCFPAK3.02 (Adult) libraries. The total dose-based site worker DCGLs (targeting the 25 mrem limit) generated from use of the default and modified libraries are 124,744 dpm/100 cm² and 77,346 dpm/100 cm², respectively. This demonstrates that use of the USEPA's FGR 15 external radiation DCFs for infinite depth reduces the total dose-based DCGL by approximately 38 percent.

**Table D-3-3. Site Worker Dose-Based Derived Concentration Guideline Levels
RESRAD-BUILD 4.0**

Isotope	DSR ([mrem/yr]/ [pCi/m ²])	DU Activity Fraction (Unitless)	Relative DSR ([mrem/yr]/ [pCi/m ²])	Isotopic Fraction of Relative DU DSR (Unitless)	Target Dose (25 mrem/year Isotopic Equivalent)	DCGL ^a (dpm/100 cm ²)
Default DCFPAK3.02 (Adult) Library^b						
U-238	4.50E-06	9.01E-01	4.06E-06	9.12E-01	2.28E+01	113,782
U-235	5.24E-06	1.45E-02	7.59E-08	1.71E-02	4.27E-01	2,129
U-234	3.75E-06	8.40E-02	3.15E-07	7.08E-02	1.77E+00	8,833
Total for DU:		1.00E+00	4.45E-06	1.00E+00	2.50E+01	124,744
Modified DCFPAK3.02 (Adult) Library^c						
U-238	7.52E-06	9.01E-01	6.78E-06	9.45E-01	2.36E+01	73,106
U-235	5.40E-06	1.45E-02	7.83E-08	1.09E-02	2.73E-01	844
U-234	3.75E-06	8.40E-02	3.15E-07	4.39E-02	1.10E+00	3,396
Total for DU:		1.00E+00	7.18E-06	1.00E+00	2.50E+01	77,346

^a Isotopic DCGLs = (Equivalent Dose/dose-to-source ratio) * (2.22 dpm/1 pCi) * (1 m²/100 cm²)

^b The RESRAD-BUILD 4.0 model default base dose libraries are used. The base internal dose library is "DCFPAK3.02 (Adult)", which includes all 2014 DCFs (ORNL 2014). The base external dose library is "DCFPAK3.02", which includes ORNL 2014 external radiation DCFs.

^c The RESRAD-BUILD 4.0 external dose library "DCFPAK3.02" is modified to replace the 2014 external radiation DCFs for infinite depth (ORNL 2014) with the corresponding FGR 15 DCFs for infinite depth (USEPA 2019).

Table D-3-4 shows a percent dose contribution evaluation for the individual external and internal radiation exposure pathways to the total receptor dose. Based on a review of the percent dose contributions from each pathway, from use of the default and modified DCFPAK3.02 (Adult) DCF libraries, the inhalation pathway contributes most predominantly to the total receptor dose (i.e., 75.7 percent and 61.3 percent, respectively). Table D-3-4 also shows that external radiation from the source (i.e., infinite depth) is the second most predominant pathway. Use of the FGR 15 external radiation DCF for infinite depth results in an increase in percent dose contribution from 23.7 percent to 38.2 percent (i.e., from use of the ORNL 2014 external radiation DCF in the default library).

Table D-3-4. Pathway-Specific Percent Dose Contributions to the Total Receptor Dose for All DU Isotopes

RESRAD 4.0 Dose Library	External Radiation Exposures			Internal Radiation Exposures				Total Over All Pathways
	External from Source (Infinite Depth)	External from Surface Deposition	Air Submersion	Inhalation	Radon	Ingestion of Source	Ingestion of Deposition	
Default DCFPK3.02 (Adult) Library	23.7%	0.0%	0.0%	75.7%	0.0%	0.0%	0.6%	100%
Modified DCFPK3.02 (Adult) Library	38.2%	0.0%	0.0%	61.3%	0.0%	0.0%	0.5%	100%

Risk-Based DCGL Calculations

Table D-3-5 shows the RSRs calculated using RESRAD-BUILD Version 4.0 for each of the DU isotopes on each of the five sources (the floor and four walls), along with the total RSR for each isotope over all sources combined. The RSRs are presented from use of both the default and modified DCFPAK3.02 Morbidity risk libraries.

**Table D-3-5. Site Worker Risk-to-Source Ratio Values
RESRAD-BUILD 4.0**

Isotope	Default DCFPAK3.02 Morbidity Library ^a RSR ([mrem/yr]/[pCi/m ²])					
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
U-238	2.19E-12	3.24E-13	3.24E-13	3.24E-13	3.24E-13	3.49E-12
U-235	2.73E-12	3.54E-13	3.54E-13	3.54E-13	3.54E-13	4.15E-12
U-234	1.67E-12	3.31E-13	3.31E-13	3.31E-13	3.31E-13	2.99E-12
Isotope	Modified DCFPAK3.02 Morbidity Library ^b RSR ([mrem/yr]/[pCi/m ²])					
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
U-238	2.19E-12	3.23E-13	3.23E-13	3.23E-13	3.23E-13	3.48E-12
U-235	2.73E-12	3.53E-13	3.53E-13	3.53E-13	3.53E-13	4.14E-12
U-234	1.66E-12	3.30E-13	3.30E-13	3.30E-13	3.30E-13	2.98E-12

^a The RESRAD-BUILD 4.0 model default base risk "DCFPK3.02 Morbidity" library is used for all CSFs.

^b The RESRAD-BUILD 4.0 model base risk "DCFPK3.02 Morbidity" library is modified to replace ORNL 2014 dietary CSFs for the ingestion pathway with the ORNL worker soil ingestion CSFs.

Table D-3-6 shows that by using the total RSR for each isotope from Table D-3-5, a relative RSR for each isotope was then calculated by multiplying the total RSR by the corresponding activity fraction for that isotope in DU. Subsequent to this, the risk-based DCGL for DU in soil on structural surfaces is calculated in the same way as the dose-based DCGL, with the exception being that the DCGL, which is based on a single-year ELCR, is divided by a factor of 25 to account for the 25-year exposure duration for the site worker. Table D-3-6 shows these calculations and the results when using the default and modified DCFPAK3.02 Morbidity libraries. The total risk-based site worker DCGLs (targeting the ELCR limit of 1E-04) generated from use of the default and modified libraries are 25,710 dpm/100 cm² and 25,746 dpm/100 cm², respectively. This demonstrates that there is no significant difference in the risk-based DCGL from use of the ORNL 2014 dietary

CSF (i.e., in the default library) versus the ORNL 2014 worker soil ingestion CSF, though the former is slightly more health-protective than the latter.

**Table D-3-6. Site Worker Risk-Based Derived Concentration Guideline Levels
RESRAD-BUILD 4.0**

Isotope	RSR ([risk/yr]/ [pCi/m ²])	DU Activity Fraction	Relative RSR ([risk/yr]/ [pCi/m ²])	Isotopic Fraction of Relative DU RSR (Unitless)	Target Cancer Risk (1E-04 Isotopic Equivalent)	Single-Year DCGL ^a (dpm/100 cm ²)	25-Year DCGL (dpm/100 cm ²)
Default DCFPAK3.02 Morbidity Library^b							
U-238	3.49E-12	9.01E-01	3.14E-12	9.10E-01	9.10E-05	5.85E+05	23,390
U-235	4.15E-12	1.45E-02	6.01E-14	1.74E-02	1.74E-06	1.12E+04	448
U-234	2.99E-12	8.40E-02	2.52E-13	7.28E-02	7.28E-06	4.68E+04	1,872
Total for DU:		1.00E+00	3.45E-12	1.00E+00	1.00E-04	6.43E+05	25,710
Modified DCFPAK3.02 Morbidity Library^c							
U-238	3.48E-12	9.01E-01	3.14E-12	9.10E-01	9.10E-05	5.86E+05	23,429
U-235	4.14E-12	1.45E-02	6.01E-14	1.74E-02	1.74E-06	1.12E+04	448
U-234	2.98E-12	8.40E-02	2.50E-13	7.26E-02	7.26E-06	4.67E+04	1,869
Total for DU:		1.00E+00	3.45E-12	1.00E+00	1.00E-04	6.44E+05	25,746

^a Isotopic DCGLs = (Equivalent Dose/dose-to-source ratio) * (2.22 dpm/1 pCi) * (1 m²/100 cm²).

^b The RESRAD-BUILD 4.0 model default base risk "DCFPAK3.02 Morbidity" library is used for all CSFs.

^c The RESRAD-BUILD 4.0 model base risk "DCFPAK3.02 Morbidity" library is modified to replace ORNL 2014 dietary CSFs for the ingestion pathway with the ORNL worker soil ingestion CSFs.

Table D-3-7 shows a percent risk contribution evaluation for the individual external and internal radiation exposure pathways to the total receptor risk. Based on a review of the percent risk contributions from each pathway to the total ELCR, Table D-3-7 shows that the inhalation pathway contributes predominantly (77 percent) to the total site worker risk-based DCGL for DU in soil on structural surfaces and that there is no significant difference in percent risk contributions from the inhalation pathway when using the default versus the modified DCFPAK3.02 Morbidity libraries (i.e., the ORNL 2014 dietary versus the worker soil ingestion CSFs, respectively). Additionally, it is unlikely that changing the deposition velocity from 0.01 m/sec to the RESRAD-BUILD Version 4.0 default value of 0.00039 m/sec would have any significant impact on the calculations. This is evident from the zero percent risk contributions of the external radiation from surface deposition and ingestion of deposition pathways.

**Table D-3-7. Pathway-Specific Percent Risk Contributions to the Total Receptor Risk for
All DU Isotopes**

RESRAD 4.0 Risk Library	External Radiation Exposures			Internal Radiation Exposures				Total Over All Pathways
	External from Source (Infinite Depth)	External from Surface Deposition	Air Submersion	Inhalation	Radon	Ingestion of Source	Ingestion of Deposition	
Default DCFPAK3.02 Morbidity Library	22.8%	0.0%	0.0%	76.7%	0.0%	0.0%	0.4%	100%
Modified DCFPAK3.02 Morbidity Library	22.9%	0.0%	0.0%	76.9%	0.0%	0.0%	0.2%	100%

CONCLUSION

Following a review of the dose- and risk-based soil DCGLs calculated in Tables D-3-3 and D-3-6, respectively, and considering only the DCGLs for U-238, the selected DCGL for use as an RG (hypothetically) from this evaluation would be the lower and more health-protective of the two risk-based DCGLs of 25,710 dpm/100 cm². The risk-based DCGL for DU determined during the FUSRAP FS was 23,033 dpm/100 cm², which remains more health-protective than the DCGL of 25,710 dpm/100 cm² calculated in this second FUSRAP FYR RG evaluation. This evaluation also demonstrates that the inhalation pathway continues to be the predominantly contributing exposure pathway when considering total dose to the site worker.

In conclusion, the structural surface DCGL recalculations in this FYR using the current RESRAD-BUILD Version 4.0 model, along with the most recent CSFs and DCFs available, demonstrate that the structural surface RG (23,000 dpm/100 cm²) established in the FUSRAP ROD (USACE 2011a) is still valid and health-protective.

The RESRAD-BUILD Version 4.0 output files for the dose and ELCR calculations used to determine DCGLs using the default DCFPAK3.02 libraries are included as Attachments D-3-1 and D-3-2, respectively. The output files for the dose and ELCR calculations used to determine DCGLs using the modified DCFPAK3.02 libraries are included as Attachments D-3-3 and D-3-4, respectively.

ATTACHMENT D-3-1

**SITE WORKER RESRAD-BUILD 4.0 DOSE OUTPUT REPORT
DEFAULT BASE INTERNAL DOSE LIBRARY: DCFPAK3.02 (ADULT)
DEFAULT BASE EXTERNAL DOSE LIBRARY: DCFPAK3.02**

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** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 2 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

```

Number of Sources : 5
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.300000E-01
  
```

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 5 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 6 **
Title : IAAAP OU8 DU Structural DCLG Calcs
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]
Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 7.000E-02
Removable fraction: 2.000E-01
Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 7 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Temporal Summary

RESRAD-BUILD Temporal Dose Tables

Dose to Receptor over the Exposure Duration

(mrem)

Evaluation Time	Receptor	Total
years	1	
0.000000000	8.31E-06	8.31E-06
1.000000000	1.35E-05	1.35E-05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 8 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	5.53E-06	6.97E-07	6.97E-07	6.97E-07	6.97E-07	8.31E-06
Total	5.53E-06	6.97E-07	6.97E-07	6.97E-07	6.97E-07	8.31E-06

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 9 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.70E-06	2.81E-06	5.08E-10	2.57E-12	2.01E-08	5.24E-16	0.00E+00	5.53E-06
Total	2.70E-06	2.81E-06	5.08E-10	2.57E-12	2.01E-08	5.24E-16	0.00E+00	5.53E-06
Source: 2								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Total	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Source: 3								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Total	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Source: 4								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Total	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Source: 5								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07
Total	1.31E-07	5.62E-07	1.02E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	6.97E-07

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 10 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.04E-06	1.04E-06
Th-230	6.34E-11	6.34E-11
Ra-226	1.08E-14	1.08E-14
Pb-210	7.10E-18	7.10E-18
Po-210	1.34E-18	1.34E-18
U-235	2.52E-06	2.52E-06
Pa-231	3.35E-10	3.35E-10
Ac-227	3.37E-12	3.37E-12
U-238	1.96E-06	1.96E-06
U-234	1.83E-12	1.83E-12
Th-230	6.50E-17	6.50E-17
Ra-226	6.54E-21	6.54E-21
Pb-210	1.46E-22	1.46E-22
Po-210	1.35E-27	1.35E-27

Source: 2

Nuclide	Receptor	Total
	1	
U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19
U-235	2.57E-07	2.57E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13
U-238	2.34E-07	2.34E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 11 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19
U-235	2.57E-07	2.57E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13
U-238	2.34E-07	2.34E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19
U-235	2.57E-07	2.57E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13
U-238	2.34E-07	2.34E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 12 **

Title : IAAAP OU8 DU Structural DCLG Calcs

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld

Evaluation Time: 0.00000000E+00 years

U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19

U-235	2.57E-07	2.57E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13

U-238	2.34E-07	2.34E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 13 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	8.40E-06	1.27E-06	1.27E-06	1.27E-06	1.27E-06	1.35E-05
Total	8.40E-06	1.27E-06	1.27E-06	1.27E-06	1.27E-06	1.35E-05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 14 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.68E-06	5.68E-06	1.12E-09	5.19E-12	4.42E-08	3.65E-15	0.00E+00	8.40E-06
Total	2.68E-06	5.68E-06	1.12E-09	5.19E-12	4.42E-08	3.65E-15	0.00E+00	8.40E-06
Source: 2								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Total	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Source: 3								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Total	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Source: 4								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Total	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Source: 5								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06
Total	1.30E-07	1.14E-06	2.23E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.27E-06

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 15 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	2.09E-06	2.09E-06
Th-230	3.13E-10	3.13E-10
Ra-226	7.90E-14	7.90E-14
Pb-210	1.45E-16	1.45E-16
Po-210	4.82E-17	4.82E-17
U-235	3.45E-06	3.45E-06
Pa-231	1.65E-09	1.65E-09
Ac-227	3.40E-11	3.40E-11
U-238	2.85E-06	2.85E-06
U-234	9.00E-12	9.00E-12
Th-230	6.99E-16	6.99E-16
Ra-226	1.17E-19	1.17E-19
Pb-210	4.26E-22	4.26E-22
Po-210	6.47E-28	6.47E-28

Source: 2

Nuclide	Receptor	Total
	1	
U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18
U-235	4.46E-07	4.46E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12
U-238	4.13E-07	4.13E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 16 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18
U-235	4.46E-07	4.46E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12
U-238	4.13E-07	4.13E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18
U-235	4.46E-07	4.46E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12
U-238	4.13E-07	4.13E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/19/23 08:40:42 Page: 17 **

Title : IAAAP OU8 DU Structural DCLG Calcs

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAK302.bld

Evaluation Time: 1.00000000 years

U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18

U-235	4.46E-07	4.46E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12

U-238	4.13E-07	4.13E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

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ATTACHMENT D-3-2

**SITE WORKER RESRAD-BUILD 4.0 RISK OUTPUT REPORT
DEFAULT BASE RISK LIBRARY: DCFPAK3.02 MORBIDITY**

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** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 2 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

```

Number of Sources : 5
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.300000E-01
  
```

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 6 **
Title : IAAAP OU8 DU Structural DCLG Calcs
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]
Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 7.000E-02
Removable fraction: 2.000E-01
Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 7 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Temporal Summary

RESRAD-BUILD Temporal Risk Tables

Risk to Receptor over the Exposure Duration

(Risk)

Evaluation Time	Receptor	Total
years	1	
0.000000000	6.50E-12	6.50E-12
1.000000000	1.06E-11	1.06E-11

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 8 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

		[Risk]					
		Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor	1	4.30E-12	5.50E-13	5.50E-13	5.50E-13	5.50E-13	6.50E-12
Total		4.30E-12	5.50E-13	5.50E-13	5.50E-13	5.50E-13	6.50E-12

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 9 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Risks

[Risk]

Source: 1

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.05E-12	2.24E-12	3.86E-16	1.91E-18	1.18E-14	2.15E-21	0.00E+00	4.30E-12
Total	2.05E-12	2.24E-12	3.86E-16	1.91E-18	1.18E-14	2.15E-21	0.00E+00	4.30E-12

Source: 2

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13

Source: 3

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13

Source: 4

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13

Source: 5

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	2.36E-15	4.30E-22	0.00E+00	5.50E-13

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 10 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	8.30E-13	8.30E-13
Th-230	5.80E-18	5.80E-18
Ra-226	1.04E-20	1.04E-20
Pb-210	4.81E-24	4.81E-24
Po-210	1.07E-24	1.07E-24
U-235	1.99E-12	1.99E-12
Pa-231	3.37E-17	3.37E-17
Ac-227	1.33E-18	1.33E-18
U-238	1.48E-12	1.48E-12
U-234	1.46E-18	1.46E-18
Th-230	5.94E-24	5.94E-24
Ra-226	6.27E-27	6.27E-27
Pb-210	9.64E-29	9.64E-29
Po-210	1.08E-33	1.08E-33

Source: 2

Nuclide	Receptor	Total
	1	
U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	8.16E-25	8.16E-25
Po-210	2.14E-25	2.14E-25
U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.10E-19	2.10E-19
U-238	1.82E-13	1.82E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.02E-28	7.02E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 11 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	8.16E-25	8.16E-25
Po-210	2.14E-25	2.14E-25
U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.10E-19	2.10E-19
U-238	1.82E-13	1.82E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.02E-28	7.02E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	8.16E-25	8.16E-25
Po-210	2.14E-25	2.14E-25
U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.10E-19	2.10E-19
U-238	1.82E-13	1.82E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.02E-28	7.02E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 12 **

Title : IAAAP OU8 DU Structural DCLG Calcs

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld

Evaluation Time: 0.00000000E+00 years

U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	8.16E-25	8.16E-25
Po-210	2.14E-25	2.14E-25

U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.10E-19	2.10E-19

U-238	1.82E-13	1.82E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.02E-28	7.02E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 13 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

[Risk]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	6.59E-12	1.01E-12	1.01E-12	1.01E-12	1.01E-12	1.06E-11
Total	6.59E-12	1.01E-12	1.01E-12	1.01E-12	1.01E-12	1.06E-11

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 14 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Risks

[Risk]

Source: 1								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.03E-12	4.53E-12	8.48E-16	3.86E-18	2.59E-14	1.50E-20	0.00E+00	6.59E-12
Total	2.03E-12	4.53E-12	8.48E-16	3.86E-18	2.59E-14	1.50E-20	0.00E+00	6.59E-12
Source: 2								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Source: 3								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Source: 4								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Source: 5								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	5.19E-15	3.00E-21	0.00E+00	1.01E-12

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 15 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.67E-12	1.67E-12
Th-230	2.86E-17	2.86E-17
Ra-226	7.52E-20	7.52E-20
Pb-210	9.99E-23	9.99E-23
Po-210	3.85E-23	3.85E-23
U-235	2.73E-12	2.73E-12
Pa-231	1.59E-16	1.59E-16
Ac-227	1.28E-17	1.28E-17
U-238	2.19E-12	2.19E-12
U-234	7.18E-18	7.18E-18
Th-230	6.38E-23	6.38E-23
Ra-226	1.12E-25	1.12E-25
Pb-210	3.01E-28	3.01E-28
Po-210	5.17E-34	5.17E-34

Source: 2

Nuclide	Receptor	Total
	1	
U-234	3.31E-13	3.31E-13
Th-230	5.69E-18	5.69E-18
Ra-226	7.58E-21	7.58E-21
Pb-210	1.78E-23	1.78E-23
Po-210	7.71E-24	7.71E-24
U-235	3.54E-13	3.54E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18
U-238	3.24E-13	3.24E-13
U-234	1.43E-18	1.43E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 16 **
 Title : IAAAP OU8 DU Structural DCLG Calcs
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	3.31E-13	3.31E-13
Th-230	5.69E-18	5.69E-18
Ra-226	7.58E-21	7.58E-21
Pb-210	1.78E-23	1.78E-23
Po-210	7.71E-24	7.71E-24
U-235	3.54E-13	3.54E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18
U-238	3.24E-13	3.24E-13
U-234	1.43E-18	1.43E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	3.31E-13	3.31E-13
Th-230	5.69E-18	5.69E-18
Ra-226	7.58E-21	7.58E-21
Pb-210	1.78E-23	1.78E-23
Po-210	7.71E-24	7.71E-24
U-235	3.54E-13	3.54E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18
U-238	3.24E-13	3.24E-13
U-234	1.43E-18	1.43E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/19/23 08:40:42 Page: 17 **

Title : IAAAP OU8 DU Structural DCLG Calcs

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAK302.bld

Evaluation Time: 1.00000000 years

U-234	3.31E-13	3.31E-13
Th-230	5.69E-18	5.69E-18
Ra-226	7.58E-21	7.58E-21
Pb-210	1.78E-23	1.78E-23
Po-210	7.71E-24	7.71E-24

U-235	3.54E-13	3.54E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18

U-238	3.24E-13	3.24E-13
U-234	1.43E-18	1.43E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

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ATTACHMENT D-3-3

**SITE WORKER RESRAD-BUILD 4.0 DOSE OUTPUT REPORT
DEFAULT BASE INTERNAL DOSE LIBRARY: DCFPAK3.02 (ADULT)
MODIFIED EXTERNAL DOSE LIBRARY: DCFPAK3.02 WITH FGR 15 EXTERNAL
DCFs, VOLUME (ADULT)**

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** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 2 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

```

Number of Sources : 5
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.300000E-01
  
```

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 6 **
Title : OU8 DU DCLG Calcs_DCFPAKMOD
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]
Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 7.000E-02
Removable fraction: 2.000E-01
Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 7 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Temporal Summary

RESRAD-BUILD Temporal Dose Tables

Dose to Receptor over the Exposure Duration

(mrem)

Evaluation Time	Receptor	Total
years	1	
0.000000000	1.15E-05	1.15E-05
1.000000000	1.67E-05	1.67E-05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 8 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	8.16E-06	8.40E-07	8.40E-07	8.40E-07	8.40E-07	1.15E-05
Total	8.16E-06	8.40E-07	8.40E-07	8.40E-07	8.40E-07	1.15E-05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 9 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	5.33E-06	2.81E-06	1.00E-09	2.57E-12	2.01E-08	5.24E-16	0.00E+00	8.16E-06
Total	5.33E-06	2.81E-06	1.00E-09	2.57E-12	2.01E-08	5.24E-16	0.00E+00	8.16E-06
Source: 2								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Total	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Source: 3								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Total	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Source: 4								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Total	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Source: 5								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07
Total	2.74E-07	5.62E-07	2.01E-10	5.14E-13	4.03E-09	1.05E-16	0.00E+00	8.40E-07

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 10 **
 Title : OU8 DU DCLG Calcs DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.04E-06	1.04E-06
Th-230	6.34E-11	6.34E-11
Ra-226	1.08E-14	1.08E-14
Pb-210	7.14E-18	7.14E-18
Po-210	1.34E-18	1.34E-18
U-235	2.67E-06	2.67E-06
Pa-231	3.35E-10	3.35E-10
Ac-227	3.37E-12	3.37E-12
U-238	4.45E-06	4.45E-06
U-234	1.83E-12	1.83E-12
Th-230	6.50E-17	6.50E-17
Ra-226	6.54E-21	6.54E-21
Pb-210	1.47E-22	1.47E-22
Po-210	1.34E-27	1.34E-27

Source: 2

Nuclide	Receptor	Total
	1	
U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19
U-235	2.62E-07	2.62E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13
U-238	3.73E-07	3.73E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 11 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19
U-235	2.62E-07	2.62E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13
U-238	3.73E-07	3.73E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19
U-235	2.62E-07	2.62E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13
U-238	3.73E-07	3.73E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 12 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 0.00000000E+00 years

U-234	2.05E-07	2.05E-07
Th-230	1.27E-11	1.27E-11
Ra-226	8.25E-16	8.25E-16
Pb-210	1.15E-18	1.15E-18
Po-210	2.67E-19	2.67E-19

U-235	2.62E-07	2.62E-07
Pa-231	6.61E-11	6.61E-11
Ac-227	6.00E-13	6.00E-13

U-238	3.73E-07	3.73E-07
U-234	3.62E-13	3.62E-13
Th-230	1.30E-17	1.30E-17
Ra-226	5.87E-22	5.87E-22
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 13 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	1.10E-05	1.42E-06	1.42E-06	1.42E-06	1.42E-06	1.67E-05
Total	1.10E-05	1.42E-06	1.42E-06	1.42E-06	1.42E-06	1.67E-05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 14 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	5.29E-06	5.68E-06	2.21E-09	5.19E-12	4.42E-08	3.65E-15	0.00E+00	1.10E-05
Total	5.29E-06	5.68E-06	2.21E-09	5.19E-12	4.42E-08	3.65E-15	0.00E+00	1.10E-05
Source: 2								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Total	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Source: 3								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Total	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Source: 4								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Total	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Source: 5								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06
Total	2.72E-07	1.14E-06	4.41E-10	1.04E-12	8.85E-09	7.31E-16	0.00E+00	1.42E-06

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 15 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	2.09E-06	2.09E-06
Th-230	3.13E-10	3.13E-10
Ra-226	7.90E-14	7.90E-14
Pb-210	1.45E-16	1.45E-16
Po-210	4.82E-17	4.82E-17
U-235	3.60E-06	3.60E-06
Pa-231	1.65E-09	1.65E-09
Ac-227	3.40E-11	3.40E-11
U-238	5.32E-06	5.32E-06
U-234	9.00E-12	9.00E-12
Th-230	6.99E-16	6.99E-16
Ra-226	1.17E-19	1.17E-19
Pb-210	4.27E-22	4.27E-22
Po-210	6.43E-28	6.43E-28

Source: 2

Nuclide	Receptor	Total
	1	
U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18
U-235	4.50E-07	4.50E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12
U-238	5.51E-07	5.51E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 16 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18
U-235	4.50E-07	4.50E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12
U-238	5.51E-07	5.51E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18
U-235	4.50E-07	4.50E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12
U-238	5.51E-07	5.51E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/20/23 16:14:27 Page: 17 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 1.00000000 years

U-234	4.15E-07	4.15E-07
Th-230	6.26E-11	6.26E-11
Ra-226	6.48E-15	6.48E-15
Pb-210	2.50E-17	2.50E-17
Po-210	9.64E-18	9.64E-18

U-235	4.50E-07	4.50E-07
Pa-231	3.27E-10	3.27E-10
Ac-227	6.30E-12	6.30E-12

U-238	5.51E-07	5.51E-07
U-234	1.79E-12	1.79E-12
Th-230	1.40E-16	1.40E-16
Ra-226	9.74E-21	9.74E-21
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

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ATTACHMENT D-3-4

**SITE WORKER RESRAD-BUILD 4.0 RISK OUTPUT REPORT
MODIFIED RISK LIBRARY: DCFPAK3.02 MORBIDITY WITH WORKER SOIL
INGESTION CSFs (ORNL 2014)**

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** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 2 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAKMOD.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

Number of Sources : 5
 Number of Receptors: 1
 Total Time : 3.650000E+02 days
 Fraction Inside : 2.300000E-01

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 6 **
Title : OU8 DU DCLG Calcs_DCFPAKMOD
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]
Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 7.000E-02
Removable fraction: 2.000E-01
Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 7 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Temporal Summary

RESRAD-BUILD Temporal Risk Tables

Risk to Receptor over the Exposure Duration

(Risk)

Evaluation Time	Receptor	Total
years	1	
0.000000000	6.49E-12	6.49E-12
1.000000000	1.06E-11	1.06E-11

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 8 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

		[Risk]					
		Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor	1	4.30E-12	5.49E-13	5.49E-13	5.49E-13	5.49E-13	6.49E-12
Total		4.30E-12	5.49E-13	5.49E-13	5.49E-13	5.49E-13	6.49E-12

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 9 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Risks

[Risk]

Source: 1								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.05E-12	2.24E-12	3.86E-16	1.91E-18	5.93E-15	2.15E-21	0.00E+00	4.30E-12
Total	2.05E-12	2.24E-12	3.86E-16	1.91E-18	5.93E-15	2.15E-21	0.00E+00	4.30E-12
Source: 2								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Source: 3								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Source: 4								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Source: 5								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13
Total	9.92E-14	4.48E-13	7.72E-17	3.83E-19	1.19E-15	4.30E-22	0.00E+00	5.49E-13

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 10 **
 Title : OU8 DU DCLG Calcs DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAKMOD.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	8.28E-13	8.28E-13
Th-230	5.79E-18	5.79E-18
Ra-226	1.04E-20	1.04E-20
Pb-210	4.64E-24	4.64E-24
Po-210	1.00E-24	1.00E-24
U-235	1.99E-12	1.99E-12
Pa-231	3.37E-17	3.37E-17
Ac-227	1.33E-18	1.33E-18
U-238	1.48E-12	1.48E-12
U-234	1.45E-18	1.45E-18
Th-230	5.94E-24	5.94E-24
Ra-226	6.26E-27	6.26E-27
Pb-210	9.42E-29	9.42E-29
Po-210	1.08E-33	1.08E-33

Source: 2

Nuclide	Receptor	Total
	1	
U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	7.83E-25	7.83E-25
Po-210	2.01E-25	2.01E-25
U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.09E-19	2.09E-19
U-238	1.81E-13	1.81E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.01E-28	7.01E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 11 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	7.83E-25	7.83E-25
Po-210	2.01E-25	2.01E-25
U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.09E-19	2.09E-19
U-238	1.81E-13	1.81E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.01E-28	7.01E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	7.83E-25	7.83E-25
Po-210	2.01E-25	2.01E-25
U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.09E-19	2.09E-19
U-238	1.81E-13	1.81E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.01E-28	7.01E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 12 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 0.00000000E+00 years

U-234	1.64E-13	1.64E-13
Th-230	1.15E-18	1.15E-18
Ra-226	1.00E-21	1.00E-21
Pb-210	7.83E-25	7.83E-25
Po-210	2.01E-25	2.01E-25

U-235	2.04E-13	2.04E-13
Pa-231	6.03E-18	6.03E-18
Ac-227	2.09E-19	2.09E-19

U-238	1.81E-13	1.81E-13
U-234	2.88E-19	2.88E-19
Th-230	1.18E-24	1.18E-24
Ra-226	7.01E-28	7.01E-28
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 13 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

[Risk]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	6.57E-12	1.01E-12	1.01E-12	1.01E-12	1.01E-12	1.06E-11
Total	6.57E-12	1.01E-12	1.01E-12	1.01E-12	1.01E-12	1.06E-11

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 14 **
 Title : OU8 DU DCLG Calcs_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGR_DCFPAKMOD.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Risks

[Risk]

Source: 1								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.03E-12	4.53E-12	8.48E-16	3.86E-18	1.30E-14	1.50E-20	0.00E+00	6.57E-12
Total	2.03E-12	4.53E-12	8.48E-16	3.86E-18	1.30E-14	1.50E-20	0.00E+00	6.57E-12
Source: 2								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Source: 3								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Source: 4								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Source: 5								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12
Total	9.85E-14	9.06E-13	1.70E-16	7.73E-19	2.60E-15	3.00E-21	0.00E+00	1.01E-12

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 15 **
 Title : OU8 DU DCLG Calcs DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLD RG_DCFPAKMOD.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.66E-12	1.66E-12
Th-230	2.85E-17	2.85E-17
Ra-226	7.51E-20	7.51E-20
Pb-210	9.60E-23	9.60E-23
Po-210	3.60E-23	3.60E-23
U-235	2.73E-12	2.73E-12
Pa-231	1.58E-16	1.58E-16
Ac-227	1.28E-17	1.28E-17
U-238	2.19E-12	2.19E-12
U-234	7.16E-18	7.16E-18
Th-230	6.36E-23	6.36E-23
Ra-226	1.11E-25	1.11E-25
Pb-210	2.93E-28	2.93E-28
Po-210	5.17E-34	5.17E-34

Source: 2

Nuclide	Receptor	Total
	1	
U-234	3.30E-13	3.30E-13
Th-230	5.68E-18	5.68E-18
Ra-226	7.56E-21	7.56E-21
Pb-210	1.70E-23	1.70E-23
Po-210	7.21E-24	7.21E-24
U-235	3.53E-13	3.53E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18
U-238	3.23E-13	3.23E-13
U-234	1.42E-18	1.42E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 16 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	3.30E-13	3.30E-13
Th-230	5.68E-18	5.68E-18
Ra-226	7.56E-21	7.56E-21
Pb-210	1.70E-23	1.70E-23
Po-210	7.21E-24	7.21E-24
U-235	3.53E-13	3.53E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18
U-238	3.23E-13	3.23E-13
U-234	1.42E-18	1.42E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 4

Nuclide	Receptor	Total
	1	
U-234	3.30E-13	3.30E-13
Th-230	5.68E-18	5.68E-18
Ra-226	7.56E-21	7.56E-21
Pb-210	1.70E-23	1.70E-23
Po-210	7.21E-24	7.21E-24
U-235	3.53E-13	3.53E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18
U-238	3.23E-13	3.23E-13
U-234	1.42E-18	1.42E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/20/23 16:14:27 Page: 17 **

Title : OU8 DU DCLG Calcs_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\OU8_SITE WKR_BLDGRG_DCFPAKMOD.bld

Evaluation Time: 1.00000000 years

U-234	3.30E-13	3.30E-13
Th-230	5.68E-18	5.68E-18
Ra-226	7.56E-21	7.56E-21
Pb-210	1.70E-23	1.70E-23
Po-210	7.21E-24	7.21E-24

U-235	3.53E-13	3.53E-13
Pa-231	2.96E-17	2.96E-17
Ac-227	2.16E-18	2.16E-18

U-238	3.23E-13	3.23E-13
U-234	1.42E-18	1.42E-18
Th-230	1.27E-23	1.27E-23
Ra-226	1.14E-26	1.14E-26
Pb-210	0.00E+00	0.00E+00
Po-210	0.00E+00	0.00E+00

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ATTACHMENT D-4

RISK AND DOSE EVALUATION FOR FS-12 AREA WEST SURVEY UNIT, WEST-CENTRAL SURVEY UNIT, AND EAST SURVEY UNIT SOIL

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Table D-4-1. EPCs for FS-12 Area Land SUs from Finalized PRAR-FSSEs

Land SU Area	Receptor Scenario	Depth	U-234	U-235	U-238
			(pCi/g)		
WSU	Site Worker	0 to 1 ft bgs	0.00	0.03	0.00
	Construction Worker	0 to 2 ft bgs	0.00	0.03	0.00
WCSU	Site Worker	0 to 1 ft bgs	0.00	0.03	0.00
	Construction Worker	0 to 2 ft bgs	0.00	0.03	0.00
ESU	Site Worker	0 to 1 ft bgs	0.00	0.04	0.61
	Construction Worker	0 to 2 ft bgs	0.00	0.03	0.29

Shaded row indicates Land SU area/receptor scenario with the maximum risk and dose selected for evaluation in this FYR using modified DCFPAK3.0 CSF/DCF libraries in RESRAD-ONSITE 7.2.

Table D-4-2. Risk and Dose Estimates for FS-12 Area Land SUs from Finalized PRAR-FSSEs

Land SU Area	Receptor Scenario	Depth	Risk ^a	Dose (mrem/year) ^a
WSU	Site Worker	0 to 1 ft bgs	7.6E-08	0.005
	Construction Worker	0 to 2 ft bgs	4.0E-09	0.005
WCSU	Site Worker	0 to 1 ft bgs	7.6E-08	0.005
	Construction Worker	0 to 2 ft bgs	4.0E-09	0.005
ESU	Site Worker	0 to 1 ft bgs	4.2E-07	0.03
	Construction Worker	0 to 2 ft bgs	1.3E-08	0.02

^a The risk and dose results in the PRAR-FSSEs were generated using the RESRAD-ONSITE 7.2 model and the default DCFPAK3.02 CSF/DCF libraries.

Shaded row indicates Land SU area/receptor scenario with the maximum risk and dose selected for evaluation in this FYR using modified DCFPAK3.0 CSF/DCF libraries in RESRAD-ONSITE 7.2.

Table D-4-3. EPCs for RUSUs from Finalized PRAR-FSSEs

RUSUs	Land SU Area Backfilled	Receptor Scenario	U-234	U-235	U-238
			(pCi/g)		
NA	WSU	Site Worker	NA	NA	NA
		Construction Worker			
1 - 142	WCSU	Site Worker	0.23	0.09	3.88
		Construction Worker			
143 - 198	ESU	Site Worker	0.00	0.03	0.32
		Construction Worker			

NA - Not applicable because evaluations of reuse soil were not conducted.

Shaded row indicates Land SU area/receptor scenario with the maximum risk and dose selected for evaluation in this FYR using modified DCFPAK3.0 CSF/DCF libraries in RESRAD-ONSITE 7.2.

Table D-4-4. Risk and Dose Estimates for FS-12 Area RUSUs from Finalized PRAR-FSSEs

RUSUs	Land SU Area Backfilled	Receptor Scenario	Risk ^a	Dose (mrem/year) ^a
NA	WSU	Site Worker, Shallow Backfill	NA	NA
		Site Worker, Deep Backfill		
		Construction Worker, Shallow Backfill		
		Construction Worker, Deep Backfill		
1 - 142	WCSU	Site Worker, Shallow Backfill	2.3E-06	0.2
		Site Worker, Deep Backfill	2.8E-06	0.2
		Construction Worker, Shallow Backfill	1.4E-07	0.2
		Construction Worker, Deep Backfill	1.3E-07	0.2
143 - 198	ESU	Site Worker, Shallow Backfill	2.5E-07	0.02
		Site Worker, Deep Backfill	3.0E-07	0.02
		Construction Worker, Shallow Backfill	1.4E-08	0.02
		Construction Worker, Deep Backfill	1.4E-08	0.02

^a The risk and dose results in the PRAR-FSSEs were generated using the RESRAD-ONSITE 7.2 model and the default DCFPAK3.02 CSF/DCF libraries.

NA - Not applicable because evaluations of reuse soil were not conducted.

Shaded row indicates RUSU/receptor scenario with the maximum risk and dose selected for evaluation in this FYR using modified DCFPAK3.02 CSF/DCF libraries in RESRAD-ONSITE 7.2.

ATTACHMENT D-4-1

**FS-12 AREA EAST SURVEY UNITS RESRAD-ONSITE VERSION 7.2 RISK AND DOSE
OUTPUTS FOR A SITE WORKER**

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Second Five-Year Review Dose Evaluation, Site Worker Exposures to Soil (0 to 1 ft bgs)
Modified DCFPAK3.02 (Adult) Library, RESRAD-ONSITE Version 7.2 Model
IAAAP Firing Site 12 East Survey Units

Part I: Mixture Sums and Single Radionuclide Guidelines	
Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary	5
Summary of Pathway Selections	10
Contaminated Zone and Total Dose Summary	11
Total Dose Components	12
.....	13
.....	14
Table of Contents	15
Time = 0.000E+00	16
Time = 1.000E+00	17
Time = 3.000E+00	18
Time = 1.000E+01	19
Time = 3.000E+01	20
Time = 1.000E+02	20
Dose/Source Ratios Summed Over All Pathways	21
Single Radionuclide Soil Guidelines	21
Dose Per Nuclide Summed Over All Pathways	21
Soil Concentration Per Nuclide	21

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: Worker Updates_Soil)	4.330E-04	2.615E-04	DCF1(1)
A-1	At-218 (Source: Worker Updates_Soil)	5.260E-04	5.567E-05	DCF1(2)
A-1	At-219 (Source: DCFPAK3.02)	0.000E+00	0.000E+00	DCF1(3)
A-1	Bi-210 (Source: Worker Updates_Soil)	1.280E-01	5.474E-03	DCF1(4)
A-1	Bi-211 (Source: Worker Updates_Soil)	2.370E-01	2.410E-01	DCF1(5)
A-1	Bi-214 (Source: Worker Updates_Soil)	9.370E+00	9.136E+00	DCF1(6)
A-1	Bi-215 (Source: Worker Updates_Soil)	1.590E+00	1.369E+00	DCF1(7)
A-1	Fr-223 (Source: Worker Updates_Soil)	2.860E-01	1.758E-01	DCF1(8)
A-1	Hg-206 (Source: Worker Updates_Soil)	7.300E-01	6.128E-01	DCF1(9)
A-1	Pa-231 (Source: Worker Updates_Soil)	1.590E-01	1.609E-01	DCF1(10)
A-1	Pa-234 (Source: Worker Updates_Soil)	8.290E+00	8.276E+00	DCF1(11)
A-1	Pa-234m (Source: Worker Updates_Soil)	4.460E-01	1.257E-01	DCF1(12)
A-1	Pb-210 (Source: Worker Updates_Soil)	2.350E-03	2.092E-03	DCF1(13)
A-1	Pb-211 (Source: Worker Updates_Soil)	5.150E-01	3.680E-01	DCF1(14)
A-1	Pb-214 (Source: Worker Updates_Soil)	1.300E+00	1.257E+00	DCF1(15)
A-1	Po-210 (Source: Worker Updates_Soil)	5.600E-05	5.642E-05	DCF1(16)
A-1	Po-211 (Source: Worker Updates_Soil)	4.670E-02	4.708E-02	DCF1(17)
A-1	Po-214 (Source: Worker Updates_Soil)	4.780E-04	4.801E-04	DCF1(18)
A-1	Po-215 (Source: Worker Updates_Soil)	9.330E-04	9.453E-04	DCF1(19)
A-1	Po-218 (Source: Worker Updates_Soil)	2.260E-06	9.229E-09	DCF1(20)
A-1	Ra-223 (Source: Worker Updates_Soil)	5.820E-01	5.791E-01	DCF1(21)
A-1	Ra-226 (Source: Worker Updates_Soil)	3.210E-02	3.176E-02	DCF1(22)
A-1	Rn-218 (Source: Worker Updates_Soil)	4.200E-03	4.260E-03	DCF1(23)
A-1	Rn-219 (Source: Worker Updates_Soil)	2.930E-01	2.970E-01	DCF1(24)
A-1	Rn-222 (Source: Worker Updates_Soil)	2.110E-03	2.130E-03	DCF1(25)
A-1	Th-227 (Source: Worker Updates_Soil)	5.600E-01	5.642E-01	DCF1(26)
A-1	Th-230 (Source: Worker Updates_Soil)	1.160E-03	1.106E-03	DCF1(27)
A-1	Th-231 (Source: Worker Updates_Soil)	4.690E-02	3.251E-02	DCF1(28)
A-1	Th-234 (Source: Worker Updates_Soil)	2.990E-02	2.317E-02	DCF1(29)
A-1	Tl-206 (Source: Worker Updates_Soil)	2.000E-01	1.278E-02	DCF1(30)
A-1	Tl-207 (Source: Worker Updates_Soil)	1.920E-01	2.391E-02	DCF1(31)
A-1	Tl-210 (Source: Worker Updates_Soil)	1.730E+01	1.678E+01	DCF1(32)
A-1	U-234 (Source: Worker Updates_Soil)	3.510E-04	3.456E-04	DCF1(33)
A-1	U-235 (Source: Worker Updates_Soil)	7.060E-01	7.006E-01	DCF1(34)
A-1	U-238 (Source: Worker Updates_Soil)	1.720E-04	1.713E-04	DCF1(35)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.459E-01	5.760E-01	DCF2(1)
B-1	Pa-231	8.505E-01	8.505E-01	DCF2(2)
B-1	Pb-210+D	3.708E-02	2.077E-02	DCF2(3)
B-1	Ra-226+D	3.541E-02	3.517E-02	DCF2(4)
B-1	Th-230	3.759E-01	3.759E-01	DCF2(5)
B-1	U-234	3.479E-02	3.479E-02	DCF2(6)
B-1	U-235+D	3.132E-02	3.132E-02	DCF2(7)
B-1	U-238	2.973E-02	2.973E-02	DCF2(8)
B-1	U-238+D	2.976E-02	2.973E-02	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.607E-03	1.191E-03	DCF3(1)

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
D-1	Pa-231	1.772E-03	1.772E-03	DCF3(2)
D-1	Pb-210+D	7.057E-03	2.575E-03	DCF3(3)
D-1	Ra-226+D	1.037E-03	1.036E-03	DCF3(4)
D-1	Th-230	7.918E-04	7.918E-04	DCF3(5)
D-1	U-234	1.831E-04	1.831E-04	DCF3(6)
D-1	U-235+D	1.740E-04	1.728E-04	DCF3(7)
D-1	U-238	1.650E-04	1.650E-04	DCF3(8)
D-1	U-238+D	1.776E-04	1.650E-04	DCF3(9)
D-34	Dose Conversion Factor (and Related) Parameter Summary (continued)			
D-34	Library: transfer factors			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
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0 Menu		Current Value#	Base Case*	Parameter Name
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC (2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC (2,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC (3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC (3,2)
D-5	Parameter Summary (continued)	5.000E+01	5.000E+01	BIOFAC (4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC (4,2)
D-5	Th-230 Worker fish	1.000E+02	1.000E+02	BIOFAC (5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC (5,2)
D-5	Parameter			
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC (6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (6,2)
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC (7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (7,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC (8,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (8,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC (9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (9,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

0 Menu		User Input	Default	(If different from user input)	Parameter
R011	Area of contaminated zone (m**2)	4.000E+04	1.000E+04		AREA
R011	Thickness of contaminated zone (m)	3.048E-01	2.000E+00	Used by RESRAD	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00		SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02		LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01		BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00		TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00		T (2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00		T (3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T (4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T (5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T (6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T (7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T (8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T (9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-235	4.000E-02	0.000E+00	---	S1 (7)
R012	Initial principal radionuclide (pCi/g): U-238	6.100E-01	0.000E+00	---	S1 (8)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1 (7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1 (8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of contaminated zone (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
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0		User	Default	(If different from user input)	Parameter
Menu		Input			Name
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	Used by RESRAD	UW
R015	Number of unsaturated zone strata	not used	1		NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00		H (1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00		DENSUZ (1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01		TPUZ (1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01		EPUZ (1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ (1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00		BUZ (1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ (1)
R016	Distribution coefficients for U-235			---	
R016		5.000E+01	5.000E+01	---	DCNUCC (7)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	---	DCNUCU (7,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCS (7)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	ALEACH (7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	---	SOLUBK (7)
R016	Solubility constant				
R016	Distribution coefficients for U-238				
R016	Specific Parameter Summary (continued)	5.000E+01	5.000E+01	---	DCNUCC (8)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	2.178E-02	DCNUCU (8,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (8)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (8)
R016	Solubility constant				
R016	Distribution coefficients for daughter Ac-227				
R016		2.000E+01	2.000E+01	---	DCNUCC (1)
R016	Contaminated zone (cm**3/g)	not used	2.000E+01	2.178E-02	DCNUCU (1,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	not used	DCNUCS (1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (1)
R016	Solubility constant				
R016	Distribution coefficients for daughter Pa-231				
R016		5.000E+01	5.000E+01	---	DCNUCC (2)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	5.410E-02	DCNUCU (2,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (2)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (2)
R016	Solubility constant				
R016	Distribution coefficients for daughter Pb-210				
R016		1.000E+02	1.000E+02	---	DCNUCC (3)
R016	Contaminated zone (cm**3/g)	not used	1.000E+02	2.178E-02	DCNUCU (3,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	not used	DCNUCS (3)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (3)
R016	Solubility constant				

				1.091E-02	
				not used	

Summary : IAAAP Firing Site 12 FSUs (0-1 ft Depth), Site Wkr Mod Library FYR2
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0 Menu		User Input	Default	(If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226	7.000E+01	7.000E+01	Used by RESRAD	DCNUCC (4)
R016	Contaminated zone (cm**3/g)	not used	7.000E+01		DCNUCU (4,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01		DCNUCS (4)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (4)
R016	Solubility constant				
R016	Distribution coefficients for daughter Th-230	6.000E+04	6.000E+04	---	DCNUCC (5)
R016	Contaminated zone (cm**3/g)	not used	6.000E+04	1.558E-02	DCNUCU (5,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	not used	DCNUCS (5)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (5)
R016	Solubility constant				
R016	Distribution coefficients for daughter U-234	5.000E+01	5.000E+01	---	DCNUCC (6)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	1.823E-05	DCNUCU (6,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (6)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (6)
R016	Solubility constant				
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03		INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	2.178E-02	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	not used	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01		SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01		FIND
R017	Fraction of time spent outdoors (on site)	2.283E-01	2.500E-01		FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	---	FS
R017	Radii of shape factor array (used if FS = -1):			---	
R017	1:	not used	5.000E+01	>0_shows circular AREA.	RAD_SHAPE (1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE (2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE (3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE (4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE (5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00		RAD_SHAPE (6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00		RAD_SHAPE (7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE (8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE (9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE (10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE (11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE (12)

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			Name
R017	Fractions of annular areas within AREA:				
R017	1	not used	1.000E+00	Used by RESRAD	FRACA (1)
R017	Ring 2	not used	2.732E-01		FRACA (2)
R017	Ring 3	not used	0.000E+00		FRACA (3)
R017	Ring 4	not used	0.000E+00		FRACA (4)
R017	Ring 5	not used	0.000E+00		FRACA (5)
R017	Ring 6	not used	0.000E+00		FRACA (6)
R017	Ring 7	not used	0.000E+00		FRACA (7)
R017	Ring 8	not used	0.000E+00	---	FRACA (8)
R017	Parameter 9	not used	0.000E+00	---	FRACA (9)
R017	Ring 10	not used	0.000E+00	---	FRACA (10)
R017	Ring 11	not used	0.000E+00	---	FRACA (11)
R017	Ring 12	not used	0.000E+00	---	FRACA (12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET (1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET (2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET (3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET (4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET (5)
R018	Site-Specific Forage Consumption (kg/yr)	not used	9.000E-01	---	DIET (6)
R018	Soil ingestion rate (g/yr)	2.500E+01	3.650E+01		SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01		DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE (1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE (2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE (3)

Summary : IAAAP Firing Site 12 FSUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 FSU_SITE WKR-0-1 FT_FYR2.RAD

0 Menu		User Input	Default	(If different from user input)	Parameter
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01		Name
R19B	Translocation Factor for Leafy	not used	1.000E+00	Used by RESRAD	TIV(1)
R19B	Translocation Factor for Fodder	not used	1.000E+00		TIV(2)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		TIV(3)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01		RDRY(1)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01		RDRY(2)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RDRY(3)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(2)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	RWET(3)
R19B				---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (l/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (l/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in swine feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):			---	
STOR		1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Fruits, non-leafy vegetables, and grain	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Milk	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Meat and poultry	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Crustacea and mollusks	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Surface water	4.500E+01	4.500E+01	---	STOR_T(9)
STOR	Livestock fodder			---	
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):			---	
R021		not used	2.000E-06	---	DIFCV
R021	in cover material	not used	3.000E-07	---	DIFFL
R021	in foundation material	not used	2.000E-06	---	DIFCZ
R021	Radon concentration in soil	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA (1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA (2)
TITL	Number of graphical time points			---	NPTS

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			
TITL	Maximum number of integration points for dose				NAME
TITL	Maximum number of integration points for risk		---	Used by RESRAD	LYMAX
		17	---		
		257	---		

Parameter	User Selection
	active
	suppressed
	suppressed
	suppressed
	suppressed
	suppressed
Summary of External gamma pathway	
2 -- inhalation (w/o radon)	
3 -- plant ingestion	
4 -- meat ingestion	suppressed
5 -- milk ingestion	
6 -- aquatic foods	active
7 -- drinking water	
8 -- soil ingestion	
9 -- radon	
Find peak pathway doses	

Summary : IAAAP Firing Site 12 FSUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 FSU_SITE WKR-0-1 FT_FYR2.RAD

Initial Soil Concentrations, pCi/g

40000.00 square meters	U-235	4.000E-02
Contaminated Zone Dose Rate	U-238	6.100E-01
Known Depth:		
Area:		

	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
t (years):	7.260E-02	7.103E-02	6.799E-02	5.833E-02	3.762E-02	7.987E-03	2.145E-05	0.000E+00
	2.904E-03	2.841E-03	2.720E-03	2.333E-03	1.505E-03	3.195E-04	8.581E-07	0.000E+00

Maximum TDOSE(t): 7.260E-02 mrem/yr at t = 0.000E+00 years
 TDOSE(t):

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
 M(t):

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Dose TDOSE(t), mrem/yr

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	6.650E-03	0.0916	4.027E-05	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.930E-05	0.0005
U-238	6.468E-02	0.8909	5.833E-04	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.115E-04	0.0084
Total	7.133E-02	0.9824	6.235E-04	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.508E-04	0.0090

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.729E-03	0.0927
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.587E-02	0.9073
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.260E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	6.507E-03	0.0916	3.942E-05	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.847E-05	0.0005
U-238	6.328E-02	0.8908	5.707E-04	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.984E-04	0.0084
Total	6.979E-02	0.9824	6.101E-04	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.368E-04	0.0090

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.584E-03	0.0927
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.445E-02	0.9073
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.103E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	6.229E-03	0.0916	3.779E-05	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.684E-05	0.0005
U-238	6.057E-02	0.8908	5.464E-04	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.729E-04	0.0084
Total	6.680E-02	0.9824	5.842E-04	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.097E-04	0.0090

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.304E-03	0.0927
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.169E-02	0.9073
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.799E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	5.349E-03	0.0917	3.259E-05	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.169E-05	0.0005
U-238	5.195E-02	0.8907	4.691E-04	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.919E-04	0.0084
Total	5.730E-02	0.9824	5.017E-04	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.235E-04	0.0090

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.414E-03	0.0928
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.292E-02	0.9072
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.833E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	3.462E-03	0.0920	2.139E-05	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.062E-05	0.0005
U-238	3.349E-02	0.8903	3.035E-04	0.0081	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.182E-04	0.0085
Total	3.695E-02	0.9824	3.249E-04	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.388E-04	0.0090

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.504E-03	0.0931
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.411E-02	0.9069
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.762E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	7.507E-04	0.0940	4.907E-06	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.585E-06	0.0006
U-238	7.092E-03	0.8879	6.609E-05	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.929E-05	0.0087
Total	7.842E-03	0.9819	7.100E-05	0.0089	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.388E-05	0.0092

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.602E-04	0.0952
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.227E-03	0.9048
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.987E-03	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	1.252E-06	0.0584	2.070E-09	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.789E-09	0.0001
U-238	2.015E-05	0.9391	2.435E-08	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.552E-08	0.0012
Total	2.140E-05	0.9975	2.642E-08	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.731E-08	0.0013

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.256E-06	0.0586
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.020E-05	0.9414
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.145E-05	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years														
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESC_SITE WKR-0-1 FT_FYR2.RAD

0 Parent	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)								
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
U-235+D	U-235+D	1.000E+00	1.682E-01	1.646E-01	1.576E-01	1.353E-01	8.752E-02	1.893E-02	3.105E-05	0.000E+00	
U-235+D	Pa-231	1.000E+00	7.619E-07	2.242E-06	5.011E-06	1.291E-05	2.424E-05	1.726E-05	4.796E-08	0.000E+00	
U-235+D	Ac-227+D	1.000E+00	6.049E-08	4.081E-07	1.986E-06	1.329E-05	5.135E-05	5.459E-05	3.062E-07	0.000E+00	
U-235+D	ΣDSR(j)		1.682E-01	1.646E-01	1.576E-01	1.353E-01	8.760E-02	1.900E-02	3.140E-05	0.000E+00	
U-238	U-238	5.450E-07	1.049E-09	1.027E-09	9.828E-10	8.439E-10	5.459E-10	1.188E-10	5.496E-14	0.000E+00	
U-238+D	U-238+D	1.000E+00	1.080E-01	1.057E-01	1.011E-01	8.675E-02	5.592E-02	1.185E-02	3.311E-05	0.000E+00	
U-238+D	U-234	1.000E+00	3.138E-09	9.234E-09	2.064E-08	5.319E-08	9.995E-08	7.170E-08	1.092E-10	0.000E+00	
U-238+D	Th-230	1.000E+00	7.272E-14	5.027E-13	2.584E-12	2.092E-11	1.334E-10	5.968E-10	2.888E-11	0.000E+00	
U-238+D	Ra-226+D	1.000E+00	1.072E-15	1.587E-14	1.799E-13	4.295E-12	7.798E-11	1.016E-09	3.040E-10	0.000E+00	
Parent and Progeny	ΣDSR(j)	1.000E+00	2.029E-01	1.982E-01	1.899E-01	1.619E-01	1.019E-01	4.872E-02	1.584E-05	1.522E-05	0.000E+00
U-238+D	ΣDSR(j)		1.080E-01	1.057E-01	1.011E-01	8.675E-02	5.592E-02	1.185E-02	3.311E-05	0.000E+00	

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

0
 Dose/Source Ratios Summed Over All Pathways

0Nuclide	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
U-235	1.486E+02	1.519E+02	1.586E+02	1.847E+02	2.854E+02	1.316E+03	7.961E+05	*2.160E+06	
U-238	2.315E+02	2.366E+02	2.472E+02	2.882E+02	4.470E+02	2.110E+03	*3.361E+05	*3.361E+05	

*At specific activity limit

0

0Nuclide	Initial	tmin	DSR(i,tmin)	G(i,tmin)	DSR(i,tmax)	G(i,tmax)
Single Radionuclide Soil (Guidelines)			G(i,t) in pCi/g	pCi/g		(pCi/g)
and at tmax = time of maximum total dose = 0.000E+00 years						
Summed Dose/Source Ratio (DSR(0,t) in mrem/yr)/(pCi/g) in pCi/g						
Single Radionuclide Soil (Guidelines)			1.682E-01	1.486E+02		
and Single Radionuclide Soil (Guidelines)			1.080E-01	2.315E+02		
U-238						

Summary : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

ONuclide	Parent (i)	THF (i)	DOSE (j, t) , mrem/yr								
			t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
(j)											
235	U-235	1.000E+00	6.729E-03	6.584E-03	6.304E-03	5.413E-03	3.501E-03	7.573E-04	1.242E-06	0.000E+00	
0Pa-231	U-235	1.000E+00	3.048E-08	8.968E-08	2.005E-07	5.164E-07	9.697E-07	6.904E-07	1.919E-09	0.000E+00	
0Ac-227	U-235	1.000E+00	2.420E-09	1.633E-08	7.944E-08	5.316E-07	2.054E-06	2.184E-06	1.225E-08	0.000E+00	
0U-238	U-238	5.450E-07	6.400E-10	6.262E-10	5.995E-10	5.148E-10	3.330E-10	7.249E-11	3.352E-14	0.000E+00	
U-238	U-238	1.000E+00	6.587E-02	6.445E-02	6.169E-02	5.292E-02	3.411E-02	7.227E-03	2.020E-05	0.000E+00	
U-238	ΣDOSE (j)		6.587E-02	6.445E-02	6.169E-02	5.292E-02	3.411E-02	7.227E-03	2.020E-05	0.000E+00	
U-234	U-238	1.000E+00	1.914E-09	5.633E-09	1.259E-08	3.244E-08	6.097E-08	4.374E-08	6.660E-11	0.000E+00	
0Th-230	U-238	1.000E+00	4.436E-14	3.067E-13	1.576E-12	1.276E-11	8.136E-11	3.641E-10	1.762E-11	0.000E+00	
0Ra-226	U-238	1.000E+00	6.538E-16	9.680E-15	1.097E-13	2.620E-12	4.756E-11	6.200E-10	1.854E-10	0.000E+00	
0Pb-210	U-238	1.000E+00	1.238E-19	3.771E-18	9.141E-17	6.215E-15	2.972E-13	9.662E-12	9.285E-12	0.000E+00	

THF(i) is the thread fraction of the parent nuclide.
 Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

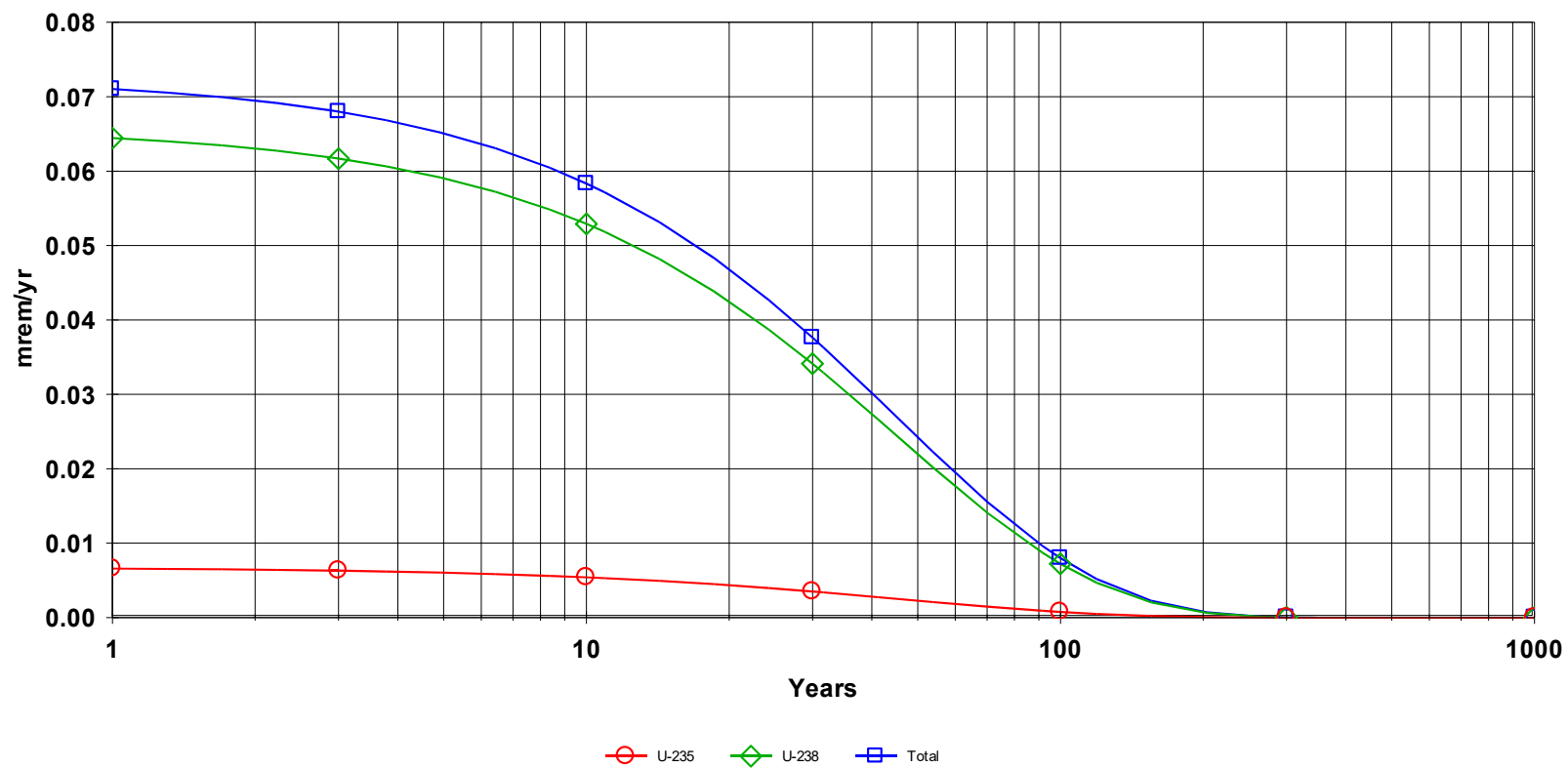
ONuclide	Parent (i)	THF(i)	S(j,t), pCi/g								
			t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
(j)											
235	U-235	1.000E+00		4.000E-02	3.914E-02	3.747E-02	3.217E-02	2.081E-02	4.531E-03	5.814E-05	1.392E-11
0Pa-231	U-235	1.000E+00		0.000E+00	8.281E-07	2.378E-06	6.806E-06	1.321E-05	9.577E-06	3.679E-07	2.914E-13
0Ac-227	U-235	1.000E+00		0.000E+00	1.290E-08	1.066E-07	8.846E-07	3.645E-06	4.013E-06	1.731E-07	1.423E-13
0U-238	U-238	5.450E-07		3.324E-07	3.253E-07	3.114E-07	2.674E-07	1.730E-07	3.766E-08	4.832E-10	1.157E-16
U-238	U-238	1.000E+00		6.100E-01	5.969E-01	5.714E-01	4.906E-01	3.174E-01	6.910E-02	8.867E-04	2.122E-10
	ΣS(j):			6.100E-01	5.969E-01	5.714E-01	4.906E-01	3.174E-01	6.910E-02	8.867E-04	2.122E-10
0U-234	U-238	1.000E+00		0.000E+00	1.685E-06	4.840E-06	1.385E-05	2.688E-05	1.951E-05	7.507E-07	5.984E-13
0Th-230	U-238	1.000E+00		0.000E+00	7.804E-12	6.823E-11	6.857E-10	4.665E-09	2.134E-08	3.283E-08	3.256E-08
0Ra-226	U-238	1.000E+00		0.000E+00	1.127E-15	2.953E-14	9.860E-13	1.989E-11	2.810E-10	8.353E-10	8.827E-10
0Pb-210	U-238	1.000E+00		0.000E+00	8.746E-18	6.803E-16	7.293E-14	3.980E-12	1.355E-10	5.980E-10	6.545E-10

THF(i) is the thread fraction of the parent nuclide.

ORESCALC.EXE execution time = 7.99 seconds

Parent Nuclide and Branch Fraction Indicated
 Individual Nuclide Soil Concentration

DOSE: All Nuclides Summed, All Pathways Summed



\\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD 04/23/2023 10:27 GRAPHICS.ASC Includes All Pathwa

Second Five-Year Review Risk Evaluation, Site Worker Exposures to Soil (0 to 1 ft bgs)
Modified DCFPAK3.02 Morbidity Library, RESRAD-ONSITE Version 7.2 Model
IAAAP Firing Site 12 East Survey Units

Part III: Intake Quantities and Health Risk Factors	
Cancer Risk Slope Factors	2
Risk Slope and ETFG for the Ground Pathway	4
Amount of Intake Quantities and Excess Cancer Risks	5
.....	8
.....	11
Time= 0.000E+00	14
Time= 0.000E+00	17
Time= 3.000E+00	20
Time= 1.000E+01	23
Time= 3.000E+01	26
Time= 1.000E+02	
Time= 3.000E+02	
Time= 1.000E+03	

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

0		Current	Base	Parameter
Menu		Value	Case*	Name
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	Ac-227+D	1.44E-06	1.98E-10	SLPF(1,1)
Sf-1	Pa-231	1.27E-07	1.27E-07	SLPF(2,1)
Sf-1	Pb-210+D	4.30E-09	1.48E-09	SLPF(3,1)
Sf-1	Ra-226+D	8.37E-06	2.50E-08	SLPF(4,1)
Sf-1	Th-230	8.45E-10	8.45E-10	SLPF(5,1)
Sf-1	U-234	2.53E-10	2.53E-10	SLPF(6,1)
Sf-1	U-235+D	5.76E-07	5.51E-07	SLPF(7,1)
Sf-1	U-238	1.24E-10	1.24E-10	SLPF(8,1)
Risk Library Worker Updates_Soil Plus DCFPAK3.02 Morbidity	U-238+D	1.19E-07	1.24E-10	SLPF(9,1)
Sf-2	Inhalation, slope factors, 1/(pCi):			
Sf-2	Ac-227+D	2.13E-07	1.49E-07	SLPF(1,2)
Sf-2	Pa-231	7.62E-08	7.62E-08	SLPF(2,2)
Cancer Risk Slope Factors Summary Table	Pb-210+D	3.08E-08	1.59E-08	SLPF(3,2)
Sf-2	Ra-226+D	2.83E-08	2.81E-08	SLPF(4,2)
Sf-2	Th-230	3.41E-08	3.41E-08	SLPF(5,2)
Sf-2	U-234	2.78E-08	2.78E-08	SLPF(6,2)
Sf-2	U-235+D	2.50E-08	2.50E-08	SLPF(7,2)
Sf-2	U-238	2.36E-08	2.36E-08	SLPF(8,2)
Sf-2	U-238+D	2.37E-08	2.36E-08	SLPF(9,2)
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	6.54E-10	2.45E-10	SLPF(1,3)
Sf-3	Pa-231	2.26E-10	2.26E-10	SLPF(2,3)
Sf-3	Pb-210+D	3.44E-09	1.18E-09	SLPF(3,3)
Sf-3	Ra-226+D	5.15E-10	5.14E-10	SLPF(4,3)
Sf-3	Th-230	1.19E-10	1.19E-10	SLPF(5,3)
Sf-3	U-234	9.55E-11	9.55E-11	SLPF(6,3)
Sf-3	U-235+D	9.76E-11	9.43E-11	SLPF(7,3)
Sf-3	U-238	8.66E-11	8.66E-11	SLPF(8,3)
Sf-3	U-238+D	1.21E-10	8.66E-11	SLPF(9,3)
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	4.87E-10	2.01E-10	SLPF(1,4)
Sf-3	Pa-231	1.72E-10	1.72E-10	SLPF(2,4)
Sf-3	Pb-210+D	2.67E-09	8.84E-10	SLPF(3,4)
Sf-3	Ra-226+D	3.85E-10	3.85E-10	SLPF(4,4)
Sf-3	Th-230	9.14E-11	9.14E-11	SLPF(5,4)
Sf-3	U-234	7.07E-11	7.07E-11	SLPF(6,4)
Sf-3	U-235+D	7.17E-11	6.95E-11	SLPF(7,4)
Sf-3	U-238	6.40E-11	6.40E-11	SLPF(8,4)
Sf-3	U-238+D	8.71E-11	6.40E-11	SLPF(9,4)
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	3.45E-10	2.45E-10	SLPF(1,5)
Sf-3	Pa-231	1.54E-10	2.26E-10	SLPF(2,5)
Sf-3	Pb-210+D	2.04E-09	1.18E-09	SLPF(3,5)
Sf-3	Ra-226+D	2.95E-10	5.14E-10	SLPF(4,5)
Sf-3	Th-230	7.73E-11	1.19E-10	SLPF(5,5)

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

0		Current	Base	Parameter
Menu		Value	Case*	Name
Sf-3	U-234	5.11E-11	9.55E-11	SLPF(6,5)
Sf-3	U-235+D	5.01E-11	9.43E-11	SLPF(7,5)
Sf-3	U-238	4.66E-11	8.66E-11	SLPF(8,5)
Sf-3	U-238+D	5.61E-11	8.66E-11	SLPF(9,5)
Sf-Rn	Radon Inhalation slope factors, 1/(pCi):			
Sf-Rn	Rn-222	1.80E-12	1.80E-12	SLPFRN(1,1)
Sf-Rn	Po-218	3.70E-12	3.70E-12	SLPFRN(1,2)
Sf-Rn	Pb-214	6.20E-12	6.20E-12	SLPFRN(1,3)
Sf-Rn	Bi-214	1.50E-11	1.50E-11	SLPFRN(1,4)
Risk Library	Worker Updates_Soil Plus DCFPAK3.02 Morbidity			
Cancer Risk Slope Factors Summary Table (continued)				
Sf-Rn	Radon R-factors, (mrem/WLM):			
Sf-Rn	Rn-222 Indoor	3.88E+02	3.88E+02	KFACTR(1,1)
Sf-Rn	Rn-222 Outdoor	3.88E+02	3.88E+02	KFACTR(1,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

0Nuclide	Slope(i) *	ETFG(i,t) At Time in Years (dimensionless)							
		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
⁽ⁱ⁾ Ac-227	1.990E-10	2.246E-01	2.246E-01	2.246E-01	2.246E-01	2.246E-01	2.241E-01	5.782E-02	0.000E+00
At-218	2.740E-11	2.214E-01	2.214E-01	2.215E-01	2.215E-01	2.215E-01	2.202E-01	1.095E-01	0.000E+00
At-219	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Bi-210	2.770E-09	2.226E-01	2.226E-01	2.226E-01	2.226E-01	2.228E-01	2.226E-01	1.123E-01	0.000E+00
Bi-211	0.000E+00	2.214E-01	2.214E-01	2.214E-01	2.213E-01	2.209E-01	2.171E-01	2.649E-02	0.000E+00
Bi-214	7.340E-06	2.146E-01	2.145E-01	2.144E-01	2.139E-01	2.122E-01	2.018E-01	2.226E-02	0.000E+00
Bi-215	1.080E-06	2.204E-01	2.204E-01	2.203E-01	2.202E-01	2.195E-01	2.139E-01	2.804E-02	0.000E+00
Bi-215	1.080E-06	2.204E-01	2.204E-01	2.203E-01	2.202E-01	2.195E-01	2.139E-01	2.804E-02	0.000E+00
Fr-223	4.830E-07	2.220E-01	2.220E-01	2.220E-01	2.219E-01	2.216E-01	2.180E-01	2.922E-02	0.000E+00
Hg-206	1.270E-07	2.222E-01	2.222E-01	2.222E-01	2.221E-01	2.219E-01	2.187E-01	2.886E-02	0.000E+00
Pa-231	6.620E-06	2.180E-01	2.180E-01	2.179E-01	2.176E-01	2.166E-01	2.092E-01	2.425E-02	0.000E+00
Pa-234	9.060E-08	2.188E-01	2.187E-01	2.187E-01	2.185E-01	2.177E-01	2.114E-01	4.989E-02	0.000E+00
Pa-234m	1.480E-09	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	9.915E-02	0.000E+00
Pb-210	2.910E-07	2.193E-01	2.193E-01	2.192E-01	2.191E-01	2.184E-01	2.124E-01	2.963E-02	0.000E+00
Pb-211	9.940E-07	2.219E-01	2.219E-01	2.219E-01	2.218E-01	2.215E-01	2.178E-01	2.722E-02	0.000E+00
Pb-214	4.510E-11	2.178E-01	2.178E-01	2.177E-01	2.174E-01	2.164E-01	2.088E-01	2.379E-02	0.000E+00
Po-210	3.760E-08	2.177E-01	2.177E-01	2.176E-01	2.173E-01	2.164E-01	2.090E-01	2.388E-02	0.000E+00
Po-211	3.850E-10	2.178E-01	2.178E-01	2.177E-01	2.175E-01	2.165E-01	2.092E-01	2.365E-02	0.000E+00
Po-214	7.480E-10	2.205E-01	2.205E-01	2.204E-01	2.203E-01	2.199E-01	2.152E-01	2.553E-02	0.000E+00
Po-215	6.840E-15	2.239E-01	2.239E-01	2.239E-01	2.239E-01	2.239E-01	2.238E-01	7.256E-02	0.000E+00
Po-218	4.550E-07	2.227E-01	2.227E-01	2.227E-01	2.227E-01	2.226E-01	2.206E-01	3.113E-02	0.000E+00
Ra-223	2.500E-08	2.229E-01	2.229E-01	2.229E-01	2.229E-01	2.228E-01	2.212E-01	2.982E-02	0.000E+00
Ra-226	3.390E-09	2.188E-01	2.188E-01	2.187E-01	2.185E-01	2.178E-01	2.117E-01	2.440E-02	0.000E+00
Rn-218	2.350E-07	2.220E-01	2.220E-01	2.219E-01	2.219E-01	2.215E-01	2.178E-01	2.664E-02	0.000E+00
Rn-219	1.690E-09	2.199E-01	2.199E-01	2.199E-01	2.197E-01	2.192E-01	2.142E-01	2.495E-02	0.000E+00
Rn-222	4.450E-07	2.225E-01	2.225E-01	2.225E-01	2.225E-01	2.223E-01	2.197E-01	2.875E-02	0.000E+00
Th-227	8.450E-10	2.240E-01	2.240E-01	2.240E-01	2.240E-01	2.241E-01	2.238E-01	5.249E-02	0.000E+00
Th-230	2.490E-08	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.282E-01	2.279E-01	5.128E-02	0.000E+00
Th-231	1.780E-08	2.239E-01	2.239E-01	2.239E-01	2.239E-01	2.238E-01	2.236E-01	4.753E-02	0.000E+00
Th-234	6.110E-09	2.218E-01	2.218E-01	2.218E-01	2.219E-01	2.221E-01	2.219E-01	1.175E-01	0.000E+00
Tl-206	1.590E-08	2.201E-01	2.200E-01	2.200E-01	2.199E-01	2.195E-01	2.153E-01	6.732E-02	0.000E+00
Tl-207	1.340E-05	2.153E-01	2.153E-01	2.151E-01	2.147E-01	2.132E-01	2.033E-01	2.280E-02	0.000E+00
Tl-210	2.530E-10	2.281E-01	2.281E-01	2.281E-01	2.281E-01	2.281E-01	2.278E-01	7.980E-02	0.000E+00
U-234	5.510E-07	2.229E-01	2.229E-01	2.229E-01	2.229E-01	2.229E-01	2.214E-01	3.013E-02	0.000E+00
U-235	1.240E-10	2.247E-01	2.247E-01	2.247E-01	2.247E-01	2.247E-01	2.233E-01	9.135E-02	0.000E+00
U-238	1.240E-10	2.247E-01	2.247E-01	2.247E-01	2.247E-01	2.247E-01	2.233E-01	9.135E-02	0.000E+00

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways											Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk		
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Water-Independent Pathways (Inhalation w/o radon)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Ra-226	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Th-230	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Sum of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	1.299E-03	0.000E+00	0.000E+00	0.000E+00	2.283E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.283E-01	
U-235	1.981E-02	0.000E+00	0.000E+00	0.000E+00	3.482E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.482E+00	
U-238												

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.								
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 0.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 0.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	1.057E-11	0.0000	2.296E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.521E-14	0.0000
Pa-231	5.232E-12	0.0000	4.592E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.630E-13	0.0000
Excels Cancer Risks (i, p) for Individual Radionuclides (i) and Pathways (p)	1.111E-20	0.0000	1.153E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.343E-19	0.0000
Ra-226	1.493E-16	0.0000	7.646E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.405E-19	0.0000
Th-230	5.990E-18	0.0000	3.502E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.396E-17	0.0000
U-234	2.179E-14	0.0000	3.412E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.101E-13	0.0000
U-235	9.909E-08	0.2361	6.265E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.205E-10	0.0005
U-238	3.070E-07	0.7314	9.042E-09	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.766E-09	0.0090
Total	4.061E-07	0.9675	9.669E-09	0.0230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.987E-09	0.0095

and Fraction of Total Risk at t= 0.000E+00 years

Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	9.910E-08	0.2361	6.272E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.208E-10	0.0005
U-238	3.070E-07	0.7314	9.042E-09	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.766E-09	0.0090
Total Excess Cancer Risk	4.061E-07	0.9675	9.869E-09	0.0230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.987E-09	0.0095

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.995E-08	0.2381
Total Excess Cancer Risk CNRSI (i,p,t) * for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.198E-07	0.7619
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.197E-07	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.197E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	4.192E-10	0.000E+00	0.000E+00	0.000E+00	7.365E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.365E-08
Pa-231	2.690E-08	0.000E+00	0.000E+00	0.000E+00	4.726E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.726E-06
Water-Indep.	2.841E-19	0.000E+00	0.000E+00	0.000E+00	4.992E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.992E-17
Ra-226	3.659E-17	0.000E+00	0.000E+00	0.000E+00	6.430E-15	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.430E-15
Th-230	2.535E-13	0.000E+00	0.000E+00	0.000E+00	4.454E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.454E-11
Sum of Ingestion Pathways	1.474E-08	0.000E+00	0.000E+00	0.000E+00	9.618E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.618E-06
U-235	1.271E-03	0.000E+00	0.000E+00	0.000E+00	2.234E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.234E-01
U-238	1.939E-02	0.000E+00	0.000E+00	0.000E+00	3.407E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.407E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	1.157E-11	0.0000	2.514E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.139E-14	0.0000
Pa-231	5.569E-12	0.0000	4.888E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.736E-13	0.0000
Ra-226	1.331E-20	0.0000	1.381E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.608E-19	0.0000
Th-230	1.725E-16	0.0000	8.839E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.624E-19	0.0000
U-234	6.669E-18	0.0000	3.898E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.554E-17	0.0000
U-235	2.319E-14	0.0000	3.632E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.172E-13	0.0000
U-238	9.695E-08	0.2361	6.130E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.158E-10	0.0005
U-238	3.003E-07	0.7313	8.847E-09	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.685E-09	0.0090
Total	3.973E-07	0.9675	9.461E-09	0.0230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.901E-09	0.0095

and Fraction of Total Risk at t= 1.000E+00 years

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.189E-11	0.0000
Excess Cancer Risks CNRS (i,p,t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.231E-12	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.879E-19	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.727E-16	0.0000
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.120E-17	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.036E-13	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.778E-08	0.2381
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.129E-07	0.7619
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.107E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i,p,t) and CNRS (i,p,t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+00 years Water Independent Pathways (Inhalation excludes radon)													
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
U-235	9.697E-08	0.2361	6.137E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.160E-10
U-238	3.003E-07	0.7313	8.847E-09	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.685E-09
Total Excess Cancer Risk CNRS (i,p,t)*** for	3.973E-07	0.9675	9.461E-09	0.0230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.901E-09

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.780E-08	0.2381
Total Excess Cancer Risk CNRSI (i,p,t) * for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.129E-07	0.7619
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.107E-07	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.107E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	3.464E-09	0.000E+00	0.000E+00	0.000E+00	6.086E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.086E-07
Pa-231	7.725E-08	0.000E+00	0.000E+00	0.000E+00	1.357E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.357E-05
Water-Indep. Pathways	2.210E-17	0.000E+00	0.000E+00	0.000E+00	3.883E-15	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.883E-15
Ra-226	9.591E-16	0.000E+00	0.000E+00	0.000E+00	1.685E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.685E-13
Th-230	2.216E-12	0.000E+00	0.000E+00	0.000E+00	3.895E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.895E-10
Sum of Ingestion Pathways	5.72E-07	0.000E+00	0.000E+00	0.000E+00	1.66E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.762E-05
U-235	1.217E-03	0.000E+00	0.000E+00	0.000E+00	2.139E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.139E-01
U-238	1.856E-02	0.000E+00	0.000E+00	0.000E+00	3.261E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.261E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	1.364E-11	0.0000	2.964E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.417E-14	0.0000
Pa-231	6.193E-12	0.0000	5.436E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.930E-13	0.0000
Ra-226	1.865E-20	0.0000	1.936E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.255E-19	0.0000
Th-230	2.266E-16	0.0000	1.162E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.134E-19	0.0000
U-234	8.148E-18	0.0000	4.763E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.899E-17	0.0000
U-235	2.580E-14	0.0000	4.039E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.304E-13	0.0000
U-238	9.282E-08	0.2361	5.869E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.066E-10	0.0005
U-238	2.874E-07	0.7313	8.470E-09	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.528E-09	0.0090
Total	3.803E-07	0.9675	9.058E-09	0.0230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.735E-09	0.0095

and Fraction of Total Risk at t= 3.000E+00 years

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESC_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.402E-11	0.0000
Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.929E-12	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.635E-19	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.269E-16	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.476E-17	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.600E-13	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.361E-08	0.2382
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.994E-07	0.7618
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.931E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS(i,p,t) and CNRS9W(i,p,t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+00 years													
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
U-235	9.284E-08	0.2362	5.877E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.069E-10
U-238	2.874E-07	0.7313	8.470E-09	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.528E-09
Total Excess Cancer Risk CNRS(i,p,t)*** for	3.803E-07	0.9675	9.058E-09	0.0230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.735E-09

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.363E-08	0.2382
Total Excess Cancer Risk CNRSI (p,t) * for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.994E-07	0.7618
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.931E-07	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.931E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways										Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	2.873E-08	0.000E+00	0.000E+00	0.000E+00	5.049E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.049E-06
Pa-231	2.211E-07	0.000E+00	0.000E+00	0.000E+00	3.885E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.885E-05
Water-Indep.	2.369E-15	0.000E+00	0.000E+00	0.000E+00	4.163E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.163E-13
Ra-226	3.203E-14	0.000E+00	0.000E+00	0.000E+00	5.627E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.627E-12
Th-230	2.227E-11	0.000E+00	0.000E+00	0.000E+00	3.913E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.913E-09
Sum of Ingestion	1.045E-03	0.000E+00	0.000E+00	0.000E+00	1.836E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.836E-01
U-235	1.594E-02	0.000E+00	0.000E+00	0.000E+00	2.800E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.800E+00
U-238											

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.								
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+01 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	2.108E-11	0.0001	4.582E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.301E-13	0.0000
Pa-231	7.904E-12	0.0000	6.940E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.464E-13	0.0000
Excelsior	5.073E-20	0.0000	5.265E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.130E-19	0.0000
Ra-226	5.054E-16	0.0000	2.597E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.770E-19	0.0000
Th-230	1.440E-17	0.0000	8.415E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.355E-17	0.0000
U-234	3.294E-14	0.0000	5.157E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.664E-13	0.0000
U-235	7.969E-08	0.2363	5.039E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.774E-10	0.0005
U-238	2.465E-07	0.7310	7.272E-09	0.0216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.029E-09	0.0090
Total	3.263E-07	0.9674	7.778E-09	0.0231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.207E-09	0.0095

and Fraction of Total Risk at t= 1.000E+01 years

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.167E-11	0.0001
Excess Cancer Risks CNRS(i,p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.844E-12	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.164E-19	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.062E-16	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.321E-16	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.151E-13	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.037E-08	0.2383
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.568E-07	0.7616
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.372E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+01 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS(i,p) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+01 years Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	7.972E-08	0.2364	5.050E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.777E-10	0.0005
U-238	2.465E-07	0.7310	7.273E-09	0.0216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.029E-09	0.0090
Total Excess Cancer Risk CNRS(i,p,t)*** for	3.263E-07	0.9674	7.778E-09	0.0231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.207E-09	0.0095

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.040E-08	0.2384
Total Excess Cancer Risk CNRSI (i,p,t) * for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.568E-07	0.7616
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.372E-07	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.372E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways										
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Total*
Ac-227	1.184E-07	0.000E+00	0.000E+00	0.000E+00	2.081E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.081E-05
Pa-231	4.290E-07	0.000E+00	0.000E+00	0.000E+00	7.537E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.537E-05
Water-Indep. Pathways	1.223E-13	0.000E+00	0.000E+00	0.000E+00	2.272E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.272E-11
Ra-226	6.461E-13	0.000E+00	0.000E+00	0.000E+00	1.135E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.135E-10
Th-230	1.515E-10	0.000E+00	0.000E+00	0.000E+00	2.663E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.663E-08
Sum of Intake Quantities (i, p, t) for Individual Radionuclides (i) and Pathways (p)	1.223E-13	0.000E+00	0.000E+00	0.000E+00	2.272E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.272E-11
U-235	6.760E-04	0.000E+00	0.000E+00	0.000E+00	1.188E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.188E-01
U-238	1.031E-02	0.000E+00	0.000E+00	0.000E+00	1.811E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.811E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of intake (i, p, t) for individual radionuclides (i) and pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+01 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	3.616E-11	0.0002	7.874E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.236E-13	0.0000
Pa-231	9.880E-12	0.0000	8.690E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.085E-13	0.0000
Ra-226	3.311E-19	0.0000	3.435E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.000E-18	0.0000
Th-230	2.179E-15	0.0000	1.128E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.073E-18	0.0000
U-234	3.749E-17	0.0000	2.191E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.735E-17	0.0000
U-235	4.124E-14	0.0000	6.458E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.084E-13	0.0000
U-238	5.153E-08	0.2369	3.259E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.147E-10	0.0005
U-238	1.589E-07	0.7302	4.704E-09	0.0216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.959E-09	0.0090
Total	2.104E-07	0.9673	5.033E-09	0.0231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.075E-09	0.0095

and Fraction of Total Risk at t= 3.000E+01 years

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.717E-11	0.0002
Excess Cancer Risks CNRS(i, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.106E-11	0.0001
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.675E-18	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.182E-15	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.439E-16	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.954E-13	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.197E-08	0.2389
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.655E-07	0.7609
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.175E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+01 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS(i, t) and CNRSW(i, t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+01 years				Water Independent Pathways (Inhalation excludes radon)										
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil		
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	5.158E-08	0.2371	3.276E-10	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.153E-10	0.0005
U-238	1.589E-07	0.7302	4.705E-09	0.0216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.960E-09	0.0090
Total Excess Cancer Risk CNRS(i, p)*** for					0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.075E-09	0.0095
Total					2.104E-07	0.9673	5.033E-09	0.0231						

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.202E-08	0.2391
Total Excess Cancer Risk CNRSI (i,p,t)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.655E-07	0.7609
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.175E-07	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.175E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+01 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.304E-07	0.000E+00	0.000E+00	0.000E+00	2.291E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.291E-05
Pa-231	3.111E-07	0.000E+00	0.000E+00	0.000E+00	5.466E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.466E-05
Water-Indep.	4.400E-12	0.000E+00	0.000E+00	0.000E+00	7.732E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.732E-10
Ra-226	9.127E-12	0.000E+00	0.000E+00	0.000E+00	1.604E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.604E-09
Th-230	6.932E-10	0.000E+00	0.000E+00	0.000E+00	1.218E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.218E-07
Sum of Intake Quantities (i) and Pathways (p)	1.336E-07	0.000E+00	0.000E+00	0.000E+00	1.133E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.113E-04
U-235	1.472E-04	0.000E+00	0.000E+00	0.000E+00	2.586E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.586E-02
U-238	2.245E-03	0.000E+00	0.000E+00	0.000E+00	3.944E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.944E-01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Inhaled Radon, 0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+02 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	2.739E-11	0.0006	6.079E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.726E-13	0.0000
Pa-231	5.679E-12	0.0001	5.089E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.807E-13	0.0000
Ra-226	4.219E-18	0.0000	4.388E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.109E-17	0.0000
Th-230	1.427E-14	0.0000	7.798E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.433E-17	0.0000
U-234	1.103E-16	0.0000	6.463E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.577E-16	0.0000
U-235	2.412E-14	0.0000	3.785E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.221E-13	0.0000
U-238	1.112E-08	0.2404	7.097E-11	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.498E-11	0.0005
U-238	3.354E-08	0.7254	1.024E-09	0.0221	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.266E-10	0.0092
Total	4.469E-08	0.9665	1.097E-09	0.0237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.521E-10	0.0098

and Fraction of Total Risk at t= 1.000E+02 years

Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	1.115E-08	0.2411	7.208E-11	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.533E-11	0.0005
U-238	3.354E-08	0.7254	1.025E-09	0.0222	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.267E-10	0.0092
Total Excess Cancer Risk	4.469E-08	0.9665	1.097E-09	0.0237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.521E-10	0.0098

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.125E-08	0.2432
Total Excess Cancer Risk CNRSI (1.0 ft) * 0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.499E-08	0.7568
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.624E-08	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.624E-08	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.799E-10	0.000E+00	0.000E+00	0.000E+00	3.161E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.161E-08
Pa-231	3.824E-10	0.000E+00	0.000E+00	0.000E+00	6.719E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.719E-08
Water-Indep	8.216E-13	0.000E+00	0.000E+00	0.000E+00	1.092E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.092E-10
Ra-226	8.682E-13	0.000E+00	0.000E+00	0.000E+00	1.526E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.526E-10
Th-230	3.412E-11	0.000E+00	0.000E+00	0.000E+00	5.996E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.996E-09
Sum of Ingestion Pathways	1.803E-10	0.000E+00	0.000E+00	0.000E+00	1.619E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.619E-04
U-235	6.044E-08	0.000E+00	0.000E+00	0.000E+00	1.062E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.062E-05
U-238	9.216E-07	0.000E+00	0.000E+00	0.000E+00	1.619E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.619E-04

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+02 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+02 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	1.870E-14	0.0011	8.951E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.542E-17	0.0000
Pa-231	3.353E-15	0.0002	6.797E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.413E-17	0.0000
Excluded	1.014E-18	0.0000	4.613E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.371E-19	0.0000
Ra-226	3.986E-16	0.0000	5.901E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.084E-19	0.0000
Th-230	4.233E-18	0.0000	2.793E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.113E-18	0.0000
U-234	5.117E-17	0.0000	5.063E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.634E-17	0.0000
U-235	2.547E-12	0.1441	3.507E-15	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.235E-15	0.0001
U-238	1.504E-11	0.8503	5.061E-14	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.108E-14	0.0012
Total	1.760E-11	0.9957	5.433E-14	0.0031	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.238E-14	0.0013

and Fraction of Total Risk at t= 3.000E+02 years

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.882E-14	0.0011
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.445E-15	0.0002
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.597E-18	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.987E-16	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.139E-18	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.181E-16	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.552E-12	0.1443
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.511E-11	0.8544
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.768E-11	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+02 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) and CNRS (i, p) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+02 years Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	2.569E-12	0.1453	3.664E-15	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.284E-15	0.0001
U-238	1.504E-11	0.8504	5.067E-14	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.110E-14	0.0012
Total Excess Cancer Risk CNRS (i, p)*** for	1.760E-11	0.9957	5.433E-14	0.0031	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.238E-14	0.0013

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.574E-12	0.1456
Total Excess Cancer Risk CNRSI (p,t) * for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.511E-11	0.8544
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.768E-11	1.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.768E-11	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR-0-1 FT_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways										
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Total*
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-Indep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sum of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+03 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Excl. Cancer Risks (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

and Fraction of Total Risk at t= 1.000E+03 years

[illegible]

Intrisk : IAAAP Firing Site 12 ESUs (0-1 ft Depth), Site Wkr Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\IAAAP FS12 ESU_SITE WKR_0-1 FT_FYR2.RAD

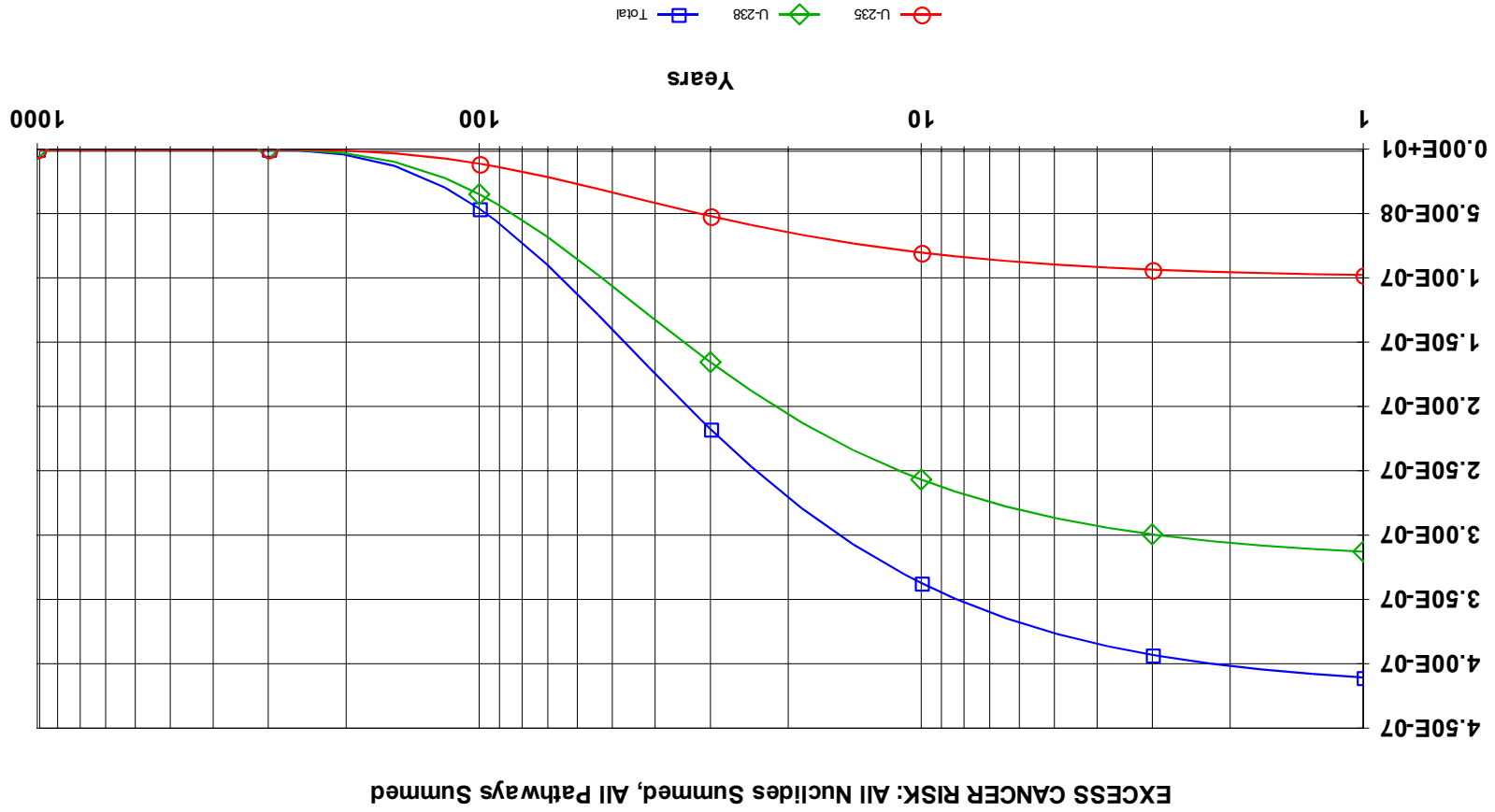
Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total Excess Cancer Risk CNRSI (i,p,t) * for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total Water	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways



\\RESRAD_FAMILY\ONSITE\7.2\USERFILES\AAAP_FS12ESU_SITE_WKR_0-1_FT_FYR2.RAD 04/23/2023 10:27 GRAPHICS.ASC Includes All Pathwa

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ATTACHMENT D-4-2

**FS-12 AREA RESUSE SOIL SURVEY UNITS 1 THROUGH 142 RESRAD-ONSITE
VERSION 7.2 RISK AND DOSE OUTPUTS FOR A SITE WORKER**

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Second Five-Year Review Dose Evaluation, Site Worker Exposures to Deep Backfill Soil (0 to 10 ft bgs)
Modified DCFPAK3.02 (Adult) Library, RESRAD-ONSITE Version 7.2 Model
IAAAP Firing Site 12 Reuse Soil Survey Units 1 through 142

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Summary : IAAAP FS12 Reuse Soil SUT-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: Worker Updates_Soil)	4.330E-04	2.615E-04	DCF1(1)
A-1	At-218 (Source: Worker Updates_Soil)	5.260E-04	5.567E-05	DCF1(2)
A-1	At-219 (Source: DCFPAK3.02)	0.000E+00	0.000E+00	DCF1(3)
A-1	Bi-210 (Source: Worker Updates_Soil)	1.280E-01	5.474E-03	DCF1(4)
A-1	Bi-211 (Source: Worker Updates_Soil)	2.370E-01	2.410E-01	DCF1(5)
A-1	Bi-214 (Source: Worker Updates_Soil)	9.370E+00	9.136E+00	DCF1(6)
A-1	Bi-215 (Source: Worker Updates_Soil)	1.590E+00	1.369E+00	DCF1(7)
A-1	Fr-223 (Source: Worker Updates_Soil)	2.860E-01	1.758E-01	DCF1(8)
A-1	Hg-206 (Source: Worker Updates_Soil)	7.300E-01	6.128E-01	DCF1(9)
A-1	Pa-231 (Source: Worker Updates_Soil)	1.590E-01	1.609E-01	DCF1(10)
A-1	Pa-234 (Source: Worker Updates_Soil)	8.290E+00	8.276E+00	DCF1(11)
A-1	Pa-234m (Source: Worker Updates_Soil)	4.460E-01	1.257E-01	DCF1(12)
A-1	Pb-210 (Source: Worker Updates_Soil)	2.350E-03	2.092E-03	DCF1(13)
A-1	Pb-211 (Source: Worker Updates_Soil)	5.150E-01	3.680E-01	DCF1(14)
A-1	Pb-214 (Source: Worker Updates_Soil)	1.300E+00	1.257E+00	DCF1(15)
A-1	Po-210 (Source: Worker Updates_Soil)	5.600E-05	5.642E-05	DCF1(16)
A-1	Po-211 (Source: Worker Updates_Soil)	4.670E-02	4.708E-02	DCF1(17)
A-1	Po-214 (Source: Worker Updates_Soil)	4.780E-04	4.801E-04	DCF1(18)
A-1	Po-215 (Source: Worker Updates_Soil)	9.330E-04	9.453E-04	DCF1(19)
A-1	Po-218 (Source: Worker Updates_Soil)	2.260E-06	9.229E-09	DCF1(20)
A-1	Ra-223 (Source: Worker Updates_Soil)	5.820E-01	5.791E-01	DCF1(21)
A-1	Ra-226 (Source: Worker Updates_Soil)	3.210E-02	3.176E-02	DCF1(22)
A-1	Rn-218 (Source: Worker Updates_Soil)	4.200E-03	4.260E-03	DCF1(23)
A-1	Rn-219 (Source: Worker Updates_Soil)	2.930E-01	2.970E-01	DCF1(24)
A-1	Rn-222 (Source: Worker Updates_Soil)	2.110E-03	2.130E-03	DCF1(25)
A-1	Th-227 (Source: Worker Updates_Soil)	5.600E-01	5.642E-01	DCF1(26)
A-1	Th-230 (Source: Worker Updates_Soil)	1.160E-03	1.106E-03	DCF1(27)
A-1	Th-231 (Source: Worker Updates_Soil)	4.690E-02	3.251E-02	DCF1(28)
A-1	Th-234 (Source: Worker Updates_Soil)	2.990E-02	2.317E-02	DCF1(29)
A-1	Tl-206 (Source: Worker Updates_Soil)	2.000E-01	1.278E-02	DCF1(30)
A-1	Tl-207 (Source: Worker Updates_Soil)	1.920E-01	2.391E-02	DCF1(31)
A-1	Tl-210 (Source: Worker Updates_Soil)	1.730E+01	1.678E+01	DCF1(32)
A-1	U-234 (Source: Worker Updates_Soil)	3.510E-04	3.456E-04	DCF1(33)
A-1	U-235 (Source: Worker Updates_Soil)	7.060E-01	7.006E-01	DCF1(34)
A-1	U-238 (Source: Worker Updates_Soil)	1.720E-04	1.713E-04	DCF1(35)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.459E-01	5.760E-01	DCF2(1)
B-1	Pa-231	8.505E-01	8.505E-01	DCF2(2)
B-1	Pb-210+D	3.708E-02	2.077E-02	DCF2(3)
B-1	Ra-226+D	3.541E-02	3.517E-02	DCF2(4)
B-1	Th-230	3.759E-01	3.759E-01	DCF2(5)
B-1	U-234	3.479E-02	3.479E-02	DCF2(6)
B-1	U-235+D	3.132E-02	3.132E-02	DCF2(7)
B-1	U-238	2.973E-02	2.973E-02	DCF2(8)
B-1	U-238+D	2.976E-02	2.973E-02	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.607E-03	1.191E-03	DCF3(1)

Summary : IAAAP FS12 Reuse Soil SUT-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
D-1	Pa-231	1.772E-03	1.772E-03	DCF3(2)
D-1	Pb-210+D	7.057E-03	2.575E-03	DCF3(3)
D-1	Ra-226+D	1.037E-03	1.036E-03	DCF3(4)
D-1	Th-230	7.918E-04	7.918E-04	DCF3(5)
D-1	U-234	1.831E-04	1.831E-04	DCF3(6)
D-1	U-235+D	1.740E-04	1.728E-04	DCF3(7)
D-1	U-238	1.650E-04	1.650E-04	DCF3(8)
D-1	U-238+D	1.776E-04	1.650E-04	DCF3(9)
D-34	Dose Conversion Factor (and Related) Parameter Summary (continued)			
D-34	Library: transfer factors			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)

Summary : IAAAP FS12 Reuse Soil SUS-1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS-1-142-SITE WKR_DEEP_FYR2.RAD

0		Current	Base	Parameter
Menu		Value#	Case*	Name
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC (2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC (2,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC (3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC (3,2)
D-5	Parameter (fish and Related) Parameter Summary (continued)	5.000E+01	5.000E+01	BIOFAC (4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC (4,2)
D-5	Th-230 Worker fish	1.000E+02	1.000E+02	BIOFAC (5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC (5,2)
D-5	Parameter			
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC (6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (6,2)
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC (7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (7,2)
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC (8,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (8,2)
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC (9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC (9,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : IAAAP FS12 Reuse Soil SUT-142 Site Wkr_Deep_Fill_Mod Library_FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			
R011	Area of contaminated zone (m**2)	1.355E+04	1.000E+04		AREA
R011	Thickness of contaminated zone (m)	3.048E+00	2.000E+00	Used by RESRAD	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00		SUBMFRACT
R011	Length parallel to aquifer flow (m)	not used	1.000E+02		LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01		BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00		TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00		T (2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00		T (3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T (4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T (5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T (6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T (7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T (8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T (9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	2.300E-01	0.000E+00	---	S1 (6)
R012	Initial principal radionuclide (pCi/g): U-235	9.000E-02	0.000E+00	---	S1 (7)
R012	Initial principal radionuclide (pCi/g): U-238	3.880E+00	0.000E+00	---	S1 (8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1 (6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1 (7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1 (8)
Site-Specific Parameter Summary					
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			
R014	Well pump intake depth (m below water table)	not used	1.000E+01		DATEWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	Used by RESRAD	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02		UW
R015	Number of unsaturated zone strata	not used	1		NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00		H (1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00		DENSUZ (1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ (1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ (1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ (1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00		BUZ (1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ (1)
R016	Distribution coefficients for U-234			---	
R016		5.000E+01	5.000E+01	---	DCNUCC (6)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	---	DCNUCU (6,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCS (6)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	ALEACH (6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	---	SOLUBK (6)
Site-Specific Parameters Summary (continued)					
R016	Distribution coefficients for U-235				
R016		5.000E+01	5.000E+01	---	DCNUCC (7)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	2.178E-03	DCNUCU (7,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (7)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (7)
R016	Solubility constant				
R016	Distribution coefficients for U-238				
R016		5.000E+01	5.000E+01	---	DCNUCC (8)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	2.178E-03	DCNUCU (8,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (8)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (8)
R016	Solubility constant				
R016	Distribution coefficients for daughter Ac-227				
R016		2.000E+01	2.000E+01	---	DCNUCC (1)
R016	Contaminated zone (cm**3/g)	not used	2.000E+01	2.178E-03	DCNUCU (1,1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	not used	DCNUCS (1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (1)
R016	Solubility constant				
R016	Distribution coefficients for daughter Pa-231				
R016		5.000E+01	5.000E+01	---	DCNUCC (2)
R016	Contaminated zone (cm**3/g)	not used	5.000E+01	5.7410E-03	DCNUCU (2,1)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	not used	DCNUCS (2)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (2)
R016	Solubility constant				

2.178E-03

not used

Summary : IAAAP FS12 Reuse Soil SUS-1-142 Site Wkr_Deep_Fill_Mod Library_FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUS-142-SITE WKR_DEEP_FYR2.RAD

0 Menu		User Input	Default	(If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210	1.000E+02	1.000E+02	Used by RESRAD	DCNUCC (3)
R016	Contaminated zone (cm**3/g)	not used	1.000E+02		DCNUCU (3,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02		DCNUCS (3)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (3)
R016	Solubility constant				
R016	Distribution coefficients for daughter Ra-226	7.000E+01	7.000E+01	---	DCNUCC (4)
R016	Contaminated zone (cm**3/g)	not used	7.000E+01	1.091E-03	DCNUCU (4,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	not used	DCNUCS (4)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (4)
R016	Solubility constant				
R016	Distribution coefficients for daughter Th-230	6.000E+04	6.000E+04	---	DCNUCC (5)
R016	Contaminated zone (cm**3/g)	not used	6.000E+04	1.558E-03	DCNUCU (5,1)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	not used	DCNUCS (5)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00		ALEACH (5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		SOLUBK (5)
R016	Solubility constant				
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03		INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	1.823E-06	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	not used	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01		SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01		FIND
R017	Fraction of time spent outdoors (on site)	2.283E-01	2.500E-01		FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	---	FS
R017	Radii of shape factor array (used if FS = -1):			---	
R017	1:	not used	5.000E+01	≥0 shows circular AREA.	RAD_SHAPE (1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE (2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE (3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE (4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE (5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00		RAD_SHAPE (6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00		RAD_SHAPE (7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE (8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE (9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE (10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE (11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE (12)

Summary : IAAAP FS12 Reuse Soil SUT-142-SITE WKR_DEEP_FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FYR2 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			Name
R017	Fractions of annular areas within AREA:				
R017	1	not used	1.000E+00	Used by RESRAD	FRACA (1)
R017	2	not used	2.732E-01		FRACA (2)
R017	3	not used	0.000E+00		FRACA (3)
R017	4	not used	0.000E+00		FRACA (4)
R017	5	not used	0.000E+00		FRACA (5)
R017	6	not used	0.000E+00		FRACA (6)
R017	7	not used	0.000E+00		FRACA (7)
R017	8	not used	0.000E+00	---	FRACA (8)
R017	Parameter 9	not used	0.000E+00	---	FRACA (9)
R017	Ring 9	not used	0.000E+00	---	FRACA (10)
R017	Ring 10	not used	0.000E+00	---	FRACA (11)
R017	Ring 11	not used	0.000E+00	---	FRACA (12)
R017	Ring 12				
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET (1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET (2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET (3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET (4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET (5)
R018	Site-Specific Searcher Consumption (kg/yr)	not used	9.000E-01	---	DIET (6)
R018	Soil ingestion rate (g/yr)	2.500E+01	3.650E+01		SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01		DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV (1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV (2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV (3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE (1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE (2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE (3)

Summary : IAAAP FS12 Reuse Soil SUT-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		User	Default	(If different from user input)	Parameter
Menu		Input			Name
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01		TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	Used by RESRAD	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00		TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01		RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01		RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (l/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (l/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in swine feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):			---	
STOR		1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Fruits, non-leafy vegetables, and grain	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Milk	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Meat and poultry	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Crustacea and mollusks	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Surface water	4.500E+01	4.500E+01	---	STOR_T(9)
STOR	Livestock fodder			---	
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):			---	
R021		not used	2.000E-06	---	DIFCV
R021	in cover material	not used	3.000E-07	---	DIFFL
R021	in foundation material	not used	2.000E-06	---	DIFCZ
R021	Radon emanation coefficient	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points			---	NPTS

0					
Menu		User	Default	(If different from user input)	Parameter
		Input			
TITL	Maximum number of integration points for dose				NAME
TITL	Maximum number of integration points for risk		---	Used by RESRAD	LYMAX
		---	---		KYMAX

	Parameter	User Selection
		active
		suppressed
		suppressed
		suppressed
		suppressed
		suppressed
Summary of External gamma pathway		
2 -- inhalation (w/o radon)		
3 -- plant ingestion		
4 -- meat ingestion		suppressed
5 -- milk ingestion		
6 -- aquatic foods		active
7 -- drinking water		
8 -- soil ingestion		
9 -- radon		
Find peak pathway doses		

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUT=142-SITE WKR_DEEP_FYR2.RAD

Initial Soil Concentrations, pCi/g

13554.00 square meters	U-234	2.300E-01
Contaminated Zone Dimensions	U-235	9.000E-02
Thickness: 0.00 meters	U-238	3.880E+00
Area:		

	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
t (years):	4.314E-01	4.305E-01	4.286E-01	4.221E-01	4.041E-01	3.471E-01	2.247E-01	4.931E-02
	1.726E-02	1.722E-02	1.714E-02	1.688E-02	1.617E-02	1.388E-02	8.987E-03	1.973E-03

Maximum TDOSE(t): 4.314E-01 mrem/yr at t = 0.000E+00 years
 TDOSE(t):

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
 M(t):

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Dose TDOSE(t), mrem/yr

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.
U-234	1.839E-05	0.0000	2.327E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.480E-02	0.0343	8.198E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.087E-01	0.9473	3.357E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.235E-01	0.9816	3.672E-03	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.912E-04	0.0011
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.497E-02	0.0347
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.159E-01	0.9642
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.314E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.314E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.
U-234	1.835E-05	0.0000	2.322E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.477E-02	0.0343	8.185E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.078E-01	0.9473	3.350E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.226E-01	0.9816	3.664E-03	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.902E-04	0.0011
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.494E-02	0.0347
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.150E-01	0.9642
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.305E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.305E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

		Water Independent Pathways (Inhalation excludes radon)												
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil		
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.828E-05	0.0000	2.312E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.386E-04	0.0006
U-235	1.470E-02	0.0343	8.160E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.878E-05	0.0002
U-238	4.060E-01	0.9473	3.335E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.902E-03	0.0091
Total	4.207E-01	0.9816	3.648E-03	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.230E-03	0.0099

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.881E-04	0.0011
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.487E-02	0.0347
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.132E-01	0.9642
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.286E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.286E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Summary : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	mrem/yr	fract.	mrem/yr	fract.
U-234	1.811E-05	0.0000	2.279E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	2.351E-04	0.0006
U-235	1.448E-02	0.0343	8.073E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	8.760E-05	0.0002
U-238	3.999E-01	0.9473	3.285E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	3.843E-03	0.0091
Total	4.144E-01	0.9816	3.593E-03	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	4.166E-03	0.0099

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Water Dependent Pathways														
Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.811E-04	0.0011
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E-02	0.0347
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.070E-01	0.9642
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.221E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.221E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.818E-05	0.0000	2.186E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.252E-04	0.0006
U-235	1.388E-02	0.0343	7.848E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.437E-05	0.0002
U-238	3.828E-01	0.9472	3.145E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.680E-03	0.0091
Total	3.967E-01	0.9816	3.442E-03	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.989E-03	0.0099

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.620E-04	0.0011
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.404E-02	0.0347
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.896E-01	0.9641
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.041E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.041E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Summary : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	mrem/yr	fract.	mrem/yr	fract.
U-234	2.420E-05	0.0001	1.892E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.196E-02	0.0345	7.162E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.287E-01	0.9471	2.701E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.407E-01	0.9816	2.962E-03	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Water Dependent Pathways														
Water			Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.074E-04	0.0012
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.211E-02	0.0349
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.345E-01	0.9639
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.471E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.471E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Summary : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.
U-234	7.387E-05	0.0003	1.261E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	7.836E-03	0.0349	5.456E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.126E-01	0.9463	1.748E-03	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.205E-01	0.9815	1.929E-03	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.280E-04	0.0015
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.942E-03	0.0353
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.164E-01	0.9632
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.247E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.247E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Summary : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Ground		Water Independent Pathways (Inhalation excludes radon)				Milk		Soil	
	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	mrem/yr	fract.	mrem/yr	fract.
U-234	3.046E-04	0.0062	3.589E-05	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.781E-03	0.0361	1.810E-05	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.630E-02	0.9388	3.817E-04	0.0077	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.838E-02	0.9811	4.357E-04	0.0088	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0
 0
 Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

0	Water Dependent Pathways													
0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.771E-04	0.0076
As mrem/yr	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.813E-03	0.0368
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.712E-02	0.9556
U-238														
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.931E-02	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

0 Parent	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)								
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
U-234	U-234	1.000E+00	2.136E-03	2.131E-03	2.122E-03	2.090E-03	2.000E-03	1.717E-03	1.110E-03	2.412E-04	
U-234	Th-230	1.000E+00	7.220E-08	2.164E-07	5.038E-07	1.500E-06	4.263E-06	1.303E-05	3.180E-05	5.836E-05	
U-234	Ra-226+D	1.000E+00	1.537E-09	1.075E-08	5.664E-08	5.018E-07	4.116E-06	4.057E-05	2.772E-04	1.303E-03	
U-234	Pb-210+D	1.000E+00	3.581E-13	5.331E-12	6.112E-11	1.524E-09	3.150E-08	6.819E-07	6.782E-06	3.677E-05	
U-234	ΣDSR(j)		2.136E-03	2.131E-03	2.122E-03	2.092E-03	2.009E-03	1.771E-03	1.426E-03	1.640E-03	
U-235+D	U-235+D	1.000E+00	1.663E-01	1.660E-01	1.653E-01	1.628E-01	1.558E-01	1.338E-01	8.655E-02	1.884E-02	
U-235+D	Pa-231	1.000E+00	7.338E-07	2.197E-06	5.105E-06	1.508E-05	4.193E-05	1.186E-04	2.288E-04	1.647E-04	
U-235+D	Ac-227+D	1.000E+00	6.035E-08	4.175E-07	2.149E-06	1.751E-05	1.149E-04	6.099E-04	1.471E-03	1.136E-03	
U-235+D	ΣDSR(j)		1.663E-01	1.660E-01	1.653E-01	1.628E-01	1.560E-01	1.345E-01	8.824E-02	2.014E-02	
U-238 and Progeny Principal Radionuclides Contributions Indicated											
U-238	U-238+D	1.000E+00	1.072E-01	1.070E-01	1.065E-01	1.049E-01	1.004E-01	8.622E-02	5.578E-02	1.215E-02	
U-238+D	U-234	1.000E+00	3.014E-09	9.024E-09	2.097E-08	6.195E-08	1.723E-07	4.873E-07	9.423E-07	6.824E-07	
U-238+D	Th-230	1.000E+00	6.793E-14	4.749E-13	2.503E-12	2.217E-11	1.816E-10	1.782E-09	1.204E-08	5.475E-08	
U-238+D	Ra-226+D	1.000E+00	1.085E-15	1.625E-14	1.890E-13	4.956E-12	1.174E-10	3.761E-09	7.367E-08	9.730E-07	
U-238+D	Pb-210+D	1.000E+00	2.024E-19	6.234E-18	1.548E-16	1.148E-14	7.043E-13	5.318E-11	1.657E-09	2.684E-08	
U-238+D	ΣDSR(j)		1.072E-01	1.070E-01	1.065E-01	1.049E-01	1.004E-01	8.622E-02	5.578E-02	1.215E-02	

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

0Nuclide	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
(j)									
U-234		1.171E+04	1.173E+04	1.178E+04	1.195E+04	1.245E+04	1.411E+04	1.753E+04	1.525E+04
U-235		1.503E+02	1.506E+02	1.513E+02	1.536E+02	1.603E+02	1.859E+02	2.833E+02	1.241E+03
U-238		2.332E+02	2.337E+02	2.347E+02	2.383E+02	2.490E+02	2.900E+02	4.482E+02	2.058E+03

0Nuclide	Initial	tmin	DSR(i,tmin)	G(i,tmin)	DSR(i,tmax)	G(i,tmax)
Single Radionuclide Soil Guidelines			G(i,t)	in pCi/g		(pCi/g)
and at tmax = time of maximum total dose = 0.000E+00 years						
Summed Dose Ratios DSR(00t) in 1mrem/yr (pCi/g) in 1mrem/yr (pCi/g)						
U-234	2.136E-03	0.000E+00	2.136E-03	1.171E+04	2.136E-03	1.171E+04
U-235	1.663E-01	0.000E+00	1.663E-01	1.503E+02	1.663E-01	1.503E+02
U-238	1.072E-01	0.000E+00	1.072E-01	2.332E+02	1.072E-01	2.332E+02

Summary : IAAAP FS12 Reuse Soil SUS-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUS-142-SITE WKR_DEEP_FYR2.RAD

ONuclide	Parent (i)	THF(i)	DOSE(j,t), mrem/yr							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
(j)										
U-234	U-234	1.000E+00	4.912E-04	4.901E-04	4.880E-04	4.806E-04	4.601E-04	3.950E-04	2.553E-04	5.548E-05
U-234	U-238	1.000E+00	1.169E-08	3.501E-08	8.135E-08	2.404E-07	6.684E-07	1.891E-06	3.656E-06	2.648E-06
U-234	ΣDOSE(j)		4.912E-04	4.902E-04	4.881E-04	4.808E-04	4.608E-04	3.968E-04	2.590E-04	5.813E-05
Th-230	U-234	1.000E+00	1.661E-08	4.977E-08	1.159E-07	3.450E-07	9.806E-07	2.998E-06	7.313E-06	1.342E-05
Th-230	U-238	1.000E+00	2.636E-13	1.843E-12	9.712E-12	8.601E-11	7.045E-10	6.915E-09	4.670E-08	2.124E-07
Th-230	ΣDOSE(j)		1.661E-08	4.977E-08	1.159E-07	3.451E-07	9.813E-07	3.005E-06	7.360E-06	1.363E-05
Ra-226	U-234	1.000E+00	3.535E-10	2.471E-09	1.303E-08	1.154E-07	9.466E-07	9.332E-06	6.376E-05	2.997E-04
Ra-226	U-238	1.000E+00	4.208E-15	6.304E-14	7.332E-13	1.923E-11	4.557E-10	1.459E-08	2.858E-07	3.775E-06
Ra-226	ΣDOSE(j)		3.535E-10	2.471E-09	1.303E-08	1.154E-07	9.470E-07	9.346E-06	6.404E-05	3.035E-04
Pb-210	U-234	1.000E+00	8.237E-14	1.226E-12	1.406E-11	3.505E-10	7.245E-09	1.568E-07	1.560E-06	8.458E-06
Pb-210	U-238	1.000E+00	7.855E-19	2.419E-17	6.005E-16	4.454E-14	2.733E-12	2.063E-10	6.431E-09	1.041E-07
Pb-210	ΣDOSE(j)		8.237E-14	1.226E-12	1.406E-11	3.506E-10	7.248E-09	1.570E-07	1.566E-06	8.562E-06
Individual Nuclide Dose Summed Over All Pathways										
Pa-231	U-235	1.000E+00	1.497E-02	1.494E-02	1.487E-02	1.465E-02	1.402E-02	1.204E-02	7.789E-03	1.696E-03
Pa-231	U-235	1.000E+00	6.605E-08	1.978E-07	4.594E-07	1.357E-06	3.774E-06	1.067E-05	2.059E-05	1.482E-05
Pa-231	ΣDOSE(j)		1.497E-02	1.494E-02	1.487E-02	1.465E-02	1.402E-02	1.204E-02	7.789E-03	1.696E-03
Parent Nuclide and Branch Fraction Indicated										
U-238	U-238	5.450E-07	3.898E-09	3.889E-09	3.872E-09	3.814E-09	3.651E-09	3.135E-09	2.028E-09	4.415E-10
U-238	U-238	1.000E+00	4.159E-01	4.150E-01	4.132E-01	4.070E-01	3.896E-01	3.345E-01	2.164E-01	4.712E-02
U-238	ΣDOSE(j)		4.159E-01	4.150E-01	4.132E-01	4.070E-01	3.896E-01	3.345E-01	2.164E-01	4.712E-02

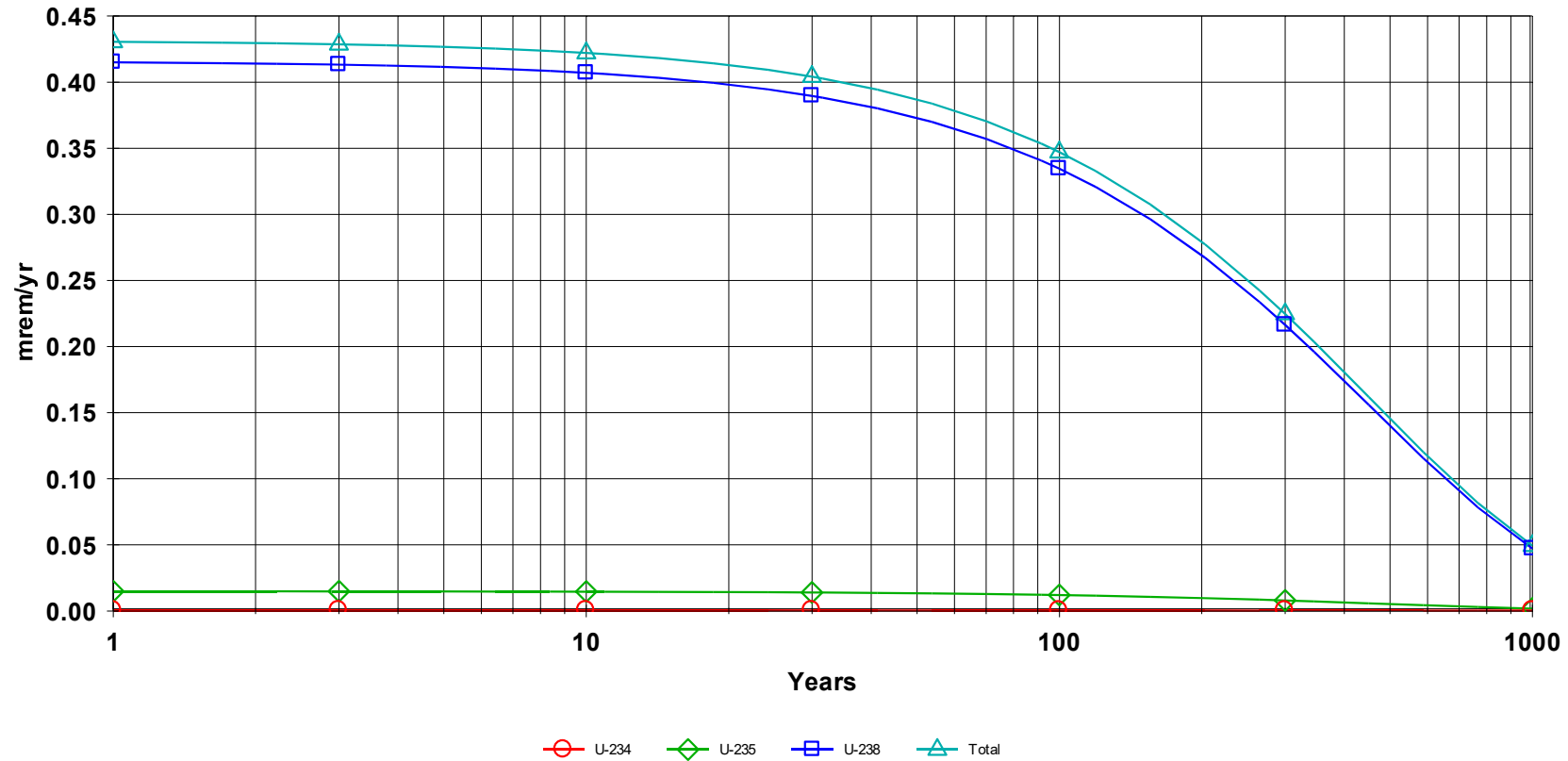
THF(i) is the thread fraction of the parent nuclide.

Summary : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0Nuclide	Parent (i)	THF(i)	S(j,t), pCi/g							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.300E-01	2.295E-01	2.285E-01	2.250E-01	2.154E-01	1.849E-01	1.196E-01	2.598E-02
U-234	U-238	1.000E+00	0.000E+00	1.093E-05	3.265E-05	1.072E-04	3.078E-04	8.810E-04	1.709E-03	1.239E-03
U-234	ΣS(j):		2.300E-01	2.295E-01	2.285E-01	2.251E-01	2.157E-01	1.858E-01	1.213E-01	2.722E-02
Th-230	U-234	1.000E+00	0.000E+00	2.113E-06	6.324E-06	2.092E-05	6.141E-05	1.899E-04	4.648E-04	8.540E-04
Th-230	U-238	1.000E+00	0.000E+00	5.029E-11	4.513E-10	4.964E-09	4.340E-08	4.360E-07	2.964E-06	1.351E-05
Th-230	ΣS(j):		0.000E+00	2.113E-06	6.324E-06	2.092E-05	6.145E-05	1.903E-04	4.678E-04	8.675E-04
Ra-226	U-234	1.000E+00	0.000E+00	4.575E-10	4.106E-09	4.518E-08	3.955E-07	3.990E-06	2.744E-05	1.293E-04
Ra-226	U-238	1.000E+00	0.000E+00	7.262E-15	1.954E-13	7.159E-12	1.872E-10	6.209E-09	1.228E-07	1.628E-06
Ra-226	ΣS(j):		0.000E+00	4.575E-10	4.106E-09	4.518E-08	3.956E-07	3.996E-06	2.756E-05	1.309E-04
Pb-210	U-234	1.000E+00	0.000E+00	4.725E-12	1.253E-10	4.360E-09	9.942E-08	2.227E-06	2.234E-05	1.214E-04
Pb-210	U-238	1.000E+00	0.000E+00	5.634E-17	4.494E-15	5.261E-13	3.686E-11	2.914E-09	9.195E-08	1.495E-06
Pb-210	ΣS(j):		0.000E+00	4.725E-12	1.253E-10	4.360E-09	9.946E-08	2.230E-06	2.243E-05	1.229E-04
Pb-210	U-235	1.000E+00	9.000E-02	8.980E-02	8.941E-02	8.806E-02	8.431E-02	7.239E-02	4.683E-02	1.020E-02
Pa-231	U-235	1.000E+00	0.000E+00	1.900E-06	5.675E-06	1.863E-05	5.350E-05	1.530E-04	2.963E-04	2.134E-04
Parent Nuclide and Branch Fraction Indicated										
Pa-231	U-238	1.000E+00	0.000E+00	2.990E-08	2.618E-07	2.647E-06	1.853E-05	1.005E-04	2.435E-04	1.883E-04
U-238	U-238	5.450E-07	2.115E-06	2.110E-06	2.101E-06	2.069E-06	1.981E-06	1.701E-06	1.100E-06	2.395E-07
U-238	U-238	1.000E+00	3.880E+00	3.872E+00	3.855E+00	3.796E+00	3.635E+00	3.121E+00	2.019E+00	4.395E-01
U-238	ΣS(j):		3.880E+00	3.872E+00	3.855E+00	3.796E+00	3.635E+00	3.121E+00	2.019E+00	4.395E-01

THF(i) is the thread fraction of the parent nuclide.
 RESCALC.EXE execution time = 8.32 seconds

DOSE: All Nuclides Summed, All Pathways Summed



I:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SU1-142_SITE WKR_DEEP_FYR2.RAD 04/23/2023 11:16 GRAPHICS.ASC Includes All Pathways

Second Five-Year Review Risk Evaluation, Site Worker Exposures to Deep Backfill Soil (0 to 10 ft bgs)
Modified DCFPAK3.02 Morbidity Library, RESRAD-ONSITE Version 7.2 Model
IAAAP Firing Site 12 Reuse Soil Survey Units 1 through 142

Part III: Intake Quantities and Health Risk Factors	
Cancer Risk Slope Factors	2
Risk Slope and ETFG for the Ground Pathway	4
Amount of Intake Quantities and Excess Cancer Risks	5
.....	8
.....	11
Time= 0.000E+00	14
Time= 0.000E+00	17
Time= 3.000E+00	20
Time= 1.000E+01	23
Time= 3.000E+01	26
Time= 1.000E+02	
Time= 3.000E+02	
Time= 1.000E+03	

Intrisk : IAAAP FS12 Reuse Soil SUS-1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUT-142-SITE WKR_DEEP_FYR2.RAD

0		Current	Base	Parameter
Menu		Value	Case*	Name
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	Ac-227+D	1.44E-06	1.98E-10	SLPF(1,1)
Sf-1	Pa-231	1.27E-07	1.27E-07	SLPF(2,1)
Sf-1	Pb-210+D	4.30E-09	1.48E-09	SLPF(3,1)
Sf-1	Ra-226+D	8.37E-06	2.50E-08	SLPF(4,1)
Sf-1	Th-230	8.45E-10	8.45E-10	SLPF(5,1)
Sf-1	U-234	2.53E-10	2.53E-10	SLPF(6,1)
Sf-1	U-235+D	5.76E-07	5.51E-07	SLPF(7,1)
Sf-1	U-238	1.24E-10	1.24E-10	SLPF(8,1)
Sf-1	U-238+D	1.19E-07	1.24E-10	SLPF(9,1)
Sf-2	Parameter, slope factors, 1/(pCi):			
Sf-2	Ac-227+D	2.13E-07	1.49E-07	SLPF(1,2)
Sf-2	Pa-231	7.62E-08	7.62E-08	SLPF(2,2)
Sf-2	Pb-210+D	3.08E-08	1.59E-08	SLPF(3,2)
Sf-2	Ra-226+D	2.83E-08	2.81E-08	SLPF(4,2)
Sf-2	Th-230	3.41E-08	3.41E-08	SLPF(5,2)
Sf-2	U-234	2.78E-08	2.78E-08	SLPF(6,2)
Sf-2	U-235+D	2.50E-08	2.50E-08	SLPF(7,2)
Sf-2	U-238	2.36E-08	2.36E-08	SLPF(8,2)
Sf-2	U-238+D	2.37E-08	2.36E-08	SLPF(9,2)
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	6.54E-10	2.45E-10	SLPF(1,3)
Sf-3	Pa-231	2.26E-10	2.26E-10	SLPF(2,3)
Sf-3	Pb-210+D	3.44E-09	1.18E-09	SLPF(3,3)
Sf-3	Ra-226+D	5.15E-10	5.14E-10	SLPF(4,3)
Sf-3	Th-230	1.19E-10	1.19E-10	SLPF(5,3)
Sf-3	U-234	9.55E-11	9.55E-11	SLPF(6,3)
Sf-3	U-235+D	9.76E-11	9.43E-11	SLPF(7,3)
Sf-3	U-238	8.66E-11	8.66E-11	SLPF(8,3)
Sf-3	U-238+D	1.21E-10	8.66E-11	SLPF(9,3)
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	4.87E-10	2.01E-10	SLPF(1,4)
Sf-3	Pa-231	1.72E-10	1.72E-10	SLPF(2,4)
Sf-3	Pb-210+D	2.67E-09	8.84E-10	SLPF(3,4)
Sf-3	Ra-226+D	3.85E-10	3.85E-10	SLPF(4,4)
Sf-3	Th-230	9.14E-11	9.14E-11	SLPF(5,4)
Sf-3	U-234	7.07E-11	7.07E-11	SLPF(6,4)
Sf-3	U-235+D	7.17E-11	6.95E-11	SLPF(7,4)
Sf-3	U-238	6.40E-11	6.40E-11	SLPF(8,4)
Sf-3	U-238+D	8.71E-11	6.40E-11	SLPF(9,4)
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	Ac-227+D	3.45E-10	2.45E-10	SLPF(1,5)
Sf-3	Pa-231	1.54E-10	2.26E-10	SLPF(2,5)
Sf-3	Pb-210+D	2.04E-09	1.18E-09	SLPF(3,5)
Sf-3	Ra-226+D	2.95E-10	5.14E-10	SLPF(4,5)
Sf-3	Th-230	7.73E-11	1.19E-10	SLPF(5,5)

Intrisk : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

0		Current	Base	Parameter
Menu		Value	Case*	Name
Sf-3	U-234	5.11E-11	9.55E-11	SLPF(6,5)
Sf-3	U-235+D	5.01E-11	9.43E-11	SLPF(7,5)
Sf-3	U-238	4.66E-11	8.66E-11	SLPF(8,5)
Sf-3	U-238+D	5.61E-11	8.66E-11	SLPF(9,5)
Sf-Rn	Radon Inhalation slope factors, 1/(pCi):			
Sf-Rn	Rn-222	1.80E-12	1.80E-12	SLPFRN(1,1)
Sf-Rn	Po-218	3.70E-12	3.70E-12	SLPFRN(1,2)
Sf-Rn	Pb-214	6.20E-12	6.20E-12	SLPFRN(1,3)
Sf-Rn	Bi-214	1.50E-11	1.50E-11	SLPFRN(1,4)
Risk Library	Worker Updates_Soil Plus DCFPAK3.02 Morbidity			
Cancer Risk Slope Factors Summary Table (continued)				
Sf-Rn	Radon R-factors, (mrem/WLM):			
Sf-Rn	Rn-222 Indoor	3.88E+02	3.88E+02	KFACTR(1,1)
Sf-Rn	Rn-222 Outdoor	3.88E+02	3.88E+02	KFACTR(1,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Intrisk : IAAAP FS12 Reuse Soil SUS-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\F512 REUSE SOIL SUS-142-SITE WKR_DEEP_FYR2.RAD

ONuclide	Slope(i) *	ETFG(i,t) At Time in Years (dimensionless)							
		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	1.990E-10	2.211E-01	2.211E-01	2.211E-01	2.211E-01	2.211E-01	2.211E-01	2.211E-01	2.211E-01
At-218	2.740E-11	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01
At-219	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Bi-210	2.770E-09	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01
Bi-211	0.000E+00	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01
Bi-214	7.340E-06	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01	2.155E-01
Bi-215	1.080E-06	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01
Bi-215	1.080E-06	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01	2.165E-01
Br-223	4.830E-07	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01
Hg-206	1.270E-07	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01
Pa-231	6.620E-06	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01
Pa-234	9.060E-08	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01
Pa-234m	1.480E-09	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01
Pb-210	2.910E-07	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01
Pb-211	9.940E-07	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01
Pb-214	4.510E-11	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01
Po-210	3.760E-08	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01
Po-211	3.850E-10	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01
Po-214	7.480E-10	2.156E-01	2.156E-01	2.156E-01	2.156E-01	2.156E-01	2.156E-01	2.156E-01	2.156E-01
Po-215	6.840E-15	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01
Po-218	4.550E-07	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01
Ra-223	2.500E-08	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01
Ra-226	3.390E-09	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01	2.144E-01
Rn-218	2.350E-07	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01	2.176E-01
Rn-219	1.690E-09	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01
Rn-222	4.450E-07	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01
Th-227	8.450E-10	2.202E-01	2.202E-01	2.202E-01	2.202E-01	2.202E-01	2.202E-01	2.202E-01	2.202E-01
Th-230	2.490E-08	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01	2.283E-01
Th-231	1.780E-08	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01	2.209E-01
Th-234	6.110E-09	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01
Tl-206	1.590E-08	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01	2.147E-01
Tl-207	1.340E-05	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01	2.151E-01
Tl-210	2.530E-10	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01	2.280E-01
U-234	5.510E-07	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01	2.180E-01
U-235	1.240E-10	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01
U-238	1.240E-10	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01	2.216E-01

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways											Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk		
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Water-Independent Pathways (Inhalation w/o radon)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Ra-226	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Th-230	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Sum of Ingestion Pathways (w/o radon)	2.620E-03	0.000E+00	0.000E+00	0.000E+00	5.137E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.137E-01	
U-235	1.129E-01	0.000E+00	0.000E+00	0.000E+00	2.215E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.215E+01	
U-238												

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.								
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 0.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 0.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	3.859E-11	0.0000	7.664E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.429E-13	0.0000
Pa-231	1.586E-11	0.0000	1.273E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.044E-13	0.0000
Ra-226	3.704E-16	0.0000	3.509E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.560E-15	0.0000
Th-230	4.196E-12	0.0000	1.912E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.920E-15	0.0000
U-234	1.208E-13	0.0000	6.438E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.864E-13	0.0000
U-235	3.230E-10	0.0001	4.534E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.633E-09	0.0006
U-238	2.755E-07	0.0981	1.594E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.263E-10	0.0002
U-238	2.429E-06	0.8648	6.504E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.023E-08	0.0108
Total	2.704E-06	0.9631	7.117E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.249E-08	0.0116

and Fraction of Total Risk at t= 0.000E+00 years

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.960E-11	0.0000
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.763E-11	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.281E-15	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.202E-12	0.0000
At-216	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.051E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.490E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.777E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.524E-06	0.8988
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.808E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 0.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) and CNRS (i, p) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 0.000E+00 years
 0 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	3.271E-10	0.0001	4.532E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.632E-09	0.0006
U-235	2.755E-07	0.0981	1.596E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.270E-10	0.0002
U-238	2.429E-06	0.8648	6.505E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.024E-08	0.0108
Water Ind. Excess Cancer Risk CNRS (i, p) *** for	2.704E-06	0.9631	7.117E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.249E-08	0.0116
Total	2.704E-06	0.9631	7.117E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.249E-08	0.0116

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUs 1-142-SITE WKR_DEEP_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.492E-09	0.0023
Total Excess Cancer Risk CNRSI (i,p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.778E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.524E-06	0.8988
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.808E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	8.702E-10	0.000E+00	0.000E+00	0.000E+00	1.706E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.706E-07
Pa-231	5.530E-08	0.000E+00	0.000E+00	0.000E+00	1.084E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.084E-05
Water-Indep. Pathways	1.375E-13	0.000E+00	0.000E+00	0.000E+00	2.697E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.697E-11
Ra-226	1.332E-11	0.000E+00	0.000E+00	0.000E+00	2.611E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.611E-09
Th-230	6.149E-08	0.000E+00	0.000E+00	0.000E+00	1.206E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.206E-05
Sum of Ingestion Pathways (p)	1.375E-13	0.000E+00	0.000E+00	0.000E+00	2.697E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.697E-11
U-235	2.614E-03	0.000E+00	0.000E+00	0.000E+00	5.126E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.126E-01
U-238	1.127E-01	0.000E+00	0.000E+00	0.000E+00	2.210E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.210E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	4.300E-11	0.0000	8.540E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.707E-13	0.0000
Pa-231	1.710E-11	0.0000	1.373E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.439E-13	0.0000
Ra-226	4.305E-16	0.0000	4.078E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.299E-15	0.0000
Th-230	4.715E-12	0.0000	2.149E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.405E-15	0.0000
U-234	1.304E-13	0.0000	6.948E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.091E-13	0.0000
U-235	3.223E-10	0.0001	4.524E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.630E-09	0.0006
U-238	2.749E-07	0.0981	1.591E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.249E-10	0.0002
U-238	2.423E-06	0.8648	6.490E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.017E-08	0.0108
Total	2.699E-06	0.9631	7.102E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.242E-08	0.0116

and Fraction of Total Risk at t= 1.000E+00 years

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.412E-11	0.0000
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.902E-11	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.137E-15	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.721E-12	0.0000
Water-Dependent Pathways	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.134E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.476E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.771E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.518E-06	0.8988
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.802E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+00 years
 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	3.269E-10	0.0001	4.522E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-09	0.0006
U-235	2.750E-07	0.0981	1.593E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.257E-10	0.0002
Water-Dependent Pathways	2.423E-06	0.8648	6.490E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.017E-08	0.0108
Total	2.699E-06	0.9631	7.102E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.242E-08	0.0116

Intrisk : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radionuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.478E-09	0.0023
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.772E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.518E-06	0.8988
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.802E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	7.619E-09	0.000E+00	0.000E+00	0.000E+00	1.494E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.494E-06
Pa-231	1.652E-07	0.000E+00	0.000E+00	0.000E+00	3.239E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.239E-05
Water-Indep.	3.646E-12	0.000E+00	0.000E+00	0.000E+00	7.150E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.150E-10
Ra-226	1.195E-10	0.000E+00	0.000E+00	0.000E+00	2.344E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.344E-08
Th-230	1.841E-07	0.000E+00	0.000E+00	0.000E+00	3.610E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.610E-05
Sum of Ingestion Pathways	6.652E-03	0.000E+00	0.000E+00	0.000E+00	1.494E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.304E+00
U-235	2.603E-03	0.000E+00	0.000E+00	0.000E+00	5.103E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.103E-01
U-238	1.122E-01	0.000E+00	0.000E+00	0.000E+00	2.200E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.200E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+00 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	5.265E-11	0.0000	1.046E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.314E-13	0.0000
Pa-231	1.957E-11	0.0000	1.571E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.224E-13	0.0000
Ra-226	5.713E-16	0.0000	5.411E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.032E-15	0.0000
Th-230	5.869E-12	0.0000	2.675E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.483E-15	0.0000
U-234	1.494E-13	0.0000	7.965E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.544E-13	0.0000
U-235	3.209E-10	0.0001	4.505E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.623E-09	0.0006
U-238	2.737E-07	0.0981	1.584E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.222E-10	0.0002
U-238	2.413E-06	0.8648	6.462E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.004E-08	0.0108
Total	2.687E-06	0.9631	7.071E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.228E-08	0.0116

and Fraction of Total Risk at t= 3.000E+00 years

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.402E-11	0.0000
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.176E-11	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.145E-15	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.877E-12	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.300E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.449E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.759E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.507E-06	0.8988
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.790E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+00 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) and CNRS (i, p) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+00 years Water Independent Pathways (Inhalation excludes radon)
 0 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	3.267E-10	0.0001	4.503E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.622E-09	0.0006
U-235	2.738E-07	0.0981	1.586E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.231E-10	0.0002
U-238	2.413E-06	0.8648	6.462E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.004E-08	0.0108
Water Ind. Excess Cancer Risk CNRS (i, p) *** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.687E-06	0.9631	7.071E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.228E-08	0.0116

Intrisk : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.451E-09	0.0023
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.760E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.507E-06	0.8988
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.790E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	7.706E-08	0.000E+00	0.000E+00	0.000E+00	1.511E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.511E-05
Pa-231	5.423E-07	0.000E+00	0.000E+00	0.000E+00	1.063E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.063E-04
Water-Indep.	1.269E-10	0.000E+00	0.000E+00	0.000E+00	2.489E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.489E-08
Ra-226	1.315E-09	0.000E+00	0.000E+00	0.000E+00	2.579E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.579E-07
Th-230	6.090E-07	0.000E+00	0.000E+00	0.000E+00	1.194E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.194E-04
Sum of Ingestion	1.553E-03	0.000E+00	0.000E+00	0.000E+00	2.855E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.855E+00
U-235	2.563E-03	0.000E+00	0.000E+00	0.000E+00	5.026E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.026E-01
U-238	1.105E-01	0.000E+00	0.000E+00	0.000E+00	2.167E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.167E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+01 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+01 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	9.383E-11	0.0000	1.864E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.906E-13	0.0000
Pa-231	2.804E-11	0.0000	2.251E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.918E-13	0.0000
Excels Cancer Risks	1.322E-15	0.0000	1.252E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.627E-14	0.0000
Ra-226	1.112E-11	0.0000	5.069E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.039E-14	0.0000
Th-230	2.155E-13	0.0000	1.149E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.112E-13	0.0000
U-234	3.161E-10	0.0001	4.438E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.599E-09	0.0006
U-235	2.696E-07	0.0981	1.560E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.128E-10	0.0002
U-238	2.376E-06	0.8648	6.364E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.958E-08	0.0108
Total	2.646E-06	0.9631	6.965E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.180E-08	0.0116

and Fraction of Total Risk at t= 1.000E+01 years

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.629E-11	0.0000
Excess Cancer Risks CNRS (i, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.118E-11	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.885E-14	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.114E-11	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.876E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.353E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.717E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.469E-06	0.8987
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.748E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+01 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, t) and CNRS (i, t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+01 years Water Independent Pathways (Inhalation excludes radon)
 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	3.271E-10	0.0001	4.435E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.597E-09	0.0006
U-235	2.697E-07	0.0981	1.564E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.143E-10	0.0002
U-238	2.376E-06	0.8648	6.365E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.958E-08	0.0108
Water Ind. Excess Cancer Risk CNRS (i, t) *** for	2.646E-06	0.9631	6.965E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.180E-08	0.0116
Total	2.646E-06	0.9631	6.965E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.180E-08	0.0116

Intrisk : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.359E-09	0.0023
Total Excess Cancer Risk CNRSI (i,p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.719E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.469E-06	0.8987
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.748E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	5.392E-07	0.000E+00	0.000E+00	0.000E+00	1.057E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.057E-04
Pa-231	1.557E-06	0.000E+00	0.000E+00	0.000E+00	3.053E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.053E-04
Water-Indep.	2.835E-09	0.000E+00	0.000E+00	0.000E+00	5.677E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.677E-07
Ra-226	1.152E-08	0.000E+00	0.000E+00	0.000E+00	2.258E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.258E-06
Th-230	1.789E-06	0.000E+00	0.000E+00	0.000E+00	3.507E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.507E-04
Sum of Ingestion Pathways	2.78E-03	0.000E+00	0.000E+00	0.000E+00	4.812E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.812E-01
U-235	2.454E-03	0.000E+00	0.000E+00	0.000E+00	4.812E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.812E-01
U-238	1.058E-01	0.000E+00	0.000E+00	0.000E+00	2.074E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.074E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Ingestion	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+01 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+01 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	2.527E-10	0.0001	5.019E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.591E-12	0.0000
Pa-231	5.081E-11	0.0000	4.079E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.616E-12	0.0000
Ra-226	6.429E-15	0.0000	6.090E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.914E-14	0.0000
Th-230	3.611E-11	0.0000	1.646E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.374E-14	0.0000
U-234	3.991E-13	0.0000	2.127E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.464E-13	0.0000
U-235	3.029E-10	0.0001	4.253E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.532E-09	0.0006
U-238	2.581E-07	0.0981	1.493E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.867E-10	0.0002
U-238	2.275E-06	0.8647	6.093E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.832E-08	0.0108
Total	2.534E-06	0.9631	6.669E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.044E-08	0.0116

and Fraction of Total Risk at t= 3.000E+01 years

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.593E-10	0.0001
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.651E-11	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.166E-14	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.616E-11	0.0000
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.473E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.088E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.601E-07	0.0989
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.364E-06	0.8987
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.631E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+01 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) and CNRS (i, p) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+01 years Water Independent Pathways (Inhalation excludes radon)
 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	3.388E-10	0.0001	4.247E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.530E-09	0.0006
U-235	2.584E-07	0.0982	1.502E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.899E-10	0.0002
U-238	2.275E-06	0.8647	6.094E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.833E-08	0.0108
Water-Dep. Excess Cancer Risks CNRS (i, p) and CNRS (i, p) for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.044E-08	0.0116
Total	2.534E-06	0.9631	6.669E-08	0.0253	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

Intrisk : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUS 1-142-SITE WKR_DEEP_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.115E-09	0.0023
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.605E-07	0.0990
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.364E-06	0.8987
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.631E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+01 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	2.925E-06	0.000E+00	0.000E+00	0.000E+00	5.736E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.736E-04
Pa-231	4.453E-06	0.000E+00	0.000E+00	0.000E+00	8.732E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.732E-04
Water-Indep.	6.420E-08	0.000E+00	0.000E+00	0.000E+00	1.273E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.273E-05
Ra-226	1.163E-07	0.000E+00	0.000E+00	0.000E+00	2.281E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.281E-05
Th-230	5.540E-06	0.000E+00	0.000E+00	0.000E+00	1.086E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.086E-03
Sum of Intake Quantities	2.107E-03	0.000E+00	0.000E+00	0.000E+00	4.131E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.131E-01
U-235	9.083E-02	0.000E+00	0.000E+00	0.000E+00	1.781E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.781E+01
U-238											

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.								
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+02 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+02 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	8.919E-10	0.0004	1.771E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.614E-12	0.0000
Pa-231	1.156E-10	0.0001	9.279E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.677E-12	0.0000
Ra-226	6.991E-14	0.0000	6.622E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.605E-13	0.0000
Th-230	2.250E-10	0.0001	1.025E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.102E-13	0.0000
U-234	9.828E-13	0.0000	5.239E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.331E-12	0.0000
U-235	2.609E-10	0.0001	3.663E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.319E-09	0.0006
U-238	2.216E-07	0.0981	1.282E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.037E-10	0.0002
U-238	1.953E-06	0.8644	5.231E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.432E-08	0.0108
Total	2.176E-06	0.9631	5.729E-08	0.0254	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.615E-08	0.0116

and Fraction of Total Risk at t= 1.000E+02 years

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.152E-10	0.0004
Excess Cancer Risks CNRS(i,p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.286E-10	0.0001
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.966E-13	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.253E-10	0.0001
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.552E-12	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.243E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.234E-07	0.0988
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.030E-06	0.8983
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.260E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+02 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS(i,p) and CNRS9W(i,p,t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 1.000E+02 years Water Independent Pathways (Inhalation excludes radon)
 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	4.852E-10	0.0002	3.649E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.316E-09	0.0006
U-235	2.226E-07	0.0985	1.309E-09	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.130E-10	0.0002
U-238	1.953E-06	0.8644	5.233E-08	0.0232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.432E-08	0.0108
Water Ind. Excess Cancer Risk CNRS(i,p,t)*** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.176E-06	0.9631	5.729E-08	0.0254	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.615E-08	0.0116

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\Fs12 REUSE SOIL SUs 1-142-SITE WKR_DEEP_FYR2.RAD

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.450E-09	0.0024
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.244E-07	0.0993
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.030E-06	0.8983
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.260E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUI-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUI-142-SITE WKR_DEEP_FYR2.RAD

Radio-Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	7.087E-06	0.000E+00	0.000E+00	0.000E+00	1.390E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.390E-03
Pa-231	8.624E-06	0.000E+00	0.000E+00	0.000E+00	1.691E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.691E-03
Water-Indep	8.522E-07	0.000E+00	0.000E+00	0.000E+00	1.280E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.280E-04
Ra-226	8.023E-07	0.000E+00	0.000E+00	0.000E+00	1.573E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.573E-04
Th-230	1.362E-05	0.000E+00	0.000E+00	0.000E+00	2.670E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.670E-03
Sum of Intake Quantities (I, P, M, and S) for Individual Radionuclides (i) and Pathways (p)	3.530E-02	0.000E+00	0.000E+00	0.000E+00	6.922E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.922E-01
U-235	1.363E-03	0.000E+00	0.000E+00	0.000E+00	2.673E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.673E-01
U-238	5.876E-02	0.000E+00	0.000E+00	0.000E+00	1.152E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.152E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
 and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Intake (I, P, M, and S) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 3.000E+02 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 3.000E+02 years

Radio-Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	1.936E-09	0.0013	3.844E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.218E-11	0.0000
Pa-231	2.074E-10	0.0001	1.665E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.597E-12	0.0000
Excels Cancer Risks (i, p) for Individual Radionuclides (i) and Pathways (p)	5.719E-13	0.0000	5.417E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.039E-12	0.0000
Ra-226	1.328E-09	0.0009	6.050E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.240E-12	0.0000
Th-230	2.239E-12	0.0000	1.193E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.310E-12	0.0000
U-234	1.703E-10	0.0001	2.391E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.611E-10	0.0006
U-235	1.433E-07	0.0979	8.294E-10	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.258E-10	0.0002
U-238	1.264E-06	0.8627	3.384E-08	0.0231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.573E-08	0.0107
Total	1.411E-06	0.9631	3.713E-08	0.0254	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.695E-08	0.0116

and Fraction of Total Risk at t= 3.000E+02 years

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
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Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.986E-09	0.0014
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.307E-10	0.0002
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.153E-12	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.329E-09	0.0009
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.948E-11	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.422E-09	0.0023
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.445E-07	0.0987
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.313E-06	0.8966
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E-06	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 3.000E+02 years

** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radionuclides

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, p) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radon and its Decay Products at t= 3.000E+02 years Water Independent Pathways (Inhalation excludes radon)
 Ground Inhalation Radon Plant Meat Milk Soil

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	1.492E-09	0.0010	2.369E-09	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.620E-10	0.0006
U-235	1.455E-07	0.0993	8.845E-10	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.446E-10	0.0002
U-238	1.264E-06	0.8627	3.388E-08	0.0231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.574E-08	0.0107
Water Ind. Excess Cancer Risks CNRS (i, p) for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.411E-06	0.9631	3.713E-08	0.0254	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.695E-08	0.0116

Intrisk : IAAAP FS12 Reuse Soil SUs 1-142 Site Wkr Deep Fill Mod Library FYR2
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Initially Existent Radionuclides (i) and Pathways (p)

Radionuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.723E-09	0.0032
Total Excess Cancer Risk CNRSI (p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.467E-07	0.1002
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.313E-06	0.8966
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Intrisk : IAAAP FS12 Reuse Soil SUS-142 Site Wkr Deep Fill Mod Library FYR2
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FS12 REUSE SOIL SUS-142-SITE WKR_DEEP_FYR2.RAD

Radio- Nuclide	Water Dependent Pathways										Total*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	5.481E-06	0.000E+00	0.000E+00	0.000E+00	1.075E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.075E-03
Pa-231	6.213E-06	0.000E+00	0.000E+00	0.000E+00	1.218E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.218E-03
Water-Indep.	3.578E-06	0.000E+00	0.000E+00	0.000E+00	7.017E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.017E-04
Ra-226	3.811E-06	0.000E+00	0.000E+00	0.000E+00	7.472E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.472E-04
Th-230	2.525E-05	0.000E+00	0.000E+00	0.000E+00	4.951E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.951E-03
Sum of Intake Quantities (i, p) for Individual Radionuclides (i) and Pathways (p)	2.923E-04	0.000E+00	0.000E+00	0.000E+00	1.554E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.554E-01
U-235	2.967E-04	0.000E+00	0.000E+00	0.000E+00	5.819E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.819E-02
U-238	1.279E-02	0.000E+00	0.000E+00	0.000E+00	2.509E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.509E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil

0
and water-dependent water, fish, plant, meat, milk pathways

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Amount of Inhaled Radon	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

As pCi/yr at t= 1.000E+03 years

Water-dep. == Water-dependent

Water-ind. == Water-independent
 Radon and its Decay Products as pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	1.450E-09	0.0044	2.880E-11	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.126E-12	0.0000
Pa-231	1.453E-10	0.0004	1.166E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.621E-12	0.0000
Ra-226	2.945E-12	0.0000	2.790E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.625E-11	0.0001
Th-230	5.970E-09	0.0183	2.721E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.578E-12	0.0000
U-234	4.048E-12	0.0000	2.158E-11	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.601E-12	0.0000
U-235	3.822E-11	0.0001	5.366E-10	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.933E-10	0.0006
U-238	3.121E-08	0.0958	1.806E-10	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.094E-11	0.0002
U-238	2.751E-07	0.8443	7.368E-09	0.0226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.425E-09	0.0105
Total	3.139E-07	0.9635	8.153E-09	0.0250	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.754E-09	0.0115

and Fraction of Total Risk at t= 1.000E+03 years

Radio- Nuclide	Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.488E-09	0.0046
Excess Cancer Risks CNRS (i, t) for Individual Radionuclides (i) and Pathways (p)	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.616E-10	0.0005
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.198E-11	0.0001
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.979E-09	0.0183
At-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.523E-11	0.0001
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.681E-10	0.0024
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.146E-08	0.0966
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.859E-07	0.8774
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.258E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		

and Fraction of Total Risk at t= 1.000E+03 years
 ** Sum of water independent ground, inhalation, plant, meat, milk, soil

0

and water dependent water, fish, plant, meat, milk pathways

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Excess Cancer Risks CNRS (i, t) and CNRS (i, t) for Inhalation of	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water Dependent Pathways	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-dep. == Water-dependent

Water-ind. == Water-independent

Initially Existent Radionuclides (i) and Pathways (p)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	5.939E-09	0.0182	5.385E-10	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.351E-10	0.0007
U-235	3.280E-08	0.1007	2.210E-10	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.469E-11	0.0003
U-238	2.752E-07	0.8446	7.393E-09	0.0227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.434E-09	0.0105
Water Ind. Excess Cancer Risk CNRS (i, t) *** for	3.139E-07	0.9635	8.153E-09	0.0250	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.754E-09	0.0115
Total	3.139E-07	0.9635	8.153E-09	0.0250	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.754E-09	0.0115

Intrisk : IAAAP FS12 Reuse Soil SUS 1-142 Site Wkr Deep Fill Mod Library FYR2
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Initially Existent Radionuclides (i) and Pathways (p)

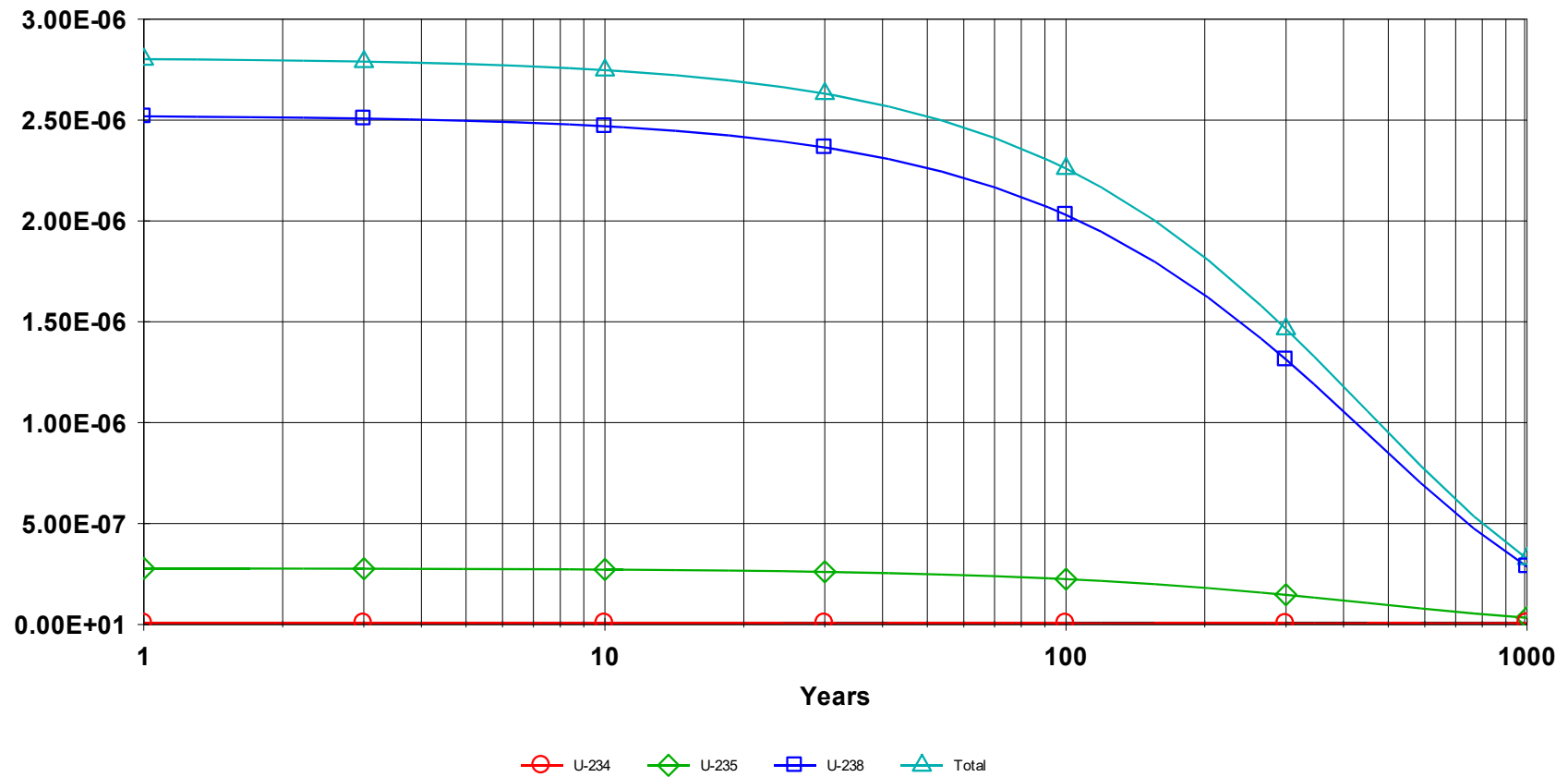
Radio- Nuclide	Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.712E-09	0.0206
Total Excess Cancer Risk CNRSI (i,p,t) ** for	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.311E-08	0.1016
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.860E-07	0.8778
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000		
Water												
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.258E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

EXCESS CANCER RISK: All Nuclides Summed, All Pathways Summed



ATTACHMENT D-5

RISK AND DOSE ASSESSMENT FOR LINE 1 STRUCTURES

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Table D-5-1. EPCs for Line 1 Structures

Description	U-234	U-235	U-238
	pCi/m ²		
Line 1 Structures ^a	60,356	10,419	647,678

^a The EPCs presented and used for evaluation in this FYR were obtained from the Line 1 RACR (USACE 2020c).

**Table D-5-2. Risk and Dose Comparisons Among RESRAD-BUILD Model and CSF/DCF Library Versions,
Line 1 Structures**

Area	Receptor Scenario	RESRAD-BUILD 3.5 FGR 13 Morbidity Library (Line 1 RACR) ^{a,b}		RESRAD-BUILD 4.0 Default DCFPAK3.02 Library (PRAR-FSSE) ^{c,d}		RESRAD-BUILD 4.0 Modified DCFPAK3.02 Library (PRAR-FSSE) ^{e,f}	
		Risk	Dose (mrem/year)	Risk	Dose (mrem/year)	Risk	Dose (mrem/year)
Line 1 Structures	Site Worker	6.9E-05	13	2.3E-06	3	2.3E-06	5

^a The RESRAD-BUILD 3.5 model default CSFs in the FGR 13 Morbidity library are from FGR 13.

^b The RESRAD-BUILD 3.5 model default internal and external DCFs in the FGR 13 Morbidity library are from FGR 11 and FGR 12, respectively.

^c The RESRAD-BUILD 4.0 model default base risk "DCFPAK3.02 Morbidity" library is used for all CSFs.

^d The RESRAD-BUILD 4.0 model default base dose libraries are used. The base internal dose library is "DCFPAK3.02 (Adult)", which includes all 2014 DCFs (ORNL 2014). The base external dose library is "DCFPAK3.02", which includes ORNL 2014 external radiation DCFs.

^e The RESRAD-BUILD 4.0 model base risk "DCFPAK3.02 Morbidity" library is modified to replace ORNL 2014 dietary CSFs for the ingestion pathway with the ORNL worker soil ingestion CSFs.

^f The RESRAD-BUILD 4.0 external dose library "DCFPAK3.02" is modified to replace the 2014 external radiation DCFs for infinite depth (ORNL 2014) with the corresponding USEPA FGR 15 DCFs for infinite depth (USEPA 2019).

ATTACHMENT D-5-1

**LINE 1 STRUCTURES RESRAD-BUILD VERSION 4.0 RISK AND DOSE OUTPUTS
FOR A SITE WORKER USING MODEL DEFAULT CANCER SLOPE AND DOSE
CONVERSION FACTORS IN THE DCFPAK3.02 (ADULT) LIBRARIES**

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** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 1 **
Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

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** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 2 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

```

Number of Sources : 5
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.300000E-01
  
```

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 3 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 5 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 6 **
Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]

Geometry:: Type: Point

Pathway ::

Direct Ingestion Rate: 0.000E+00 [1/hr]

Fraction released to air: 7.000E-02

Removable fraction: 2.000E-01

Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::

Nuclide Concentration

	[pCi]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 7 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Temporal Summary

RESRAD-BUILD Temporal Dose Tables

Dose to Receptor over the Exposure Duration

(mrem)

Evaluation Time	Receptor	Total
years	1	
0.000000000	1.87E+00	1.87E+00
1.000000000	2.92E+00	2.92E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 8 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	1.36E+00	1.67E-01	1.67E-01	1.67E-01	7.33E-03	1.87E+00
Total	1.36E+00	1.67E-01	1.67E-01	1.67E-01	7.33E-03	1.87E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 9 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	7.19E-01	6.36E-01	1.36E-04	3.57E-07	4.82E-03	3.16E-11	0.00E+00	1.36E+00
Total	7.19E-01	6.36E-01	1.36E-04	3.57E-07	4.82E-03	3.16E-11	0.00E+00	1.36E+00
Source: 2								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.86E-02	1.27E-01	2.71E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	1.67E-01
Total	3.86E-02	1.27E-01	2.71E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	1.67E-01
Source: 3								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.86E-02	1.27E-01	2.71E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	1.67E-01
Total	3.86E-02	1.27E-01	2.71E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	1.67E-01
Source: 4								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.86E-02	1.27E-01	2.71E-05	7.13E-08	9.63E-04	6.32E-12	0.00E+00	1.67E-01
Total	3.86E-02	1.27E-01	2.71E-05	7.13E-08	9.63E-04	6.32E-12	0.00E+00	1.67E-01
Source: 5								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.17E-04	6.36E-03	1.36E-06	3.56E-09	4.81E-05	3.16E-13	0.00E+00	7.33E-03
Total	9.17E-04	6.36E-03	1.36E-06	3.56E-09	4.81E-05	3.16E-13	0.00E+00	7.33E-03

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 10 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	6.29E-02	6.29E-02
Th-230	3.83E-06	3.83E-06
Ra-226	6.53E-10	6.53E-10
Pb-210	4.29E-13	4.29E-13
Po-210	8.07E-14	8.07E-14
U-235	2.62E-02	2.62E-02
Pa-231	3.48E-06	3.48E-06
Ac-227	3.50E-08	3.50E-08
U-238	1.27E+00	1.27E+00
U-234	1.18E-06	1.18E-06
Th-230	4.21E-11	4.21E-11
Ra-226	5.47E-15	5.47E-15
Pb-210	1.06E-16	1.06E-16
Po-210	0.00E+00	0.00E+00

Source: 2

Nuclide	Receptor	Total
	1	
U-234	1.24E-02	1.24E-02
Th-230	7.65E-07	7.65E-07
Ra-226	4.98E-11	4.98E-11
Pb-210	6.96E-14	6.96E-14
Po-210	1.61E-14	1.61E-14
U-235	2.68E-03	2.68E-03
Pa-231	6.87E-07	6.87E-07
Ac-227	6.24E-09	6.24E-09
U-238	1.52E-01	1.52E-01
U-234	2.34E-07	2.34E-07
Th-230	8.42E-12	8.42E-12
Ra-226	4.14E-16	4.14E-16
Pb-210	0.00E+00	0.00E+00
Po-210	5.31E-18	5.31E-18

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 11 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	1.24E-02	1.24E-02
Th-230	7.65E-07	7.65E-07
Ra-226	4.98E-11	4.98E-11
Pb-210	6.96E-14	6.96E-14
Po-210	1.61E-14	1.61E-14
U-235	2.68E-03	2.68E-03
Pa-231	6.87E-07	6.87E-07
Ac-227	6.24E-09	6.24E-09
U-238	1.52E-01	1.52E-01
U-234	2.34E-07	2.34E-07
Th-230	8.42E-12	8.42E-12
Ra-226	4.14E-16	4.14E-16
Pb-210	0.00E+00	0.00E+00
Po-210	5.31E-18	5.31E-18

Source: 4

Nuclide	Receptor	Total
	1	
U-234	1.24E-02	1.24E-02
Th-230	7.64E-07	7.64E-07
Ra-226	4.98E-11	4.98E-11
Pb-210	6.95E-14	6.95E-14
Po-210	1.61E-14	1.61E-14
U-235	2.68E-03	2.68E-03
Pa-231	6.88E-07	6.88E-07
Ac-227	6.25E-09	6.25E-09
U-238	1.52E-01	1.52E-01
U-234	2.34E-07	2.34E-07
Th-230	8.41E-12	8.41E-12
Ra-226	3.15E-16	3.15E-16
Pb-210	2.14E-20	2.14E-20
Po-210	1.09E-17	1.09E-17

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 12 **

Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Evaluation Time: 0.00000000E+00 years

U-234	6.21E-04	6.21E-04
Th-230	3.82E-08	3.82E-08
Ra-226	3.08E-12	3.08E-12
Pb-210	3.28E-15	3.28E-15
Po-210	8.07E-16	8.07E-16

U-235	1.67E-04	1.67E-04
Pa-231	3.45E-08	3.45E-08
Ac-227	3.16E-10	3.16E-10

U-238	6.54E-03	6.54E-03
U-234	1.17E-08	1.17E-08
Th-230	4.21E-13	4.21E-13
Ra-226	1.66E-17	1.66E-17
Pb-210	3.66E-19	3.66E-19
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 13 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	2.01E+00	2.97E-01	2.97E-01	2.97E-01	1.39E-02	2.92E+00
Total	2.01E+00	2.97E-01	2.97E-01	2.97E-01	1.39E-02	2.92E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 14 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Doses

[mrem]

Source: 1

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	7.14E-01	1.29E+00	2.98E-04	7.20E-07	1.06E-02	2.21E-10	0.00E+00	2.01E+00
Total	7.14E-01	1.29E+00	2.98E-04	7.20E-07	1.06E-02	2.21E-10	0.00E+00	2.01E+00

Source: 2

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.83E-02	2.57E-01	5.96E-05	1.44E-07	2.12E-03	4.41E-11	0.00E+00	2.97E-01
Total	3.83E-02	2.57E-01	5.96E-05	1.44E-07	2.12E-03	4.41E-11	0.00E+00	2.97E-01

Source: 3

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.83E-02	2.57E-01	5.96E-05	1.44E-07	2.12E-03	4.41E-11	0.00E+00	2.97E-01
Total	3.83E-02	2.57E-01	5.96E-05	1.44E-07	2.12E-03	4.41E-11	0.00E+00	2.97E-01

Source: 4

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.83E-02	2.57E-01	5.96E-05	1.44E-07	2.11E-03	4.41E-11	0.00E+00	2.97E-01
Total	3.83E-02	2.57E-01	5.96E-05	1.44E-07	2.11E-03	4.41E-11	0.00E+00	2.97E-01

Source: 5

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.10E-04	1.28E-02	2.98E-06	7.20E-09	1.06E-04	2.20E-12	0.00E+00	1.39E-02
Total	9.10E-04	1.28E-02	2.98E-06	7.20E-09	1.06E-04	2.20E-12	0.00E+00	1.39E-02

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 15 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.26E-01	1.26E-01
Th-230	1.89E-05	1.89E-05
Ra-226	4.77E-09	4.77E-09
Pb-210	8.75E-12	8.75E-12
Po-210	2.91E-12	2.91E-12
U-235	3.59E-02	3.59E-02
Pa-231	1.71E-05	1.71E-05
Ac-227	3.54E-07	3.54E-07
U-238	1.85E+00	1.85E+00
U-234	5.83E-06	5.83E-06
Th-230	4.53E-10	4.53E-10
Ra-226	7.77E-14	7.77E-14
Pb-210	3.58E-16	3.58E-16
Po-210	2.87E-17	2.87E-17

Source: 2

Nuclide	Receptor	Total
	1	
U-234	2.51E-02	2.51E-02
Th-230	3.78E-06	3.78E-06
Ra-226	3.92E-10	3.92E-10
Pb-210	1.51E-12	1.51E-12
Po-210	5.82E-13	5.82E-13
U-235	4.63E-03	4.63E-03
Pa-231	3.40E-06	3.40E-06
Ac-227	6.55E-08	6.55E-08
U-238	2.68E-01	2.68E-01
U-234	1.16E-06	1.16E-06
Th-230	9.05E-11	9.05E-11
Ra-226	6.37E-15	6.37E-15
Pb-210	0.00E+00	0.00E+00
Po-210	1.71E-17	1.71E-17

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 16 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	2.51E-02	2.51E-02
Th-230	3.78E-06	3.78E-06
Ra-226	3.92E-10	3.92E-10
Pb-210	1.51E-12	1.51E-12
Po-210	5.82E-13	5.82E-13
U-235	4.63E-03	4.63E-03
Pa-231	3.40E-06	3.40E-06
Ac-227	6.55E-08	6.55E-08
U-238	2.68E-01	2.68E-01
U-234	1.16E-06	1.16E-06
Th-230	9.05E-11	9.05E-11
Ra-226	6.37E-15	6.37E-15
Pb-210	0.00E+00	0.00E+00
Po-210	1.71E-17	1.71E-17

Source: 4

Nuclide	Receptor	Total
	1	
U-234	2.50E-02	2.50E-02
Th-230	3.78E-06	3.78E-06
Ra-226	3.91E-10	3.91E-10
Pb-210	1.51E-12	1.51E-12
Po-210	5.82E-13	5.82E-13
U-235	4.64E-03	4.64E-03
Pa-231	3.40E-06	3.40E-06
Ac-227	6.56E-08	6.56E-08
U-238	2.68E-01	2.68E-01
U-234	1.16E-06	1.16E-06
Th-230	9.05E-11	9.05E-11
Ra-226	6.27E-15	6.27E-15
Pb-210	2.52E-17	2.52E-17
Po-210	4.81E-17	4.81E-17

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:18:46 Page: 17 **

Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Evaluation Time: 1.00000000 years

U-234	1.25E-03	1.25E-03
Th-230	1.89E-07	1.89E-07
Ra-226	2.37E-11	2.37E-11
Pb-210	7.25E-14	7.25E-14
Po-210	2.91E-14	2.91E-14

U-235	2.64E-04	2.64E-04
Pa-231	1.70E-07	1.70E-07
Ac-227	3.30E-09	3.30E-09

U-238	1.23E-02	1.23E-02
U-234	5.80E-08	5.80E-08
Th-230	4.52E-12	4.52E-12
Ra-226	3.75E-16	3.75E-16
Pb-210	4.90E-19	4.90E-19
Po-210	0.00E+00	0.00E+00

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** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 2 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

```

Number of Sources : 5
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.300000E-01
  
```

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 5 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 6 **
Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]

Geometry:: Type: Point

Pathway ::

Direct Ingestion Rate: 0.000E+00 [1/hr]

Fraction released to air: 7.000E-02

Removable fraction: 2.000E-01

Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::

Nuclide Concentration

	[pCi]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 7 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Temporal Summary

RESRAD-BUILD Temporal Risk Tables

Risk to Receptor over the Exposure Duration

(Risk)

Evaluation Time years	Receptor 1	Total
0.000000000	1.43E-06	1.43E-06
1.000000000	2.26E-06	2.26E-06

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 8 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

		[Risk]					
		Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor	1	1.03E-06	1.30E-07	1.30E-07	1.30E-07	5.77E-09	1.43E-06
Total		1.03E-06	1.30E-07	1.30E-07	1.30E-07	5.77E-09	1.43E-06

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 9 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Risks

[Risk]

Source: 1								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	5.23E-07	5.06E-07	9.87E-11	2.15E-13	3.20E-09	1.30E-16	0.00E+00	1.03E-06
Total	5.23E-07	5.06E-07	9.87E-11	2.15E-13	3.20E-09	1.30E-16	0.00E+00	1.03E-06
Source: 2								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.80E-08	1.01E-07	1.97E-11	4.29E-14	6.39E-10	2.60E-17	0.00E+00	1.30E-07
Total	2.80E-08	1.01E-07	1.97E-11	4.29E-14	6.39E-10	2.60E-17	0.00E+00	1.30E-07
Source: 3								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.80E-08	1.01E-07	1.97E-11	4.29E-14	6.39E-10	2.60E-17	0.00E+00	1.30E-07
Total	2.80E-08	1.01E-07	1.97E-11	4.29E-14	6.39E-10	2.60E-17	0.00E+00	1.30E-07
Source: 4								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.80E-08	1.01E-07	1.97E-11	4.29E-14	6.39E-10	2.59E-17	0.00E+00	1.30E-07
Total	2.80E-08	1.01E-07	1.97E-11	4.29E-14	6.39E-10	2.59E-17	0.00E+00	1.30E-07
Source: 5								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	6.78E-10	5.06E-09	9.87E-13	2.15E-15	3.19E-11	1.30E-18	0.00E+00	5.77E-09
Total	6.78E-10	5.06E-09	9.87E-13	2.15E-15	3.19E-11	1.30E-18	0.00E+00	5.77E-09

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 10 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	5.01E-08	5.01E-08
Th-230	3.50E-13	3.50E-13
Ra-226	6.27E-16	6.27E-16
Pb-210	2.91E-19	2.91E-19
Po-210	6.47E-20	6.47E-20
U-235	2.07E-08	2.07E-08
Pa-231	3.50E-13	3.50E-13
Ac-227	1.38E-14	1.38E-14
U-238	9.62E-07	9.62E-07
U-234	9.44E-13	9.44E-13
Th-230	3.85E-18	3.85E-18
Ra-226	5.25E-21	5.25E-21
Pb-210	7.22E-23	7.22E-23
Po-210	0.00E+00	0.00E+00

Source: 2

Nuclide	Receptor	Total
	1	
U-234	9.90E-09	9.90E-09
Th-230	6.95E-14	6.95E-14
Ra-226	6.07E-17	6.07E-17
Pb-210	4.93E-20	4.93E-20
Po-210	1.29E-20	1.29E-20
U-235	2.12E-09	2.12E-09
Pa-231	6.27E-14	6.27E-14
Ac-227	2.18E-15	2.18E-15
U-238	1.18E-07	1.18E-07
U-234	1.87E-13	1.87E-13
Th-230	7.65E-19	7.65E-19
Ra-226	5.06E-22	5.06E-22
Pb-210	0.00E+00	0.00E+00
Po-210	4.54E-24	4.54E-24

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 11 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	9.90E-09	9.90E-09
Th-230	6.95E-14	6.95E-14
Ra-226	6.07E-17	6.07E-17
Pb-210	4.93E-20	4.93E-20
Po-210	1.29E-20	1.29E-20
U-235	2.12E-09	2.12E-09
Pa-231	6.27E-14	6.27E-14
Ac-227	2.18E-15	2.18E-15
U-238	1.18E-07	1.18E-07
U-234	1.87E-13	1.87E-13
Th-230	7.65E-19	7.65E-19
Ra-226	5.06E-22	5.06E-22
Pb-210	0.00E+00	0.00E+00
Po-210	4.54E-24	4.54E-24

Source: 4

Nuclide	Receptor	Total
	1	
U-234	9.89E-09	9.89E-09
Th-230	6.94E-14	6.94E-14
Ra-226	6.06E-17	6.06E-17
Pb-210	4.92E-20	4.92E-20
Po-210	1.29E-20	1.29E-20
U-235	2.13E-09	2.13E-09
Pa-231	6.29E-14	6.29E-14
Ac-227	2.18E-15	2.18E-15
U-238	1.18E-07	1.18E-07
U-234	1.87E-13	1.87E-13
Th-230	7.64E-19	7.64E-19
Ra-226	3.79E-22	3.79E-22
Pb-210	1.10E-26	1.10E-26
Po-210	8.34E-24	8.34E-24

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 12 **

Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Evaluation Time: 0.00000000E+00 years

U-234	4.96E-10	4.96E-10
Th-230	3.47E-15	3.47E-15
Ra-226	3.51E-18	3.51E-18
Pb-210	2.37E-21	2.37E-21
Po-210	6.47E-22	6.47E-22

U-235	1.32E-10	1.32E-10
Pa-231	3.19E-15	3.19E-15
Ac-227	1.12E-16	1.12E-16

U-238	5.15E-09	5.15E-09
U-234	9.35E-15	9.35E-15
Th-230	3.82E-20	3.82E-20
Ra-226	1.87E-23	1.87E-23
Pb-210	2.81E-25	2.81E-25
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 13 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

		[Risk]					
		Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor	1	1.55E-06	2.34E-07	2.34E-07	2.34E-07	1.10E-08	2.26E-06
Total		1.55E-06	2.34E-07	2.34E-07	2.34E-07	1.10E-08	2.26E-06

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 14 **
 Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Risks

[Risk]

Source: 1

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	5.19E-07	1.02E-06	2.17E-10	4.33E-13	7.02E-09	9.05E-16	0.00E+00	1.55E-06
Total	5.19E-07	1.02E-06	2.17E-10	4.33E-13	7.02E-09	9.05E-16	0.00E+00	1.55E-06

Source: 2

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.78E-08	2.05E-07	4.34E-11	8.67E-14	1.40E-09	1.81E-16	0.00E+00	2.34E-07
Total	2.78E-08	2.05E-07	4.34E-11	8.67E-14	1.40E-09	1.81E-16	0.00E+00	2.34E-07

Source: 3

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.78E-08	2.05E-07	4.34E-11	8.67E-14	1.40E-09	1.81E-16	0.00E+00	2.34E-07
Total	2.78E-08	2.05E-07	4.34E-11	8.67E-14	1.40E-09	1.81E-16	0.00E+00	2.34E-07

Source: 4

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.78E-08	2.04E-07	4.33E-11	8.66E-14	1.40E-09	1.81E-16	0.00E+00	2.34E-07
Total	2.78E-08	2.04E-07	4.33E-11	8.66E-14	1.40E-09	1.81E-16	0.00E+00	2.34E-07

Source: 5

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	6.73E-10	1.02E-08	2.17E-12	4.33E-15	7.02E-11	9.05E-18	0.00E+00	1.10E-08
Total	6.73E-10	1.02E-08	2.17E-12	4.33E-15	7.02E-11	9.05E-18	0.00E+00	1.10E-08

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 15 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.01E-07	1.01E-07
Th-230	1.73E-12	1.73E-12
Ra-226	4.54E-15	4.54E-15
Pb-210	6.03E-18	6.03E-18
Po-210	2.33E-18	2.33E-18
U-235	2.84E-08	2.84E-08
Pa-231	1.65E-12	1.65E-12
Ac-227	1.33E-13	1.33E-13
U-238	1.42E-06	1.42E-06
U-234	4.65E-12	4.65E-12
Th-230	4.13E-17	4.13E-17
Ra-226	7.40E-20	7.40E-20
Pb-210	2.53E-22	2.53E-22
Po-210	2.63E-23	2.63E-23

Source: 2

Nuclide	Receptor	Total
	1	
U-234	2.00E-08	2.00E-08
Th-230	3.44E-13	3.44E-13
Ra-226	4.58E-16	4.58E-16
Pb-210	1.08E-18	1.08E-18
Po-210	4.65E-19	4.65E-19
U-235	3.68E-09	3.68E-09
Pa-231	3.08E-13	3.08E-13
Ac-227	2.25E-14	2.25E-14
U-238	2.10E-07	2.10E-07
U-234	9.24E-13	9.24E-13
Th-230	8.22E-18	8.22E-18
Ra-226	7.44E-21	7.44E-21
Pb-210	0.00E+00	0.00E+00
Po-210	1.29E-23	1.29E-23

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 16 **
 Title : IAAAP Line 1 Struct Site Wkr_DCFPAK3.02
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld
 Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	2.00E-08	2.00E-08
Th-230	3.44E-13	3.44E-13
Ra-226	4.58E-16	4.58E-16
Pb-210	1.08E-18	1.08E-18
Po-210	4.65E-19	4.65E-19
U-235	3.68E-09	3.68E-09
Pa-231	3.08E-13	3.08E-13
Ac-227	2.25E-14	2.25E-14
U-238	2.10E-07	2.10E-07
U-234	9.24E-13	9.24E-13
Th-230	8.22E-18	8.22E-18
Ra-226	7.44E-21	7.44E-21
Pb-210	0.00E+00	0.00E+00
Po-210	1.29E-23	1.29E-23

Source: 4

Nuclide	Receptor	Total
	1	
U-234	2.00E-08	2.00E-08
Th-230	3.43E-13	3.43E-13
Ra-226	4.58E-16	4.58E-16
Pb-210	1.07E-18	1.07E-18
Po-210	4.65E-19	4.65E-19
U-235	3.69E-09	3.69E-09
Pa-231	3.09E-13	3.09E-13
Ac-227	2.25E-14	2.25E-14
U-238	2.10E-07	2.10E-07
U-234	9.24E-13	9.24E-13
Th-230	8.22E-18	8.22E-18
Ra-226	7.32E-21	7.32E-21
Pb-210	1.78E-23	1.78E-23
Po-210	3.86E-23	3.86E-23

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:18:46 Page: 17 **

Title : IAAAP Line 1 Struct_Site Wkr_DCFPAK3.02

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302.bld

Evaluation Time: 1.00000000 years

U-234	1.00E-09	1.00E-09
Th-230	1.72E-14	1.72E-14
Ra-226	2.62E-17	2.62E-17
Pb-210	5.24E-20	5.24E-20
Po-210	2.33E-20	2.33E-20

U-235	2.10E-10	2.10E-10
Pa-231	1.56E-14	1.56E-14
Ac-227	1.14E-15	1.14E-15

U-238	9.76E-09	9.76E-09
U-234	4.62E-14	4.62E-14
Th-230	4.11E-19	4.11E-19
Ra-226	4.14E-22	4.14E-22
Pb-210	3.76E-25	3.76E-25
Po-210	0.00E+00	0.00E+00

ATTACHMENT D-5-2

**LINE 1 STRUCTURES RESRAD-BUILD VERSION 4.0 RISK AND DOSE OUTPUTS
FOR A SITE WORKER USING UPDATED CANCER SLOPE AND DOSE
CONVERSION FACTORS IN MODIFIED DCFPAK3.02 (ADULT) LIBRARIES**

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** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 2 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

Number of Sources : 5
 Number of Receptors: 1
 Total Time : 3.650000E+02 days
 Fraction Inside : 2.300000E-01

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 5 **
 Title : IAAAP Line1 Struct SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 6 **
Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]

Geometry:: Type: Point

Pathway ::

Direct Ingestion Rate: 0.000E+00 [1/hr]

Fraction released to air: 7.000E-02

Removable fraction: 2.000E-01

Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::

Nuclide Concentration

	[pCi]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 7 **
 Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Temporal Summary

RESRAD-BUILD Temporal Dose Tables

Dose to Receptor over the Exposure Duration

(mrem)

Evaluation Time years	Receptor 1	Total
0.000000000	3.75E+00	3.75E+00
1.000000000	4.79E+00	4.79E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 8 **
 Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	2.97E+00	2.57E-01	2.57E-01	2.57E-01	7.33E-03	3.75E+00
Total	2.97E+00	2.57E-01	2.57E-01	2.57E-01	7.33E-03	3.75E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 9 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.33E+00	6.36E-01	4.40E-04	3.57E-07	4.82E-03	3.16E-11	0.00E+00	2.97E+00
Total	2.33E+00	6.36E-01	4.40E-04	3.57E-07	4.82E-03	3.16E-11	0.00E+00	2.97E+00
Source: 2								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.28E-01	1.27E-01	8.80E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	2.57E-01
Total	1.28E-01	1.27E-01	8.80E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	2.57E-01
Source: 3								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.28E-01	1.27E-01	8.80E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	2.57E-01
Total	1.28E-01	1.27E-01	8.80E-05	7.13E-08	9.63E-04	6.33E-12	0.00E+00	2.57E-01
Source: 4								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.28E-01	1.27E-01	8.80E-05	7.13E-08	9.63E-04	6.32E-12	0.00E+00	2.57E-01
Total	1.28E-01	1.27E-01	8.80E-05	7.13E-08	9.63E-04	6.32E-12	0.00E+00	2.57E-01
Source: 5								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.17E-04	6.36E-03	4.40E-06	3.56E-09	4.81E-05	3.16E-13	0.00E+00	7.33E-03
Total	9.17E-04	6.36E-03	4.40E-06	3.56E-09	4.81E-05	3.16E-13	0.00E+00	7.33E-03

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 10 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	6.29E-02	6.29E-02
Th-230	3.83E-06	3.83E-06
Ra-226	6.53E-10	6.53E-10
Pb-210	4.31E-13	4.31E-13
Po-210	8.07E-14	8.07E-14
U-235	2.77E-02	2.77E-02
Pa-231	3.48E-06	3.48E-06
Ac-227	3.50E-08	3.50E-08
U-238	2.88E+00	2.88E+00
U-234	1.18E-06	1.18E-06
Th-230	4.21E-11	4.21E-11
Ra-226	5.47E-15	5.47E-15
Pb-210	1.07E-16	1.07E-16
Po-210	0.00E+00	0.00E+00

Source: 2

Nuclide	Receptor	Total
	1	
U-234	1.24E-02	1.24E-02
Th-230	7.65E-07	7.65E-07
Ra-226	4.98E-11	4.98E-11
Pb-210	6.96E-14	6.96E-14
Po-210	1.61E-14	1.61E-14
U-235	2.72E-03	2.72E-03
Pa-231	6.87E-07	6.87E-07
Ac-227	6.24E-09	6.24E-09
U-238	2.42E-01	2.42E-01
U-234	2.34E-07	2.34E-07
Th-230	8.42E-12	8.42E-12
Ra-226	4.14E-16	4.14E-16
Pb-210	0.00E+00	0.00E+00
Po-210	5.31E-18	5.31E-18

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 11 **
 Title : IAAAP Line1 Struct SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	1.24E-02	1.24E-02
Th-230	7.65E-07	7.65E-07
Ra-226	4.98E-11	4.98E-11
Pb-210	6.96E-14	6.96E-14
Po-210	1.61E-14	1.61E-14
U-235	2.72E-03	2.72E-03
Pa-231	6.87E-07	6.87E-07
Ac-227	6.24E-09	6.24E-09
U-238	2.42E-01	2.42E-01
U-234	2.34E-07	2.34E-07
Th-230	8.42E-12	8.42E-12
Ra-226	4.14E-16	4.14E-16
Pb-210	0.00E+00	0.00E+00
Po-210	5.31E-18	5.31E-18

Source: 4

Nuclide	Receptor	Total
	1	
U-234	1.24E-02	1.24E-02
Th-230	7.64E-07	7.64E-07
Ra-226	4.98E-11	4.98E-11
Pb-210	6.96E-14	6.96E-14
Po-210	1.61E-14	1.61E-14
U-235	2.73E-03	2.73E-03
Pa-231	6.88E-07	6.88E-07
Ac-227	6.25E-09	6.25E-09
U-238	2.42E-01	2.42E-01
U-234	2.34E-07	2.34E-07
Th-230	8.41E-12	8.41E-12
Ra-226	3.15E-16	3.15E-16
Pb-210	2.16E-20	2.16E-20
Po-210	1.09E-17	1.09E-17

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 12 **

Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Evaluation Time: 0.00000000E+00 years

U-234	6.21E-04	6.21E-04
Th-230	3.82E-08	3.82E-08
Ra-226	3.08E-12	3.08E-12
Pb-210	3.28E-15	3.28E-15
Po-210	8.07E-16	8.07E-16

U-235	1.67E-04	1.67E-04
Pa-231	3.45E-08	3.45E-08
Ac-227	3.16E-10	3.16E-10

U-238	6.54E-03	6.54E-03
U-234	1.17E-08	1.17E-08
Th-230	4.21E-13	4.21E-13
Ra-226	1.66E-17	1.66E-17
Pb-210	3.66E-19	3.66E-19
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 13 **
 Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]						
	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	3.61E+00	3.87E-01	3.87E-01	3.87E-01	1.39E-02	4.79E+00
Total	3.61E+00	3.87E-01	3.87E-01	3.87E-01	1.39E-02	4.79E+00

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 14 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Doses

[mrem]

Source: 1								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.31E+00	1.29E+00	9.67E-04	7.20E-07	1.06E-02	2.21E-10	0.00E+00	3.61E+00
Total	2.31E+00	1.29E+00	9.67E-04	7.20E-07	1.06E-02	2.21E-10	0.00E+00	3.61E+00
Source: 2								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.28E-01	2.57E-01	1.93E-04	1.44E-07	2.12E-03	4.41E-11	0.00E+00	3.87E-01
Total	1.28E-01	2.57E-01	1.93E-04	1.44E-07	2.12E-03	4.41E-11	0.00E+00	3.87E-01
Source: 3								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.28E-01	2.57E-01	1.93E-04	1.44E-07	2.12E-03	4.41E-11	0.00E+00	3.87E-01
Total	1.28E-01	2.57E-01	1.93E-04	1.44E-07	2.12E-03	4.41E-11	0.00E+00	3.87E-01
Source: 4								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	1.27E-01	2.57E-01	1.93E-04	1.44E-07	2.11E-03	4.41E-11	0.00E+00	3.87E-01
Total	1.27E-01	2.57E-01	1.93E-04	1.44E-07	2.11E-03	4.41E-11	0.00E+00	3.87E-01
Source: 5								
	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	9.10E-04	1.28E-02	9.66E-06	7.20E-09	1.06E-04	2.20E-12	0.00E+00	1.39E-02
Total	9.10E-04	1.28E-02	9.66E-06	7.20E-09	1.06E-04	2.20E-12	0.00E+00	1.39E-02

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 15 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.26E-01	1.26E-01
Th-230	1.89E-05	1.89E-05
Ra-226	4.77E-09	4.77E-09
Pb-210	8.78E-12	8.78E-12
Po-210	2.91E-12	2.91E-12
U-235	3.74E-02	3.74E-02
Pa-231	1.71E-05	1.71E-05
Ac-227	3.54E-07	3.54E-07
U-238	3.45E+00	3.45E+00
U-234	5.83E-06	5.83E-06
Th-230	4.53E-10	4.53E-10
Ra-226	7.77E-14	7.77E-14
Pb-210	3.58E-16	3.58E-16
Po-210	2.87E-17	2.87E-17

Source: 2

Nuclide	Receptor	Total
	1	
U-234	2.51E-02	2.51E-02
Th-230	3.78E-06	3.78E-06
Ra-226	3.92E-10	3.92E-10
Pb-210	1.51E-12	1.51E-12
Po-210	5.82E-13	5.82E-13
U-235	4.68E-03	4.68E-03
Pa-231	3.40E-06	3.40E-06
Ac-227	6.55E-08	6.55E-08
U-238	3.57E-01	3.57E-01
U-234	1.16E-06	1.16E-06
Th-230	9.05E-11	9.05E-11
Ra-226	6.37E-15	6.37E-15
Pb-210	0.00E+00	0.00E+00
Po-210	1.71E-17	1.71E-17

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 16 **
 Title : IAAAP Line1 Struct SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	2.51E-02	2.51E-02
Th-230	3.78E-06	3.78E-06
Ra-226	3.92E-10	3.92E-10
Pb-210	1.51E-12	1.51E-12
Po-210	5.82E-13	5.82E-13
U-235	4.68E-03	4.68E-03
Pa-231	3.40E-06	3.40E-06
Ac-227	6.55E-08	6.55E-08
U-238	3.57E-01	3.57E-01
U-234	1.16E-06	1.16E-06
Th-230	9.05E-11	9.05E-11
Ra-226	6.37E-15	6.37E-15
Pb-210	0.00E+00	0.00E+00
Po-210	1.71E-17	1.71E-17

Source: 4

Nuclide	Receptor	Total
	1	
U-234	2.50E-02	2.50E-02
Th-230	3.78E-06	3.78E-06
Ra-226	3.91E-10	3.91E-10
Pb-210	1.51E-12	1.51E-12
Po-210	5.82E-13	5.82E-13
U-235	4.69E-03	4.69E-03
Pa-231	3.40E-06	3.40E-06
Ac-227	6.56E-08	6.56E-08
U-238	3.57E-01	3.57E-01
U-234	1.16E-06	1.16E-06
Th-230	9.05E-11	9.05E-11
Ra-226	6.27E-15	6.27E-15
Pb-210	2.52E-17	2.52E-17
Po-210	4.81E-17	4.81E-17

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Dose Program Output, Version 4.0 04/23/23 12:29:19 Page: 17 **

Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Evaluation Time: 1.00000000 years

U-234	1.25E-03	1.25E-03
Th-230	1.89E-07	1.89E-07
Ra-226	2.37E-11	2.37E-11
Pb-210	7.25E-14	7.25E-14
Po-210	2.91E-14	2.91E-14

U-235	2.64E-04	2.64E-04
Pa-231	1.70E-07	1.70E-07
Ac-227	3.30E-09	3.30E-09

U-238	1.24E-02	1.24E-02
U-234	5.80E-08	5.80E-08
Th-230	4.52E-12	4.52E-12
Ra-226	3.75E-16	3.75E-16
Pb-210	4.90E-19	4.90E-19
Po-210	0.00E+00	0.00E+00

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Risk by Nuclide Detail.....	10
For time = 1.00E+00 yr	
Receptor-Source Risk Summary.....	13
Risk by Pathway Detail.....	14
Risk by Nuclide Detail.....	15

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 2 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

```

=====
=====
=====
RESRAD-BUILD Input Parameters
=====
=====
=====
  
```

Number of Sources : 5
 Number of Receptors: 1
 Total Time : 3.650000E+02 days
 Fraction Inside : 2.300000E-01

Transformations data from: ICRP107
 Cut off half life : 30.0000000 days
 Library information in the Dose Coefficients and Slope Factors report

```

===== Receptor Information =====
  
```

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	5.000	5.000	1.000	1.000	3.36E+01	1.00E-04

```

===== Receptor-Source Shielding Relationship =====
  
```

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete
1	2	2.40E+00	0.00E+00	Concrete
1	3	2.40E+00	0.00E+00	Concrete
1	4	2.40E+00	0.00E+00	Concrete
1	5	2.40E+00	0.00E+00	Concrete

===== Building Information =====

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 0.00E+00
H1: 2.500	* Room 1	* Q10 : 0.00E+00
	* LAMBDA: 0.00E+00	*
Area 100.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 0.00E+00 [1/s]
 Deposition velocity: 5.00E-07 [m/s] Resuspension Rate:

===== Source Information =====

Source: 1

Location:: Room : 1 x: 5.00 y: 5.00 z: 0.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:1.00E+01 Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 2

Location:: Room : 1 x: 5.00 y: 10.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]

 Radon Release Fraction: 1.000E-01

Contamination::
Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 3

Location:: Room : 1 x: 10.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.040E+04
U-235	1.040E+04
U-238	6.480E+05

Source: 4

Location:: Room : 1 x: 0.00 y: 5.00 z: 1.00[m]
 Geometry:: Type: Area Length[m]:1.00E+01 Width[m]:2.00E+00 Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 7.000E-02
 Removable fraction: 2.000E-01
 Time to Remove: 1.000E+04 [day]
 Radon Release Fraction: 1.000E-01

Contamination::
 Nuclide Concentration

	[pCi/m2]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 6 **
Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Source: 5

Location:: Room : 1 x: 5.00 y: 0.00 z: 1.00[m]

Geometry:: Type: Point

Pathway ::

Direct Ingestion Rate: 0.000E+00 [1/hr]

Fraction released to air: 7.000E-02

Removable fraction: 2.000E-01

Time to Remove: 1.000E+04 [day]

Radon Release Fraction: 1.000E-01

Contamination::

Nuclide Concentration

	[pCi]
U-234	6.036E+04
U-235	1.042E+04
U-238	6.477E+05

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 7 **
 Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Temporal Summary

RESRAD-BUILD Temporal Risk Tables

Risk to Receptor over the Exposure Duration

(Risk)

Evaluation Time years	Receptor 1	Total
0.000000000	1.43E-06	1.43E-06
1.000000000	2.25E-06	2.25E-06

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 8 **
 Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

		[Risk]					
		Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor	1	1.03E-06	1.30E-07	1.30E-07	1.30E-07	5.42E-09	1.43E-06
Total		1.03E-06	1.30E-07	1.30E-07	1.30E-07	5.42E-09	1.43E-06

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 9 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

Pathway Detail of Risks

[Risk]

Source: 1								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	5.23E-07	5.06E-07	9.87E-11	2.15E-13	1.51E-09	1.30E-16	0.00E+00	1.03E-06
Total	5.23E-07	5.06E-07	9.87E-11	2.15E-13	1.51E-09	1.30E-16	0.00E+00	1.03E-06
Source: 2								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.80E-08	1.01E-07	1.97E-11	4.29E-14	3.01E-10	2.60E-17	0.00E+00	1.30E-07
Total	2.80E-08	1.01E-07	1.97E-11	4.29E-14	3.01E-10	2.60E-17	0.00E+00	1.30E-07
Source: 3								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.80E-08	1.01E-07	1.97E-11	4.29E-14	3.01E-10	2.60E-17	0.00E+00	1.30E-07
Total	2.80E-08	1.01E-07	1.97E-11	4.29E-14	3.01E-10	2.60E-17	0.00E+00	1.30E-07
Source: 4								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.80E-08	1.01E-07	1.97E-11	4.29E-14	3.01E-10	2.59E-17	0.00E+00	1.30E-07
Total	2.80E-08	1.01E-07	1.97E-11	4.29E-14	3.01E-10	2.59E-17	0.00E+00	1.30E-07
Source: 5								
	External directly from	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.40E-10	5.06E-09	9.87E-13	2.15E-15	1.50E-11	1.30E-18	0.00E+00	5.42E-09
Total	3.40E-10	5.06E-09	9.87E-13	2.15E-15	1.50E-11	1.30E-18	0.00E+00	5.42E-09

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 10 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	5.00E-08	5.00E-08
Th-230	3.50E-13	3.50E-13
Ra-226	6.27E-16	6.27E-16
Pb-210	2.81E-19	2.81E-19
Po-210	6.07E-20	6.07E-20
U-235	2.07E-08	2.07E-08
Pa-231	3.50E-13	3.50E-13
Ac-227	1.38E-14	1.38E-14
U-238	9.60E-07	9.60E-07
U-234	9.42E-13	9.42E-13
Th-230	3.85E-18	3.85E-18
Ra-226	5.25E-21	5.25E-21
Pb-210	7.08E-23	7.08E-23
Po-210	0.00E+00	0.00E+00

Source: 2

Nuclide	Receptor	Total
	1	
U-234	9.88E-09	9.88E-09
Th-230	6.94E-14	6.94E-14
Ra-226	6.06E-17	6.06E-17
Pb-210	4.73E-20	4.73E-20
Po-210	1.21E-20	1.21E-20
U-235	2.12E-09	2.12E-09
Pa-231	6.27E-14	6.27E-14
Ac-227	2.18E-15	2.18E-15
U-238	1.18E-07	1.18E-07
U-234	1.86E-13	1.86E-13
Th-230	7.63E-19	7.63E-19
Ra-226	5.05E-22	5.05E-22
Pb-210	0.00E+00	0.00E+00
Po-210	4.39E-24	4.39E-24

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 11 **
 Title : IAAAP Line1 Struct SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 0.00000000E+00 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	9.88E-09	9.88E-09
Th-230	6.94E-14	6.94E-14
Ra-226	6.06E-17	6.06E-17
Pb-210	4.73E-20	4.73E-20
Po-210	1.21E-20	1.21E-20
U-235	2.12E-09	2.12E-09
Pa-231	6.27E-14	6.27E-14
Ac-227	2.18E-15	2.18E-15
U-238	1.18E-07	1.18E-07
U-234	1.86E-13	1.86E-13
Th-230	7.63E-19	7.63E-19
Ra-226	5.05E-22	5.05E-22
Pb-210	0.00E+00	0.00E+00
Po-210	4.39E-24	4.39E-24

Source: 4

Nuclide	Receptor	Total
	1	
U-234	9.87E-09	9.87E-09
Th-230	6.93E-14	6.93E-14
Ra-226	6.05E-17	6.05E-17
Pb-210	4.72E-20	4.72E-20
Po-210	1.21E-20	1.21E-20
U-235	2.12E-09	2.12E-09
Pa-231	6.28E-14	6.28E-14
Ac-227	2.18E-15	2.18E-15
U-238	1.18E-07	1.18E-07
U-234	1.86E-13	1.86E-13
Th-230	7.63E-19	7.63E-19
Ra-226	3.78E-22	3.78E-22
Pb-210	1.10E-26	1.10E-26
Po-210	7.63E-24	7.63E-24

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 12 **

Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Evaluation Time: 0.00000000E+00 years

U-234	4.95E-10	4.95E-10
Th-230	3.47E-15	3.47E-15
Ra-226	3.50E-18	3.50E-18
Pb-210	2.27E-21	2.27E-21
Po-210	6.06E-22	6.06E-22

U-235	1.27E-10	1.27E-10
Pa-231	3.19E-15	3.19E-15
Ac-227	1.12E-16	1.12E-16

U-238	4.80E-09	4.80E-09
U-234	9.33E-15	9.33E-15
Th-230	3.82E-20	3.82E-20
Ra-226	1.87E-23	1.87E-23
Pb-210	2.81E-25	2.81E-25
Po-210	0.00E+00	0.00E+00

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 13 **
 Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

RESRAD-BUILD Risk Tables

Source Contributions to Receptor Risks

		[Risk]					
		Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor	1	1.55E-06	2.33E-07	2.33E-07	2.33E-07	1.06E-08	2.25E-06
Total		1.55E-06	2.33E-07	2.33E-07	2.33E-07	1.06E-08	2.25E-06

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 14 **
 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

Pathway Detail of Risks

[Risk]

Source: 1

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	5.19E-07	1.02E-06	2.17E-10	4.33E-13	3.31E-09	9.05E-16	0.00E+00	1.55E-06
Total	5.19E-07	1.02E-06	2.17E-10	4.33E-13	3.31E-09	9.05E-16	0.00E+00	1.55E-06

Source: 2

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.78E-08	2.05E-07	4.34E-11	8.67E-14	6.61E-10	1.81E-16	0.00E+00	2.33E-07
Total	2.78E-08	2.05E-07	4.34E-11	8.67E-14	6.61E-10	1.81E-16	0.00E+00	2.33E-07

Source: 3

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.78E-08	2.05E-07	4.34E-11	8.67E-14	6.61E-10	1.81E-16	0.00E+00	2.33E-07
Total	2.78E-08	2.05E-07	4.34E-11	8.67E-14	6.61E-10	1.81E-16	0.00E+00	2.33E-07

Source: 4

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	2.78E-08	2.04E-07	4.33E-11	8.66E-14	6.61E-10	1.81E-16	0.00E+00	2.33E-07
Total	2.78E-08	2.04E-07	4.33E-11	8.66E-14	6.61E-10	1.81E-16	0.00E+00	2.33E-07

Source: 5

	External directly from Source	Inhalation	External from Deposition on floor	External from Suspension in air	Ingestion of Deposition	Radon	Ingestion of Source	Total
Receptor 1	3.38E-10	1.02E-08	2.17E-12	4.33E-15	3.30E-11	9.05E-18	0.00E+00	1.06E-08
Total	3.38E-10	1.02E-08	2.17E-12	4.33E-15	3.30E-11	9.05E-18	0.00E+00	1.06E-08

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 Title : IAAAP Line1 Struct SiteWkr DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

Nuclide Detail of Risks

[Risk]

Source: 1

Nuclide	Receptor	Total
	1	
U-234	1.00E-07	1.00E-07
Th-230	1.72E-12	1.72E-12
Ra-226	4.54E-15	4.54E-15
Pb-210	5.80E-18	5.80E-18
Po-210	2.18E-18	2.18E-18
U-235	2.84E-08	2.84E-08
Pa-231	1.65E-12	1.65E-12
Ac-227	1.33E-13	1.33E-13
U-238	1.42E-06	1.42E-06
U-234	4.64E-12	4.64E-12
Th-230	4.12E-17	4.12E-17
Ra-226	7.39E-20	7.39E-20
Pb-210	2.44E-22	2.44E-22
Po-210	2.63E-23	2.63E-23

Source: 2

Nuclide	Receptor	Total
	1	
U-234	1.99E-08	1.99E-08
Th-230	3.43E-13	3.43E-13
Ra-226	4.57E-16	4.57E-16
Pb-210	1.03E-18	1.03E-18
Po-210	4.35E-19	4.35E-19
U-235	3.67E-09	3.67E-09
Pa-231	3.08E-13	3.08E-13
Ac-227	2.25E-14	2.25E-14
U-238	2.09E-07	2.09E-07
U-234	9.22E-13	9.22E-13
Th-230	8.21E-18	8.21E-18
Ra-226	7.43E-21	7.43E-21
Pb-210	0.00E+00	0.00E+00
Po-210	1.16E-23	1.16E-23

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 Title : IAAAP Line1 Struct SiteWkr_DCFPAKMOD
 Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld
 Evaluation Time: 1.00000000 years

Source: 3

Nuclide	Receptor	Total
	1	
U-234	1.99E-08	1.99E-08
Th-230	3.43E-13	3.43E-13
Ra-226	4.57E-16	4.57E-16
Pb-210	1.03E-18	1.03E-18
Po-210	4.35E-19	4.35E-19
U-235	3.67E-09	3.67E-09
Pa-231	3.08E-13	3.08E-13
Ac-227	2.25E-14	2.25E-14
U-238	2.09E-07	2.09E-07
U-234	9.22E-13	9.22E-13
Th-230	8.21E-18	8.21E-18
Ra-226	7.43E-21	7.43E-21
Pb-210	0.00E+00	0.00E+00
Po-210	1.16E-23	1.16E-23

Source: 4

Nuclide	Receptor	Total
	1	
U-234	1.99E-08	1.99E-08
Th-230	3.43E-13	3.43E-13
Ra-226	4.57E-16	4.57E-16
Pb-210	1.03E-18	1.03E-18
Po-210	4.35E-19	4.35E-19
U-235	3.68E-09	3.68E-09
Pa-231	3.08E-13	3.08E-13
Ac-227	2.25E-14	2.25E-14
U-238	2.09E-07	2.09E-07
U-234	9.22E-13	9.22E-13
Th-230	8.20E-18	8.20E-18
Ra-226	7.30E-21	7.30E-21
Pb-210	1.67E-23	1.67E-23
Po-210	3.61E-23	3.61E-23

Source: 5

Nuclide	Receptor	Total
	1	

** RESRAD-BUILD Risk Program Output, Version 4.0 04/23/23 12:29:19 Page: 17 **

Title : IAAAP Line1 Struct_SiteWkr_DCFPAKMOD

Input File : C:\RESRAD_Family\BUILD\RESRAD-BUILD User Files\L1BLDG_SITE WKR_DCFPAK302MOD.bld

Evaluation Time: 1.00000000 years

U-234	9.98E-10	9.98E-10
Th-230	1.71E-14	1.71E-14
Ra-226	2.61E-17	2.61E-17
Pb-210	5.00E-20	5.00E-20
Po-210	2.18E-20	2.18E-20

U-235	2.05E-10	2.05E-10
Pa-231	1.55E-14	1.55E-14
Ac-227	1.14E-15	1.14E-15

U-238	9.39E-09	9.39E-09
U-234	4.61E-14	4.61E-14
Th-230	4.10E-19	4.10E-19
Ra-226	4.13E-22	4.13E-22
Pb-210	3.76E-25	3.76E-25
Po-210	0.00E+00	0.00E+00