Nevada
Environmental
Management
Operations Activity

DOE/NV--1533

Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 411: Double Tracks Plutonium Dispersion (Nellis), Nevada Test and Training Range, Nevada

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/s/ Joseph P. Johnston 03/11/2015
Joseph P. Johnston, Navarro CO Date

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STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 411: DOUBLE TRACKS PLUTONIUM DISPERSION (NELLIS), NEVADA TEST AND TRAINING RANGE, NEVADA

U.S. Department of Energy, National Nuclear Security Administration
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Las Vegas, Nevada

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List of Acronyms and Abbreviations

Ag	Silver
Al	Aluminum
Am	Americium
ASTM	ASTM International
bgs	Below ground surface
CA	Contamination area
CAA	Corrective action alternative
CAI	Corrective action investigation
CAS	Corrective action site
CAU	Corrective action unit
CFR	*Code of Federal Regulations*
cm	Centimeter
Cm	Curium
Co	Cobalt
COC	Contaminant of concern
COPC	Contaminant of potential concern
CR	Closure report
Cs	Cesium
CSM	Conceptual site model
DAC	Derived air concentration
day/yr	Days per year
DCF	Dose conversion factor
DOE	U.S. Department of Energy
dpm/100 cm^2	Disintegrations per minute per 100 square centimeters
DQA	Data quality assessment
DQI	Data quality indicator

List of Acronyms and Abbreviations *(Continued)*

DQO	Data quality objective
DT	Double Tracks
EPA	U.S. Environmental Protection Agency
Eu	Europium
FAL	Final action level
FFACO	*Federal Facility Agreement and Consent Order*
FIDLER	Field instrument for the detection of low-energy radiation
FSL	Field-screening level
FSR	Field-screening result
ft	Foot
gal	Gallon
g/cm^3	Grams per cubic centimeter
g/m^3	Grams per cubic meter
GPS	Global Positioning System
g/yr	Grams per year
GZ	Ground zero
HASL	Health and Safety Laboratory
HCA	High contamination area
hr/day	Hours per day
hr/yr	Hours per year
IDW	Investigation-derived waste
in.	Inch
LCL	Lower confidence limit
m	Meter
m^2	Square meter
m^3/hr	Cubic meters per hour

List of Acronyms and Abbreviations *(Continued)*

m^3/min	Cubic meters per minute
m^3/yr	Cubic meters per year
mg/day	Milligrams per day
mi	Mile
mrem	Millirem
mrem/yr	Millirem per year
m/sec	Meters per second
m/yr	Meters per year
NAC	*Nevada Administrative Code*
NAD	North American Datum
NaI	Sodium iodide
Nb	Niobium
NDD	Normalized dose difference
NDEP	Nevada Division of Environmental Protection
NNSA/NFO	U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NNSS	Nevada National Security Site
NTTR	Nevada Test and Training Range
Np	Neptunium
PAL	Preliminary action level
pCi/g	Picocuries per gram
PPE	Personal protective equipment
PSM	Potential source material
Pu	Plutonium
QA	Quality assurance

List of Acronyms and Abbreviations *(Continued)*

QAP	Quality Assurance Plan
QC	Quality control
r^2	Coefficient of determination
RBCA	Risk-based corrective action
RCRA	*Resource Conservation and Recovery Act*
RRMG	Residual radioactive material guideline
RSL	Regional screening level
SAFER	Streamlined Approach for Environmental Restoration
Sr	Strontium
SVOC	Semivolatile organic compound
Tc	Technetium
TCLP	Toxicity characteristic leaching procedure
TED	Total effective dose
Th	Thorium
TLD	Thermoluminescent dosimeter
TTR	Tonopah Test Range
U	Uranium
UCL	Upper confidence limit
USAF	U.S. Air Force
UTM	Universal Transverse Mercator
UXO	Unexploded ordnance
VOC	Volatile organic compound
µm	Micrometer
µCi/mL	Microcuries per milliliter

Executive Summary

This Streamlined Approach for Environmental Restoration (SAFER) Plan addresses the actions needed to achieve closure for Corrective Action Unit (CAU) 411, Double Tracks Plutonium Dispersion (Nellis), identified in the *Federal Facility Agreement and Consent Order* (FFACO). CAU 411 is located on the Nevada Test and Training Range and consists of a single corrective action site (CAS), NAFR-23-01, Pu Contaminated Soil.

There is sufficient information and historical documentation from previous investigations and the 1996 interim corrective action to recommend closure of CAU 411 using the SAFER process. Based on existing data, the presumed corrective action for CAU 411 is clean closure. However, additional data will be obtained during a field investigation to document and verify the adequacy of existing information, and to determine whether the CAU 411 closure objectives have been achieved. This SAFER Plan provides the methodology to gather the necessary information for closing the CAU. The results of the field investigation will be presented in a closure report that will be prepared and submitted to the Nevada Division of Environmental Protection (NDEP) for review and approval.

The site will be investigated based on the data quality objectives (DQOs) developed on November 20, 2014, by representatives of NDEP, the U.S. Air Force (USAF), and the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Field Office. The DQO process was used to identify and define the type, amount, and quality of data needed to determine whether CAU 411 closure objectives have been achieved.

The following text summarizes the SAFER activities that will support the closure of CAU 411:

- Collect environmental samples from designated target populations to confirm or disprove the presence of contaminants of concern (COCs) as necessary to supplement existing information.
- If COCs are no longer present, establish clean closure as the corrective action.
- If COCs are present, the extent of contamination will be defined and further corrective actions will be evaluated with the stakeholders (NDEP, USAF).
- Confirm the preferred closure option is sufficient to protect human health and the environment.

This SAFER Plan has been developed in accordance with the FFACO that was agreed to by the State of Nevada; DOE, Environmental Management; U.S. Department of Defense; and DOE, Legacy Management. Under the FFACO, this SAFER Plan will be submitted to NDEP for approval.

1.0 Introduction

This Streamlined Approach for Environmental Restoration (SAFER) Plan addresses the actions necessary for the closure of Corrective Action Unit (CAU) 411, Double Tracks Plutonium Dispersion (Nellis). This document has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (1996, as amended) that was agreed to by the State of Nevada; U.S. Department of Energy (DOE), Environmental Management; U.S. Department of Defense; and DOE, Legacy Management.

A SAFER may be performed when the following criteria are met (FFACO; 1996, as amended):

- Conceptual corrective actions are clearly identified (although some degree of investigation may be necessary to select a specific corrective action before completion of the Corrective Action Investigation [CAI]).
- Uncertainty of the nature, extent, and corrective action must be limited to an acceptable level of risk.
- The SAFER Plan includes decision points and criteria for making data quality objective (DQO) decisions.

There is sufficient information from previous investigations and the 1996 interim corrective action regarding the nature and extent of contamination to recommend closure of CAU 411 using the SAFER process. The presumed corrective action for CAU 411 is clean closure. This presumption is based on the following:

- Completion of the 1996 interim corrective action, which included removal of the most highly contaminated soil and debris within the plume and at ground zero (GZ) (see Section 2.2.3)
- Ground-based confirmation radiological surveys (KIWI) that demonstrated achievement of the 1996 target cleanup goal (see Section 2.2.3)
- Post-remediation aerial radiological survey data from 2006 that confirmed the overall distribution of radioactivity at the site (see Section 2.2.3)
- Removable contamination surveys from 2007 that identify current radiological conditions at the site (see Sections 2.2.4 and 2.2.5.2)
- Soil sample data and ground-based radiological surveys from 2012 (see Section 2.2.5)

However, additional data will be obtained during a CAI to supplement existing information in order to determine whether site closure objectives have been achieved. This SAFER Plan provides the methodology to gather the necessary information for closing CAU 411 under the FFACO.

CAU 411 consists of one corrective action site (CAS), NAFR-23-01, Pu Contaminated Soil, which is located on Range 71N of the Nevada Test and Training Range (NTTR), west of the Tonopah Test Range (TTR) (Figure 1-1). Because CAU 411 consists of a single CAS, the CAS nomenclature is generally not used in this SAFER Plan. Instead, the CAS is referred to as Double Tracks (DT) or CAU 411 throughout this document.

1.1 SAFER Process Description

CAUs that may be closed using the SAFER process have conceptual corrective actions that are clearly identified. Consequently, corrective action alternatives (CAAs) can be chosen before completing a CAI, given anticipated investigation results.

The SAFER process combines elements of the DQO process and the observational approach to plan and conduct closure activities. The DQOs are used to identify the problem and define the type and quality of data needed to complete closure. The purpose of the CAI is to verify the adequacy of existing information used to determine the chosen corrective action and to confirm that closure objectives were achieved.

Use of the SAFER process allows technical decisions to be made based on incomplete but sufficient information, and the experience of the decision maker. Based on a detailed review of historical documentation, there is sufficient process knowledge to close CAU 411 using the SAFER process. Any uncertainties are addressed by documented assumptions that are verified by sampling and analysis, data evaluation, and onsite observations, as necessary. Closure activities may proceed simultaneously with site characterization as sufficient data are gathered to confirm or disprove the assumptions made during selection of the corrective action. If, at any time during the closure process, new information is discovered that indicates that closure activities should be revised, closure activities will be reevaluated by the stakeholders.

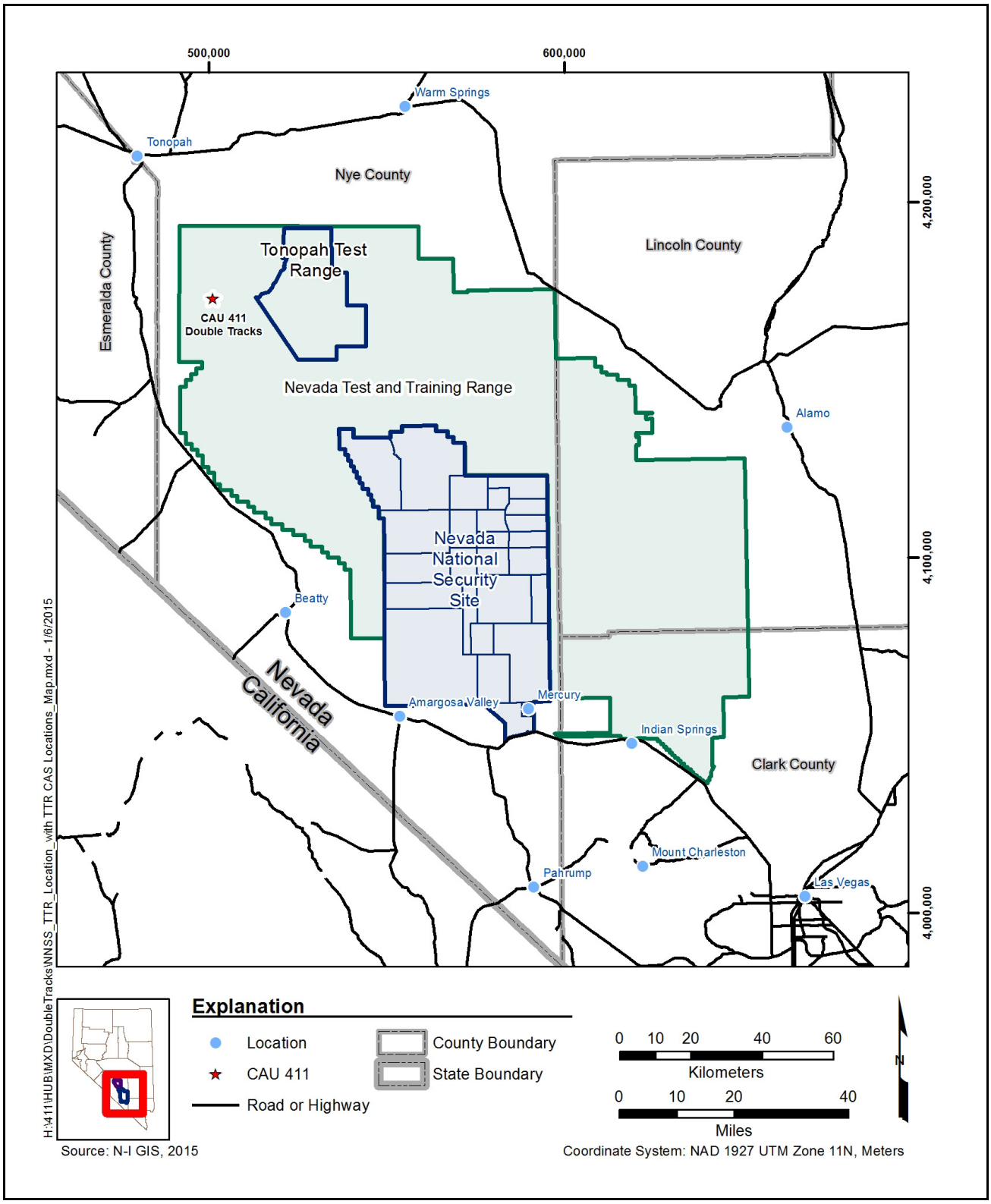

Figure 1-1
CAU 411 Location, NTTR

1.2 Summary of Corrective Actions and Closures

The decision process for closure of CAU 411 is summarized in Figure 1-2. This process starts with the initial CAI in which the appropriate target population(s) within the CAU (defined in the DQO process; see Appendix B) is sampled. If contaminants are detected at concentrations that are above the final action levels (FALs), the nature and extent of contamination will be delineated by additional sampling. However, contingencies are built into the process in the event new information is identified which indicates that the selected closure option should be revised. Based on the results of environmental samples, a closure report (CR) is prepared and the SAFER process culminates in closure of the site.

Decision points that require a consensus between DOE, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) and the stakeholders (Nevada Division of Environmental Protection [NDEP], U.S. Air Force [USAF]) before continuing are indicated in Figure 1-2. The CAI may be temporarily suspended if any of the following unexpected conditions occur:

- Conditions outside the scope of work are encountered.
- Radiological screening yields results requiring an upgrade in procedures to continue survey work in specific areas.
- Elevated levels of additional COCs are found that were not originally identified as being present at the site.
- Unexpected conditions, including unexpected waste and/or contamination, are encountered.
- Out-of-scope work activities are required due to the detection of other COCs that would require reevaluating a disposal pathway, such as with hazardous or low-level waste.
- Unsafe conditions or work practices are encountered.

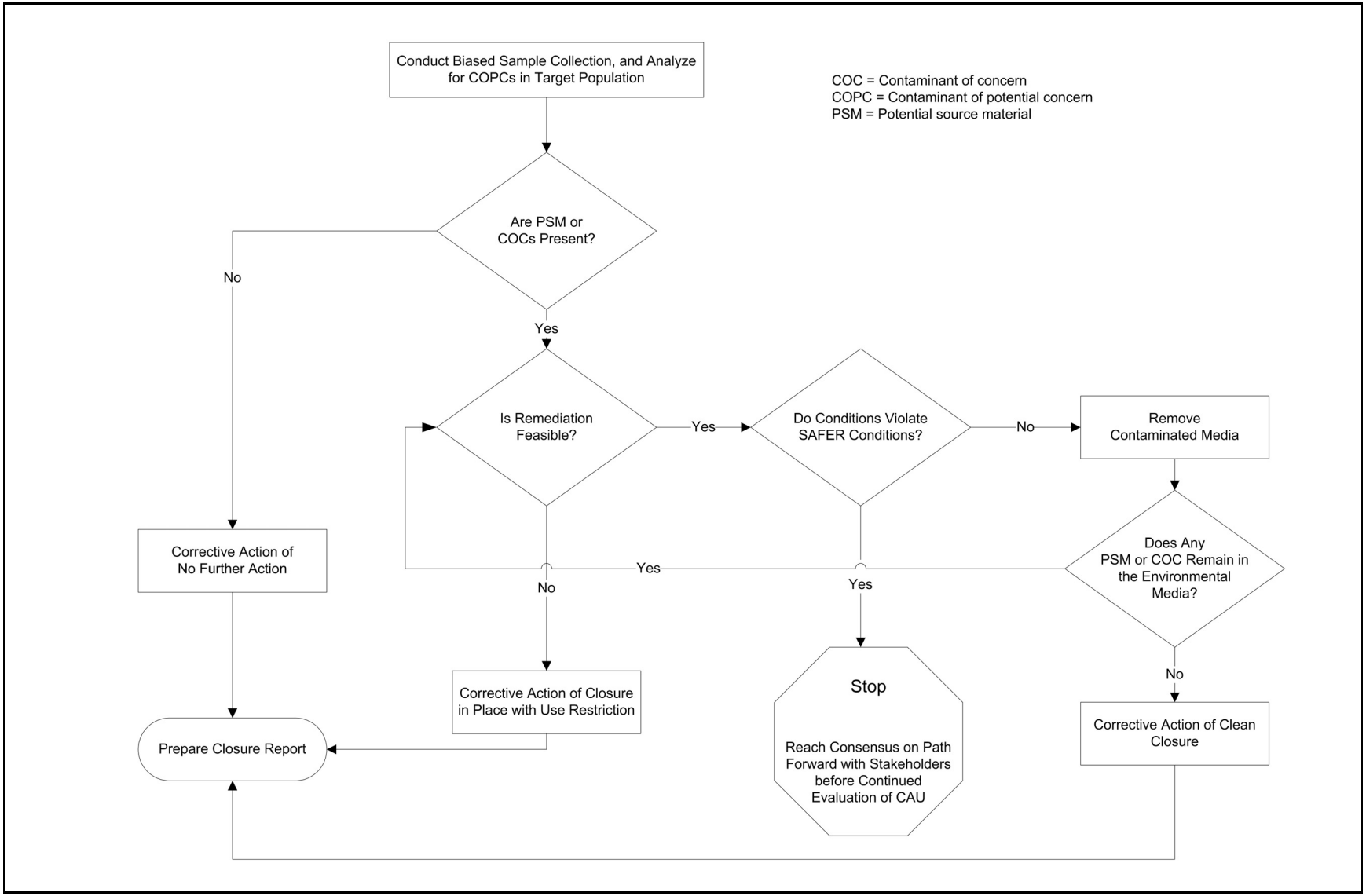

Figure 1-2
CAU 411 Closure Decision Process

2.0 Unit Description

CAU 411, Double Tracks Plutonium Dispersion (Nellis), consists of one CAS: NAFR-23-01, Pu Contaminated Soil. The DT site is located in Stonewall Flat on Range 71 North of the NTTR, northwest of the Nevada National Security Site (NNSS) (Figure 1-1). The NTTR is an active USAF range used for military training. The nearest town is Goldfield, Nevada, located approximately 22 kilometers (14 miles [mi]) west of the site.

The operational history, process knowledge, and release information for CAU 411 is summarized in this section. This information was obtained through review of historical documents, site photographs, aerial maps, and previous investigation results. Based on this information, assumptions were made to formulate a conceptual site model (CSM) that describes the most probable scenario for the current conditions at the CAU. Additional information on the CSM for CAU 411 is provided in Section 3.2.5.

2.1 History and Process Knowledge

The DT site consists of a release of radionuclides to the surrounding soil from a storage–transportation test conducted on May 15, 1963. The DT test was the first of four storage–transportation tests that constituted Operation Roller Coaster; the other tests were Clean Slate I, Clean Slate II, and Clean Slate III. The objective of the DT test was to evaluate the dispersal of radionuclides in the environment and the uptake and fate of plutonium in animals. The test involved the detonation of a combination of high explosives, plutonium, and depleted uranium approximately 1 foot (ft) above a steel plate on top of a reinforced concrete pad. The test scattered radioactive material, earth, and other material (concrete and metal) into the air. The debris and most of the dirt fell to earth at relatively short distances from the GZ area. However, some of the finer-grained material was spread over a larger area downwind, to the south of GZ. No fission yield was detected from the test, and the total amount of plutonium deposited on the steel plate, concrete pad, and ground surface was estimated between 980 and 1,600 grams (Shreve, 1965). The debris in the vicinity of GZ and identified fragments to distances of 90 to 120 meters (m) (300 to 800 ft) were collected and buried near GZ (DOE/NV, 1996b). An area of approximately 43 acres enclosing the GZ area was fenced and posted with radiological control signs sometime after the test. This original fence is still intact and posted with Contamination Area (CA) signs. In 1996, an interim corrective action

was completed at the DT site that removed the mounded soil and debris at GZ and a large volume of highly contaminated soil that had been dispersed on the ground surface as a result of the experiment.

2.2 Available Characterization Information

The DT site was studied extensively in the years after the experiment and well into the 1970s. Studies included ground-based and aerial radiological surveys, and collection and analysis of soil and vegetation samples. Details of these studies may be found in the *Double Tracks Test Site Characterization Report* (DOE/NV, 1996a) and associated reference documents, and are not repeated herein.

Investigation of the DT site began in 1994, before the FFACO was signed. However, with the signing of the FFACO in 1996, the DT site became subject to the FFACO site closure process. A summary of investigation and interim corrective actions is presented in Table 2-1.

Table 2-1
Summary of Activities at CAU 411

Activities	Year	Work Completed	Data Use
Initial Site Characterization	1994–1995	Ground-based radiological surveys, vertical soil profiling, soil sampling, soil treatability studies, geophysical surveys at GZ	Informational Data
Interim Corrective Action	1996	Soil and debris removal and offsite disposal, KIWI survey of excavated area	Decision-Supporting Data
Air Monitoring	1996–1999	Particulate size analysis, plutonium analyses, meteorological measurements	Informational Data
Aerial Radiological Survey	2006	Aerial radiological survey of post-remediated site	Decision-Supporting Data
10 CFR 835 Compliance Survey	2010	Swipe sampling for removable contamination, *in situ* radiological measurements	Decision-Supporting Data
Preliminary Investigation	2012	Visual surveys, soil sampling, ground-based radiological surveys	Decisional Data

CFR = *Code of Federal Regulations*

2.2.1 Initial Site Characterization

Site investigations at the DT site under the DOE Environmental Restoration program began in 1994, before the FFACO was established in May 1996. Site investigation activities included ground-based radiological surveys, vertical soil profiling to determine contamination depth, limited soil sampling, geophysical surveys to locate buried debris at GZ, and soil treatability studies.

The initial characterization at the DT site included four separate events conducted from October 1994 to July 1995. The results of all four site characterization events are found in the *Double Tracks Test Site Characterization Report* (DOE/NV, 1996a). During the first event, discrete soil samples and depth soil profile samples were collected and analyzed for radionuclides and metals. This sampling indicated that the contaminants of potential concern in soil at the DT site are americium (Am)-241 and plutonium; uranium was present only in background concentrations. These sampling results indicated that contamination levels were highly variable on the spatial scale represented by discrete soil samples.

The second characterization event consisted of the field evaluation of several *in situ* radiation measurement systems. During the *in situ* survey work, localized areas of elevated radiation ("hot spots") were located and investigated by conducting *in situ* radiation measurements at several depths and by collecting discrete soil samples. Relatively large, highly radioactive metallic fragments were found at many hot spot locations. In preparation for the third characterization event, these metal fragments and a small volume of soil surrounding the fragments, were removed and placed in a central storage location at the site. Hot spot soil samples were collected and analyzed for Am-241, isotopic plutonium (Pu), and total uranium. In addition, several samples underwent the toxicity characteristic leaching procedure (TCLP) for *Resource Conservation and Recovery Act* (RCRA) metals. The TCLP indicated that soil contaminated with Am-241 and plutonium did not exhibit the toxicity characteristic for metals.

The third characterization event consisted of a systematic *in situ* radiological survey of the site using a measurement system nicknamed the KIWI. The KIWI system is a collection of six sodium iodide (NaI) radiation detectors mounted approximately 2.5 ft above the ground surface on the back of a sport utility vehicle. This array of NaI detectors measures gamma radiation in counts per second and produces a field of view of approximately 10 ft. This system was combined with a Global Positioning

System (GPS) instrument to provide both radiation measurements and locations. Several shallow soil boreholes were advanced in a soil mound at GZ to assess the extent of contamination. Downhole radiation measurements were taken in several soil borings and indicated that radiological contamination (soil and possibly experiment debris) was present within the soil mound at GZ. The depth of contamination in the mound was estimated as deep as 0.9 meters (m) (3.0 ft). *In situ* measurements indicated that most of the activity is present within the top 2.5 centimeters (cm) (1 inch [in.]) of the soil profile. Where significant amounts of plutonium (greater than 1,000 picocuries per gram [pCi/g]) were present, it was assumed that the uppermost 5 cm (2 in.) of the soil profile was contaminated. Based on the *in situ* survey, the surface area with total Pu-239/240 activity greater than 200 pCi/g was approximated at 8,780 square meters (m^2) (95,400 square feet).

The focus of the fourth characterization event was to collect contaminated soil for treatability testing. Ten surface soil samples were collected in the approximate center of the contaminant plume south of GZ. Treatability testing consisted of grain-size analysis, bench scale attrition scrubbing, and gamma spectroscopy and isotopic analysis. The results of the treatability testing indicated that volume reduction techniques were feasible at the DT site but would not be cost effective due to the relatively small volume of soil requiring remediation.

Data collected in the four site characterization events described in this subsection are presented as informational data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data will not be used to support or make DQO decisions.

2.2.2 Air Monitoring

Air quality and meteorological data were collected at the DT site from 1996 to 1999. High-volume air samplers were placed at seven locations along the outside perimeter of the CA fence: five locations to the north, one location to the west, and one location to the south. Particulate samples less than 10 micrometers (µm) (PM_{10}) were collected and analyzed for particle size and Pu-238 and Pu-239/240 activity. Continuous meteorological data, including wind speed and direction, were also collected. A yearly summary of the Pu-238 and Pu-239/240 activity (in microcuries per milliliter [µCi/mL]) was reported in each of the Nevada Test Site Annual Environmental Reports for the years when monitoring occurred (Black and Townsend, 1997, 1998, 1999; Townsend and Grossman, 2000). Given these data and assuming an exposure duration of 2,000 hours per year (hr/yr), the

radionuclide-specific derived air concentrations (DACs) were used to calculate an estimated inhalation dose for a receptor standing just outside the CA fence. The Pu-238 and Pu-239/240 concentrations and the corresponding estimated inhalation doses are presented in Table 2-2.

Table 2-2
Annual Average Radiological Concentration in Air and Estimated Inhalation Dose (1996–1999)

Year	Pu-238		Pu-239/240	
	µCi/mL[a]	mrem/yr[b]	µCi/mL[a]	mrem/yr[c]
1996	1.1E-17[d]	0.0	1.4E-15[d]	1.4
1997	-8.0E-20	0.0	4.5E-18	0.0
1998	1.6E-19	0.0	1.4E-17	0.0
1999	3.1E-19	0.0	1.5E-18	0.0

[a] The data in this column are from Black and Townsend (1997, 1998, 1999), and Townsend and Grossman (2000).
[b] The DAC for Pu-238 used to calculate the inhalation dose is 6E-12 µCi/mL from 10 CFR 835, Appendix A (CFR, 2015).
[c] The DAC for Pu-239/240 used to calculate the inhalation dose is 5E-12 µCi/mL from 10 CFR 835, Appendix A (CFR, 2015).
[d] This value is the maximum value detected in air monitoring in 1996.

mrem/yr = Millirem per year

As detailed in Section 2.2.3, an interim corrective action was completed at the DT site in June and July 1996. Air samples were composited weekly and analyzed for Pu-238 and Pu-239/240 on a quarterly basis, before, during, and after ground-disturbing activities. Soil excavation at the DT site took place in late June 1996 during the second quarter of the year, and soil packaging and transport occurred in July and August, during the third quarter. The Pu-238 and Pu-239/240 concentrations for the first three quarters of 1996 and the estimated inhalation dose are presented in Table 2-3.

The air-monitoring data described in this subsection are presented as informational data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data will not be used to support or make DQO decisions.

2.2.3 Interim Corrective Action

An interim corrective action was completed at the DT site in 1996 in accordance with the *Double Tracks Site Interim Corrective Action Plan* (DOE/NV, 1996b). The corrective action involved the removal and offsite disposal of approximately 2,000 cubic yards of contaminated soil and debris (NNSA/NSO, 2003). In addition to contaminated soil scraped from the ground surface, the debris that

Table 2-3
1996 Quarterly Radiological Concentration in Air and Estimated Inhalation Dose

Quarter	Pu-238		Pu-239/240	
	µCi/mL[a]	mrem/yr[b]	µCi/mL[a]	mrem/yr[c]
First	3.43E-19	0.0	3.10E-18	0.0
Second	1.09E-17	0.0	1.39E-15	1.4
Third	3.90E-16	0.3	3.02E-18	0.0

[a] The data in this column are from NNSA/NSO (2003).
[b] The DAC for Pu-238 used to calculate the inhalation dose is 6E-12 µCi/mL from 10 CFR 835, Appendix A (CFR, 2015).
[c] The DAC for Pu-239/240 used to calculate the inhalation dose is 5E-12 µCi/mL from 10 CFR 835, Appendix A (CFR, 2015).

had been mounded at GZ after the test was removed, as well as several radioactively contaminated metal fragments scattered on or near the ground surface. The concrete pad used in the test was crushed into pieces that were also removed from the site. The soil and concrete debris was disposed of as low-level radioactive waste at the NNSS. Due to the high radioactivity associated with the scattered metal fragments, these were combined with similar fragments from the three other Operation Roller Coaster sites and disposed of at the Waste Isolation Pilot Plant as transuranic waste. Notably, the steel plate that was used in the 1963 test was removed from the DT site in 1965 and buried at the Operation Roller Coaster RADSAFE area (designated CAU 407) on TTR. Ultimately, the steel plate was exhumed from this location and disposed of as low-level radioactive waste at the NNSS (DOE/NV, 1996b).

A ground-based radiological survey using the KIWI system was conducted within the CA fence after remediation to confirm the removal of contamination to the agreed-upon interim corrective action level, which was 200 pCi/g total transuranic activity at the time. The KIWI system is a collection of six NaI radiation detectors mounted approximately 2.5 ft above ground surface on the back of a sport utility vehicle. This array of detectors measures gamma radiation in counts per second and produces a field of view of approximately 10 ft (DOE/NV, 1996a). The results of the KIWI survey are shown in Figure 2-1 (NSTec, 2009). This KIWI survey shows better resolution than the 2006 aerial survey discussed below, thus revealing detectable radioactivity in areas within the fence that were not detected by the aerial survey.

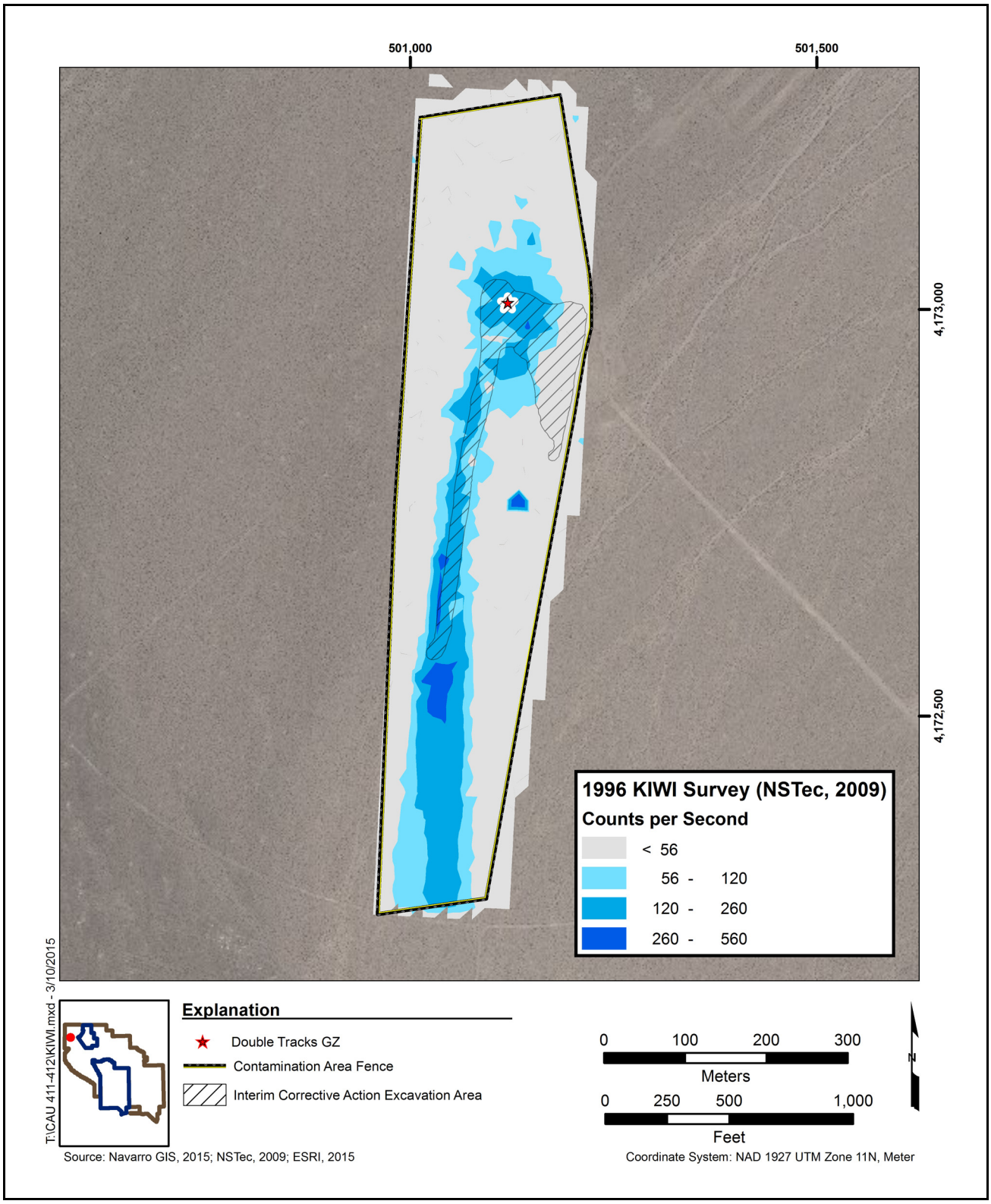

Figure 2-1
1996 Post-Remediation KIWI Survey Results

The *Double Tracks Closure Report* was written in 1997 after the interim corrective action, but the document was not approved. Further action at the DT site was suspended by mutual agreement between the DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) and NDEP in 1998 because concurrence could not be reached regarding future land use at the site, a final corrective action level, and the parameters used to determine the corrective action level (NNSA/NSO, 2003). NNSA/NSO discussions with the USAF (as landowner) and NDEP (as regulator) continued in the years following. By 2002, agreement had been reached between the parties on future land use and most, but not all, of the parameters used to establish a final corrective action level. The *Closure Report for Corrective Action Unit 411: Double Tracks Plutonium Dispersion* was submitted to NDEP in 2003 with revised dose calculations, but the report was not approved, and future work at the DT site was suspended (NNSA/NSO, 2003).

In 2006, a post-remediation aerial survey of the DT site was completed and is shown in Figure 2-2. This survey was flown at an altitude of 50 ft with flight lines approximately 75 ft apart. The aerial survey data, combined with the *in situ* data described in Section 2.2.4, were used to identify the locations of highest radioactivity at the site in order to bias sample locations for the 2012 preliminary investigation and the CAI.

The data from the aerial and KIWI radiological surveys described in this subsection are categorized as decision-supporting data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data were used to bias sampling locations for the 2012 preliminary investigation discussed in Section 2.2.5 and the CAI proposed in this SAFER Plan.

2.2.4 Radiological Posting Compliance Investigation

In the fall of 2010, a radiological control posting compliance investigation was performed at the four Operation Roller Coaster sites, including the DT site (NSTec, 2011). The purpose of this investigation was to determine whether the existing postings and associated boundaries were compliant with the radiological control program requirements found in 10 CFR 835 (CFR, 2015). The investigation included removable contamination surveys and *in situ* soil measurements of radioactivity at locations outside the existing fences. Removable contamination is defined as radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or washing (NNSA/NSO, 2012a). The removable contamination surveys were completed along the

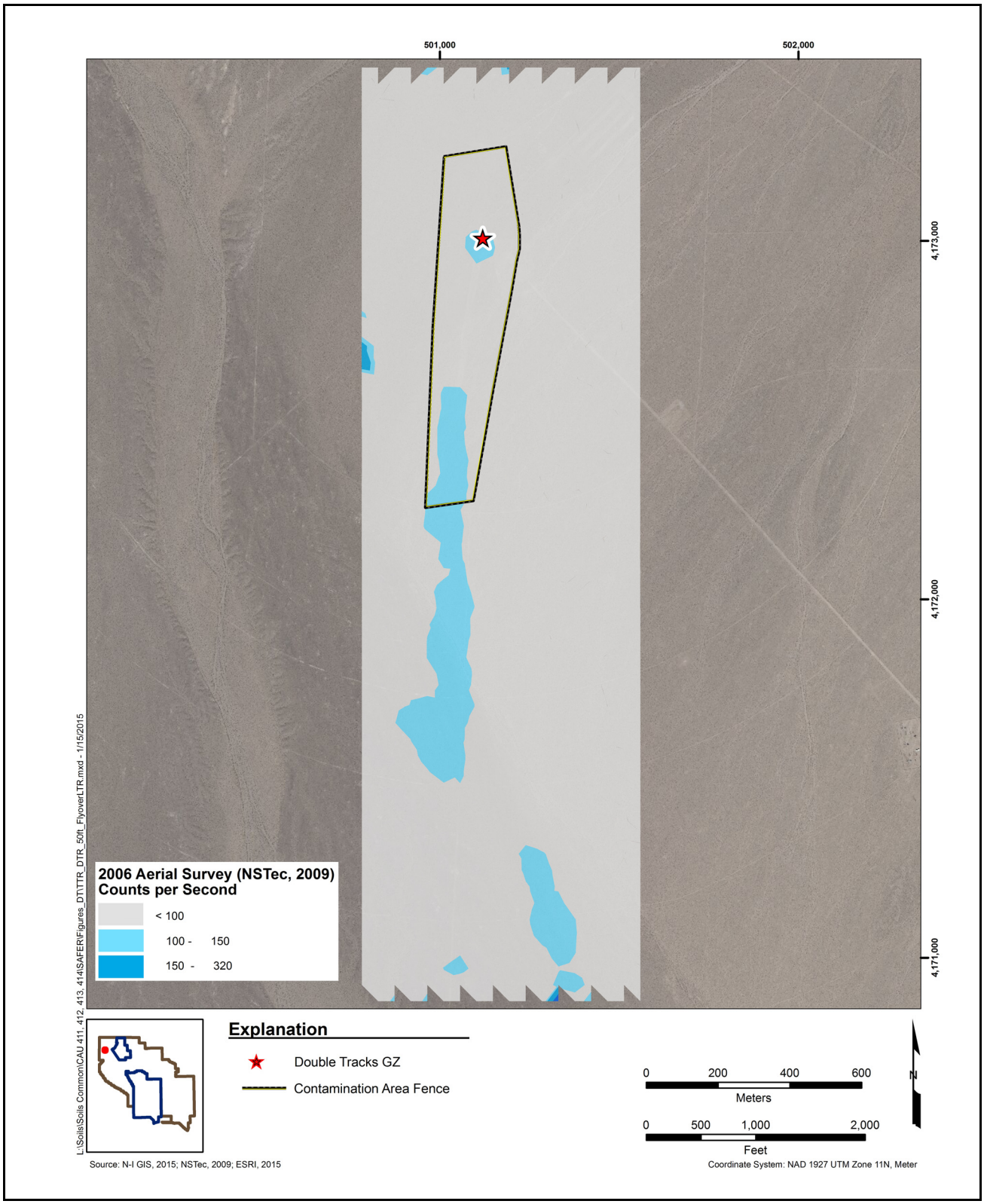

Figure 2-2
2006 Aerial Survey Results

center line of the detectable radiation plume identified outside the existing fence by the 2006 aerial radiation surveys at each site. Figure 2-3 presents the 2010 removable contamination survey locations at CAU 411. These surveys were completed using the "stomp and tromp" methodology, which uses swipe samples of the ground surface to determine the activity of removable radioactive material in the soil in units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). The results of the removable contamination survey indicate that conditions outside the fence at the DT site do not require posting as a CA (i.e., the areas surveyed have removable alpha contamination at levels below 20 dpm/100 cm^2). Although these data were collected for the purpose of determining compliance with 10 CFR 835, it is relevant to site closure and was considered in the development of the sampling design outlined in this SAFER Plan. These data, combined with removable contamination survey data obtained in the 2012 preliminary investigation and the CAI, will be used to resolve DQO decisions relating to removable contamination at CAU 411.

The *in situ* data were collected using the In Situ Object Counting System, which measures radioactivity in counts per second using portable gamma spectroscopy (NSTec, 2011). These data were considered in planning the 2012 preliminary investigation described below. Specifically, the *in situ* data were considered in combination with the 2006 aerial data, to identify the locations of highest radioactivity at the site.

The data collected in the posting compliance investigation described in this subsection are categorized as decision-supporting data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data were used to bias removable contamination survey locations for the 2012 preliminary investigation discussed in Section 2.2.5 and the CAI proposed in this SAFER Plan.

2.2.5 Preliminary Investigation

In the summer of 2012, additional investigation work, referred to as the preliminary investigation, was completed at the DT site. Preliminary investigation fieldwork included ground-based radiological surveys, visual surveys, and soil sampling. The radiological surveys included continuous scanning surveys using a field instrument for the detection of low-energy radiation (FIDLER) and limited removable contamination surveys. A summary of the preliminary investigation results are presented in the following subsections. Details of the investigation and analytical results may be

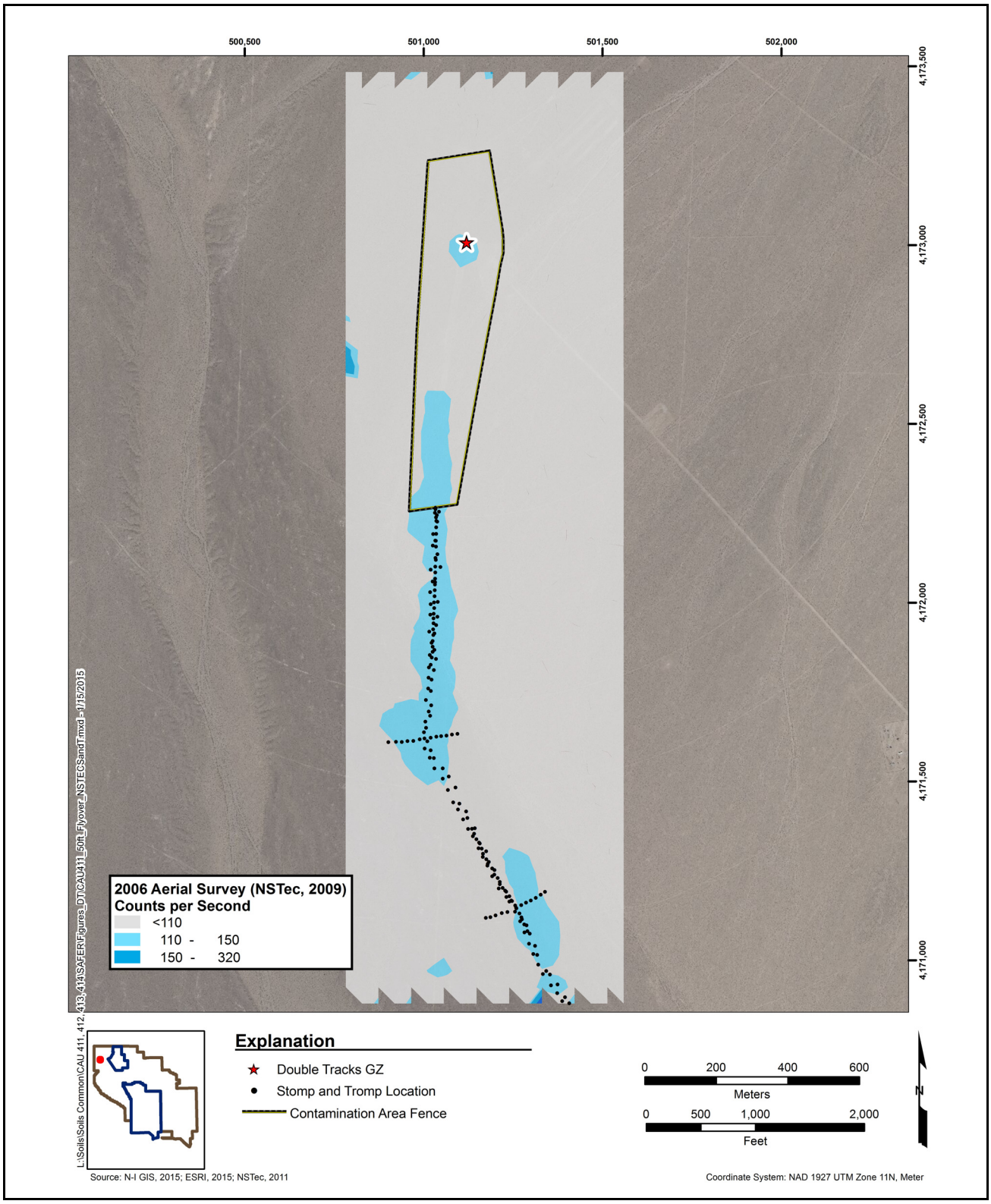

Figure 2-3
2010 Removable Contamination Survey Locations

found in the *Preliminary Investigation Results and Recommendations for CAUs 411, 412, 413, and 414* report (N-I, 2013).

The data collected in the preliminary investigation described in this subsection are categorized as decisional data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data will be combined with the data collected during the CAI to make DQO decisions regarding site closure. The quality of all decisional data will be addressed in the Data Quality Assessment (DQA) appendix to the CR for CAU 411.

2.2.5.1 FIDLER Survey

The FIDLER survey included the area inside the CA fence and the area outside the fence along the visible plume identified in the 2006 aerial survey. In addition, select locations on the periphery of the aerial survey flight path were surveyed. The FIDLER surveys displayed better spatial resolution than the 2006 aerial survey (Figure 2-4), as indicated by the detection of small, metal fragments (i.e., point sources) and other localized areas of elevated radioactivity that were not evident in the aerial survey.

2.2.5.2 Removable Contamination Survey

A removable contamination survey was conducted at the soil sample location within the CA fence (Figure 2-5). The survey did not detect removable alpha contamination in excess of 20 dpm/100 cm^2 (the lower threshold for CA posting).

2.2.5.3 Visual Survey

Visual surveys were conducted by walking the perimeter of the site and inside the CA fence. The visual surveys were conducted to identify physical features (e.g., drainages), unexploded ordnance (UXO), PSM, and waste. The visual survey at the DT site identified the following surface features, as shown on Figure 2-5:

- A small partially fenced area located north of the CA fence
- An abandoned weather station located east of the CA fence
- A cattle guard at the eastern edge of the DT fence line
- Drainage channels
- Four UXO items
- A single, empty 55-gallon (gal) drum

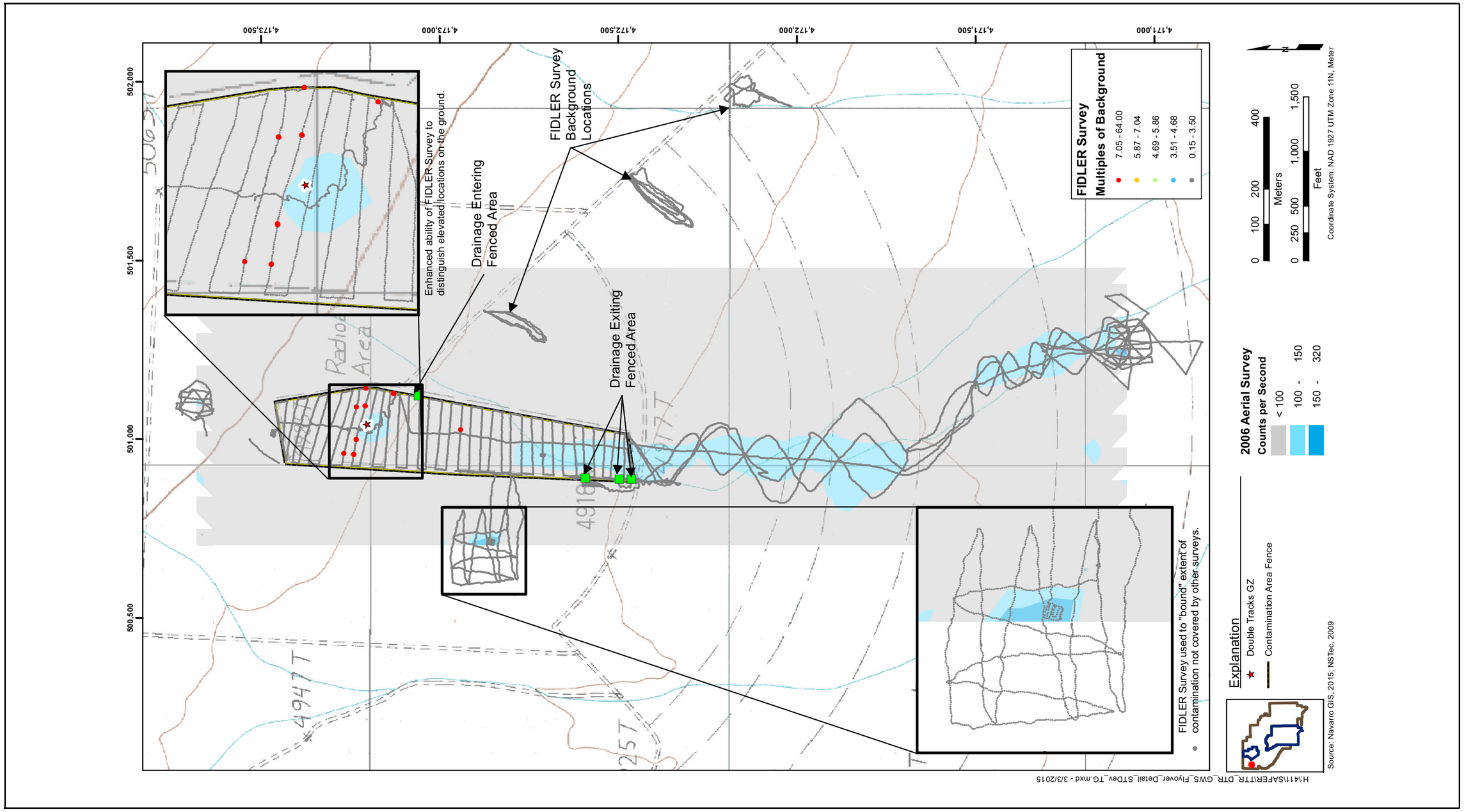

Figure 2-4
2012 FIDLER Survey Results

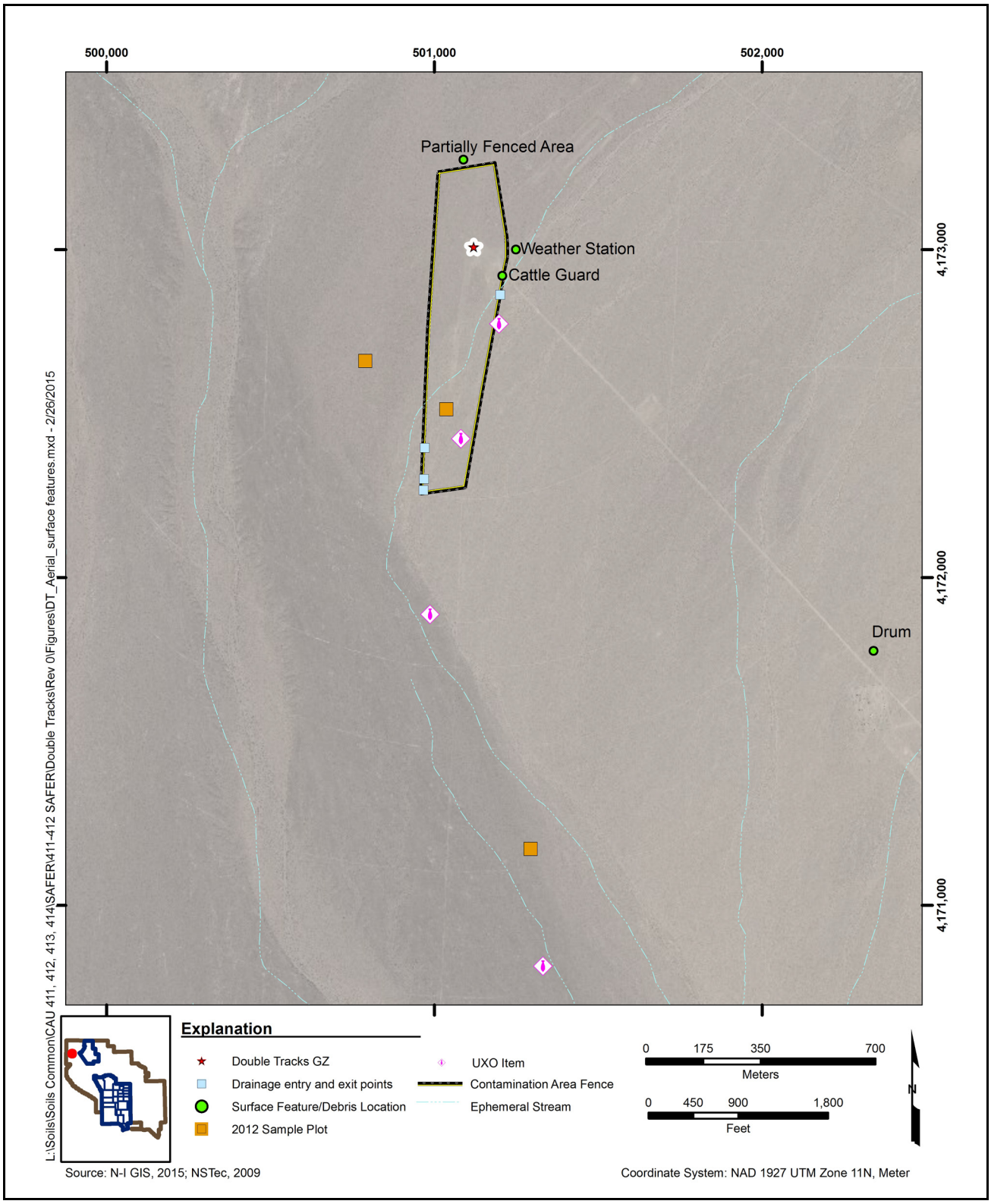

Figure 2-5
2012 Soil Sample Plot and Removable Contamination Survey Locations

The partially fenced area is located approximately 50 ft north of the CA fence. The original purpose of this area is unknown. A FIDLER survey of this general area did not identify elevated radiological readings. An abandoned weather station and a cattle guard are located east of the CA fence.

A drainage channel was identified that transects the fenced area of the DT site from the northeast to the southwest. This drainage channel appears to split into three separate channels as it exits the CA fence (Figure 2-4). A FIDLER survey was conducted of the three drainage channels that exit the fenced area along the southwestern edge of the CA fence. The survey did not identify any areas of elevated radioactivity in the drainages.

The four UXO items identified during the preliminary investigation were determined inactive (i.e., not live) by UXO personnel and left undisturbed.

The single metal 55-gal closed-top (bung) drum was identified south of the DT site along the access road. The drum is empty and has no identifiable markings. There are no visible indications of a release underneath the drum or in close proximity to the drum. It is unknown whether the drum is associated with DOE activities.

2.2.5.4 Soil Sampling

Soil sampling was performed at three sample plot locations: one located inside the fence and two outside the CA fence (Figure 2-5). A total of 12 soil samples were collected and analyzed for gamma spectroscopy, isotopic Pu, isotopic Am, and isotopic uranium (U). The results of these soil samples are presented in the *Preliminary Investigation Results and Recommendations for CAUs 411, 412, 413, and 414* report (N-I, 2013). These data will be combined with soil and thermoluminescent dosimeter (TLD) data collected during the CAI to determine whether COCs are present at CAU 411.

3.0 Data Quality Objectives

This section contains a summary of the DQO process that is presented in Appendix B. The DQO process is a strategic planning approach based on the scientific method that is designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommendation of viable corrective actions.

3.1 Summary of DQO Analysis

The DQO strategy for CAU 411 was developed at a meeting with NDEP and the USAF on November 20, 2014. The DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and to design a data collection program that will satisfy these purposes. During the DQO discussions for CAU 411, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 411 is as follows: "Existing information on the nature and extent of contamination is insufficient to determine whether site closure objectives have been achieved." To address this question, resolution of two decisions statements is required:

- **Decision I.** "Does any location exceed the FALs?"

  The FALs are developed using the risk-based decision process described in Section 3.2.1 and represent the action levels used in evaluating DQO decisions. The FALs are not established in the SAFER; rather, they will be presented in the CAU 411 CR. If either FAL is exceeded, then radiological contamination will be designated as a COC; additional corrective action will be required; and Decision II must be resolved.

- **Decision II.** "Is there sufficient information to achieve closure objectives?"

  Determining whether there is sufficient information takes into account the following:

  - The lateral and vertical extent of COC contamination
  - The information needed to predict potential remediation waste types and volumes

A corrective action will also be necessary if there is a potential for wastes that are present at the site to contain contaminants that, if released, could cause the surrounding soil to contain a COC. Such a

waste will be evaluated using the PSM criteria listed in the Soils risk-based corrective action (RBCA) document (NNSA/NFO, 2014) to determine the need for corrective action.

The informational inputs and data needs to resolve the problem statement and the decision statements were generated as part of the DQO process for this CAU and are documented in Appendix B. The information necessary to resolve the DQO decisions will be generated by collecting and analyzing samples generated during a field investigation. The presence of a COC will be determined by collecting and analyzing samples from locations determined most likely to contain a COC, based on the presence of a biasing factor.

Decision I soil plot samples will be submitted to the analytical laboratory for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241 analyses. Table B.2-2 presents the analytes that are reported by the laboratory for each of these analytical methods. The COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts, and inferred activities associated with the CAU.

The data quality indicators (DQIs) of precision, accuracy, representativeness, completeness, comparability, and sensitivity needed to satisfy DQO requirements are discussed in Section 7.2. Laboratory data will be assessed in the CR to confirm or refute the CSM and determine whether the DQO data needs were met.

3.2 Results of the DQO Analysis

3.2.1 Action Level Determination and Basis

NNSA/NFO uses an RBCA process to evaluate corrective actions. This process conforms with *Nevada Administrative Code* (NAC) 445A.227, which lists the requirements for sites with soil contamination (NAC, 2014a). For the evaluation of corrective actions, NAC 445A.22705 (NAC, 2014b) requires the use of ASTM International (ASTM) Method E1739 (ASTM, 1995) to "conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards or to establish that corrective action is not necessary."

The RBCA process, summarized in Figure 3-1, defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- **Tier 1 evaluation.** Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., preliminary action levels [PALs]).
- **Tier 2 evaluation.** Conducted by calculating Tier 2 action levels using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 action levels are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis.
- **Tier 3 evaluation.** Conducted by calculating Tier 3 action levels on the basis of more sophisticated risk analyses using methodologies described in ASTM Method E1739 that consider site-, pathway-, and receptor-specific parameters.

The PALs (i.e., Tier 1 action levels) presented in this document are used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation, thereby streamlining the consideration of remedial alternatives. All data collected during the CAI will initially be compared to the PALs.

The FALs may then be established as the PALs, or different FALs may be calculated using a Tier 2 evaluation. DQO decisions are based on comparison of data to FALs, not the PALs. The FALs, along with the basis for their selection, will be proposed in the CAU 411 CR. The RBCA process used to establish FALs is described in the Soils RBCA document (NNSA/NFO, 2014).

3.2.1.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the U.S. Environmental Protection Agency (EPA) Region 9 Regional Screening Levels (RSLs) for chemical contaminants in industrial soils (EPA, 2015). Background concentrations for RCRA metals will be used instead of RSLs when natural background concentrations exceed the RSL. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established RSLs, the protocol

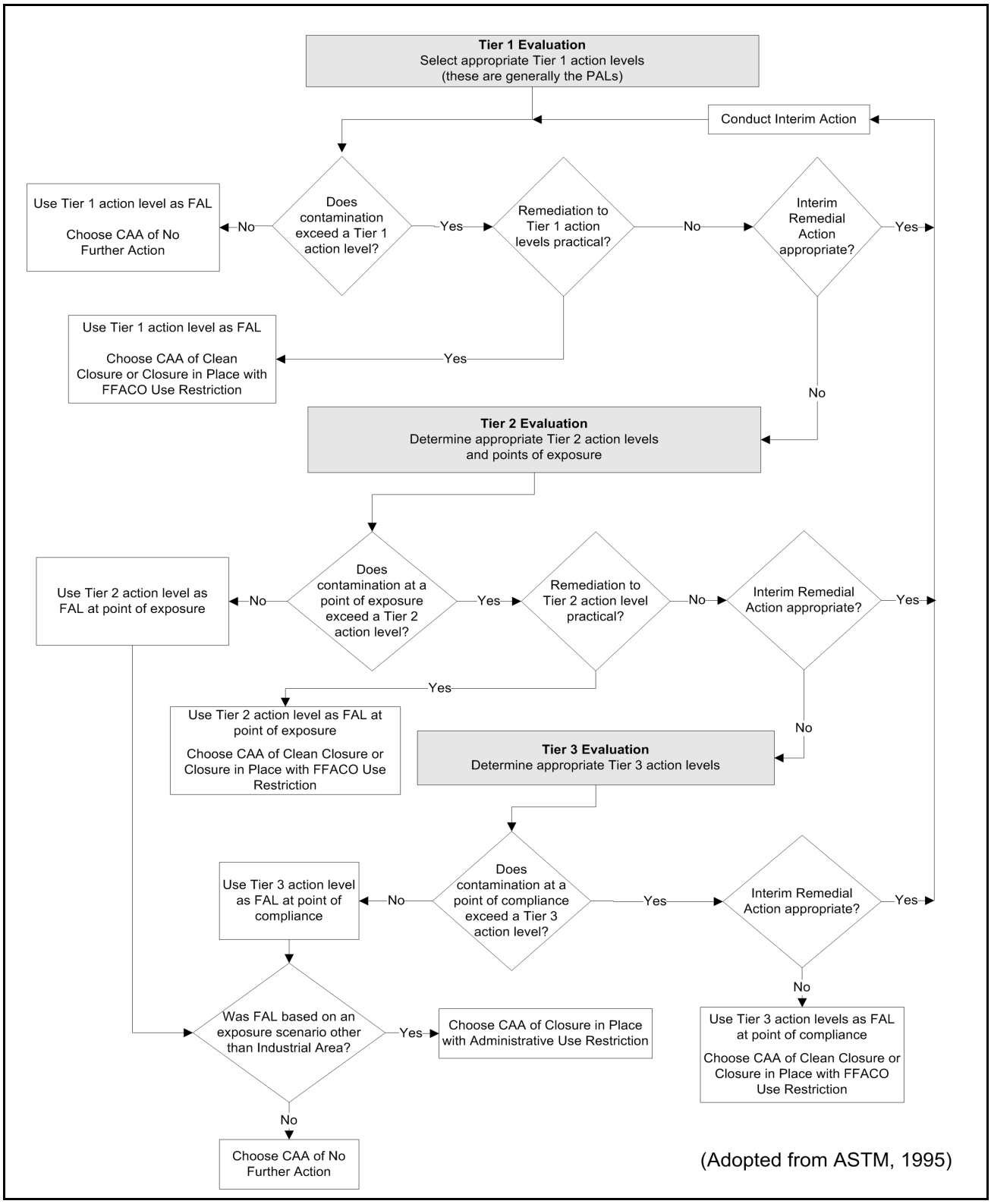

Figure 3-1
RBCA Decision Process

used by EPA Region 9 in establishing RSLs (or similar) will be used to establish PALs. If used, this process will be documented in the CR.

3.2.1.2 Radionuclide PALs

There are two radionuclide PALs for the DT site: (1) a radiological dose-based action level and (2) a removable contamination action level. The radiological dose PAL for the DT site is a total effective dose (TED) of 25 mrem/yr, based upon the construction worker exposure scenario developed by DOE, NDEP, and the USAF. The TED is calculated as the sum of external dose and internal dose. External dose is typically determined using TLD measurements. Internal dose is determined by comparing analytical results from soil samples to residual radioactive material guidelines (RRMGs) that are established using the RESRAD computer code (Yu et al., 2001). RRMGs are radionuclide-specific values for radioactivity in surface soils. The RRMG is the value, in picocuries per gram of surface soil, for a particular radionuclide that would result in an internal dose of 25 mrem/yr to a receptor (under the appropriate exposure scenario) independent of any other radionuclide (assuming that no other radionuclides contribute dose).

The removable contamination PAL was agreed to by the stakeholders in the November 20, 2014, DQO meeting for CAU 411. This PAL is 2,000 dpm/100 cm^2 removable alpha contamination. Although the dose from onsite removable contamination is accounted for in the construction worker exposure scenario, the exposure of a receptor to removable contamination that may be inadvertently taken off site (e.g., on shoes, clothes) is not considered in the scenario. And, even though an area with removable contamination may not exceed the radiological dose-based PAL, it still may contain high levels of removable contamination that could be tracked offsite. In order to ensure that removable contamination is accounted for during FFACO site closure, the regulatory criteria for the DOE radiological control program are used to determine when corrective action is necessary. The PAL is based on 10 CFR 835, “Occupational Radiation Protection,” which contains the regulations governing the DOE occupational radiation control program (CFR, 2015). Under this program, areas that contain removable alpha contamination above this threshold require management as high contamination areas (HCAs), which carry strict access control requirements.

3.2.2 Hypothesis Test

The baseline condition (i.e., null hypothesis) and alternative condition are as follows:

- **Baseline condition.** Closure objectives have not been met.
- **Alternative condition.** Closure objectives have been met.

Sufficient evidence to reject the null hypothesis is as follows:

- The lateral and vertical extent of COC contamination
- The information needed to predict potential remediation waste types and volumes

3.2.3 Statistical Model

A combination of judgmental and probabilistic sampling approaches will be used in the CAI for the DT site. The location of the sample plots, TLDs, and removable contamination samples will be selected and evaluated judgmentally, and the soil samples collected within the sample plots will be collected and evaluated probabilistically. It is assumed that the soil and TLD sample data are not normally distributed and that the statistical test will be to compare results to the FALs.

3.2.4 Design Description/Option

The sampling design for the CAU 411 CAI includes soil and TLD sampling and removable contamination surveys. A biased sampling strategy will be used for Decision I samples to target areas with the highest potential for contamination. Sample locations will be selected based on process knowledge, previously acquired data, or the field-screening and biasing factors discussed in Section B.8.1.

Statistical methods that generate site characteristics will be used for evaluation of soil and TLD samples in calculating TED. The information provided from probabilistic sampling at the sample plots allows for establishing contaminant concentrations that represent the site as a whole. Random sample locations within each sample plot will be chosen using a random start, triangular grid method. If a sample cannot be collected from a pre-determined location for any reason (e.g., rock, caliche or buried concrete), the Site Supervisor will establish an alternate location at the nearest location where a sample can be obtained. The Site Supervisor has the discretion to modify the judgmental sample

locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

Because individual swipe sample results, rather than statistically based values, will be compared to the removable contamination PAL, statistical methods to generate site characteristics will not be used for the removable contamination samples.

3.2.5 Conceptual Site Model and Drawing

The CSM describes the most probable scenario for current conditions at the site and defines the assumptions that are the basis for identifying the future land use, contaminant sources, release mechanisms, migration pathways, exposure points, and exposure routes. The CSM was used to develop appropriate sampling strategies and data collection methods. The CSM was developed using information from the physical setting, potential contaminant sources, release information, historical background information, and physical and chemical properties of the potentially affected media, and COPCs. Figure 3-2 depicts a graphical representation of the CSM. Figure 3-3 depicts the conceptual pathways to receptors from CAU 411 release sources. If evidence of contamination that is not consistent with the presented CSM is identified during CAI sampling activities, the situation will be reviewed; the CSM will be revised; the DQOs will be reassessed; and a recommendation will be made as to how best to proceed. In such cases, the stakeholders will be notified and the DQOs will be revisited. A detailed discussion of the CSM is presented in Appendix B.

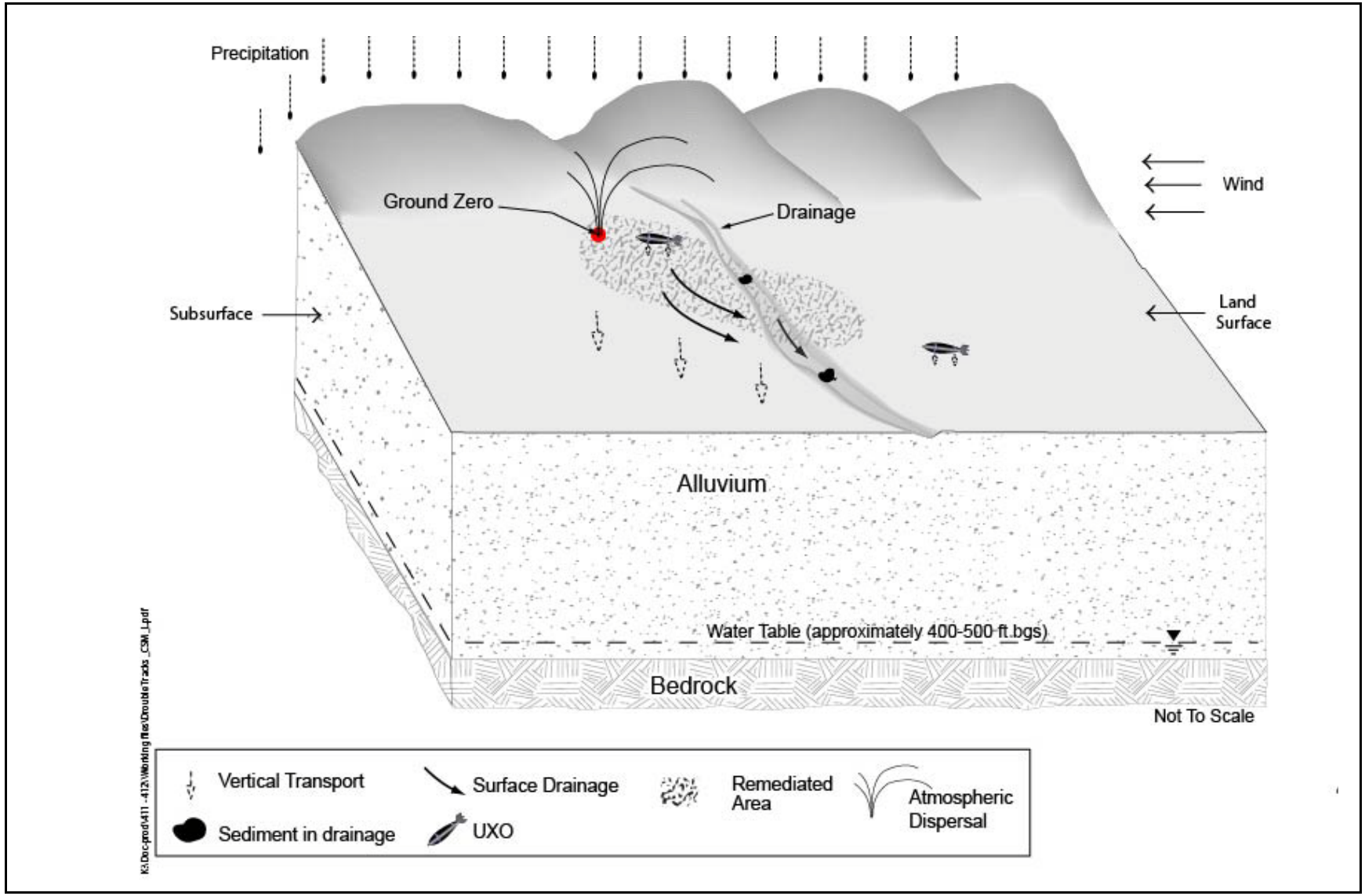

Figure 3-2
CSM for CAU 411

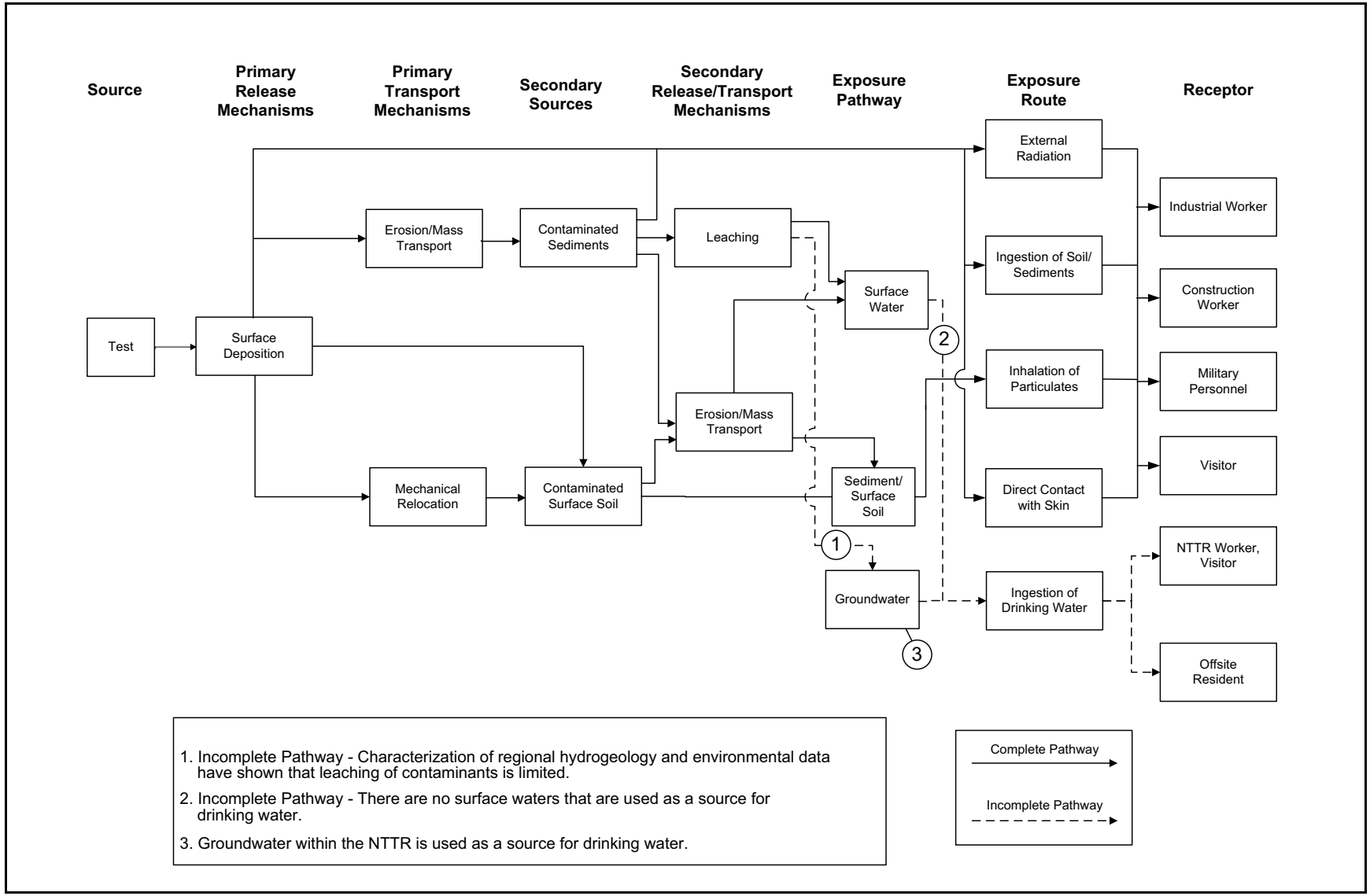

Figure 3-3
CSM Flowchart for CAU 411

4.0 Field Activities and Closure Objectives

This section of the SAFER Plan provides a description of the field activities and closure objectives for CAU 411. A CAI is planned to determine whether there are COCs present at the DT site and whether the site meets closure objectives. All sampling activities will be conducted in compliance with the Soils Activity QAP (NNSA/NSO, 2012c) and other applicable, approved procedures and instructions.

4.1 Contaminants of Potential Concern

COPCs were identified during the planning process through the review of site history, process knowledge, personnel interviews, past investigation efforts, and inferred activities associated with the CAU. The list of COPCs is intended to encompass all contaminants reasonably expected at the site that could contribute to a dose exceeding action levels.

The COPCs for CAU 411 are as follows:

- Pu-238
- Pu-239/240
- Pu-241
- Am-241
- U-234
- U-235
- U-238

Chemical COPCs are not reasonably expected to be present at CAU 411 based on the history of the DT experiment and on chemical analyses that were performed during previous investigations, as discussed in Section B.2.2.2.

4.2 Remediation

An interim corrective action was conducted at the DT site in 1996, as detailed in Section 2.2.3. The interim corrective action involved the removal of radioactively contaminated surface soil and subsurface soil and debris in the vicinity of GZ. The DQOs developed for CAU 411 require additional data collection to determine whether site closure objectives have been achieved and whether clean closure is the most appropriate corrective action for the site. As a result, additional soil and TLD

samples will be collected and radiological surveys conducted to confirm that the interim corrective action removed contamination to levels below the PAL (i.e., 25 mrem/yr using a construction worker exposure scenario). A decision point approach based on the DQOs is summarized in Figure 1-2.

4.3 Verification

The information necessary to determine whether the CAU 411 closure objectives have been achieved and clean closure is the most appropriate corrective action for the DT site will be generated through the collection and analyses of soil samples and TLDs, collection of removable contamination swipe samples, and completion of radiological surveys during a CAI. This section presents the method used in selecting soil sample and TLD locations, a summary of the sampling methods and analytical requirements, and the criteria used to evaluate the investigation results. Additional detail regarding the sampling design may be found in Appendix B. Modifications to the sampling design may be required should unexpected field conditions be encountered. Significant modifications must be justified and documented in a Record of Technical Change before implementation. If an unexpected condition indicates that conditions are significantly different than the corresponding CSM, the activity will be evaluated and the decision makers will be notified.

4.3.1 Selection of Sample Locations

A biased sampling strategy was used for locating Decision I samples to target areas with the highest potential for radiological contamination. Sample plot locations were selected based on an evaluation of aerial and ground-based radiological survey data collected after the interim corrective action at the site. These surveys include a 2006 aerial survey and a 1996 ground-based KIWI survey. These radiological survey data (aerial and KIWI) were modeled to produce average values over each 1,000-m^2 area of the site; the resulting model was then used to bias the selection of the sample locations to the areas of highest radioactivity. Based on the model results, a total of four sample plots will be established at the DT site. Two sample plots will be located inside the CA fence at the two most elevated areas identified by the 1996 KIWI survey, and two plots will be located outside the CA fence at the two most elevated areas identified by the 2006 aerial survey. The proposed sample plot locations are shown in Figure B.8-1. In order to further bias these sample plot locations, a FIDLER survey of the area surrounding the proposed locations will be performed before the sample plot is established. The sample plot will be placed at the location of the highest FIDLER readings.

4.3.2 Soil and TLD Samples

Soil samples will be collected within each sample plot using a probabilistic sampling approach, as follows:

- Four composite samples will be collected from each sample plot.
- Each composite sample will be composed of nine subsamples taken from randomly selected locations within each plot. These locations will be predetermined using a random start with a triangular grid pattern (Figure B.8-2).
- The entire volume of the composited material collected will be submitted to the laboratory for analysis.

Decision I soil samples collected at CAU 411 will be submitted to the laboratory for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241 analyses (see Table B.2-2). Decision II samples will be submitted for the analysis of all unbounded COCs. In addition, samples will be submitted for analyses as needed to support waste management or health and safety decisions.

One TLD will be placed at the center of each sample plot at a height of 1 m (3.3 ft) above ground surface. TLDs will also be placed at background locations in the vicinity of CAU 411 to measure naturally occurring radiation (e.g., cosmic, terrestrial). Three background TLDs will be placed at locations that are representative of the general area, but beyond the influence of the CAU 411 release.

TLD placement and processing will follow the protocols established in *Nevada Test Site Routine Radiological Environmental Monitoring Plan* (BN, 2003). TLDs will be left in place for a targeted total exposure time of 2,000 hours, or the resulting data will be adjusted to be equivalent to an exposure time of 2,000 hours.

4.3.3 Removable Contamination

Removable contamination data are obtained by collecting swipe samples from the surface of interest (e.g., an area of land, a piece of debris). In order to ensure that removable contamination is accounted for during FFACO site closure, the regulatory criteria for the DOE radiological control program are used to determine when corrective action is necessary. The PAL for removable contamination at the DT site is 2,000 dpm/100 cm^2 alpha contamination. This value is the same threshold value for

establishing an HCA under the DOE occupational radiation protection program in 10 CFR 835 (CFR, 2015). Thus, if HCA conditions are present at a site, corrective action under the FFACO is required, in addition to any radiological control requirements under 10 CFR 835.

Additional removable contamination data will be collected during the CAI from random locations within each of the two soil sample plots located inside the CA fence, to verify that removable contamination is below the posting threshold. These data, combined with removable contamination data from previous investigations, will be compared to the removable contamination PAL of 2,000 dpm/100 cm^2 to determine whether corrective action is required at the site.

4.3.4 PSM

Samples of PSM or soil potentially impacted by PSM will be collected judgmentally, based on visual and/or radiological biasing factors. The locations of surface debris identified during the 2012 preliminary investigation (Section 2.2.5.3) will be revisited during the CAI to determine whether any visual or radiological biasing factors (e.g., stained soil, elevated FIDLER readings) are present. If biasing factors are present, either a grab soil sample will be collected directly underneath the debris or a composite soil sample of the impacted area will be collected. If previously unidentified surface debris or impacted soil is identified during the CAI and biasing factors are present, samples of the debris and/or associated soil will be collected. PSM and soil samples will be analyzed for one or more of the following: gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, Pu-241, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and total RCRA metals. Sample analyses will be determined in the field based on the biasing factors present, the type of PSM, and the sample location. For example, if a lead brick is identified, the soil sample from underneath the brick may be analyzed for total RCRA metals only. If the brick is found inside the CA fence, this sample may also be analyzed for radiological constituents. Sample results will initially be compared to the radiological dose PAL and individual chemical PALs, as appropriate. If the PALs are exceeded, the data will be compared to the FALs to determine whether corrective action is required.

4.3.5 Drainages

The three drainages that exit the CA fence to the southwest (Figure 2-4) will be visually surveyed to locate sedimentation areas. Because the previous FIDLER survey of these drainages did not identify

any areas of elevated radioactivity, the sedimentation areas will be used to bias drainage sample locations. If present, the two sedimentation areas in each drainage channel located closest to the CA fence will be sampled. At each location, additional FIDLER surveys will be conducted to determine whether elevated radioactivity (i.e., above background levels) is present. Soil samples will be collected in the areas of highest radioactivity, if present. A TLD will also be placed at each drainage sample location.

Soil samples will be collected at each sample location as follows:

- At each sample location within the sediment accumulation area, a sample will be collected from each 5-cm depth interval until native material is encountered or until a significant reduction in radiological screening levels is measured.
- Each sample will be field screened with an alpha/beta detection instrument and compared to the established background field-screening level (FSL) for the site.
- If the depth sample with the highest field-screening result (FSR) is not significantly different (at least 20 percent difference) than the FSR of the surface sample, then only the surface sample will be submitted for analysis. If the FSR is greater than 20 percent higher than the surface sample, then both the surface sample and the depth sample with the highest elevated FSR will be submitted for analysis.
- If the FSL is not exceeded in any depth sample, then only the surface sample will be submitted for analysis.

Soil samples from the drainages will be analyzed for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241.

If screening results are not significantly different from the surface results, it will be assumed that buried contamination does not exist. If screening results are significantly different from the surface results, it will be assumed that buried contamination exists. For subsurface screening and sampling, it will be conservatively assumed that the highest TED from either surface or subsurface samples will be used to resolve DQO decisions. If a subsurface sample results in a higher internal dose than a surface sample, a TLD-equivalent external dose will be calculated for the subsurface sample. This will be accomplished by establishing a correlation between RESRAD-calculated external dose from surface samples and the RESRAD-calculated external dose from the subsurface samples. This surface

TLD reading will be increased by this proportion to estimate a TLD-equivalent external dose for the subsurface soil.

4.3.6 Data Evaluation and Closure Verification

The dataset to be evaluated in verifying DT site closure will include (1) the removable contamination data collected outside the CA fence in 2010, (2) the soil sample and removable contamination data collected during the 2012 preliminary investigation, and (3) the data collected during the CAI. All soil sample data used in making DQO decisions will be validated. As evidenced in Figure B.8-1, two of the most elevated locations detected in the KIWI and aerial surveys were sampled during the 2012 preliminary investigation at the DT site. These soil sample results, and the results of the third 2012 sample plot location, will be combined with data from the CAI to evaluate the presence of radiological COCs at the DT site.

For soil and TLD samples, the TED will be calculated using the RRMG-calculated internal dose estimates from the soil samples and the external dose calculations from the TLDs. The 95 percent upper confidence limit (UCL) of the TED for each sample location will be established as the sum of the 95 percent UCL of the internal dose and the 95 percent UCL of the external dose. For the 2012 sample plot data for which no corresponding TLD data exist, the maximum TLD measurement from the CAI will be added to the internal dose calculated for the sample plot. The 95 percent UCL of the TED will be compared to the dose-based PAL of 25 mrem/yr. If the PAL is exceeded, the TED will be compared to the established FAL. Any 95 percent UCL of the average contaminant concentration above the FAL will result in radiological contamination being designated a COC at CAU 411.

- If no COCs are detected, the dose-based closure objective will have been met, and no additional corrective action will be required.
- If COCs are detected, the extent of contamination (based on dose) will be defined, and further corrective actions will be evaluated with the stakeholders (i.e., NDEP, USAF).

Removable contamination data will be evaluated against the PAL of 2,000 dpm/100 cm^2.

- If removable contamination is not detected above the PAL, the removable contamination closure objective will have been met, and no further corrective action will be required.

- If removable contamination is detected above the PAL, the data will be compared to the established FAL. If removable contamination is detected above the FAL, the extent of contamination will be defined, and further corrective actions will be evaluated with the stakeholders (i.e., NDEP, USAF).

4.4 Closure

The closure objectives for CAU 411 are as follows:

- Radiological contamination at the site is less than the FAL using the construction worker exposure scenario.
- Removable alpha contamination is less than the FAL.
- No PSM is present at the site, and any impacted soil associated with PSM has been removed so that remaining soil contains contaminants at concentrations less than the FALs.
- There is sufficient information to characterize investigation and remediation waste for disposal.

The corrective action of clean closure will be confirmed as appropriate for closure of CAU 411 if the above closure objectives have been achieved.

4.4.1 Changes in Land Use

The closure of CAU 411 under the FFACO means that the selected corrective action has been accepted and approved by NDEP and other stakeholders. The closure of CAU 411 under this SAFER Plan is based on the construction worker exposure scenario, which was agreed to by the stakeholders in the DQOs. If the agreed-upon scenario should change from what was evaluated in this SAFER, the closure of CAU 411 would have to be reevaluated to account for the new land use or exposure scenario. In the future, should the land custodian determine that a proposed mission use would not comport with the proposed closure of CAU 411, or that there is a proposed transfer/relinquishment of all or part of the NTTR that will impact CAU 411, then DOE will work with the custodian and NDEP to address and resolve cleanup issues associated with the proposed use or transfer/relinquishment. DOE remains responsible for working with NDEP, as needed to revise or renegotiate any closure agreements, and remains liable for all costs associated with any future negotiation and/or remediation action for CAU 411, consistent with its responsibilities under applicable law.

4.5 Duration

Table 4-1 provides a tentative duration of activities (in calendar days) for SAFER activities:

Table 4-1
SAFER Field Activities

Duration (days)	Activity
5	Site Preparation
2	Site Mobilization
21	Field Work
90	Sample Analysis
30	Data Validation and Assessment
120	Closure Report
60	Waste Management and Disposition

5.0 Reports and Records Availability

Reports generated during ongoing field activities will be provided to NDEP and USAF upon request. Historical information and documents referenced in this plan are retained in the NNSA/NFO project files in Las Vegas, Nevada, and can be obtained through written request to the NNSA/NFO Soils Activity Lead. This document is available in the DOE public reading facilities located in Las Vegas and Carson City, Nevada, or by contacting the appropriate DOE Soils Activity Lead.

6.0 Investigation/Remediation Waste Management

Investigation/remediation waste generated during the CAU 411 CAI will be managed in accordance with all applicable DOE orders, federal and state regulations, and agreements and permits between DOE and NDEP. Wastes will be characterized based on these regulations using process knowledge, FSRs, and analytical results from investigation and waste samples. Disposable sampling equipment and personal protective equipment (PPE) are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., metal and concrete). These wastes may be characterized based on CAI sample results of associated samples, process knowledge, or directly sampled. Chemicals were not known to be used or present at this CAU in a manner that would generate listed hazardous waste; therefore, wastes will be characterized based on their chemical characteristics.

6.1 Waste Minimization

The CAI will be conducted so as to minimize the generation of wastes using process knowledge, segregation, visual examination, and/or field screening (e.g., radiological survey and swipe results) to avoid cross-contaminating uncontaminated soil or uncontaminated investigation-derived waste (IDW) that would otherwise be characterized and disposed of as industrial waste. As appropriate, soil and debris will be returned to their original location. To limit unnecessary generation of hazardous or mixed waste, hazardous materials will not be used during the CAI unless approved before use. Other waste minimization practices will include, as appropriate, avoiding contact with contaminated materials, performing dry decontamination or wet decontamination over source locations, and carefully segregating waste streams.

6.2 Potential Waste Streams

The anticipated waste streams to be generated during the CAU 411 field investigation include industrial and low-level radioactive IDW. These waste streams may be in the form of disposable sampling equipment, PPE, debris, and potentially small volumes of soil.

Known debris at the site includes an empty drum, UXO, and small metal fragments. Debris that is removed during the CAI will be managed as IDW, unless it is eligible for recycling.

6.2.1 Industrial Waste

Industrial IDW will be collected, managed, and disposed of in accordance with the solid waste regulations and the permits for operation of the NNSS Solid Waste Disposal Sites. Industrial IDW generated at CAU 411 will be collected in plastic bags, sealed, labeled with the CAU number, and dated. The waste will then be placed in a roll-off box or similar storage container. The number of bags of industrial IDW placed in the roll-off box will be counted as they are placed in the roll-off box, noted in a log, and documented in the field activity daily log. These logs will provide necessary tracking information for ultimate disposal.

6.2.2 Low-Level Waste

Low-level radioactive wastes, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE orders, and the requirements of the current version of the *Nevada National Security Site Waste Acceptance Criteria* (NNSA/NSO, 2012b). Potential radioactive waste drums containing soil, PPE, and/or disposable sampling equipment may be staged and managed at a designated radioactive material area.

7.0 QA/QC

The overall objective of the characterization activities described in this SAFER Plan is to collect accurate and defensible data to support the closure of CAU 411. All characterization activities, including those related to TLD measurements, will be conducted in accordance with the Soils QAP (NNSA/NFO, 2012c) and the Soils RBCA document (NNSA/NFO, 2014), which define rigorous data quality requirements. Sections 7.1 and 7.2 discuss the collection of required quality control (QC) samples in the field and quality assurance (QA) requirements for laboratory/analytical data to achieve closure.

7.1 Sample Collection Activities

Field QC samples will be collected in accordance with established procedures. Field QC samples are collected and analyzed to aid in determining the validity of environmental sample results. The number of required QC samples depends on the types and number of environmental samples collected. The minimum frequency for collecting and analyzing QC samples for this CAI, as determined in the DQO process, is as follows:

- Field duplicates (1 per 20 grab (judgmental) environmental samples, or 1 per CAU if less than 20 collected)

Additional QC samples may be submitted based on site conditions at the discretion of the Task Manager or Site Supervisor. Field QC samples must be analyzed using the same analytical procedures implemented for associated environmental samples. Additional details regarding field QC samples are available in the Soils Activity QAP (NNSA/NSO, 2012c).

7.2 Applicable Laboratory/Analytical Data Quality Indicators

As stated in the DQOs (see Appendix B) and in the Soils QAP (NNSA/NFO, 2012c), data used for making DQO decisions will be evaluated for data quality. The Soils QAP defines and establishes data quality criteria that are evaluated in three defined steps:

1. Data Verification
2. Data Validation
3. Data Quality Assessment

Data verification will include an evaluation of all chemical and radiological laboratory data for data quality in accordance with company-specific procedures. The data will be reviewed to evaluate the completeness, correctness, and conformance of each dataset. This verification will include a review of sample collection, handling and transfer, and documentation associated with sampling activities.

Data validation must be performed on a portion of the environmental sample results to determine the analytical quality of a dataset. Data validation criteria must be based upon the DQOs and the intended use of the data. Validation should include an evaluation of method and contract compliance, data calculations, QC and calibration verifications, raw data, and data generation methods. Validation can include qualifying data that may restrict or limit data use. The data validation includes an evaluation of the DQI criteria for the following:

- Precision
- Accuracy/bias
- Representativeness
- Completeness
- Comparability
- Sensitivity

Data that do not meet the DQI criteria must be evaluated for usability in the investigation report.

A data quality assessment (DQA) must be performed to determine whether the data meet the DQO requirements of the investigation and the performance criteria for the DQIs as defined in the Soils QAP (NNSA/NFO, 2012c). The DQA considers how the data relate to decisions to be made, the intended use of the data, and whether data are suitable for making those decisions. The results of this assessment will be documented in the investigation report. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

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Appendix A

Activity Organization

A.1.0 Activity Organization

The NNSA/NFO Soils Activity Lead is Tiffany Lantow. She may be contacted at (702) 295-7645. The identification of the activity Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate plan. However, personnel are subject to change and it is suggested that the NNSA/NFO Soils Activity Lead be contacted for further information. The Task Manager will be identified in the FFACO Monthly Activity Report prior to the start of field activities.

Appendix B

DQO Process

B.1.0 Introduction

The DQO process described in this appendix is a seven-step strategic systematic planning method used to plan data collection activities and define performance criteria for the CAU 411 CAI. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to determine the appropriate corrective actions, to verify the adequacy of existing information, to provide sufficient data to implement the corrective actions, and to verify that closure was achieved.

The CAU 411 CAI is based on the DQOs presented in this appendix as developed by representatives of the USAF, NDEP, and NNSA/NFO. The seven steps of the DQO process presented in Sections B.2.0 through B.8.0 were developed in accordance with EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006). In general, the procedures used in the DQO process provide the following:

- A method to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study.
- Criteria that will be used to establish the final data collection design such as
  - the nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated,
  - the decisions or estimates that need to be made and the order of priority for resolving them,
  - the type of data needed, and
  - an analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings.
- Acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data.
- A data collection design that will generate data meeting the quantitative and qualitative criteria specified. A data collection design specifies the type, number, location, and physical quantity of samples and data, as well as the QA and QC activities that will ensure that sampling design and measurement errors are managed sufficiently to meet the performance or acceptance criteria specified in the DQOs.

B.2.0 Step 1 - State the Problem

Step 1 of the DQO process defines the problem that requires study, identifies the planning team, and develops a conceptual model of the environmental hazards to be investigated. The problem statement for CAU 411 is as follows: "Existing information on the nature and extent of contamination is insufficient to determine whether site closure objectives have been achieved."

B.2.1 Planning Team Members

The DQO planning team consists of representatives from the USAF, NDEP, and NNSA/NFO. The DQO planning team met on November 20, 2014, for the DQO meeting.

B.2.2 Conceptual Site Model

The CSM is used to organize and communicate information about site characteristics. It reflects the best interpretation of available information at a given point in time. The CSM is a primary vehicle for communicating assumptions about release mechanisms, potential migration pathways, or specific constraints. It provides a summary of how and where contaminants are expected to move and what impacts such movement may have. It is the basis for assessing how contaminants could reach receptors both in the present and future. The CSM describes the most probable scenario for current conditions at the site and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. Accurate CSMs are important as they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

The CSM was developed for CAU 411 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs.

The CSM consists of the following:

- Potential contaminant releases, including media subsequently affected
- Release mechanisms (the conditions associated with the release)

- Potential contaminant source characteristics, including contaminants suspected to be present and contaminant-specific properties
- Site characteristics, including physical, topographical, and meteorological information
- Migration pathways and transport mechanisms that describe the potential for migration and where the contamination may be transported
- The locations of points of exposure where individuals or populations may come in contact with a COC associated with the CAU
- Routes of exposure where contaminants may enter the receptor

If additional elements are identified during the CAI that are outside the scope of the CSM, the DQOs will be revisited and revised by the stakeholders before completion of the CAI.

Table B.2-1 provides information on CSM elements that will be used throughout the remaining steps of the DQO process. Figure B.2-1 depicts a representation of the conceptual pathways to receptors from CAU 411 sources and Figure B.2-2 depicts a graphical representation of the CSM.

B.2.2.1 Release Sources

The most likely locations of the contamination and releases to the environment are surface soils onto which radionuclides were dispersed by the test and soils adjacent to the area disturbed by the 1996 interim corrective action.

B.2.2.2 Potential Contaminants

Release-specific COPCs were identified during the planning process through the review of site history, process knowledge, personnel interviews, past investigation efforts, and inferred activities associated with the CAU. The list of COPCs is intended to encompass all contaminants reasonably expected at the site that could contribute to a dose or risk exceeding action levels.

The COPCs for CAU 411 are as follows:

- Pu-238
- Pu-239/240
- Pu-241
- Am-241

Table B.2-1
CSM Description of Elements for CAU 411

CAS Identifier	NAFR-23-01
CAS Description	Pu Contaminated Soil
Site Status	Inactive, abandoned
Exposure Scenario	Construction Worker
Sources of Potential Soil Contamination	Atmospheric deposition of radionuclides from storage-transportation test
Location of Contamination/ Release Point	Surface soil surrounding and downwind of GZ
Amount Released	Unknown
Affected Media	Surface soil (0 to 5 cm)
Potential Contaminants	Pu-238, Pu-239/240, Pu-241, Am-241, U-234, U-235, U-238
Transport Mechanisms	Percolation of precipitation through subsurface media serves as the major driving force for migration of contaminants. Surface water runoff may provide for the transportation of some contaminants via surface drainages within or outside the CAU. Wind may cause limited resuspension and transport of windborne contaminants.
Migration Pathways	Vertical and lateral transport
Lateral and Vertical Extent of Contamination	Contamination, if present, may be contiguous or non-contiguous to the release points, due to major remediation activities at the site. Groundwater contamination is not expected. Lateral and vertical extent of COC contamination is assumed to be within the spatial boundaries.
Exposure Pathways	The potential for contamination exposure is limited to personnel conducting periodic inspections or radiological surveys, personnel conducting UXO retrieval operations, or future construction activities. These human receptors may be exposed to COCs through oral ingestion or inhalation of, or dermal contact (absorption) with soil and/or debris due to inadvertent disturbance of these materials, or irradiation by radioactive materials.

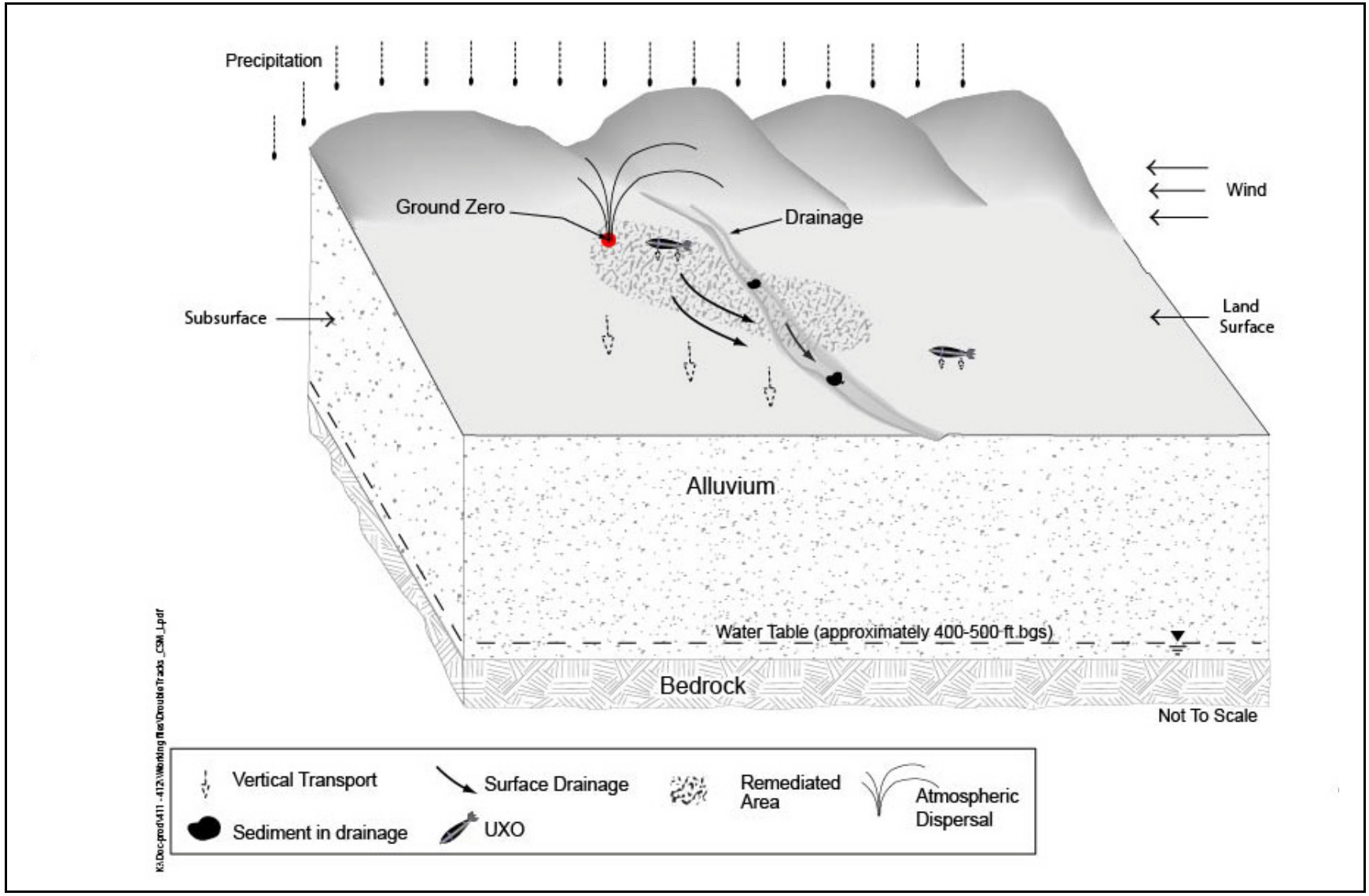
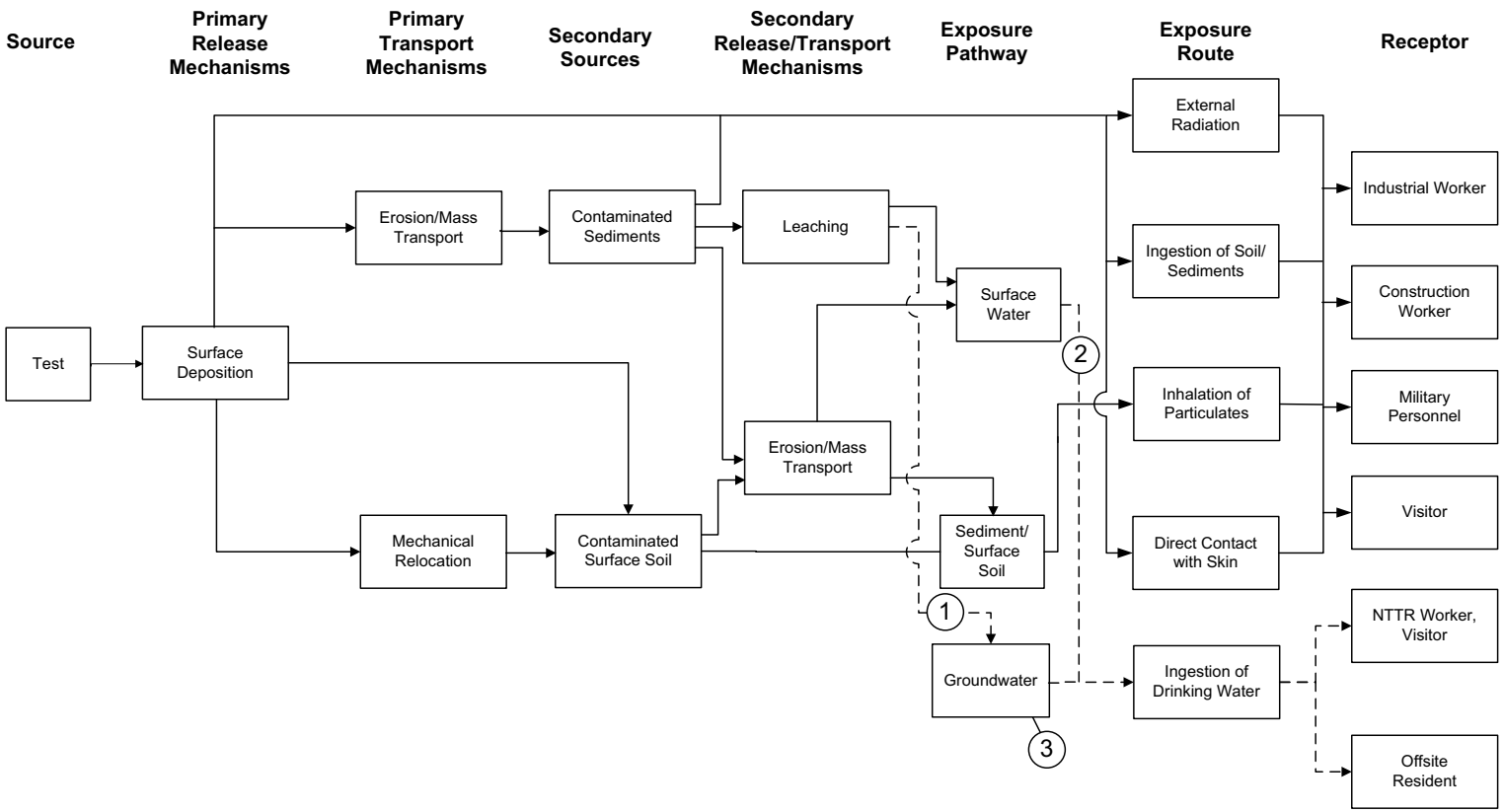


Figure B.2-1
CSM for CAU 411



1. Incomplete Pathway - Characterization of regional hydrogeology and environmental data have shown that leaching of contaminants is limited.
2. Incomplete Pathway - There are no surface waters that are used as a source for drinking water.
3. Groundwater within the NTTR is used as a source for drinking water.

Complete Pathway →

Incomplete Pathway - - - - - - - - - - →

Figure B.2-2
CSM Flowchart for CAU 411

- U-234
- U-235
- U-238

Soil plot samples collected at CAU 411 will be submitted to the laboratory for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241 analyses. Table B.2-2 presents the analytes that are reported by the laboratory for each of these analytical methods.

Table B.2-2
Radionuclides Reported by Analytical Methods

Gamma Spectroscopy Method Ga-01-R [a]		Isotopic Pu Method Pu-02-RC [a]	Isotopic Am Method Am-01 [a]	Isotopic U Method U-02-RC	Lab-Specific Methods [b]
Actinium-228	Lead-212	Plutonium-238	Americium-241	Uranium-234	Plutonium-241
Aluminum-26	Lead-214	Plutonium-239/240	Americium-243	Uranium-235	
Americium-241	Niobium-94			Uranium-238	
Cesium-137	Potassium-40				
Cobalt-60	Proactinium-233				
Curium-243	Silver-108m				
Europium-152	Thallium-208				
Europium-154	Thorium-229				
Europium-155	Thorium-234				
Uranium-235	Neptunium-239				

[a]The Procedures Manual of the Environmental Measurements Laboratory, which includes HASL-300 Methods (DOE, 1997).
[b]The most current EPA, DOE, or equivalent accepted analytical method may be used, including Laboratory Standard Operating Procedures approved by the contractor in accordance with industry standards and the contractor's Statement of Work requirements.

HASL = Health and Safety Laboratory

Historical records indicate that during the DT experiment, the only materials known to have been released were radioactive materials. There are no historical records indicating that significant amounts of RCRA constituents were either present or released at the DT site (DOE/NV, 1996). In order to confirm that chemical COPCs were not present, previous investigation soil samples were analyzed for Target Analyte List metals and leachable RCRA metals via the TCLP. The results of the TCLP tests indicated leachable RCRA metals at concentrations below the regulatory criteria. Thus, no chemical COPCs are identified for CAU 411.

B.2.2.3 Contaminant Characteristics

Contaminant characteristics include, but are not limited to, solubility, density, and adsorption potential. In general, contaminants with large particle size, low solubility, high affinity for media, and/or high density can be expected to be found relatively close to release points. The radionuclides dispersed by the DT test (i.e., uranium and plutonium) have a high melting point and are generally found near GZ.

Based on the conclusions of a travel time analysis conducted for the DT site, the radionuclide contaminants at CAU 411 are moderately to highly adsorbed on the valley-fill alluvial materials present at the site (N-I, 2013a). This analysis was based primarily on regional groundwater models using conservative input parameters. The study suggests that the residual radioactive contamination on the ground surface at the DT site will travel 0.76 m over a 1,000-year time period. And, using the highest mobility rate, the contamination will not reach the water table for 878,000 years (N-I, 2013a).

B.2.2.4 Site Characteristics

The DT site is located in Stonewall Flat on Range 71N of the NTTR. The NTTR has a semiarid climate. Annual precipitation is low, approximately 6 in. per year (French, 1983). Stonewall Flat is bordered by the Cactus Range to the east, the Goldfield Hills to the north, and Stonewall Mountain to the south (Ekren et al., 1972). Greater precipitation in the mountains provides most of the recharge to the groundwater system; water that reaches the desert floor, such as at Stonewall Flat, is lost primarily through evaporation. The estimated annual rate of potential evaporation in the area is between 58 and 69 in. (Houghton et al, 1975). It has been estimated that less than 4 percent of all precipitation reaches the water table on the NTTR, with the rest being lost to evapotranspiration (USAF et al., 1991).

The DT site is relatively flat with surface runoff toward the southwest. Ephemeral surface drainage north, west, and east of the site gathers in the Stonewall Flat playa, which borders the south edge of the site. The site elevation is approximately 5,000 ft above mean sea level.

The depth of the alluvial material beneath the site is not accurately known but is suspected to be deeper than 250 m (800 ft). There are no groundwater wells close to the DT site. Groundwater in the vicinity of Stonewall Flat is at an elevation of approximately 1,400 m (4,500 ft), or approximately

150 m (500 ft) below ground surface (bgs) (Thomas et al., 1986). Groundwater in the closest well to the DT site, approximately 7 mi south of the site, is estimated at 400 ft bgs (N-I, 2013a).

Major plant species found on the site are shadscale (Atriplex confertifolia), budsage (Artemisia spinescens), winterfat (Ceratoides lanata), greasewood (Sarcobatus vermiculatus), burrobush (Hymenoclea salsola), and Indian ricegrass (Oryzopsis hymenoides). Soils are predominantly gravelly, sandy loams and gravelly loams (Leavitt, 1974); and blow-sand mounds are common beneath shrubbery.

B.2.2.5 Migration Pathways and Transport Mechanisms

Migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils. One shallow drainage channel was identified at the DT site. This channel transects the fenced area of the DT site from the east to the southwest. This ephemeral wash is usually dry but is subject to infrequent stormwater flows. These stormwater flow events provide an intermittent mechanism for both vertical and lateral transport of contaminants. Ground-based radiological surveys of the wash at the points where it exits the fenced area southwest of the fence were completed in 2012 (Figure 2-4). These surveys suggest that lateral migration of contaminants from the fenced area is not occurring; however, additional investigation of these drainages will be completed during the CAI.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high potential evapotranspiration (58 to 69 in.), and limited annual precipitation for this region (6 in.), percolation of infiltrated precipitation at the DT site does not provide a significant mechanism for vertical migration of contaminants to groundwater.

Wind is another potential migration pathway due to the presence of contamination on the ground surface. The potential for exposure to airborne contamination was studied at CAU 411 before, during, and after the interim corrective action in 1996. Section 2.2.2 discusses the results of this air monitoring. Based on the data, the highest calculated inhalation dose to a receptor was 1.4 mrem/yr (assuming an exposure duration of 2,000 hr/yr). This dose was calculated using the maximum Pu-239/240 concentration detected at the DT site in 1996, the year when the interim corrective actions took place (Black and Townsend, 1997; NNSA/NSO, 2003).

The CSM assumes there is little to no potential that earthmoving activities during the 1996 interim corrective action redistributed contamination within or adjacent to the excavation area. The heavy equipment used may have forced contamination downward into the excavation or moved contamination laterally during operations; however, based on the design of the interim corrective action, it is not likely that excavation activities resulted in surface contamination being inadvertently buried under uncontaminated soil. The objective of the interim corrective action was to remove surface and subsurface soil contaminated with radionuclides above the established cleanup level (DOE/NV, 1996a; NNSA/NSO, 2003). The removal of contaminated soil was verified by radiological field instruments immediately after excavation and by surveying the entire fenced area with the KIWI upon project completion (DOE/NV, 1996a; NNSA/NSO, 2003). Contamination that might have been pushed downward into the excavation would have been detected before further digging. Therefore, it is unlikely that the excavation area or adjacent areas have subsurface contamination at greater concentrations than the ground surface. As a result, the CSM does not include the potential for the presence of buried contamination at or near the interim corrective action excavation.

B.2.2.6 Exposure Scenario

In consultation with stakeholders, the foreseeable exposure scenario applicable to the CAU 411 site was selected as the construction worker exposure scenario (USAF, 2014). The construction worker is defined as an adult receptor who works at the CAU 411 site for 120 days per year (day/yr) for 8 hours per day (hr/day), for a total of 960 hr/yr. Additional detail on the exposure scenario for CAU 411 is presented in Section C.1.1.

B.3.0 Step 2 - Identify the Goal of the Study

Step 2 of the DQO process states how environmental data will be used in meeting objectives and solving the problem, identifies study questions or decision statement(s), and considers alternative outcomes or actions that can occur upon answering the question(s). Figure B.3-1 depicts the sequential flow of questions, answers, and action alternatives required to fulfill the objectives of the SAFER process.

B.3.1 Decision Statements

The Decision I statement is:

- "Does any location exceed the FALs?"

Two FALs will be established for the DT site: (1) a radiological dose-based action level and (2) a removable contamination action level. If the dose-based FAL is exceeded, then any COPC that has a 95 percent UCL of the average concentration above the FAL will result in that COPC being designated as a COC and Decision II must be resolved. If the removable contamination FAL is exceeded, then Decision II must be resolved.

The Decision II statement is:

- "Is there sufficient information to achieve closure objectives?"

Determining whether there is sufficient information takes into account the following:

- The lateral and vertical extent of COC contamination
- The information needed to predict potential remediation waste types and volumes

B.3.2 Alternative Actions to Decision I

If neither of the FALs are exceeded at the DT site, then further assessment of the CAU is not required and the CAA of clean closure without further corrective action will be selected. If either of the FALs is exceeded, then the extent of COC contamination will be defined and potential remediation waste types will be identified.

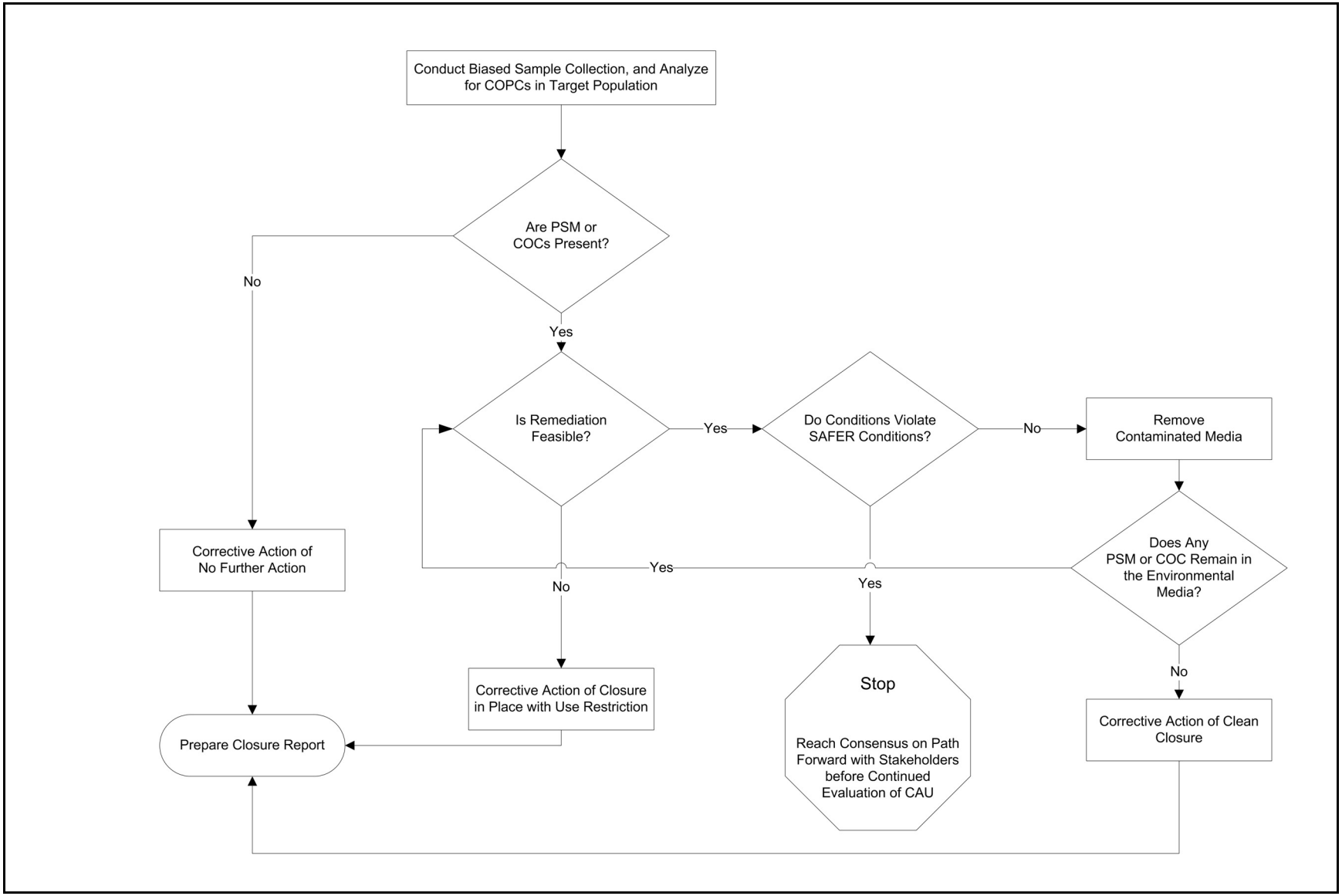


Figure B.3-1
SAFER Closure Decision Process for CAU 411

B.3.3 Alternative Actions to Decision II

If the extent of the COC contamination is defined and remediation is feasible, then the contaminated media and/or debris will be removed. If the extent of contamination has been determined and remediation is not feasible, then work will stop and a consensus reached with NDEP and the USAF on the path forward before investigation of the CAU may continue.

If sample analytical results are not sufficient to predict potential remediation waste types, then additional waste characterization samples will be collected.

B.4.0 Step 3 - Identify Information Inputs

Step 3 of the DQO process identifies the information needed, determines sources of information, and identifies sampling and analysis methods that will allow reliable comparisons with the FALs.

B.4.1 Information Needs

To resolve Decision I, samples will be collected and analyzed in accordance with the following criteria:

- Collected in areas most likely to contain a COPC
- Properly represent contamination at the CAU
- The analytical suite selected must be sufficient to identify any COCs present in the samples

The extent of COC contamination (Decision II) will be determined using one of the following methods:

- **Method 1.** TED rates need to be established at locations where the TED values bound the FAL dose rate and provide sufficient information to establish a coefficient of determination (or r^2) greater than 0.8 between TED values and radiation survey values. A boundary will then be determined around the radiation survey isopleth that correlates to the 25-mrem/yr FAL.

- **Method 2.** The lateral and vertical extent of COC contamination will be defined by sample results from locations contiguous to the contamination where TED or COC concentrations are less than the FAL.

- **Method 3.** The lateral and vertical extent of COC contamination will be defined by the entire lateral and vertical extent of a material with clearly identifiable physical properties that is assumed to be entirely contaminated at levels exceeding the FAL.

If additional information is needed to complete corrective actions, additional samples will be collected and analyzed.

B.4.2 Sources of Information

A large volume of information on the DT site was gathered during site investigation and interim corrective action activities in the mid-1990s and through various studies conducted afterwards.

Information and data from the following reports and surveys were considered in the development of this SAFER Plan:

- *Double Tracks Test Site Interim Corrective Action Plan* (DOE/NV, 1996a)
- *Double Tracks Test Site Characterization Report* (DOE/NV, 1996b)
- *Closure Report for Corrective Action Unit 411: Double Tracks Plutonium Dispersion* (NNSA/NSO, 2003)
- 1996 ground-based KIWI survey (NSTec, 2009)
- 2006 aerial radiological survey (NSTec, 2009)
- *Nevada Test and Training Range Results of the 10 CFR 835 Posting Compliance Field Investigation, Clean Slates I, II, and III and Double Tracks* (NSTec, 2011)
- *Preliminary Investigation Results and Recommendation for CAUs 411, 412, 413, and 414* (N-I, 2013b)

A summary of the information obtained in these efforts is presented in Section 2.2. Information generated in the mid-1990s was used to characterize the site, complete the interim corrective action, and confirm that the interim cleanup action levels had been met. The 1996 and 2006 radiological survey data and the 2010 posting compliance survey data were used to bias sampling during the 2012 investigation. The data obtained in the 2012 preliminary investigation will be used in conjunction with the data obtained in the CAI to determine whether site closure objective have been achieved at the DT site.

Information to satisfy Decision I will be generated by collecting soil and TLD samples, and conducting removable contamination surveys. Soil samples will be submitted to analytical laboratories meeting the quality criteria stipulated in the Soils Activity QAP (NNSA/NSO, 2012). TLDs will be submitted to the Environmental Technical Services group at the NNSS, which is certified by the DOE Laboratory Accreditation Program for dosimetry. Sample collection and handling activities will follow standard procedures.

B.4.2.1 Sample Locations

Design of the sampling approach for CAU 411 must ensure that the data collected are sufficient to answer the Decision I and II questions in this DQO. The soil and TLD sample locations, and the removable contamination surveys, were selected to coincide with the areas of highest detected radioactivity, based on existing radiological surveys. Section 4.3 discusses the selection of soil, TLD, and swipe sample locations for the CAI.

B.4.2.2 Analytical Methods

Analytical methods are available to provide the data needed to resolve the decision statements. The analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) are provided in the Soils Activity QAP (NNSA/NSO, 2012).

B.5.0 Step 4 - Define the Boundaries of the Study

Step 4 of the DQO process defines the target population of interest and its relevant spatial boundaries, specifies temporal and other practical constraints associated with sample/data collection, and defines the sampling units on which decisions or estimates will be made.

B.5.1 Target Populations of Interest

The populations of interest to resolve Decision I ("Does any location exceed the FALs?") are as follows:

- For radiological dose, the population of interest is the actual TED at the site. This is represented by the calculated TED. The calculated TED from each sample location is compared to the dose-based FAL.
- For removable contamination, the population of interest is the actual removable contamination at the site. This is represented by the swipe sample results, which are compared to the removable contamination FAL.
- For PSM, the population of interest is the PSM and/or the associated soil. The analytical results from the PSM and/or associated soil is compared to the radiological and chemical FALs.

The populations of interest to resolve Decision II ("Is there sufficient information to achieve closure objectives?") are as follows:

- For radiological dose, the TED and corresponding radiation survey values.
- For removable contamination, the removable contamination survey data from step-out locations.
- Investigation waste and potential remediation waste characteristics.

B.5.2 Spatial Boundaries

Spatial boundaries define the maximum lateral and vertical extent of the CSM. COC contamination identified beyond the vertical and lateral boundaries indicates a flaw in the CSM and requires reevaluation of the CSM before the CAI can proceed.

For CAU 411, the maximum vertical extent of the CSM is 5 cm (2 in.), and the lateral extent is 4 mi. The vertical extent is based on the results of the 1995 investigation at the DT site, before the interim corrective action. *In situ* measurements indicated that 80 to 90 percent of the radioactivity was present within the top 2.5 cm (1 in.) of the soil profile outside the GZ area (DOE/NV, 1996b). The GZ area contained buried contamination, which was estimated to extend 3 to 5 ft below the ground surface. Where significant amounts of plutonium (greater than 1,000 pCi/g) were present, it was assumed that the uppermost 5 cm (2 in.) of the soil profile was contaminated (DOE/NV, 1996). Soil that contained plutonium at greater than 200 pCi/g was removed in the interim corrective action, and the buried contamination at the GZ was removed. Therefore, any remaining contamination at the DT site is anticipated to be no greater than 5 cm (2 in.) in depth.

The lateral boundary of the CSM is based on the extent of detectable activity measured by the 2006 aerial radiological survey of the DT site (NSTec, 2007). The DT test scattered radioactive material, soil, concrete, and metal into the air. The debris and most of the soil fell to earth at relatively short distances; however, some of the finer-grained material was spread over a larger area downwind, south of GZ (NNSA/NSO, 2003). The extent of the radioactivity measured by the aerial radiological survey is non-continuous and covers an area of land approximately 1.5 mi long by 0.2 mi wide south of GZ (Figure 2-2).

B.5.3 Practical Constraints

No practical constraints that would prevent completion of CAI activities were identified at the DT site. However, activities or site conditions that may delay investigation at the site include military activities at the NTTR; weather (i.e., high winds, rain, lightning, extreme heat); and/or access restrictions.

B.5.4 Define the Sampling Units

The scale of decision making refers to the smallest, most appropriate area or volume for which decisions will be made. The scale of decision making for Decision I is defined as the CAU. A COC detected at any location will cause the determination that the site is contaminated and needs further evaluation. The scale of decision making for Decision II is defined as a contiguous area contaminated with any COC originating from the CAU. Resolution of Decision II requires this contiguous area to be bounded laterally and vertically.

B.6.0 Step 5 - Develop the Analytic Approach

Step 5 of the DQO process specifies appropriate population parameters for making decisions, defines action levels, and generates decision rules that define the conditions under which possible alternative actions will be chosen. This step also specifies the parameters that characterize the population of interest, specifies the FALs, and confirms that the analytical detection limits are capable of detecting FALs.

B.6.1 Population Parameters

Population parameters are the parameters that will be compared to action levels. For Decision I radiological soil sampling results, the population parameter is the calculated 95 percent UCL of the TED over the area of the sample plot. Resolution of DQO decisions associated with sample plot data requires determining, with a specified degree of confidence, whether the true TED at the site in question exceeds the FAL. Because a calculated TED is an estimate of the true (unknown) TED, it is uncertain how well the calculated TED represents the true TED. If the calculated TED were significantly different from the true TED, a decision based on the calculated TED could result in a decision error. To reduce the probability of making a false-negative decision error, a conservative estimate of the true TED is used to compare to the FAL instead of the calculated TED. This conservative estimate (overestimation) of the true TED will be calculated as the 95 percent UCL of the average TED values. By definition, there will be a 95 percent probability that the true TED is less than the 95 percent UCL of the calculated TED. The computation of appropriate confidence limits will be accomplished as described in the Soils RBCA document (NNSA/NFO, 2014). For Decision I, the 95 percent UCL will be used to compare with the FAL. For Decision II, the 95 percent lower confidence limit (LCL) of the regression will be used to determine the radiological survey value that corresponds to 25 mrem/yr of TED.

For Decision I and II removable contamination results, the population parameter is the measured value of removable alpha contamination swipe samples.

B.6.2 Action Levels

Two radiological PALs have been identified for the DT site. One is a radiological dose in mrem/yr, and the other is specific to removable contamination.

B.6.2.1 Radiological Dose

The radiological dose PAL is based on the guidelines for residual concentration of radionuclides in DOE Order 458.1 (DOE, 2013) and the exposure scenario developed by DOE, NDEP, and the USAF. The PAL for the DT site is a TED of 25 mrem/yr, based on the construction worker exposure scenario. The construction scenario is summarized in Section B.2.2.6 and described more fully in Appendix C.

The TED is calculated as the sum of external dose and internal dose. External dose is calculated using TLD data. Internal dose is determined by comparing analytical results from soil samples to RRMGs that were established using the RESRAD computer code (Yu et al., 2001). The RRMGs are radionuclide-specific values for radioactivity in surface soils. The RRMG is the value, in picocuries per gram of surface soil, for an individual radionuclide that would result in an internal dose of 25 mrem/yr to a receptor (under the appropriate land use scenario) independent of any other radionuclide (assuming that no other radionuclides contribute dose). In the RESRAD calculation, several input parameters are not specified so that site-specific information can be used. The default and site-specific input parameters used in the RESRAD calculation of RRMGs for the construction scenario are presented in Appendix D. The calculated RRMGs for the construction worker exposure scenario are presented in Appendix E.

Any COPC that has a 95 percent UCL of the average concentration above the FAL will result in that COPC being designated as a COC. If a COC is detected above the FAL, then the corrective action of clean closure with no further corrective action will be reevaluated.

B.6.2.2 Removable Contamination

The nature of the DT test resulted in the dispersion of radionuclides, a portion of which are in the form of “removable contamination.” Removable contamination is defined as radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or washing (NNSA/NSO, 2012). In order to ensure that removable contamination is accounted for

during FFACO site closure, a criterion from the DOE radiological control program is used to determine when corrective action is necessary for removable contamination. The PAL for removable contamination at the DT site is 2,000 dpm/100 cm^2 alpha contamination. If the removable contamination PAL is exceeded, the data will be compared to the removable contamination FAL. If the FAL is exceeded, the DT site would require corrective action under the FFACO and appropriate radiological controls in accordance with the DOE radiological control program.

B.6.3 Decision Rules

The decision rules applicable to the CAI are as follows:

Decision I

- If the radiological dose FAL or the removable contamination FAL is exceeded, then corrective action is required and Decision II must be resolved; else, no further corrective action is required and the selected corrective action for the DT site is clean closure.

Decision II

- If the spatial extent of any COC has not been defined, then additional information will be generated to define the extent using one of the methods described in Section B.4.1, else no further investigation will be necessary.

- If sufficient information is not available to determine the extent of removable contamination, then step out locations will be sampled; else, the extent of removable contamination is defined and corrective actions will be evaluated.

- If sufficient information is not available to determine waste types, additional waste samples will be collected; else, existing analytical data will be used to characterize waste.

B.7.0 Step 6 - Specify Performance or Acceptance Criteria

Step 6 of the DQO process defines the decision hypotheses, specifies controls against false rejection and false acceptance decision errors, examines consequences of making incorrect decisions from the test, and places acceptable limits on the likelihood of making decision errors.

B.7.1 Decision Hypotheses

The baseline condition (i.e., null hypothesis) and alternative condition for Decision I are as follows:

- **Baseline condition.** A COC is present.
- **Alternative condition.** A COC is not present.

The baseline condition (i.e., null hypothesis) and alternative condition for Decision II are as follows:

- **Baseline condition.** The extent of a COC has not been defined.
- **Alternative condition.** The extent of a COC has been defined.

Decisions and/or criteria have false-negative or false-positive errors associated with their determination. The impact of these decision errors and the methods that will be used to control these errors are discussed in the following subsections. In general terms, confidence in DQO decisions based on Decision I and II sampling results will be established qualitatively by the following:

- Confirming the CSM developed by the stakeholders during the DQO process.
- Conducting validity testing of the CSM based on investigation results.
- Evaluating data quality based on DQI parameters.

B.7.2 False-Negative Decision Error

The false-negative decision error would mean deciding that a COC is not present when it actually is (Decision I), or deciding that the extent of a COC has been defined when it has not (Decision II). In both cases the potential consequence is an increased risk to human health and environment.

For the DT CAI, the sampling design includes elements of both judgmental and probabilistic sampling. Each sample plot location is selected based on radiological biasing factors (i.e., results of aerial and ground-based radiological surveys), which is typical of a judgmental sampling approach.

The sample design of the sample plot itself is probabilistic in nature because the sample locations within the plot are random (i.e., non-biased) and the objective is to characterize the 100-m^2 area of the sample plot (as opposed to a single sample location). This combination of judgmental and probabilistic approaches results in data upon which the DQO decisions for the site as a whole are based.

B.7.2.1 False-Negative Decision Error for Judgmental Sampling

The false-negative decision error for judgmental sampling designs is controlled by meeting these criteria:

- For Decision I, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAU. For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- Having a high degree of confidence that the dataset is of sufficient quality and completeness.

To satisfy the first criterion, Decision I samples must be collected in areas most likely to be contaminated by COCs. The following characteristics must be considered to control decision errors for the first criterion:

- Source and location of release
- Chemical nature and fate properties
- Physical transport pathways and properties
- Hydrologic drivers

These characteristics were considered during the development of the CSM and selection of sampling locations. The sample plot and TLD locations will be further biased using FSRs collected in the vicinity of the proposed locations to ensure that the areas with the most elevated radiological measurements are sampled (see Section B.8.1). Radiological survey instruments and field-screening equipment will be calibrated and checked in accordance with the manufacturer's instructions and approved procedures. The DT CR will present an assessment on the DQI of representativeness, which will determine whether samples were collected from those locations that best represent the populations of interest as defined in Section B.5.1.

To satisfy the second criterion, Decision I samples will be analyzed for the radiological parameters listed in Section B.2.2.2. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (i.e., detection limits) that were less than or equal to the corresponding FALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives, and will be included in the DT CR.

To satisfy the third criterion, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, completeness, and comparability as defined in the Soils Activity QAP (NNSA/NSO, 2012). The DQIs of precision and accuracy will be used to assess overall analytical method performance as well as to assess the need to potentially qualify individual contaminant results when corresponding QC sample results are not within the established control limits for precision and accuracy. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the analyte performance criteria based on an assessment of the data. The DQI for completeness will be assessed to ensure that all data needs identified in the DQO have been met. The DQI of comparability will be assessed to ensure that all analytical methods used are equivalent to standard EPA methods so that results will be comparable to regulatory action levels that have been established using those procedures. Strict adherence to established procedures and QA/QC protocol protects against false negatives. To provide information for the assessment of the DQIs of precision and accuracy, the following QC samples will be collected:

- Field duplicates (1 per 20 grab [judgmental] environmental samples, or 1 per CAS if less than 20 collected)

B.7.2.2 False-Negative Decision Error for Probabilistic Sampling

The false-negative error rate goal for the DT site was established by the DQO meeting participants at 0.05 (or 5 percent probability). Upon validation of the analytical results, statistical parameters will be calculated for each COC identified at the site. Maintenance of a false-negative error rate of 0.05 is contingent upon the following:

- Sample size
- Actual variability
- Measurement error

Control of the false-negative decision error, therefore, for probabilistic sampling designs is accomplished by ensuring the following:

- A sufficient sample size was collected.
- The actual standard deviation of each major contaminant is calculated.
- Analyses conducted were sufficient to detect any COCs present in samples.

B.7.3 False-Positive Decision Error

The false-positive decision error would mean deciding that a COC is present when it is not, or a COC is unbounded when it is not, resulting in increased costs for unnecessary sampling and analysis.

False-positive results are typically attributed to laboratory and/or sampling and handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted in accordance with established, approved procedures and only clean sample containers will be used. To determine whether a false-positive analytical result may have occurred, the following QC samples will be collected:

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment rinsate blanks (1 per VOC sampling event)

For probabilistic sampling, the false-positive decision error rate goal was established by the DQO meeting participants at 0.20 (or 20 percent probability). Protection against this decision error is also afforded by the controls listed in Section B.7.2 for probabilistic sampling designs.

B.8.0 Step 7 - Develop the Plan for Obtaining Data

Step 7 of the DQO process selects and documents a sampling design that will yield data that will best achieve performance or acceptance criteria. The sampling design for the DT site includes collection of soil, TLD, and removable contamination samples. The location of the sample plots, TLDs, and removable contamination samples will be selected and evaluated judgmentally, and the soil samples collected within the sample plots will be collected and evaluated probabilistically. Samples of PSM or soil potentially impacted by PSM will be collected judgmentally, based on visual and/or radiological biasing factors. Investigation results will be compared to FALs to determine the need for corrective action.

B.8.1 Selection of Sampling Locations

A biased sampling strategy will be used for Decision I samples to target areas with the highest potential for contamination. Sample plot locations were selected based on an evaluation of aerial and ground-based radiological survey data collected after the interim corrective action at the site. These surveys include a 1996 ground-based KIWI survey and a 2006 aerial survey (Section 2.2.3). The 1996 survey was conducted after remediation at the DT site to confirm the removal of contamination to the target action level. Because interim corrective action operations were only conducted inside the CA fence, the KIWI data are limited to this area. The extent of the 2006 aerial survey is shown in Figure B.8-1, and includes the fenced CA and a significant portion of land to the south of the fence (i.e., downwind of DT GZ).

The radiological survey data (aerial and KIWI) were modeled to produce average values over each 1,000-m^2 area of the site; the resulting model was then used to bias the selection of the sample locations to the areas of highest radioactivity. The contours resulting from the model are presented in Figure B.8-1. Based on this model, a total of four sample plots will be established at the DT site. Two sample plots will be located at the two most elevated areas identified by the KIWI survey (inside the CA fence) that have not been previously sampled, and two plots will be located outside the CA fence at the two most elevated areas that have not been previously sampled identified by the 2006 aerial survey. The proposed sample plot locations, as well as the 2012 sample plot locations, are shown in Figure B.8-1. In order to further bias these sample plot locations, a FIDLER survey of the area

surrounding the proposed locations will be performed before the sample plot is established. The sample plot will be centered on the area of the highest FIDLER readings.

As evidenced in the top portion of Figure B.8-1, two of the most elevated locations detected in the KIWI and aerial surveys were sampled during the 2012 preliminary investigation at the DT site. These soil sample results, and the results of the third 2012 sample plot location, will be combined with data from the CAI to evaluate the presence of COCs at the DT site.

The selection of PSM sample locations will be based on the presence of PSM, radiological surveys, and/or visual biasing factors (e.g., soil staining).

B.8.2 Soil and TLD Samples

Radiological dose at the site will be calculated using data from soil samples and TLDs. Soil samples will be collected within each sample plot using a probabilistic sampling approach. One TLD will be placed in the center of each sample plot.

B.8.2.1 Soil Sample Plots

The probabilistic sampling scheme will be implemented to select sample locations within the sample plots and evaluate the analytical results. For each sample collected within the sample plot, randomly selected subsample locations will be chosen based on a random start, triangular pattern. If sufficient sample material cannot be collected at a specified location (e.g., rock, caliche, or buried concrete), the Site Supervisor will establish the location at the nearest place that a surface sample can be obtained. Composite samples will be collected at each sample plot in the following manner:

- Four composite samples will be collected from each sample plot.
- Each composite sample will be composed of nine subsamples taken from randomly selected locations within each plot. These locations will be predetermined using a random start with a triangular grid pattern (Figure B.8-2).
- Samples will be sieved to eliminate material greater than 0.25-in. diameter that cannot effectively be inhaled or ingested.
- The entire volume of the composited material collected will be submitted to the laboratory for analysis.

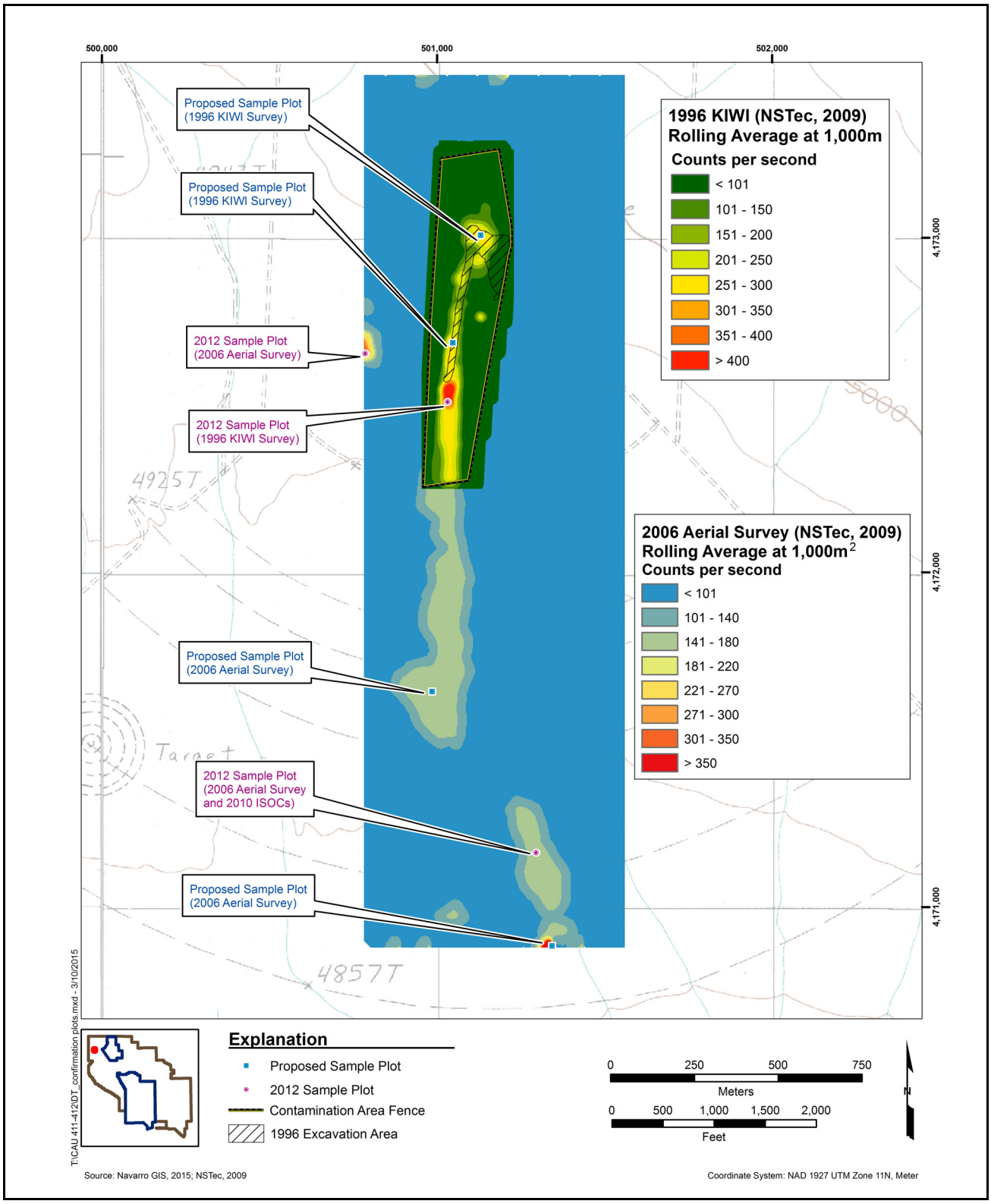


Figure B.8-1
Proposed Sample Locations at CAU 411

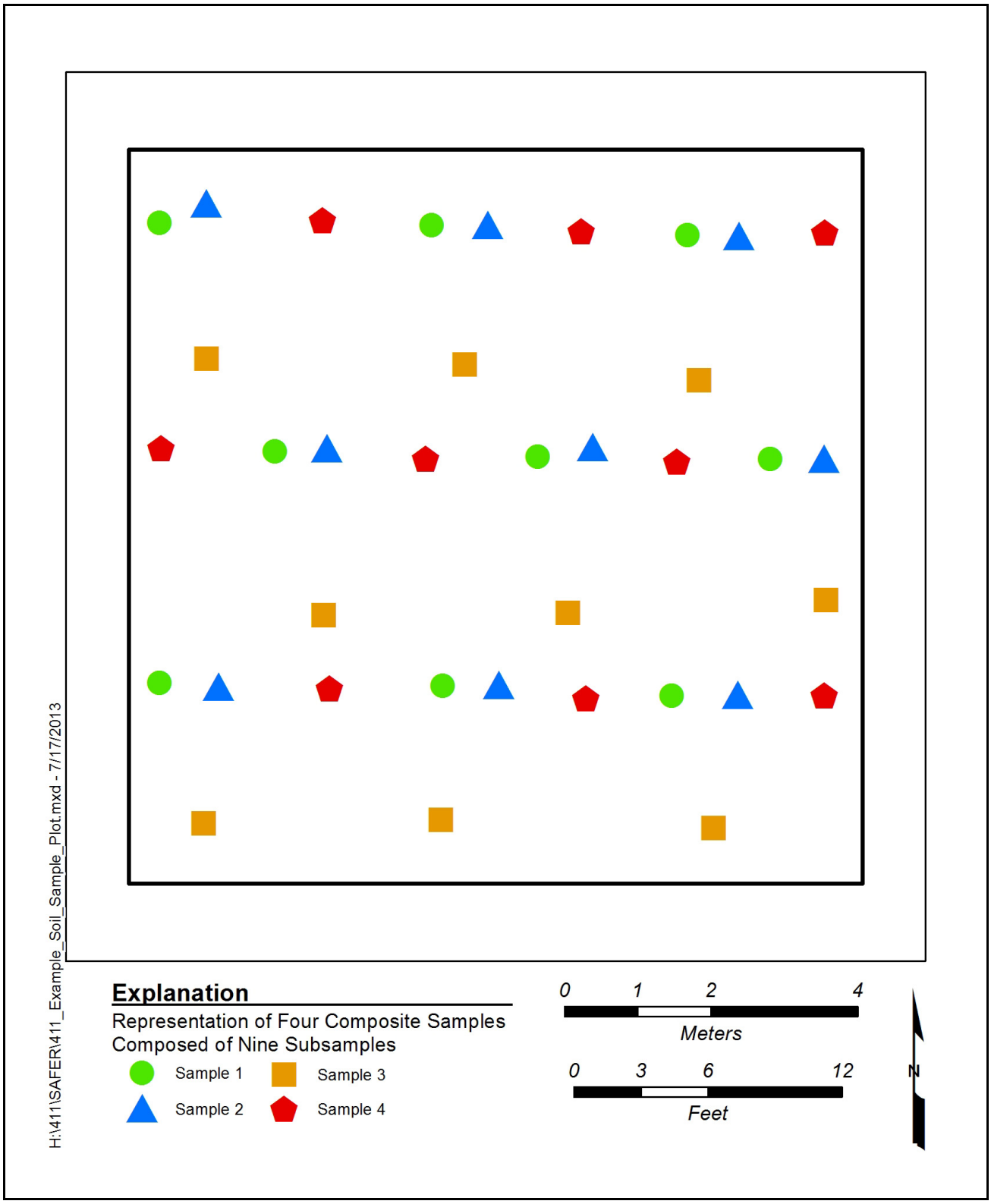


Figure B.8-2
Sample Plot Subsample Locations

Soil samples collected at CAU 411 will be submitted to the laboratory for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241 analyses. After sample analysis and validation, statistical methods will be used to establish internal dose estimates that represent the sample plot as a whole.

B.8.2.2 TLD Samples

One TLD will be placed at the center of each sample plot at the DT site, at a height of approximately 1 m (3.3 ft). TLD placement and processing will follow the protocols established in *Nevada Test Site Routine Radiological Environmental Monitoring Plan* (BN, 2003). TLDs will be left in place for a targeted total exposure time of 2,000 hours, or the resulting data will be adjusted to be equivalent to an exposure time of 2,000 hours. Three background TLDs will be placed at locations that are representative of the general area, but beyond the influence of the CAU 411 release.

B.8.2.3 Dose Calculation

The internal dose component of the TED is calculated using the soil sample results, and the external dose component is calculated using associated TLD results. The TED will be calculated as the sum of the RRMG-calculated internal dose estimates from the soil samples and the calculated external dose from the TLDs. The 95 percent UCL of the TED for each sample location will be established as the sum of the 95 percent UCL of the internal dose and the 95 percent UCL of the external dose. Appendix C contains additional information on the calculation of dose.

B.8.2.4 Minimum Sample Size

Because determination of the minimum sample size cannot be accomplished until after the data have been generated, the sufficiency of the number of samples collected will be evaluated based on TED results. For TED at sample plots, the minimum number of samples required for each sample plot will be calculated for internal dose (soil samples) and external dose (TLD elements) samples. The minimum sample size (n) was calculated using the following EPA sample size formula (EPA, 2006):

$$n = \frac{s^2(z_{.95} + z_{.80})^2}{(\mu - C)^2} + \frac{z^2_{.95}}{2}$$

where

s = standard deviation
$z_{.95}$ = z score associated with the false-negative rate of 5 percent
$z_{.80}$ = z score associated with the false-positive rate of 20 percent
μ = dose level where false-positive decision is not acceptable (12.5 mrem/yr)
C = FAL (25 mrem/yr)

The use of this formula requires the input of basic statistical values associated with the sample data. Data from a minimum of three samples are required to calculate these statistical values and, as such, the least possible number of samples required to apply the formula is three. Therefore, in instances where the formula results in a value less than three, three is adopted as the minimum number of samples required.

The results of the calculations for the determination of sample size sufficiency will be provided in the CAU 411 CR. If the criteria established in this section result in a determination that the minimum sample size was not met for a plot, additional soil samples may be collected to meet the sample size requirement. If these criteria cannot be met, justifications for use of the resulting TED without meeting the criteria will be justified, or it will be assumed that the TED exceeds the FAL.

B.8.3 Removable Contamination

Removable contamination data will be collected during the CAI from random locations at the two soil sample plots located inside the CA fence. These data, combined with removable contamination data from previous investigations, will be compared to the removable contamination FAL to determine whether corrective action is required at the site.

B.8.4 PSM

Samples of PSM or soil potentially impacted by PSM will be collected judgmentally, based on visual and/or radiological biasing factors. The results of the visual survey conducted at CAU 411 in 2012 identified surface debris at the site (Section 2.2.5.3). The locations of this debris will be revisited during the CAI to determine whether any biasing factors are present. If there are visual or radiological biasing factor identified at any of these locations, either a grab soil sample will be collected directly underneath the debris or a composite soil sample of the impacted area will be collected. If previously

unidentified PSM or potential impacted soil is identified during the CAI, samples of the PSM (e.g., drum contents) and/or associated soil will be collected. PSM and soil samples will be analyzed for one or more of the following: gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, Pu-241, VOCs, SVOCs, and total RCRA metals. Sample analyses will be determined in the field based on the biasing factors present, the type of PSM, and the sample location.

B.8.5 Drainages

The three drainages that exit the CA fence to the southwest (Section 2.2.5.3) will be visually surveyed to locate sedimentation areas. Because the previous FIDLER survey of these drainages did not identify any areas of elevated radioactivity, the sedimentation areas will be used to bias drainage sample locations. If present, the two sedimentation areas in each drainage channel located closest to the CA fence will be sampled. At each location, additional FIDLER surveys will be conducted to determine whether elevated radioactivity (i.e., above background levels) is present. Soil samples will be collected in the areas of highest radioactivity, if present. Soil samples from the drainages will be analyzed for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241. A TLD will be also be placed at each drainage sample location.

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Appendix C

Dose Calculation Methodology

C.1.0 Dose Calculation Methodology

Radiological dose at CAU 411 will be calculated using the construction worker exposure scenario and site-specific radiological data. The process for calculating radiological dose is summarized in the following subsections and presented in detail in the *Soils Risk-Based Corrective Action Evaluation Process* document (NNSA/NFO, 2014).

C.1.1 Scenario Definition

In consultation with stakeholders, a construction land use scenario was determined applicable to the CAU 411 site (USAF, 2014). This scenario assumes primarily outdoor construction activities that may include road construction/maintenance, underground utilities excavation, and/or target or other structure placement in the vicinity of CAU 411.The most exposed individual in this scenario is defined as an adult construction worker who works at CAU 411 for 120 day/yr, 8 hr/day, for a total of 960 hr/yr. The construction worker spends an average of 6 hr/day outdoors, and 2 hr/day indoors during the work day. The worker is exposed to surface soil, and subsurface soil to 0.45 m bgs to account for the placement of structure footers and/or building foundations. The worker receives an internal dose through incidental ingestion of surface and subsurface soil and inhalation of soil particulates. The worker receives an external dose through dermal contact (absorption) with soil and debris or by external irradiation. Dermal exposure to soil and debris is limited to the face, hands, and forearms. It is assumed the construction worker does not obtain drinking water from the site.

Using the construction worker exposure scenario assumptions, RRMGs specific to CAU 411 were calculated using RESRAD. The RRMGs are radionuclide-specific activities, in picocuries per gram, that will present a radiological dose of 25 mrem/yr, independent of other radionuclides. The input parameters for the RESRAD model are discussed in detail in Appendix D. Where possible, site-specific data were used for model input; RESRAD default parameters were used where appropriate.

At the request of the CAU 411 stakeholders, the impact a wound may have on total dose to a receptor at the DT site was evaluated. The evaluation used conservative assumptions, including a 1-µg deposition of radioactive material in the wound and the maximum concentrations of radionuclides

detected in soil at (1) a previously remediated site (DT) and (2) a site that has not been remediated (Clean Slate III). The evaluation concluded that the additional dose a potential receptor would receive from a wound imbedded with contaminated soil from either a remediated or non-remediated site was insignificant when compared to the 25-mrem/yr action level. The complete evaluation may be found in the "Evaluation of Personnel Dose as a Result of Wound Exposure from Contaminated Soils" (N-I, 2015).

C.1.2 Internal Dose Estimates

Internal dose is estimated using the radionuclide analytical results from soil samples and the corresponding RRMG (NNSA/NFO, 2014). The internal dose RRMG concentration for a particular radionuclide is that concentration in surface soil that would cause an internal dose to a receptor of 25 mrem/yr under the appropriate land use scenario, independent of any other radionuclide and assuming that no other radionuclides contribute dose. The internal dose RRMG for each detected radionuclide (in picocuries per gram of soil) is derived using RESRAD computer code (Yu et al., 2001) using the appropriate exposure scenario (NNSA/NFO, 2014). The construction worker exposure scenario was used for CAU 411. Dose estimates obtained from the use of RRMGs are valid only for the pathways and exposure scenario used in the calculation of the RRMGs.The RESRAD output data have been included in Appendix F.

The internal dose associated with any specific radionuclide in a single soil sample is established using the following equation:

$$\text{Dose (mrem/yr)} = \text{Analytical result (pCi/g)} / [\text{RRMG (pCi/g / 25 mrem/yr)}] \qquad \text{(Eq. 1)}$$

The internal dose (depending upon the RRMG used) would be calculated as the sum of the doses associated with each radionuclide present in the sample. The doses calculated from analytical results are conservatively assumed to be entirely from nuclear testing activities (i.e., no background radioactivity is subtracted from the results).

The analytical results used to calculate dose will be the detected values reported by the analytical laboratories with special consideration for U-235 and the reported Am and Pu isotopes. Because U-235 generally has a homogeneous distribution in soil, the more precise isotopic results will be used instead of the corresponding result reported from gamma spectrometry when an isotopic U-235 result is available.

The special consideration for Am and Pu isotope concentrations is related to the nature of these contaminants in soil. These isotopes may be present in soil in the form of small particles that may or may not be captured in a 1- to 2-gram portion of a soil sample as used for isotopic analyses. As individual particles of these radionuclides have high specific activities, they can make a significant impact on analytical results. This may result in analytical results from the same soil sample that are significantly different (i.e., poor accuracy). However, the Am and Pu isotopes are co-located (e.g., Am-241 is a daughter product of Pu-241), and the relative concentrations between different samples from the same site (i.e., the ratio of Am to Pu isotope concentrations) should be equal. Based on process knowledge and demonstrated by analytical results from previously sampled Soils Activity sites, the ratios between Am and Pu isotopes in soil contamination from any given source is expected to be the same throughout the contaminant plume at any given time.

Am-241 is reported by the gamma spectrometry method as well as the isotopic Am method. As the gamma spectrometry measurement is based on a much larger soil sample (usually 1 liter), the particle distribution problem discussed above is greatly diminished, and the probability of the result being representative of the sampled site is much improved. Therefore, the ratios between the Am and Pu isotopes will be established using the isotopic analytical results. These ratios will be used to infer concentrations of Pu isotopes using the gamma spectrometry results for Am-241.

C.1.3 External Dose Calculations

External dose may be estimated using the total dose RRMGs or may be calculated using TLD data, if available. Where TLD measurements are not available, such as at soil sample locations established during the preliminary investigation in 2012, the external dose component of TED is calculated using the total dose RRMGs in the following formula:

$$\textit{External Dose (mrem/yr)} = [\textit{Analytical result (pCi/g)/TED RRMG (pCi/g)}] \times 25 \textit{ mrem/yr}$$

The soil sampling design for the CAU 411 CAI includes emplacement of TLDs at soil sample locations. Thus, external dose at these locations will be calculated using TLD data. TLDs integrate the penetrating radiation dose at the location being evaluated. Because these devices will also integrate the external dose from natural sources of penetrating radiation (i.e., cosmic rays, radon, naturally occurring radionuclides in soil), a natural background external dose level must be subtracted from the gross TLD reading. The natural background external dose is estimated using the same methods used for the environmental TLDs except that these additional devices are placed in adjacent areas with similar characteristics that are not affected by the release.

The potential external dose at each TLD location is determined from the results of the TLD placed at a height of 1 m above the soil surface. The net external dose (the gross TLD dose reading minus the background external dose) is then divided by the number of hours the TLD was exposed to site contamination resulting in an hourly dose rate. That hourly dose rate is then multiplied by the same annual exposure time used to calculate the appropriate RRMG action level.

The TLDs used to measure external dose are the same as those used in the routine NNSS environmental monitoring program. These TLDs contain four individual elements. The readings from each element are compared as part of the routine QA checks during the TLD processing. External dose at each TLD location is then determined using the readings from TLD elements 2, 3, and 4. Element 1 is designed to measure dose to the skin and is not relevant to the determination of the external dose. Each of the elements is considered to be a separate, independent sample. A 95 percent UCL of the average of these samples will be calculated as the external dose for each TLD location.

Data from the TLD measurements meet rigorous data quality requirements. TLDs are obtained from, and measured by, the Environmental Technical Services group at the NNSS. This group is responsible for a routine environmental monitoring program at the NNSS. TLDs are submitted to the Environmental Technical Services group for analysis using automated TLD readers that are calibrated and maintained by the National Security Technologies, LLC, Radiological Control Department in accordance with existing QC procedures for TLD processing. A summary of the routine environmental monitoring TLD QC program can be found in the *Nevada Test Site Routine Radiological Environmental Monitoring Plan* (BN, 2003). Certification is maintained through the DOE Laboratory Accreditation Program for dosimetry.

The determination of the external dose component of the TED by TLDs was determined to be the most accurate method because of the following factors:

- *TLDs are exposed for an extended time period that approximates the 2,000 hours of exposure time used for the Industrial Area exposure scenario.* This eliminates errors in reading dose-rate meter scale graduations and needle fluctuations that would be magnified when as-read meter values are multiplied from units of "per-hour" to 2,000 hours.

- *The use of a TLD to determine an individual's external dose is the standard in radiation safety and serves as the "legal dose of record" when other measurements are available.* Specifically, 10 CFR Part 835.402 (CFR, 2015) indicates that personal dosimeters must be provided to monitor individual exposures and that the monitoring program that uses the dosimeters must be accredited in accordance with a DOE Laboratory Accreditation Program.

C.1.4 Total Effective Dose

The calculated TED is the sum of the internal dose and the external dose for each sample location. For soil sample plot locations where TLD data were not collected (i.e., preliminary investigation sample plots), TED was calculated as the sum of the estimated external dose and the 95 percent UCL of the average internal dose estimate. For soil sample locations where a TLD sample will be placed during the CAI, TED will be calculated as the sum of the 95 percent UCL of the average external dose and the 95 percent UCL of the average internal dose.

The calculated TED is an estimate of the true (unknown) TED. If a calculated TED were directly compared to the FAL, any significant difference between the true TED and the measured TED could lead to decision errors. Soil samples at CAU 411 will be collected from locations of highest radioactivity as shown by aerial and ground-based (KIWI) radiological surveys. Samples from these biased locations will produce TED results that are higher than from adjacent locations of lower radioactivity within the exposure area that is being characterized for dose. This will conservatively overestimate the TED of the exposure area and protect against false-negative decision errors.

C.2.0 References

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Appendix D

RESRAD Input Parameter Review

D.1.0 RESRAD Input Parameters

All RESRAD input parameters for the modeled pathways were identified and reviewed to ensure that appropriate values would be used in the development of RRMGs. These input parameters are presented in Table D.1-1 with their RESRAD default values and the values for the site-specific construction worker exposure scenario.

Table D.1-1
RESRAD Input Parameters for Construction Worker Exposure Scenario
(Page 1 of 2)

Parameter	Default	Site-Specific Value	Units
Area of contaminated zone	10,000	1,000	m^2
Thickness of contaminated zone	2	0.05	m
Cover depth	0	0	m
Density of contaminated zone	1.5	1.5	g/cm^3
Contaminated zone erosion rate	0.001	0	m/yr
Contaminated zone total porosity	0.4	0.43	None
Contaminated zone field capacity	0.2	0.2	None
Contaminated zone hydraulic conductivity	10	1,090	m/yr
Contaminated zone b parameter	5.3	4.9	None
Evapotranspiration coefficient	0.5	0.98	None
Wind speed	2	3.12	m/sec
Precipitation	1	0.096	m/yr
Irrigation	0.2	0	m/yr
Runoff coefficient	0.2	0.4	None
Inhalation rate	8,400	12,000	m^3/yr
Mass loading for inhalation	0.0001	0.0006	g/m^3
Exposure duration	30	25	years
Indoor dust filtration factor	0.4	1	None
External gamma shielding factor	0.7	0.7	None

Table D.1-1
RESRAD Input Parameters for Construction Worker Exposure Scenario
(Page 2 of 2)

Parameter	Default	Site-Specific Value	Units
Indoor time fraction	0.5	0.0274	None
Outdoor time fraction	0.25	0.0822	None
Soil ingestion	36.5	31.9	g/yr
Depth of soil mixing layer	0.15	0.45	m

g/cm^3 = Grams per cubic centimeter
g/m^3 = Grams per cubic meter
g/yr = Grams per year
m/sec = Meters per second
m/yr = Meters per year
m^3/yr = Cubic meters per year

Each parameter was reviewed for the following factors:

- Its role in the model
- How it affects model results
- How it relates to NTTR/TTR-specific conditions

While all parameters were reviewed, the parameters that had more effect on RRMG values received more scrutiny. Based on this review, values were determined and justified for each parameter that was considered to be conservatively representative of CAU 411 conditions.

D.2.0 Review of Individual Parameters

The RESRAD title screen as shown in Figure D.2-1 presents some basic options for setting up the model run and formatting the output. Input options for this title screen are discussed in Section D.2.1.

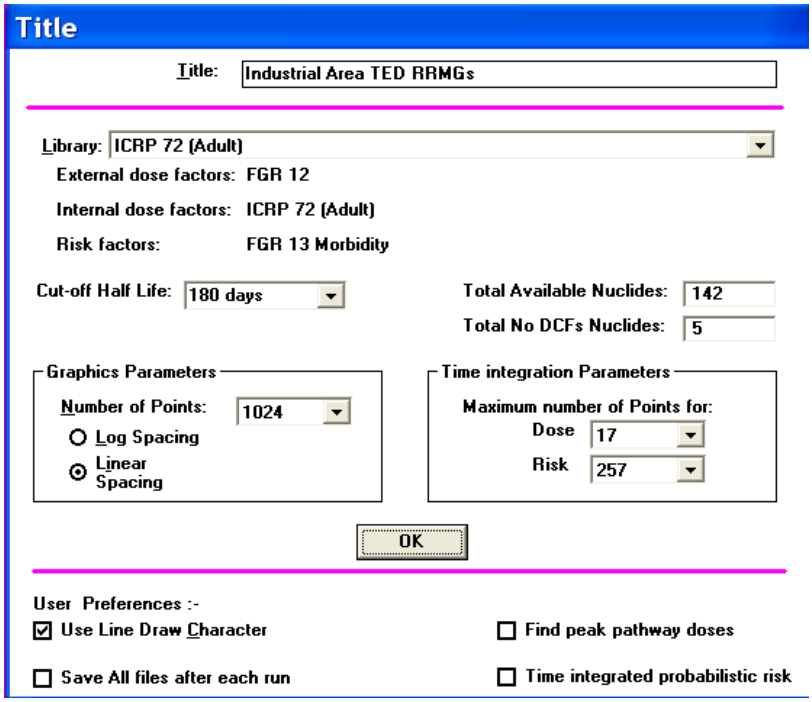

Figure D.2-1
RESRAD Title Screen

The following RESRAD input parameters were determined to be sensitive parameters and are discussed in Sections D.2.2 through D.2.10:

- Area of contaminated zone
- Thickness of contaminated zone
- Wind speed
- Inhalation rate
- Mass loading for inhalation
- Indoor dust filtration factor
- External gamma shielding factor
- Indoor time fraction and Outdoor time fraction
- Soil ingestion

The following RESRAD input parameters were determined to not be sensitive parameters and are discussed in Sections D.2.11 through D.2.19.

- Cover depth, Irrigation, and Contaminated zone erosion rate
- Density of contaminated zone and Contaminated zone total porosity
- Contaminated zone field capacity
- Contaminated zone hydraulic conductivity and Contaminated zone b parameter
- Evapotranspiration coefficient
- Precipitation
- Runoff coefficient
- Exposure duration
- Depth of soil mixing layer

The sources for each parameter are presented in the "Source(s)" subsections at the end of each individual parameter section.

How a change in a parameter value affects the RRMGs is addressed for each input parameter in the "Model Response to Parameter" subsections (e.g., Sections D.2.2.1, D.2.3.1, D.2.4.1) throughout this appendix. This evaluation is based on a sensitivity analysis in which a single parameter value is changed while the other parameter values remain fixed. This was accomplished as described in Kamboj et al. (2005), where the influence of a parameter considers both the change it makes on the RRMGs as well as the range of its values. Therefore, a reasonable minimum and maximum value for each parameter was determined along with the recommended value presented herein. The influence of each input parameter was calculated as a percent normalized dose difference (NDD) defined as the difference in RRMG values based on the minimum (Dlow) and maximum (Dhigh) input parameter values divided by the RRMG value based on the recommended input parameter value (Dbase), as follows:

$$NDD = [(Dhigh - Dlow)/Dbase] \times 100\%$$

An NDD was calculated for each input parameter and each radionuclide in the RRMG list. The NDDs for the TED are presented in Table D.2-1, and the NDDs for the internal dose are presented in Table D.2-2. If the NDD was greater than 10, the parameter was defined as a sensitive parameter for that radionuclide and is identified in the tables with dark gray shading. For NDD values between 5 and 10, the parameter was defined as moderately sensitive and is identified in the tables with light gray shading. Parameters with NDDs less than 5 were defined to be not sensitive.

Table D.2-1
Parameter NDD for TED

Parameter	Am-241	Cs-137	Eu-155	Pu-239	Sr-90	Th-232	U-234	U-235	U-238
Area of contaminated zone	70.0	38.8	23.8	372.6	65.4	57.2	444.1	32.5	42.5
Wind speed	4.0	0.0	0.0	10.1	0.0	1.3	4.0	0.0	0.3
Contaminated zone b parameter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Contaminated zone erosion rate	0.6	0.8	0.5	1.0	0.7	1.0	1.0	0.6	0.7
Contaminated zone field capacity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Contaminated zone hydraulic conductivity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Density of contaminated zone and Contaminated zone total porosity	0.1	0.8	0.5	0.0	0.6	0.7	0.0	0.7	0.6
Evapotranspiration coefficient	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
Exposure duration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Inhalation rate	4.3	0.0	0.0	10.0	0.0	1.4	4.3	0.0	0.3
Mass loading for inhalation	41.9	0.0	0.0	75.5	0.4	17.5	42.6	0.7	3.7
Precipitation	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Runoff coefficient	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
External gamma shielding factor	23.8	40.0	40.0	0.2	32.2	33.7	2.1	39.5	37.3
Indoor dust filtration factor	3.7	0.0	0.0	9.3	0.0	1.2	3.7	0.0	0.2
Soil ingestion	46.2	0.1	0.0	117.9	27.1	19.0	126.8	1.6	9.1
Thickness of contaminated zone	2.6	43.8	18.4	0.2	30.9	44.6	0.9	31.0	39.0

Dark gray shaded cells = Sensitive parameters
Light gray shaded cells = Moderately sensitive parameters

Cs = Cesium
Eu = Europium
Sr = Strontium
Th = Thorium

Table D.2-2
Parameter NDD for Internal Dose

Parameter	Am-241	Cs-137	Eu-155	Pu-239	Sr-90	Th-232	U-234	U-235	U-238
Area of contaminated zone	380.4	892.0	844.8	380.3	886.0	413.0	574.3	587.8	604.5
Wind speed	10.2	0.1	0.5	10.2	0.1	8.8	4.3	4.0	3.7
Contaminated zone b parameter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Contaminated zone erosion rate	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Contaminated zone field capacity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Contaminated zone hydraulic conductivity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Density of contaminated zone and Contaminated zone total porosity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evapotranspiration coefficient	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Exposure duration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Inhalation rate	10.0	0.1	0.6	10.0	0.1	8.8	4.6	4.3	4.0
Mass loading for inhalation	75.7	1.1	7.4	75.8	1.9	69.7	44.3	42.4	40.0
Precipitation	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Runoff coefficient	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indoor dust filtration factor	9.4	0.1	0.4	9.4	0.1	8.1	4.0	3.7	3.4
Soil ingestion	118.8	151.6	149.9	118.8	151.4	122.5	136.2	137.2	138.2
Thickness of contaminated zone	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Dark gray shaded cells = Sensitive parameters
Light gray shaded cells = Moderately sensitive parameters

Source: Kamboj, S., J-J. Cheng, and C. Yu. 2005. "Deterministic vs. Probabilistic Analyses To Identify Sensitive Parameters in Dose Assessment Using RESRAD." In *Health Physics*, Vol. 88: pp. S104-S106.

D.2.1 RESRAD Title Screen Inputs

The RESRAD title screen input options as shown in Figure D.2-1, are discussed in this section.

D.2.1.1 Library

The International Commission on Radiological Protection 72 (Adult) internal dose conversion factor (DCF) library in RESRAD was selected for the following reasons:

- It reflects the updated dosimetric models referenced in 10 CFR 835 (CFR, 2015).
- It was developed for receptors in an outdoor environment.
- It is for an adult receptor, consistent with the construction worker exposure scenario selected for evaluation.

D.2.1.2 Cut-off Half-Life

The use of a larger cut-off half-life value results in some RRMGs that are slightly lower. The value of 180 days is a RESRAD default value and the maximum available value. This option is available to limit the impact of radionuclides with very short half-lives. Selection of the maximum available cut-off half-life value of 180 days was determined to be reasonable and conservative because a radionuclide with this half-life value would have decayed more than 100 half-lives since the last atmospheric nuclear detonation (99.999 percent of a radionuclide will have decayed away in 18 half-lives).

D.2.1.3 Graphics Parameters, Time Integration Parameters, and User Preferences

These input parameters are for visual presentation of RESRAD outputs and have no effect on RRMG values.

D.2.2 Area of Contaminated Zone

The area of contaminated zone parameter is defined in the User's Manual for RESRAD Version 6 (Yu et al., 2001) as a compact area that contains the locations of all soil samples with radionuclide concentrations that are clearly (two standard deviations) above background.

D.2.2.1 Model Response to Parameter

As demonstrated by Figure D.2-2, increasing area of contaminated zone values up to approximately 1,000 m^2 significantly reduce RRMG values. This was determined to be a sensitive parameter for both the internal and total dose pathways.

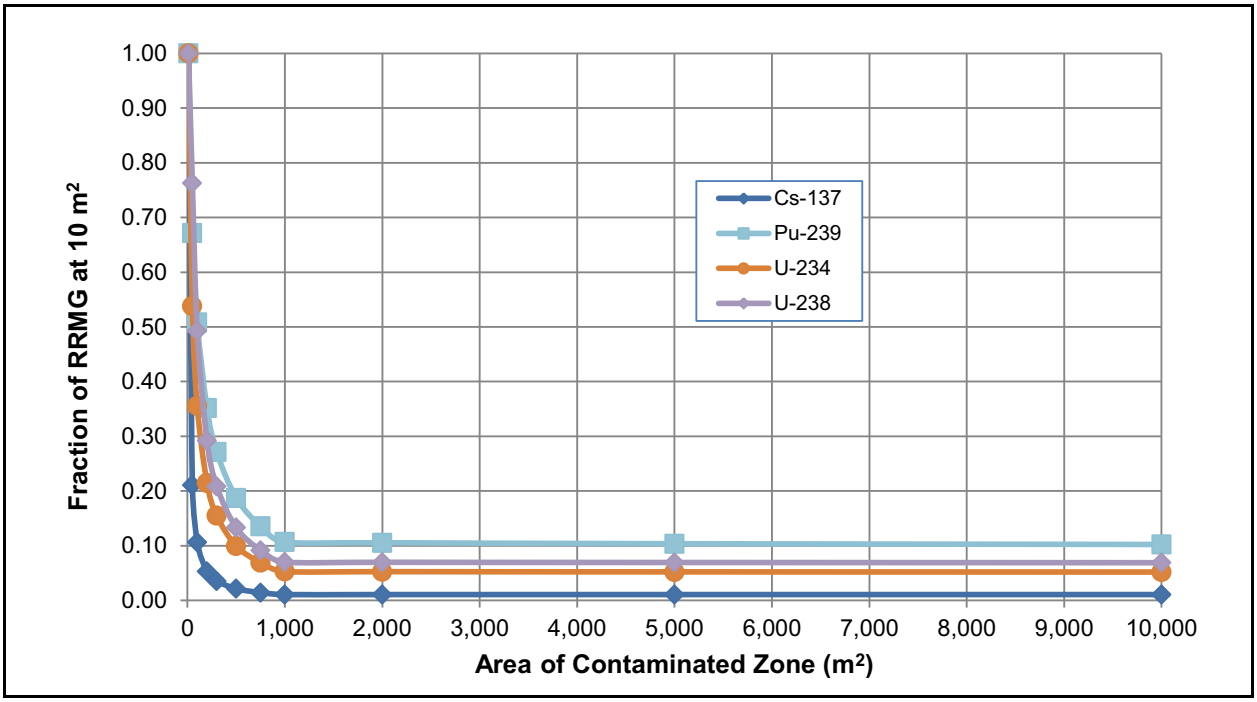

Figure D.2-2
Effect of Area of Contaminated Zone on RRMG Values

D.2.2.2 Recommended Value

At CAU 411, the soil samples used to calculate dose were collected from sample plots, which represent an area of 100 m^2 and were located in areas of the highest radiation survey readings. Expanding the 100-m^2 area could include areas of lower radioactivity and thus result in a lower average dose. To prevent this from occurring, DOE guidance recommends that the area for dose

measurements be limited to no more than 100 m^2 (DOE, 2013). However, if the area of contaminated zone is set to 100 m^2, RESRAD considers the adjacent soil to be free of contamination that could contribute to the total dose received. At CAU 411, it is assumed that the locations where dose was measured have adjacent contamination that could also contribute to dose, therefore the area of contaminated zone was increased to include this area. This is a conservative approach, as RESRAD would consider this additional area as equally contaminated and would overestimate the resulting dose. To estimate the effect of the area of contaminated zone on RRMG values, RRMGs were determined using RESRAD for several area of contaminated zone values. The RESRAD response to increasing area of contamination values is shown in Figure D.2-2. This demonstrates that the presence of adjacent contamination does not have a significant impact on dose for areas larger than 1,000 m^2. Therefore, the value of 1,000 m^2 for the area of contaminated zone was used for CAU 411.

D.2.2.3 Sources

U.S. Department of Energy. 2013. *Radiation Protection of the Public and the Environment*, DOE Order 458.1, Change 3. Washington, DC: Office of Health, Safety and Security.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014. *Soils Risk-Based Corrective Action Evaluation Process*, Rev. 1, DOE/NV--1475. Las Vegas, NV.

D.2.3 Thickness of Contaminated Zone

The thickness of contaminated zone parameter is defined as the distance between the shallowest and the deepest depth of contamination. This parameter value is a starting thickness of uniform contaminant concentration that is reduced by the model based on erosion.

D.2.3.1 Model Response to Parameter

Higher values of the thickness of the contaminated zone provide lower RRMG values for the radionuclides that emit significant amounts of gamma radiation. This was determined to be a sensitive parameter for the total dose pathway. For the internal dose pathway, four radionuclides (silver [Ag]-108, aluminum [Al]-26, niobium [Nb]-94, and technetium [Tc]-99) that are not COCs at CAU 411 showed moderate sensitivity. However, no significant changes in RRMG values were observed for any other radionuclide. Therefore, this parameter is not considered sensitive for the internal dose pathway.

The significantly different effect this parameter has on the total dose and internal dose pathways show that changes in this parameter only affect external dose. However, where external dose is calculated from TLDs as is planned for CAU 411 verification samples, changing the depth of contamination value has no effect on the dose calculation results.

D.2.3.2 Recommended Value

Soil profile studies completed before interim corrective action activities at CAU 411 indicated that 80 to 90 percent of the radioactive contamination deposited by the DT experiment was located in the top 5 cm of soil (DOE/NV, 1996). Concentrating contamination in the top 5 cm and setting the erosion rate to 0 results in lower, more conservative RRMGs. Therefore, a value of 5 cm (0.05 m) for the thickness of the contaminated zone was used for CAU 411.

D.2.3.3 Sources

Gilbert, R.O., E.H. Essington, D.N. Brady, P.G. Doctor, and L.L Eberhardt. 1977. "Statistical Activities during 1976 and the Design and Initial Analysis of Nuclear Site Studies." In *Transuranics in Desert Ecosystems*, NVO-181. pp. 331-366. November. Las Vegas, NV: U.S. Department of Energy, Nevada Operations Office.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014. *Soils Risk-Based Corrective Action Evaluation Process*, Rev. 1, DOE/NV--1475. Las Vegas, NV.

D.2.4 Wind Speed

The wind speed number reflects the overall average of the wind speed, measured near the ground, in a one-year period.

D.2.4.1 Model Response to Parameter

Lower values of wind speed provide lower RRMG values. This is considered to be a sensitive parameter for the Pu isotopes under both the internal and total dose pathways as well as for Am-241, Am-243, and curium (Cm)-244 under the internal dose pathway. It is also moderately sensitive for Cm-244 under the total dose pathway and for Cm-243, Np-237, and Th-232 under the internal dose pathway.

D.2.4.2 Recommended Value

DOE operates three meteorological stations at TTR: Station 400, located near the Range Operations Center; Station 401, located at the north end of the Clean Slate III site; and Station 402, located at the north end of the Clean Slate I site. Stations 400 and 401 began collecting data in 2008; Station 402 began collecting data in 2011. For each station, the average wind speed was calculated using data from complete years through 2014. The average of the three stations was used to calculate a recommended wind speed of 3.12 m/sec for use in the CAU 411 model.

D.2.4.3 Source

Desert Research Institute. 2015. "Western Regional Climate Center" web page. As accessed at www.wrcc.dri.edu/weather/ntcl.html on 16 January.

D.2.5 Inhalation Rate

The inhalation rate is an average yearly rate in cubic meters per year (m^3/yr) that accounts for different activity levels performed outdoors. A site-specific value can be obtained with the assumed land use scenario and an activity profile.

D.2.5.1 Model Response to Parameter

Higher inhalation rate values provide lower RRMG values for most radionuclides. For the internal dose pathway, this parameter is considered to be sensitive for the Am and Pu isotopes; and moderately sensitive for Np-237, Th-232, and the Cm isotopes. For the total dose pathway, this parameter is considered to be moderately sensitive for Cm-244 and the Pu isotopes. It is not sensitive for the remaining radionuclides under either pathway.

D.2.5.2 Recommended Value

The recommended value for this parameter was developed using the methodology in the RESRAD Data Collection Handbook (Yu et al., 1993, Section 43.1) with updated inhalation rate information as published in the 2011 version of the EPA Exposure Factors Handbook (EPA, 2011). The average time spent (in hours) at different levels of activity per day for the construction worker exposure scenario is

listed in Table D.2-3. The inhalation rate was projected over 24 hr/day and 365 day/yr, resulting in the recommended annual inhalation rate of 12,000 m^3/yr for construction activities. These results are shown in Table D.2-3.

Table D.2-3
Construction Worker Inhalation Rate Calculation

Activity Level	Average Time Spent per Day at this Activity Level (hr/day)	Average Inhalation Rate (m^3/min)[a]	Inhalation Rate During this Activity Level (m^3/hr)	Workday Rate (m^3/8 hr)	Daily Rate (m^3/hr)	Annual Rate (m^3/yr)
Resting	1	4.58E-03	2.75E-01	2.75E-01	--	--
Light Work	1.5	1.25E-02	7.50E-01	1.13E+00	--	--
Moderate Physical Labor	5	2.75E-02	1.65E+00	8.25E+00	--	--
Hard Physical Labor	0.5	5.10E-02	3.06E+00	1.53E+00	--	--
Total	8	--	--	11.18	1.40	1.2E+04

[a] Average inhalation rate from Table 6-2 of EPA Exposure Factors Handbook (EPA, 2011), as the mean short term inhalation rate for age groups 21–61.

m^3/hr = Cubic meters per hour
m^3/min = Cubic meters per minute

-- = Not applicable

D.2.5.3 Sources

U.S. Department of Energy, Nevada Operations Office. 1998. "Transmittal, Soil Related Information, Attachments A, B, C, and D: Air Force Land Uses," 7 January. Las Vegas, NV.

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory.

D.2.6 Mass Loading for Inhalation

The mass loading parameter is the concentration of soil particles in the air and is obtained directly from empirical data for locations and conditions similar to those applicable for the scenario used.

D.2.6.1 Model Response to Parameter

Higher values of mass loading provide lower RRMG values for most radionuclides. For the internal dose pathway, this parameter is considered to be sensitive for Np-237, Th-232, and the Am, Pu, U, and Cm isotopes; and moderately sensitive for Tc-99, Nb-94, Ag-108m, and the Eu isotopes. For the total dose pathway, this parameter is considered to be sensitive for Th-232, U-234, U-235, Cm-244, Am-241, and the Pu isotopes; and moderately sensitive to Am-243 and Cm-243. It is not sensitive for the remaining radionuclides under either pathway.

D.2.6.2 Recommended Value

The RESRAD default value for the mass loading for inhalation parameter is 2E-04 g/m^3. This value is appropriate for the industrial worker scenario; however, it is recommended that the value be increased to 6E-04 g/m^3 for the construction worker exposure scenario (Yu et. al., 1998; Oztunali et al., 1981). This higher value is more appropriate as it accounts for dust generating activities typical of a construction site (e.g., road building, vehicular traffic on unpaved roads).

D.2.6.3 Sources

Oztunali, O.I., G.C. Ré, P.M. Moskowitz, E.D. Picazo, and C.J. Pitt. 1981. *Data Base for Radioactive Waste Management, Impacts Analyses Methodology Report*, NUREG/CR-1759, Vol. 3. Prepared for the U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Division of Waste Management. White Plains, NY: Dames and Moore, Inc.

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory.

D.2.7 Indoor Dust Filtration Factor

This factor is the ratio of airborne dust concentration indoors on site to the concentration outdoors on site. It is based on the fact that a building would provide shielding against entry of wind-blown dust particles.

D.2.7.1 Model Response to Parameter

Higher values of indoor dust filtration factor result in lower RRMG values for some radionuclides. This parameter is moderately sensitive for Cm-244 and the Pu isotopes under both the internal and total dose pathways. It is also moderately sensitive for Am-241, Am-243, Cm-243, Np-237, and Th-232 under the internal dose pathway. It is not sensitive for the remaining radionuclides under either pathway.

D.2.7.2 Recommended Value

A site worker under the construction worker exposure scenario is defined as working 6 hours outdoors and 2 hours indoors per day at the site. Because the majority of time will be spent outdoors, a conservative approach is recommended that does not take credit for indoor shielding of airborne dust particles. Therefore, the recommended value for the indoor dust filtration factor parameter is 1, which results in an equal concentration of indoor and outdoor dust.

D.2.7.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 411.

D.2.8 External Gamma Shielding Factor

This factor is the ratio of the external gamma radiation level indoors on site to the radiation level outdoors on site. It is based on the fact that a building would provide shielding against penetration of gamma radiation.

D.2.8.1 Model Response to Parameter

Higher values of external gamma shielding factor provide lower RRMG values under the total dose pathway. This is not an active parameter under the internal dose pathway, so it is considered for the total dose pathway only. It is a sensitive parameter for all radionuclides except the Pu isotopes, Cm-244, U-233, and U-234. It is moderately sensitive for U-233.

D.2.8.2 Recommended Value

The default external gamma shielding factor value in the RESRAD code is 0.7, which assumes that the external gamma radiation level indoors is 30 percent lower than the outdoor gamma radiation level.

D.2.8.3 Sources

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory.

Yu, C., A.J. Zielen, J.-J. Cheng, D.J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo, III, W.A. Williams, and H. Peterson. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4. Argonne, IL: Argonne National Laboratory, Environmental Assessment Division. (Version 6.5 released in October 2009.)

D.2.9 Indoor Time Fraction and Outdoor Time Fraction

The fraction of time spent indoors and outdoors on site is the average fraction of time in a year during which an individual stays inside and outside a building on the contaminated site, respectively.

D.2.9.1 Model Response to Parameter

Higher values for the indoor and outdoor time fractions result in lower RRMG values. Changing these parameter values changes the amount of time exposed to contamination. These are sensitive parameters for both the internal and total dose pathways.

D.2.9.2 Recommended Value

For the construction worker exposure scenario, it is assumed that a site worker spend 2 hours indoors and 6 hours outdoors. Therefore, the values for the indoor and outdoor time fractions is a simple calculation of the total hours spent at the contaminated site divided by 8,760 (the total number of hours in a year). This results in the indoor and outdoor time fractions at the contaminated site as presented in Table D.2-4 for the construction worker exposure scenario.

Table D.2-4
Annual Indoor and Outdoor Times Spent on Site

Exposure Scenario	Total Hours/year	Indoor Hours	Outdoor Hours	Indoor Time Fraction	Outdoor Time Fraction
Construction worker	8,760	240	720	0.0274	0.0822

D.2.9.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 411.

D.2.10 Soil Ingestion

This parameter is the accidental ingestion rate of soil material or soil dust.

D.2.10.1 Model Response to Parameter

Higher values for the soil ingestion provide lower RRMG values. This is considered to be a sensitive parameter for all radionuclides under the internal dose pathway. For the total dose pathway, it is a sensitive parameter for Am-241, Cm-244, Sr-90, Tc-99, Th-232, U-233, U-234, and the Pu isotopes. It is moderately sensitive for Am-243, Cm-243, and U-238. It is not sensitive for the remaining radionuclides.

D.2.10.2 Recommended Value

The values for soil ingestion are dependent upon the time spent indoors and outdoors. The EPA recommends a soil ingestion rate of 100 milligrams per day (mg/day) for outdoor activities (EPA, 2002). For the construction worker exposure scenario, the worker is assumed to spend 6 hr/day outdoors and 2 hr/day indoors. As shown in Table D.2-5, this results in a soil ingestion rate of 87.5 mg/day. When the rate is extrapolated to a yearly rate, it results in a value of 31.9 g/yr, which is the recommended value for use at CAU 411.

D.2.10.3 Source

U.S. Environmental Protection Agency. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, OSWER 9355.4-24. Washington, DC: Office of Emergency and Remedial Response.

Table D.2-5
Construction Worker Exposure Scenario Ingestion Rate

Activity	Rate (mg/day)	Fraction of Time	Adjusted rate (mg/day)	Annual Total (g/yr)
Indoor	50	0.25	12.5	--
Outdoor	100	0.75	75.0	--
Total	--	--	87.5	31.9

D.2.11 Cover Depth, Irrigation, and Contaminated Zone Erosion Rate

The cover depth is the distance from the ground surface to the location of the uppermost soil sample with radionuclide concentrations that are clearly above background. Irrigation is the practice of supplying water artificially to the soil in order to permit agricultural use of the land in an arid region or to compensate for occasional droughts in semidry or semihumid regions. The erosion rate is the average volume of soil material that is removed from one place to another by running water, waves and currents, wind, or moving ice.

D.2.11.1 Model Response to Parameter

A shallower cover depth results in lower RRMG values. Lower irrigation values also result in lower RRMG values. Lower erosion rates will remove the contaminated material slower, leading to lower RRMG values. None of these parameters are considered sensitive for either the internal or total dose pathways, and are not applicable to CAU 411.

D.2.11.2 Recommended Value

For CAU 411, it is assumed that contamination is on the surface (i.e., there is no cover) and that no irrigation or erosion will occur. Assuming no erosion is not necessarily realistic, but results in a more conservative dose estimate. Thus, a value of 0 was used for the cover depth, irrigation, and contaminated zone erosion rate for CAU 411.

D.2.11.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 411.

D.2.12 Density of Contaminated Zone and Contaminated Zone Total Porosity

These two parameters have the following relationship:

$$total\ \ porosity = 1 - \frac{bulk\ \ density}{particle\ \ density}$$

Therefore, a change in the value of one of these parameters necessitates a change in the other using this relationship. The value of the particle density is considered to be a constant for silica-based material at 2.65 g/cm^3.

D.2.12.1 Model Response to Parameter

The use of a higher bulk density (and a corresponding lower porosity) results in slightly lower RRMG values. These are not considered to be sensitive parameters for either the internal or total dose pathways.

D.2.12.2 Recommended Values

The value of 1.5 g/cm^3 is a standard value used in EPA's Soil Screening Level Supplemental Guidance (EPA, 2002). Table D.2-6 presents the bulk density statistics of 93 soil samples collected in the Death Valley region that had a rock content of less than 50 percent. This shows very little variability in bulk density and an average bulk density value that is equal to the EPA standard value. Therefore, it is recommended that a value of 1.5 g/cm^3 for the density of the contaminated zone and the resulting total porosity of 0.43 be used for CAU 411.

Table D.2-6
Bulk Density Statistics for Samples from Death Valley Region

	Average	STDEV	n	$t_{\alpha/2}$	LCL_{95}	UCL_{95}
Bulk Density	1.50	0.0771	93	1.66	1.49	1.51

D.2.12.3 Sources

Hevesi, J.A., A.L. Flint, and L.E. Flint. 2003. *Simulation of Net Infiltration and Potential Recharge Using a Distributed-Parameter Watershed Model of the Death Valley Region, Nevada and California*, Water-Resources Investigations Report 03-4090. Sacramento, CA: U.S. Geological Survey.

U.S. Environmental Protection Agency. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*, OSWER 9355.4-24. Washington, DC: Office of Emergency and Remedial Response.

D.2.13 Contaminated Zone Field Capacity

The field capacity sets the lower limit of the volumetric water content and is used to replace the calculated value when the calculated value is smaller. This is used to calculate percolation of infiltrating water through the contaminated zone.

D.2.13.1 Model Response to Parameter

There are no significant impacts to RRMG values by changing the value of this parameter for either the internal or total dose pathways. This parameter is moderately sensitive for four radionuclides (Ag-108, Al-26, Nb-94, and Tc-99) that are not COCs for CAU 411, under both pathway scenarios. Therefore, this is not considered to be a sensitive parameter for either the internal or total dose pathways.

D.2.13.2 Recommended Value

It is recommended that the default RESRAD value of 0.2 (unitless) for the contaminated zone field capacity be used for CAU 411.

D.2.13.3 Source

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory.

D.2.14 Contaminated Zone Hydraulic Conductivity and Contaminated Zone b Parameter

Soil hydraulic conductivity is a measure of the ability of soil to transmit water when subjected to a hydraulic gradient. The soil-specific “b” parameter is an empirical and dimensionless parameter that is used to evaluate the saturation ratio (or the volumetric water saturation) of the soil, according to a soil characteristic function called the conductivity function (i.e., the relationship between the unsaturated hydraulic conductivity, K, and the saturation ratio). The soil-specific exponential “b”

parameter is one of several hydrological parameters used to calculate the radionuclide leaching rate of the contaminated zone.

D.2.14.1 Model Response to Parameters

There are no significant impacts to RRMG values by changing the value of these parameters for either the internal or total dose pathways. Thus, these parameters are not considered sensitive.

D.2.14.2 Recommended Value

It is recommended that CAU 411 use the representative values for a sandy loam from Clapp and Hornberger (1978) (as shown in Table D.2-7) to select the values for the contaminated zone hydraulic conductivity (1,090 m/yr) and for the contaminated zone b parameter (4.9).

Table D.2-7
Hydraulic Properties of Soil Types

Texture	Hydraulic Conductivity (m/yr)	Saturated Water Content	Soil-Specific Exponential Parameter, b
Sand	5,550	0.395	4.05
Loamy sand	4,930	0.41	4.38
Sandy loam	1,090	0.435	4.9
Silty loam	227	0.485	5.3
Loam	219	0.451	5.39
Sandy clay loam	199	0.42	7.12
Silty clay loam	53.6	0.477	7.75
Clay loam	77.3	0.476	8.52
Sandy clay	68.4	0.426	10.4
Silty clay	32.6	0.492	10.4
Clay	40.5	0.482	11.4

Source: Clapp and Hornberger, 1978

D.2.14.3 Source

Clapp, R.B., and G.M. Hornberger. 1978. "Empirical Equations for Some Soil Hydraulic Properties." In *Water Resources Research*, Vol. 14(4): pp. 601-604. Washington, DC: American Geophysical Union.

D.2.15 Evapotranspiration Coefficient

Evapotranspiration represents the combination of two separate processes: (1) evaporation (i.e., the change of phase of water near the ground surface and the direct transfer of water vapor from the ground to the atmosphere) and (2) transpiration (i.e., the transfer of water from the ground to the atmosphere through plants).

D.2.15.1 Model Response to Parameter

Higher values of the evapotranspiration coefficient provide lower RRMG values for some radionuclides. This parameter is sensitive for four radionuclides (Ag-108, Al-26, Nb-94, and Tc-99) that are not COPCs for CAU 411, under both pathway scenarios. No significant changes in RRMG values were observed for any other radionuclide. Therefore, this parameter is not sensitive for either the internal or total dose pathways.

D.2.15.2 Recommended Value

It is recommended that CAU 411 use the average value of the evapotranspiration coefficient from 61 locations in the Death Valley region from the Hevesi et al. (2003) study. As shown in Table D.2-8, the statistics for this parameter were very constant with an 95 percent lower confidence limit (LCL) of 0.98 and a 95 percent UCL of 0.99. Therefore, it is recommended that the average value of 0.98 is used for CAU 411.

Table D.2-8
Evapotranspiration Coefficient Statistics from the Death Valley Region

	Average	STDEV	n	$t_{\alpha/2}$	LCL_{95}	UCL_{95}
Evapotranspiration Coefficient	0.98	0.013671	61	1.67	0.98	0.99

Source: Hevesi et al., 2003

D.2.15.3 Source

Hevesi, J.A., A.L. Flint, and L.E. Flint. 2003. *Simulation of Net Infiltration and Potential Recharge Using a Distributed-Parameter Watershed Model of the Death Valley Region, Nevada and California*, Water-Resources Investigations Report 03-4090. Sacramento, CA: U.S. Geological Survey.

D.2.16 Precipitation

The average annual precipitation is the average of the total amount of precipitation received in a one-year period.

D.2.16.1 Model Response to Parameter

Lower values of precipitation provide lower RRMG values for some radionuclides. This parameter is sensitive for four radionuclides (Ag-108, Al-26, Nb-94, and Tc-99) that are not COPCs at CAU 411, under both pathway scenarios. No significant changes in RRMG values were observed for any other radionuclide. Therefore, this parameter is not sensitive for either the internal or total dose pathways.

D.2.16.2 Recommended Value

DOE operates three meteorological stations at TTR: Station 400, located near the Range Operations Center; Station 401, located at the north end of the Clean Slate III site; and Station 402, located at the north end of the Clean Slate I site. Stations 400 and 401 began collecting data in 2008; Station 402 began collecting data in 2011. For each station, the average precipitation was calculated using data from complete years through 2014. The lowest average precipitation value of all three stations, 0.096 m/yr (3.8 in. per year), is recommended to be used in the model for CAU 411.

D.2.16.3 Source

Desert Research Institute. 2015. “Western Regional Climate Center” web page. As accessed at www.wrcc.dri.edu/weather/ntcl.html on 16 January.

D.2.17 Runoff Coefficient

The runoff coefficient is the fraction of the average annual precipitation in excess of the deep percolation and evapotranspiration that becomes surface flow and ends up in either perennial or intermittent surface water bodies.

D.2.17.1 Model Response to Parameter

While higher runoff coefficient values provide slightly lower RRMG values for some radionuclides, there are no significant impacts to RRMG values by changing the value of this parameter. This is not considered to be a sensitive parameter for either the internal or total dose pathways.

D.2.17.2 Recommended Value

A methodology for estimating the runoff coefficient is presented in the RESRAD Data Collection Handbook based on the type of soil and land utilization. The best estimate of the runoff coefficient using this methodology is 0.4. As this is not a sensitive parameter, this is the recommended value to use for the runoff coefficient for CAU 411.

D.2.17.3 Source

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory.

D.2.18 Exposure Duration

The exposure duration is the span of time, in years, during which an individual is expected to spend time on the site.

D.2.18.1 Model Response to Parameter

The value for the exposure duration does not affect RRMG values. This is not considered to be a sensitive parameter for either the internal or total dose pathways.

D.2.18.2 Recommended Value

It is recommended that the exposure duration of 25 years be used for the construction worker exposure scenario. The default value used by EPA in risk assessments for industrial workers is 25 years.

D.2.18.3 Source

U.S. Environmental Protection Agency. 1991. *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" Interim Final,* OSWER Directive 9285.6-03. Washington, DC: Office of Emergency and Remedial Response, Toxics Integration Branch.

D.2.19 Depth of Soil Mixing Layer

The depth of the soil mixing layer is the depth of surface soil available for resuspension and is used in the calculation of the radioactivity associated with resuspended particles. This parameter reflects an assumed surface layer that is sufficiently disturbed to uniformly distribute contamination within this layer. The soil mixing layer provides a modeled pathway for subsurface contamination to be brought to the surface.

D.2.19.1 Model Response to Parameter

For sites with surface contamination such as CAU 411, soil mixing layer depths that are greater than the thickness of the contaminated zone will effectively dilute the concentration of radionuclides by mixing the additional thickness of uncontaminated soil. This will result in higher RRMG values. Soil mixing layer depths that are less than the thickness of the contaminated zone do not have an effect on RRMG values. Thus, if the depth of the soil mixing layer is greater than the thickness of the contaminated zone, this parameter is sensitive for both the internal or total dose pathways.

D.2.19.2 Recommended Value

The construction worker exposure scenario includes potential activities that disturb the soil at depths greater than the top 5 cm of soil (i.e., thickness of the contaminated zone), to include construction of building foundations and structure supports. Grading may also be required as part of general site preparation for roads, building foundations, parking lots, targets, or other work areas. It is recommended that a value of 0.45 m for the depth of soil mixing layer be used for CAU 411. Although this will allow for dilution of contaminated soil with uncontaminated soil in the model, it represents a more realistic scenario than using the same value as the thickness of the contaminated zone (0.05 m).

D.2.19.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 411.

D.3.0 References

CFR, see *Code of Federal Regulations.*

Clapp, R.B., and G.M. Hornberger. 1978. "Empirical Equations for Some Soil Hydraulic Properties." In *Water Resources Research*, Vol. 14(4): pp. 601-604. Washington, DC: American Geophysical Union.

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Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Argonne, IL: Environmental Assessment and Information Sciences Division, Argonne National Laboratory.

Yu, C., A.J. Zielen, J.-J. Cheng, D.J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo, III, W.A. Williams, and H. Peterson. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4. Argonne, IL: Argonne National Laboratory, Environmental Assessment Division. (Version 6.5 released in October 2009.)

Appendix E

Construction Worker Exposure Scenario RRMGs for CAU 411

Table E.1-1
Total Effective Dose RRMGs for the Construction Worker Exposure Scenario

Radionuclide	RRMG (pCi/g)
Ag-108m	5.36E+01
Al-26	3.46E+01
Am-241	3.27E+03
Am-243	3.94E+02
Cm-243	6.44E+02
Cm-244	1.14E+04
Co-60	3.68E+01
Cs-137	1.47E+02
Eu-152	7.69E+01
Eu-154	7.18E+01
Eu-155	1.93E+03
Nb-94	5.56E+01
Np-237	3.73E+02
Pu-238	5.82E+03
Pu-239/240	5.31E+03
Pu-241	2.63E+05
Sr-90	1.71E+04
Tc-99	2.32E+06
Th-232	1.06E+03
U-233	4.85E+04
U-234	5.66E+04
U-235	5.13E+02
U-238	2.92E+03

A soil sample at this RRMG value would present a TED potential of 25 mrem per calendar year.

Co = Cobalt
mrem = Millirem
Np = Neptunium

Table E.1-2
Internal Dose RRMGs
for the Construction Worker Exposure Scenario

Radionuclide	RRMG (pCi/g)
Ag-108m	5.72E+06
Al-26	4.59E+06
Am-241	6.68E+03
Am-243	6.67E+03
Cm-243	9.36E+03
Cm-244	1.14E+04
Co-60	4.44E+06
Cs-137	1.26E+06
Eu-152	7.28E+06
Eu-154	5.43E+06
Eu-155	3.79E+07
Nb-94	6.29E+06
Np-237	1.27E+04
Pu-238	5.84E+03
Pu-239/240	5.33E+03
Pu-241	2.76E+05
Sr-90	5.05E+05
Tc-99	1.90E+07
Th-232	5.68E+03
U-233	5.95E+04
U-234	6.10E+04
U-235	6.66E+04
U-238	6.97E+04

A soil sample at this RRMG value would present an internal dose potential of 25 mrem per calendar year.

Appendix F

RESRAD Model Results for Construction Worker Exposure Scenario

(82 Pages)

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Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-225 (Source: FGR 12)	6.371E-02	6.371E-02	DCF1(1)
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(2)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(3)
A-1	Ag-108 (Source: FGR 12)	1.143E-01	1.143E-01	DCF1(4)
A-1	Ag-108m (Source: FGR 12)	9.640E+00	9.640E+00	DCF1(5)
A-1	Al-26 (Source: FGR 12)	1.741E+01	1.741E+01	DCF1(6)
A-1	Am-241 (Source: FGR 12)	4.372E-02	4.372E-02	DCF1(7)
A-1	Am-243 (Source: FGR 12)	1.420E-01	1.420E-01	DCF1(8)
A-1	At-217 (Source: FGR 12)	1.773E-03	1.773E-03	DCF1(9)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(10)
A-1	Ba-137m (Source: FGR 12)	3.606E+00	3.606E+00	DCF1(11)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(12)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(13)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(14)
A-1	Bi-213 (Source: FGR 12)	7.660E-01	7.660E-01	DCF1(15)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(16)
A-1	Cm-243 (Source: FGR 12)	5.829E-01	5.829E-01	DCF1(17)
A-1	Cm-244 (Source: FGR 12)	1.259E-04	1.259E-04	DCF1(18)
A-1	Co-60 (Source: FGR 12)	1.622E+01	1.622E+01	DCF1(19)
A-1	Cs-137 (Source: FGR 12)	7.510E-04	7.510E-04	DCF1(20)
A-1	Eu-152 (Source: FGR 12)	7.006E+00	7.006E+00	DCF1(21)
A-1	Eu-154 (Source: FGR 12)	7.678E+00	7.678E+00	DCF1(22)
A-1	Eu-155 (Source: FGR 12)	1.822E-01	1.822E-01	DCF1(23)
A-1	Fr-221 (Source: FGR 12)	1.536E-01	1.536E-01	DCF1(24)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(25)
A-1	Gd-152 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Nb-94 (Source: FGR 12)	9.677E+00	9.677E+00	DCF1(27)
A-1	Np-237 (Source: FGR 12)	7.790E-02	7.790E-02	DCF1(28)
A-1	Np-239 (Source: FGR 12)	7.529E-01	7.529E-01	DCF1(29)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(30)
A-1	Pa-233 (Source: FGR 12)	1.020E+00	1.020E+00	DCF1(31)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(32)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(33)
A-1	Pb-209 (Source: FGR 12)	7.734E-04	7.734E-04	DCF1(34)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(35)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(36)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(37)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(38)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(39)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(40)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(41)
A-1	Po-213 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(42)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(43)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(44)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(45)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(46)
A-1	Pu-238 (Source: FGR 12)	1.513E-04	1.513E-04	DCF1(47)
A-1	Pu-239 (Source: FGR 12)	2.952E-04	2.952E-04	DCF1(48)
A-1	Pu-240 (Source: FGR 12)	1.467E-04	1.467E-04	DCF1(49)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	Pu-241 (Source: FGR 12)	5.904E-06	5.904E-06	DCF1(50)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(51)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(52)
A-1	Ra-225 (Source: FGR 12)	1.102E-02	1.102E-02	DCF1(53)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(54)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(55)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(56)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(57)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(58)
A-1	Sr-90 (Source: FGR 12)	7.043E-04	7.043E-04	DCF1(59)
A-1	Tc-99 (Source: FGR 12)	1.255E-04	1.255E-04	DCF1(60)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(61)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(62)
A-1	Th-229 (Source: FGR 12)	3.213E-01	3.213E-01	DCF1(63)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(64)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(65)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(66)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(67)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(68)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(69)
A-1	Tl-209 (Source: FGR 12)	1.293E+01	1.293E+01	DCF1(70)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(71)
A-1	U-233 (Source: FGR 12)	1.397E-03	1.397E-03	DCF1(72)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(73)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(74)
A-1	U-236 (Source: FGR 12)	2.148E-04	2.148E-04	DCF1(75)
A-1	U-237 (Source: FGR 12)	5.306E-01	5.306E-01	DCF1(76)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(77)
A-1	Y-90 (Source: FGR 12)	2.391E-02	2.391E-02	DCF1(78)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	2.109E+00	2.035E+00	DCF2(1)
B-1	Ag-108m+D	1.370E-04	1.369E-04	DCF2(2)
B-1	Al-26	7.400E-05	7.400E-05	DCF2(3)
B-1	Am-241	3.550E-01	3.552E-01	DCF2(4)
B-1	Am-243+D	3.550E-01	3.552E-01	DCF2(5)
B-1	Cm-243	2.550E-01	2.553E-01	DCF2(6)
B-1	Cm-244	2.110E-01	2.109E-01	DCF2(8)
B-1	Co-60	1.150E-04	1.147E-04	DCF2(11)
B-1	Cs-137+D	1.440E-04	1.443E-04	DCF2(12)
B-1	Eu-152	1.550E-04	1.554E-04	DCF2(13)
B-1	Eu-154	1.960E-04	1.961E-04	DCF2(15)
B-1	Eu-155	2.550E-05	2.553E-05	DCF2(16)
B-1	Gd-152	7.030E-02	7.030E-02	DCF2(17)
B-1	Nb-94	1.810E-04	1.813E-04	DCF2(18)
B-1	Np-237+D	1.850E-01	1.850E-01	DCF2(19)
B-1	Pa-231	5.180E-01	5.180E-01	DCF2(20)
B-1	Pb-210+D	3.694E-02	2.072E-02	DCF2(21)
B-1	Pu-238	4.070E-01	4.070E-01	DCF2(22)
B-1	Pu-239	4.440E-01	4.440E-01	DCF2(24)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Pu-240	4.440E-01	4.440E-01	DCF2(25)
B-1	Pu-241	8.510E-03	8.510E-03	DCF2(27)
B-1	Pu-241+D	8.517E-03	8.510E-03	DCF2(28)
B-1	Ra-226+D	3.531E-02	3.515E-02	DCF2(29)
B-1	Ra-228+D	5.929E-02	5.920E-02	DCF2(30)
B-1	Sr-90+D	5.976E-04	5.920E-04	DCF2(31)
B-1	Tc-99	4.810E-05	4.810E-05	DCF2(32)
B-1	Th-228+D	1.614E-01	1.480E-01	DCF2(33)
B-1	Th-229+D	9.481E-01	8.880E-01	DCF2(34)
B-1	Th-230	3.700E-01	3.700E-01	DCF2(35)
B-1	Th-232	4.070E-01	4.070E-01	DCF2(36)
B-1	U-233	3.550E-02	3.552E-02	DCF2(37)
B-1	U-234	3.480E-02	3.478E-02	DCF2(38)
B-1	U-235+D	3.150E-02	3.145E-02	DCF2(39)
B-1	U-236	3.220E-02	3.219E-02	DCF2(40)
B-1	U-238	2.960E-02	2.960E-02	DCF2(41)
B-1	U-238+D	2.963E-02	2.960E-02	DCF2(42)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	4.473E-03	4.070E-03	DCF3(1)
D-1	Ag-108m+D	8.510E-06	8.510E-06	DCF3(2)
D-1	Al-26	1.300E-05	1.295E-05	DCF3(3)
D-1	Am-241	7.400E-04	7.400E-04	DCF3(4)
D-1	Am-243+D	7.430E-04	7.400E-04	DCF3(5)
D-1	Cm-243	5.550E-04	5.550E-04	DCF3(6)
D-1	Cm-244	4.440E-04	4.440E-04	DCF3(8)
D-1	Co-60	1.260E-05	1.258E-05	DCF3(11)
D-1	Cs-137+D	4.810E-05	4.810E-05	DCF3(12)
D-1	Eu-152	5.180E-06	5.180E-06	DCF3(13)
D-1	Eu-154	7.400E-06	7.400E-06	DCF3(15)
D-1	Eu-155	1.180E-06	1.184E-06	DCF3(16)
D-1	Gd-152	1.520E-04	1.517E-04	DCF3(17)
D-1	Nb-94	6.290E-06	6.290E-06	DCF3(18)
D-1	Np-237+D	4.102E-04	4.070E-04	DCF3(19)
D-1	Pa-231	2.630E-03	2.627E-03	DCF3(20)
D-1	Pb-210+D	6.995E-03	2.553E-03	DCF3(21)
D-1	Pu-238	8.510E-04	8.510E-04	DCF3(22)
D-1	Pu-239	9.250E-04	9.250E-04	DCF3(24)
D-1	Pu-240	9.250E-04	9.250E-04	DCF3(25)
D-1	Pu-241	1.780E-05	1.776E-05	DCF3(27)
D-1	Pu-241+D	2.061E-05	1.776E-05	DCF3(28)
D-1	Ra-226+D	1.041E-03	1.036E-03	DCF3(29)
D-1	Ra-228+D	2.552E-03	2.553E-03	DCF3(30)
D-1	Sr-90+D	1.140E-04	1.036E-04	DCF3(31)
D-1	Tc-99	2.370E-06	2.368E-06	DCF3(32)
D-1	Th-228+D	5.302E-04	2.664E-04	DCF3(33)
D-1	Th-229+D	2.266E-03	1.813E-03	DCF3(34)
D-1	Th-230	7.770E-04	7.770E-04	DCF3(35)
D-1	Th-232	8.510E-04	8.510E-04	DCF3(36)
D-1	U-233	1.890E-04	1.887E-04	DCF3(37)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-1	U-234	1.810E-04	1.813E-04	DCF3(38)
D-1	U-235+D	1.753E-04	1.739E-04	DCF3(39)
D-1	U-236	1.740E-04	1.739E-04	DCF3(40)
D-1	U-238	1.670E-04	1.665E-04	DCF3(41)
D-1	U-238+D	1.796E-04	1.665E-04	DCF3(42)
D-34	Food 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				
D-34	Ag-108m+D , plant/soil concentration ratio, dimensionless	1.500E-01	1.500E-01	RTF(2,1)
D-34	Ag-108m+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-03	3.000E-03	RTF(2,2)
D-34	Ag-108m+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.500E-02	2.500E-02	RTF(2,3)
D-34				
D-34	Al-26 , plant/soil concentration ratio, dimensionless	4.000E-03	4.000E-03	RTF(3,1)
D-34	Al-26 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-04	5.000E-04	RTF(3,2)
D-34	Al-26 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-04	2.000E-04	RTF(3,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(4,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(4,3)
D-34				
D-34	Am-243+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Am-243+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(5,2)
D-34	Am-243+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(5,3)
D-34				
D-34	Cm-243 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Cm-243 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,2)
D-34	Cm-243 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(6,3)
D-34				
D-34	Cm-244 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Cm-244 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,2)
D-34	Cm-244 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(8,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(11,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(11,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(11,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(12,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(12,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(12,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(13,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(13,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(15,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(15,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(15,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(16,2)
D-34	Eu-155 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(16,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(17,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(17,3)
D-34				
D-34	Nb-94 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(18,1)
D-34	Nb-94 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-07	3.000E-07	RTF(18,2)
D-34	Nb-94 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(18,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(19,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(19,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(20,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(20,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(20,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(21,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(21,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(21,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(22,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(22,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(22,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(24,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(24,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(24,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(25,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(25,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(25,3)
D-34				
D-34	Pu-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(27,1)
D-34	Pu-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(27,2)
D-34	Pu-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(27,3)
D-34				
D-34	Pu-241+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(28,1)
D-34	Pu-241+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(28,2)
D-34	Pu-241+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(28,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(29,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(29,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(29,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(30,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(30,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(30,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(31,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(31,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(31,3)
D-34				
D-34	Tc-99 , plant/soil concentration ratio, dimensionless	5.000E+00	5.000E+00	RTF(32,1)
D-34	Tc-99 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(32,2)
D-34	Tc-99 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(32,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(33,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(33,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(33,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(34,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(34,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(34,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(35,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(35,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(35,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(36,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(36,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(36,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(37,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(37,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(37,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(38,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(38,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(38,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(39,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(39,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(39,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(40,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(40,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(40,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(41,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(41,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(41,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(42,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(42,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(42,3)
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)
D-5	Ag-108m+D , fish	5.000E+00	5.000E+00	BIOFAC(2,1)
D-5	Ag-108m+D , crustacea and mollusks	7.700E+02	7.700E+02	BIOFAC(2,2)
D-5	Al-26 , fish	5.000E+02	5.000E+02	BIOFAC(3,1)
D-5	Al-26 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(3,2)
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(4,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(4,2)
D-5	Am-243+D , fish	3.000E+01	3.000E+01	BIOFAC(5,1)
D-5	Am-243+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5	Cm-243 , fish	3.000E+01	3.000E+01	BIOFAC(6,1)
D-5	Cm-243 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5	Cm-244 , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Cm-244 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(11,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(11,2)
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(12,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(12,2)
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(13,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(13,2)
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(15,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(15,2)
D-5	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(16,1)
D-5	Eu-155 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(16,2)
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(17,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(17,2)
D-5	Nb-94 , fish	3.000E+02	3.000E+02	BIOFAC(18,1)
D-5	Nb-94 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(18,2)
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(19,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(19,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(20,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(21,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(21,2)
D-5				
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(22,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(22,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(24,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(24,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(25,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(25,2)
D-5				
D-5	Pu-241 , fish	3.000E+01	3.000E+01	BIOFAC(27,1)
D-5	Pu-241 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(27,2)
D-5				
D-5	Pu-241+D , fish	3.000E+01	3.000E+01	BIOFAC(28,1)
D-5	Pu-241+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(28,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(29,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(29,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(30,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(30,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(31,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(31,2)
D-5				
D-5	Tc-99 , fish	2.000E+01	2.000E+01	BIOFAC(32,1)
D-5	Tc-99 , crustacea and mollusks	5.000E+00	5.000E+00	BIOFAC(32,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(33,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(33,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(34,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(34,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(35,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(35,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(36,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(36,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(37,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(37,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(38,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(38,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(39,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(39,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(40,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(40,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(41,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(41,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(42,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(42,2)

#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.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E-02	2.000E+00	---	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)	1.000E+01	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+02	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+03	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	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): Ag-108m	1.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Al-26	1.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Am-241	1.000E+02	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Am-243	1.000E+02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Cm-243	1.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Cm-244	1.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+02	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+02	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.000E+02	0.000E+00	---	S1(13)
R012	Initial principal radionuclide (pCi/g): Eu-154	1.000E+02	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g): Eu-155	1.000E+02	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): Nb-94	1.000E+02	0.000E+00	---	S1(18)
R012	Initial principal radionuclide (pCi/g): Np-237	1.000E+02	0.000E+00	---	S1(19)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.000E+02	0.000E+00	---	S1(22)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+02	0.000E+00	---	S1(24)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.000E+02	0.000E+00	---	S1(25)
R012	Initial principal radionuclide (pCi/g): Pu-241	1.000E+02	0.000E+00	---	S1(27)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+02	0.000E+00	---	S1(31)
R012	Initial principal radionuclide (pCi/g): Tc-99	1.000E+02	0.000E+00	---	S1(32)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+02	0.000E+00	---	S1(36)
R012	Initial principal radionuclide (pCi/g): U-233	1.000E+02	0.000E+00	---	S1(37)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+02	0.000E+00	---	S1(38)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+02	0.000E+00	---	S1(39)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+02	0.000E+00	---	S1(41)
R012	Concentration in groundwater (pCi/L): Ag-108m	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Al-26	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Am-243	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Cm-243	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Cm-244	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W1(15)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): Nb-94	not used	0.000E+00	---	W1(18)
R012	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W1(19)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(22)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(24)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(25)
R012	Concentration in groundwater (pCi/L): Pu-241	not used	0.000E+00	---	W1(27)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(31)
R012	Concentration in groundwater (pCi/L): Tc-99	not used	0.000E+00	---	W1(32)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(36)
R012	Concentration in groundwater (pCi/L): U-233	not used	0.000E+00	---	W1(37)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(38)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(39)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(41)
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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.090E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.120E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.800E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.600E-02	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-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
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 Ag-108m				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Al-26				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.629E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Am-243				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.629E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Cm-243				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	1.378E+03	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.115E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Cm-244				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	1.378E+03	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.115E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.536E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	4.600E+03	4.600E+03	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	4.600E+03	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	4.600E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.339E-06	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for Eu-155				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for Nb-94				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.964E-05	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(22)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(22,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(24)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(24,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(24)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(24)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(25)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(25,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(25)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(25)
R016	Distribution coefficients for Pu-241				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(27)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(27,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(27)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(27)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCC(31)
R016	Unsaturated zone 1 (cm**3/g)	not used	3.000E+01	---	DCNUCU(31,1)
R016	Saturated zone (cm**3/g)	not used	3.000E+01	---	DCNUCS(31)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.097E-04	ALEACH(31)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(31)
R016	Distribution coefficients for Tc-99				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(32)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(32,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(32)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(32)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(32)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(36)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(36,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(36)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(36)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(36)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(37)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(37,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(37)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(37)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(37)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(38)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(38,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(38)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(38)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(38)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(39)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(39,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(39)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(39)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(39)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(41)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(41,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(41)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(41)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(41)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.629E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)

Site-Specific Parameter Summary (continued)

enu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:016	Distribution coefficients for daughter Pb-210				
:016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(21)
:016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(21,1)
:016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(21)
:016	Leach rate (/yr)	0.000E+00	0.000E+00	1.534E-04	ALEACH(21)
:016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
:016	Distribution coefficients for daughter Ra-226				
:016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(29)
:016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(29,1)
:016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(29)
:016	Leach rate (/yr)	0.000E+00	0.000E+00	2.190E-04	ALEACH(29)
:016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(29)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(30)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(30,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(30)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.190E-04	ALEACH(30)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(30)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(33)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(33,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(33)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(33)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(33)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(34)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(34,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(34)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(34)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(34)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(35)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(35,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(35)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(35)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(35)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(40)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(40,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(40)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(40)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(40)
R017	Inhalation rate (m**3/yr)	1.200E+04	8.400E+03	---	INHALR

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Mass loading for inhalation (g/m**3)	6.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	1.000E+00	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	2.740E-02	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	8.220E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	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)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	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	Ring 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	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.190E+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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	4.500E-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)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	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 (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/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 milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	4.668E+01	0.1353
Al-26	0.000E+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	7.225E+01	0.2094
Am-241	0.000E+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	7.646E-01	0.0022
Am-243	0.000E+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	6.345E+00	0.0184
Cm-243	0.000E+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	3.882E+00	0.0113
Cm-244	0.000E+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	2.201E-01	0.0006
Co-60	0.000E+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	6.789E+01	0.1967
Cs-137	0.000E+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	1.705E+01	0.0494
Eu-152	0.000E+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	3.252E+01	0.0942
Eu-154	0.000E+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	3.484E+01	0.1010
Eu-155	0.000E+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	1.294E+00	0.0037
Nb-94	0.000E+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	4.494E+01	0.1302
Np-237	0.000E+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	6.703E+00	0.0194
Pu-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	4.297E-01	0.0012
Pu-239	0.000E+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	4.709E-01	0.0014
Pu-240	0.000E+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	4.703E-01	0.0014
Pu-241	0.000E+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	9.508E-03	0.0000
Sr-90	0.000E+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	1.466E-01	0.0004
Tc-99	0.000E+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	1.078E-03	0.0000
Th-232	0.000E+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	2.358E+00	0.0068
U-233	0.000E+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	5.152E-02	0.0001
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	4.419E-02	0.0001
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	4.871E+00	0.0141
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	8.556E-01	0.0025
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	3.451E+02	1.0000

*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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	4.137E+01	0.1300	1.116E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.760E-04	0.0000
Al-26	6.438E+01	0.2024	6.075E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.251E-04	0.0000
Am-241	3.892E-01	0.0012	3.450E-01	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.865E-02	0.0001
Am-243	5.965E+00	0.0187	3.458E-01	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.883E-02	0.0001
Cm-243	3.528E+00	0.0111	2.398E-01	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.079E-02	0.0001
Cm-244	1.193E-03	0.0000	1.944E-01	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-02	0.0001
Co-60	5.952E+01	0.1871	9.214E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.021E-04	0.0000
Cs-137	1.666E+01	0.0524	1.357E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-03	0.0000
Eu-152	3.087E+01	0.0970	1.398E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.861E-04	0.0000
Eu-154	3.220E+01	0.1012	1.699E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.555E-04	0.0000
Eu-155	1.125E+00	0.0035	2.018E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.720E-05	0.0000
Nb-94	4.005E+01	0.1259	1.486E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.057E-04	0.0000
Np-237	6.506E+00	0.0204	1.804E-01	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-02	0.0001
Pu-238	1.391E-03	0.0000	3.922E-01	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.267E-02	0.0001
Pu-239	1.994E-03	0.0000	4.330E-01	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.593E-02	0.0001
Pu-240	1.366E-03	0.0000	4.329E-01	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.593E-02	0.0001
Pu-241	1.024E-03	0.0000	8.523E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.099E-04	0.0000
Sr-90	1.383E-01	0.0004	5.619E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.270E-03	0.0000
Tc-99	8.440E-04	0.0000	3.949E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.750E-05	0.0000
Th-232	6.369E+00	0.0200	4.127E-01	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.022E-02	0.0002
U-233	1.037E-02	0.0000	3.474E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.351E-03	0.0000
U-234	3.222E-03	0.0000	3.393E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.028E-03	0.0000
U-235	4.832E+00	0.0152	3.073E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.809E-03	0.0000
U-238	8.194E-01	0.0026	2.888E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.974E-03	0.0000
Total	3.147E+02	0.9893	3.115E+00	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.020E-01	0.0009

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	4.137E+01	0.1300
Al-26	0.000E+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	6.439E+01	0.2024
Am-241	0.000E+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	7.628E-01	0.0024
Am-243	0.000E+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	6.340E+00	0.0199
Cm-243	0.000E+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	3.789E+00	0.0119
Cm-244	0.000E+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	2.119E-01	0.0007
Co-60	0.000E+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	5.952E+01	0.1871
Cs-137	0.000E+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	1.666E+01	0.0524
Eu-152	0.000E+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	3.087E+01	0.0970
Eu-154	0.000E+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	3.220E+01	0.1012
Eu-155	0.000E+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	1.125E+00	0.0035
Nb-94	0.000E+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	4.005E+01	0.1259
Np-237	0.000E+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	6.702E+00	0.0211
Pu-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	4.263E-01	0.0013
Pu-239	0.000E+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	4.709E-01	0.0015
Pu-240	0.000E+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	4.702E-01	0.0015
Pu-241	0.000E+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	1.026E-02	0.0000
Sr-90	0.000E+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	1.431E-01	0.0004
Tc-99	0.000E+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	9.609E-04	0.0000
Th-232	0.000E+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	6.831E+00	0.0215
U-233	0.000E+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	5.246E-02	0.0002
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	4.418E-02	0.0001
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	4.869E+00	0.0153
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	8.553E-01	0.0027
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	3.182E+02	1.0000

*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+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	1.397E+01	0.0740	3.766E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.318E-05	0.0000
Al-26	2.283E+01	0.1210	2.154E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.507E-04	0.0000
Am-241	3.810E-01	0.0020	3.377E-01	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.804E-02	0.0001
Am-243	5.919E+00	0.0314	3.432E-01	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.861E-02	0.0002
Cm-243	2.835E+00	0.0150	1.927E-01	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.671E-02	0.0001
Cm-244	8.462E-04	0.0000	1.381E-01	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E-02	0.0001
Co-60	1.822E+01	0.0966	2.821E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.231E-04	0.0000
Cs-137	1.353E+01	0.0717	1.102E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.466E-03	0.0000
Eu-152	1.933E+01	0.1024	8.756E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.166E-04	0.0000
Eu-154	1.584E+01	0.0840	8.360E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.257E-04	0.0000
Eu-155	3.198E-01	0.0017	5.737E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.057E-05	0.0000
Nb-94	1.420E+01	0.0752	5.267E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.291E-05	0.0000
Np-237	6.502E+00	0.0345	1.803E-01	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-02	0.0001
Pu-238	1.296E-03	0.0000	3.653E-01	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.043E-02	0.0002
Pu-239	1.993E-03	0.0000	4.328E-01	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.592E-02	0.0002
Pu-240	1.365E-03	0.0000	4.325E-01	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.589E-02	0.0002
Pu-241	5.171E-03	0.0000	9.521E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.920E-04	0.0000
Sr-90	1.111E-01	0.0006	4.515E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.431E-03	0.0000
Tc-99	2.992E-04	0.0000	1.400E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.748E-05	0.0000
Th-232	4.557E+01	0.2415	5.309E-01	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.162E-01	0.0006
U-233	1.801E-02	0.0001	3.542E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.405E-03	0.0000
U-234	3.225E-03	0.0000	3.386E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.011E-03	0.0000
U-235	4.819E+00	0.0255	3.080E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.815E-03	0.0000
U-238	8.172E-01	0.0043	2.880E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.955E-03	0.0000
Total	1.852E+02	0.9817	3.093E+00	0.0164	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.539E-01	0.0019

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	1.397E+01	0.0740
Al-26	0.000E+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	2.283E+01	0.1210
Am-241	0.000E+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	7.468E-01	0.0040
Am-243	0.000E+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	6.291E+00	0.0333
Cm-243	0.000E+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+00	0.0161
Cm-244	0.000E+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	1.505E-01	0.0008
Co-60	0.000E+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	1.822E+01	0.0966
Cs-137	0.000E+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	1.353E+01	0.0717
Eu-152	0.000E+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	1.933E+01	0.1024
Eu-154	0.000E+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	1.584E+01	0.0840
Eu-155	0.000E+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	3.198E-01	0.0017
Nb-94	0.000E+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	1.420E+01	0.0752
Np-237	0.000E+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	6.699E+00	0.0355
Pu-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	3.970E-01	0.0021
Pu-239	0.000E+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	4.708E-01	0.0025
Pu-240	0.000E+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	4.697E-01	0.0025
Pu-241	0.000E+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	1.548E-02	0.0001
Sr-90	0.000E+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	1.150E-01	0.0006
Tc-99	0.000E+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	3.407E-04	0.0000
Th-232	0.000E+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	4.622E+01	0.2450
U-233	0.000E+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	6.083E-02	0.0003
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	4.410E-02	0.0002
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	4.857E+00	0.0257
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	8.529E-01	0.0045
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	1.887E+02	1.0000

*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+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	2.685E-04	0.0000	7.241E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.792E-09	0.0000
Al-26	7.173E-04	0.0000	6.768E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.736E-09	0.0000
Am-241	3.081E-01	0.0033	2.729E-01	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.266E-02	0.0002
Am-243	5.480E+00	0.0582	3.189E-01	0.0034	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.658E-02	0.0003
Cm-243	3.173E-01	0.0034	2.203E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.908E-03	0.0000
Cm-244	3.061E-05	0.0000	5.553E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.645E-04	0.0000
Co-60	1.318E-04	0.0000	2.041E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.908E-10	0.0000
Cs-137	1.691E+00	0.0180	1.377E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.832E-04	0.0000
Eu-152	1.791E-01	0.0019	8.112E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.080E-06	0.0000
Eu-154	1.320E-02	0.0001	6.963E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.047E-07	0.0000
Eu-155	1.101E-06	0.0000	1.976E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.642E-11	0.0000
Nb-94	4.448E-04	0.0000	1.650E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.284E-09	0.0000
Np-237	6.467E+00	0.0687	1.794E-01	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E-02	0.0002
Pu-238	6.366E-04	0.0000	1.793E-01	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.493E-02	0.0002
Pu-239	1.987E-03	0.0000	4.314E-01	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.580E-02	0.0004
Pu-240	1.351E-03	0.0000	4.281E-01	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.553E-02	0.0004
Pu-241	1.068E-02	0.0001	9.532E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.914E-04	0.0000
Sr-90	1.246E-02	0.0001	5.062E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.846E-04	0.0000
Tc-99	9.400E-09	0.0000	4.398E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.632E-10	0.0000
Th-232	7.118E+01	0.7557	6.118E-01	0.0065	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.526E-01	0.0016
U-233	9.287E-02	0.0010	4.216E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.935E-03	0.0001
U-234	4.103E-03	0.0000	3.322E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.847E-03	0.0001
U-235	4.706E+00	0.0500	3.377E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.061E-03	0.0001
U-238	7.950E-01	0.0084	2.803E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.768E-03	0.0001
Total	9.126E+01	0.9689	2.596E+00	0.0276	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.362E-01	0.0036

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	2.685E-04	0.0000
Al-26	0.000E+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	7.173E-04	0.0000
Am-241	0.000E+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	6.037E-01	0.0064
Am-243	0.000E+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	5.825E+00	0.0618
Cm-243	0.000E+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	3.413E-01	0.0036
Cm-244	0.000E+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	6.048E-03	0.0001
Co-60	0.000E+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	1.318E-04	0.0000
Cs-137	0.000E+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	1.691E+00	0.0180
Eu-152	0.000E+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	1.791E-01	0.0019
Eu-154	0.000E+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	1.320E-02	0.0001
Eu-155	0.000E+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	1.101E-06	0.0000
Nb-94	0.000E+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	4.448E-04	0.0000
Np-237	0.000E+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	6.663E+00	0.0707
Pu-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	1.949E-01	0.0021
Pu-239	0.000E+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	4.692E-01	0.0050
Pu-240	0.000E+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	4.650E-01	0.0049
Pu-241	0.000E+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	2.101E-02	0.0002
Sr-90	0.000E+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	1.289E-02	0.0001
Tc-99	0.000E+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	1.070E-08	0.0000
Th-232	0.000E+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	7.194E+01	0.7638
U-233	0.000E+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	1.430E-01	0.0015
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	4.417E-02	0.0005
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	4.747E+00	0.0504
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	8.297E-01	0.0088
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	9.419E+01	1.0000

*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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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
Al-26	0.000E+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
Am-241	3.736E-02	0.0004	3.246E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.695E-03	0.0000
Am-243	2.534E+00	0.0290	1.551E-01	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.293E-02	0.0001
Cm-243	2.661E-05	0.0000	4.952E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.110E-05	0.0000
Cm-244	3.388E-06	0.0000	1.073E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.908E-05	0.0000
Co-60	0.000E+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
Cs-137	1.570E-09	0.0000	1.278E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.701E-13	0.0000
Eu-152	8.339E-22	0.0000	2.319E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.997E-16	0.0000
Eu-154	0.000E+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
Eu-155	0.000E+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
Nb-94	0.000E+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
Np-237	6.129E+00	0.0702	1.702E-01	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.505E-02	0.0002
Pu-238	2.229E-05	0.0000	1.557E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.423E-05	0.0000
Pu-239	1.926E-03	0.0000	4.175E-01	0.0048	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.465E-02	0.0004
Pu-240	1.220E-03	0.0000	3.864E-01	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.207E-02	0.0004
Pu-241	1.308E-03	0.0000	1.137E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.441E-05	0.0000
Sr-90	3.911E-12	0.0000	1.590E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.208E-13	0.0000
Tc-99	0.000E+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
Th-232	7.116E+01	0.8155	6.116E-01	0.0070	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.525E-01	0.0017
U-233	7.053E-01	0.0081	9.683E-02	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.218E-02	0.0001
U-234	7.494E-02	0.0009	2.779E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.815E-03	0.0001
U-235	3.747E+00	0.0429	6.070E-02	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.146E-03	0.0001
U-238	6.034E-01	0.0069	2.134E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.150E-03	0.0001
Total	8.500E+01	0.9740	1.983E+00	0.0227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.824E-01	0.0032

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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
Al-26	0.000E+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
Am-241	0.000E+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	7.251E-02	0.0008
Am-243	0.000E+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	2.702E+00	0.0310
Cm-243	0.000E+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	5.630E-04	0.0000
Cm-244	0.000E+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	1.166E-03	0.0000
Co-60	0.000E+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
Cs-137	0.000E+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	1.570E-09	0.0000
Eu-152	0.000E+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-15	0.0000
Eu-154	0.000E+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
Eu-155	0.000E+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
Nb-94	0.000E+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
Np-237	0.000E+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	6.314E+00	0.0724
Pu-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	1.922E-04	0.0000
Pu-239	0.000E+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	4.541E-01	0.0052
Pu-240	0.000E+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	4.197E-01	0.0048
Pu-241	0.000E+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	2.539E-03	0.0000
Sr-90	0.000E+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	4.048E-12	0.0000
Tc-99	0.000E+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
Th-232	0.000E+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	7.192E+01	0.8242
U-233	0.000E+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	8.143E-01	0.0093
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	1.085E-01	0.0012
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	3.816E+00	0.0437
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	6.299E-01	0.0072
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	8.726E+01	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Ag-108m+D	Ag-108m+D	1.000E+00	4.668E-01	4.137E-01	1.397E-01	2.685E-06	0.000E+00
Al-26	Al-26	1.000E+00	7.225E-01	6.439E-01	2.283E-01	7.173E-06	0.000E+00
Am-241	Am-241	1.000E+00	7.646E-03	7.628E-03	7.467E-03	6.035E-03	7.171E-04
Am-241	Np-237+D	1.000E+00	1.085E-08	3.250E-08	2.251E-07	1.936E-06	7.982E-06
Am-241	U-233	1.000E+00	1.204E-16	8.425E-16	3.952E-14	3.337E-12	1.638E-10
Am-241	Th-229+D	1.000E+00	5.599E-19	8.393E-18	2.581E-15	2.120E-12	1.200E-09
Am-241	äDSR(j)		7.646E-03	7.628E-03	7.468E-03	6.037E-03	7.251E-04
Am-243+D	Am-243+D	1.000E+00	6.345E-02	6.340E-02	6.291E-02	5.824E-02	2.694E-02
Am-243+D	Pu-239	1.000E+00	6.780E-08	2.033E-07	1.418E-06	1.304E-05	8.926E-05
Am-243+D	U-235+D	1.000E+00	2.302E-16	1.611E-15	7.591E-14	6.705E-12	4.702E-10
Am-243+D	Pa-231	1.000E+00	4.246E-22	6.367E-21	1.963E-18	1.660E-15	1.171E-12
Am-243+D	Ac-227+D	1.000E+00	2.202E-23	6.787E-22	1.260E-18	6.392E-15	8.645E-12
Am-243+D	äDSR(j)		6.345E-02	6.340E-02	6.291E-02	5.825E-02	2.702E-02
Cm-243	Cm-243	2.400E-03	9.318E-05	9.094E-05	7.305E-05	8.177E-06	2.524E-15
Cm-243	Am-243+D	2.400E-03	7.095E-09	2.105E-08	1.320E-07	5.064E-07	2.586E-07
Cm-243	Pu-239	2.400E-03	5.064E-15	3.520E-14	1.547E-12	7.642E-11	8.054E-10
Cm-243	U-235+D	2.400E-03	1.291E-23	1.926E-22	5.639E-20	3.050E-17	4.070E-15
Cm-243	Pa-231	2.400E-03	1.907E-29	5.885E-28	1.108E-24	6.214E-21	9.749E-18
Cm-243	Ac-227+D	2.400E-03	8.254E-31	5.156E-29	5.801E-25	2.164E-20	7.169E-17
Cm-243	äDSR(j)		9.318E-05	9.096E-05	7.318E-05	8.683E-06	2.594E-07
Cm-243	Cm-243	9.976E-01	3.873E-02	3.780E-02	3.037E-02	3.399E-03	1.049E-12
Cm-243	Pu-239	9.976E-01	6.711E-08	1.992E-07	1.254E-06	5.066E-06	5.370E-06
Cm-243	U-235+D	9.976E-01	2.283E-16	1.587E-15	6.987E-14	3.520E-12	4.623E-11
Cm-243	Pa-231	9.976E-01	4.216E-22	6.291E-21	1.844E-18	1.010E-15	1.557E-13
Cm-243	Ac-227+D	9.976E-01	2.188E-23	6.717E-22	1.197E-18	4.128E-15	1.176E-12
Cm-243	äDSR(j)		3.873E-02	3.780E-02	3.037E-02	3.404E-03	5.370E-06
Cm-244	Cm-244	1.350E-06	2.971E-09	2.859E-09	2.026E-09	6.459E-11	7.010E-26
Cm-244	Cm-244	4.950E-08	1.089E-10	1.048E-10	7.428E-11	2.368E-12	2.570E-27
Cm-244	Pu-240	4.950E-08	1.219E-14	3.594E-14	2.133E-13	6.255E-13	5.771E-13
Cm-244	äDSR(j)		1.089E-10	1.049E-10	7.449E-11	2.994E-12	5.771E-13
Cm-244	Cm-244	1.000E+00	2.200E-03	2.118E-03	1.501E-03	4.784E-05	5.192E-20
Cm-244	Pu-240	1.000E+00	2.462E-07	7.261E-07	4.308E-06	1.264E-05	1.166E-05
Cm-244	U-236	1.000E+00	2.071E-16	1.434E-15	6.070E-14	2.414E-12	2.606E-11
Cm-244	Th-232	1.000E+00	2.780E-26	4.136E-25	1.178E-22	5.366E-20	7.290E-18
Cm-244	Ra-228+D	1.000E+00	4.303E-26	1.298E-24	1.965E-21	2.878E-18	4.685E-16
Cm-244	Th-228+D	1.000E+00	3.775E-27	2.211E-25	1.407E-21	4.078E-18	7.095E-16
Cm-244	äDSR(j)		2.201E-03	2.119E-03	1.505E-03	6.048E-05	1.166E-05

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03 (mrem/yr)/(pCi/g)
Co-60	Co-60	1.000E+00	6.789E-01	5.952E-01	1.822E-01	1.318E-06	0.000E+00
Cs-137+D	Cs-137+D	1.000E+00	1.705E-01	1.666E-01	1.353E-01	1.691E-02	1.570E-11
Eu-152	Eu-152	7.208E-01	2.344E-01	2.225E-01	1.393E-01	1.291E-03	6.011E-24
Eu-152	Eu-152	2.792E-01	9.079E-02	8.619E-02	5.397E-02	5.000E-04	2.328E-24
Eu-152	Gd-152	2.792E-01	6.557E-19	1.923E-18	1.079E-17	2.548E-17	2.519E-17
Eu-152	äDSR(j)		9.079E-02	8.619E-02	5.397E-02	5.000E-04	2.519E-17
Eu-154	Eu-154	1.000E+00	3.484E-01	3.220E-01	1.584E-01	1.320E-04	2.118E-35
Eu-155	Eu-155	1.000E+00	1.294E-02	1.125E-02	3.198E-03	1.101E-08	0.000E+00
Nb-94	Nb-94	1.000E+00	4.494E-01	4.005E-01	1.420E-01	4.448E-06	0.000E+00
Np-237+D	Np-237+D	1.000E+00	6.703E-02	6.702E-02	6.699E-02	6.663E-02	6.313E-02
Np-237+D	U-233	1.000E+00	1.116E-09	3.348E-09	2.340E-08	2.203E-07	1.861E-06
Np-237+D	Th-229+D	1.000E+00	6.918E-12	4.842E-11	2.286E-09	2.064E-07	1.782E-05
Np-237+D	äDSR(j)		6.703E-02	6.702E-02	6.699E-02	6.663E-02	6.314E-02
Pu-238	Pu-238	1.840E-09	7.906E-12	7.844E-12	7.305E-12	3.585E-12	2.909E-15
Pu-238	Pu-238	1.000E+00	4.297E-03	4.263E-03	3.970E-03	1.949E-03	1.581E-06
Pu-238	U-234	1.000E+00	6.247E-10	1.867E-09	1.260E-08	8.536E-08	1.209E-07
Pu-238	Th-230	1.000E+00	1.699E-14	1.186E-13	5.475E-12	3.979E-10	9.824E-09
Pu-238	Ra-226+D	1.000E+00	2.342E-16	3.507E-15	1.064E-12	7.703E-10	2.088E-07
Pu-238	Pb-210+D	1.000E+00	1.007E-20	3.101E-19	5.695E-16	2.562E-12	1.356E-09
Pu-238	äDSR(j)		4.297E-03	4.263E-03	3.970E-03	1.949E-03	1.922E-06
Pu-239	Pu-239	1.000E+00	4.709E-03	4.709E-03	4.708E-03	4.692E-03	4.541E-03
Pu-239	U-235+D	1.000E+00	2.399E-11	7.195E-11	5.028E-10	4.739E-09	4.056E-08
Pu-239	Pa-231	1.000E+00	5.898E-17	4.128E-16	1.948E-14	1.748E-12	1.420E-10
Pu-239	Ac-227+D	1.000E+00	3.819E-18	5.688E-17	1.638E-14	7.978E-12	1.075E-09
Pu-239	äDSR(j)		4.709E-03	4.709E-03	4.708E-03	4.692E-03	4.541E-03
Pu-240	Pu-240	4.950E-08	2.328E-10	2.328E-10	2.325E-10	2.302E-10	2.078E-10
Pu-240	Pu-240	1.000E+00	4.703E-03	4.702E-03	4.697E-03	4.650E-03	4.197E-03
Pu-240	U-236	1.000E+00	5.915E-12	1.774E-11	1.240E-10	1.164E-09	9.609E-09
Pu-240	Th-232	1.000E+00	1.057E-21	7.395E-21	3.493E-19	3.157E-17	2.764E-15
Pu-240	Ra-228+D	1.000E+00	2.034E-21	2.974E-20	7.229E-18	1.751E-15	1.777E-13
Pu-240	Th-228+D	1.000E+00	2.123E-22	6.079E-21	5.925E-18	2.514E-15	2.692E-13
Pu-240	äDSR(j)		4.703E-03	4.702E-03	4.697E-03	4.650E-03	4.197E-03

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03 (mrem/yr)/(pCi/g)
Pu-241	Pu-241	1.000E+00	8.819E-05	8.405E-05	5.449E-05	7.155E-07	1.090E-25
Pu-241	Am-241	1.000E+00	6.036E-06	1.771E-05	9.982E-05	2.093E-04	2.512E-05
Pu-241	Np-237+D	1.000E+00	5.730E-12	3.954E-11	1.619E-09	5.222E-08	2.647E-07
Pu-241	U-233	1.000E+00	4.784E-20	7.099E-19	1.971E-16	7.551E-14	5.308E-12
Pu-241	Th-229+D	1.000E+00	1.782E-22	5.476E-21	9.885E-18	4.156E-14	3.798E-11
Pu-241	ãDSR(j)		9.423E-05	1.018E-04	1.543E-04	2.101E-04	2.539E-05
Pu-241+D	Pu-241+D	2.450E-05	8.494E-07	8.095E-07	5.249E-07	6.891E-09	1.049E-27
Pu-241+D	Np-237+D	2.450E-05	2.617E-13	7.687E-13	4.382E-12	1.091E-11	1.042E-11
Pu-241+D	U-233	2.450E-05	2.918E-21	2.014E-20	8.303E-19	2.894E-17	3.014E-16
Pu-241+D	Th-229+D	2.450E-05	1.359E-23	2.018E-22	5.631E-20	2.289E-17	2.826E-15
Pu-241+D	ãDSR(j)		8.494E-07	8.095E-07	5.249E-07	6.902E-09	1.042E-11
Sr-90+D	Sr-90+D	1.000E+00	1.466E-03	1.431E-03	1.150E-03	1.289E-04	4.048E-14
Tc-99	Tc-99	1.000E+00	1.078E-05	9.609E-06	3.407E-06	1.070E-10	0.000E+00
Th-232	Th-232	1.000E+00	4.341E-03	4.341E-03	4.341E-03	4.341E-03	4.340E-03
Th-232	Ra-228+D	1.000E+00	1.645E-02	4.682E-02	2.036E-01	2.834E-01	2.834E-01
Th-232	Th-228+D	1.000E+00	2.796E-03	1.715E-02	2.542E-01	4.316E-01	4.315E-01
Th-232	ãDSR(j)		2.358E-02	6.831E-02	4.622E-01	7.194E-01	7.192E-01
U-233	U-233	1.000E+00	5.105E-04	5.103E-04	5.089E-04	4.949E-04	3.741E-04
U-233	Th-229+D	1.000E+00	4.745E-06	1.423E-05	9.946E-05	9.347E-04	7.769E-03
U-233	ãDSR(j)		5.152E-04	5.246E-04	6.083E-04	1.430E-03	8.143E-03
U-234	U-234	1.000E+00	4.419E-04	4.417E-04	4.405E-04	4.284E-04	3.243E-04
U-234	Th-230	1.000E+00	1.801E-08	5.402E-08	3.776E-07	3.563E-06	3.085E-05
U-234	Ra-226+D	1.000E+00	3.310E-10	2.316E-09	1.092E-07	9.712E-06	7.255E-04
U-234	Pb-210+D	1.000E+00	1.776E-14	2.647E-13	7.639E-11	3.761E-08	4.750E-06
U-234	ãDSR(j)		4.419E-04	4.418E-04	4.410E-04	4.417E-04	1.085E-03
U-235+D	U-235+D	1.000E+00	4.871E-02	4.869E-02	4.856E-02	4.724E-02	3.585E-02
U-235+D	Pa-231	1.000E+00	1.796E-07	5.388E-07	3.761E-06	3.498E-05	2.618E-04
U-235+D	Ac-227+D	1.000E+00	1.548E-08	1.074E-07	4.614E-06	1.988E-04	2.049E-03
U-235+D	ãDSR(j)		4.871E-02	4.869E-02	4.857E-02	4.747E-02	3.816E-02
U-238	U-238	5.400E-05	1.963E-08	1.962E-08	1.957E-08	1.904E-08	1.445E-08
U-238+D	U-238+D	9.999E-01	8.555E-03	8.553E-03	8.529E-03	8.297E-03	6.298E-03
U-238+D	U-234	9.999E-01	6.263E-10	1.878E-09	1.311E-08	1.221E-07	9.212E-07
U-238+D	Th-230	9.999E-01	1.702E-14	1.191E-13	5.621E-12	5.050E-10	4.160E-08
U-238+D	Ra-226+D	9.999E-01	2.346E-16	3.518E-15	1.085E-12	9.227E-10	6.865E-07
U-238+D	Pb-210+D	9.999E-01	1.008E-20	3.108E-19	5.787E-16	2.997E-12	4.359E-09
U-238+D	ãDSR(j)		8.555E-03	8.553E-03	8.529E-03	8.297E-03	6.299E-03

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ
Ag-108m	5.356E+01	6.043E+01	1.790E+02	9.309E+06	*2.609E+13
Al-26	3.460E+01	3.883E+01	1.095E+02	3.485E+06	*1.921E+10
Am-241	3.270E+03	3.277E+03	3.348E+03	4.141E+03	3.448E+04
Am-243	3.940E+02	3.943E+02	3.974E+02	4.292E+02	9.251E+02
Cm-243	6.439E+02	6.598E+02	8.213E+02	7.326E+03	4.441E+06
Cm-244	1.136E+04	1.180E+04	1.661E+04	4.134E+05	2.144E+06
Co-60	3.683E+01	4.200E+01	1.372E+02	1.896E+07	*1.132E+15
Cs-137	1.466E+02	1.500E+02	1.847E+02	1.478E+03	1.592E+12
Eu-152	7.688E+01	8.099E+01	1.293E+02	1.396E+04	*1.765E+14
Eu-154	7.176E+01	7.765E+01	1.578E+02	1.895E+05	*2.639E+14
Eu-155	1.932E+03	2.222E+03	7.816E+03	2.270E+09	*4.652E+14
Nb-94	5.562E+01	6.242E+01	1.761E+02	5.621E+06	*1.875E+11
Np-237	3.730E+02	3.730E+02	3.732E+02	3.752E+02	3.959E+02
Pu-238	5.818E+03	5.864E+03	6.297E+03	1.283E+04	1.301E+07
Pu-239	5.309E+03	5.309E+03	5.311E+03	5.328E+03	5.506E+03
Pu-240	5.316E+03	5.317E+03	5.322E+03	5.377E+03	5.956E+03
Pu-241	2.629E+05	2.437E+05	1.615E+05	1.190E+05	9.847E+05
Sr-90	1.705E+04	1.747E+04	2.174E+04	1.939E+05	*1.365E+14
Tc-99	2.319E+06	2.602E+06	7.337E+06	*1.697E+10	*1.697E+10
Th-232	1.060E+03	3.660E+02	5.409E+01	3.475E+01	3.476E+01
U-233	4.852E+04	4.766E+04	4.109E+04	1.749E+04	3.070E+03
U-234	5.658E+04	5.659E+04	5.669E+04	5.660E+04	2.303E+04
U-235	5.133E+02	5.134E+02	5.148E+02	5.266E+02	6.551E+02
U-238	2.922E+03	2.923E+03	2.931E+03	3.013E+03	3.969E+03
ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍÍ

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ
Ag-108m	1.000E+02	0.000E+00	4.668E-01	5.356E+01	4.668E-01	5.356E+01
Al-26	1.000E+02	0.000E+00	7.225E-01	3.460E+01	7.225E-01	3.460E+01
Am-241	1.000E+02	0.000E+00	7.646E-03	3.270E+03	7.646E-03	3.270E+03
Am-243	1.000E+02	0.000E+00	6.345E-02	3.940E+02	6.345E-02	3.940E+02
Cm-243	1.000E+02	0.000E+00	3.882E-02	6.439E+02	3.882E-02	6.439E+02
Cm-244	1.000E+02	0.000E+00	2.201E-03	1.136E+04	2.201E-03	1.136E+04
Co-60	1.000E+02	0.000E+00	6.789E-01	3.683E+01	6.789E-01	3.683E+01
Cs-137	1.000E+02	0.000E+00	1.705E-01	1.466E+02	1.705E-01	1.466E+02
Eu-152	1.000E+02	0.000E+00	3.252E-01	7.688E+01	3.252E-01	7.688E+01
Eu-154	1.000E+02	0.000E+00	3.484E-01	7.176E+01	3.484E-01	7.176E+01
Eu-155	1.000E+02	0.000E+00	1.294E-02	1.932E+03	1.294E-02	1.932E+03
Nb-94	1.000E+02	0.000E+00	4.494E-01	5.562E+01	4.494E-01	5.562E+01
Np-237	1.000E+02	0.000E+00	6.703E-02	3.730E+02	6.703E-02	3.730E+02
Pu-238	1.000E+02	0.000E+00	4.297E-03	5.818E+03	4.297E-03	5.818E+03
Pu-239	1.000E+02	0.000E+00	4.709E-03	5.309E+03	4.709E-03	5.309E+03
Pu-240	1.000E+02	0.000E+00	4.703E-03	5.316E+03	4.703E-03	5.316E+03
Pu-241	1.000E+02	56.2 ñ 0.1	2.230E-04	1.121E+05	9.508E-05	2.629E+05
Sr-90	1.000E+02	0.000E+00	1.466E-03	1.705E+04	1.466E-03	1.705E+04
Tc-99	1.000E+02	0.000E+00	1.078E-05	2.319E+06	1.078E-05	2.319E+06
Th-232	1.000E+02	109.3 ñ 0.2	7.194E-01	3.475E+01	2.358E-02	1.060E+03
U-233	1.000E+02	1.000E+03	8.143E-03	3.070E+03	5.152E-04	4.852E+04
U-234	1.000E+02	1.000E+03	1.085E-03	2.303E+04	4.419E-04	5.658E+04
U-235	1.000E+02	0.000E+00	4.871E-02	5.133E+02	4.871E-02	5.133E+02
U-238	1.000E+02	0.000E+00	8.556E-03	2.922E+03	8.556E-03	2.922E+03
ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ
Ag-108m	Ag-108m	1.000E+00	4.668E+01	4.137E+01	1.397E+01	2.685E-04	0.000E+00
Al-26	Al-26	1.000E+00	7.225E+01	6.439E+01	2.283E+01	7.173E-04	0.000E+00
Am-241	Am-241	1.000E+00	7.646E-01	7.628E-01	7.467E-01	6.035E-01	7.171E-02
Am-241	Pu-241	1.000E+00	6.036E-04	1.771E-03	9.982E-03	2.093E-02	2.512E-03
Am-241	äDOSE(j)		7.652E-01	7.646E-01	7.567E-01	6.244E-01	7.423E-02
Np-237	Am-241	1.000E+00	1.085E-06	3.250E-06	2.251E-05	1.936E-04	7.982E-04
Np-237	Np-237	1.000E+00	6.703E+00	6.702E+00	6.699E+00	6.663E+00	6.313E+00
Np-237	Pu-241	1.000E+00	5.730E-10	3.954E-09	1.619E-07	5.222E-06	2.647E-05
Np-237	Pu-241	2.450E-05	2.617E-11	7.687E-11	4.382E-10	1.091E-09	1.042E-09
Np-237	äDOSE(j)		6.703E+00	6.702E+00	6.699E+00	6.663E+00	6.313E+00
U-233	Am-241	1.000E+00	1.204E-14	8.425E-14	3.952E-12	3.337E-10	1.638E-08
U-233	Np-237	1.000E+00	1.116E-07	3.348E-07	2.340E-06	2.203E-05	1.861E-04
U-233	Pu-241	1.000E+00	4.784E-18	7.099E-17	1.971E-14	7.551E-12	5.308E-10
U-233	Pu-241	2.450E-05	2.918E-19	2.014E-18	8.303E-17	2.894E-15	3.014E-14
U-233	U-233	1.000E+00	5.105E-02	5.103E-02	5.089E-02	4.949E-02	3.741E-02
U-233	äDOSE(j)		5.105E-02	5.103E-02	5.089E-02	4.951E-02	3.760E-02
Th-229	Am-241	1.000E+00	5.599E-17	8.393E-16	2.581E-13	2.120E-10	1.200E-07
Th-229	Np-237	1.000E+00	6.918E-10	4.842E-09	2.286E-07	2.064E-05	1.782E-03
Th-229	Pu-241	1.000E+00	1.782E-20	5.476E-19	9.885E-16	4.156E-12	3.798E-09
Th-229	Pu-241	2.450E-05	1.359E-21	2.018E-20	5.631E-18	2.289E-15	2.826E-13
Th-229	U-233	1.000E+00	4.745E-04	1.423E-03	9.946E-03	9.347E-02	7.769E-01
Th-229	äDOSE(j)		4.745E-04	1.423E-03	9.946E-03	9.349E-02	7.786E-01
Am-243	Am-243	1.000E+00	6.345E+00	6.340E+00	6.291E+00	5.824E+00	2.694E+00
Am-243	Cm-243	2.400E-03	7.095E-07	2.105E-06	1.320E-05	5.064E-05	2.586E-05
Am-243	äDOSE(j)		6.345E+00	6.340E+00	6.291E+00	5.824E+00	2.694E+00
Pu-239	Am-243	1.000E+00	6.780E-06	2.033E-05	1.418E-04	1.304E-03	8.926E-03
Pu-239	Cm-243	2.400E-03	5.064E-13	3.520E-12	1.547E-10	7.642E-09	8.054E-08
Pu-239	Cm-243	9.976E-01	6.711E-06	1.992E-05	1.254E-04	5.066E-04	5.370E-04
Pu-239	Pu-239	1.000E+00	4.709E-01	4.709E-01	4.708E-01	4.692E-01	4.541E-01
Pu-239	äDOSE(j)		4.709E-01	4.710E-01	4.710E-01	4.710E-01	4.635E-01
U-235	Am-243	1.000E+00	2.302E-14	1.611E-13	7.591E-12	6.705E-10	4.702E-08
U-235	Cm-243	2.400E-03	1.291E-21	1.926E-20	5.639E-18	3.050E-15	4.070E-13
U-235	Cm-243	9.976E-01	2.283E-14	1.587E-13	6.987E-12	3.520E-10	4.623E-09
U-235	Pu-239	1.000E+00	2.399E-09	7.195E-09	5.028E-08	4.739E-07	4.056E-06
U-235	U-235	1.000E+00	4.871E+00	4.869E+00	4.856E+00	4.724E+00	3.585E+00
U-235	äDOSE(j)		4.871E+00	4.869E+00	4.856E+00	4.724E+00	3.585E+00
Pa-231	Am-243	1.000E+00	4.246E-20	6.367E-19	1.963E-16	1.660E-13	1.171E-10
Pa-231	Cm-243	2.400E-03	1.907E-27	5.885E-26	1.108E-22	6.214E-19	9.749E-16
Pa-231	Cm-243	9.976E-01	4.216E-20	6.291E-19	1.844E-16	1.010E-13	1.557E-11
Pa-231	Pu-239	1.000E+00	5.898E-15	4.128E-14	1.948E-12	1.748E-10	1.420E-08

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Pa-231	U-235	1.000E+00	1.796E-05	5.388E-05	3.761E-04	3.498E-03	2.618E-02
Pa-231	ãDOSE(j)		1.796E-05	5.388E-05	3.761E-04	3.498E-03	2.618E-02
Ac-227	Am-243	1.000E+00	2.202E-21	6.787E-20	1.260E-16	6.392E-13	8.645E-10
Ac-227	Cm-243	2.400E-03	0.000E+00	5.091E-27	5.801E-23	2.164E-18	7.169E-15
Ac-227	Cm-243	9.976E-01	2.188E-21	6.717E-20	1.197E-16	4.128E-13	1.176E-10
Ac-227	Pu-239	1.000E+00	3.819E-16	5.688E-15	1.638E-12	7.978E-10	1.075E-07
Ac-227	U-235	1.000E+00	1.548E-06	1.074E-05	4.614E-04	1.988E-02	2.049E-01
Ac-227	ãDOSE(j)		1.548E-06	1.074E-05	4.614E-04	1.988E-02	2.049E-01
Cm-243	Cm-243	2.400E-03	9.318E-03	9.094E-03	7.305E-03	8.177E-04	2.524E-13
Cm-243	Cm-243	9.976E-01	3.873E+00	3.780E+00	3.037E+00	3.399E-01	1.049E-10
Cm-243	ãDOSE(j)		3.882E+00	3.789E+00	3.044E+00	3.407E-01	1.051E-10
Cm-244	Cm-244	1.350E-06	2.971E-07	2.859E-07	2.026E-07	6.459E-09	7.010E-24
Cm-244	Cm-244	4.950E-08	1.089E-08	1.048E-08	7.428E-09	2.368E-10	2.570E-25
Cm-244	ãDOSE(j)		3.080E-07	2.964E-07	2.100E-07	6.695E-09	7.267E-24
Pu-240	Cm-244	4.950E-08	1.219E-12	3.594E-12	2.133E-11	6.255E-11	5.771E-11
Pu-240	Pu-240	4.950E-08	2.328E-08	2.328E-08	2.325E-08	2.302E-08	2.078E-08
Pu-240	ãDOSE(j)		2.328E-08	2.328E-08	2.327E-08	2.308E-08	2.083E-08
Cm-244	Cm-244	1.000E+00	2.200E-01	2.118E-01	1.501E-01	4.784E-03	5.192E-18
Pu-240	Cm-244	1.000E+00	2.462E-05	7.261E-05	4.308E-04	1.264E-03	1.166E-03
U-236	Cm-244	1.000E+00	2.071E-14	1.434E-13	6.070E-12	2.414E-10	2.606E-09
U-236	Pu-240	1.000E+00	5.915E-10	1.774E-09	1.240E-08	1.164E-07	9.609E-07
U-236	ãDOSE(j)		5.915E-10	1.774E-09	1.240E-08	1.167E-07	9.635E-07
Th-232	Cm-244	1.000E+00	2.780E-24	4.136E-23	1.178E-20	5.366E-18	7.290E-16
Th-232	Pu-240	1.000E+00	1.057E-19	7.395E-19	3.493E-17	3.157E-15	2.764E-13
Th-232	Th-232	1.000E+00	4.341E-01	4.341E-01	4.341E-01	4.341E-01	4.340E-01
Th-232	ãDOSE(j)		4.341E-01	4.341E-01	4.341E-01	4.341E-01	4.340E-01
Ra-228	Cm-244	1.000E+00	4.303E-24	1.298E-22	1.965E-19	2.878E-16	4.685E-14
Ra-228	Pu-240	1.000E+00	2.034E-19	2.974E-18	7.229E-16	1.751E-13	1.777E-11
Ra-228	Th-232	1.000E+00	1.645E+00	4.682E+00	2.036E+01	2.834E+01	2.834E+01
Ra-228	ãDOSE(j)		1.645E+00	4.682E+00	2.036E+01	2.834E+01	2.834E+01
Th-228	Cm-244	1.000E+00	3.775E-25	2.211E-23	1.407E-19	4.078E-16	7.095E-14
Th-228	Pu-240	1.000E+00	2.123E-20	6.079E-19	5.925E-16	2.514E-13	2.692E-11
Th-228	Th-232	1.000E+00	2.796E-01	1.715E+00	2.542E+01	4.316E+01	4.315E+01
Th-228	ãDOSE(j)		2.796E-01	1.715E+00	2.542E+01	4.316E+01	4.315E+01
Co-60	Co-60	1.000E+00	6.789E+01	5.952E+01	1.822E+01	1.318E-04	0.000E+00
Cs-137	Cs-137	1.000E+00	1.705E+01	1.666E+01	1.353E+01	1.691E+00	1.570E-09

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ
Eu-152	Eu-152	7.208E-01	2.344E+01	2.225E+01	1.393E+01	1.291E-01	6.011E-22
Eu-152	Eu-152	2.792E-01	9.079E+00	8.619E+00	5.397E+00	5.000E-02	2.328E-22
Eu-152	äDOSE(j)		3.252E+01	3.087E+01	1.933E+01	1.791E-01	8.339E-22
Gd-152	Eu-152	2.792E-01	6.557E-17	1.923E-16	1.079E-15	2.548E-15	2.519E-15
Eu-154	Eu-154	1.000E+00	3.484E+01	3.220E+01	1.584E+01	1.320E-02	0.000E+00
Eu-155	Eu-155	1.000E+00	1.294E+00	1.125E+00	3.198E-01	1.101E-06	0.000E+00
Nb-94	Nb-94	1.000E+00	4.494E+01	4.005E+01	1.420E+01	4.448E-04	0.000E+00
Pu-238	Pu-238	1.840E-09	7.906E-10	7.844E-10	7.305E-10	3.585E-10	2.909E-13
Pu-238	Pu-238	1.000E+00	4.297E-01	4.263E-01	3.970E-01	1.949E-01	1.581E-04
Pu-238	äDOSE(j)		4.297E-01	4.263E-01	3.970E-01	1.949E-01	1.581E-04
U-234	Pu-238	1.000E+00	6.247E-08	1.867E-07	1.260E-06	8.536E-06	1.209E-05
U-234	U-234	1.000E+00	4.419E-02	4.417E-02	4.405E-02	4.284E-02	3.243E-02
U-234	U-238	9.999E-01	6.263E-08	1.878E-07	1.311E-06	1.221E-05	9.212E-05
U-234	äDOSE(j)		4.419E-02	4.417E-02	4.405E-02	4.286E-02	3.254E-02
Th-230	Pu-238	1.000E+00	1.699E-12	1.186E-11	5.475E-10	3.979E-08	9.824E-07
Th-230	U-234	1.000E+00	1.801E-06	5.402E-06	3.776E-05	3.563E-04	3.085E-03
Th-230	U-238	9.999E-01	1.702E-12	1.191E-11	5.621E-10	5.050E-08	4.160E-06
Th-230	äDOSE(j)		1.801E-06	5.402E-06	3.776E-05	3.564E-04	3.090E-03
Ra-226	Pu-238	1.000E+00	2.342E-14	3.507E-13	1.064E-10	7.703E-08	2.088E-05
Ra-226	U-234	1.000E+00	3.310E-08	2.316E-07	1.092E-05	9.712E-04	7.255E-02
Ra-226	U-238	9.999E-01	2.346E-14	3.518E-13	1.085E-10	9.227E-08	6.865E-05
Ra-226	äDOSE(j)		3.310E-08	2.316E-07	1.092E-05	9.714E-04	7.264E-02
Pb-210	Pu-238	1.000E+00	1.007E-18	3.101E-17	5.695E-14	2.562E-10	1.356E-07
Pb-210	U-234	1.000E+00	1.776E-12	2.647E-11	7.639E-09	3.761E-06	4.750E-04
Pb-210	U-238	9.999E-01	1.008E-18	3.108E-17	5.787E-14	2.997E-10	4.359E-07
Pb-210	äDOSE(j)		1.776E-12	2.647E-11	7.639E-09	3.761E-06	4.756E-04
Pu-240	Pu-240	1.000E+00	4.703E-01	4.702E-01	4.697E-01	4.650E-01	4.197E-01
Pu-241	Pu-241	1.000E+00	8.819E-03	8.405E-03	5.449E-03	7.155E-05	1.090E-23
Pu-241	Pu-241	2.450E-05	8.494E-05	8.095E-05	5.249E-05	6.891E-07	1.049E-25
Pu-241	äDOSE(j)		8.904E-03	8.486E-03	5.502E-03	7.224E-05	1.100E-23
Sr-90	Sr-90	1.000E+00	1.466E-01	1.431E-01	1.150E-01	1.289E-02	4.048E-12
Tc-99	Tc-99	1.000E+00	1.078E-03	9.609E-04	3.407E-04	1.070E-08	0.000E+00
U-238	U-238	5.400E-05	1.963E-06	1.962E-06	1.957E-06	1.904E-06	1.445E-06
U-238	U-238	9.999E-01	8.555E-01	8.553E-01	8.529E-01	8.297E-01	6.298E-01
U-238	äDOSE(j)		8.556E-01	8.553E-01	8.529E-01	8.297E-01	6.298E-01
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THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ
Ag-108m	Ag-108m	1.000E+00	1.000E+02	8.863E+01	2.992E+01	5.753E-04	0.000E+00
Al-26	Al-26	1.000E+00	1.000E+02	8.912E+01	3.160E+01	9.929E-04	0.000E+00
Am-241	Am-241	1.000E+00	1.000E+02	9.976E+01	9.766E+01	7.893E+01	9.379E+00
Am-241	Pu-241	1.000E+00	0.000E+00	1.564E-01	1.257E+00	2.737E+00	3.286E-01
Am-241	äS(j):		1.000E+02	9.992E+01	9.892E+01	8.166E+01	9.708E+00
Np-237	Am-241	1.000E+00	0.000E+00	3.235E-05	3.200E-04	2.875E-03	1.191E-02
Np-237	Np-237	1.000E+00	1.000E+02	9.999E+01	9.994E+01	9.940E+01	9.418E+01
Np-237	Pu-241	1.000E+00	0.000E+00	2.554E-08	2.208E-06	7.747E-05	3.949E-04
Np-237	Pu-241	2.450E-05	0.000E+00	7.747E-10	6.296E-09	1.627E-08	1.554E-08
Np-237	äS(j):		1.000E+02	9.999E+01	9.994E+01	9.941E+01	9.419E+01
U-233	Am-241	1.000E+00	0.000E+00	7.076E-11	7.018E-09	6.473E-07	3.206E-05
U-233	Np-237	1.000E+00	0.000E+00	4.372E-04	4.365E-03	4.293E-02	3.643E-01
U-233	Pu-241	1.000E+00	0.000E+00	3.738E-14	3.347E-11	1.462E-08	1.039E-06
U-233	Pu-241	2.450E-05	0.000E+00	1.707E-15	1.485E-13	5.635E-12	5.901E-11
U-233	U-233	1.000E+00	1.000E+02	9.997E+01	9.969E+01	9.694E+01	7.329E+01
U-233	äS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.365E+01
Th-229	Am-241	1.000E+00	0.000E+00	2.228E-15	2.214E-12	2.079E-09	1.192E-06
Th-229	Np-237	1.000E+00	0.000E+00	2.065E-08	2.062E-06	2.033E-04	1.771E-02
Th-229	Pu-241	1.000E+00	0.000E+00	8.848E-19	8.096E-15	4.065E-11	3.774E-08
Th-229	Pu-241	2.450E-05	0.000E+00	5.396E-20	4.857E-17	2.250E-14	2.809E-12
Th-229	U-233	1.000E+00	0.000E+00	9.442E-03	9.424E-02	9.254E-01	7.726E+00
Th-229	äS(j):		0.000E+00	9.442E-03	9.425E-02	9.256E-01	7.743E+00
Am-243	Am-243	1.000E+00	1.000E+02	9.991E+01	9.915E+01	9.179E+01	4.245E+01
Am-243	Cm-243	2.400E-03	0.000E+00	2.226E-05	1.992E-04	7.971E-04	4.076E-04
Am-243	äS(j):		1.000E+02	9.991E+01	9.915E+01	9.179E+01	4.245E+01
Pu-239	Am-243	1.000E+00	0.000E+00	2.879E-03	2.867E-02	2.755E-01	1.895E+00
Pu-239	Cm-243	2.400E-03	0.000E+00	3.219E-10	2.989E-08	1.611E-06	1.710E-05
Pu-239	Cm-243	9.976E-01	0.000E+00	2.839E-03	2.550E-02	1.075E-01	1.140E-01
Pu-239	Pu-239	1.000E+00	1.000E+02	1.000E+02	9.996E+01	9.964E+01	9.642E+01
Pu-239	äS(j):		1.000E+02	1.000E+02	1.000E+02	1.000E+02	9.843E+01
U-235	Am-243	1.000E+00	0.000E+00	1.418E-12	1.413E-10	1.363E-08	9.645E-07
U-235	Cm-243	2.400E-03	0.000E+00	1.059E-19	1.001E-16	6.182E-14	8.349E-12
U-235	Cm-243	9.976E-01	0.000E+00	1.403E-12	1.305E-10	7.174E-09	9.486E-08
U-235	Pu-239	1.000E+00	0.000E+00	9.847E-08	9.832E-07	9.682E-06	8.322E-05
U-235	U-235	1.000E+00	1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
U-235	äS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
Pa-231	Am-243	1.000E+00	0.000E+00	1.000E-17	9.965E-15	9.629E-12	6.888E-09
Pa-231	Cm-243	2.400E-03	0.000E+00	5.608E-25	5.357E-21	3.593E-17	5.732E-14
Pa-231	Cm-243	9.976E-01	0.000E+00	9.917E-18	9.385E-15	5.873E-12	9.160E-10
Pa-231	Pu-239	1.000E+00	0.000E+00	1.042E-12	1.040E-10	1.019E-08	8.351E-07

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ
Eu-152	Eu-152	7.208E-01	7.208E+01	6.843E+01	4.285E+01	3.969E-01	1.849E-21
Eu-152	Eu-152	2.792E-01	2.792E+01	2.650E+01	1.660E+01	1.538E-01	7.160E-22
Eu-152	äS(j):		1.000E+02	9.493E+01	5.944E+01	5.507E-01	2.565E-21
Gd-152	Eu-152	2.792E-01	0.000E+00	1.746E-13	1.397E-12	3.421E-12	3.382E-12
Eu-154	Eu-154	1.000E+00	1.000E+02	9.242E+01	4.548E+01	3.788E-02	6.081E-33
Eu-155	Eu-155	1.000E+00	1.000E+02	8.696E+01	2.472E+01	8.512E-05	0.000E+00
Nb-94	Nb-94	1.000E+00	1.000E+02	8.912E+01	3.159E+01	9.896E-04	0.000E+00
Pu-238	Pu-238	1.840E-09	1.840E-07	1.826E-07	1.700E-07	8.344E-08	6.769E-11
Pu-238	Pu-238	1.000E+00	1.000E+02	9.921E+01	9.240E+01	4.535E+01	3.679E-02
Pu-238	äS(j):		1.000E+02	9.921E+01	9.240E+01	4.535E+01	3.679E-02
U-234	Pu-238	1.000E+00	0.000E+00	2.823E-04	2.721E-03	1.925E-02	2.737E-02
U-234	U-234	1.000E+00	1.000E+02	9.997E+01	9.969E+01	9.696E+01	7.340E+01
U-234	U-238	9.999E-01	0.000E+00	2.834E-04	2.826E-03	2.749E-02	2.084E-01
U-234	äS(j):		1.000E+02	9.997E+01	9.970E+01	9.700E+01	7.364E+01
Th-230	Pu-238	1.000E+00	0.000E+00	1.273E-09	1.242E-07	9.857E-06	2.454E-04
Th-230	U-234	1.000E+00	0.000E+00	9.000E-04	8.988E-03	8.860E-02	7.706E-01
Th-230	U-238	9.999E-01	0.000E+00	1.276E-09	1.273E-07	1.250E-05	1.039E-03
Th-230	äS(j):		0.000E+00	9.001E-04	8.988E-03	8.862E-02	7.718E-01
Ra-226	Pu-238	1.000E+00	0.000E+00	1.839E-13	1.802E-10	1.491E-07	4.095E-05
Ra-226	U-234	1.000E+00	0.000E+00	1.949E-07	1.944E-05	1.888E-03	1.423E-01
Ra-226	U-238	9.999E-01	0.000E+00	1.842E-13	1.837E-10	1.785E-07	1.346E-04
Ra-226	äS(j):		0.000E+00	1.949E-07	1.944E-05	1.888E-03	1.425E-01
Pb-210	Pu-238	1.000E+00	0.000E+00	1.420E-15	1.323E-11	7.117E-08	3.827E-05
Pb-210	U-234	1.000E+00	0.000E+00	2.004E-09	1.867E-06	1.049E-03	1.341E-01
Pb-210	U-238	9.999E-01	0.000E+00	1.423E-15	1.343E-11	8.317E-08	1.230E-04
Pb-210	äS(j):		0.000E+00	2.004E-09	1.867E-06	1.050E-03	1.342E-01
Pu-240	Pu-240	1.000E+00	1.000E+02	9.999E+01	9.989E+01	9.887E+01	8.925E+01
Pu-241	Pu-241	1.000E+00	1.000E+02	9.530E+01	6.179E+01	8.113E-01	1.235E-19
Pu-241	Pu-241	2.450E-05	2.450E-03	2.335E-03	1.514E-03	1.988E-05	3.027E-24
Pu-241	äS(j):		1.000E+02	9.530E+01	6.179E+01	8.113E-01	1.235E-19
Sr-90	Sr-90	1.000E+00	1.000E+02	9.760E+01	7.842E+01	8.792E+00	2.761E-09
Tc-99	Tc-99	1.000E+00	1.000E+02	8.912E+01	3.160E+01	9.926E-04	0.000E+00
U-238	U-238	5.400E-05	5.400E-03	5.398E-03	5.383E-03	5.237E-03	3.975E-03
U-238	U-238	9.999E-01	9.999E+01	9.996E+01	9.969E+01	9.698E+01	7.361E+01
U-238	äS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ

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

RESCALC.EXE execution time = 6.80 seconds

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Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-225 (Source: FGR 12)	6.371E-02	6.371E-02	DCF1(1)
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(2)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(3)
A-1	Ag-108 (Source: FGR 12)	1.143E-01	1.143E-01	DCF1(4)
A-1	Ag-108m (Source: FGR 12)	9.640E+00	9.640E+00	DCF1(5)
A-1	Al-26 (Source: FGR 12)	1.741E+01	1.741E+01	DCF1(6)
A-1	Am-241 (Source: FGR 12)	4.372E-02	4.372E-02	DCF1(7)
A-1	Am-243 (Source: FGR 12)	1.420E-01	1.420E-01	DCF1(8)
A-1	At-217 (Source: FGR 12)	1.773E-03	1.773E-03	DCF1(9)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(10)
A-1	Ba-137m (Source: FGR 12)	3.606E+00	3.606E+00	DCF1(11)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(12)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(13)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(14)
A-1	Bi-213 (Source: FGR 12)	7.660E-01	7.660E-01	DCF1(15)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(16)
A-1	Cm-243 (Source: FGR 12)	5.829E-01	5.829E-01	DCF1(17)
A-1	Cm-244 (Source: FGR 12)	1.259E-04	1.259E-04	DCF1(18)
A-1	Co-60 (Source: FGR 12)	1.622E+01	1.622E+01	DCF1(19)
A-1	Cs-137 (Source: FGR 12)	7.510E-04	7.510E-04	DCF1(20)
A-1	Eu-152 (Source: FGR 12)	7.006E+00	7.006E+00	DCF1(21)
A-1	Eu-154 (Source: FGR 12)	7.678E+00	7.678E+00	DCF1(22)
A-1	Eu-155 (Source: FGR 12)	1.822E-01	1.822E-01	DCF1(23)
A-1	Fr-221 (Source: FGR 12)	1.536E-01	1.536E-01	DCF1(24)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(25)
A-1	Gd-152 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Nb-94 (Source: FGR 12)	9.677E+00	9.677E+00	DCF1(27)
A-1	Np-237 (Source: FGR 12)	7.790E-02	7.790E-02	DCF1(28)
A-1	Np-239 (Source: FGR 12)	7.529E-01	7.529E-01	DCF1(29)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(30)
A-1	Pa-233 (Source: FGR 12)	1.020E+00	1.020E+00	DCF1(31)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(32)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(33)
A-1	Pb-209 (Source: FGR 12)	7.734E-04	7.734E-04	DCF1(34)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(35)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(36)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(37)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(38)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(39)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(40)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(41)
A-1	Po-213 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(42)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(43)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(44)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(45)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(46)
A-1	Pu-238 (Source: FGR 12)	1.513E-04	1.513E-04	DCF1(47)
A-1	Pu-239 (Source: FGR 12)	2.952E-04	2.952E-04	DCF1(48)
A-1	Pu-240 (Source: FGR 12)	1.467E-04	1.467E-04	DCF1(49)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	Pu-241 (Source: FGR 12)	5.904E-06	5.904E-06	DCF1(50)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(51)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(52)
A-1	Ra-225 (Source: FGR 12)	1.102E-02	1.102E-02	DCF1(53)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(54)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(55)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(56)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(57)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(58)
A-1	Sr-90 (Source: FGR 12)	7.043E-04	7.043E-04	DCF1(59)
A-1	Tc-99 (Source: FGR 12)	1.255E-04	1.255E-04	DCF1(60)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(61)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(62)
A-1	Th-229 (Source: FGR 12)	3.213E-01	3.213E-01	DCF1(63)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(64)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(65)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(66)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(67)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(68)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(69)
A-1	Tl-209 (Source: FGR 12)	1.293E+01	1.293E+01	DCF1(70)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(71)
A-1	U-233 (Source: FGR 12)	1.397E-03	1.397E-03	DCF1(72)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(73)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(74)
A-1	U-236 (Source: FGR 12)	2.148E-04	2.148E-04	DCF1(75)
A-1	U-237 (Source: FGR 12)	5.306E-01	5.306E-01	DCF1(76)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(77)
A-1	Y-90 (Source: FGR 12)	2.391E-02	2.391E-02	DCF1(78)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	2.109E+00	2.035E+00	DCF2(1)
B-1	Ag-108m+D	1.370E-04	1.369E-04	DCF2(2)
B-1	Al-26	7.400E-05	7.400E-05	DCF2(3)
B-1	Am-241	3.550E-01	3.552E-01	DCF2(4)
B-1	Am-243+D	3.550E-01	3.552E-01	DCF2(5)
B-1	Cm-243	2.550E-01	2.553E-01	DCF2(6)
B-1	Cm-244	2.110E-01	2.109E-01	DCF2(8)
B-1	Co-60	1.150E-04	1.147E-04	DCF2(11)
B-1	Cs-137+D	1.440E-04	1.443E-04	DCF2(12)
B-1	Eu-152	1.550E-04	1.554E-04	DCF2(13)
B-1	Eu-154	1.960E-04	1.961E-04	DCF2(15)
B-1	Eu-155	2.550E-05	2.553E-05	DCF2(16)
B-1	Gd-152	7.030E-02	7.030E-02	DCF2(17)
B-1	Nb-94	1.810E-04	1.813E-04	DCF2(18)
B-1	Np-237+D	1.850E-01	1.850E-01	DCF2(19)
B-1	Pa-231	5.180E-01	5.180E-01	DCF2(20)
B-1	Pb-210+D	3.694E-02	2.072E-02	DCF2(21)
B-1	Pu-238	4.070E-01	4.070E-01	DCF2(22)
B-1	Pu-239	4.440E-01	4.440E-01	DCF2(24)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Pu-240	4.440E-01	4.440E-01	DCF2(25)
B-1	Pu-241	8.510E-03	8.510E-03	DCF2(27)
B-1	Pu-241+D	8.517E-03	8.510E-03	DCF2(28)
B-1	Ra-226+D	3.531E-02	3.515E-02	DCF2(29)
B-1	Ra-228+D	5.929E-02	5.920E-02	DCF2(30)
B-1	Sr-90+D	5.976E-04	5.920E-04	DCF2(31)
B-1	Tc-99	4.810E-05	4.810E-05	DCF2(32)
B-1	Th-228+D	1.614E-01	1.480E-01	DCF2(33)
B-1	Th-229+D	9.481E-01	8.880E-01	DCF2(34)
B-1	Th-230	3.700E-01	3.700E-01	DCF2(35)
B-1	Th-232	4.070E-01	4.070E-01	DCF2(36)
B-1	U-233	3.550E-02	3.552E-02	DCF2(37)
B-1	U-234	3.480E-02	3.478E-02	DCF2(38)
B-1	U-235+D	3.150E-02	3.145E-02	DCF2(39)
B-1	U-236	3.220E-02	3.219E-02	DCF2(40)
B-1	U-238	2.960E-02	2.960E-02	DCF2(41)
B-1	U-238+D	2.963E-02	2.960E-02	DCF2(42)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	4.473E-03	4.070E-03	DCF3(1)
D-1	Ag-108m+D	8.510E-06	8.510E-06	DCF3(2)
D-1	Al-26	1.300E-05	1.295E-05	DCF3(3)
D-1	Am-241	7.400E-04	7.400E-04	DCF3(4)
D-1	Am-243+D	7.430E-04	7.400E-04	DCF3(5)
D-1	Cm-243	5.550E-04	5.550E-04	DCF3(6)
D-1	Cm-244	4.440E-04	4.440E-04	DCF3(8)
D-1	Co-60	1.260E-05	1.258E-05	DCF3(11)
D-1	Cs-137+D	4.810E-05	4.810E-05	DCF3(12)
D-1	Eu-152	5.180E-06	5.180E-06	DCF3(13)
D-1	Eu-154	7.400E-06	7.400E-06	DCF3(15)
D-1	Eu-155	1.180E-06	1.184E-06	DCF3(16)
D-1	Gd-152	1.520E-04	1.517E-04	DCF3(17)
D-1	Nb-94	6.290E-06	6.290E-06	DCF3(18)
D-1	Np-237+D	4.102E-04	4.070E-04	DCF3(19)
D-1	Pa-231	2.630E-03	2.627E-03	DCF3(20)
D-1	Pb-210+D	6.995E-03	2.553E-03	DCF3(21)
D-1	Pu-238	8.510E-04	8.510E-04	DCF3(22)
D-1	Pu-239	9.250E-04	9.250E-04	DCF3(24)
D-1	Pu-240	9.250E-04	9.250E-04	DCF3(25)
D-1	Pu-241	1.780E-05	1.776E-05	DCF3(27)
D-1	Pu-241+D	2.061E-05	1.776E-05	DCF3(28)
D-1	Ra-226+D	1.041E-03	1.036E-03	DCF3(29)
D-1	Ra-228+D	2.552E-03	2.553E-03	DCF3(30)
D-1	Sr-90+D	1.140E-04	1.036E-04	DCF3(31)
D-1	Tc-99	2.370E-06	2.368E-06	DCF3(32)
D-1	Th-228+D	5.302E-04	2.664E-04	DCF3(33)
D-1	Th-229+D	2.266E-03	1.813E-03	DCF3(34)
D-1	Th-230	7.770E-04	7.770E-04	DCF3(35)
D-1	Th-232	8.510E-04	8.510E-04	DCF3(36)
D-1	U-233	1.890E-04	1.887E-04	DCF3(37)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-1	U-234	1.810E-04	1.813E-04	DCF3(38)
D-1	U-235+D	1.753E-04	1.739E-04	DCF3(39)
D-1	U-236	1.740E-04	1.739E-04	DCF3(40)
D-1	U-238	1.670E-04	1.665E-04	DCF3(41)
D-1	U-238+D	1.796E-04	1.665E-04	DCF3(42)
D-34	Food 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				
D-34	Ag-108m+D , plant/soil concentration ratio, dimensionless	1.500E-01	1.500E-01	RTF(2,1)
D-34	Ag-108m+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-03	3.000E-03	RTF(2,2)
D-34	Ag-108m+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.500E-02	2.500E-02	RTF(2,3)
D-34				
D-34	Al-26 , plant/soil concentration ratio, dimensionless	4.000E-03	4.000E-03	RTF(3,1)
D-34	Al-26 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-04	5.000E-04	RTF(3,2)
D-34	Al-26 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-04	2.000E-04	RTF(3,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(4,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(4,3)
D-34				
D-34	Am-243+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Am-243+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(5,2)
D-34	Am-243+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(5,3)
D-34				
D-34	Cm-243 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Cm-243 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,2)
D-34	Cm-243 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(6,3)
D-34				
D-34	Cm-244 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Cm-244 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,2)
D-34	Cm-244 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(8,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(11,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(11,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(11,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(12,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(12,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(12,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(13,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(13,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(15,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(15,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(15,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(16,2)
D-34	Eu-155 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(16,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(17,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(17,3)
D-34				
D-34	Nb-94 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(18,1)
D-34	Nb-94 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-07	3.000E-07	RTF(18,2)
D-34	Nb-94 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(18,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(19,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(19,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(20,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(20,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(20,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(21,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(21,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(21,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(22,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(22,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(22,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(24,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(24,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(24,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(25,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(25,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(25,3)
D-34				
D-34	Pu-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(27,1)
D-34	Pu-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(27,2)
D-34	Pu-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(27,3)
D-34				
D-34	Pu-241+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(28,1)
D-34	Pu-241+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(28,2)
D-34	Pu-241+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(28,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(29,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(29,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(29,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(30,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(30,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(30,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(31,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(31,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(31,3)
D-34				
D-34	Tc-99 , plant/soil concentration ratio, dimensionless	5.000E+00	5.000E+00	RTF(32,1)
D-34	Tc-99 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(32,2)
D-34	Tc-99 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(32,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(33,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(33,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(33,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(34,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(34,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(34,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(35,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(35,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(35,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(36,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(36,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(36,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(37,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(37,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(37,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(38,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(38,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(38,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(39,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(39,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(39,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(40,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(40,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(40,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(41,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(41,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(41,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(42,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(42,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(42,3)
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)
D-5	Ag-108m+D , fish	5.000E+00	5.000E+00	BIOFAC(2,1)
D-5	Ag-108m+D , crustacea and mollusks	7.700E+02	7.700E+02	BIOFAC(2,2)
D-5	Al-26 , fish	5.000E+02	5.000E+02	BIOFAC(3,1)
D-5	Al-26 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(3,2)
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(4,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(4,2)
D-5	Am-243+D , fish	3.000E+01	3.000E+01	BIOFAC(5,1)
D-5	Am-243+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5	Cm-243 , fish	3.000E+01	3.000E+01	BIOFAC(6,1)
D-5	Cm-243 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5	Cm-244 , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Cm-244 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(11,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(11,2)
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(12,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(12,2)
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(13,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(13,2)
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(15,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(15,2)
D-5	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(16,1)
D-5	Eu-155 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(16,2)
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(17,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(17,2)
D-5	Nb-94 , fish	3.000E+02	3.000E+02	BIOFAC(18,1)
D-5	Nb-94 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(18,2)
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(19,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(19,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(20,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(21,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(21,2)
D-5				
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(22,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(22,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(24,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(24,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(25,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(25,2)
D-5				
D-5	Pu-241 , fish	3.000E+01	3.000E+01	BIOFAC(27,1)
D-5	Pu-241 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(27,2)
D-5				
D-5	Pu-241+D , fish	3.000E+01	3.000E+01	BIOFAC(28,1)
D-5	Pu-241+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(28,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(29,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(29,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(30,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(30,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(31,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(31,2)
D-5				
D-5	Tc-99 , fish	2.000E+01	2.000E+01	BIOFAC(32,1)
D-5	Tc-99 , crustacea and mollusks	5.000E+00	5.000E+00	BIOFAC(32,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(33,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(33,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(34,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(34,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(35,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(35,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(36,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(36,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(37,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(37,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(38,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(38,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & ICRP 72 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(39,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(39,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(40,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(40,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(41,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(41,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(42,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(42,2)

#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.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E-02	2.000E+00	---	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)	1.000E+01	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+02	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+03	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	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): Ag-108m	1.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Al-26	1.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Am-241	1.000E+02	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Am-243	1.000E+02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Cm-243	1.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Cm-244	1.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+02	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+02	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.000E+02	0.000E+00	---	S1(13)
R012	Initial principal radionuclide (pCi/g): Eu-154	1.000E+02	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g): Eu-155	1.000E+02	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): Nb-94	1.000E+02	0.000E+00	---	S1(18)
R012	Initial principal radionuclide (pCi/g): Np-237	1.000E+02	0.000E+00	---	S1(19)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.000E+02	0.000E+00	---	S1(22)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+02	0.000E+00	---	S1(24)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.000E+02	0.000E+00	---	S1(25)
R012	Initial principal radionuclide (pCi/g): Pu-241	1.000E+02	0.000E+00	---	S1(27)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+02	0.000E+00	---	S1(31)
R012	Initial principal radionuclide (pCi/g): Tc-99	1.000E+02	0.000E+00	---	S1(32)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+02	0.000E+00	---	S1(36)
R012	Initial principal radionuclide (pCi/g): U-233	1.000E+02	0.000E+00	---	S1(37)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+02	0.000E+00	---	S1(38)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+02	0.000E+00	---	S1(39)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+02	0.000E+00	---	S1(41)
R012	Concentration in groundwater (pCi/L): Ag-108m	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Al-26	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Am-243	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Cm-243	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Cm-244	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W1(15)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): Nb-94	not used	0.000E+00	---	W1(18)
R012	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W1(19)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(22)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(24)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(25)
R012	Concentration in groundwater (pCi/L): Pu-241	not used	0.000E+00	---	W1(27)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(31)
R012	Concentration in groundwater (pCi/L): Tc-99	not used	0.000E+00	---	W1(32)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(36)
R012	Concentration in groundwater (pCi/L): U-233	not used	0.000E+00	---	W1(37)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(38)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(39)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(41)
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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.090E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.120E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.800E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.600E-02	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-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
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 Ag-108m				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Al-26				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.629E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Am-243				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.629E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Cm-243				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	1.378E+03	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.115E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Cm-244				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	1.378E+03	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.115E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.536E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	4.600E+03	4.600E+03	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	4.600E+03	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	4.600E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.339E-06	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for Eu-155				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for Nb-94				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.964E-05	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(22)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(22,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(24)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(24,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(24)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(24)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(25)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(25,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(25)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(25)
R016	Distribution coefficients for Pu-241				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(27)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(27,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.679E-06	ALEACH(27)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(27)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCC(31)
R016	Unsaturated zone 1 (cm**3/g)	not used	3.000E+01	---	DCNUCU(31,1)
R016	Saturated zone (cm**3/g)	not used	3.000E+01	---	DCNUCS(31)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.097E-04	ALEACH(31)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(31)
R016	Distribution coefficients for Tc-99				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(32)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(32,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(32)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.152E-01	ALEACH(32)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(32)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(36)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(36,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(36)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(36)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(36)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(37)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(37,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(37)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(37)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(37)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(38)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(38,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(38)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(38)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(38)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(39)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(39,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(39)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(39)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(39)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(41)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(41,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(41)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(41)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(41)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.629E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(21)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(21,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.534E-04	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(29)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(29,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(29)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.190E-04	ALEACH(29)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(29)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(30)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(30,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(30)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.190E-04	ALEACH(30)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(30)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(33)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(33,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(33)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(33)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(33)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(34)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(34,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(34)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(34)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(34)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(35)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(35,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(35)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-07	ALEACH(35)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(35)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(40)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(40,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(40)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.064E-04	ALEACH(40)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(40)
R017	Inhalation rate (m**3/yr)	1.200E+04	8.400E+03	---	INHALR

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Mass loading for inhalation (g/m**3)	6.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	1.000E+00	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	2.740E-02	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	8.220E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	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)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	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	Ring 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	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.190E+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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	4.500E-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)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	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 (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/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 milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
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	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	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	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	suppressed
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions

Area:	1000.00 square meters
Thickness:	0.05 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Ag-108m	1.000E+02
Al-26	1.000E+02
Am-241	1.000E+02
Am-243	1.000E+02
Cm-243	1.000E+02
Cm-244	1.000E+02
Co-60	1.000E+02
Cs-137	1.000E+02
Eu-152	1.000E+02
Eu-154	1.000E+02
Eu-155	1.000E+02
Nb-94	1.000E+02
Np-237	1.000E+02
Pu-238	1.000E+02
Pu-239	1.000E+02
Pu-240	1.000E+02
Pu-241	1.000E+02
Sr-90	1.000E+02
Tc-99	1.000E+02
Th-232	1.000E+02
U-233	1.000E+02
U-234	1.000E+02
U-235	1.000E+02
U-238	1.000E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
TDOSE(t):	3.413E+00	3.417E+00	3.447E+00	2.932E+00	2.265E+00
M(t):	1.365E-01	1.367E-01	1.379E-01	1.173E-01	9.061E-02

Maximum TDOSE(t): 3.448E+00 mrem/yr at t = 8.68 ñ 0.02 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.675E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
Ag-108m	0.000E+00	0.0000	4.419E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.093E-04	0.0000
Al-26	0.000E+00	0.0000	2.509E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.756E-04	0.0001
Am-241	0.000E+00	0.0000	3.388E-01	0.0983	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.813E-02	0.0082
Am-243	0.000E+00	0.0000	3.436E-01	0.0997	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.865E-02	0.0083
Cm-243	0.000E+00	0.0000	1.990E-01	0.0577	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.726E-02	0.0050
Cm-244	0.000E+00	0.0000	1.452E-01	0.0421	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.217E-02	0.0035
Co-60	0.000E+00	0.0000	3.358E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E-04	0.0000
Cs-137	0.000E+00	0.0000	1.136E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.512E-03	0.0004
Eu-152	0.000E+00	0.0000	9.380E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.249E-04	0.0000
Eu-154	0.000E+00	0.0000	9.280E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.396E-04	0.0000
Eu-155	0.000E+00	0.0000	6.904E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.273E-05	0.0000
Nb-94	0.000E+00	0.0000	6.136E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.493E-05	0.0000
Np-237	0.000E+00	0.0000	1.803E-01	0.0523	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-02	0.0046
Pu-238	0.000E+00	0.0000	3.691E-01	0.1071	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.075E-02	0.0089
Pu-239	0.000E+00	0.0000	4.329E-01	0.1255	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.592E-02	0.0104
Pu-240	0.000E+00	0.0000	4.326E-01	0.1255	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.590E-02	0.0104
Pu-241	0.000E+00	0.0000	9.406E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.825E-04	0.0002
Sr-90	0.000E+00	0.0000	4.663E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.543E-03	0.0010
Tc-99	0.000E+00	0.0000	1.631E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.201E-05	0.0000
Th-232	0.000E+00	0.0000	5.177E-01	0.1501	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.101E-01	0.0319
U-233	0.000E+00	0.0000	3.532E-02	0.0102	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.397E-03	0.0021
U-234	0.000E+00	0.0000	3.387E-02	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.014E-03	0.0020
U-235	0.000E+00	0.0000	3.079E-02	0.0089	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.813E-03	0.0020
U-238	0.000E+00	0.0000	2.881E-02	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.958E-03	0.0020
Total	0.000E+00	0.0000	3.098E+00	0.8986	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.496E-01	0.1014

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.675E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
Ag-108m	0.000E+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	1.535E-04	0.0000
Al-26	0.000E+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	2.007E-04	0.0001
Am-241	0.000E+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	3.669E-01	0.1064
Am-243	0.000E+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	3.723E-01	0.1080
Cm-243	0.000E+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	2.163E-01	0.0627
Cm-244	0.000E+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	1.574E-01	0.0456
Co-60	0.000E+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	1.801E-04	0.0001
Cs-137	0.000E+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	1.625E-03	0.0005
Eu-152	0.000E+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	2.187E-04	0.0001
Eu-154	0.000E+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	2.324E-04	0.0001
Eu-155	0.000E+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	1.963E-05	0.0000
Nb-94	0.000E+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	1.463E-04	0.0000
Np-237	0.000E+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	1.963E-01	0.0569
Pu-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	3.999E-01	0.1160
Pu-239	0.000E+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	4.688E-01	0.1360
Pu-240	0.000E+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	4.685E-01	0.1359
Pu-241	0.000E+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	1.019E-02	0.0030
Sr-90	0.000E+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	4.009E-03	0.0012
Tc-99	0.000E+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	4.832E-05	0.0000
Th-232	0.000E+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	6.277E-01	0.1821
U-233	0.000E+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	4.272E-02	0.0124
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	4.089E-02	0.0119
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	3.760E-02	0.0109
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	3.577E-02	0.0104
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	3.448E+00	1.0000

*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 = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	1.259E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.114E-04	0.0001
Al-26	0.000E+00	0.0000	6.817E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.770E-04	0.0001
Am-241	0.000E+00	0.0000	3.458E-01	0.1013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.871E-02	0.0084
Am-243	0.000E+00	0.0000	3.461E-01	0.1014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.885E-02	0.0085
Cm-243	0.000E+00	0.0000	2.457E-01	0.0720	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.130E-02	0.0062
Cm-244	0.000E+00	0.0000	2.019E-01	0.0592	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.692E-02	0.0050
Co-60	0.000E+00	0.0000	1.051E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.587E-04	0.0001
Cs-137	0.000E+00	0.0000	1.388E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.847E-03	0.0005
Eu-152	0.000E+00	0.0000	1.473E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.961E-04	0.0001
Eu-154	0.000E+00	0.0000	1.838E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.764E-04	0.0001
Eu-155	0.000E+00	0.0000	2.321E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.278E-05	0.0000
Nb-94	0.000E+00	0.0000	1.667E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.308E-04	0.0001
Np-237	0.000E+00	0.0000	1.804E-01	0.0529	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.594E-02	0.0047
Pu-238	0.000E+00	0.0000	3.954E-01	0.1158	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.293E-02	0.0096
Pu-239	0.000E+00	0.0000	4.330E-01	0.1269	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.593E-02	0.0105
Pu-240	0.000E+00	0.0000	4.330E-01	0.1269	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.593E-02	0.0105
Pu-241	0.000E+00	0.0000	8.376E-03	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.978E-04	0.0002
Sr-90	0.000E+00	0.0000	5.757E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.375E-03	0.0013
Tc-99	0.000E+00	0.0000	4.431E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.696E-05	0.0000
Th-232	0.000E+00	0.0000	4.013E-01	0.1176	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.893E-02	0.0114
U-233	0.000E+00	0.0000	3.466E-02	0.0102	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.345E-03	0.0022
U-234	0.000E+00	0.0000	3.394E-02	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.030E-03	0.0021
U-235	0.000E+00	0.0000	3.072E-02	0.0090	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.808E-03	0.0020
U-238	0.000E+00	0.0000	2.889E-02	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.976E-03	0.0020
Total	0.000E+00	0.0000	3.121E+00	0.9143	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.926E-01	0.0857

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	4.373E-04	0.0001
Al-26	0.000E+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	5.452E-04	0.0002
Am-241	0.000E+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	3.745E-01	0.1097
Am-243	0.000E+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	3.749E-01	0.1098
Cm-243	0.000E+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	0.0782
Cm-244	0.000E+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	2.188E-01	0.0641
Co-60	0.000E+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	5.637E-04	0.0002
Cs-137	0.000E+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	1.986E-03	0.0006
Eu-152	0.000E+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	3.434E-04	0.0001
Eu-154	0.000E+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	4.602E-04	0.0001
Eu-155	0.000E+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	6.599E-05	0.0000
Nb-94	0.000E+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	3.975E-04	0.0001
Np-237	0.000E+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	1.964E-01	0.0575
Pu-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	4.283E-01	0.1255
Pu-239	0.000E+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	4.689E-01	0.1374
Pu-240	0.000E+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	4.689E-01	0.1374
Pu-241	0.000E+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	9.074E-03	0.0027
Sr-90	0.000E+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	4.951E-03	0.0015
Tc-99	0.000E+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	1.313E-04	0.0000
Th-232	0.000E+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	4.402E-01	0.1290
U-233	0.000E+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	4.200E-02	0.0123
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	4.097E-02	0.0120
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	3.753E-02	0.0110
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	3.587E-02	0.0105
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	3.413E+00	1.0000

*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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	1.116E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.760E-04	0.0001
Al-26	0.000E+00	0.0000	6.075E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.251E-04	0.0001
Am-241	0.000E+00	0.0000	3.450E-01	0.1010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.865E-02	0.0084
Am-243	0.000E+00	0.0000	3.458E-01	0.1012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.883E-02	0.0084
Cm-243	0.000E+00	0.0000	2.398E-01	0.0702	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.079E-02	0.0061
Cm-244	0.000E+00	0.0000	1.944E-01	0.0569	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-02	0.0048
Co-60	0.000E+00	0.0000	9.214E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.021E-04	0.0001
Cs-137	0.000E+00	0.0000	1.357E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-03	0.0005
Eu-152	0.000E+00	0.0000	1.398E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.861E-04	0.0001
Eu-154	0.000E+00	0.0000	1.699E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.555E-04	0.0001
Eu-155	0.000E+00	0.0000	2.018E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.720E-05	0.0000
Nb-94	0.000E+00	0.0000	1.486E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.057E-04	0.0001
Np-237	0.000E+00	0.0000	1.804E-01	0.0528	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-02	0.0047
Pu-238	0.000E+00	0.0000	3.922E-01	0.1148	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.267E-02	0.0096
Pu-239	0.000E+00	0.0000	4.330E-01	0.1267	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.593E-02	0.0105
Pu-240	0.000E+00	0.0000	4.329E-01	0.1267	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.593E-02	0.0105
Pu-241	0.000E+00	0.0000	8.523E-03	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.099E-04	0.0002
Sr-90	0.000E+00	0.0000	5.619E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.270E-03	0.0012
Tc-99	0.000E+00	0.0000	3.949E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.750E-05	0.0000
Th-232	0.000E+00	0.0000	4.127E-01	0.1208	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.022E-02	0.0147
U-233	0.000E+00	0.0000	3.474E-02	0.0102	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.351E-03	0.0022
U-234	0.000E+00	0.0000	3.393E-02	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.028E-03	0.0021
U-235	0.000E+00	0.0000	3.073E-02	0.0090	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.809E-03	0.0020
U-238	0.000E+00	0.0000	2.888E-02	0.0085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.974E-03	0.0020
Total	0.000E+00	0.0000	3.115E+00	0.9116	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.020E-01	0.0884

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	3.876E-04	0.0001
Al-26	0.000E+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	4.859E-04	0.0001
Am-241	0.000E+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	3.736E-01	0.1094
Am-243	0.000E+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	3.746E-01	0.1096
Cm-243	0.000E+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	2.606E-01	0.0763
Cm-244	0.000E+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	2.107E-01	0.0617
Co-60	0.000E+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	4.943E-04	0.0001
Cs-137	0.000E+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	1.941E-03	0.0006
Eu-152	0.000E+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	3.260E-04	0.0001
Eu-154	0.000E+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	4.254E-04	0.0001
Eu-155	0.000E+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	5.738E-05	0.0000
Nb-94	0.000E+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	3.543E-04	0.0001
Np-237	0.000E+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	1.964E-01	0.0575
Pu-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	4.249E-01	0.1244
Pu-239	0.000E+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	4.689E-01	0.1372
Pu-240	0.000E+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	4.689E-01	0.1372
Pu-241	0.000E+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	9.233E-03	0.0027
Sr-90	0.000E+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	4.832E-03	0.0014
Tc-99	0.000E+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	1.170E-04	0.0000
Th-232	0.000E+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	4.629E-01	0.1355
U-233	0.000E+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	4.209E-02	0.0123
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	4.096E-02	0.0120
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	3.753E-02	0.0110
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	3.586E-02	0.0105
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	3.417E+00	1.0000

*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+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	3.766E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.318E-05	0.0000
Al-26	0.000E+00	0.0000	2.154E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.507E-04	0.0000
Am-241	0.000E+00	0.0000	3.377E-01	0.0980	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.804E-02	0.0081
Am-243	0.000E+00	0.0000	3.432E-01	0.0996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.861E-02	0.0083
Cm-243	0.000E+00	0.0000	1.927E-01	0.0559	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.671E-02	0.0048
Cm-244	0.000E+00	0.0000	1.381E-01	0.0401	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E-02	0.0034
Co-60	0.000E+00	0.0000	2.821E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.231E-04	0.0000
Cs-137	0.000E+00	0.0000	1.102E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.466E-03	0.0004
Eu-152	0.000E+00	0.0000	8.756E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.166E-04	0.0000
Eu-154	0.000E+00	0.0000	8.360E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.257E-04	0.0000
Eu-155	0.000E+00	0.0000	5.737E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.057E-05	0.0000
Nb-94	0.000E+00	0.0000	5.267E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.291E-05	0.0000
Np-237	0.000E+00	0.0000	1.803E-01	0.0523	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-02	0.0046
Pu-238	0.000E+00	0.0000	3.653E-01	0.1060	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.043E-02	0.0088
Pu-239	0.000E+00	0.0000	4.328E-01	0.1256	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.592E-02	0.0104
Pu-240	0.000E+00	0.0000	4.325E-01	0.1255	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.589E-02	0.0104
Pu-241	0.000E+00	0.0000	9.521E-03	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.920E-04	0.0002
Sr-90	0.000E+00	0.0000	4.515E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.431E-03	0.0010
Tc-99	0.000E+00	0.0000	1.400E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.748E-05	0.0000
Th-232	0.000E+00	0.0000	5.309E-01	0.1540	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.162E-01	0.0337
U-233	0.000E+00	0.0000	3.542E-02	0.0103	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.405E-03	0.0021
U-234	0.000E+00	0.0000	3.386E-02	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.011E-03	0.0020
U-235	0.000E+00	0.0000	3.080E-02	0.0089	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.815E-03	0.0020
U-238	0.000E+00	0.0000	2.880E-02	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.955E-03	0.0020
Total	0.000E+00	0.0000	3.093E+00	0.8973	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.539E-01	0.1027

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	1.308E-04	0.0000
Al-26	0.000E+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	1.723E-04	0.0000
Am-241	0.000E+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	3.658E-01	0.1061
Am-243	0.000E+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	3.719E-01	0.1079
Cm-243	0.000E+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	2.094E-01	0.0608
Cm-244	0.000E+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	1.496E-01	0.0434
Co-60	0.000E+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	1.513E-04	0.0000
Cs-137	0.000E+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	1.576E-03	0.0005
Eu-152	0.000E+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	2.041E-04	0.0001
Eu-154	0.000E+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	2.093E-04	0.0001
Eu-155	0.000E+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	1.631E-05	0.0000
Nb-94	0.000E+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-04	0.0000
Np-237	0.000E+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	1.962E-01	0.0569
Pu-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	3.957E-01	0.1148
Pu-239	0.000E+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	4.688E-01	0.1360
Pu-240	0.000E+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	4.684E-01	0.1359
Pu-241	0.000E+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	1.031E-02	0.0030
Sr-90	0.000E+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	3.882E-03	0.0011
Tc-99	0.000E+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	4.148E-05	0.0000
Th-232	0.000E+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	6.472E-01	0.1878
U-233	0.000E+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	4.283E-02	0.0124
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	4.087E-02	0.0119
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	3.762E-02	0.0109
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	3.576E-02	0.0104
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	3.447E+00	1.0000

*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+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	7.241E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.792E-09	0.0000
Al-26	0.000E+00	0.0000	6.768E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.736E-09	0.0000
Am-241	0.000E+00	0.0000	2.729E-01	0.0931	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.266E-02	0.0077
Am-243	0.000E+00	0.0000	3.189E-01	0.1087	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.658E-02	0.0091
Cm-243	0.000E+00	0.0000	2.203E-02	0.0075	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.908E-03	0.0007
Cm-244	0.000E+00	0.0000	5.553E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.645E-04	0.0002
Co-60	0.000E+00	0.0000	2.041E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.908E-10	0.0000
Cs-137	0.000E+00	0.0000	1.377E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.832E-04	0.0001
Eu-152	0.000E+00	0.0000	8.112E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.080E-06	0.0000
Eu-154	0.000E+00	0.0000	6.963E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.047E-07	0.0000
Eu-155	0.000E+00	0.0000	1.976E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.642E-11	0.0000
Nb-94	0.000E+00	0.0000	1.650E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.284E-09	0.0000
Np-237	0.000E+00	0.0000	1.794E-01	0.0612	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E-02	0.0054
Pu-238	0.000E+00	0.0000	1.793E-01	0.0611	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.493E-02	0.0051
Pu-239	0.000E+00	0.0000	4.314E-01	0.1471	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.580E-02	0.0122
Pu-240	0.000E+00	0.0000	4.281E-01	0.1460	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.553E-02	0.0121
Pu-241	0.000E+00	0.0000	9.532E-03	0.0033	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.914E-04	0.0003
Sr-90	0.000E+00	0.0000	5.062E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.846E-04	0.0001
Tc-99	0.000E+00	0.0000	4.398E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.632E-10	0.0000
Th-232	0.000E+00	0.0000	6.118E-01	0.2086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.526E-01	0.0520
U-233	0.000E+00	0.0000	4.216E-02	0.0144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.935E-03	0.0027
U-234	0.000E+00	0.0000	3.322E-02	0.0113	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.847E-03	0.0023
U-235	0.000E+00	0.0000	3.377E-02	0.0115	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.061E-03	0.0024
U-238	0.000E+00	0.0000	2.803E-02	0.0096	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.768E-03	0.0023
Total	0.000E+00	0.0000	2.596E+00	0.8853	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.362E-01	0.1147

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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	2.516E-09	0.0000
Al-26	0.000E+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	5.413E-09	0.0000
Am-241	0.000E+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	2.956E-01	0.1008
Am-243	0.000E+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	3.454E-01	0.1178
Cm-243	0.000E+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	2.394E-02	0.0082
Cm-244	0.000E+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	6.017E-03	0.0021
Co-60	0.000E+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	1.095E-09	0.0000
Cs-137	0.000E+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	1.970E-04	0.0001
Eu-152	0.000E+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	1.891E-06	0.0000
Eu-154	0.000E+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	1.743E-07	0.0000
Eu-155	0.000E+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	5.617E-11	0.0000
Nb-94	0.000E+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	3.934E-09	0.0000
Np-237	0.000E+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	1.952E-01	0.0666
Pu-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	1.942E-01	0.0662
Pu-239	0.000E+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	4.672E-01	0.1593
Pu-240	0.000E+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	4.636E-01	0.1581
Pu-241	0.000E+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	1.032E-02	0.0035
Sr-90	0.000E+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	4.353E-04	0.0001
Tc-99	0.000E+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	1.303E-09	0.0000
Th-232	0.000E+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	7.643E-01	0.2607
U-233	0.000E+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	5.009E-02	0.0171
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	4.007E-02	0.0137
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	4.083E-02	0.0139
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	3.480E-02	0.0119
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	2.932E+00	1.0000

*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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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
Al-26	0.000E+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
Am-241	0.000E+00	0.0000	3.246E-02	0.0143	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.695E-03	0.0012
Am-243	0.000E+00	0.0000	1.551E-01	0.0685	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.293E-02	0.0057
Cm-243	0.000E+00	0.0000	4.952E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.110E-05	0.0000
Cm-244	0.000E+00	0.0000	1.073E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.908E-05	0.0000
Co-60	0.000E+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
Cs-137	0.000E+00	0.0000	1.278E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.701E-13	0.0000
Eu-152	0.000E+00	0.0000	2.319E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.997E-16	0.0000
Eu-154	0.000E+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
Eu-155	0.000E+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
Nb-94	0.000E+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
Np-237	0.000E+00	0.0000	1.702E-01	0.0751	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.505E-02	0.0066
Pu-238	0.000E+00	0.0000	1.557E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.423E-05	0.0000
Pu-239	0.000E+00	0.0000	4.175E-01	0.1843	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.465E-02	0.0153
Pu-240	0.000E+00	0.0000	3.864E-01	0.1706	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.207E-02	0.0142
Pu-241	0.000E+00	0.0000	1.137E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.441E-05	0.0000
Sr-90	0.000E+00	0.0000	1.590E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.208E-13	0.0000
Tc-99	0.000E+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
Th-232	0.000E+00	0.0000	6.116E-01	0.2700	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.525E-01	0.0673
U-233	0.000E+00	0.0000	9.683E-02	0.0427	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.218E-02	0.0054
U-234	0.000E+00	0.0000	2.779E-02	0.0123	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.815E-03	0.0026
U-235	0.000E+00	0.0000	6.070E-02	0.0268	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.146E-03	0.0040
U-238	0.000E+00	0.0000	2.134E-02	0.0094	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.150E-03	0.0023
Total	0.000E+00	0.0000	1.983E+00	0.8753	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.824E-01	0.1247

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+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
Al-26	0.000E+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
Am-241	0.000E+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	3.515E-02	0.0155
Am-243	0.000E+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	1.680E-01	0.0742
Cm-243	0.000E+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	5.363E-04	0.0002
Cm-244	0.000E+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	1.163E-03	0.0005
Co-60	0.000E+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
Cs-137	0.000E+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	1.829E-13	0.0000
Eu-152	0.000E+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-15	0.0000
Eu-154	0.000E+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
Eu-155	0.000E+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
Nb-94	0.000E+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
Np-237	0.000E+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	1.853E-01	0.0818
Pu-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	1.699E-04	0.0001
Pu-239	0.000E+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	4.521E-01	0.1996
Pu-240	0.000E+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	4.185E-01	0.1847
Pu-241	0.000E+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	1.231E-03	0.0005
Sr-90	0.000E+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	1.367E-13	0.0000
Tc-99	0.000E+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
Th-232	0.000E+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	7.641E-01	0.3373
U-233	0.000E+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	1.090E-01	0.0481
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	3.360E-02	0.0148
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	6.984E-02	0.0308
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	2.649E-02	0.0117
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	2.265E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) 0.000E+00	At Time in Years 1.000E+00	1.000E+01	(mrem/yr)/(pCi/g) 1.000E+02	1.000E+03
ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃÃ
Ag-108m+D	Ag-108m+D	1.000E+00	4.373E-06	3.876E-06	1.308E-06	2.516E-11	0.000E+00
Al-26	Al-26	1.000E+00	5.452E-06	4.859E-06	1.723E-06	5.413E-11	0.000E+00
Am-241	Am-241	1.000E+00	3.745E-03	3.736E-03	3.658E-03	2.956E-03	3.513E-04
Am-241	Np-237+D	1.000E+00	3.178E-10	9.523E-10	6.594E-09	5.671E-08	2.339E-07
Am-241	U-233	1.000E+00	9.900E-17	6.925E-16	3.248E-14	2.742E-12	1.346E-10
Am-241	Th-229+D	1.000E+00	5.641E-20	8.456E-19	2.600E-16	2.136E-13	1.209E-10
Am-241	ãDSR(j)		3.745E-03	3.736E-03	3.658E-03	2.956E-03	3.515E-04
Am-243+D	Am-243+D	1.000E+00	3.749E-03	3.746E-03	3.717E-03	3.441E-03	1.592E-03
Am-243+D	Pu-239	1.000E+00	6.752E-08	2.025E-07	1.412E-06	1.298E-05	8.888E-05
Am-243+D	U-235+D	1.000E+00	1.774E-18	1.241E-17	5.848E-16	5.165E-14	3.623E-12
Am-243+D	Pa-231	1.000E+00	1.518E-22	2.277E-21	7.021E-19	5.936E-16	4.189E-13
Am-243+D	Ac-227+D	1.000E+00	3.532E-24	1.088E-22	2.021E-19	1.025E-15	1.386E-12
Am-243+D	ãDSR(j)		3.749E-03	3.746E-03	3.719E-03	3.454E-03	1.680E-03
Cm-243	Cm-243	2.400E-03	6.408E-06	6.254E-06	5.024E-06	5.623E-07	1.735E-16
Cm-243	Am-243+D	2.400E-03	4.192E-10	1.244E-09	7.797E-09	2.992E-08	1.528E-08
Cm-243	Pu-239	2.400E-03	5.043E-15	3.505E-14	1.540E-12	7.610E-11	8.020E-10
Cm-243	U-235+D	2.400E-03	9.948E-26	1.484E-24	4.344E-22	2.350E-19	3.136E-17
Cm-243	Pa-231	2.400E-03	6.819E-30	2.104E-28	3.962E-25	2.222E-21	3.486E-18
Cm-243	Ac-227+D	2.400E-03	1.324E-31	8.268E-30	9.303E-26	3.471E-21	1.150E-17
Cm-243	ãDSR(j)		6.408E-06	6.255E-06	5.032E-06	5.923E-07	1.608E-08
Cm-243	Cm-243	9.976E-01	2.663E-03	2.599E-03	2.088E-03	2.337E-04	7.214E-14
Cm-243	Pu-239	9.976E-01	6.683E-08	1.983E-07	1.248E-06	5.045E-06	5.347E-06
Cm-243	U-235+D	9.976E-01	1.759E-18	1.223E-17	5.383E-16	2.712E-14	3.562E-13
Cm-243	Pa-231	9.976E-01	1.508E-22	2.250E-21	6.592E-19	3.613E-16	5.569E-14
Cm-243	Ac-227+D	9.976E-01	3.510E-24	1.077E-22	1.919E-19	6.621E-16	1.885E-13
Cm-243	ãDSR(j)		2.664E-03	2.600E-03	2.089E-03	2.388E-04	5.347E-06
Cm-244	Cm-244	1.350E-06	2.954E-09	2.843E-09	2.014E-09	6.422E-11	6.970E-26
Cm-244	Cm-244	4.950E-08	1.083E-10	1.042E-10	7.386E-11	2.355E-12	2.556E-27
Cm-244	Pu-240	4.950E-08	1.215E-14	3.584E-14	2.126E-13	6.237E-13	5.755E-13
Cm-244	ãDSR(j)		1.083E-10	1.043E-10	7.407E-11	2.979E-12	5.755E-13
Cm-244	Cm-244	1.000E+00	2.188E-03	2.106E-03	1.492E-03	4.757E-05	5.163E-20
Cm-244	Pu-240	1.000E+00	2.455E-07	7.240E-07	4.296E-06	1.260E-05	1.163E-05
Cm-244	U-236	1.000E+00	1.977E-16	1.369E-15	5.795E-14	2.304E-12	2.488E-11
Cm-244	Th-232	1.000E+00	2.753E-26	4.096E-25	1.166E-22	5.315E-20	7.220E-18
Cm-244	Ra-228+D	1.000E+00	2.378E-28	7.175E-27	1.086E-23	1.591E-20	2.589E-18
Cm-244	Th-228+D	1.000E+00	1.554E-29	9.102E-28	5.791E-24	1.679E-20	2.921E-18
Cm-244	ãDSR(j)		2.188E-03	2.107E-03	1.496E-03	6.017E-05	1.163E-05

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	5.637E-06	4.943E-06	1.513E-06	1.095E-11	0.000E+00
Cs-137+D	Cs-137+D	1.000E+00	1.986E-05	1.941E-05	1.576E-05	1.970E-06	1.829E-15
Eu-152	Eu-152	7.208E-01	2.475E-06	2.350E-06	1.471E-06	1.363E-08	6.348E-29
Eu-152	Eu-152	2.792E-01	9.587E-07	9.101E-07	5.699E-07	5.280E-09	2.459E-29
Eu-152	Gd-152	2.792E-01	6.557E-19	1.923E-18	1.079E-17	2.548E-17	2.519E-17
Eu-152	äDSR(j)		9.587E-07	9.101E-07	5.699E-07	5.280E-09	2.519E-17
Eu-154	Eu-154	1.000E+00	4.602E-06	4.254E-06	2.093E-06	1.743E-09	2.799E-40
Eu-155	Eu-155	1.000E+00	6.599E-07	5.738E-07	1.631E-07	5.617E-13	0.000E+00
Nb-94	Nb-94	1.000E+00	3.975E-06	3.543E-06	1.256E-06	3.934E-11	0.000E+00
Np-237+D	Np-237+D	1.000E+00	1.964E-03	1.964E-03	1.962E-03	1.952E-03	1.849E-03
Np-237+D	U-233	1.000E+00	9.175E-10	2.752E-09	1.923E-08	1.810E-07	1.529E-06
Np-237+D	Th-229+D	1.000E+00	6.969E-13	4.878E-12	2.303E-10	2.079E-08	1.795E-06
Np-237+D	äDSR(j)		1.964E-03	1.964E-03	1.962E-03	1.952E-03	1.853E-03
Pu-238	Pu-238	1.840E-09	7.881E-12	7.818E-12	7.281E-12	3.574E-12	2.899E-15
Pu-238	Pu-238	1.000E+00	4.283E-03	4.249E-03	3.957E-03	1.942E-03	1.576E-06
Pu-238	U-234	1.000E+00	5.792E-10	1.731E-09	1.168E-08	7.913E-08	1.121E-07
Pu-238	Th-230	1.000E+00	1.660E-14	1.159E-13	5.350E-12	3.888E-10	9.600E-09
Pu-238	Ra-226+D	1.000E+00	3.443E-19	5.154E-18	1.564E-15	1.132E-12	3.069E-10
Pu-238	Pb-210+D	1.000E+00	8.756E-21	2.696E-19	4.951E-16	2.228E-12	1.179E-09
Pu-238	äDSR(j)		4.283E-03	4.249E-03	3.957E-03	1.942E-03	1.699E-06
Pu-239	Pu-239	1.000E+00	4.689E-03	4.689E-03	4.688E-03	4.672E-03	4.521E-03
Pu-239	U-235+D	1.000E+00	1.848E-13	5.543E-13	3.874E-12	3.651E-11	3.125E-10
Pu-239	Pa-231	1.000E+00	2.109E-17	1.476E-16	6.965E-15	6.250E-13	5.077E-11
Pu-239	Ac-227+D	1.000E+00	6.124E-19	9.121E-18	2.627E-15	1.279E-12	1.723E-10
Pu-239	äDSR(j)		4.689E-03	4.689E-03	4.688E-03	4.672E-03	4.521E-03
Pu-240	Pu-240	4.950E-08	2.321E-10	2.321E-10	2.319E-10	2.295E-10	2.072E-10
Pu-240	Pu-240	1.000E+00	4.689E-03	4.689E-03	4.684E-03	4.636E-03	4.185E-03
Pu-240	U-236	1.000E+00	5.648E-12	1.694E-11	1.184E-10	1.112E-09	9.174E-09
Pu-240	Th-232	1.000E+00	1.046E-21	7.325E-21	3.459E-19	3.127E-17	2.737E-15
Pu-240	Ra-228+D	1.000E+00	1.124E-23	1.644E-22	3.995E-20	9.680E-18	9.820E-16
Pu-240	Th-228+D	1.000E+00	8.742E-25	2.503E-23	2.439E-20	1.035E-17	1.108E-15
Pu-240	äDSR(j)		4.689E-03	4.689E-03	4.684E-03	4.636E-03	4.185E-03

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) 0.000E+00	At Time in Years 1.000E+00	1.000E+01	(mrem/yr)/(pCi/g) 1.000E+02	1.000E+03
Pu-241	Pu-241	1.000E+00	8.778E-05	8.365E-05	5.424E-05	7.121E-07	1.084E-25
Pu-241	Am-241	1.000E+00	2.957E-06	8.675E-06	4.889E-05	1.025E-04	1.231E-05
Pu-241	Np-237+D	1.000E+00	1.679E-13	1.158E-12	4.745E-11	1.530E-09	7.756E-09
Pu-241	U-233	1.000E+00	3.932E-20	5.835E-19	1.620E-16	6.206E-14	4.362E-12
Pu-241	Th-229+D	1.000E+00	1.795E-23	5.517E-22	9.959E-19	4.187E-15	3.827E-12
Pu-241	äDSR(j)		9.073E-05	9.233E-05	1.031E-04	1.032E-04	1.231E-05
Pu-241+D	Pu-241+D	2.450E-05	2.178E-09	2.076E-09	1.346E-09	1.767E-11	2.691E-30
Pu-241+D	Np-237+D	2.450E-05	7.668E-15	2.252E-14	1.284E-13	3.196E-13	3.052E-13
Pu-241+D	U-233	2.450E-05	2.398E-21	1.656E-20	6.825E-19	2.379E-17	2.477E-16
Pu-241+D	Th-229+D	2.450E-05	1.369E-24	2.033E-23	5.673E-21	2.306E-18	2.847E-16
Pu-241+D	äDSR(j)		2.178E-09	2.076E-09	1.346E-09	1.799E-11	3.058E-13
Sr-90+D	Sr-90+D	1.000E+00	4.951E-05	4.832E-05	3.882E-05	4.353E-06	1.367E-15
Tc-99	Tc-99	1.000E+00	1.313E-06	1.170E-06	4.148E-07	1.303E-11	0.000E+00
Th-232	Th-232	1.000E+00	4.300E-03	4.300E-03	4.300E-03	4.300E-03	4.299E-03
Th-232	Ra-228+D	1.000E+00	9.090E-05	2.588E-04	1.126E-03	1.567E-03	1.566E-03
Th-232	Th-228+D	1.000E+00	1.151E-05	7.061E-05	1.046E-03	1.777E-03	1.777E-03
Th-232	äDSR(j)		4.402E-03	4.629E-03	6.472E-03	7.643E-03	7.641E-03
U-233	U-233	1.000E+00	4.196E-04	4.194E-04	4.183E-04	4.067E-04	3.075E-04
U-233	Th-229+D	1.000E+00	4.781E-07	1.434E-06	1.002E-05	9.417E-05	7.827E-04
U-233	äDSR(j)		4.200E-04	4.209E-04	4.283E-04	5.009E-04	1.090E-03
U-234	U-234	1.000E+00	4.096E-04	4.095E-04	4.084E-04	3.972E-04	3.007E-04
U-234	Th-230	1.000E+00	1.760E-08	5.279E-08	3.690E-07	3.482E-06	3.014E-05
U-234	Ra-226+D	1.000E+00	4.865E-13	3.405E-12	1.605E-10	1.427E-08	1.066E-06
U-234	Pb-210+D	1.000E+00	1.544E-14	2.301E-13	6.641E-11	3.270E-08	4.129E-06
U-234	äDSR(j)		4.097E-04	4.096E-04	4.087E-04	4.007E-04	3.360E-04
U-235+D	U-235+D	1.000E+00	3.752E-04	3.751E-04	3.741E-04	3.639E-04	2.762E-04
U-235+D	Pa-231	1.000E+00	6.424E-08	1.927E-07	1.345E-06	1.251E-05	9.363E-05
U-235+D	Ac-227+D	1.000E+00	2.483E-09	1.722E-08	7.400E-07	3.188E-05	3.286E-04
U-235+D	äDSR(j)		3.753E-04	3.753E-04	3.762E-04	4.083E-04	6.984E-04
U-238	U-238	5.400E-05	1.909E-08	1.908E-08	1.903E-08	1.851E-08	1.405E-08
U-238+D	U-238+D	9.999E-01	3.586E-04	3.585E-04	3.576E-04	3.478E-04	2.640E-04
U-238+D	U-234	9.999E-01	5.806E-10	1.741E-09	1.216E-08	1.132E-07	8.540E-07
U-238+D	Th-230	9.999E-01	1.663E-14	1.164E-13	5.493E-12	4.935E-10	4.065E-08
U-238+D	Ra-226+D	9.999E-01	3.448E-19	5.170E-18	1.595E-15	1.356E-12	1.009E-09
U-238+D	Pb-210+D	9.999E-01	8.767E-21	2.702E-19	5.031E-16	2.606E-12	3.790E-09
U-238+D	äDSR(j)		3.586E-04	3.585E-04	3.576E-04	3.479E-04	2.649E-04

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
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Ag-108m	5.717E+06	6.450E+06	1.911E+07	9.937E+11	*2.609E+13
Al-26	4.586E+06	5.146E+06	1.451E+07	*1.921E+10	*1.921E+10
Am-241	6.675E+03	6.691E+03	6.835E+03	8.458E+03	7.112E+04
Am-243	6.668E+03	6.673E+03	6.723E+03	7.237E+03	1.488E+04
Cm-243	9.364E+03	9.594E+03	1.194E+04	1.044E+05	4.661E+06
Cm-244	1.142E+04	1.187E+04	1.671E+04	4.155E+05	2.150E+06
Co-60	4.435E+06	5.058E+06	1.652E+07	2.283E+12	*1.132E+15
Cs-137	1.259E+06	1.288E+06	1.586E+06	1.269E+07	*8.704E+13
Eu-152	7.280E+06	7.669E+06	1.225E+07	1.322E+09	*1.765E+14
Eu-154	5.432E+06	5.877E+06	1.194E+07	1.434E+10	*2.639E+14
Eu-155	3.788E+07	4.357E+07	1.533E+08	4.451E+13	*4.652E+14
Nb-94	6.289E+06	7.057E+06	1.991E+07	*1.875E+11	*1.875E+11
Np-237	1.273E+04	1.273E+04	1.274E+04	1.281E+04	1.349E+04
Pu-238	5.837E+03	5.884E+03	6.317E+03	1.287E+04	1.472E+07
Pu-239	5.331E+03	5.331E+03	5.333E+03	5.351E+03	5.529E+03
Pu-240	5.331E+03	5.332E+03	5.337E+03	5.392E+03	5.973E+03
Pu-241	2.755E+05	2.708E+05	2.424E+05	2.422E+05	2.030E+06
Sr-90	5.050E+05	5.174E+05	6.440E+05	5.744E+06	*1.365E+14
Tc-99	1.904E+07	2.137E+07	6.027E+07	*1.697E+10	*1.697E+10
Th-232	5.679E+03	5.400E+03	3.863E+03	3.271E+03	3.272E+03
U-233	5.952E+04	5.940E+04	5.837E+04	4.991E+04	2.293E+04
U-234	6.103E+04	6.104E+04	6.116E+04	6.239E+04	7.440E+04
U-235	6.661E+04	6.661E+04	6.646E+04	6.123E+04	3.579E+04
U-238	6.970E+04	6.972E+04	6.991E+04	7.185E+04	9.437E+04
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*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 8.68 ñ 0.02 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ
Ag-108m	1.000E+02	0.000E+00	4.373E-06	5.717E+06	1.535E-06	1.628E+07
Al-26	1.000E+02	0.000E+00	5.452E-06	4.586E+06	2.007E-06	1.246E+07
Am-241	1.000E+02	0.000E+00	3.745E-03	6.675E+03	3.669E-03	6.814E+03
Am-243	1.000E+02	0.000E+00	3.749E-03	6.668E+03	3.723E-03	6.716E+03
Cm-243	1.000E+02	0.000E+00	2.670E-03	9.364E+03	2.163E-03	1.156E+04
Cm-244	1.000E+02	0.000E+00	2.188E-03	1.142E+04	1.574E-03	1.589E+04
Co-60	1.000E+02	0.000E+00	5.637E-06	4.435E+06	1.801E-06	1.388E+07
Cs-137	1.000E+02	0.000E+00	1.986E-05	1.259E+06	1.625E-05	1.538E+06
Eu-152	1.000E+02	0.000E+00	3.434E-06	7.280E+06	2.187E-06	1.143E+07
Eu-154	1.000E+02	0.000E+00	4.602E-06	5.432E+06	2.324E-06	1.076E+07
Eu-155	1.000E+02	0.000E+00	6.599E-07	3.788E+07	1.963E-07	1.274E+08
Nb-94	1.000E+02	0.000E+00	3.975E-06	6.289E+06	1.463E-06	1.709E+07
Np-237	1.000E+02	0.000E+00	1.964E-03	1.273E+04	1.963E-03	1.274E+04
Pu-238	1.000E+02	0.000E+00	4.283E-03	5.837E+03	3.999E-03	6.252E+03
Pu-239	1.000E+02	0.000E+00	4.689E-03	5.331E+03	4.688E-03	5.333E+03
Pu-240	1.000E+02	0.000E+00	4.689E-03	5.331E+03	4.685E-03	5.337E+03
Pu-241	1.000E+02	40.06 ñ 0.08	1.135E-04	2.203E+05	1.019E-04	2.454E+05
Sr-90	1.000E+02	0.000E+00	4.951E-05	5.050E+05	4.009E-05	6.236E+05
Tc-99	1.000E+02	0.000E+00	1.313E-06	1.904E+07	4.832E-07	5.174E+07
Th-232	1.000E+02	103.9 ñ 0.2	7.643E-03	3.271E+03	6.277E-03	3.983E+03
U-233	1.000E+02	1.000E+03	1.090E-03	2.293E+04	4.272E-04	5.852E+04
U-234	1.000E+02	0.000E+00	4.097E-04	6.103E+04	4.089E-04	6.115E+04
U-235	1.000E+02	1.000E+03	6.984E-04	3.579E+04	3.760E-04	6.649E+04
U-238	1.000E+02	0.000E+00	3.587E-04	6.970E+04	3.577E-04	6.989E+04
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Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Ag-108m	Ag-108m	1.000E+00	4.373E-04	3.876E-04	1.308E-04	2.516E-09	0.000E+00
Al-26	Al-26	1.000E+00	5.452E-04	4.859E-04	1.723E-04	5.413E-09	0.000E+00
Am-241	Am-241	1.000E+00	3.745E-01	3.736E-01	3.658E-01	2.956E-01	3.513E-02
Am-241	Pu-241	1.000E+00	2.957E-04	8.675E-04	4.889E-03	1.025E-02	1.231E-03
Am-241	ãDOSE(j)		3.748E-01	3.745E-01	3.706E-01	3.058E-01	3.636E-02
Np-237	Am-241	1.000E+00	3.178E-08	9.523E-08	6.594E-07	5.671E-06	2.339E-05
Np-237	Np-237	1.000E+00	1.964E-01	1.964E-01	1.962E-01	1.952E-01	1.849E-01
Np-237	Pu-241	1.000E+00	1.679E-11	1.158E-10	4.745E-09	1.530E-07	7.756E-07
Np-237	Pu-241	2.450E-05	7.668E-13	2.252E-12	1.284E-11	3.196E-11	3.052E-11
Np-237	ãDOSE(j)		1.964E-01	1.964E-01	1.962E-01	1.952E-01	1.850E-01
U-233	Am-241	1.000E+00	9.900E-15	6.925E-14	3.248E-12	2.742E-10	1.346E-08
U-233	Np-237	1.000E+00	9.175E-08	2.752E-07	1.923E-06	1.810E-05	1.529E-04
U-233	Pu-241	1.000E+00	3.932E-18	5.835E-17	1.620E-14	6.206E-12	4.362E-10
U-233	Pu-241	2.450E-05	2.398E-19	1.656E-18	6.825E-17	2.379E-15	2.477E-14
U-233	U-233	1.000E+00	4.196E-02	4.194E-02	4.183E-02	4.067E-02	3.075E-02
U-233	ãDOSE(j)		4.196E-02	4.194E-02	4.183E-02	4.069E-02	3.090E-02
Th-229	Am-241	1.000E+00	5.641E-18	8.456E-17	2.600E-14	2.136E-11	1.209E-08
Th-229	Np-237	1.000E+00	6.969E-11	4.878E-10	2.303E-08	2.079E-06	1.795E-04
Th-229	Pu-241	1.000E+00	1.795E-21	5.517E-20	9.959E-17	4.187E-13	3.827E-10
Th-229	Pu-241	2.450E-05	1.369E-22	2.033E-21	5.673E-19	2.306E-16	2.847E-14
Th-229	U-233	1.000E+00	4.781E-05	1.434E-04	1.002E-03	9.417E-03	7.827E-02
Th-229	ãDOSE(j)		4.781E-05	1.434E-04	1.002E-03	9.419E-03	7.845E-02
Am-243	Am-243	1.000E+00	3.749E-01	3.746E-01	3.717E-01	3.441E-01	1.592E-01
Am-243	Cm-243	2.400E-03	4.192E-08	1.244E-07	7.797E-07	2.992E-06	1.528E-06
Am-243	ãDOSE(j)		3.749E-01	3.746E-01	3.717E-01	3.441E-01	1.592E-01
Pu-239	Am-243	1.000E+00	6.752E-06	2.025E-05	1.412E-04	1.298E-03	8.888E-03
Pu-239	Cm-243	2.400E-03	5.043E-13	3.505E-12	1.540E-10	7.610E-09	8.020E-08
Pu-239	Cm-243	9.976E-01	6.683E-06	1.983E-05	1.248E-04	5.045E-04	5.347E-04
Pu-239	Pu-239	1.000E+00	4.689E-01	4.689E-01	4.688E-01	4.672E-01	4.521E-01
Pu-239	ãDOSE(j)		4.689E-01	4.690E-01	4.690E-01	4.690E-01	4.616E-01
U-235	Am-243	1.000E+00	1.774E-16	1.241E-15	5.848E-14	5.165E-12	3.623E-10
U-235	Cm-243	2.400E-03	9.948E-24	1.484E-22	4.344E-20	2.350E-17	3.136E-15
U-235	Cm-243	9.976E-01	1.759E-16	1.223E-15	5.383E-14	2.712E-12	3.562E-11
U-235	Pu-239	1.000E+00	1.848E-11	5.543E-11	3.874E-10	3.651E-09	3.125E-08
U-235	U-235	1.000E+00	3.752E-02	3.751E-02	3.741E-02	3.639E-02	2.762E-02
U-235	ãDOSE(j)		3.752E-02	3.751E-02	3.741E-02	3.639E-02	2.762E-02
Pa-231	Am-243	1.000E+00	1.518E-20	2.277E-19	7.021E-17	5.936E-14	4.189E-11
Pa-231	Cm-243	2.400E-03	6.819E-28	2.104E-26	3.962E-23	2.222E-19	3.486E-16
Pa-231	Cm-243	9.976E-01	1.508E-20	2.250E-19	6.592E-17	3.613E-14	5.569E-12
Pa-231	Pu-239	1.000E+00	2.109E-15	1.476E-14	6.965E-13	6.250E-11	5.077E-09

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ
Pa-231	U-235	1.000E+00	6.424E-06	1.927E-05	1.345E-04	1.251E-03	9.363E-03
Pa-231	ãDOSE(j)		6.424E-06	1.927E-05	1.345E-04	1.251E-03	9.363E-03
Ac-227	Am-243	1.000E+00	3.532E-22	1.088E-20	2.021E-17	1.025E-13	1.386E-10
Ac-227	Cm-243	2.400E-03	0.000E+00	7.624E-28	9.303E-24	3.471E-19	1.150E-15
Ac-227	Cm-243	9.976E-01	3.510E-22	1.077E-20	1.919E-17	6.621E-14	1.885E-11
Ac-227	Pu-239	1.000E+00	6.124E-17	9.121E-16	2.627E-13	1.279E-10	1.723E-08
Ac-227	U-235	1.000E+00	2.483E-07	1.722E-06	7.400E-05	3.188E-03	3.286E-02
Ac-227	ãDOSE(j)		2.483E-07	1.722E-06	7.400E-05	3.188E-03	3.286E-02
Cm-243	Cm-243	2.400E-03	6.408E-04	6.254E-04	5.024E-04	5.623E-05	1.735E-14
Cm-243	Cm-243	9.976E-01	2.663E-01	2.599E-01	2.088E-01	2.337E-02	7.214E-12
Cm-243	ãDOSE(j)		2.670E-01	2.606E-01	2.093E-01	2.343E-02	7.231E-12
Cm-244	Cm-244	1.350E-06	2.954E-07	2.843E-07	2.014E-07	6.422E-09	6.970E-24
Cm-244	Cm-244	4.950E-08	1.083E-08	1.042E-08	7.386E-09	2.355E-10	2.556E-25
Cm-244	ãDOSE(j)		3.062E-07	2.947E-07	2.088E-07	6.658E-09	7.226E-24
Pu-240	Cm-244	4.950E-08	1.215E-12	3.584E-12	2.126E-11	6.237E-11	5.755E-11
Pu-240	Pu-240	4.950E-08	2.321E-08	2.321E-08	2.319E-08	2.295E-08	2.072E-08
Pu-240	ãDOSE(j)		2.321E-08	2.321E-08	2.321E-08	2.301E-08	2.077E-08
Cm-244	Cm-244	1.000E+00	2.188E-01	2.106E-01	1.492E-01	4.757E-03	5.163E-18
Pu-240	Cm-244	1.000E+00	2.455E-05	7.240E-05	4.296E-04	1.260E-03	1.163E-03
U-236	Cm-244	1.000E+00	1.977E-14	1.369E-13	5.795E-12	2.304E-10	2.488E-09
U-236	Pu-240	1.000E+00	5.648E-10	1.694E-09	1.184E-08	1.112E-07	9.174E-07
U-236	ãDOSE(j)		5.648E-10	1.694E-09	1.184E-08	1.114E-07	9.199E-07
Th-232	Cm-244	1.000E+00	2.753E-24	4.096E-23	1.166E-20	5.315E-18	7.220E-16
Th-232	Pu-240	1.000E+00	1.046E-19	7.325E-19	3.459E-17	3.127E-15	2.737E-13
Th-232	Th-232	1.000E+00	4.300E-01	4.300E-01	4.300E-01	4.300E-01	4.299E-01
Th-232	ãDOSE(j)		4.300E-01	4.300E-01	4.300E-01	4.300E-01	4.299E-01
Ra-228	Cm-244	1.000E+00	2.378E-26	7.175E-25	1.086E-21	1.591E-18	2.589E-16
Ra-228	Pu-240	1.000E+00	1.124E-21	1.644E-20	3.995E-18	9.680E-16	9.820E-14
Ra-228	Th-232	1.000E+00	9.090E-03	2.588E-02	1.126E-01	1.567E-01	1.566E-01
Ra-228	ãDOSE(j)		9.090E-03	2.588E-02	1.126E-01	1.567E-01	1.566E-01
Th-228	Cm-244	1.000E+00	1.554E-27	9.102E-26	5.791E-22	1.679E-18	2.921E-16
Th-228	Pu-240	1.000E+00	8.742E-23	2.503E-21	2.439E-18	1.035E-15	1.108E-13
Th-228	Th-232	1.000E+00	1.151E-03	7.061E-03	1.046E-01	1.777E-01	1.777E-01
Th-228	ãDOSE(j)		1.151E-03	7.061E-03	1.046E-01	1.777E-01	1.777E-01
Co-60	Co-60	1.000E+00	5.637E-04	4.943E-04	1.513E-04	1.095E-09	0.000E+00
Cs-137	Cs-137	1.000E+00	1.986E-03	1.941E-03	1.576E-03	1.970E-04	1.829E-13

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Eu-152	Eu-152	7.208E-01	2.475E-04	2.350E-04	1.471E-04	1.363E-06	6.348E-27
Eu-152	Eu-152	2.792E-01	9.587E-05	9.101E-05	5.699E-05	5.280E-07	2.459E-27
Eu-152	ãDOSE(j)		3.434E-04	3.260E-04	2.041E-04	1.891E-06	8.806E-27
Gd-152	Eu-152	2.792E-01	6.557E-17	1.923E-16	1.079E-15	2.548E-15	2.519E-15
Eu-154	Eu-154	1.000E+00	4.602E-04	4.254E-04	2.093E-04	1.743E-07	0.000E+00
Eu-155	Eu-155	1.000E+00	6.599E-05	5.738E-05	1.631E-05	5.617E-11	0.000E+00
Nb-94	Nb-94	1.000E+00	3.975E-04	3.543E-04	1.256E-04	3.934E-09	0.000E+00
Pu-238	Pu-238	1.840E-09	7.881E-10	7.818E-10	7.281E-10	3.574E-10	2.899E-13
Pu-238	Pu-238	1.000E+00	4.283E-01	4.249E-01	3.957E-01	1.942E-01	1.576E-04
Pu-238	ãDOSE(j)		4.283E-01	4.249E-01	3.957E-01	1.942E-01	1.576E-04
U-234	Pu-238	1.000E+00	5.792E-08	1.731E-07	1.168E-06	7.913E-06	1.121E-05
U-234	U-234	1.000E+00	4.096E-02	4.095E-02	4.084E-02	3.972E-02	3.007E-02
U-234	U-238	9.999E-01	5.806E-08	1.741E-07	1.216E-06	1.132E-05	8.540E-05
U-234	ãDOSE(j)		4.096E-02	4.095E-02	4.084E-02	3.974E-02	3.016E-02
Th-230	Pu-238	1.000E+00	1.660E-12	1.159E-11	5.350E-10	3.888E-08	9.600E-07
Th-230	U-234	1.000E+00	1.760E-06	5.279E-06	3.690E-05	3.482E-04	3.014E-03
Th-230	U-238	9.999E-01	1.663E-12	1.164E-11	5.493E-10	4.935E-08	4.065E-06
Th-230	ãDOSE(j)		1.760E-06	5.279E-06	3.690E-05	3.482E-04	3.019E-03
Ra-226	Pu-238	1.000E+00	3.443E-17	5.154E-16	1.564E-13	1.132E-10	3.069E-08
Ra-226	U-234	1.000E+00	4.865E-11	3.405E-10	1.605E-08	1.427E-06	1.066E-04
Ra-226	U-238	9.999E-01	3.448E-17	5.170E-16	1.595E-13	1.356E-10	1.009E-07
Ra-226	ãDOSE(j)		4.865E-11	3.405E-10	1.605E-08	1.428E-06	1.068E-04
Pb-210	Pu-238	1.000E+00	8.756E-19	2.696E-17	4.951E-14	2.228E-10	1.179E-07
Pb-210	U-234	1.000E+00	1.544E-12	2.301E-11	6.641E-09	3.270E-06	4.129E-04
Pb-210	U-238	9.999E-01	8.767E-19	2.702E-17	5.031E-14	2.606E-10	3.790E-07
Pb-210	ãDOSE(j)		1.544E-12	2.301E-11	6.641E-09	3.270E-06	4.134E-04
Pu-240	Pu-240	1.000E+00	4.689E-01	4.689E-01	4.684E-01	4.636E-01	4.185E-01
Pu-241	Pu-241	1.000E+00	8.778E-03	8.365E-03	5.424E-03	7.121E-05	1.084E-23
Pu-241	Pu-241	2.450E-05	2.178E-07	2.076E-07	1.346E-07	1.767E-09	2.454E-28
Pu-241	ãDOSE(j)		8.778E-03	8.365E-03	5.424E-03	7.121E-05	1.084E-23
Sr-90	Sr-90	1.000E+00	4.951E-03	4.832E-03	3.882E-03	4.353E-04	1.367E-13
Tc-99	Tc-99	1.000E+00	1.313E-04	1.170E-04	4.148E-05	1.303E-09	0.000E+00
U-238	U-238	5.400E-05	1.909E-06	1.908E-06	1.903E-06	1.851E-06	1.405E-06
U-238	U-238	9.999E-01	3.586E-02	3.585E-02	3.576E-02	3.478E-02	2.640E-02
U-238	ãDOSE(j)		3.587E-02	3.586E-02	3.576E-02	3.478E-02	2.640E-02

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ
Ag-108m	Ag-108m	1.000E+00	1.000E+02	8.863E+01	2.992E+01	5.753E-04	0.000E+00
Al-26	Al-26	1.000E+00	1.000E+02	8.912E+01	3.160E+01	9.929E-04	0.000E+00
Am-241	Am-241	1.000E+00	1.000E+02	9.976E+01	9.766E+01	7.893E+01	9.379E+00
Am-241	Pu-241	1.000E+00	0.000E+00	1.564E-01	1.257E+00	2.737E+00	3.286E-01
Am-241	äS(j):		1.000E+02	9.992E+01	9.892E+01	8.166E+01	9.708E+00
Np-237	Am-241	1.000E+00	0.000E+00	3.235E-05	3.200E-04	2.875E-03	1.191E-02
Np-237	Np-237	1.000E+00	1.000E+02	9.999E+01	9.994E+01	9.940E+01	9.418E+01
Np-237	Pu-241	1.000E+00	0.000E+00	2.554E-08	2.208E-06	7.747E-05	3.949E-04
Np-237	Pu-241	2.450E-05	0.000E+00	7.747E-10	6.296E-09	1.627E-08	1.554E-08
Np-237	äS(j):		1.000E+02	9.999E+01	9.994E+01	9.941E+01	9.419E+01
U-233	Am-241	1.000E+00	0.000E+00	7.076E-11	7.018E-09	6.473E-07	3.206E-05
U-233	Np-237	1.000E+00	0.000E+00	4.372E-04	4.365E-03	4.293E-02	3.643E-01
U-233	Pu-241	1.000E+00	0.000E+00	3.738E-14	3.347E-11	1.462E-08	1.039E-06
U-233	Pu-241	2.450E-05	0.000E+00	1.707E-15	1.485E-13	5.635E-12	5.901E-11
U-233	U-233	1.000E+00	1.000E+02	9.997E+01	9.969E+01	9.694E+01	7.329E+01
U-233	äS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.365E+01
Th-229	Am-241	1.000E+00	0.000E+00	2.228E-15	2.214E-12	2.079E-09	1.192E-06
Th-229	Np-237	1.000E+00	0.000E+00	2.065E-08	2.062E-06	2.033E-04	1.771E-02
Th-229	Pu-241	1.000E+00	0.000E+00	8.848E-19	8.096E-15	4.065E-11	3.774E-08
Th-229	Pu-241	2.450E-05	0.000E+00	5.396E-20	4.857E-17	2.250E-14	2.809E-12
Th-229	U-233	1.000E+00	0.000E+00	9.442E-03	9.424E-02	9.254E-01	7.726E+00
Th-229	äS(j):		0.000E+00	9.442E-03	9.425E-02	9.256E-01	7.743E+00
Am-243	Am-243	1.000E+00	1.000E+02	9.991E+01	9.915E+01	9.179E+01	4.245E+01
Am-243	Cm-243	2.400E-03	0.000E+00	2.226E-05	1.992E-04	7.971E-04	4.076E-04
Am-243	äS(j):		1.000E+02	9.991E+01	9.915E+01	9.179E+01	4.245E+01
Pu-239	Am-243	1.000E+00	0.000E+00	2.879E-03	2.867E-02	2.755E-01	1.895E+00
Pu-239	Cm-243	2.400E-03	0.000E+00	3.219E-10	2.989E-08	1.611E-06	1.710E-05
Pu-239	Cm-243	9.976E-01	0.000E+00	2.839E-03	2.550E-02	1.075E-01	1.140E-01
Pu-239	Pu-239	1.000E+00	1.000E+02	1.000E+02	9.996E+01	9.964E+01	9.642E+01
Pu-239	äS(j):		1.000E+02	1.000E+02	1.000E+02	1.000E+02	9.843E+01
U-235	Am-243	1.000E+00	0.000E+00	1.418E-12	1.413E-10	1.363E-08	9.645E-07
U-235	Cm-243	2.400E-03	0.000E+00	1.059E-19	1.001E-16	6.182E-14	8.349E-12
U-235	Cm-243	9.976E-01	0.000E+00	1.403E-12	1.305E-10	7.174E-09	9.486E-08
U-235	Pu-239	1.000E+00	0.000E+00	9.847E-08	9.832E-07	9.682E-06	8.322E-05
U-235	U-235	1.000E+00	1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
U-235	äS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
Pa-231	Am-243	1.000E+00	0.000E+00	1.000E-17	9.965E-15	9.629E-12	6.888E-09
Pa-231	Cm-243	2.400E-03	0.000E+00	5.608E-25	5.357E-21	3.593E-17	5.732E-14
Pa-231	Cm-243	9.976E-01	0.000E+00	9.917E-18	9.385E-15	5.873E-12	9.160E-10
Pa-231	Pu-239	1.000E+00	0.000E+00	1.042E-12	1.040E-10	1.019E-08	8.351E-07

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Pa-231	U-235	1.000E+00	0.000E+00	2.115E-03	2.109E-02	2.050E-01	1.541E+00
Pa-231	ãS(j):		0.000E+00	2.115E-03	2.109E-02	2.050E-01	1.541E+00
Ac-227	Am-243	1.000E+00	0.000E+00	7.907E-20	7.446E-16	4.516E-12	6.208E-09
Ac-227	Cm-243	2.400E-03	0.000E+00	3.554E-27	3.260E-22	1.524E-17	5.148E-14
Ac-227	Cm-243	9.976E-01	0.000E+00	7.852E-20	7.090E-16	2.922E-12	8.446E-10
Ac-227	Pu-239	1.000E+00	0.000E+00	1.097E-14	1.019E-11	5.666E-09	7.719E-07
Ac-227	U-235	1.000E+00	0.000E+00	3.331E-05	3.023E-03	1.420E-01	1.473E+00
Ac-227	ãS(j):		0.000E+00	3.331E-05	3.023E-03	1.420E-01	1.473E+00
Cm-243	Cm-243	2.400E-03	2.400E-01	2.342E-01	1.882E-01	2.106E-02	6.500E-12
Cm-243	Cm-243	9.976E-01	9.976E+01	9.736E+01	7.821E+01	8.754E+00	2.702E-09
Cm-243	ãS(j):		1.000E+02	9.760E+01	7.840E+01	8.775E+00	2.708E-09
Cm-244	Cm-244	1.350E-06	1.350E-04	1.299E-04	9.206E-05	2.935E-06	3.186E-21
Cm-244	Cm-244	4.950E-08	4.950E-06	4.764E-06	3.375E-06	1.076E-07	1.168E-22
Cm-244	ãS(j):		1.400E-04	1.347E-04	9.543E-05	3.043E-06	3.302E-21
Pu-240	Cm-244	4.950E-08	0.000E+00	5.149E-10	4.358E-09	1.330E-08	1.227E-08
Pu-240	Pu-240	4.950E-08	4.950E-06	4.949E-06	4.944E-06	4.894E-06	4.418E-06
Pu-240	ãS(j):		4.950E-06	4.950E-06	4.949E-06	4.907E-06	4.430E-06
Cm-244	Cm-244	1.000E+00	1.000E+02	9.624E+01	6.819E+01	2.174E+00	2.360E-15
Pu-240	Cm-244	1.000E+00	0.000E+00	1.040E-02	8.804E-02	2.686E-01	2.479E-01
U-236	Cm-244	1.000E+00	0.000E+00	1.549E-10	1.385E-08	6.000E-07	6.516E-06
U-236	Pu-240	1.000E+00	0.000E+00	2.960E-06	2.954E-05	2.899E-04	2.403E-03
U-236	ãS(j):		0.000E+00	2.960E-06	2.955E-05	2.905E-04	2.410E-03
Th-232	Cm-244	1.000E+00	0.000E+00	2.556E-21	2.349E-18	1.221E-15	1.677E-13
Th-232	Pu-240	1.000E+00	0.000E+00	7.301E-17	7.292E-15	7.201E-13	6.360E-11
Th-232	Th-232	1.000E+00	1.000E+02	1.000E+02	1.000E+02	1.000E+02	9.997E+01
Th-232	ãS(j):		1.000E+02	1.000E+02	1.000E+02	1.000E+02	9.997E+01
Ra-228	Cm-244	1.000E+00	0.000E+00	7.535E-23	5.753E-19	1.000E-15	1.648E-13
Ra-228	Pu-240	1.000E+00	0.000E+00	2.847E-18	2.223E-15	6.102E-13	6.251E-11
Ra-228	Th-232	1.000E+00	0.000E+00	1.136E+01	6.998E+01	9.982E+01	9.979E+01
Ra-228	ãS(j):		0.000E+00	1.136E+01	6.998E+01	9.982E+01	9.979E+01
Th-228	Cm-244	1.000E+00	0.000E+00	5.173E-24	2.623E-19	9.304E-16	1.639E-13
Th-228	Pu-240	1.000E+00	0.000E+00	2.417E-19	1.164E-15	5.751E-13	6.219E-11
Th-228	Th-232	1.000E+00	0.000E+00	1.864E+00	5.640E+01	9.982E+01	9.979E+01
Th-228	ãS(j):		0.000E+00	1.864E+00	5.640E+01	9.982E+01	9.979E+01
Co-60	Co-60	1.000E+00	1.000E+02	8.768E+01	2.684E+01	1.942E-04	0.000E+00
Cs-137	Cs-137	1.000E+00	1.000E+02	9.772E+01	7.937E+01	9.918E+00	9.209E-09

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ	ÃÃÃÃÃÃÃÃÃ
Eu-152	Eu-152	7.208E-01	7.208E+01	6.843E+01	4.285E+01	3.969E-01	1.849E-21
Eu-152	Eu-152	2.792E-01	2.792E+01	2.650E+01	1.660E+01	1.538E-01	7.160E-22
Eu-152	ãS(j):		1.000E+02	9.493E+01	5.944E+01	5.507E-01	2.565E-21
Gd-152	Eu-152	2.792E-01	0.000E+00	1.746E-13	1.397E-12	3.421E-12	3.382E-12
Eu-154	Eu-154	1.000E+00	1.000E+02	9.242E+01	4.548E+01	3.788E-02	6.081E-33
Eu-155	Eu-155	1.000E+00	1.000E+02	8.696E+01	2.472E+01	8.512E-05	0.000E+00
Nb-94	Nb-94	1.000E+00	1.000E+02	8.912E+01	3.159E+01	9.896E-04	0.000E+00
Pu-238	Pu-238	1.840E-09	1.840E-07	1.826E-07	1.700E-07	8.344E-08	6.769E-11
Pu-238	Pu-238	1.000E+00	1.000E+02	9.921E+01	9.240E+01	4.535E+01	3.679E-02
Pu-238	ãS(j):		1.000E+02	9.921E+01	9.240E+01	4.535E+01	3.679E-02
U-234	Pu-238	1.000E+00	0.000E+00	2.823E-04	2.721E-03	1.925E-02	2.737E-02
U-234	U-234	1.000E+00	1.000E+02	9.997E+01	9.969E+01	9.696E+01	7.340E+01
U-234	U-238	9.999E-01	0.000E+00	2.834E-04	2.826E-03	2.749E-02	2.084E-01
U-234	ãS(j):		1.000E+02	9.997E+01	9.970E+01	9.700E+01	7.364E+01
Th-230	Pu-238	1.000E+00	0.000E+00	1.273E-09	1.242E-07	9.857E-06	2.454E-04
Th-230	U-234	1.000E+00	0.000E+00	9.000E-04	8.988E-03	8.860E-02	7.706E-01
Th-230	U-238	9.999E-01	0.000E+00	1.276E-09	1.273E-07	1.250E-05	1.039E-03
Th-230	ãS(j):		0.000E+00	9.001E-04	8.988E-03	8.862E-02	7.718E-01
Ra-226	Pu-238	1.000E+00	0.000E+00	1.839E-13	1.802E-10	1.491E-07	4.095E-05
Ra-226	U-234	1.000E+00	0.000E+00	1.949E-07	1.944E-05	1.888E-03	1.423E-01
Ra-226	U-238	9.999E-01	0.000E+00	1.842E-13	1.837E-10	1.785E-07	1.346E-04
Ra-226	ãS(j):		0.000E+00	1.949E-07	1.944E-05	1.888E-03	1.425E-01
Pb-210	Pu-238	1.000E+00	0.000E+00	1.420E-15	1.323E-11	7.117E-08	3.827E-05
Pb-210	U-234	1.000E+00	0.000E+00	2.004E-09	1.867E-06	1.049E-03	1.341E-01
Pb-210	U-238	9.999E-01	0.000E+00	1.423E-15	1.343E-11	8.317E-08	1.230E-04
Pb-210	ãS(j):		0.000E+00	2.004E-09	1.867E-06	1.050E-03	1.342E-01
Pu-240	Pu-240	1.000E+00	1.000E+02	9.999E+01	9.989E+01	9.887E+01	8.925E+01
Pu-241	Pu-241	1.000E+00	1.000E+02	9.530E+01	6.179E+01	8.113E-01	1.235E-19
Pu-241	Pu-241	2.450E-05	2.450E-03	2.335E-03	1.514E-03	1.988E-05	3.027E-24
Pu-241	ãS(j):		1.000E+02	9.530E+01	6.179E+01	8.113E-01	1.235E-19
Sr-90	Sr-90	1.000E+00	1.000E+02	9.760E+01	7.842E+01	8.792E+00	2.761E-09
Tc-99	Tc-99	1.000E+00	1.000E+02	8.912E+01	3.160E+01	9.926E-04	0.000E+00
U-238	U-238	5.400E-05	5.400E-03	5.398E-03	5.383E-03	5.237E-03	3.975E-03
U-238	U-238	9.999E-01	9.999E+01	9.996E+01	9.969E+01	9.698E+01	7.361E+01
U-238	ãS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ

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

RESCALC.EXE execution time = 5.56 seconds

Appendix G

Nevada Division of Environmental Protection Comments

(16 Pages)

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Draft Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 411: Double Tracks Plutonium Dispersion (Nellis), Nevada National Security Site, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro-INTERA
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	2/20/2015
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 or 237	**9. Reviewer's Signature:**	

10. Comment Number/Locatio	11. Type*	12. Comment	13. Comment Response	14. Accept
1.) Section Executive Summary, Page ES-1, 4th Paragraph		The sentence pre-supposes that CAU 411 will closed after the bulleted items are executed. Suggest restate: "...activities that will help determine if existing information and data are sufficient to warrant NDEP approval of closures..."	The intent of this sentence was not to provide a “checklist” for meeting the requirements for site closure. Rather, it summarizes SAFER activities that *support* the closure of CAU 411. Because the statement reads as intended, no changes were made.	
2.) Section 1.0, Page 1, 2nd Paragraph		Add a reference describing when SAFER process is appropriate.	The first sentence preceding the bulleted list has been revised to read, “A SAFER may be performed when the following criteria are met (FFACO; 1996, as amended): …”.	

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10. Comment Number/Locatio	11. Type*	12. Comment	13. Comment Response	14. Accept
3.) Section 1.0, Page 1, 3rd Paragraph		State succinctly the supporting assumptions about why clean closure is appropriate for this CAU.	The second sentence of the third paragraph has been revised to read, “The presumed corrective action for CAU 411 is clean closure. This presumption is based on the following: • Completion of the 1996 interim corrective action, which included removal of the most highly contaminated soil and debris within the plume and at ground zero (GZ) (see Section 2.2.3) • Ground-based confirmation radiological surveys (KIWI) that demonstrated achievement of the 1996 target cleanup goal (see Section 2.2.3) • Post-remediation aerial radiological survey data from 2006 that confirmed the overall distribution of radioactivity at the site (see Section 2.2.3) • Removable contamination surveys from 2007 that identify current radiological conditions at the site (see Sections 2.2.4 and 2.2.5.2) • Soil sample data and ground-based radiological surveys from 2012 (see Section 2.2.5)	
4.) Section 1.2, Page 3, 1st Paragraph		Last sentence: assumes closure is certain. Suggest restate IAW revised content in comment 1.	The last sentence was revised to read, “Based on the results of environmental samples, a closure report (CR) is prepared and the SAFER process culminates in closure of the site.”	

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10. Comment Number/Locatio	11. Type*	12. Comment	13. Comment Response	14. Accept
5.) Section 2.1, Page 6, 1st Paragraph		The reference for this section (DOE/NV, 1996b) states Pu deposition on steel plate, concrete slab, and ground surface was estimated between 980 and 1,600 grams (Shreve, 1965). After the sentence ending in "pad", insert (from DOE/NV, 1996a) the following: page 1-3, last paragraph beginning with sentence "The experiment..." and including the 3 sentences which follow, ending with, "...buried near ground zero".	The two sentences after the sentence ending in “pad” were replaced with the following, “The test scattered radioactive material, earth, and other material (concrete and metal) into the air. The debris and most of the dirt fell to earth at relatively short distances from the GZ area. However, some of the finer-grained material was spread over a larger area downwind, to the south of GZ. No fission yield was detected from the test, and the total amount of plutonium deposited on the steel plate, concrete pad, and ground surface was estimated between 980 and 1,600 grams (Shreve, 1965). The debris in the vicinity of GZ and identified fragments to distances of 90 to 120 meters (m) (300 to 800 ft) were collected and buried near GZ (DOE/NV, 1996b).”	

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10. Comment Number/Locatio	11. Type*	12. Comment	13. Comment Response	14. Accept
6.) Section 2.2, Page 7, Paragraphs 1 or 2		This section must include a brief discussion about the known validity of the historical data used, including historical DQOs and QA/QC methodology (if any); need not be detailed, but summary statements about their validity in relation to current proposed corrective action are required.	At the end of each subsection of Section 2.2, text has been added to indicate the categorization of existing data with regard to the DQO process (as defined in the Soils Activity Quality Assurance Plan [QAP] [NNSA/NSO, 2012c]). The following has been added at the end of Section 2.2.1: “Data collected in the four site characterization events described in this subsection are presented as informational data, as defined in the Soils Quality Assurance Plan (QAP) (NNSA/NSO, 2012c). These data will not be used to support or make DQO decisions.” The following has been added at the end of Section 2.2.2: “The air−monitoring data described in this subsection are presented as informational data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data will not be used to support or make DQO decisions.” The following has been added at the end of Section 2.2.3: “The data from the aerial and KIWI radiological surveys described in this subsection are categorized as decision-supporting data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data were used to bias sampling locations for the 2012 preliminary investigation discussed in Section 2.2.5 and the CAI proposed in this SAFER Plan.” The following has been added at the end of Section 2.2.4: “The data collected in the posting compliance investigation described in this subsection are categorized as decision-supporting data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data were used to bias removable	

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			contamination survey locations for the 2012 preliminary investigation discussed in Section 2.2.5 and the CAI proposed in this SAFER Plan." The following has been added at the end of Section 2.2.5: "The data collected in the preliminary investigation described in this subsection are categorized as decisional data, as defined in the Soils QAP (NNSA/NSO, 2012c). These data will be combined with the data collected during the CAI to make DQO decisions regarding site closure. The quality of all decisional data will be addressed in the Data Quality Assessment (DQA) appendix to the CR for CAU 411."	
7.) Section 2.2, Page 7, Table 2-1		Add an additional column: briefly summarize how the 'Activities' support and are utilized in this SAFER Plan.	A new column, "Data Use," was added to the table. For each activity, the new column lists whether the resulting data are "decisional data," "decision-supporting data," or "informational data," as defined in the Soils QAP.	
8.) Section 2.2.1, Pages 8-9, All Paragraphs		Each of the four site characterization events (other than that cited on P. 7) should be referenced by date and document/date source.	The results of each of the four site characterization events were reported in the *Double Tracks Site Characterization Report*; there are not separate reports for each event. To clarify, the third sentence in Section 2.2.1 was moved to after the first sentence on Page 8 and was revised to read, "The results of all four site characterization events are found in the *Double Tracks Site Characterization Report* (DOE/NV, 1996a)."	

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5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	2/20/2015
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10. Comment Number/Locatio	11. Type*	12. Comment	13. Comment Response	14. Accept
9.) Section 2.2.3, Page 11, 2nd Paragraph		Were the 1997 KIWI data reprocessed in 2009 to produce Figure 2-1? Clarify.	The KIWI data were not reprocessed in 2009. This year is associated with the reference for the KIWI data, which includes the electronic KIWI data and several other GIS datasets. To clarify, the KIWI survey reference was inserted into the text in Section 2.2.3, second paragraph, fourth sentence, as follows, “The results of the KIWI survey are shown in Figure 2-1 (NSTec, 2009).”	
10.) Figure 2-1, Page 12		Confirm the KIWI survey was conducted in 1997: NDEP has an archival report showing an apparent post-remediation KIWI image dated November 1996.	The year of the KIWI survey is incorrect and was changed to 1996 throughout the document.	
11.) Section 2.2.3, Page 11, 4th Paragraph		Briefly explain why Figures 2-1 and 2-2 appear to show different results.	The difference in the two figures represents the difference in resolution between the two radiological surveys. Figure 2-1 shows the results of the 2006 aerial survey, which was conducted at a height approximately 50 ft above the ground surface. Figure 2-2 shows the results of the 1996 KIWI survey, which was conducted at a height approximately 2.5 ft above the ground surface. To clarify, the following was added to Section 2.2.3, second paragraph, after the fourth sentence:, “This KIWI survey shows better resolution than the 2006 aerial survey discussed below, thus revealing detectable radioactivity in areas within the fence that were not detected by the aerial survey.”	

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10. Comment Number/Locatio	11. Type*	12. Comment	13. Comment Response	14. Accept
12.) Section 2.2.5.2, Page 16, 1st Paragraph		Is there a figure reference for this survey?	As a result of this comment and #13 and #14, a new figure (Figure 2-5) was added to Section 2.2.5 and is referenced in this section. The new figure presents all identified surface features at the site (see first bullet of comment #13) and the locations of the 2012 sample plots (see comment # 14), which coincide with the locations of the removable contamination surveys mentioned in this comment.	
13.) Figure 2-4, Page 17		• Add all the bulleted surface features identified in Section 2.2.5.3 • Under "Explanation" legend, add a symbol for FIDLER survey track • "Counts per Second" legend: the <'100' cps shaded area is nearly invisible on the larger figure • Add GZ • Add in appropriate section a brief explanation of why standard deviation increased with increases in FIDLER MOB measurements • Inset detail maps should be connected with 'zoom' lines to larger figure; at first glance it's not obvious what they represent	• A new figure (Figure 2-5) was added to Section 2.2.5 that includes all of the bulleted surface features identified in Section 2.2.5.3. • As a result of the DOE/NDEP comment resolution meeting on March 2, 2015, this comment was withdrawn by NDEP. No changes were made to the figure. • The <100 cps area was darkened to make more visible. • The GZ location was added. • The standard deviation represented here is for the population of background measurements in this survey and is the same value for all levels. As we no longer use this designation, the multiples of standard deviation information was removed from the legend. • Lines were added connecting insets, as requested.	
14.) Section 2.2.5.4, Page 18, 1st Paragraph		Is there a figure reference for this survey?	The referenced section discusses soil sampling. The new figure (Figure 2-5) in Section 2.2.5 includes the locations of the 2012 sample plot locations and is referenced in Section 2.2.5.4.	

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15.) Section 3.2.1.2, Page 23, 2nd Paragraph		• 1st sentence: add the date of the DQO meeting as reference • beginning with sentence, "The PAL is taken from...", insert the phrase "Occupational Radiation Protection" after "10 CFR 835" • add quantitative description of an HCA and its relationship to this PAL	• The first sentence has been revised to read, “The removable contamination PAL was agreed to by the stakeholders in the November 20, 2014, DQO meeting for CAU 411.” • The referenced sentence has been revised to read, “The PAL is based on 10 CFR 835, “Occupational Radiation Protection,” which contains the regulations governing the DOE occupational radiation control program (CFR, 2015).” • The second-to-last and last sentence of this paragraph provide the relationship of the PAL to HCA criteria. Further discussion of the PAL and removable contamination results will be included in the CAU 411 Closure Report. No changes were made to the document.	

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16.) Figure 3-2, Page 26		This diagram requires revision: • Move the "Wind" CSM element from beneath the subsurface position on the block diagram to above the surface. • Symbology for "Remediated Area", "Sediment in Drainage", and "Bedrock" are very difficult to differentiate. • the "Drainage" feature does not coincide with "Surface Drainage" symbols. • label the Land Surface • since there is no on-site wells, it's probably inappropriate to suggest DTW is exactly 404 ft. bgs. • add North arrow • Is Vertical Transport intended below UXO? Very difficult to see. • If "DT" refers to "Double Tracks" suggest spell out here for clarity. • Does "Vertical Transport" refer to precipitation infiltration? • Topography shown in the drawing appears not to reflect local hydrogeologic conditions, i.e., site appears to be located at base of hills instead of on a flat alluvial basin thousands of feet from rock exposures, which is the actual geomorphic setting.	• The “wind” element was moved to a position above the ground surface. • The symbology for the remediated area was changed to distinguish it from the bedrock symbology. • A surface drainage symbol was added directly in the drainage feature. • The land surface (and subsurface) was labeled. • The label was revised to state “Water Table (approximately 400-500 ft bgs)” • As a result of the DOE/NDEP comment resolution meeting on March 2, 2015, this comment was withdrawn by NDEP. No changes were made to the figure. • The vertical transport arrows beneath the UXO symbol were darkened. • The abbreviation “DT” was deleted. • Vertical transport may include precipitation infiltration, but may also include transport of contaminants via gravity. • As indicated in the figure, the model is not to scale. The DT site is located on Stonewall Flat, which is bordered by the Cactus Range to the east, the Goldfield Hills to the north, and Stonewall Mountain to the south (see Section B.2.2.4).	

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17.) Section 4.1, Page 28, 2nd Paragraph		Are chemical COPCs reasonably expected to be present (i.e., lead, etc.)?	The following was added after the bulleted list in Section 4.1, “Chemical COPCs are not reasonably expected to be present at CAU 411 based on the history of the DT experiment and on chemical analyses that were performed during previous investigations, as discussed in Section B.2.2.2.”	
18.) Section 4.3.5, Page 31, 1st Paragraph		1st sentence: add a reference to Figure 2-4.	The sentence was revised to read, “The three drainages that exit the CA fence to the southwest (Figure 2-4) will be visually surveyed to locate sedimentation areas.”	
19.) Section 4.4.1, Page 34, 1st Paragraph		Last sentence: substitute "NDEP" for "the regulators"	The sentence was revised to read, “DOE remains responsible for working with NDEP, as needed to revise or renegotiate any closure agreements, and remains liable for all costs associated with any future negotiation and/or remediation action for CAU 411, consistent with its responsibilities under applicable law.”	
20.) Section 5.0, Page 36, 1st Paragraph		Clarify is a DTRA or NTTR/USAF program manager also be a POC for document availability?	The CAU 411 SAFER is a DOE document; therefore, DOE is listed as the sole POC for document availability. No changes were made to the document.	
21.) Section B.2.2.2, Page B-4, Table B.2-1		4th Row: "storage-transportation test" - DT was more accurately an "experiment to evaluate dispersal of radionuclides in the environment and uptake and fate of plutonium in several animal species." (DOE/NV, 1996a).	The term “storage-transportation” is the official description of the Double Tracks experiment listed in the DOE reference, *United States Nuclear Tests, July 1945 through September 1992* (DOE/NV-209-REV 15, December 2000). No changes were made to the table.	

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22.) Section B.2.2.2, Page B-5, Figure B.2-1		See comment 16.	See comment response to Comment #16.	
23.) Section B.2.2.4, Page B-9, 1st Paragraph		Based on these DTW statements, showing DTW at DT exactly at 404 bgs in Figure 2-1 may not appropriate for a 'conceptual' drawing.	See comment response to Comment #16.	
24.) Section B2.2.5, Page B-9, 1st Paragraph		Sentence beginning with "Ground-based..."; add a reference to Figure 2-4 at end of this sentence. Second to last sentence: restate in the affirmative, i.e., what did the surveys reveal?	The sentence was revised to read, “Ground-based radiological surveys of the wash at the points where it exits the fenced area southwest of the fence were completed in 2012 (Figure 2-4).” The second to last sentence was revised to read, “These surveys suggest that lateral migration of contaminants from the fenced area is not occurring; however, additional investigation of these drainages will be completed during the CAI.”	

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25.) Section B.2.2.5, Page B-9, 3rd Paragraph		Restate the appropriate references from Section 2.2.2 here.	The fourth and fifth sentences of the third paragraph were revised to read, “Based on the data, the highest calculated inhalation dose to a receptor was 1.4 mrem/yr (assuming an exposure duration of 2,000 hr/yr). This dose was calculated using the maximum Pu-239/240 concentration detected at the DT site in 1996, the year when the interim corrective actions took place (Black and Townsend, 1997; NNSA/NSO, 2003).” Note: The following reference was added to Section B.9.0, *References*: Black, S.C, and Y.E. Townsend ed. 1997. *Nevada Test Site Annual Site Environmental Report for Calendar Year 1996*, DOE/NV/11718-137. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV: Bechtel Nevada.	

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26.) Section B.2.2.5, Page B-10, 1st Paragraph		This section requires reference(s) and additional validation to elaborate on and substantiate conclusions which appear to be largely speculative as written.	The third and fourth sentences of the first paragraph on Page B-10 were revised to read, “The objective of the interim corrective action was to remove surface and subsurface soil contaminated with radionuclides above the established cleanup level (DOE/NV, 1996a; NNSA/NSO, 2003). The removal of contaminated soil was verified by radiological field instruments immediately after excavation and by surveying the entire fenced area with the KIWI upon project completion (DOE/NV, 1996a; NNSA/NSO, 2003).” Note: The following reference was added to Section B.9.0, *References*: U.S. Department of Energy, Nevada Operations Office. 1996a. *Double Tracks Test Site Interim Corrective Action Plan*, DOE/NV--11718-112. Las Vegas, NV.	

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27.) Section B.4.2, Page B-15, 2nd Paragraph		Bulleted items: if these are taken from documents in Section B.9.0 - "References" section, list them according to full reference title; i.e., the only DOE/NV, 1997 reference in B.9.0 is not a site investigation report, but a CADD For bulleted items which are not references, relate them in some way to relevant report sections. 2nd sentence: "information includes..."; implies there are additional historical data sources that were consulted but not bulleted; if bulleted are the most relevant to SAFER, so state; disclose generally the extent of what is not presented but was consulted.	The second sentence in Section B.4.2 has been revised to read, “Information and data from the following reports and surveys were considered in the development of this SAFER Plan: • *Double Tracks Test Site Interim Corrective Action Plan* (DOE/NV, 1996a) • *Double Tracks Test Site Characterization Report* (DOE/NV, 1996b) • *Closure Report for Corrective Action Unit 411: Double Tracks Plutonium Dispersion* (NNSA/NSO, 2003) • 1996 ground-based KIWI survey (NSTec, 2009) • 2006 aerial radiological survey (NSTec, 2009) • *Nevada Test and Training Range Results of the 10 CFR 835 Posting Compliance Field Investigation, Clean Slates I, II, and III and Double Tracks* (NSTec, 2011) • *Preliminary Investigation Results and Recommendation for CAUs 411, 412, 413, and 414 (N-I, 2013b)* Note: The existing DOE/NV 1997 reference was deleted from and the following references were added to Section B.9.0, *References*: • DOE/NV, 1996b • N-I, 2013b	

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28.) Section B.5.2, Page B-18, 1st Paragraph		3rd sentence: provide reference after, "GZ area."	The sentence was revised to read, "*In situ* measurements indicated that 80 to 90 percent of the radioactivity was present within the top 2.5 cm (1 in.) of the soil profile outside the GZ area (DOE/NV, 1996b)."	
29.) Section B.6.2.2, Page B-21, 1st Paragraph		2nd sentence: add reference, using CA/HCA rad control implications as appropriate.	The last sentence of Section B.6.2.2 was revised to read, "If the FAL is exceeded, the DT site would require corrective action under the FFACO and appropriate radiological controls in accordance with the DOE radiological control program."	
30.) Section B.8.1, B-26, 1st Paragraph		The dispersion zone south of the CA fence is approx.. 2,500-ft. long; this area might be more better characterized by adding an additional fifth sampling plot between the proposed sampling location and the CA fence southern boundary.	The selection of sample locations was biased to the locations of highest radioactivity, so placing a sample location as requested would not be consistent with the current approach. It should be noted that the actual sample plot location will be refined in the field using a FIDLER to ensure that the plot is placed at the location of the highest radiological measurements, as stated in Section B.8.1. No changes were made to the document.	

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31.) Section D.2.16.2, Page D-22, 1st Paragraph		Last sentence: although not sensitive for CAU 411 radionuclide COPCs, clarify why are lowest average values are recommended, e.g., 2013 Sandia ASER for TTR estimates averages on desert valley floors at approx. 4-inches.	As noted in Section 2.16.1, *Model Response to Parameter*, lower values of precipitation provide lower RRMG values for the radionuclides present at CAU 411. Thus, the lowest average precipitation value was selected because it results in a more conservative (i.e., lower) RRMG value. It should be noted that the value listed in the draft SAFER as the lowest average precipitation value of all three stations (0.008 m/yr) is incorrect and was replaced with the correct value of 0.096 m/yr (3.8 in. per year). The RRMGs (Appendix E) and the RESRAD output (Appendix F) were recalculated using the correct precipitation value.	
32.) Appendix E, Model Output		Page 11: Clarify why the model run with "Initial principal radionuclides" beginning with row "R012" includes radionuclides not thought to be part of DT test device.	The “initial principal radionuclides” entered into RESRAD are listed in Appendix B (Instructions for Calculating RRMGs Using RESRAD) of the *Soils Risk-Based Corrective Action Evaluation Process* document (DOE/NV-1475 REV 1, March 2014). This list is intended to include any radionuclide that may be encountered at any Soils Activity site, regardless of the type of experiment conducted at the location (storage-transportation, weapons test). Because each individual RRMG value represents the activity concentration of a single radionuclide that equates to a 25-mrem/yr exposure, the addition or deletion of non-COPC radionuclides does not impact the RRMGs for the site-specific COPCs. No changes were made to the document.	

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