Nevada
Environmental
Management
Operations Activity

DOE/NV--1534

National Nuclear Security Administration

Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion (TTR) Tonopah Test Range, Nevada

Controlled Copy No.: ___
Revision No.: 0

April 2015

UNCLASSIFIED

/s/ Joseph P. Johnston 04/20/2015
Joseph P. Johnston, Navarro CO Date

Approved for public release; further dissemination unlimited.

U.S. Department of Energy
National Nuclear Security Administration
Nevada Field Office

Available for sale to the public from:

U.S. Department of Commerce
National Technical Information Service
5301 Shawnee Road
Alexandria, VA 22312
Telephone: 800.553.6847
Fax: 703.605.6900
E-mail: *orders@ntis.gov*
Online Ordering: *http://www.ntis.gov/help/ordermethods.aspx*

Available electronically at *http://www.osti.gov/scitech*

Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Phone: 865.576.8401
Fax: 865.576.5728
Email: *reports@adonis.osti.gov*

DOE/NV--1534

STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 412: CLEAN SLATE I PLUTONIUM DISPERSION (TTR) TONOPAH TEST RANGE, NEVADA

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

Controlled Copy No.: ___

Revision No.: 0

April 2015

Approved for public release; further dissemination unlimited.

STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 412: CLEAN SLATE I PLUTONIUM DISPERSION (TTR) TONOPAH TEST RANGE, NEVADA

Approved by: /s/ Tiffany A. Lantow Date: 04/20/2015

Tiffany A. Lantow
Soils Activity Lead

Approved by: /s/ Robert F. Boehlecke Date: 04/20/2015

Robert F. Boehlecke
Environmental Management Operations Manager

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Appendix C - Dose Calculation Methodology

Appendix D - RESRAD Input Parameter Review

Table of Contents *(Continued)*

Table of Contents (Continued)

List of Figures

List of Tables

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
CSI	Clean Slate I
CSM	Conceptual site model
DAC	Derived air concentration
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
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
FSR	Field-screening result
ft	Foot
g/cm^3	Grams per cubic centimeter
g/m^3	Grams per cubic meter
g/yr	Grams per year
GZ	Ground zero
HASL	Health and Safety Laboratory
HCA	High contamination area
HPGe	High-purity germanium
hr/day	Hours per day
hr/yr	Hours per year
IDW	Investigation-derived waste
in.	Inch
km	Kilometer
LCL	Lower confidence limit
m	Meter
m^2	Square meter
m^3/hr	Cubic meters per hour
m^3/min	Cubic meters per minute
m^3/yr	Cubic meters per year

List of Acronyms and Abbreviations (Continued)

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
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
QAP	*Quality Assurance Plan*
QC	Quality control
r^2	Coefficient of determination

List of Acronyms and Abbreviations (Continued)

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
°C	Degrees Celsius
°F	Degrees Fahrenheit
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) 412, Clean Slate I Plutonium Dispersion (TTR), identified in the *Federal Facility Agreement and Consent Order* (FFACO). CAU 412 is located on the Tonopah Test Range and consists of a single corrective action site (CAS), TA-23-01CS, Pu Contaminated Soil.

There is sufficient information and historical documentation from previous investigations and the 1997 interim corrective action to recommend closure of CAU 412 using the SAFER process. Based on existing data, the presumed corrective action for CAU 412 is clean closure. However, additional data will be obtained during a field investigation to document and verify the adequacy of existing information and determine whether the CAU 412 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 412 closure objectives have been achieved.

The following summarizes the SAFER activities that will support the closure of CAU 412:

- 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 no COCs are 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) 412, Clean Slate I Plutonium Dispersion (TTR). The Plan 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 1997 interim corrective action regarding the nature and extent of contamination to recommend closure of CAU 412 using the SAFER process. The presumed corrective action for CAU 412 is clean closure. This presumption is based on the following:

- Completion of the 1997 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 1997 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 2010 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 412 under the FFACO.

CAU 412 consists of one corrective action site (CAS), TA-23-01CS, Pu Contaminated Soil, which is located in the central portion of the Tonopah Test Range (TTR) in Nye County, Nevada (Figure 1-1). Because CAU 412 consists of a single CAS, the CAS nomenclature is generally not used in this SAFER Plan. Instead, the CAS is referred to as Clean Slate I (CSI) or CAU 412 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 phase 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 412 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 as appropriate.

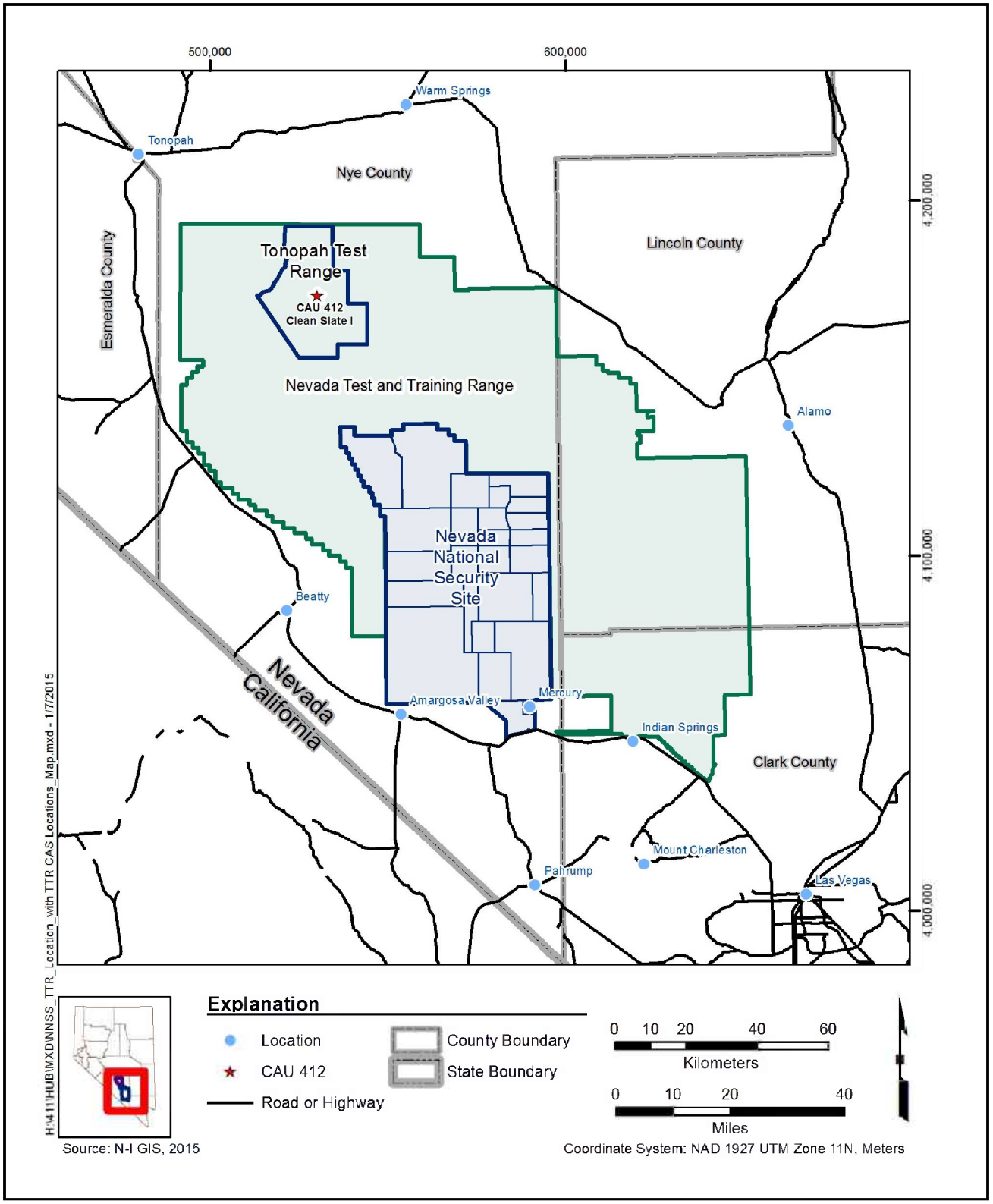

Figure 1-1
CAU 412 Location, TTR

1.2 Summary of Corrective Actions and Closures

The decision process for closure of CAU 412 is summarized in Figure 1-2. This process starts with the 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.

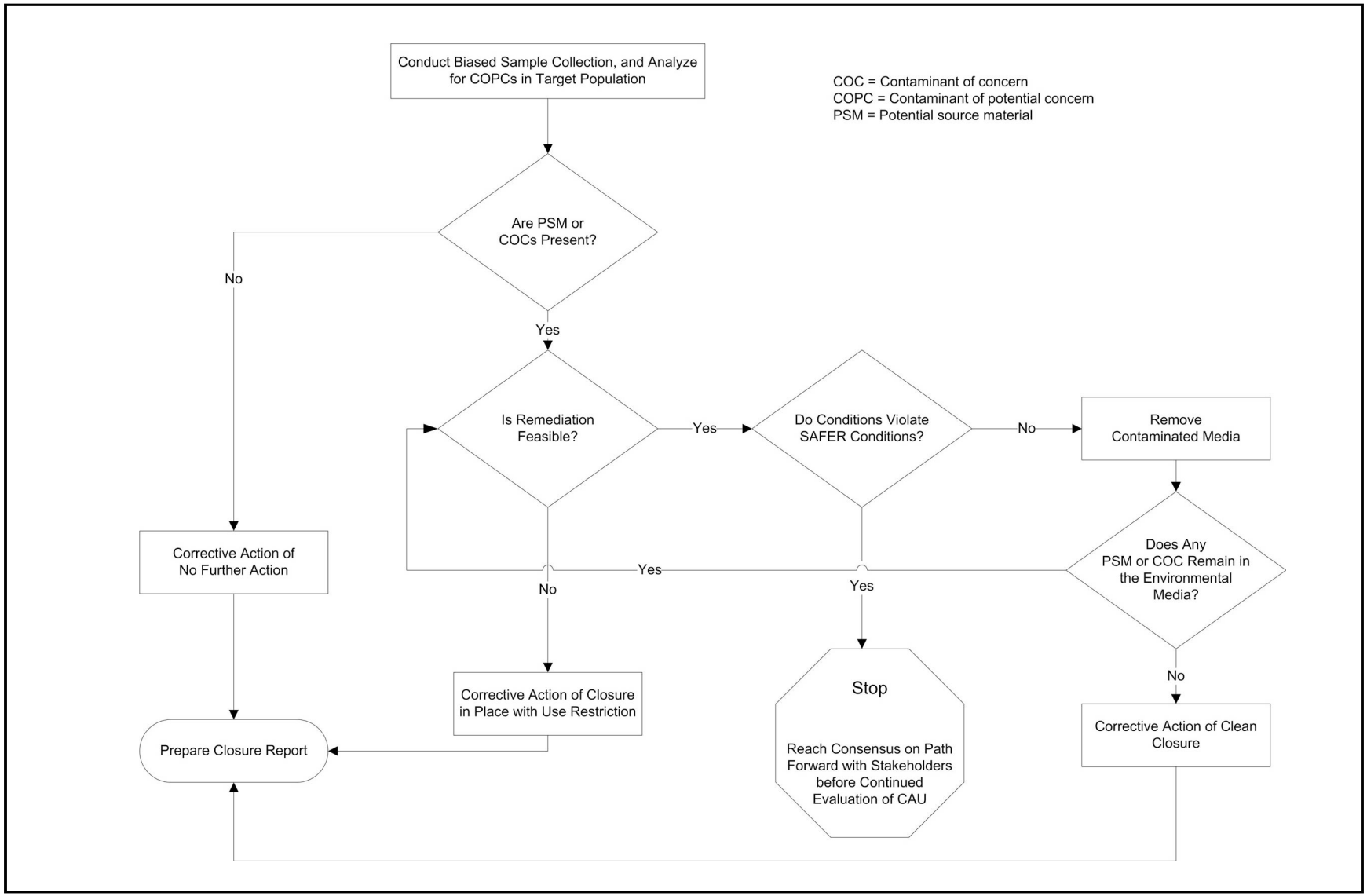

Figure 1-2
CAU 412 Closure Decision Process

2.0 Unit Description

CAU 412, Clean Slate I Plutonium Dispersion (TTR), consists of one CAS: TA-23-01CS, Pu Contaminated Soil. The CSI site is located on the TTR, approximately 210 kilometers (km) (130 miles [mi]) northwest of Las Vegas and approximately 64 km (40 mi) southeast of Tonopah, Nevada (Figure 1-1). The TTR is an active USAF range used for military training. The TTR is part of the Nevada Test and Training Range (NTTR) and is bordered on the north side by sparsely populated public land administered by the U.S. Bureau of Land Management and the U.S. Forest Service. The nearest community is Goldfield, Nevada, which is located approximately 42 km (26 mi) west of the TTR boundary.

The operational history, process knowledge, and release information for CAU 412 is summarized in this section. This information was obtained through review of historical documents, site photographs, aerial maps, and previous investigation results. Based on the 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 412 is provided in Section 3.2.5.

2.1 History and Process Knowledge

The CSI site consists of a release of radionuclides to the surrounding soil from a storage–transportation test conducted on May 25, 1963 (DOE/NV, 2000). The CSI test was the second of four storage–transportation tests that constituted Operation Roller Coaster; the other tests were Double Tracks, Clean Slate II, and Clean Slate III. The objective of the CSI test was to evaluate the dispersal of radionuclides in the environment. The test involved the detonation of a combination of high explosives, plutonium, and depleted uranium on a 24-by-24-foot (ft) reinforced concrete pad. No fission yield was detected from the test, and the total amount of plutonium deposited on the concrete slab and ground surface was estimated at 976 grams (Shreve, 1965). After the test, metal and concrete debris was scraped from the ground surface and mounded at GZ, and the immediate area surrounding GZ was fenced (DOE/NV, 1996). As a result of a 1973 FIDLER survey, an outer fence was constructed that encompassed approximately 57 acres, including the area previously fenced (DOE/NV, 1997b). This outer fence is still intact and posted with “Contamination Area” signs. In

1997, an interim corrective action was completed at the CSI 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. The soil and debris was disposed of as low-level radioactive waste at the NNSS (NNSA/NSO, 2003).

2.2 Available Characterization Information

The CSI 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 *Clean Slate Corrective Action Investigation Plan* (DOE/NV, 1996) and associated reference documents, and are not repeated herein.

With the signing of the FFACO in 1996, the CSI site became subject to the FFACO site closure process, additional investigation of the site began, and CAU 412 was created. A summary of FFACO investigation and interim corrective actions is presented in Table 2-1.

Table 2-1
Summary of CAU 412 Activities from 1996 to Present

Activities	Year	Work Completed	Data Use
Initial Site Characterization	1996	Ground-based radiological surveys, vertical soil profiling, soil sampling, soil treatability studies, geophysical surveys at GZ	Informational Data
Interim Corrective Action	1997	Soil and debris removal and offsite disposal, KIWI survey of excavated area	Decision-Supporting Data
Air Monitoring	1996–1998	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 investigation at the CSI site began in 1996 and included ground-based radiological surveys, vertical soil profiling to determine contamination depth, limited soil sampling, geophysical surveys to determine the location of buried debris, and soil treatability studies. The initial site investigation was conducted in three phases: *in situ* (i.e., in place) radiological surveys, soil sampling, and GZ characterization.The results of the three site characterization phases are found in the *Corrective Action Decision Document, Corrective Action Unit 412* (DOE/NV, 1997b).

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

In situ surveys. During initial characterization efforts, it was discovered that small, highly radioactive metal fragments, presumably parts of the CSI test device, were skewing the ground-based radiological survey results. In an effort to correct this, metal fragments were removed before further surveying. Hand-held and vehicle-mounted field instrument for the detection of low-energy radiation (FIDLER) instruments were used to locate the metal fragments and soil with elevated radiological readings. A KIWI survey was completed inside and just outside the CA fence to determine the horizontal extent of contamination. A mast-mounted high-purity germanium (HPGe) detector was also used to survey the outside perimeter of the CA fence. The HPGe system appeared to be the most accurate in measuring surface soil contamination, but it required long counting times and was not used extensively. Initial surveys provided data pertinent to the background and isotopic ratios, location of areas of elevated radioactivity, and the horizontal extent of radiological contamination. After the horizontal extent had been determined, *in situ* depth profile surveys were conducted inside the radiologically contaminated area identified by the previous surveys. The soil depth profiling identified contamination at 1 to 2 inches (in.) in the general plume area and up to 8 ft in the soil mound at GZ.

Soil sampling. Surface soil samples were collected during the first and second phases of the initial investigation. Site characterization soil sampling was limited to the collection of a total of 16 surface soil samples. No *Resource Conservation and Recovery Act* (RCRA)-regulated contaminants were identified in the samples, and thus no chemical parameters were identified as COCs for CAU 412.

Treatability testing concluded that volume reduction by grain-size separation was not feasible at the site. Other treatability results were inconsistent, so further study was abandoned.

GZ characterization. Geophysical surveys, shallow soil borings, and land surveys were completed in the area of GZ to determine whether the concrete pad and/or any debris remained. Magnetic and electromagnetic geophysical surveys located anomalies that were then investigated with ground-penetrating radar and shallow soil borings. The GZ characterization concluded that there was concrete debris inside the GZ burial mound, but no other burial areas were discovered.

2.2.2 Air Monitoring

Air quality and meteorological data were collected at the CSI site from 1996 to 1998. High-volume air samplers were placed at nine locations along the outside perimeter of the CA fence: seven locations to the east, one location to the southwest, and one location to the northwest. Particulate samples less than 10 micrometers (µm) (PM_{10}) were collected and analyzed for particle size and plutonium (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 data was reported in each of the *Nevada Test Site Annual Environmental Reports* for the years when monitoring occurred (Black and Townsend, 1997, 1998, and 1999). 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 their estimated inhalation doses are presented in Table 2-2.

The air monitoring data described in this subsection are presented as informational data, as defined in the Soils Activity 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 CSI site in 1997 in accordance with the *Clean Slate 1 Corrective Action Plan* (DOE/NV, 1997a). The corrective action involved the removal and offsite disposal of approximately 5,420 cubic yards of contaminated soil and debris

Table 2-2
Annual Average Radiological Concentration in Air and Estimated Inhalation Dose (1996–1998)

Year	Pu-238		Pu-239/240	
	µCi/mL[a]	mrem/yr[b]	µCi/mL[a]	mrem/yr[c]
1996	9.7E-19[d]	0.0	4.5E-16[d]	0.5
1997	2.2E-18	0.0	4.0E-16	0.4
1998	9.4E-19	0.0	1.9E-16	0.2

[a] The data in this column are from Black and Townsend (1997, 1998, 1999).
[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.

µCi/mL = Microcuries per milliliter

(NNSA/NSO, 2003). In addition to contaminated soil scraped from the ground surface, the debris that 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. Broken pieces of the concrete pad used as the platform for the test were found within the mounded area at GZ and were also removed. The soil and concrete was disposed of as low-level radioactive waste at the Nevada National Security Site (NNSS). The metal fragments 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.

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 picocuries per gram (pCi/g) total transuranic activity at the time. The KIWI system is a collection of six sodium iodide 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 (Black and Townsend, 1998). 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.

Further action at the CSI 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 sites, 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 412: Clean Slate I Plutonium Dispersion* was submitted to NDEP in 2003 with revised dose calculations, but the report was not approved, and future work at the CSI site was suspended (NNSA/NSO, 2003).

In 2006, an aerial survey of the CSI 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 Activity 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 CSI 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 center line of the detectable radiation plume identified outside the existing

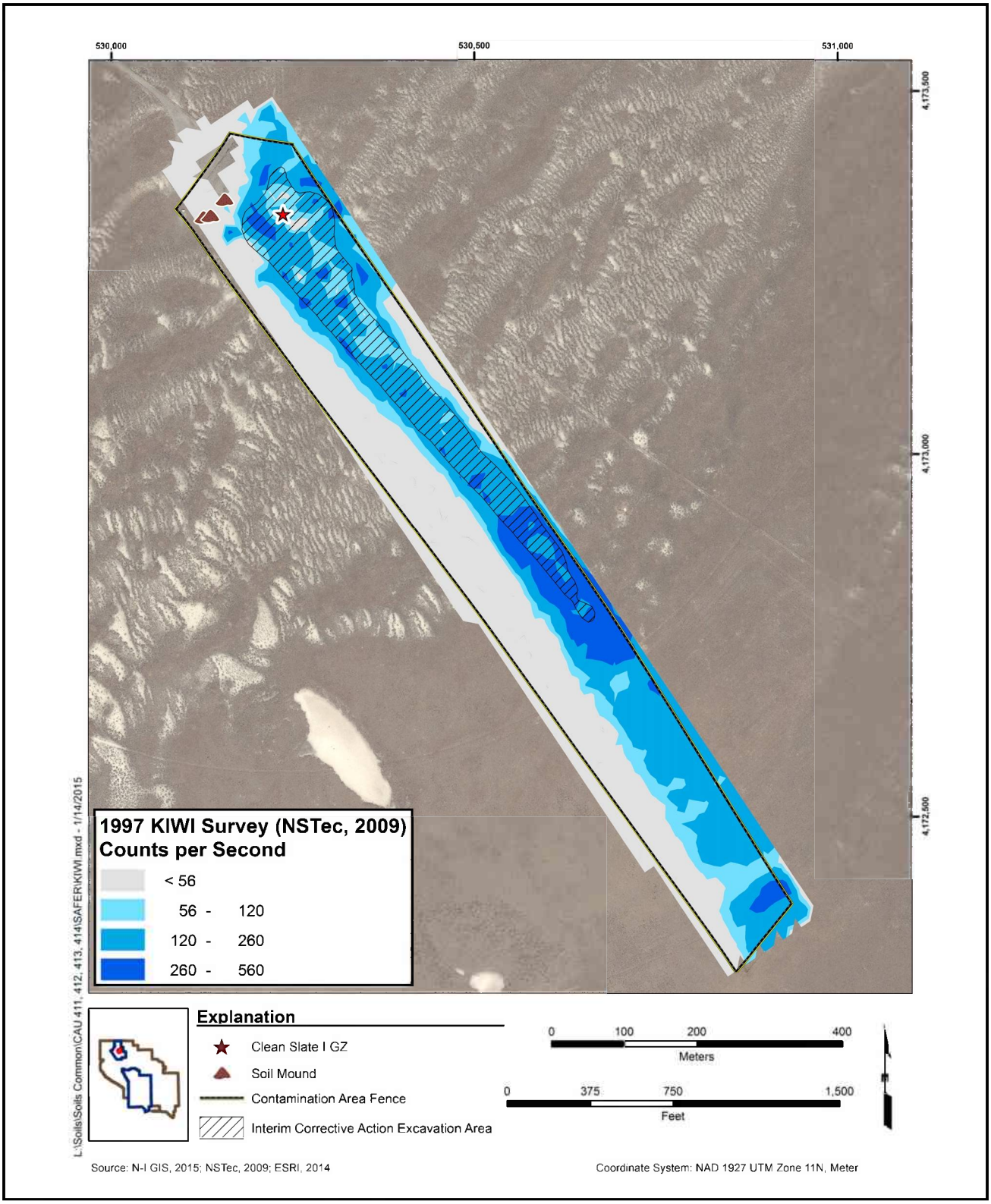

Figure 2-1
CAU 412 Post-Remediation KIWI Survey Results

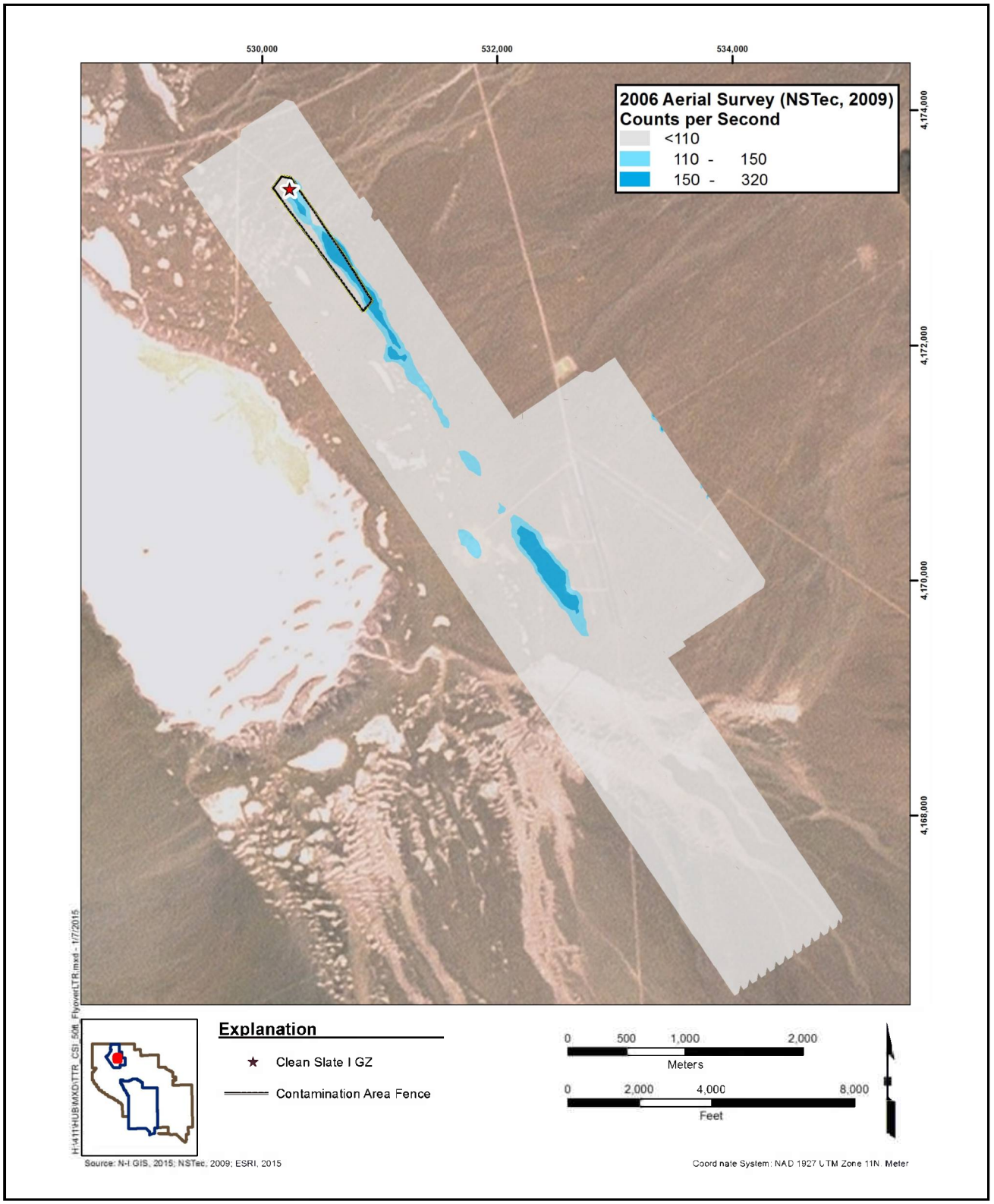

Figure 2-2
CAU 412 Aerial Radiological Survey Results

fence by the 2006 aerial radiation surveys at each site. Figure 2-3 presents the removable contamination survey locations at CAU 412. 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 CSI 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 412.

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 Activity 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 a the preliminary investigation, was completed at the CSI site. Preliminary investigation fieldwork included ground-based radiological surveys, visual surveys, and soil sampling. The radiological surveys included continuous scanning surveys using a FIDLER instrument 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 found in the *Preliminary Investigation Results and Recommendations for CAUs 411, 412, 413, and 414* report (N-I, 2013).

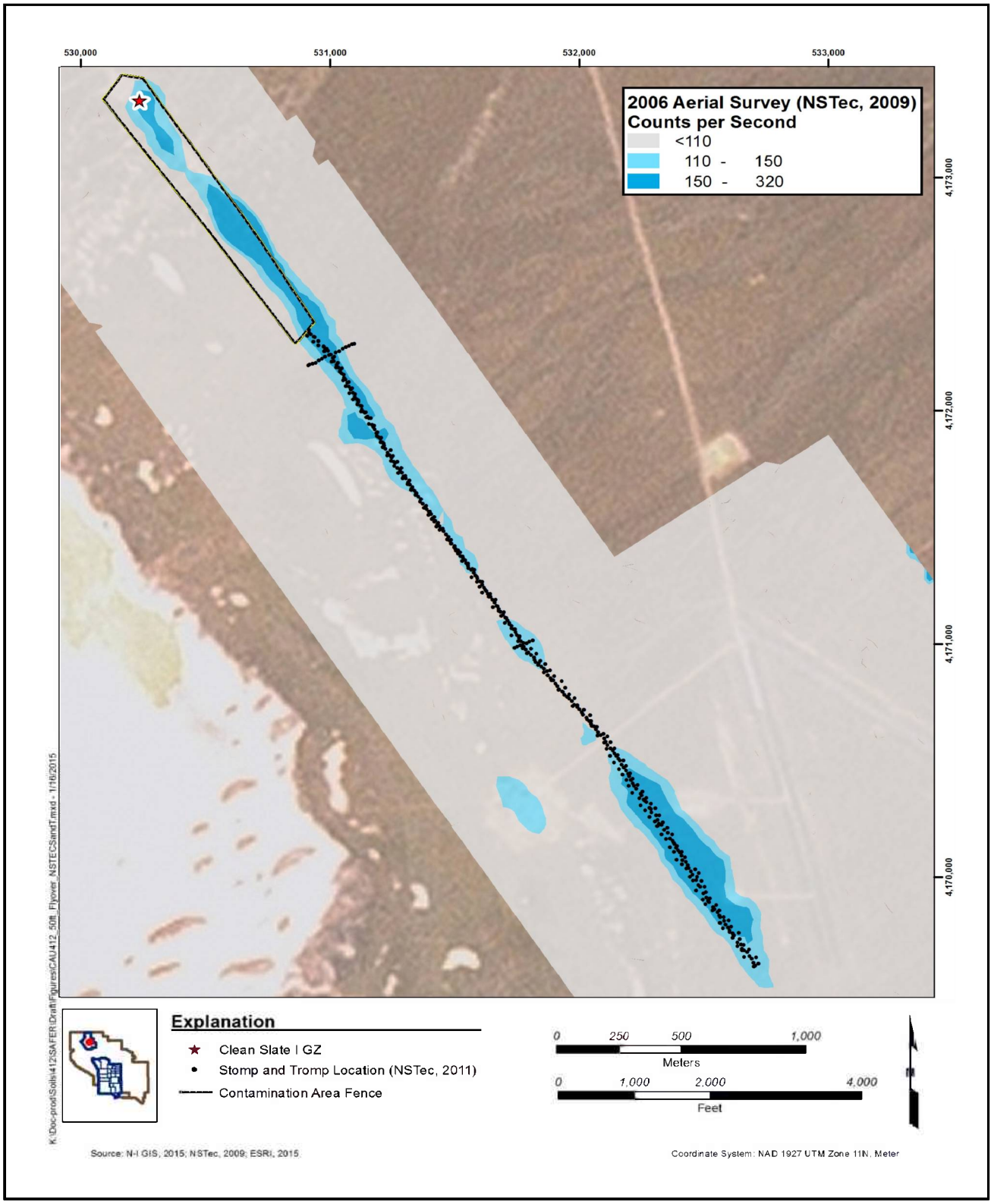

Figure 2-3
CAU 412 Removable Contamination Survey Locations

The data collected in the preliminary investigation described in this subsection are categorized as decisional data, as defined in the Soils Activity 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 412.

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 (NSTec, 2007). 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. Identification of unexploded ordnance (UXO) items at the CSI site was conducted concurrent with the FIDLER surveys. Four spent UXO items were identified and their locations were recorded.

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 removable contamination survey did not detect removable alpha contamination in excess of 20 dpm/100 cm^2 (the limit that requires posting as a CA).

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 identified physical features (e.g., soil mounds), UXO, PSM, and waste. The visual survey at CSI identified the following surface features:

- An active weather station located northeast of the CA fence
- A concrete loading dock with earthen ramp located northwest of the CA fence
- Discarded black hose material located inside the CA fence
- Four UXO items and several 0.50 caliber rounds
- Soil mounds located inside the CA fence

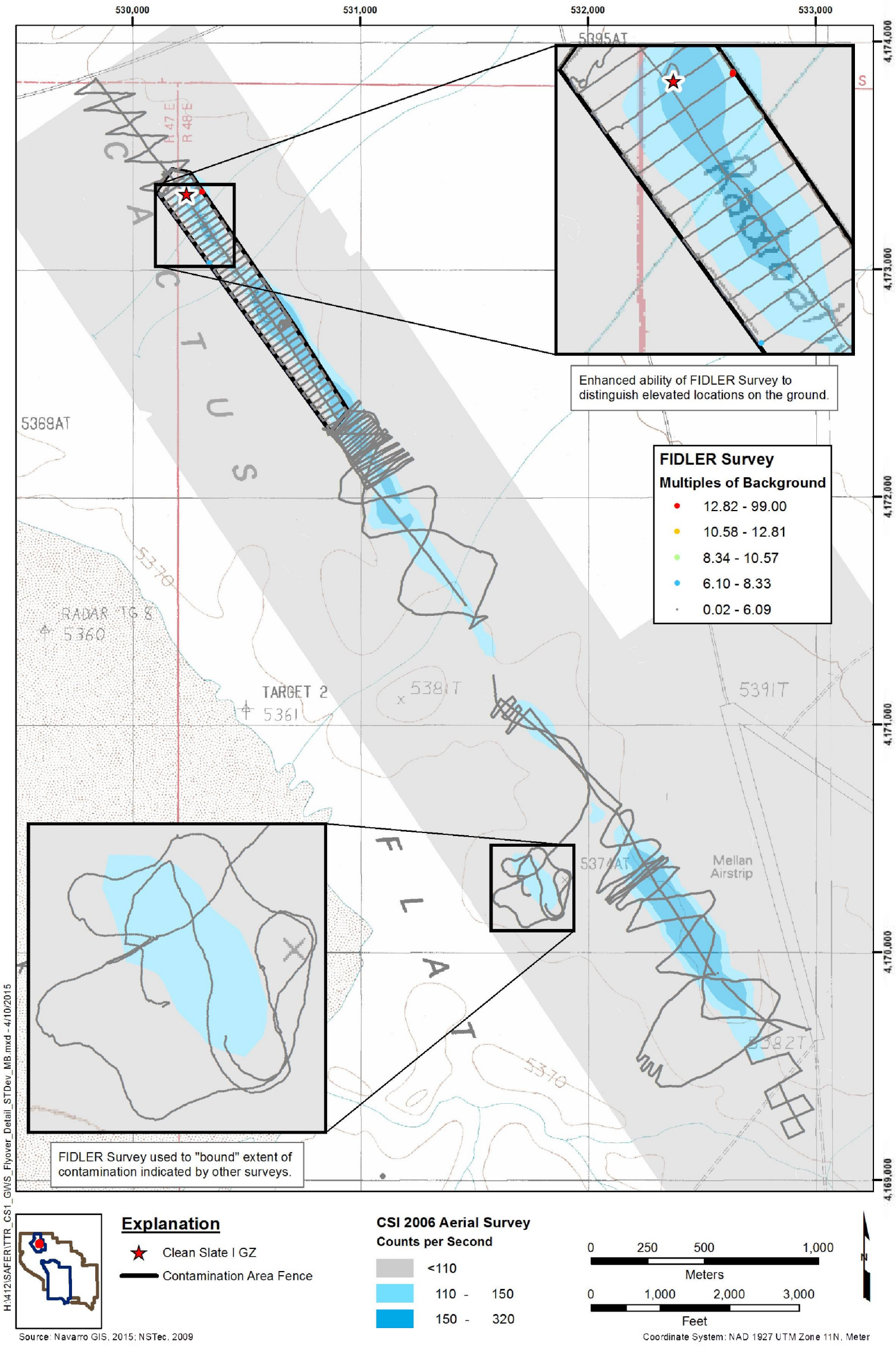

Figure 2-4
2012 FIDLER Survey Results

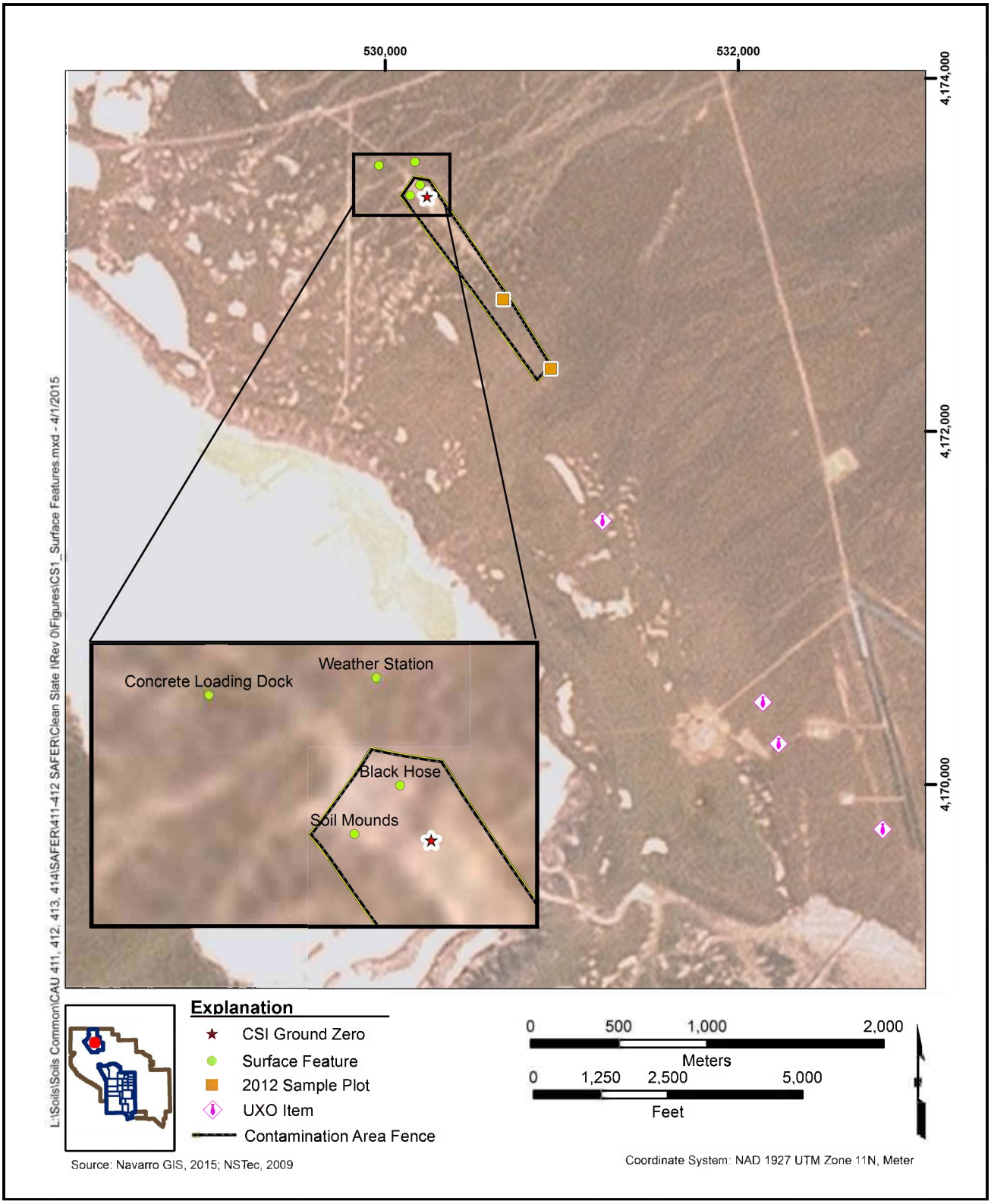

Figure 2-5
2012 Soil Sample Plot and Removable Contamination Survey Locations

The concrete loading dock is located on the northwest side of the CSI site outside the CA fence. The loading dock consists of a concrete pad with a sloped earthen ramp leading to the top of the concrete pad. The date of construction and original purpose of the loading dock are unknown.

Multiple joints of a black hose were identified during the visual walkover survey of the site. The hose is located inside the CA fence in the northwest quadrant of the site. The use and purpose of the hose is unknown.

The four UXO items identified during the preliminary investigation were determined inactive (i.e., not live) by UXO personnel and left undisturbed. At the time, it was not noted if the 0.50 caliber rounds were live or spent, but they too were left in place.

After the preliminary investigation, historical documentation pertaining to the soil mounds was located. The three existing mounds located within the CA fence (Figure 2-1) consist of topsoil scraped from planned equipment loading/unloading and staging areas before the interim corrective action. The soil was staged in an attempt to retain topsoil and seeds for future revegetation of the site after remediation. The soil mounds were discussed during the DQOs and are included in the sampling design for the CAI (see Section B.8.2.2).

2.2.5.4 Soil Sampling

Soil sampling was performed at two sample plot locations, one inside the CA fence and one outside the CA fence (Figure 2-5). A total of eight soil samples were collected and analyzed for gamma spectroscopy, isotopic Pu, isotopic americium (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 412.

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 the DQO Analysis

The DQO strategy for CAU 412 was developed at a meeting 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, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 412 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 412 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 412 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

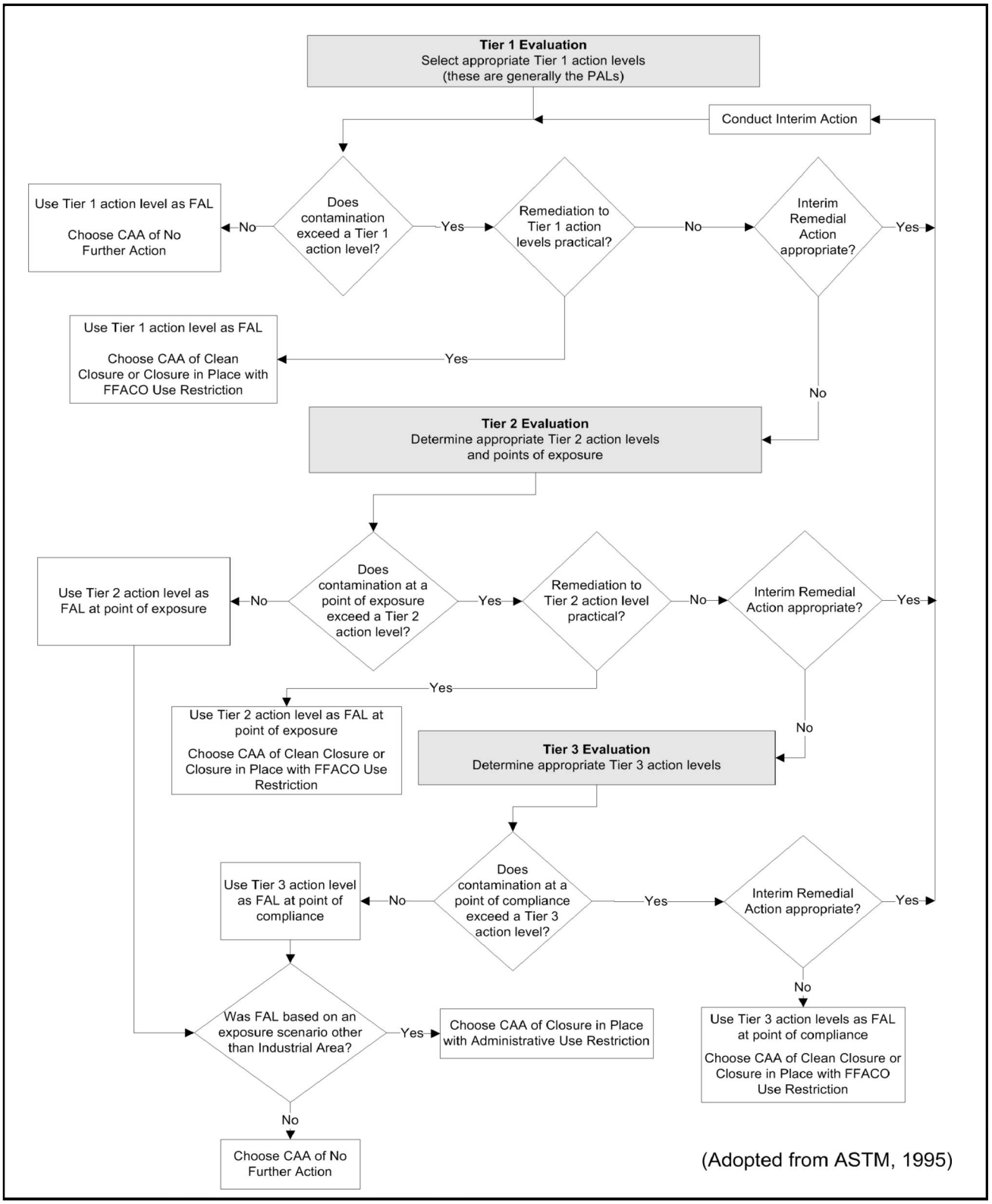

Figure 3-1
RBCA Decision Process

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 CSI site: (1) a radiological dose-based action level and (2) a removable contamination action level. The radiological dose PAL for the CSI site is a total effective dose (TED) of 25 millirem per year (mrem/yr), based upon the ground troops 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 412. This PAL is 2,000 dpm/100 cm^2 removable alpha contamination. Although the dose from onsite removable contamination is accounted for in the ground troops 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 CSI 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 412 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 412 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, participants in the DQO process will be notified and given the opportunity to comment on and/or concur with the recommendation. A detailed discussion of the CSM is presented in Appendix B.

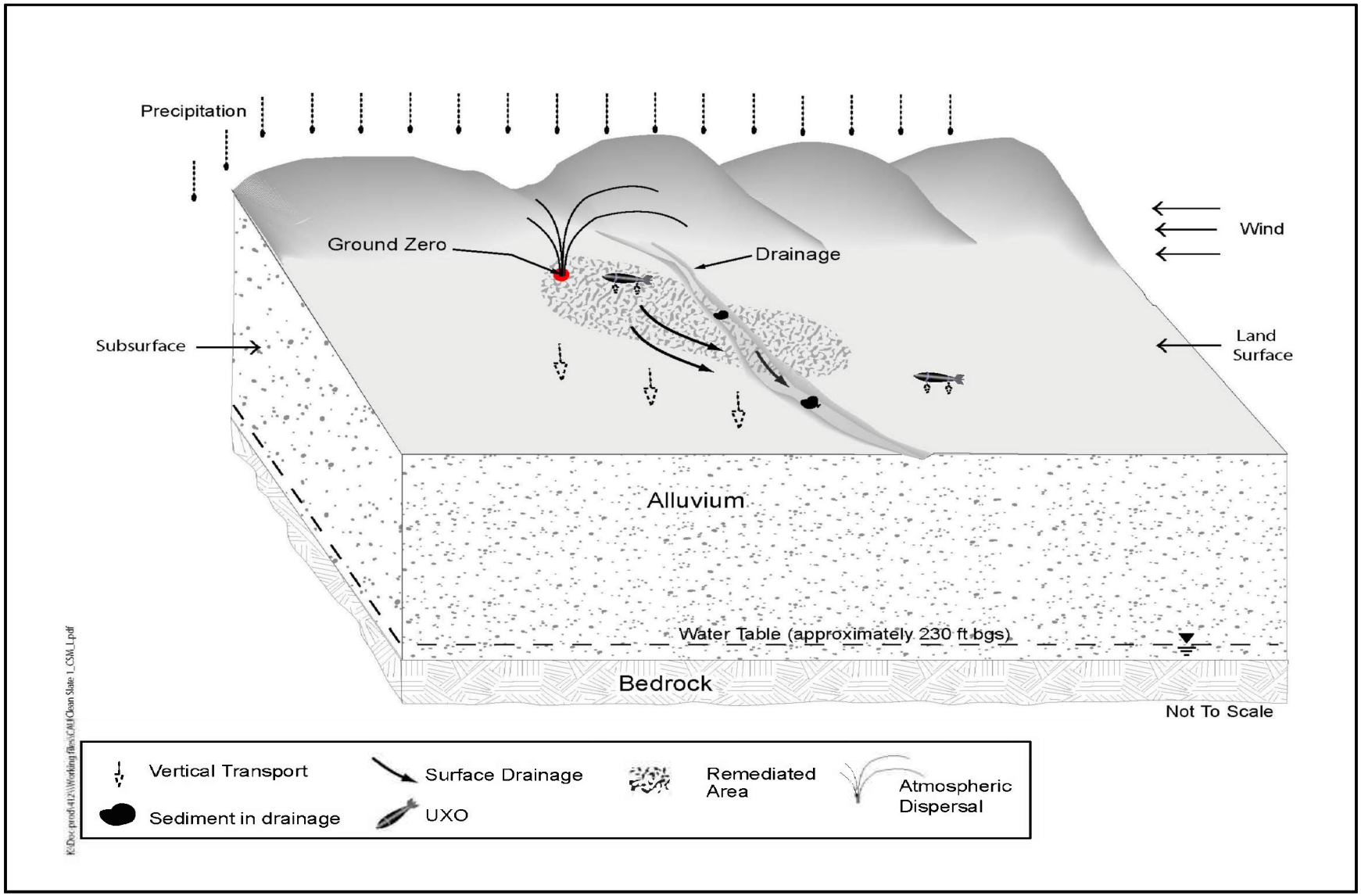

Figure 3-2
CSM for CAU 412

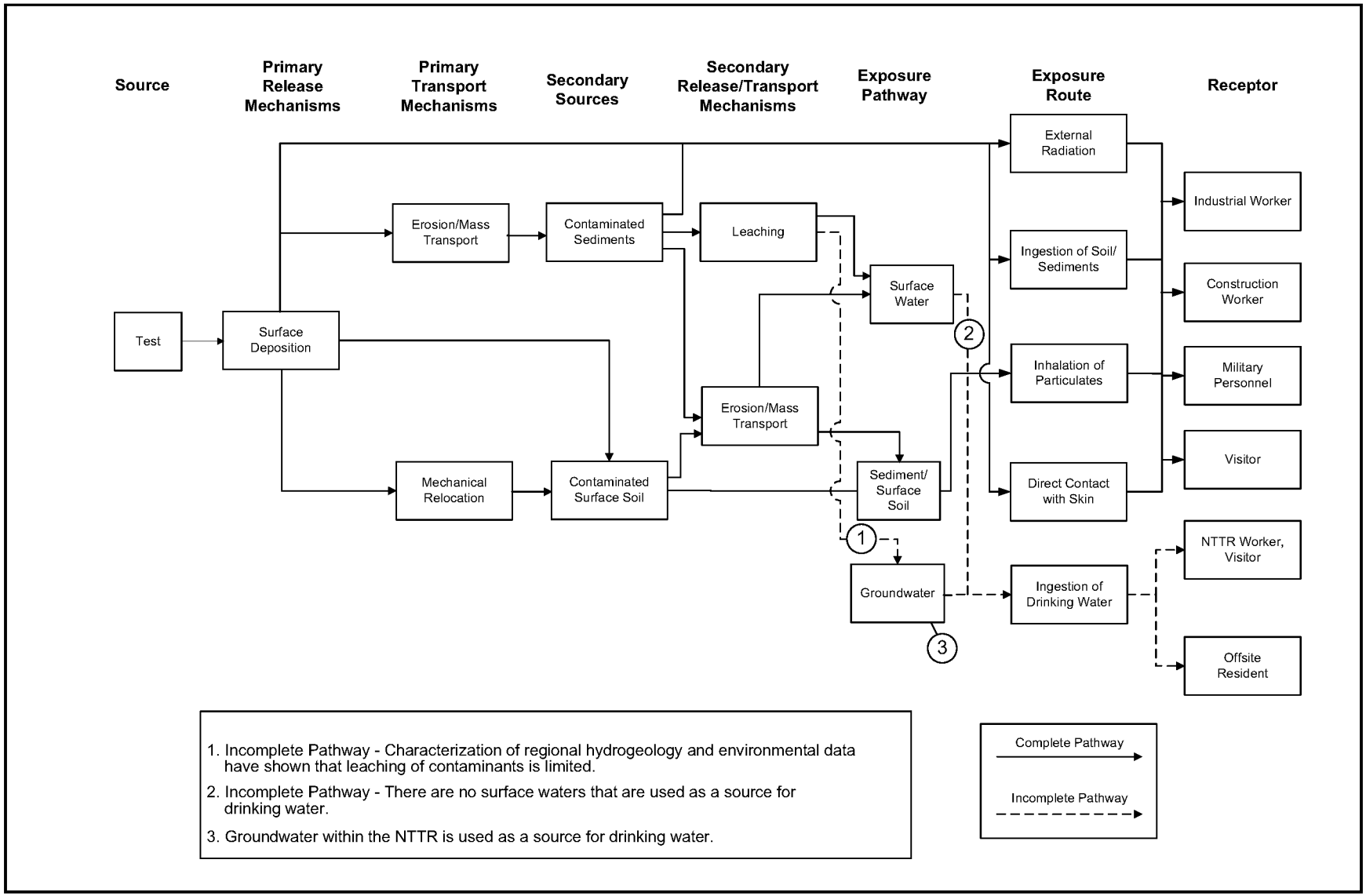

Figure 3-3
CSM Flowchart for CAU 412

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 412. A CAI is planned to determine whether there are COCs present at the CSI 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 412 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 412 based on the history of the CSI 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 CSI site in 1997, 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 412 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 ground troops 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 412 closure objectives have been achieved and clean closure is the most appropriate corrective action for the CSI site will be generated through the collection and analyses of soil samples and TLDs, collection of removable contamination swipe samples, and completion of ground-based 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 NDEP will be notified.

4.3.1 Selection of Sample Locations

A biased sampling strategy will be used for Decision I samples to target areas with the highest potential for radiological contamination. Composite soil samples will be collected within sample plots and at each of the three soil mounds.

Sample plot locations were selected based on an evaluation of aerial and ground-based radiological survey data collected after completion of the interim corrective action at the site. These surveys include a 2006 aerial survey and a 1997 ground-based KIWI survey. These radiological survey data (aerial and KIWI) were modeled to produce average values over each 1,000-square meter (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, a total of five sample plots will be established at the CSI site. Three sample plots will be located inside the CA fence at the three most elevated areas identified by the 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 and TLD samples will be collected from soil sample plots and the three soil mounds. TLDs will also be placed at background locations in the vicinity of CAU 412 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 412 release.

TLD 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.

4.3.2.1 Soil Sample Plots

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 412 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.

Two TLDs will be placed at the center of each sample plot, one at a height of approximately 1 meter (m) (3.3 ft) and the other at a height of approximately 0.3 m (1 ft). Placement of a TLD at the 1-m height is standard practice in the NNSS environmental monitoring program and is based on DOE guidance (BN, 2003). As discussed in Section D.2.5.2, the ground troops exposure scenario includes an 8-hours-per-day (hr/day) resting period, which could include sleeping or sitting at or near the ground surface. Placement of a TLD at a height of 0.3 m (1 ft) is intended to measure external radiation to a prone individual who may spend a portion of his or her day closer to the radiological contamination on the ground surface. The highest measurements from the two TLDs at each sample plot will be used to calculate dose for CAU 412.

4.3.2.2 Soil Mounds

There are three soil mounds within the CA fence at the CSI site near GZ. One composite soil sample, composed of six random subsamples, will be collected from the surface of each soil mound. These soil samples will be submitted to the laboratory for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241 analyses. One TLD will be placed at the center of each mound at an approximate height of 1 m (3.3 ft) and will be processed in the same manner as the TLDs placed at the sample plots.

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 CSI 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 three 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 Data Evaluation and Closure Verification

The dataset to be evaluated in verifying CSI 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 conform to the requirements for decisional data as stipulated in the Soils Activity QAP (NNSA/NFO, 2012c). As evidenced in Figure B.8-1, the two most elevated locations detected in the KIWI and aerial surveys were sampled during the 2012

preliminary investigation at the CSI site. These soil sample results will be combined with data from the CAI to evaluate the presence of COCs at the CSI site.

For soil and TLD samples, the TED will be calculated using the RRMG-calculated internal dose estimates from the soil samples and the three 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 that contaminant being designated as a COC at CAU 412.

- 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 present, 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 removable contamination 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 412 are as follows:

- Radiological contamination at the site is less than the FAL using the ground troops 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 to concentrations below 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 412 if the above closure objectives have been achieved.

4.4.1 Changes in Land Use

The closure of CAU 412 under the FFACO means that the selected corrective action has been accepted and approved by NDEP and other stakeholders. The closure of CAU 412 under this SAFER Plan is based on the ground troops 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 412 would have to be reevaluated to account for the new land use and/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 412, or that there is a proposed transfer/relinquishment of all or part of the NTTR that will impact CAU 412, 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 412, 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 412 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, field-screening results (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 412 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 UXO, small metal fragments, and discarded hoses. 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 412 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 412. All characterization activities, including those related to TLD measurements, will be conducted in accordance with the Soils Activity 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 Activity QAP (NNSA/NFO, 2012c), data used for making DQO decisions will be evaluated for data quality. The Soils Activity 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 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 Activity 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).

8.0 References

ASTM, see ASTM International.

ASTM International. 1995 (reapproved 2010). *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, ASTM E1739 - 95(2010)e1. West Conshohocken, PA.

BN, see Bechtel Nevada.

Bechtel Nevada. 2003. *Nevada Test Site Routine Radiological Environmental Monitoring Plan*, DOE/NV/11718--804. Prepared for the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. Las Vegas, NV.

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.

Black, S.C, and Y.E. Townsend ed. 1998. *Nevada Test Site Annual Site Environmental Report for Calendar Year 1997*, DOE/NV/11718-231. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV: Bechtel Nevada.

Black, S.C, and Y.E. Townsend ed. 1999. *Nevada Test Site Annual Site Environmental Report for Calendar Year 1998*, DOE/NV/11718-361. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV: Bechtel Nevada.

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 2015. Title 10 CFR, Part 835, "Occupational Radiation Protection." Washington, DC: U.S. Government Printing Office.

DOE/NV, see U.S. Department of Energy, Nevada Operations Office.

EPA, see U.S. Environmental Protection Agency.

ESRI, see ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, and IGP.

ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, and IGP. 2015. ArcGIS Online website. As accessed at http://www.arcgis.com/home/gallery.html on 6 January.

FFACO, see *Federal Facility Agreement and Consent Order*.

Federal Facility Agreement and Consent Order. 1996 (as amended March 2010). Agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management. Appendix VI, which contains the Soils Sites Strategy, was last modified June 2014, Revision No. 5.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC) titled "Background Concentrations for NTS and TTR Soil Samples," 3 February. Las Vegas, NV: IT Corporation.

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

N-I, see Navarro-Intera, LLC.

N-I GIS, see Navarro-Intera Geographic Information Systems.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

NNSA/NSO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

NSTec, see National Security Technologies, LLC.

National Security Technologies, LLC. 2007. Written communication. Subject: *Aerial Flyover Surveys at the Tonopah Test Range Soils Sites 2006*. Las Vegas, NV.

National Security Technologies, LLC. 2009. GIS Data Transmittal to U.S. Air Force, Product ID 20091029-01-P012-R04, 15 December. Las Vegas, NV.

National Security Technologies, LLC. 2011. *Nevada Test and Training Range Results of the 10 CFR 835 Posting Compliance Field Investigation, Clean Slates I, II, and III and Double Tracks, Tonopah Test Range, Nevada*. April. Las Vegas, NV.

Navarro-Intera Geographic Information Systems. 2015. ESRI ArcGIS Software.

Navarro-Intera, LLC. 2013. *Preliminary Investigation Results and Recommendations for CAUs 411, 412, 413, and 414, Nevada Test and Training Range and Tonopah Test Range, Nevada*, Rev. 0. N-I/28091--052. Las Vegas, NV.

Nevada Administrative Code. 2014a. NAC 445A.227, "Contamination of Soil: Order by Director for Corrective Action; Factors To Be Considered in Determining Whether Corrective Action Required." Carson City, NV. As accessed at http://www.leg.state.nv.us/nac on 9 January 2015.

Nevada Administrative Code. 2014b. NAC 445A.22705, "Contamination of Soil: Evaluation of Site by Owner or Operator; Review of Evaluation by Division." Carson City, NV. As accessed at http://www.leg.state.nv.us/nac on 9 January 2015.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open-File Report 98-1. Reno, NV.

Shreve, J.D., Jr. Sandia Corporation. 1965. *Operation Roller Coaster, Scientific Director's Summary Report,* DASA-l644. Albuquerque, NM.

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-Rev. 1. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003. *Closure Report for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion*, Rev.0, DOE/NV--881. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2012a. *Nevada National Security Site Radiological Control Manual*, DOE/NV/25946--801, Rev. 2. Prepared by Radiological Control Managers' Council. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2012b. *Nevada National Security Site Waste Acceptance Criteria*, DOE/NV-325-Rev. 9. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2012c. *Soils Activity Quality Assurance Plan*, Rev. 0, DOE/NV--1478. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996. *Clean Slate Corrective Action Investigation Plan,* Rev. 0, DOE/NV--456. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997a. *Clean Slate 1 Corrective Action Plan,* Rev. 0, DOE/NV--11718-100. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997b. *Corrective Action Decision Document, Corrective Action Unit No. 412*, Rev. 1, DOE/NV--472. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000. *United States Nuclear Tests, July 1945 through September 1992,* DOE/NV--209-REV 15. Las Vegas, NV.

U.S. Environmental Protection Agency. 2015. *SW-846 On-Line, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* As accessed at http://www.epa.gov/epawaste/hazard/testmethods/sw846 on 9 January.

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 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 412 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 412 CAI will be 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 412 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 any 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 each site and defines the assumptions that are the bases 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 412 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 a 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, 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 412 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 1997 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 412 are as follows:

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

Table B.2-1
CSM Description of Elements for CAU 412

CAS Identifier	TA-23-01CS
CAS Description	Pu Contaminated Soil
Site Status	Inactive, abandoned
Exposure Scenario	Ground Troops
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 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, and military personnel conducting training exercises. 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.

cm = Centimeter

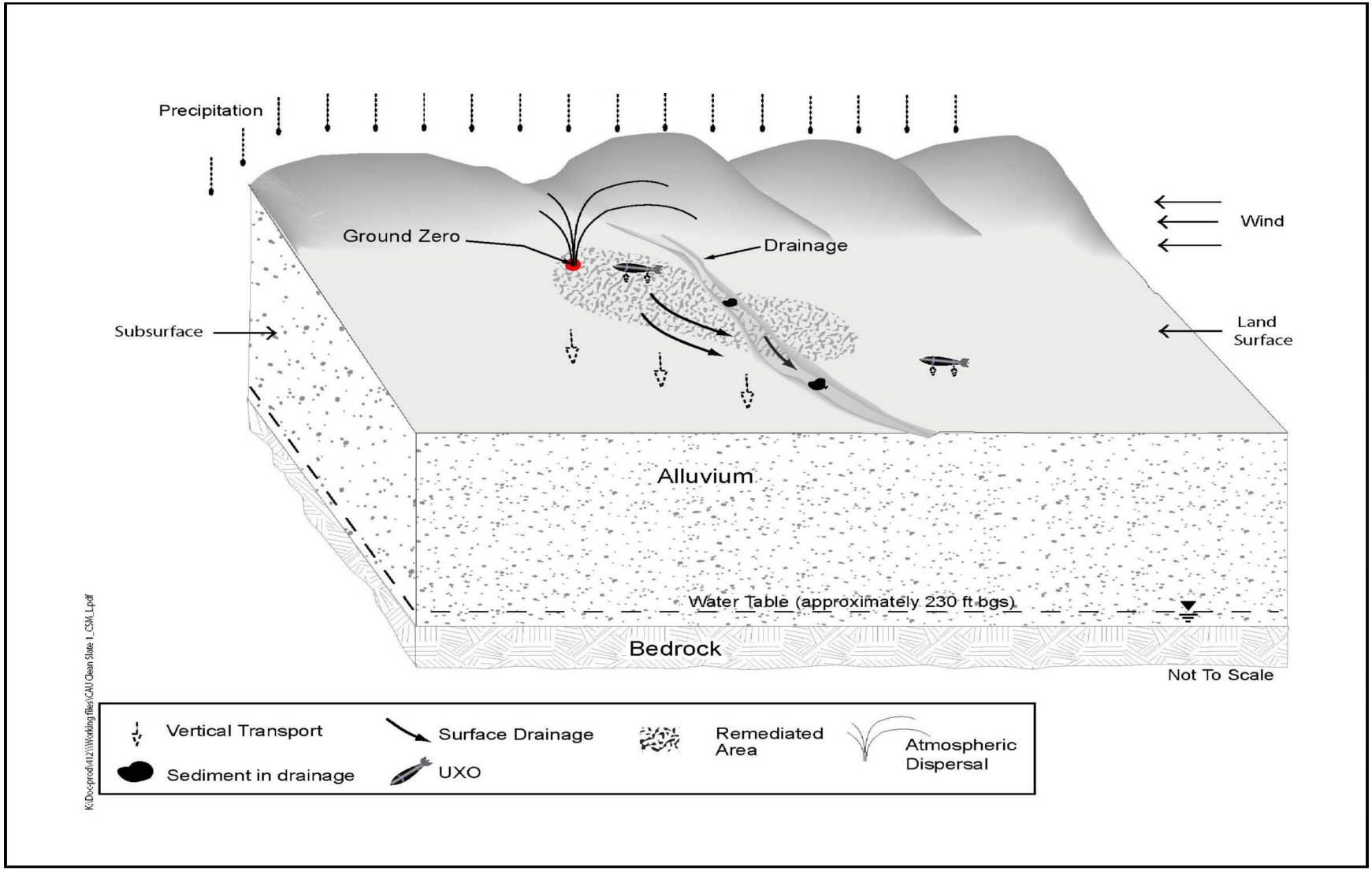

Figure B.2-1
CSM for CAU 412

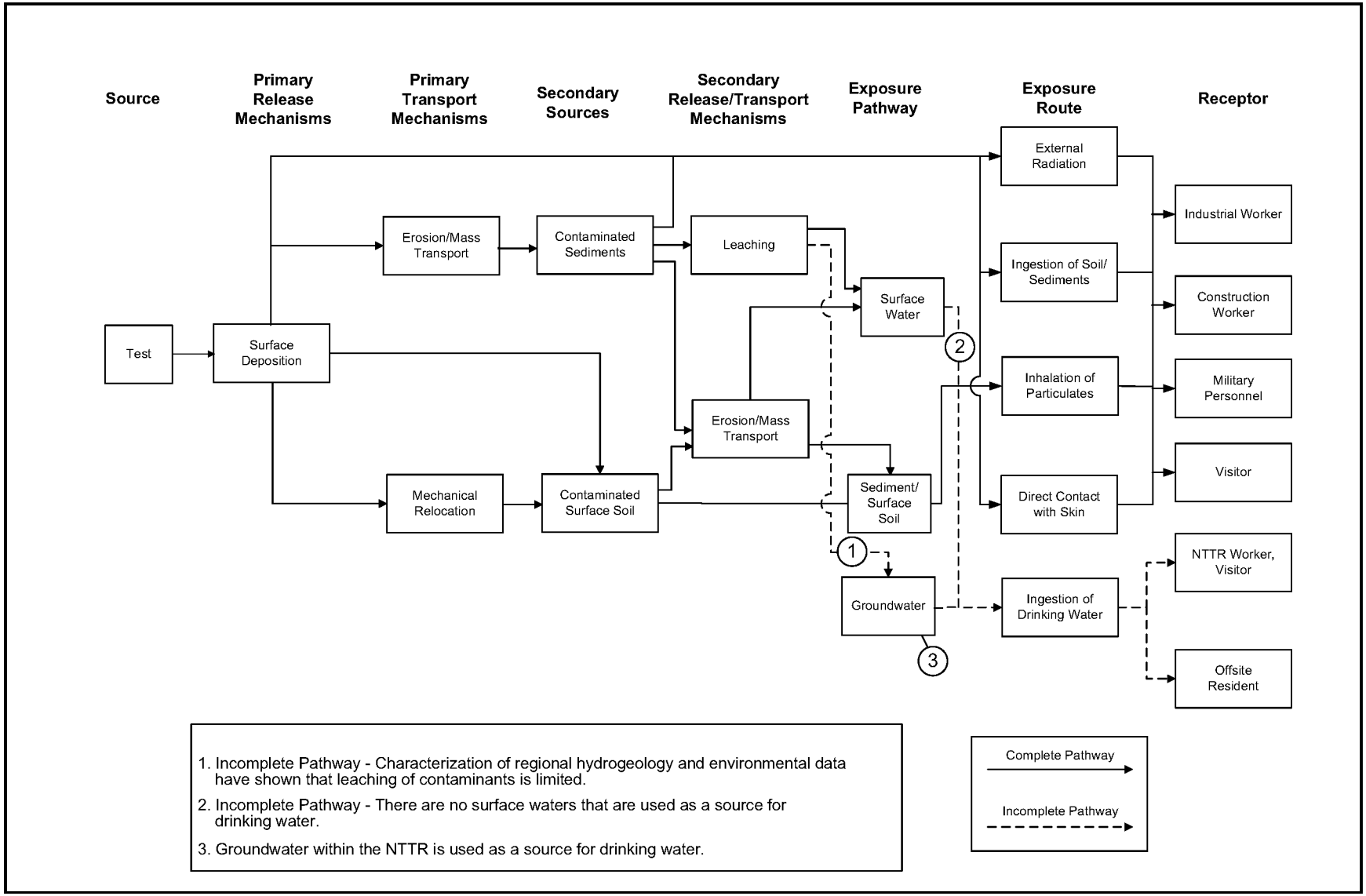

Figure B.2-2
CSM Flowchart for CAU 412

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

Soil samples collected at CAU 412 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 CSI 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 CSI 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 toxicity characteristic leaching procedure (TCLP). These samples were collected from the top 5 cm of surface soil at locations within the CA fence and were collocated with radiological samples. The CSI site metal

results were typical of desert soil developed from siliceous and intermediate volcanic parent material (DOE/NV, 1996). The results of the TCLP tests indicated leachable RCRA metals at concentrations well below the regulatory criteria. Thus, no chemical COPCs are identified for CAU 412.

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 CSI test (i.e., uranium and plutonium) have a very high melting point and are generally found near GZ.

Based on the conclusions of a travel time analysis conducted for the CSI site, the radionuclide contaminants at CAU 412 are moderately to highly adsorbed on the valley-fill alluvial materials present at the site (N-I, 2013b). 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 CSI 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 42,200 years (N-I, 2013b).

B.2.2.4 Site Characteristics

The CSI site is located within the high desert region of south-central Nevada in a broad valley known as Cactus Flat with an approximate elevation of 1,620 m (5,300 ft) above mean sea level. Annual precipitation at the TTR is 13 to 15 cm (5 to 6 in.) in Cactus Flat (French, 1985). Average temperatures for the warmest and coldest hours in January from the TTR weather station are 7 degrees Celsius (°C) (44 degrees Fahrenheit [°F]) and -8 °C (18 °F), respectively. Corresponding temperatures in July are 32 °C (90 °F) and 14 °C (58 °F) (Schaeffer, 1968). The depth to groundwater in the vicinity of Cactus Flat varies from ground surface at springs located in the Cactus and Kawich mountains bordering Cactus Flats, to more than 120 m (393 ft) on the valley floor (Ekren et al., 1971). The average depth to groundwater estimated from the three closest well to the CSI site is 70.2 m (230 ft) below ground surface (bgs) (N-I, 2013b).

No permanent surface water streams or lakes are present at the CSI site. Several dry lake beds (playas) exist at the TTR, most notably Main and Antelope Lakes on Cactus Flat. The playas retain surface water after heavy rains but are normally dry again within a few days due to evaporation. Numerous stream channels that remain dry most of the year and only discharge water after rain are present on Cactus Flat. No drainage channels or systems were identified at the CSI site during previous investigations.

Additional information on the environmental setting of the CSI site may be found in the *Clean Slate Corrective Action Investigation Plan* (DOE/NV, 1996).

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. No drainage systems or channels were identified at the CSI site during the most recent investigation in 2012. Therefore, the lateral migration of potential contaminants from surface water flow during storm events does not appear to be a potential transport mechanism at CSI.

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 CSI 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 412 before, during, and after the interim corrective action in 1997. Section discusses the results of the air monitoring. Based on the 1997 data, the calculated inhalation dose to a receptor was 0.4 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 CSI site in 1997, the year when the interim corrective actions took place (Black and Townsend, 1998; NNSA/NSO, 2003).

The CSM assumes there is little to no potential that earthmoving activities during the 1997 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, 1997a; 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, 1997a; 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 412 site was selected as the ground troops exposure scenario (USAF, 2014). This scenario assumes 100 percent outdoor activities that may include performing light, moderate, and hard physical labor and periods at rest. This scenario assumes that the troops bivouac at the CAU 412 site. The maximum amount of time an individual ground troop could be deployed during any single mission or operation is 14 days, 24 hr/day, and will participate in 3 such deployments a year. This results in a total of 1,008 hr/yr of potential exposure. Additional details on the exposure scenario for CAU 412 are 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 as follows:

- "Does any location exceed the FALs?"

Two FALs will be established for the CSI 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 as follows:

- "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 CSI 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.

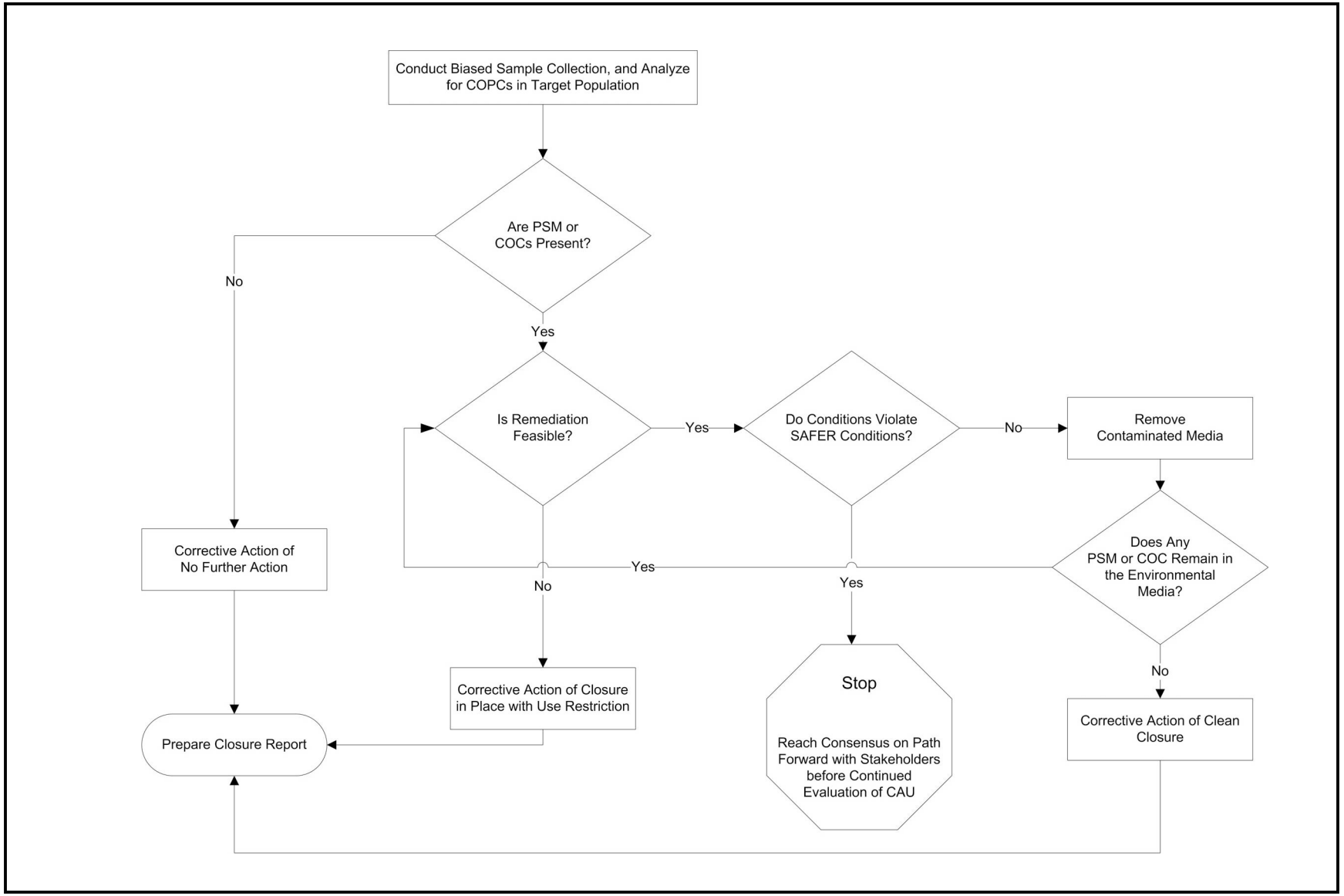

Figure B.3-1
SAFER Closure Decision Process for CAU 412

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 COPCs 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 CSI 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:

- *Clean Slate Corrective Action Investigation Plan* (DOE/NV, 1996)
- *Corrective Action Decision Document, Corrective Action Unit No. 412* (DOE/NV, 1997c)
- *Clean Slate 1 Corrective Action Plan* (DOE/NV, 1997a)
- *Closure Report for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion* (NNSA/NSO, 2003)
- 1997 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, 2013a)

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 1997 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 objectives have been achieved at the CSI 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 412 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 are 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 412, 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 1996 investigation at the CSI site and the 1997 interim removal action. Site characterization at CSI suggested that radiological contamination in the general plume area (i.e., outside of the GZ burial area) was present within the top 5 cm (2 in.) of the soil profile (DOE/NV, 1997a). The interim corrective action removed buried contamination at GZ and soil at depths from 1.5 to 3 in. in the general plume area within the CA fence (DOE/NV, 1997b). Post-remediation radiological surveys indicate that residual contamination remaining in the excavation areas may be found up to 1 in. bgs (NNSA/NSO, 2003). Therefore, the vertical extent of expected contamination at the CSI site is anticipated to be no greater than 5 cm (2 in.) at any location at the site.

The lateral boundary of the CSM is based on the extent of detectable activity measured by the 2006 aerial radiological survey of the CSI site (NSTec, 2007). The CSI 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 3.0 mi long by 0.2 mi wide south of GZ (Figure 2-2).

Contamination found beyond the vertical and lateral boundaries may indicate a flaw in the CSM and may require reevaluation of the CSM before Decision I sampling could continue.

B.5.3 Practical Constraints

No practical constraints that would prevent completion of CAI activities were identified at the CSI site. However, activities or site conditions that may delay investigation at the site include military activities at the TTR; 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 CAU 412 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 CSI site. One is a risk-based 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 CSI site is a TED of 25 mrem/yr, based upon the ground troops exposure scenario. The ground troops exposure 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 from TLD measurements. 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 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). 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 ground troops exposure scenario are presented in Appendix D. The calculated RRMGs for the ground troops 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 CSI 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 CSI 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 CSI site would require corrective action under the FFACO and 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 CSI 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:

- Developing and achieving concurrence of the CSM by stakeholder participants 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 CSI 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 CSI 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 CSI 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 constituent 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 for the CSI 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

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 CSI 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 1997 ground-based survey and a 2006 aerial survey. The 1997 survey was conducted after the interim corrective action at the CSI 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 area and a significant portion of land southeast of the fence (i.e., downwind of CSI GZ).

As explained in Section 6.2 of the Soils RBCA document (NNSA/NFO, 2014), the radiological survey data (aerial and KIWI) were averaged over every 1,000-m^2 area of the site. This provides data at the resolution equivalent to a minimal exposure area for the most exposed individual. These data were then used to identify areas to perform intensive ground surveys to bias 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 five sample plots will be established at the CSI site. Three sample plots will be located inside the CA fence at the three most elevated areas identified by the 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.

As evidenced in Figure B.8-1, the two most elevated locations detected in the KIWI and aerial surveys were sampled during the 2012 preliminary investigation at the CSI site. These soil sample results will be combined with data from the CAI to evaluate the presence of COCs at the CSI 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. Composite soil samples will be collected within each sample plot using a probabilistic sampling approach, and grab samples will be collected at each soil mound at the site. One TLD will be placed in the center of each sample plot and each soil mound.

B.8.2.1 Soil Sample Plots

The probabilistic sampling scheme will be implemented to select sample locations within the sample plots. Randomly selected subsample locations will be based on a random start, triangular pattern. If sufficient sample material cannot be collected at a specified location, 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.

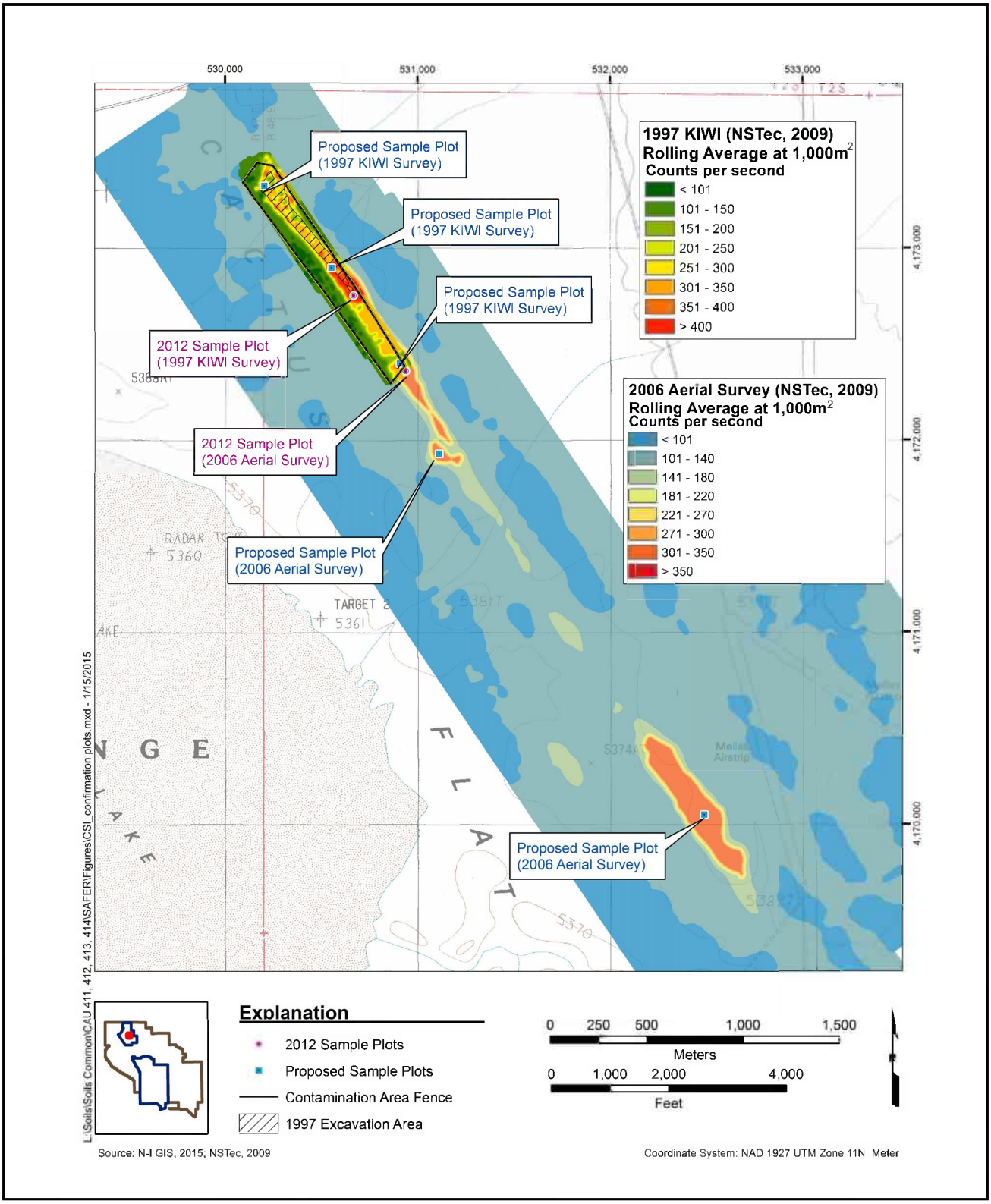

Figure B.8-1
Proposed Sample Locations at CAU 412

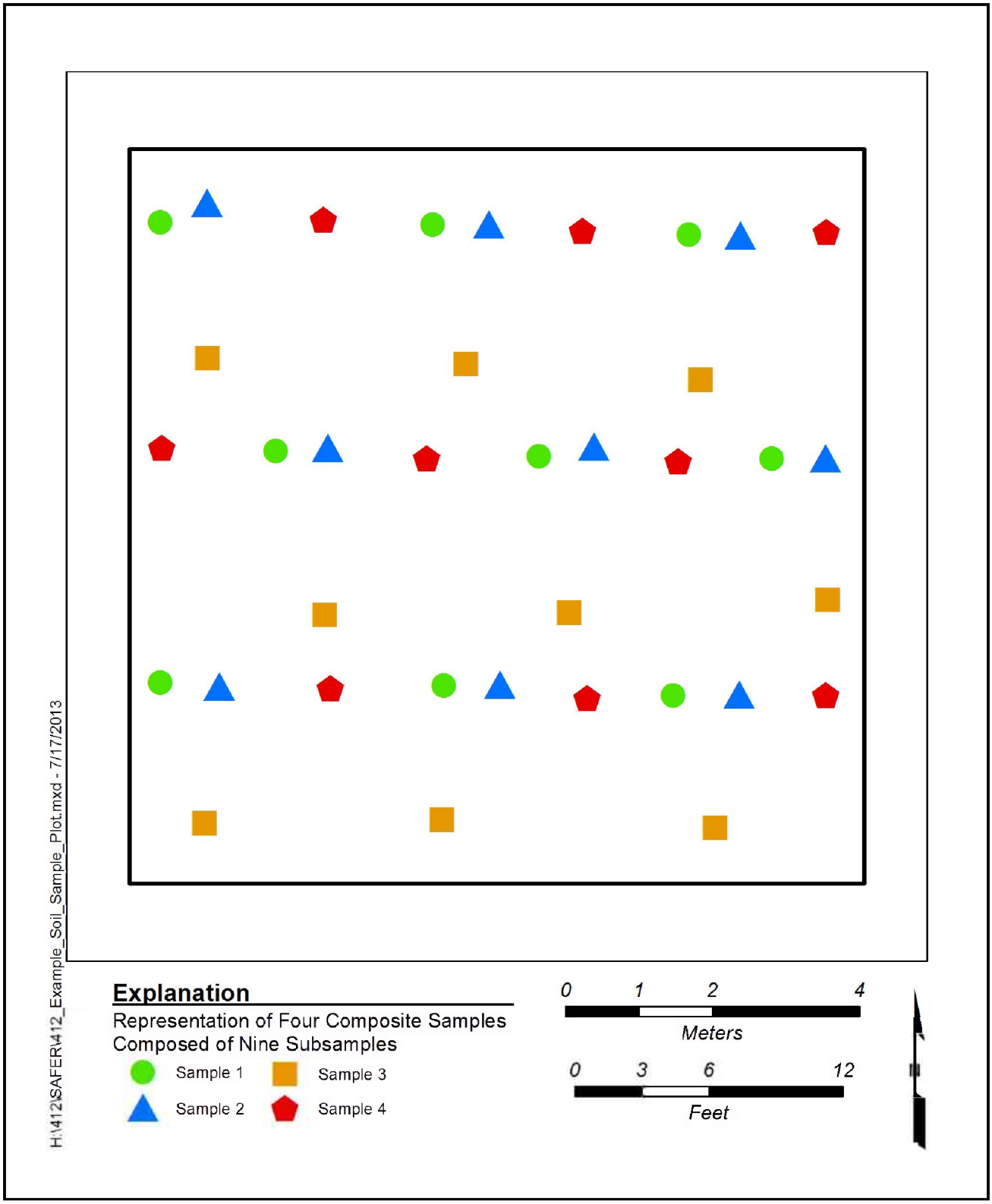

Figure B.8-2
Sample Plot Subsample Locations

Soil samples 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 Soil Mounds

There are three soil mounds within the CA fence at the CSI site near GZ (Figures B.8-3 and B.8-4). Historical documentation identifies the vicinity of the existing soil mounds as a stockpile area for topsoil to be used in revegetation of the site following interim corrective actions (DOE/NV, 1997b). The topsoil was salvaged to retain the pool of seeds from native plants found in the surface soil and was removed from planned equipment loading/unloading and staging areas before the start of remediation work. If radioactive contamination is present in the mounds, it is expected to be at concentrations consistent with the surface soil at the site; otherwise, it is expected that the mounded soil would have been removed as part of the interim corrective action. For the purposes of the CSM, it is assumed that the soil within each mound is homogenous. Six random subsamples will be collected from the surface (0 to 5 cm [0 to 2 in.]) of each mound and composited. The surface composite soil sample will be analyzed for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241.One composite soil sample from the interior of each mound will also be collected to confirm the homogeneity of the mounds. For each mound, this sample will be collected at the same six random subsample locations at which the surface composite sample was collected, but at a depth of 15 to 30 cm (6 to 12 in.) below the surface of the mound. These interior soil samples will be analyzed for the same parameters as the surface composite soil samples.

B.8.2.3 TLD Samples

Two TLDs will be placed at the center of each sample plot, one at a height of approximately 1 m (3.3 ft) and the other at a height of approximately 0.3 m (1 ft). Placement of a TLD at the 1-m height is standard practice in the NNSS and TTR environmental monitoring programs and is based on DOE guidance (BN, 2003). Placement of a TLD at a height of 0.3 m is intended to measure external radiation to a prone individual who may spend a portion of their day closer to the radiological contamination on the ground surface. As discussed in Section D.2.5.2, the ground troops exposure scenario includes an 8-hr/day resting period, which could involve sleeping at or near the ground surface. In addition, one TLD will be placed at the center of each soil mound at a height of

Figure B.8-3
Two Small Soil Mounds at CSI

approximately 1 m (3.3 ft). TLDs will also be placed at background locations in the vicinity of CAU 412 to measure natural sources of 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 412 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.

Figure B.8-4
Large Soil Mound at CSI

B.8.2.4 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.8.2.5 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 was 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 412 CR. If the criteria established in this section result in a determination that the minimum sample size was not met, additional samples may be collected. If these criteria cannot be met, justifications for use of the resulting TED without meeting the criteria will be made in the CR.

B.8.3 Removable Contamination

Removable contamination data will be collected during the CAI from random locations at the three soil sample plots located inside the CA fence and on the surface of the three soil mounds. 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 412 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.9.0 References

BN, see Bechtel Nevada.

Bechtel Nevada. 2003. *Nevada Test Site Routine Radiological Environmental Monitoring Plan*, DOE/NV/11718--804. Prepared for the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. Las Vegas, NV.

Black, S.C, and Y.E. Townsend ed. 1998. *Nevada Test Site Annual Site Environmental Report for Calendar Year 1997*, DOE/NV/11718-231. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV: Bechtel Nevada.

DOE, see U.S. Department of Energy.

DOE/NV, see U.S. Department of Energy, Nevada Operations Office.

EPA, see U.S. Environmental Protection Agency.

Ekren, E.B., R.E. Anderson, C.L. Rogers, and D.C. Noble. 1971. *Geology of Northern Nellis Air Force Base Bombing and Gunnery Range, Nye County, Nevada*, Professional Paper 651. Washington, DC: U.S. Geological Survey.

French, R.H. 1985. *Daily, Seasonal, and Annual Precipitation at the Nevada Test Site, Nevada* (Preliminary), DOE/NV/10384--01; Publication No. 45042. Las Vegas, NV: Desert Research Institute.

N-I, see Navarro-Intera, LLC.

N-I GIS, see Navarro-Intera Geographic Information Systems.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

NNSA/NSO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

NSTec, see National Security Technologies, LLC.

National Security Technologies, LLC. 2007. Written communication. Subject: *Aerial Flyover Surveys at the Tonopah Test Range Soils Sites 2006*. Las Vegas, NV.

National Security Technologies, LLC. 2009. GIS Data Transmittal to U.S. Air Force, Product ID 20091029-01-P012-R04, 15 December. Las Vegas, NV.

National Security Technologies, LLC. 2011. *Nevada Test and Training Range Results of the 10 CFR 835 Posting Compliance Field Investigation, Clean Slates I, II, and III and Double Tracks, Tonopah Test Range, Nevada*. April. Las Vegas, NV.

Navarro-Intera Geographic Information Systems. 2015. ESRI ArcGIS Software.

Navarro-Intera, LLC. 2013a. *Preliminary Investigation Results and Recommendations for CAUs 411, 412, 413, and 414, Nevada Test and Training Range and Tonopah Test Range, Nevada*, Rev. 0. N-I/28091--052. Las Vegas, NV.

Navarro-Intera, LLC. 2013b. *Water and Solute Travel Time Analysis for Soils Corrective Action Units 375, 411, 412, 413, 414, and 415,* N-I/28091--076. Las Vegas, NV.

Schaeffer, J.R. 1968. *Climatology of Tonopah Test Range, 1967*, SC-M-68-522. Albuquerque, NM: Sandia Corporation.

USAF, see U.S. Air Force, 99 ABW/CC.

U.S. Air Force, 99 ABW/CC. 2014. Letter to R. Boehlecke (NNSA/NFO) titled "Air Force Response to DOE Request to Close Five Radiological Sites on the NTTR" 2 May. Nellis AFB, NV.

U.S. Department of Energy. 1997. *The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300. 28th Edition, Vol. I. February. New York, NY.

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-Rev. 1. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003. *Closure Report for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion*, Rev. 0, DOE/NV--881. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2012. *Soils Activity Quality Assurance Plan*, Rev. 0, DOE/NV--1478. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996. *Clean Slate Corrective Action Investigation Plan,* Rev. 0, DOE/NV--456. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997a. *Clean Slate 1 Corrective Action Plan*, Rev. 0, DOE/NV--11718-100. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997b. *Clean Slate 1 Revegetation and Monitoring Plan*, Rev. 0. DOE/NV--11718-062. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997c. *Corrective Action Decision Document, Corrective Action Unit No. 412*, Rev. 1, DOE/NV--472. Las Vegas, NV.

U.S. Environmental Protection Agency. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001. Washington, DC: Office of Environmental Information.

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 C

Dose Calculation Methodology

C.1.0 Dose Calculation Methodology

Radiological dose at CAU 412 will be calculated using the ground troops 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 ground troops exposure scenario was determined applicable to the CAU 412 site (USAF, 2014). The most exposed individual in this scenario is defined as an adult member of the military, who spends 100 percent of his or her time outdoors engaged in activities that may include light, moderate and hard physical labor and periods at rest. This scenario assumes that the troop bivouacs at the CAU 412 site. The maximum amount of time an individual ground troop could be deployed during any single mission or operation is 14 days, 24 hr/day, and will participate in 3 such deployments a year. This results in a total of 1,008 hr/yr of potential exposure.

Using the ground troops exposure scenario assumptions, RRMGs specific to CAU 412 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 412 stakeholders, the impact a wound may have on total dose to a receptor at the CSI 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 (Double Tracks) 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 embedded 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 is included in Appendix G.

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 412. 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:

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

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:

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

The soil sampling design for the CAU 412 CAI includes emplacement of TLDs at two different heights at each soil sample plot: one at a height of approximately 1 m (3.3 ft) and the other at a height of approximately 0.3 m (1 ft). Therefore, external dose at these locations will be calculated using TLD data. An external dose will be calculated for each of the two TLDs at each sample plot. External dose is determined using the readings from TLD elements 2, 3, and 4. Each of the elements is considered a separate, independent sample. A 95 percent UCL of the average of these samples will be calculated as the external dose. The highest calculated external dose of the two TLDs at each sample plot location will be used in the estimation of TED for that sample location (Section 4.3.2).

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 (background TLDs) are placed in adjacent areas with similar characteristics that are not affected by the release. 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. 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.

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., 2012 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 412 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

BN, see Bechtel Nevada.

Bechtel Nevada. 2003. *Nevada Test Site Routine Radiological Environmental Monitoring Plan*, DOE/NV/11718--804. Prepared for the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. Las Vegas, NV.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

USAF, see U.S. Air Force, 99 ABW/CC.

U.S. Air Force, 99 ABW/CC. 2014. Letter to R.Boehlecke (NNSA/NFO) titled "Air Force Response to DOE Request to Close Five Radiological Sites on the NTTR," 2 May. Nellis AFB, NV.

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-Rev. 1. Las Vegas, NV.

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 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 ground troops exposure scenario. The parameter values that are different than the default values are highlighted.

Table D.1-1
RESRAD Input Parameters for Ground Troops 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	8,800	m^3/yr
Mass loading for inhalation	0.0001	0.0000272	g/m^3
Exposure duration	30	25	years
Indoor dust filtration factor	0.4	1	None
External gamma shielding factor	0.7	1	None

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

Parameter	Default	Site-Specific Value	Units
Indoor time fraction	0.5	0	None
Outdoor time fraction	0.25	0.115	None
Soil ingestion	36.5	36.5	g/yr
Depth of soil mixing layer	0.15	0.05	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 412 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.

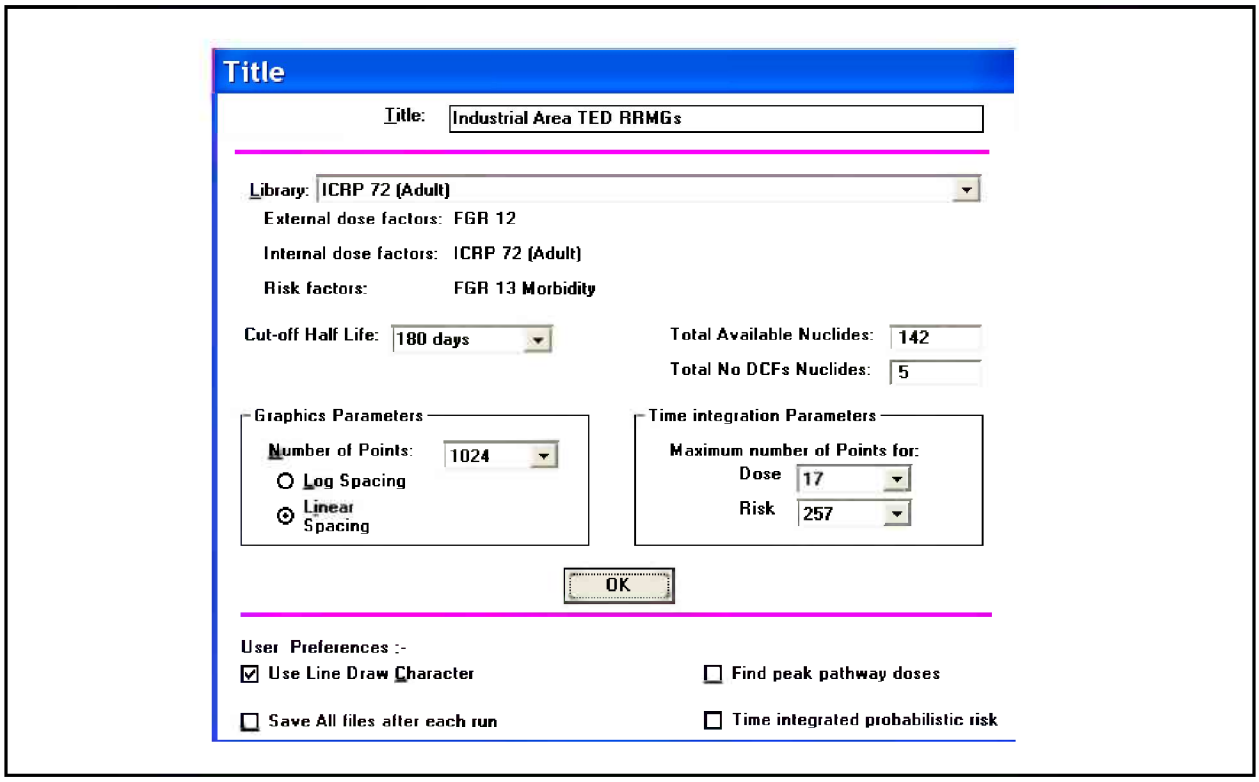

Figure D.2-1
RESRAD Title Screen

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

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.

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.

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

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 ground troops 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.

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. The sources for each parameter are presented at the end of each subsection.

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.

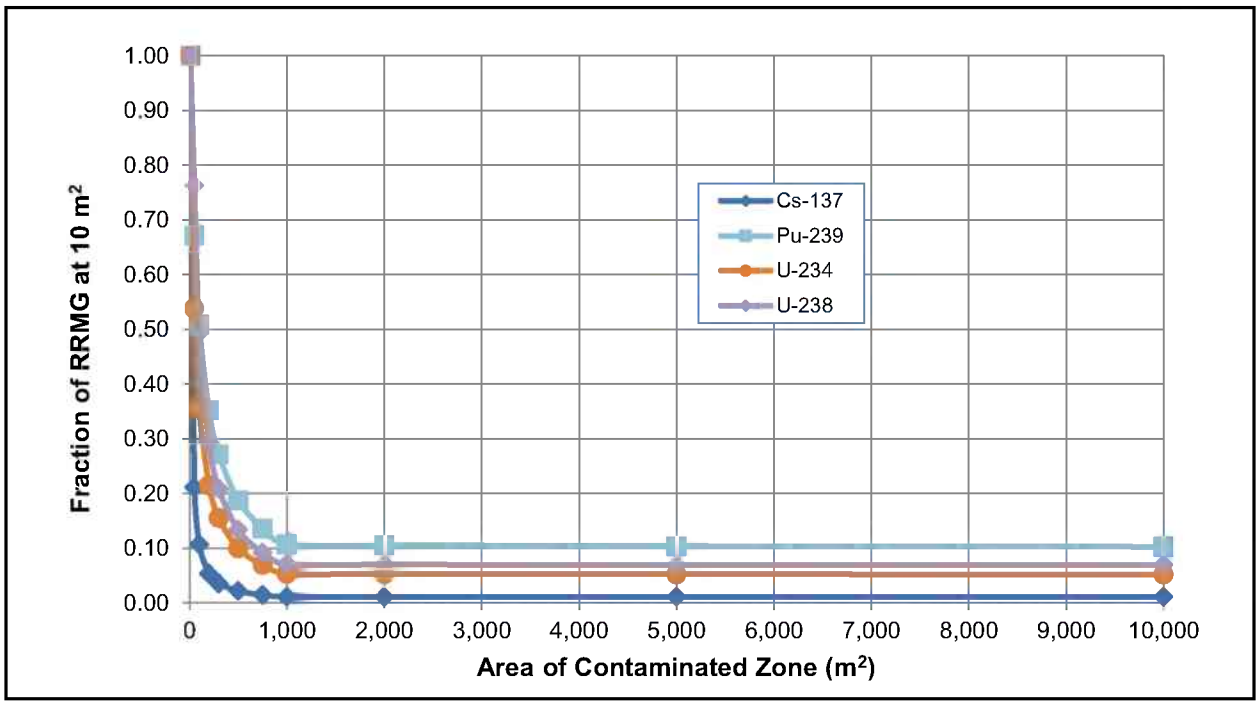

Figure D.2-2
Effect of Area of Contaminated Zone on RRMG Values

D.2.2.2 Recommended Value

At CAU 412, 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 412, 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 412.

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 412, 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 412 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 412 indicated that the radioactive contamination deposited by the CSI experiment was located in the top 3 to 5 cm of soil. Concentrating contamination in the top 5 cm and setting the erosion rate to zero 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 412.

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 CSI 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 412 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 exposure 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 ground troops exposure scenario is listed in Table D.2-3. It is assumed that all activities under the ground troops exposure scenario will be conducted outdoors. The inhalation rate was projected over 24 hr/day and 365 days per year, resulting in the recommended annual inhalation rate of 8,800 m^3/yr for ground troop activities.

Table D.2-3
Ground Troops Inhalation Rate Calculation

Activity	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^3/24 hr)	Annual Rate (m^3/yr)
Resting	8	4.58E-03	2.75E-01	2.20E+00	--
Light Work	8	1.25E-02	7.50E-01	6.00E+00	--
Moderate Physical Labor	6	2.75E-02	1.65E+00	9.90E+00	--
Hard Physical Labor	2	5.10E-02	3.06E+00	6.12E+00	--
Total	24	--	--	24.22	8.8E+03

[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

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 value for mass loading of contaminated respirable dust particles outdoors is presented in Table D.2-4. The mass loading values for resting and light work is from the annual average mass loading measurements in data from the TTR (Shinn, 1994). This study measured resuspension at the Clean Slate III site at TTR from October 1990 through August 1991. The mass loading for moderate physical labor was assumed to be twice that for resting and light work. The mass loading for hard physical labor was assumed to be 10 times higher than that for light work and resting. The recommended value for the mass loading parameter for use in the CAU 412 model is 0.0000272 g/m^3.

Table D.2-4
Ground Troops Exposure Scenario Mass Loading

Activity Level	Average time Spent per Day at This Activity Level (hr/day)	Mass Loading Outdoors of Respirable Particles Associated with Contaminated Surface Soils during this Activity Level (g/m^3)	Mass Loading for This Activity (g/m^3)	Mass Loading Weighted Average (g/m^3)
Resting	8	1.36E-05	1.09E-04	--
Light Work	8	1.36E-05	1.09E-04	--
Moderate Physical Labor	6	2.72E-05	1.63E-04	--
Hard Physical Labor	2	1.36E-04	2.72E-04	--
Total	24	--	6.53E-04	2.72E-05

Source: Shinn, 1994; DOE/NV, 1998

-- = Not applicable

D.2.6.3 Sources

Shinn, J.H., Lawrence Livermore National Laboratory. 1994. Letter to R. Smiecinski titled "Data from Tonopah Test Range," 14 September. Livermore, CA.

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.

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

The individual in the ground troops exposure scenario is defined as working and resting outdoors for 24 hr/day at the site. Because all of the time will be spent outdoors, no credit for indoor shielding of airborne dust particles is assumed. 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 412.

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

Because all of the time on site is outdoors in the ground troops exposure scenario, the external gamma shielding factor is not applicable. Therefore, the recommended value for the external gamma shielding factor parameter is 1, which assumes no shielding (e.g., buildings, structures).

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 ground troops exposure scenario, it is assumed that an individual spends the entire day (24 hours) outdoors. Therefore, the values for the indoor time fraction is zero, and the outdoor time fraction is a simple calculation of the total hours spent at the contaminated site (1,008 hours) 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.2-5.

Table D.2-5
Annual Indoor and Outdoor Times Spent on Site

Exposure Scenario	Total Hours/year	Indoor Hours	Outdoor Hours	Indoor Time Fraction	Outdoor Time Fraction
Ground Troops	8,760	0	1,008	0	0.115

D.2.9.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 412.

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). Because it is assumed that all work under the ground troops exposure scenario is performed outside, a soil ingestion rate of 100 mg/day (0.1 grams per day) is used based upon this EPA guidance. When this rate is extrapolated into a yearly rate, it results in a value of 36.5 g/yr.

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.

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.

D.2.11.2 Recommended Value

For CAU 412, 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 zero was used for the cover depth, irrigation, and contaminated zone erosion rate for CAU 412.

D.2.11.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 412.

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 412.

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 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.

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 412, 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 412.

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 412 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 COCs for CAU 412, 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 412 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 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 412.

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 COCs at CAU 412, 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 CSI 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 412.

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 412.

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 ground troops 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 412, 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. Therefore, as long as the depth of the soil mixing layer is less than the thickness of the contaminated zone, this parameter is not sensitive for the internal or total dose pathways.

D.2.19.2 Recommended Value

The ground troops exposure scenario does not include activities that disturb the soil at depths greater than the top 5 cm of soil (i.e., thickness of the contaminated zone). Therefore, it is recommended that the depth of soil mixing layer value be equal to the thickness of contaminated zone value of 0.05 m.

D.2.19.3 Source

This input parameter value was agreed to by decision makers during the DQO process for CAU 412.

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.

Code of Federal Regulations. 2015. Title 10 CFR, Part 835, "Occupational Radiation Protection." Washington, DC: U.S. Government Printing Office.

DOE, see U.S. Department of Energy.

DOE/NV, see U.S. Department of Energy, Nevada Operations Office.

DRI, see Desert Research Institute.

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

EPA, see U.S. Environmental Protection Agency.

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.

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.

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.

Shinn, J.H., Lawrence Livermore National Laboratory. 1994. Letter to R. Smiecinski titled "Data from Tonopah Test Range, 14 September. Livermore, CA.

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.

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.

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.

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.

U.S. Environmental Protection Agency. 2011. *Exposure Factors Handbook: 2011 Edition,* EPA/600/R-09/052F. Washington, DC: Office of Research and Development.

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

Ground Troops Exposure Scenario RRMGs for CAU 412

Table E.1-1
Total Effective Dose RRMGs
for the Ground Troops Exposure Scenario

Radionuclide	RRMG (pCi/g)
Ag-108m	4.72E+01
Al-26	3.05E+01
Am-241	2.90E+03
Am-243	3.48E+02
Cm-243	5.67E+02
Cm-244	1.01E+04
Co-60	3.25E+01
Cs-137	1.29E+02
Eu-152	6.78E+01
Eu-154	6.33E+01
Eu-155	1.70E+03
Nb-94	4.90E+01
Np-237	3.29E+02
Pu-238	5.19E+03
Pu-239/240	4.76E+03
Pu-241	2.35E+05
Sr-90	1.20E+04
Tc-99	1.23E+06
Th-232	9.18E+02
U-233	2.47E+04
U-234	2.77E+04
U-235	4.49E+02
U-238	2.47E+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 Ground Troops Exposure Scenario

Radionuclide	RRMG (pCi/g)
Ag-108m	7.34E+05
Al-26	4.83E+05
Am-241	5.97E+03
Am-243	5.95E+03
Cm-243	8.14E+03
Cm-244	1.02E+04
Co-60	5.01E+05
Cs-137	1.25E+05
Eu-152	1.16E+06
Eu-154	8.21E+05
Eu-155	5.32E+06
Nb-94	9.82E+05
Np-237	1.09E+04
Pu-238	5.21E+03
Pu-239/240	4.77E+03
Pu-241	2.46E+05
Sr-90	5.27E+04
Tc-99	2.62E+06
Th-232	4.57E+03
U-233	2.77E+04
U-234	2.89E+04
U-235	3.00E+04
U-238	2.96E+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 Ground Troops Exposure Scenario

(83 Pages)

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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)
D-5				

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)

enu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:016	Distribution coefficients for U-233				
2016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(37)
2016	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)	8.800E+03	8.400E+03	---	INHALR

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)	5.000E-02	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	active
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

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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):	3.917E+02	3.613E+02	2.149E+02	1.080E+02	1.001E+02
M(t):	1.567E+01	1.445E+01	8.596E+00	4.319E+00	4.004E+00

Maximum TDOSE(t): 3.917E+02 mrem/yr at t = 0.000E+00 years

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	5.295E+01	0.1352	3.951E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.365E-03	0.0000
Al-26	8.195E+01	0.2092	2.140E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.154E-03	0.0000
Am-241	4.425E-01	0.0011	1.086E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.102E-01	0.0008
Am-243	6.772E+00	0.0173	1.086E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.117E-01	0.0008
Cm-243	4.101E+00	0.0105	7.713E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.302E-01	0.0006
Cm-244	1.406E-03	0.0000	6.339E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.829E-01	0.0005
Co-60	7.701E+01	0.1966	3.299E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.956E-03	0.0000
Cs-137	1.934E+01	0.0494	4.358E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.996E-02	0.0001
Eu-152	3.689E+01	0.0942	4.624E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.119E-03	0.0000
Eu-154	3.952E+01	0.1009	5.771E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.987E-03	0.0000
Eu-155	1.468E+00	0.0037	7.286E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.622E-04	0.0000
Nb-94	5.098E+01	0.1302	5.234E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.494E-03	0.0000
Np-237	7.380E+00	0.0188	5.664E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-01	0.0004
Pu-238	1.591E-03	0.0000	1.241E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.558E-01	0.0009
Pu-239	2.262E-03	0.0000	1.359E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.883E-01	0.0010
Pu-240	1.550E-03	0.0000	1.359E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-01	0.0010
Pu-241	4.925E-04	0.0000	2.629E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.540E-03	0.0000
Sr-90	1.607E-01	0.0004	1.807E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.727E-02	0.0001
Tc-99	1.074E-03	0.0000	1.391E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.396E-04	0.0000
Th-232	2.176E+00	0.0056	1.260E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.207E-01	0.0011
U-233	1.080E-02	0.0000	1.088E-02	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.937E-02	0.0002
U-234	3.656E-03	0.0000	1.065E-02	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.596E-02	0.0002
U-235	5.482E+00	0.0140	9.645E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.357E-02	0.0002
U-238	9.298E-01	0.0024	9.070E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.538E-02	0.0002
Total	3.876E+02	0.9894	9.797E-01	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.162E+00	0.0081

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	5.295E+01	0.1352
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	8.196E+01	0.2092
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	8.613E-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	7.193E+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	4.408E+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	2.477E-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	7.701E+01	0.1966
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	1.936E+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	3.689E+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	3.952E+01	0.1009
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	1.468E+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	5.098E+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	7.609E+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	4.815E-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	5.265E-01	0.0013
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	5.257E-01	0.0013
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	1.066E-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	2.081E-01	0.0005
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	2.028E-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	2.723E+00	0.0070
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	1.010E-01	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	9.027E-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	5.566E+00	0.0142
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.014E+00	0.0026
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	3.917E+02	1.0000

*Sum of all water independent and dependent pathways.

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	4.693E+01	0.1299	3.502E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.983E-03	0.0000
Al-26	7.303E+01	0.2022	1.907E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.593E-03	0.0000
Am-241	4.415E-01	0.0012	1.083E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.095E-01	0.0009
Am-243	6.766E+00	0.0187	1.086E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.115E-01	0.0009
Cm-243	4.003E+00	0.0111	7.528E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.246E-01	0.0006
Cm-244	1.353E-03	0.0000	6.102E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.760E-01	0.0005
Co-60	6.752E+01	0.1869	2.893E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.345E-03	0.0000
Cs-137	1.890E+01	0.0523	4.259E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.950E-02	0.0001
Eu-152	3.502E+01	0.0969	4.390E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.011E-03	0.0000
Eu-154	3.652E+01	0.1011	5.333E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.761E-03	0.0000
Eu-155	1.276E+00	0.0035	6.336E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.020E-04	0.0000
Nb-94	4.543E+01	0.1258	4.665E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.222E-03	0.0000
Np-237	7.380E+00	0.0204	5.664E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-01	0.0005
Pu-238	1.578E-03	0.0000	1.231E-01	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.530E-01	0.0010
Pu-239	2.261E-03	0.0000	1.359E-01	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-01	0.0011
Pu-240	1.550E-03	0.0000	1.359E-01	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-01	0.0011
Pu-241	1.161E-03	0.0000	2.676E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.670E-03	0.0000
Sr-90	1.568E-01	0.0004	1.764E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.613E-02	0.0001
Tc-99	9.573E-04	0.0000	1.240E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.374E-04	0.0000
Th-232	7.224E+00	0.0200	1.296E-01	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.426E-01	0.0015
U-233	1.176E-02	0.0000	1.091E-02	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.943E-02	0.0002
U-234	3.655E-03	0.0000	1.065E-02	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.594E-02	0.0002
U-235	5.481E+00	0.0152	9.646E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.357E-02	0.0002
U-238	9.295E-01	0.0026	9.067E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.536E-02	0.0002
Total	3.570E+02	0.9883	9.778E-01	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.264E+00	0.0090

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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	4.693E+01	0.1299
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	7.304E+01	0.2022
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	8.593E-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	7.186E+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	4.302E+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	2.384E-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	6.752E+01	0.1869
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	1.892E+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	3.502E+01	0.0969
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	3.653E+01	0.1011
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	1.277E+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	4.543E+01	0.1258
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	7.609E+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	4.777E-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	5.264E-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	5.257E-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	1.151E-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	2.031E-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	1.807E-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	7.896E+00	0.0219
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	1.021E-01	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	9.025E-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	5.564E+00	0.0154
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.014E+00	0.0028
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	3.613E+02	1.0000

*Sum of all water independent and dependent pathways.

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	1.584E+01	0.0737	1.182E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.007E-03	0.0000
Al-26	2.590E+01	0.1205	6.763E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-03	0.0000
Am-241	4.322E-01	0.0020	1.060E-01	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.030E-01	0.0014
Am-243	6.714E+00	0.0312	1.078E-01	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.092E-01	0.0014
Cm-243	3.215E+00	0.0150	6.051E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-01	0.0008
Cm-244	9.598E-04	0.0000	4.334E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.250E-01	0.0006
Co-60	2.067E+01	0.0962	8.856E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.330E-03	0.0000
Cs-137	1.535E+01	0.0714	3.459E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E-02	0.0001
Eu-152	2.193E+01	0.1020	2.749E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.259E-03	0.0000
Eu-154	1.797E+01	0.0836	2.625E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.359E-03	0.0000
Eu-155	3.628E-01	0.0017	1.801E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.143E-04	0.0000
Nb-94	1.610E+01	0.0749	1.654E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.878E-04	0.0000
Np-237	7.376E+00	0.0343	5.661E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.721E-01	0.0008
Pu-238	1.470E-03	0.0000	1.147E-01	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.287E-01	0.0015
Pu-239	2.261E-03	0.0000	1.359E-01	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.881E-01	0.0018
Pu-240	1.548E-03	0.0000	1.358E-01	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.878E-01	0.0018
Pu-241	5.866E-03	0.0000	2.989E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.558E-03	0.0000
Sr-90	1.260E-01	0.0006	1.417E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.707E-02	0.0002
Tc-99	3.394E-04	0.0000	4.396E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.969E-04	0.0000
Th-232	5.169E+01	0.2405	1.667E-01	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.256E+00	0.0058
U-233	2.043E-02	0.0001	1.112E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.002E-02	0.0004
U-234	3.658E-03	0.0000	1.063E-02	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.576E-02	0.0004
U-235	5.466E+00	0.0254	9.670E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.364E-02	0.0003
U-238	9.270E-01	0.0043	9.043E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.515E-02	0.0003
Total	2.101E+02	0.9777	9.710E-01	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.824E+00	0.0178

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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	1.584E+01	0.0737
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	2.590E+01	0.1205
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	8.412E-01	0.0039
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	7.131E+00	0.0332
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	3.456E+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	1.693E-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	2.067E+01	0.0962
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	1.537E+01	0.0715
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	2.193E+01	0.1020
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	1.797E+01	0.0836
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	3.629E-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	1.611E+01	0.0749
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	7.605E+00	0.0354
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	4.449E-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	5.263E-01	0.0024
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	5.251E-01	0.0024
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	1.741E-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	1.632E-01	0.0008
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	6.408E-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	5.311E+01	0.2471
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	1.116E-01	0.0005
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	9.005E-02	0.0004
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.550E+00	0.0258
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.011E+00	0.0047
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	2.149E+02	1.0000

*Sum of all water independent and dependent pathways.

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	3.046E-04	0.0000	2.273E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.936E-08	0.0000
Al-26	8.137E-04	0.0000	2.125E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.117E-08	0.0000
Am-241	3.495E-01	0.0032	8.568E-02	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E-01	0.0023
Am-243	6.216E+00	0.0576	1.001E-01	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.872E-01	0.0027
Cm-243	3.599E-01	0.0033	6.916E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.062E-02	0.0002
Cm-244	3.472E-05	0.0000	1.743E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.019E-03	0.0000
Co-60	1.496E-04	0.0000	6.408E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.625E-09	0.0000
Cs-137	1.918E+00	0.0178	4.323E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.979E-03	0.0000
Eu-152	2.031E-01	0.0019	2.547E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.167E-05	0.0000
Eu-154	1.497E-02	0.0001	2.186E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.131E-06	0.0000
Eu-155	1.249E-06	0.0000	6.202E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.935E-10	0.0000
Nb-94	5.045E-04	0.0000	5.180E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.468E-08	0.0000
Np-237	7.336E+00	0.0679	5.631E-02	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.712E-01	0.0016
Pu-238	7.221E-04	0.0000	5.629E-02	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.614E-01	0.0015
Pu-239	2.254E-03	0.0000	1.354E-01	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.868E-01	0.0036
Pu-240	1.532E-03	0.0000	1.344E-01	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.839E-01	0.0036
Pu-241	1.212E-02	0.0001	2.992E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.552E-03	0.0001
Sr-90	1.413E-02	0.0001	1.589E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.156E-03	0.0000
Tc-99	1.066E-08	0.0000	1.381E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.327E-09	0.0000
Th-232	8.074E+01	0.7478	1.921E-01	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.648E+00	0.0153
U-233	1.053E-01	0.0010	1.323E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.574E-02	0.0008
U-234	4.655E-03	0.0000	1.043E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.398E-02	0.0007
U-235	5.339E+00	0.0494	1.060E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.629E-02	0.0007
U-238	9.018E-01	0.0084	8.799E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.312E-02	0.0007
Total	1.035E+02	0.9588	8.150E-01	0.0075	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.633E+00	0.0337

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	3.046E-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	8.137E-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	6.800E-01	0.0063
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	6.603E+00	0.0612
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	3.875E-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	6.797E-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	1.496E-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	1.920E+00	0.0178
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	2.031E-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	1.497E-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	1.250E-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	5.045E-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	7.564E+00	0.0701
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	2.184E-01	0.0020
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	5.245E-01	0.0049
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	5.198E-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	2.366E-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	1.830E-02	0.0002
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	2.013E-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	8.258E+01	0.7648
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	2.043E-01	0.0019
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	8.906E-02	0.0008
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.425E+00	0.0503
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	9.837E-01	0.0091
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	1.080E+02	1.0000

*Sum of all water independent and dependent pathways.

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	4.238E-02	0.0004	1.019E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.912E-02	0.0003
Am-243	2.875E+00	0.0287	4.870E-02	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.397E-01	0.0014
Cm-243	3.019E-05	0.0000	1.555E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.441E-04	0.0000
Cm-244	3.843E-06	0.0000	3.370E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.626E-04	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	1.781E-09	0.0000	4.014E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.838E-12	0.0000
Eu-152	9.460E-22	0.0000	7.280E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.158E-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	6.953E+00	0.0695	5.344E-02	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.626E-01	0.0016
Pu-238	2.528E-05	0.0000	4.887E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.538E-04	0.0000
Pu-239	2.185E-03	0.0000	1.311E-01	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.744E-01	0.0037
Pu-240	1.383E-03	0.0000	1.213E-01	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.465E-01	0.0035
Pu-241	1.483E-03	0.0000	3.569E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.020E-03	0.0000
Sr-90	4.437E-12	0.0000	4.990E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.305E-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	8.072E+01	0.8065	1.920E-01	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.648E+00	0.0165
U-233	8.000E-01	0.0080	3.040E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.316E-01	0.0013
U-234	8.501E-02	0.0008	8.723E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.283E-02	0.0006
U-235	4.250E+00	0.0425	1.906E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.882E-02	0.0010
U-238	6.845E-01	0.0068	6.700E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.565E-02	0.0006
Total	9.641E+01	0.9633	6.225E-01	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.052E+00	0.0305

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	8.169E-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	3.063E+00	0.0306
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	6.297E-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	1.303E-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	1.783E-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	2.886E-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	7.169E+00	0.0716
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	2.279E-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	5.076E-01	0.0051
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	4.692E-01	0.0047
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	2.860E-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	5.747E-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	8.256E+01	0.8249
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	9.620E-01	0.0096
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	1.566E-01	0.0016
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	4.368E+00	0.0436
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.469E-01	0.0075
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	1.001E+02	1.0000

*Sum of all water independent and dependent pathways.

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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	5.295E-01	4.693E-01	1.584E-01	3.046E-06	0.000E+00
Al-26	Al-26	1.000E+00	8.196E-01	7.304E-01	2.590E-01	8.137E-06	0.000E+00
Am-241	Am-241	1.000E+00	8.613E-03	8.593E-03	8.412E-03	6.798E-03	8.078E-04
Am-241	Np-237+D	1.000E+00	1.231E-08	3.690E-08	2.555E-07	2.198E-06	9.062E-06
Am-241	U-233	1.000E+00	2.371E-16	1.659E-15	7.780E-14	6.569E-12	3.225E-10
Am-241	Th-229+D	1.000E+00	6.403E-19	9.598E-18	2.951E-15	2.425E-12	1.372E-09
Am-241	ãDSR(j)		8.613E-03	8.593E-03	8.412E-03	6.800E-03	8.169E-04
Am-243+D	Am-243+D	1.000E+00	7.193E-02	7.186E-02	7.131E-02	6.602E-02	3.053E-02
Am-243+D	Pu-239	1.000E+00	7.580E-08	2.273E-07	1.585E-06	1.457E-05	9.979E-05
Am-243+D	U-235+D	1.000E+00	2.631E-16	1.841E-15	8.675E-14	7.661E-12	5.373E-10
Am-243+D	Pa-231	1.000E+00	6.251E-22	9.373E-21	2.890E-18	2.444E-15	1.724E-12
Am-243+D	Ac-227+D	1.000E+00	2.497E-23	7.695E-22	1.429E-18	7.248E-15	9.802E-12
Am-243+D	ãDSR(j)		7.193E-02	7.186E-02	7.131E-02	6.603E-02	3.063E-02
Cm-243	Cm-243	2.400E-03	1.058E-04	1.033E-04	8.295E-05	9.285E-06	2.865E-15
Cm-243	Am-243+D	2.400E-03	8.042E-09	2.386E-08	1.496E-07	5.740E-07	2.932E-07
Cm-243	Pu-239	2.400E-03	5.661E-15	3.935E-14	1.729E-12	8.543E-11	9.004E-10
Cm-243	U-235+D	2.400E-03	1.476E-23	2.201E-22	6.443E-20	3.485E-17	4.651E-15
Cm-243	Pa-231	2.400E-03	2.807E-29	8.663E-28	1.631E-24	9.147E-21	1.435E-17
Cm-243	Ac-227+D	2.400E-03	9.359E-31	5.846E-29	6.577E-25	2.454E-20	8.129E-17
Cm-243	ãDSR(j)		1.058E-04	1.033E-04	8.310E-05	9.859E-06	2.941E-07
Cm-243	Cm-243	9.976E-01	4.398E-02	4.292E-02	3.448E-02	3.859E-03	1.191E-12
Cm-243	Pu-239	9.976E-01	7.503E-08	2.227E-07	1.401E-06	5.664E-06	6.003E-06
Cm-243	U-235+D	9.976E-01	2.609E-16	1.814E-15	7.984E-14	4.022E-12	5.283E-11
Cm-243	Pa-231	9.976E-01	6.207E-22	9.261E-21	2.714E-18	1.487E-15	2.292E-13
Cm-243	Ac-227+D	9.976E-01	2.481E-23	7.616E-22	1.357E-18	4.681E-15	1.333E-12
Cm-243	ãDSR(j)		4.398E-02	4.292E-02	3.448E-02	3.865E-03	6.003E-06
Cm-244	Cm-244	1.350E-06	3.343E-09	3.217E-09	2.280E-09	7.268E-11	7.889E-26
Cm-244	Cm-244	4.950E-08	1.226E-10	1.180E-10	8.359E-11	2.665E-12	2.892E-27
Cm-244	Pu-240	4.950E-08	1.362E-14	4.018E-14	2.384E-13	6.993E-13	6.452E-13
Cm-244	ãDSR(j)		1.226E-10	1.180E-10	8.383E-11	3.364E-12	6.452E-13
Cm-244	Cm-244	1.000E+00	2.476E-03	2.383E-03	1.689E-03	5.384E-05	5.843E-20
Cm-244	Pu-240	1.000E+00	2.752E-07	8.118E-07	4.816E-06	1.413E-05	1.303E-05
Cm-244	U-236	1.000E+00	4.401E-16	3.047E-15	1.290E-13	5.129E-12	5.537E-11
Cm-244	Th-232	1.000E+00	3.115E-26	4.635E-25	1.320E-22	6.014E-20	8.169E-18
Cm-244	Ra-228+D	1.000E+00	5.019E-26	1.514E-24	2.292E-21	3.357E-18	5.464E-16
Cm-244	Th-228+D	1.000E+00	4.289E-27	2.512E-25	1.598E-21	4.633E-18	8.060E-16
Cm-244	ãDSR(j)		2.477E-03	2.384E-03	1.693E-03	6.797E-05	1.303E-05

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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	7.701E-01	6.752E-01	2.067E-01	1.496E-06	0.000E+00
Cs-137+D	Cs-137+D	1.000E+00	1.936E-01	1.892E-01	1.537E-01	1.920E-02	1.783E-11
Eu-152	Eu-152	7.208E-01	2.659E-01	2.524E-01	1.580E-01	1.464E-03	6.819E-24
Eu-152	Eu-152	2.792E-01	1.030E-01	9.777E-02	6.122E-02	5.672E-04	2.641E-24
Eu-152	Gd-152	2.792E-01	7.514E-19	2.203E-18	1.237E-17	2.919E-17	2.886E-17
Eu-152	äDSR(j)		1.030E-01	9.777E-02	6.122E-02	5.672E-04	2.886E-17
Eu-154	Eu-154	1.000E+00	3.952E-01	3.653E-01	1.797E-01	1.497E-04	2.403E-35
Eu-155	Eu-155	1.000E+00	1.468E-02	1.277E-02	3.629E-03	1.250E-08	0.000E+00
Nb-94	Nb-94	1.000E+00	5.098E-01	4.543E-01	1.611E-01	5.045E-06	0.000E+00
Np-237+D	Np-237+D	1.000E+00	7.609E-02	7.609E-02	7.605E-02	7.564E-02	7.166E-02
Np-237+D	U-233	1.000E+00	2.198E-09	6.592E-09	4.607E-08	4.336E-07	3.663E-06
Np-237+D	Th-229+D	1.000E+00	7.911E-12	5.537E-11	2.614E-09	2.360E-07	2.037E-05
Np-237+D	äDSR(j)		7.609E-02	7.609E-02	7.605E-02	7.564E-02	7.169E-02
Pu-238	Pu-238	1.840E-09	8.860E-12	8.790E-12	8.186E-12	4.018E-12	3.260E-15
Pu-238	Pu-238	1.000E+00	4.815E-03	4.777E-03	4.449E-03	2.184E-03	1.771E-06
Pu-238	U-234	1.000E+00	1.276E-09	3.815E-09	2.575E-08	1.744E-07	2.471E-07
Pu-238	Th-230	1.000E+00	1.909E-14	1.333E-13	6.154E-12	4.473E-10	1.104E-08
Pu-238	Ra-226+D	1.000E+00	2.674E-16	4.003E-15	1.215E-12	8.793E-10	2.383E-07
Pu-238	Pb-210+D	1.000E+00	8.535E-20	2.627E-18	4.826E-15	2.171E-11	1.149E-08
Pu-238	äDSR(j)		4.815E-03	4.777E-03	4.449E-03	2.184E-03	2.279E-06
Pu-239	Pu-239	1.000E+00	5.265E-03	5.264E-03	5.263E-03	5.245E-03	5.076E-03
Pu-239	U-235+D	1.000E+00	2.741E-11	8.221E-11	5.746E-10	5.416E-09	4.635E-08
Pu-239	Pa-231	1.000E+00	8.682E-17	6.076E-16	2.867E-14	2.573E-12	2.090E-10
Pu-239	Ac-227+D	1.000E+00	4.330E-18	6.449E-17	1.857E-14	9.046E-12	1.218E-09
Pu-239	äDSR(j)		5.265E-03	5.264E-03	5.263E-03	5.245E-03	5.076E-03
Pu-240	Pu-240	4.950E-08	2.602E-10	2.602E-10	2.599E-10	2.573E-10	2.323E-10
Pu-240	Pu-240	1.000E+00	5.257E-03	5.257E-03	5.251E-03	5.198E-03	4.692E-03
Pu-240	U-236	1.000E+00	1.257E-11	3.771E-11	2.635E-10	2.474E-09	2.042E-08
Pu-240	Th-232	1.000E+00	1.184E-21	8.288E-21	3.914E-19	3.538E-17	3.097E-15
Pu-240	Ra-228+D	1.000E+00	2.372E-21	3.469E-20	8.432E-18	2.043E-15	2.073E-13
Pu-240	Th-228+D	1.000E+00	2.412E-22	6.906E-21	6.730E-18	2.856E-15	3.058E-13
Pu-240	äDSR(j)		5.257E-03	5.257E-03	5.251E-03	5.198E-03	4.692E-03

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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
Pu-241	Pu-241	1.000E+00	9.885E-05	9.420E-05	6.108E-05	8.020E-07	1.221E-25
Pu-241	Am-241	1.000E+00	6.800E-06	1.995E-05	1.124E-04	2.358E-04	2.830E-05
Pu-241	Np-237+D	1.000E+00	6.505E-12	4.489E-11	1.839E-09	5.928E-08	3.006E-07
Pu-241	U-233	1.000E+00	9.418E-20	1.398E-18	3.880E-16	1.487E-13	1.045E-11
Pu-241	Th-229+D	1.000E+00	2.038E-22	6.262E-21	1.130E-17	4.752E-14	4.344E-11
Pu-241	ãDSR(j)		1.057E-04	1.142E-04	1.735E-04	2.366E-04	2.860E-05
Pu-241+D	Pu-241+D	2.450E-05	9.638E-07	9.185E-07	5.955E-07	7.819E-09	1.191E-27
Pu-241+D	Np-237+D	2.450E-05	2.971E-13	8.727E-13	4.975E-12	1.238E-11	1.183E-11
Pu-241+D	U-233	2.450E-05	5.744E-21	3.966E-20	1.635E-18	5.699E-17	5.934E-16
Pu-241+D	Th-229+D	2.450E-05	1.554E-23	2.308E-22	6.440E-20	2.617E-17	3.232E-15
Pu-241+D	ãDSR(j)		9.638E-07	9.185E-07	5.955E-07	7.831E-09	1.183E-11
Sr-90+D	Sr-90+D	1.000E+00	2.081E-03	2.031E-03	1.632E-03	1.830E-04	5.747E-14
Tc-99	Tc-99	1.000E+00	2.028E-05	1.807E-05	6.408E-06	2.013E-10	0.000E+00
Th-232	Th-232	1.000E+00	4.865E-03	4.865E-03	4.865E-03	4.865E-03	4.864E-03
Th-232	Ra-228+D	1.000E+00	1.918E-02	5.461E-02	2.375E-01	3.306E-01	3.305E-01
Th-232	Th-228+D	1.000E+00	3.176E-03	1.948E-02	2.887E-01	4.903E-01	4.902E-01
Th-232	ãDSR(j)		2.723E-02	7.896E-02	5.311E-01	8.258E-01	8.256E-01
U-233	U-233	1.000E+00	1.005E-03	1.005E-03	1.002E-03	9.742E-04	7.366E-04
U-233	Th-229+D	1.000E+00	5.427E-06	1.628E-05	1.137E-04	1.069E-03	8.884E-03
U-233	ãDSR(j)		1.010E-03	1.021E-03	1.116E-03	2.043E-03	9.620E-03
U-234	U-234	1.000E+00	9.027E-04	9.024E-04	8.999E-04	8.752E-04	6.626E-04
U-234	Th-230	1.000E+00	2.024E-08	6.072E-08	4.244E-07	4.005E-06	3.467E-05
U-234	Ra-226+D	1.000E+00	3.778E-10	2.644E-09	1.247E-07	1.109E-05	8.281E-04
U-234	Pb-210+D	1.000E+00	1.505E-13	2.243E-12	6.473E-10	3.187E-07	4.025E-05
U-234	ãDSR(j)		9.027E-04	9.025E-04	9.005E-04	8.906E-04	1.566E-03
U-235+D	U-235+D	1.000E+00	5.566E-02	5.564E-02	5.549E-02	5.398E-02	4.097E-02
U-235+D	Pa-231	1.000E+00	2.645E-07	7.931E-07	5.536E-06	5.150E-05	3.855E-04
U-235+D	Ac-227+D	1.000E+00	1.756E-08	1.217E-07	5.232E-06	2.254E-04	2.323E-03
U-235+D	ãDSR(j)		5.566E-02	5.564E-02	5.550E-02	5.425E-02	4.368E-02
U-238	U-238	5.400E-05	4.335E-08	4.334E-08	4.322E-08	4.205E-08	3.191E-08
U-238+D	U-238+D	9.999E-01	1.014E-02	1.014E-02	1.011E-02	9.836E-03	7.466E-03
U-238+D	U-234	9.999E-01	1.279E-09	3.837E-09	2.679E-08	2.494E-07	1.882E-06
U-238+D	Th-230	9.999E-01	1.913E-14	1.339E-13	6.318E-12	5.677E-10	4.676E-08
U-238+D	Ra-226+D	9.999E-01	2.678E-16	4.015E-15	1.239E-12	1.053E-09	7.836E-07
U-238+D	Pb-210+D	9.999E-01	8.545E-20	2.634E-18	4.904E-15	2.540E-11	3.694E-08
U-238+D	ãDSR(j)		1.014E-02	1.014E-02	1.011E-02	9.837E-03	7.469E-03

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

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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
Ag-108m	4.721E+01	5.327E+01	1.578E+02	8.206E+06	*2.609E+13
Al-26	3.050E+01	3.423E+01	9.653E+01	3.072E+06	*1.921E+10
Am-241	2.903E+03	2.909E+03	2.972E+03	3.676E+03	3.060E+04
Am-243	3.476E+02	3.479E+02	3.506E+02	3.786E+02	8.161E+02
Cm-243	5.671E+02	5.811E+02	7.233E+02	6.452E+03	3.970E+06
Cm-244	1.009E+04	1.049E+04	1.476E+04	3.678E+05	1.918E+06
Co-60	3.246E+01	3.702E+01	1.209E+02	1.671E+07	*1.132E+15
Cs-137	1.291E+02	1.321E+02	1.627E+02	1.302E+03	1.402E+12
Eu-152	6.777E+01	7.139E+01	1.140E+02	1.231E+04	*1.765E+14
Eu-154	6.326E+01	6.845E+01	1.391E+02	1.670E+05	*2.639E+14
Eu-155	1.703E+03	1.958E+03	6.889E+03	2.000E+09	*4.652E+14
Nb-94	4.903E+01	5.502E+01	1.552E+02	4.955E+06	*1.875E+11
Np-237	3.286E+02	3.286E+02	3.287E+02	3.305E+02	3.487E+02
Pu-238	5.192E+03	5.233E+03	5.619E+03	1.145E+04	1.097E+07
Pu-239	4.749E+03	4.749E+03	4.750E+03	4.766E+03	4.925E+03
Pu-240	4.755E+03	4.756E+03	4.761E+03	4.810E+03	5.328E+03
Pu-241	2.345E+05	2.173E+05	1.436E+05	1.056E+05	8.740E+05
Sr-90	1.201E+04	1.231E+04	1.532E+04	1.366E+05	*1.365E+14
Tc-99	1.233E+06	1.383E+06	3.902E+06	*1.697E+10	*1.697E+10
Th-232	9.183E+02	3.166E+02	4.707E+01	3.027E+01	3.028E+01
U-233	2.474E+04	2.449E+04	2.241E+04	1.224E+04	2.599E+03
U-234	2.769E+04	2.770E+04	2.776E+04	2.807E+04	1.597E+04
U-235	4.492E+02	4.493E+02	4.505E+02	4.608E+02	5.724E+02
U-238	2.465E+03	2.466E+03	2.472E+03	2.541E+03	3.347E+03

*At specific activity limit

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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)
Ag-108m	1.000E+02	0.000E+00	5.295E-01	4.721E+01	5.295E-01	4.721E+01
Al-26	1.000E+02	0.000E+00	8.196E-01	3.050E+01	8.196E-01	3.050E+01
Am-241	1.000E+02	0.000E+00	8.613E-03	2.903E+03	8.613E-03	2.903E+03
Am-243	1.000E+02	0.000E+00	7.193E-02	3.476E+02	7.193E-02	3.476E+02
Cm-243	1.000E+02	0.000E+00	4.408E-02	5.671E+02	4.408E-02	5.671E+02
Cm-244	1.000E+02	0.000E+00	2.477E-03	1.009E+04	2.477E-03	1.009E+04
Co-60	1.000E+02	0.000E+00	7.701E-01	3.246E+01	7.701E-01	3.246E+01
Cs-137	1.000E+02	0.000E+00	1.936E-01	1.291E+02	1.936E-01	1.291E+02
Eu-152	1.000E+02	0.000E+00	3.689E-01	6.777E+01	3.689E-01	6.777E+01
Eu-154	1.000E+02	0.000E+00	3.952E-01	6.326E+01	3.952E-01	6.326E+01
Eu-155	1.000E+02	0.000E+00	1.468E-02	1.703E+03	1.468E-02	1.703E+03
Nb-94	1.000E+02	0.000E+00	5.098E-01	4.903E+01	5.098E-01	4.903E+01
Np-237	1.000E+02	0.000E+00	7.609E-02	3.286E+02	7.609E-02	3.286E+02
Pu-238	1.000E+02	0.000E+00	4.815E-03	5.192E+03	4.815E-03	5.192E+03
Pu-239	1.000E+02	0.000E+00	5.265E-03	4.749E+03	5.265E-03	4.749E+03
Pu-240	1.000E+02	0.000E+00	5.257E-03	4.755E+03	5.257E-03	4.755E+03
Pu-241	1.000E+02	56.3 ñ 0.1	2.512E-04	9.954E+04	1.066E-04	2.345E+05
Sr-90	1.000E+02	0.000E+00	2.081E-03	1.201E+04	2.081E-03	1.201E+04
Tc-99	1.000E+02	0.000E+00	2.028E-05	1.233E+06	2.028E-05	1.233E+06
Th-232	1.000E+02	109.0 ñ 0.2	8.258E-01	3.027E+01	2.723E-02	9.183E+02
U-233	1.000E+02	1.000E+03	9.620E-03	2.599E+03	1.010E-03	2.474E+04
U-234	1.000E+02	1.000E+03	1.566E-03	1.597E+04	9.027E-04	2.769E+04
U-235	1.000E+02	0.000E+00	5.566E-02	4.492E+02	5.566E-02	4.492E+02
U-238	1.000E+02	0.000E+00	1.014E-02	2.465E+03	1.014E-02	2.465E+03

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	5.295E+01	4.693E+01	1.584E+01	3.046E-04	0.000E+00
Al-26	Al-26	1.000E+00	8.196E+01	7.304E+01	2.590E+01	8.137E-04	0.000E+00
Am-241	Am-241	1.000E+00	8.613E-01	8.593E-01	8.412E-01	6.798E-01	8.078E-02
Am-241	Pu-241	1.000E+00	6.800E-04	1.995E-03	1.124E-02	2.358E-02	2.830E-03
Am-241	äDOSE(j)		8.620E-01	8.613E-01	8.524E-01	7.034E-01	8.361E-02
Np-237	Am-241	1.000E+00	1.231E-06	3.690E-06	2.555E-05	2.198E-04	9.062E-04
Np-237	Np-237	1.000E+00	7.609E+00	7.609E+00	7.605E+00	7.564E+00	7.166E+00
Np-237	Pu-241	1.000E+00	6.505E-10	4.489E-09	1.839E-07	5.928E-06	3.006E-05
Np-237	Pu-241	2.450E-05	2.971E-11	8.727E-11	4.975E-10	1.238E-09	1.183E-09
Np-237	äDOSE(j)		7.609E+00	7.609E+00	7.605E+00	7.564E+00	7.167E+00
U-233	Am-241	1.000E+00	2.371E-14	1.659E-13	7.780E-12	6.569E-10	3.225E-08
U-233	Np-237	1.000E+00	2.198E-07	6.592E-07	4.607E-06	4.336E-05	3.663E-04
U-233	Pu-241	1.000E+00	9.418E-18	1.398E-16	3.880E-14	1.487E-11	1.045E-09
U-233	Pu-241	2.450E-05	5.744E-19	3.966E-18	1.635E-16	5.699E-15	5.934E-14
U-233	U-233	1.000E+00	1.005E-01	1.005E-01	1.002E-01	9.742E-02	7.366E-02
U-233	äDOSE(j)		1.005E-01	1.005E-01	1.002E-01	9.747E-02	7.402E-02
Th-229	Am-241	1.000E+00	6.403E-17	9.598E-16	2.951E-13	2.425E-10	1.372E-07
Th-229	Np-237	1.000E+00	7.911E-10	5.537E-09	2.614E-07	2.360E-05	2.037E-03
Th-229	Pu-241	1.000E+00	2.038E-20	6.262E-19	1.130E-15	4.752E-12	4.344E-09
Th-229	Pu-241	2.450E-05	1.554E-21	2.308E-20	6.440E-18	2.617E-15	3.232E-13
Th-229	U-233	1.000E+00	5.427E-04	1.628E-03	1.137E-02	1.069E-01	8.884E-01
Th-229	äDOSE(j)		5.427E-04	1.628E-03	1.137E-02	1.069E-01	8.904E-01
Am-243	Am-243	1.000E+00	7.193E+00	7.186E+00	7.131E+00	6.602E+00	3.053E+00
Am-243	Cm-243	2.400E-03	8.042E-07	2.386E-06	1.496E-05	5.740E-05	2.932E-05
Am-243	äDOSE(j)		7.193E+00	7.186E+00	7.131E+00	6.602E+00	3.053E+00
Pu-239	Am-243	1.000E+00	7.580E-06	2.273E-05	1.585E-04	1.457E-03	9.979E-03
Pu-239	Cm-243	2.400E-03	5.661E-13	3.935E-12	1.729E-10	8.543E-09	9.004E-08
Pu-239	Cm-243	9.976E-01	7.503E-06	2.227E-05	1.401E-04	5.664E-04	6.003E-04
Pu-239	Pu-239	1.000E+00	5.265E-01	5.264E-01	5.263E-01	5.245E-01	5.076E-01
Pu-239	äDOSE(j)		5.265E-01	5.265E-01	5.266E-01	5.266E-01	5.182E-01
U-235	Am-243	1.000E+00	2.631E-14	1.841E-13	8.675E-12	7.661E-10	5.373E-08
U-235	Cm-243	2.400E-03	1.476E-21	2.201E-20	6.443E-18	3.485E-15	4.651E-13
U-235	Cm-243	9.976E-01	2.609E-14	1.814E-13	7.984E-12	4.022E-10	5.283E-09
U-235	Pu-239	1.000E+00	2.741E-09	8.221E-09	5.746E-08	5.416E-07	4.635E-06
U-235	U-235	1.000E+00	5.566E+00	5.564E+00	5.549E+00	5.398E+00	4.097E+00
U-235	äDOSE(j)		5.566E+00	5.564E+00	5.549E+00	5.398E+00	4.097E+00
Pa-231	Am-243	1.000E+00	6.251E-20	9.373E-19	2.890E-16	2.444E-13	1.724E-10
Pa-231	Cm-243	2.400E-03	2.807E-27	8.663E-26	1.631E-22	9.147E-19	1.435E-15
Pa-231	Cm-243	9.976E-01	6.207E-20	9.261E-19	2.714E-16	1.487E-13	2.292E-11
Pa-231	Pu-239	1.000E+00	8.682E-15	6.076E-14	2.867E-12	2.573E-10	2.090E-08

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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	2.645E-05	7.931E-05	5.536E-04	5.150E-03	3.855E-02
Pa-231	ăDOSE(j)		2.645E-05	7.931E-05	5.536E-04	5.150E-03	3.855E-02
Ac-227	Am-243	1.000E+00	2.497E-21	7.695E-20	1.429E-16	7.248E-13	9.802E-10
Ac-227	Cm-243	2.400E-03	0.000E+00	5.846E-27	6.577E-23	2.454E-18	8.129E-15
Ac-227	Cm-243	9.976E-01	2.481E-21	7.616E-20	1.357E-16	4.681E-13	1.333E-10
Ac-227	Pu-239	1.000E+00	4.330E-16	6.449E-15	1.857E-12	9.046E-10	1.218E-07
Ac-227	U-235	1.000E+00	1.756E-06	1.217E-05	5.232E-04	2.254E-02	2.323E-01
Ac-227	ăDOSE(j)		1.756E-06	1.217E-05	5.232E-04	2.254E-02	2.323E-01
Cm-243	Cm-243	2.400E-03	1.058E-02	1.033E-02	8.295E-03	9.285E-04	2.865E-13
Cm-243	Cm-243	9.976E-01	4.398E+00	4.292E+00	3.448E+00	3.859E-01	1.191E-10
Cm-243	ăDOSE(j)		4.408E+00	4.302E+00	3.456E+00	3.869E-01	1.194E-10
Cm-244	Cm-244	1.350E-06	3.343E-07	3.217E-07	2.280E-07	7.268E-09	7.889E-24
Cm-244	Cm-244	4.950E-08	1.226E-08	1.180E-08	8.359E-09	2.665E-10	2.892E-25
Cm-244	ăDOSE(j)		3.466E-07	3.335E-07	2.363E-07	7.535E-09	8.178E-24
Pu-240	Cm-244	4.950E-08	1.362E-12	4.018E-12	2.384E-11	6.993E-11	6.452E-11
Pu-240	Pu-240	4.950E-08	2.602E-08	2.602E-08	2.599E-08	2.573E-08	2.323E-08
Pu-240	ăDOSE(j)		2.602E-08	2.602E-08	2.602E-08	2.580E-08	2.329E-08
Cm-244	Cm-244	1.000E+00	2.476E-01	2.383E-01	1.689E-01	5.384E-03	5.843E-18
Pu-240	Cm-244	1.000E+00	2.752E-05	8.118E-05	4.816E-04	1.413E-03	1.303E-03
U-236	Cm-244	1.000E+00	4.401E-14	3.047E-13	1.290E-11	5.129E-10	5.537E-09
U-236	Pu-240	1.000E+00	1.257E-09	3.771E-09	2.635E-08	2.474E-07	2.042E-06
U-236	ăDOSE(j)		1.257E-09	3.771E-09	2.636E-08	2.480E-07	2.048E-06
Th-232	Cm-244	1.000E+00	3.115E-24	4.635E-23	1.320E-20	6.014E-18	8.169E-16
Th-232	Pu-240	1.000E+00	1.184E-19	8.288E-19	3.914E-17	3.538E-15	3.097E-13
Th-232	Th-232	1.000E+00	4.865E-01	4.865E-01	4.865E-01	4.865E-01	4.864E-01
Th-232	ăDOSE(j)		4.865E-01	4.865E-01	4.865E-01	4.865E-01	4.864E-01
Ra-228	Cm-244	1.000E+00	5.019E-24	1.514E-22	2.292E-19	3.357E-16	5.464E-14
Ra-228	Pu-240	1.000E+00	2.372E-19	3.469E-18	8.432E-16	2.043E-13	2.073E-11
Ra-228	Th-232	1.000E+00	1.918E+00	5.461E+00	2.375E+01	3.306E+01	3.305E+01
Ra-228	ăDOSE(j)		1.918E+00	5.461E+00	2.375E+01	3.306E+01	3.305E+01
Th-228	Cm-244	1.000E+00	4.289E-25	2.512E-23	1.598E-19	4.633E-16	8.060E-14
Th-228	Pu-240	1.000E+00	2.412E-20	6.906E-19	6.730E-16	2.856E-13	3.058E-11
Th-228	Th-232	1.000E+00	3.176E-01	1.948E+00	2.887E+01	4.903E+01	4.902E+01
Th-228	ăDOSE(j)		3.176E-01	1.948E+00	2.887E+01	4.903E+01	4.902E+01
Co-60	Co-60	1.000E+00	7.701E+01	6.752E+01	2.067E+01	1.496E-04	0.000E+00
Cs-137	Cs-137	1.000E+00	1.936E+01	1.892E+01	1.537E+01	1.920E+00	1.783E-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+01	1.000E+02	1.000E+03
Eu-152	Eu-152	7.208E-01	2.659E+01	2.524E+01	1.580E+01	1.464E-01	6.819E-22
Eu-152	Eu-152	2.792E-01	1.030E+01	9.777E+00	6.122E+00	5.672E-02	2.641E-22
Eu-152	ăDOSE(j)		3.689E+01	3.502E+01	2.193E+01	2.031E-01	9.460E-22
Gd-152	Eu-152	2.792E-01	7.514E-17	2.203E-16	1.237E-15	2.919E-15	2.886E-15
Eu-154	Eu-154	1.000E+00	3.952E+01	3.653E+01	1.797E+01	1.497E-02	0.000E+00
Eu-155	Eu-155	1.000E+00	1.468E+00	1.277E+00	3.629E-01	1.250E-06	0.000E+00
Nb-94	Nb-94	1.000E+00	5.098E+01	4.543E+01	1.611E+01	5.045E-04	0.000E+00
Pu-238	Pu-238	1.840E-09	8.860E-10	8.790E-10	8.186E-10	4.018E-10	3.260E-13
Pu-238	Pu-238	1.000E+00	4.815E-01	4.777E-01	4.449E-01	2.184E-01	1.771E-04
Pu-238	ăDOSE(j)		4.815E-01	4.777E-01	4.449E-01	2.184E-01	1.771E-04
U-234	Pu-238	1.000E+00	1.276E-07	3.815E-07	2.575E-06	1.744E-05	2.471E-05
U-234	U-234	1.000E+00	9.027E-02	9.024E-02	8.999E-02	8.752E-02	6.626E-02
U-234	U-238	9.999E-01	1.279E-07	3.837E-07	2.679E-06	2.494E-05	1.882E-04
U-234	ăDOSE(j)		9.027E-02	9.025E-02	9.000E-02	8.757E-02	6.647E-02
Th-230	Pu-238	1.000E+00	1.909E-12	1.333E-11	6.154E-10	4.473E-08	1.104E-06
Th-230	U-234	1.000E+00	2.024E-06	6.072E-06	4.244E-05	4.005E-04	3.467E-03
Th-230	U-238	9.999E-01	1.913E-12	1.339E-11	6.318E-10	5.677E-08	4.676E-06
Th-230	ăDOSE(j)		2.024E-06	6.072E-06	4.244E-05	4.006E-04	3.473E-03
Ra-226	Pu-238	1.000E+00	2.674E-14	4.003E-13	1.215E-10	8.793E-08	2.383E-05
Ra-226	U-234	1.000E+00	3.778E-08	2.644E-07	1.247E-05	1.109E-03	8.281E-02
Ra-226	U-238	9.999E-01	2.678E-14	4.015E-13	1.239E-10	1.053E-07	7.836E-05
Ra-226	ăDOSE(j)		3.778E-08	2.644E-07	1.247E-05	1.109E-03	8.292E-02
Pb-210	Pu-238	1.000E+00	8.535E-18	2.627E-16	4.826E-13	2.171E-09	1.149E-06
Pb-210	U-234	1.000E+00	1.505E-11	2.243E-10	6.473E-08	3.187E-05	4.025E-03
Pb-210	U-238	9.999E-01	8.545E-18	2.634E-16	4.904E-13	2.540E-09	3.694E-06
Pb-210	ăDOSE(j)		1.505E-11	2.243E-10	6.473E-08	3.187E-05	4.030E-03
Pu-240	Pu-240	1.000E+00	5.257E-01	5.257E-01	5.251E-01	5.198E-01	4.692E-01
Pu-241	Pu-241	1.000E+00	9.885E-03	9.420E-03	6.108E-03	8.020E-05	1.221E-23
Pu-241	Pu-241	2.450E-05	9.638E-05	9.185E-05	5.955E-05	7.819E-07	1.190E-25
Pu-241	ăDOSE(j)		9.981E-03	9.512E-03	6.168E-03	8.098E-05	1.233E-23
Sr-90	Sr-90	1.000E+00	2.081E-01	2.031E-01	1.632E-01	1.830E-02	5.747E-12
Tc-99	Tc-99	1.000E+00	2.028E-03	1.807E-03	6.408E-04	2.013E-08	0.000E+00
U-238	U-238	5.400E-05	4.335E-06	4.334E-06	4.322E-06	4.205E-06	3.191E-06
U-238	U-238	9.999E-01	1.014E+00	1.014E+00	1.011E+00	9.836E-01	7.466E-01
U-238	ăDOSE(j)		1.014E+00	1.014E+00	1.011E+00	9.836E-01	7.466E-01

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
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	ãS(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	ãS(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	ãS(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	ãS(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	ãS(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	ãS(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	ãS(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

Summary : CSI_Ground Troops_Total
File : G:\RESRAD\CSI_GROUND TROOPS_TOTAL.RAD

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
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

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

RESCALC.EXE execution time = 5.35 seconds

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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				
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)
D-5				

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)	8.800E+03	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)	2.720E-05	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	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.150E-01	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)	3.650E+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)	5.000E-02	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

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	1000.00 square meters	Ag-108m	1.000E+02
Thickness:	0.05 meters	Al-26	1.000E+02
Cover Depth:	0.00 meters	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):	4.141E+00	4.241E+00	4.795E+00	4.448E+00	3.674E+00
M(t):	1.657E-01	1.697E-01	1.918E-01	1.779E-01	1.470E-01

Maximum TDOSE(t): 4.920E+00 mrem/yr at t = 20.31 ñ 0.04 years

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.031E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	3.410E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.904E-04	0.0001
Al-26	0.000E+00	0.0000	2.063E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.969E-04	0.0001
Am-241	0.000E+00	0.0000	1.035E-01	0.0210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.957E-01	0.0601
Am-243	0.000E+00	0.0000	1.069E-01	0.0217	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.066E-01	0.0623
Cm-243	0.000E+00	0.0000	4.712E-02	0.0096	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.406E-01	0.0286
Cm-244	0.000E+00	0.0000	2.934E-02	0.0060	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.463E-02	0.0172
Co-60	0.000E+00	0.0000	2.284E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.430E-04	0.0001
Cs-137	0.000E+00	0.0000	2.726E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.248E-02	0.0025
Eu-152	0.000E+00	0.0000	1.608E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.368E-04	0.0001
Eu-154	0.000E+00	0.0000	1.165E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.032E-04	0.0001
Eu-155	0.000E+00	0.0000	4.266E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.706E-05	0.0000
Nb-94	0.000E+00	0.0000	5.043E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.403E-04	0.0000
Np-237	0.000E+00	0.0000	5.658E-02	0.0115	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.720E-01	0.0350
Pu-238	0.000E+00	0.0000	1.057E-01	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.030E-01	0.0616
Pu-239	0.000E+00	0.0000	1.358E-01	0.0276	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.880E-01	0.0789
Pu-240	0.000E+00	0.0000	1.356E-01	0.0276	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.874E-01	0.0787
Pu-241	0.000E+00	0.0000	3.183E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.107E-03	0.0019
Sr-90	0.000E+00	0.0000	1.103E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.885E-02	0.0059
Tc-99	0.000E+00	0.0000	1.341E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.058E-05	0.0000
Th-232	0.000E+00	0.0000	1.846E-01	0.0375	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.535E+00	0.3119
U-233	0.000E+00	0.0000	1.137E-02	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.068E-02	0.0164
U-234	0.000E+00	0.0000	1.061E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.555E-02	0.0154
U-235	0.000E+00	0.0000	9.729E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.380E-02	0.0150
U-238	0.000E+00	0.0000	9.014E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.491E-02	0.0152
Total	0.000E+00	0.0000	9.492E-01	0.1929	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.971E+00	0.8071

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.031E+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	2.938E-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	4.990E-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	3.992E-01	0.0811
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	4.134E-01	0.0840
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	1.877E-01	0.0382
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	1.140E-01	0.0232
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	3.453E-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	1.251E-02	0.0025
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	7.529E-04	0.0002
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	6.149E-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	2.749E-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	2.453E-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	2.286E-01	0.0465
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	4.087E-01	0.0831
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	5.238E-01	0.1065
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	5.230E-01	0.1063
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	1.229E-02	0.0025
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	2.896E-02	0.0059
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	9.192E-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	1.719E+00	0.3495
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	9.205E-02	0.0187
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	8.616E-02	0.0175
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	8.353E-02	0.0170
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	8.393E-02	0.0171
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.920E+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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	3.951E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.365E-03	0.0008
Al-26	0.000E+00	0.0000	2.140E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.154E-03	0.0012
Am-241	0.000E+00	0.0000	1.086E-01	0.0262	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.102E-01	0.0749
Am-243	0.000E+00	0.0000	1.086E-01	0.0262	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.117E-01	0.0753
Cm-243	0.000E+00	0.0000	7.713E-02	0.0186	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.302E-01	0.0556
Cm-244	0.000E+00	0.0000	6.339E-02	0.0153	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.829E-01	0.0442
Co-60	0.000E+00	0.0000	3.299E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.956E-03	0.0012
Cs-137	0.000E+00	0.0000	4.358E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.996E-02	0.0048
Eu-152	0.000E+00	0.0000	4.624E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.119E-03	0.0005
Eu-154	0.000E+00	0.0000	5.771E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.987E-03	0.0007
Eu-155	0.000E+00	0.0000	7.286E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.622E-04	0.0001
Nb-94	0.000E+00	0.0000	5.234E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.494E-03	0.0006
Np-237	0.000E+00	0.0000	5.664E-02	0.0137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-01	0.0416
Pu-238	0.000E+00	0.0000	1.241E-01	0.0300	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.558E-01	0.0859
Pu-239	0.000E+00	0.0000	1.359E-01	0.0328	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.883E-01	0.0938
Pu-240	0.000E+00	0.0000	1.359E-01	0.0328	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-01	0.0937
Pu-241	0.000E+00	0.0000	2.629E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.540E-03	0.0018
Sr-90	0.000E+00	0.0000	1.807E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.727E-02	0.0114
Tc-99	0.000E+00	0.0000	1.391E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.396E-04	0.0002
Th-232	0.000E+00	0.0000	1.260E-01	0.0304	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.207E-01	0.1016
U-233	0.000E+00	0.0000	1.088E-02	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.937E-02	0.0192
U-234	0.000E+00	0.0000	1.065E-02	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.596E-02	0.0183
U-235	0.000E+00	0.0000	9.645E-03	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.357E-02	0.0178
U-238	0.000E+00	0.0000	9.070E-03	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.538E-02	0.0182
Total	0.000E+00	0.0000	9.797E-01	0.2366	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.162E+00	0.7634

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	3.404E-03	0.0008
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	5.176E-03	0.0012
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	4.188E-01	0.1011
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	4.204E-01	0.1015
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	3.073E-01	0.0742
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	2.463E-01	0.0595
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	4.989E-03	0.0012
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	2.000E-02	0.0048
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	2.165E-03	0.0005
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	3.045E-03	0.0007
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	4.695E-04	0.0001
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	2.546E-03	0.0006
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	2.288E-01	0.0553
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	4.799E-01	0.1159
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	5.242E-01	0.1266
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	5.242E-01	0.1266
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	1.017E-02	0.0025
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	4.745E-02	0.0115
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	9.536E-04	0.0002
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	5.467E-01	0.1320
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	9.025E-02	0.0218
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	8.662E-02	0.0209
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	8.321E-02	0.0201
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	8.445E-02	0.0204
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.141E+00	1.0000

*Sum of all water independent and dependent pathways.

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	3.502E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.983E-03	0.0007
Al-26	0.000E+00	0.0000	1.907E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.593E-03	0.0011
Am-241	0.000E+00	0.0000	1.083E-01	0.0255	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.095E-01	0.0730
Am-243	0.000E+00	0.0000	1.086E-01	0.0256	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.115E-01	0.0734
Cm-243	0.000E+00	0.0000	7.528E-02	0.0177	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.246E-01	0.0530
Cm-244	0.000E+00	0.0000	6.102E-02	0.0144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.760E-01	0.0415
Co-60	0.000E+00	0.0000	2.893E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.345E-03	0.0010
Cs-137	0.000E+00	0.0000	4.259E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.950E-02	0.0046
Eu-152	0.000E+00	0.0000	4.390E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.011E-03	0.0005
Eu-154	0.000E+00	0.0000	5.333E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.761E-03	0.0007
Eu-155	0.000E+00	0.0000	6.336E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.020E-04	0.0001
Nb-94	0.000E+00	0.0000	4.665E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.222E-03	0.0005
Np-237	0.000E+00	0.0000	5.664E-02	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-01	0.0406
Pu-238	0.000E+00	0.0000	1.231E-01	0.0290	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.530E-01	0.0832
Pu-239	0.000E+00	0.0000	1.359E-01	0.0320	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-01	0.0915
Pu-240	0.000E+00	0.0000	1.359E-01	0.0320	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-01	0.0915
Pu-241	0.000E+00	0.0000	2.676E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.670E-03	0.0018
Sr-90	0.000E+00	0.0000	1.764E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.613E-02	0.0109
Tc-99	0.000E+00	0.0000	1.240E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.374E-04	0.0002
Th-232	0.000E+00	0.0000	1.296E-01	0.0305	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.426E-01	0.1279
U-233	0.000E+00	0.0000	1.091E-02	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.943E-02	0.0187
U-234	0.000E+00	0.0000	1.065E-02	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.594E-02	0.0179
U-235	0.000E+00	0.0000	9.646E-03	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.357E-02	0.0173
U-238	0.000E+00	0.0000	9.067E-03	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.536E-02	0.0178
Total	0.000E+00	0.0000	9.778E-01	0.2305	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.264E+00	0.7695

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

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	3.018E-03	0.0007
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	4.612E-03	0.0011
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	4.178E-01	0.0985
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	4.200E-01	0.0990
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	2.999E-01	0.0707
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	2.371E-01	0.0559
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	4.374E-03	0.0010
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	1.955E-02	0.0046
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	2.055E-03	0.0005
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	2.814E-03	0.0007
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	4.083E-04	0.0001
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	2.269E-03	0.0005
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	2.288E-01	0.0539
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	4.761E-01	0.1123
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	5.242E-01	0.1236
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	5.241E-01	0.1236
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	1.035E-02	0.0024
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	4.631E-02	0.0109
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	8.498E-04	0.0002
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	6.722E-01	0.1585
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	9.034E-02	0.0213
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	8.660E-02	0.0204
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	8.321E-02	0.0196
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	8.442E-02	0.0199
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.241E+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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	1.182E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.007E-03	0.0002
Al-26	0.000E+00	0.0000	6.763E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-03	0.0003
Am-241	0.000E+00	0.0000	1.060E-01	0.0221	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.030E-01	0.0632
Am-243	0.000E+00	0.0000	1.078E-01	0.0225	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.092E-01	0.0645
Cm-243	0.000E+00	0.0000	6.051E-02	0.0126	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-01	0.0376
Cm-244	0.000E+00	0.0000	4.334E-02	0.0090	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.250E-01	0.0261
Co-60	0.000E+00	0.0000	8.856E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.330E-03	0.0003
Cs-137	0.000E+00	0.0000	3.459E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E-02	0.0033
Eu-152	0.000E+00	0.0000	2.749E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.259E-03	0.0003
Eu-154	0.000E+00	0.0000	2.625E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.359E-03	0.0003
Eu-155	0.000E+00	0.0000	1.801E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.143E-04	0.0000
Nb-94	0.000E+00	0.0000	1.654E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.878E-04	0.0002
Np-237	0.000E+00	0.0000	5.661E-02	0.0118	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.721E-01	0.0359
Pu-238	0.000E+00	0.0000	1.147E-01	0.0239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.287E-01	0.0686
Pu-239	0.000E+00	0.0000	1.359E-01	0.0283	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.881E-01	0.0809
Pu-240	0.000E+00	0.0000	1.358E-01	0.0283	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.878E-01	0.0809
Pu-241	0.000E+00	0.0000	2.989E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.558E-03	0.0018
Sr-90	0.000E+00	0.0000	1.417E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.707E-02	0.0077
Tc-99	0.000E+00	0.0000	4.396E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.969E-04	0.0001
Th-232	0.000E+00	0.0000	1.667E-01	0.0348	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.256E+00	0.2619
U-233	0.000E+00	0.0000	1.112E-02	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.002E-02	0.0167
U-234	0.000E+00	0.0000	1.063E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.576E-02	0.0158
U-235	0.000E+00	0.0000	9.670E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.364E-02	0.0154
U-238	0.000E+00	0.0000	9.043E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.515E-02	0.0157
Total	0.000E+00	0.0000	9.710E-01	0.2025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.824E+00	0.7975

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	1.019E-03	0.0002
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	1.635E-03	0.0003
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	4.090E-01	0.0853
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	4.169E-01	0.0869
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	2.411E-01	0.0503
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	1.684E-01	0.0351
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	1.339E-03	0.0003
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	1.588E-02	0.0033
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	1.287E-03	0.0003
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	1.385E-03	0.0003
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	1.161E-04	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	8.043E-04	0.0002
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	2.287E-01	0.0477
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	4.434E-01	0.0925
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	5.240E-01	0.1093
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	5.236E-01	0.1092
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	1.155E-02	0.0024
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	3.721E-02	0.0078
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	3.013E-04	0.0001
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	1.423E+00	0.2967
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	9.114E-02	0.0190
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	8.639E-02	0.0180
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	8.331E-02	0.0174
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	8.419E-02	0.0176
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.795E+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)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	2.273E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.936E-08	0.0000
Al-26	0.000E+00	0.0000	2.125E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.117E-08	0.0000
Am-241	0.000E+00	0.0000	8.568E-02	0.0193	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E-01	0.0550
Am-243	0.000E+00	0.0000	1.001E-01	0.0225	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.872E-01	0.0646
Cm-243	0.000E+00	0.0000	6.916E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.062E-02	0.0046
Cm-244	0.000E+00	0.0000	1.743E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.019E-03	0.0011
Co-60	0.000E+00	0.0000	6.408E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.625E-09	0.0000
Cs-137	0.000E+00	0.0000	4.323E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.979E-03	0.0004
Eu-152	0.000E+00	0.0000	2.547E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.167E-05	0.0000
Eu-154	0.000E+00	0.0000	2.186E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.131E-06	0.0000
Eu-155	0.000E+00	0.0000	6.202E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.935E-10	0.0000
Nb-94	0.000E+00	0.0000	5.180E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.468E-08	0.0000
Np-237	0.000E+00	0.0000	5.631E-02	0.0127	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.712E-01	0.0385
Pu-238	0.000E+00	0.0000	5.629E-02	0.0127	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.614E-01	0.0363
Pu-239	0.000E+00	0.0000	1.354E-01	0.0304	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.868E-01	0.0870
Pu-240	0.000E+00	0.0000	1.344E-01	0.0302	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.839E-01	0.0863
Pu-241	0.000E+00	0.0000	2.992E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.552E-03	0.0019
Sr-90	0.000E+00	0.0000	1.589E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.156E-03	0.0009
Tc-99	0.000E+00	0.0000	1.381E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.327E-09	0.0000
Th-232	0.000E+00	0.0000	1.921E-01	0.0432	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.648E+00	0.3706
U-233	0.000E+00	0.0000	1.323E-02	0.0030	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.574E-02	0.0193
U-234	0.000E+00	0.0000	1.043E-02	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.398E-02	0.0166
U-235	0.000E+00	0.0000	1.060E-02	0.0024	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.629E-02	0.0172
U-238	0.000E+00	0.0000	8.799E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.312E-02	0.0164
Total	0.000E+00	0.0000	8.150E-01	0.1832	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.633E+00	0.8168

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

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	1.959E-08	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	5.139E-08	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	3.306E-01	0.0743
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	3.873E-01	0.0871
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	2.753E-02	0.0062
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	6.762E-03	0.0015
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	9.689E-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	1.984E-03	0.0004
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	1.192E-05	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	1.153E-06	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	3.997E-10	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	2.520E-08	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	2.275E-01	0.0511
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	2.177E-01	0.0489
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	5.223E-01	0.1174
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	5.183E-01	0.1165
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	1.154E-02	0.0026
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	4.172E-03	0.0009
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	9.465E-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	1.840E+00	0.4137
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	9.897E-02	0.0222
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	8.441E-02	0.0190
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	8.689E-02	0.0195
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	8.192E-02	0.0184
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.448E+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 = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	1.019E-02	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.912E-02	0.0079
Am-243	0.000E+00	0.0000	4.870E-02	0.0133	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.397E-01	0.0380
Cm-243	0.000E+00	0.0000	1.555E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.441E-04	0.0001
Cm-244	0.000E+00	0.0000	3.370E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.626E-04	0.0003
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	4.014E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.838E-12	0.0000
Eu-152	0.000E+00	0.0000	7.280E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.158E-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	5.344E-02	0.0145	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.626E-01	0.0443
Pu-238	0.000E+00	0.0000	4.887E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.538E-04	0.0000
Pu-239	0.000E+00	0.0000	1.311E-01	0.0357	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.744E-01	0.1019
Pu-240	0.000E+00	0.0000	1.213E-01	0.0330	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.465E-01	0.0943
Pu-241	0.000E+00	0.0000	3.569E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.020E-03	0.0003
Sr-90	0.000E+00	0.0000	4.990E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.305E-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	1.920E-01	0.0523	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.648E+00	0.4485
U-233	0.000E+00	0.0000	3.040E-02	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.316E-01	0.0358
U-234	0.000E+00	0.0000	8.723E-03	0.0024	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.283E-02	0.0171
U-235	0.000E+00	0.0000	1.906E-02	0.0052	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.882E-02	0.0269
U-238	0.000E+00	0.0000	6.700E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.565E-02	0.0151
Total	0.000E+00	0.0000	6.225E-01	0.1694	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.052E+00	0.8306

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

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	3.931E-02	0.0107
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	1.884E-01	0.0513
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	5.996E-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	1.300E-03	0.0004
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	1.842E-12	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	2.886E-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	2.161E-01	0.0588
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	2.027E-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	5.054E-01	0.1376
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	4.678E-01	0.1273
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	1.377E-03	0.0004
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	1.310E-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	1.840E+00	0.5008
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	1.620E-01	0.0441
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	7.156E-02	0.0195
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.179E-01	0.0321
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	6.235E-02	0.0170
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	3.674E+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) 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	3.404E-05	3.018E-05	1.019E-05	1.959E-10	0.000E+00
Al-26	Al-26	1.000E+00	5.176E-05	4.612E-05	1.635E-05	5.139E-10	0.000E+00
Am-241	Am-241	1.000E+00	4.188E-03	4.178E-03	4.090E-03	3.305E-03	3.928E-04
Am-241	Np-237+D	1.000E+00	3.703E-10	1.110E-09	7.684E-09	6.609E-08	2.725E-07
Am-241	U-233	1.000E+00	2.128E-16	1.488E-15	6.981E-14	5.895E-12	2.894E-10
Am-241	Th-229+D	1.000E+00	6.915E-20	1.037E-18	3.187E-16	2.619E-13	1.481E-10
Am-241	ãDSR(j)		4.188E-03	4.178E-03	4.090E-03	3.306E-03	3.931E-04
Am-243+D	Am-243+D	1.000E+00	4.204E-03	4.200E-03	4.168E-03	3.859E-03	1.784E-03
Am-243+D	Pu-239	1.000E+00	7.547E-08	2.263E-07	1.578E-06	1.451E-05	9.936E-05
Am-243+D	U-235+D	1.000E+00	3.933E-18	2.752E-17	1.297E-15	1.145E-13	8.032E-12
Am-243+D	Pa-231	1.000E+00	3.156E-22	4.733E-21	1.459E-18	1.234E-15	8.708E-13
Am-243+D	Ac-227+D	1.000E+00	3.995E-24	1.231E-22	2.286E-19	1.160E-15	1.568E-12
Am-243+D	ãDSR(j)		4.204E-03	4.200E-03	4.169E-03	3.873E-03	1.884E-03
Cm-243	Cm-243	2.400E-03	7.375E-06	7.197E-06	5.782E-06	6.472E-07	1.997E-16
Cm-243	Am-243+D	2.400E-03	4.700E-10	1.394E-09	8.742E-09	3.355E-08	1.713E-08
Cm-243	Pu-239	2.400E-03	5.637E-15	3.918E-14	1.722E-12	8.507E-11	8.965E-10
Cm-243	U-235+D	2.400E-03	2.206E-25	3.291E-24	9.632E-22	5.210E-19	6.953E-17
Cm-243	Pa-231	2.400E-03	1.418E-29	4.375E-28	8.237E-25	4.619E-21	7.247E-18
Cm-243	Ac-227+D	2.400E-03	1.498E-31	9.354E-30	1.052E-25	3.927E-21	1.301E-17
Cm-243	ãDSR(j)		7.375E-06	7.199E-06	5.791E-06	6.808E-07	1.803E-08
Cm-243	Cm-243	9.976E-01	3.065E-03	2.992E-03	2.403E-03	2.690E-04	8.302E-14
Cm-243	Pu-239	9.976E-01	7.471E-08	2.217E-07	1.395E-06	5.640E-06	5.978E-06
Cm-243	U-235+D	9.976E-01	3.901E-18	2.711E-17	1.194E-15	6.013E-14	7.897E-13
Cm-243	Pa-231	9.976E-01	3.134E-22	4.676E-21	1.370E-18	7.510E-16	1.158E-13
Cm-243	Ac-227+D	9.976E-01	3.970E-24	1.219E-22	2.171E-19	7.490E-16	2.133E-13
Cm-243	ãDSR(j)		3.066E-03	2.992E-03	2.405E-03	2.746E-04	5.978E-06
Cm-244	Cm-244	1.350E-06	3.324E-09	3.199E-09	2.267E-09	7.227E-11	7.844E-26
Cm-244	Cm-244	4.950E-08	1.219E-10	1.173E-10	8.311E-11	2.650E-12	2.876E-27
Cm-244	Pu-240	4.950E-08	1.358E-14	4.006E-14	2.377E-13	6.972E-13	6.433E-13
Cm-244	ãDSR(j)		1.219E-10	1.173E-10	8.335E-11	3.347E-12	6.433E-13
Cm-244	Cm-244	1.000E+00	2.462E-03	2.370E-03	1.679E-03	5.353E-05	5.810E-20
Cm-244	Pu-240	1.000E+00	2.744E-07	8.094E-07	4.802E-06	1.409E-05	1.300E-05
Cm-244	U-236	1.000E+00	4.295E-16	2.974E-15	1.259E-13	5.006E-12	5.404E-11
Cm-244	Th-232	1.000E+00	3.085E-26	4.590E-25	1.307E-22	5.956E-20	8.090E-18
Cm-244	Ra-228+D	1.000E+00	1.650E-27	4.979E-26	7.536E-23	1.104E-19	1.797E-17
Cm-244	Th-228+D	1.000E+00	2.375E-29	1.391E-27	8.848E-24	2.565E-20	4.462E-18
Cm-244	ãDSR(j)		2.463E-03	2.371E-03	1.684E-03	6.762E-05	1.300E-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	4.989E-05	4.374E-05	1.339E-05	9.689E-11	0.000E+00
Cs-137+D	Cs-137+D	1.000E+00	2.000E-04	1.955E-04	1.588E-04	1.984E-05	1.842E-14
Eu-152	Eu-152	7.208E-01	1.561E-05	1.481E-05	9.276E-06	8.593E-08	4.002E-28
Eu-152	Eu-152	2.792E-01	6.045E-06	5.738E-06	3.593E-06	3.329E-08	1.550E-28
Eu-152	Gd-152	2.792E-01	7.514E-19	2.203E-18	1.237E-17	2.919E-17	2.886E-17
Eu-152	ãDSR(j)		6.045E-06	5.738E-06	3.593E-06	3.329E-08	2.886E-17
Eu-154	Eu-154	1.000E+00	3.045E-05	2.814E-05	1.385E-05	1.153E-08	1.851E-39
Eu-155	Eu-155	1.000E+00	4.695E-06	4.083E-06	1.161E-06	3.997E-12	0.000E+00
Nb-94	Nb-94	1.000E+00	2.546E-05	2.269E-05	8.043E-06	2.520E-10	0.000E+00
Np-237+D	Np-237+D	1.000E+00	2.288E-03	2.288E-03	2.287E-03	2.275E-03	2.155E-03
Np-237+D	U-233	1.000E+00	1.972E-09	5.915E-09	4.134E-08	3.891E-07	3.287E-06
Np-237+D	Th-229+D	1.000E+00	8.543E-13	5.979E-12	2.823E-10	2.549E-08	2.200E-06
Np-237+D	ãDSR(j)		2.288E-03	2.288E-03	2.287E-03	2.275E-03	2.161E-03
Pu-238	Pu-238	1.840E-09	8.831E-12	8.761E-12	8.159E-12	4.005E-12	3.249E-15
Pu-238	Pu-238	1.000E+00	4.799E-03	4.761E-03	4.434E-03	2.176E-03	1.766E-06
Pu-238	U-234	1.000E+00	1.225E-09	3.660E-09	2.470E-08	1.673E-07	2.371E-07
Pu-238	Th-230	1.000E+00	1.865E-14	1.303E-13	6.012E-12	4.370E-10	1.079E-08
Pu-238	Ra-226+D	1.000E+00	2.059E-18	3.082E-17	9.352E-15	6.771E-12	1.835E-09
Pu-238	Pb-210+D	1.000E+00	8.386E-20	2.582E-18	4.742E-15	2.133E-11	1.129E-08
Pu-238	ãDSR(j)		4.799E-03	4.761E-03	4.434E-03	2.177E-03	2.027E-06
Pu-239	Pu-239	1.000E+00	5.242E-03	5.242E-03	5.240E-03	5.223E-03	5.054E-03
Pu-239	U-235+D	1.000E+00	4.097E-13	1.229E-12	8.589E-12	8.096E-11	6.928E-10
Pu-239	Pa-231	1.000E+00	4.384E-17	3.068E-16	1.448E-14	1.299E-12	1.055E-10
Pu-239	Ac-227+D	1.000E+00	6.928E-19	1.032E-17	2.972E-15	1.447E-12	1.949E-10
Pu-239	ãDSR(j)		5.242E-03	5.242E-03	5.240E-03	5.223E-03	5.054E-03
Pu-240	Pu-240	4.950E-08	2.595E-10	2.594E-10	2.592E-10	2.565E-10	2.316E-10
Pu-240	Pu-240	1.000E+00	5.242E-03	5.241E-03	5.236E-03	5.183E-03	4.678E-03
Pu-240	U-236	1.000E+00	1.227E-11	3.680E-11	2.571E-10	2.415E-09	1.993E-08
Pu-240	Th-232	1.000E+00	1.173E-21	8.208E-21	3.876E-19	3.504E-17	3.067E-15
Pu-240	Ra-228+D	1.000E+00	7.800E-23	1.141E-21	2.773E-19	6.718E-17	6.815E-15
Pu-240	Th-228+D	1.000E+00	1.336E-24	3.823E-23	3.726E-20	1.581E-17	1.693E-15
Pu-240	ãDSR(j)		5.242E-03	5.241E-03	5.236E-03	5.183E-03	4.678E-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 (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Pu-241	Pu-241	1.000E+00	9.838E-05	9.376E-05	6.079E-05	7.982E-07	1.215E-25
Pu-241	Am-241	1.000E+00	3.306E-06	9.701E-06	5.468E-05	1.146E-04	1.376E-05
Pu-241	Np-237+D	1.000E+00	1.956E-13	1.350E-12	5.529E-11	1.783E-09	9.039E-09
Pu-241	U-233	1.000E+00	8.452E-20	1.254E-18	3.482E-16	1.334E-13	9.377E-12
Pu-241	Th-229+D	1.000E+00	2.201E-23	6.763E-22	1.221E-18	5.132E-15	4.691E-12
Pu-241	ãDSR(j)		1.017E-04	1.035E-04	1.155E-04	1.154E-04	1.377E-05
Pu-241+D	Pu-241+D	2.450E-05	2.693E-09	2.566E-09	1.664E-09	2.185E-11	3.327E-30
Pu-241+D	Np-237+D	2.450E-05	8.936E-15	2.624E-14	1.496E-13	3.724E-13	3.557E-13
Pu-241+D	U-233	2.450E-05	5.155E-21	3.559E-20	1.467E-18	5.114E-17	5.325E-16
Pu-241+D	Th-229+D	2.450E-05	1.679E-24	2.492E-23	6.955E-21	2.827E-18	3.490E-16
Pu-241+D	ãDSR(j)		2.693E-09	2.566E-09	1.664E-09	2.222E-11	3.566E-13
Sr-90+D	Sr-90+D	1.000E+00	4.745E-04	4.631E-04	3.721E-04	4.172E-05	1.310E-14
Tc-99	Tc-99	1.000E+00	9.536E-06	8.498E-06	3.013E-06	9.465E-11	0.000E+00
Th-232	Th-232	1.000E+00	4.818E-03	4.818E-03	4.818E-03	4.818E-03	4.817E-03
Th-232	Ra-228+D	1.000E+00	6.308E-04	1.796E-03	7.811E-03	1.087E-02	1.087E-02
Th-232	Th-228+D	1.000E+00	1.758E-05	1.079E-04	1.599E-03	2.715E-03	2.714E-03
Th-232	ãDSR(j)		5.467E-03	6.722E-03	1.423E-02	1.840E-02	1.840E-02
U-233	U-233	1.000E+00	9.019E-04	9.016E-04	8.991E-04	8.743E-04	6.610E-04
U-233	Th-229+D	1.000E+00	5.860E-07	1.758E-06	1.228E-05	1.154E-04	9.594E-04
U-233	ãDSR(j)		9.025E-04	9.034E-04	9.114E-04	9.897E-04	1.620E-03
U-234	U-234	1.000E+00	8.662E-04	8.659E-04	8.635E-04	8.398E-04	6.358E-04
U-234	Th-230	1.000E+00	1.978E-08	5.932E-08	4.147E-07	3.913E-06	3.387E-05
U-234	Ra-226+D	1.000E+00	2.909E-12	2.036E-11	9.600E-10	8.537E-08	6.377E-06
U-234	Pb-210+D	1.000E+00	1.479E-13	2.204E-12	6.360E-10	3.131E-07	3.955E-05
U-234	ãDSR(j)		8.662E-04	8.660E-04	8.639E-04	8.441E-04	7.156E-04
U-235+D	U-235+D	1.000E+00	8.320E-04	8.317E-04	8.294E-04	8.069E-04	6.124E-04
U-235+D	Pa-231	1.000E+00	1.335E-07	4.005E-07	2.796E-06	2.601E-05	1.946E-04
U-235+D	Ac-227+D	1.000E+00	2.809E-09	1.948E-08	8.371E-07	3.607E-05	3.717E-04
U-235+D	ãDSR(j)		8.321E-04	8.321E-04	8.331E-04	8.689E-04	1.179E-03
U-238	U-238	5.400E-05	4.274E-08	4.273E-08	4.261E-08	4.145E-08	3.146E-08
U-238+D	U-238+D	9.999E-01	8.444E-04	8.442E-04	8.419E-04	8.190E-04	6.216E-04
U-238+D	U-234	9.999E-01	1.228E-09	3.682E-09	2.570E-08	2.393E-07	1.806E-06
U-238+D	Th-230	9.999E-01	1.869E-14	1.308E-13	6.173E-12	5.546E-10	4.568E-08
U-238+D	Ra-226+D	9.999E-01	2.062E-18	3.092E-17	9.540E-15	8.110E-12	6.034E-09
U-238+D	Pb-210+D	9.999E-01	8.396E-20	2.588E-18	4.818E-15	2.495E-11	3.629E-08
U-238+D	ãDSR(j)		8.444E-04	8.442E-04	8.419E-04	8.192E-04	6.235E-04

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

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

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
Ag-108m	7.343E+05	8.285E+05	2.454E+06	1.276E+11	*2.609E+13
Al-26	4.830E+05	5.420E+05	1.529E+06	*1.921E+10	*1.921E+10
Am-241	5.969E+03	5.983E+03	6.112E+03	7.563E+03	6.360E+04
Am-243	5.947E+03	5.952E+03	5.996E+03	6.455E+03	1.327E+04
Cm-243	8.136E+03	8.336E+03	1.037E+04	9.080E+04	4.170E+06
Cm-244	1.015E+04	1.055E+04	1.485E+04	3.697E+05	1.924E+06
Co-60	5.011E+05	5.716E+05	1.867E+06	2.580E+11	*1.132E+15
Cs-137	1.250E+05	1.279E+05	1.575E+05	1.260E+06	*8.704E+13
Eu-152	1.155E+06	1.216E+06	1.943E+06	2.097E+08	*1.765E+14
Eu-154	8.211E+05	8.884E+05	1.805E+06	2.168E+09	*2.639E+14
Eu-155	5.324E+06	6.123E+06	2.154E+07	6.255E+12	*4.652E+14
Nb-94	9.819E+05	1.102E+06	3.108E+06	9.922E+10	*1.875E+11
Np-237	1.093E+04	1.093E+04	1.093E+04	1.099E+04	1.157E+04
Pu-238	5.209E+03	5.251E+03	5.638E+03	1.149E+04	1.234E+07
Pu-239	4.769E+03	4.769E+03	4.771E+03	4.787E+03	4.946E+03
Pu-240	4.769E+03	4.770E+03	4.775E+03	4.824E+03	5.344E+03
Pu-241	2.458E+05	2.416E+05	2.165E+05	2.166E+05	1.815E+06
Sr-90	5.269E+04	5.398E+04	6.719E+04	5.992E+05	*1.365E+14
Tc-99	2.622E+06	2.942E+06	8.297E+06	*1.697E+10	*1.697E+10
Th-232	4.573E+03	3.719E+03	1.757E+03	1.358E+03	1.359E+03
U-233	2.770E+04	2.767E+04	2.743E+04	2.526E+04	1.543E+04
U-234	2.886E+04	2.887E+04	2.894E+04	2.962E+04	3.494E+04
U-235	3.004E+04	3.004E+04	3.001E+04	2.877E+04	2.121E+04
U-238	2.960E+04	2.961E+04	2.969E+04	3.052E+04	4.010E+04

*At specific activity limit

Summary : CSI_Ground Troops_Internal
File : G:\RESRAD\CSI_GROUND TROOPS_INTERNAL.RAD

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 = 20.31 ñ 0.04 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ag-108m	1.000E+02	0.000E+00	3.404E-05	7.343E+05	2.938E-06	8.510E+06
Al-26	1.000E+02	0.000E+00	5.176E-05	4.830E+05	4.990E-06	5.010E+06
Am-241	1.000E+02	0.000E+00	4.188E-03	5.969E+03	3.992E-03	6.263E+03
Am-243	1.000E+02	0.000E+00	4.204E-03	5.947E+03	4.134E-03	6.047E+03
Cm-243	1.000E+02	0.000E+00	3.073E-03	8.136E+03	1.877E-03	1.332E+04
Cm-244	1.000E+02	0.000E+00	2.463E-03	1.015E+04	1.140E-03	2.194E+04
Co-60	1.000E+02	0.000E+00	4.989E-05	5.011E+05	3.453E-06	7.240E+06
Cs-137	1.000E+02	0.000E+00	2.000E-04	1.250E+05	1.251E-04	1.998E+05
Eu-152	1.000E+02	0.000E+00	2.165E-05	1.155E+06	7.529E-06	3.321E+06
Eu-154	1.000E+02	0.000E+00	3.045E-05	8.211E+05	6.149E-06	4.066E+06
Eu-155	1.000E+02	0.000E+00	4.695E-06	5.324E+06	2.749E-07	9.095E+07
Nb-94	1.000E+02	0.000E+00	2.546E-05	9.819E+05	2.453E-06	1.019E+07
Np-237	1.000E+02	0.000E+00	2.288E-03	1.093E+04	2.286E-03	1.094E+04
Pu-238	1.000E+02	0.000E+00	4.799E-03	5.209E+03	4.087E-03	6.116E+03
Pu-239	1.000E+02	0.000E+00	5.242E-03	4.769E+03	5.238E-03	4.773E+03
Pu-240	1.000E+02	0.000E+00	5.242E-03	4.769E+03	5.230E-03	4.780E+03
Pu-241	1.000E+02	40.02 ñ 0.08	1.269E-04	1.970E+05	1.229E-04	2.034E+05
Sr-90	1.000E+02	0.000E+00	4.745E-04	5.269E+04	2.896E-04	8.632E+04
Tc-99	1.000E+02	0.000E+00	9.536E-06	2.622E+06	9.192E-07	2.720E+07
Th-232	1.000E+02	107.5 ñ 0.2	1.840E-02	1.358E+03	1.719E-02	1.454E+03
U-233	1.000E+02	1.000E+03	1.620E-03	1.543E+04	9.205E-04	2.716E+04
U-234	1.000E+02	0.000E+00	8.662E-04	2.886E+04	8.616E-04	2.902E+04
U-235	1.000E+02	1.000E+03	1.179E-03	2.121E+04	8.353E-04	2.993E+04
U-238	1.000E+02	0.000E+00	8.445E-04	2.960E+04	8.393E-04	2.979E+04

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	3.404E-03	3.018E-03	1.019E-03	1.959E-08	0.000E+00
Al-26	Al-26	1.000E+00	5.176E-03	4.612E-03	1.635E-03	5.139E-08	0.000E+00
Am-241	Am-241	1.000E+00	4.188E-01	4.178E-01	4.090E-01	3.305E-01	3.928E-02
Am-241	Pu-241	1.000E+00	3.306E-04	9.701E-04	5.468E-03	1.146E-02	1.376E-03
Am-241	äDOSE(j)		4.191E-01	4.188E-01	4.145E-01	3.420E-01	4.066E-02
Np-237	Am-241	1.000E+00	3.703E-08	1.110E-07	7.684E-07	6.609E-06	2.725E-05
Np-237	Np-237	1.000E+00	2.288E-01	2.288E-01	2.287E-01	2.275E-01	2.155E-01
Np-237	Pu-241	1.000E+00	1.956E-11	1.350E-10	5.529E-09	1.783E-07	9.039E-07
Np-237	Pu-241	2.450E-05	8.936E-13	2.624E-12	1.496E-11	3.724E-11	3.557E-11
Np-237	äDOSE(j)		2.288E-01	2.288E-01	2.287E-01	2.275E-01	2.155E-01
U-233	Am-241	1.000E+00	2.128E-14	1.488E-13	6.981E-12	5.895E-10	2.894E-08
U-233	Np-237	1.000E+00	1.972E-07	5.915E-07	4.134E-06	3.891E-05	3.287E-04
U-233	Pu-241	1.000E+00	8.452E-18	1.254E-16	3.482E-14	1.334E-11	9.377E-10
U-233	Pu-241	2.450E-05	5.155E-19	3.559E-18	1.467E-16	5.114E-15	5.325E-14
U-233	U-233	1.000E+00	9.019E-02	9.016E-02	8.991E-02	8.743E-02	6.610E-02
U-233	äDOSE(j)		9.019E-02	9.016E-02	8.991E-02	8.747E-02	6.643E-02
Th-229	Am-241	1.000E+00	6.915E-18	1.037E-16	3.187E-14	2.619E-11	1.481E-08
Th-229	Np-237	1.000E+00	8.543E-11	5.979E-10	2.823E-08	2.549E-06	2.200E-04
Th-229	Pu-241	1.000E+00	2.201E-21	6.763E-20	1.221E-16	5.132E-13	4.691E-10
Th-229	Pu-241	2.450E-05	1.679E-22	2.492E-21	6.955E-19	2.827E-16	3.490E-14
Th-229	U-233	1.000E+00	5.860E-05	1.758E-04	1.228E-03	1.154E-02	9.594E-02
Th-229	äDOSE(j)		5.860E-05	1.758E-04	1.228E-03	1.155E-02	9.616E-02
Am-243	Am-243	1.000E+00	4.204E-01	4.200E-01	4.168E-01	3.859E-01	1.784E-01
Am-243	Cm-243	2.400E-03	4.700E-08	1.394E-07	8.742E-07	3.355E-06	1.713E-06
Am-243	äDOSE(j)		4.204E-01	4.200E-01	4.168E-01	3.859E-01	1.784E-01
Pu-239	Am-243	1.000E+00	7.547E-06	2.263E-05	1.578E-04	1.451E-03	9.936E-03
Pu-239	Cm-243	2.400E-03	5.637E-13	3.918E-12	1.722E-10	8.507E-09	8.965E-08
Pu-239	Cm-243	9.976E-01	7.471E-06	2.217E-05	1.395E-04	5.640E-04	5.978E-04
Pu-239	Pu-239	1.000E+00	5.242E-01	5.242E-01	5.240E-01	5.223E-01	5.054E-01
Pu-239	äDOSE(j)		5.242E-01	5.242E-01	5.243E-01	5.243E-01	5.160E-01
U-235	Am-243	1.000E+00	3.933E-16	2.752E-15	1.297E-13	1.145E-11	8.032E-10
U-235	Cm-243	2.400E-03	2.206E-23	3.291E-22	9.632E-20	5.210E-17	6.953E-15
U-235	Cm-243	9.976E-01	3.901E-16	2.711E-15	1.194E-13	6.013E-12	7.897E-11
U-235	Pu-239	1.000E+00	4.097E-11	1.229E-10	8.589E-10	8.096E-09	6.928E-08
U-235	U-235	1.000E+00	8.320E-02	8.317E-02	8.294E-02	8.069E-02	6.124E-02
U-235	äDOSE(j)		8.320E-02	8.317E-02	8.294E-02	8.069E-02	6.124E-02
Pa-231	Am-243	1.000E+00	3.156E-20	4.733E-19	1.459E-16	1.234E-13	8.708E-11
Pa-231	Cm-243	2.400E-03	1.418E-27	4.375E-26	8.237E-23	4.619E-19	7.247E-16
Pa-231	Cm-243	9.976E-01	3.134E-20	4.676E-19	1.370E-16	7.510E-14	1.158E-11
Pa-231	Pu-239	1.000E+00	4.384E-15	3.068E-14	1.448E-12	1.299E-10	1.055E-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	1.335E-05	4.005E-05	2.796E-04	2.601E-03	1.946E-02
Pa-231	ăDOSE(j)		1.335E-05	4.005E-05	2.796E-04	2.601E-03	1.946E-02
Ac-227	Am-243	1.000E+00	3.995E-22	1.231E-20	2.286E-17	1.160E-13	1.568E-10
Ac-227	Cm-243	2.400E-03	0.000E+00	9.354E-28	1.052E-23	3.927E-19	1.301E-15
Ac-227	Cm-243	9.976E-01	3.970E-22	1.219E-20	2.171E-17	7.490E-14	2.133E-11
Ac-227	Pu-239	1.000E+00	6.928E-17	1.032E-15	2.972E-13	1.447E-10	1.949E-08
Ac-227	U-235	1.000E+00	2.809E-07	1.948E-06	8.371E-05	3.607E-03	3.717E-02
Ac-227	ăDOSE(j)		2.809E-07	1.948E-06	8.371E-05	3.607E-03	3.717E-02
Cm-243	Cm-243	2.400E-03	7.375E-04	7.197E-04	5.782E-04	6.472E-05	1.997E-14
Cm-243	Cm-243	9.976E-01	3.065E-01	2.992E-01	2.403E-01	2.690E-02	8.302E-12
Cm-243	ăDOSE(j)		3.073E-01	2.999E-01	2.409E-01	2.697E-02	8.322E-12
Cm-244	Cm-244	1.350E-06	3.324E-07	3.199E-07	2.267E-07	7.227E-09	7.844E-24
Cm-244	Cm-244	4.950E-08	1.219E-08	1.173E-08	8.311E-09	2.650E-10	2.876E-25
Cm-244	ăDOSE(j)		3.446E-07	3.317E-07	2.350E-07	7.492E-09	8.131E-24
Pu-240	Cm-244	4.950E-08	1.358E-12	4.006E-12	2.377E-11	6.972E-11	6.433E-11
Pu-240	Pu-240	4.950E-08	2.595E-08	2.594E-08	2.592E-08	2.565E-08	2.316E-08
Pu-240	ăDOSE(j)		2.595E-08	2.595E-08	2.594E-08	2.572E-08	2.322E-08
Cm-244	Cm-244	1.000E+00	2.462E-01	2.370E-01	1.679E-01	5.353E-03	5.810E-18
Pu-240	Cm-244	1.000E+00	2.744E-05	8.094E-05	4.802E-04	1.409E-03	1.300E-03
U-236	Cm-244	1.000E+00	4.295E-14	2.974E-13	1.259E-11	5.006E-10	5.404E-09
U-236	Pu-240	1.000E+00	1.227E-09	3.680E-09	2.571E-08	2.415E-07	1.993E-06
U-236	ăDOSE(j)		1.227E-09	3.680E-09	2.572E-08	2.420E-07	1.998E-06
Th-232	Cm-244	1.000E+00	3.085E-24	4.590E-23	1.307E-20	5.956E-18	8.090E-16
Th-232	Pu-240	1.000E+00	1.173E-19	8.208E-19	3.876E-17	3.504E-15	3.067E-13
Th-232	Th-232	1.000E+00	4.818E-01	4.818E-01	4.818E-01	4.818E-01	4.817E-01
Th-232	ăDOSE(j)		4.818E-01	4.818E-01	4.818E-01	4.818E-01	4.817E-01
Ra-228	Cm-244	1.000E+00	1.650E-25	4.979E-24	7.536E-21	1.104E-17	1.797E-15
Ra-228	Pu-240	1.000E+00	7.800E-21	1.141E-19	2.773E-17	6.718E-15	6.815E-13
Ra-228	Th-232	1.000E+00	6.308E-02	1.796E-01	7.811E-01	1.087E+00	1.087E+00
Ra-228	ăDOSE(j)		6.308E-02	1.796E-01	7.811E-01	1.087E+00	1.087E+00
Th-228	Cm-244	1.000E+00	2.375E-27	1.391E-25	8.848E-22	2.565E-18	4.462E-16
Th-228	Pu-240	1.000E+00	1.336E-22	3.823E-21	3.726E-18	1.581E-15	1.693E-13
Th-228	Th-232	1.000E+00	1.758E-03	1.079E-02	1.599E-01	2.715E-01	2.714E-01
Th-228	ăDOSE(j)		1.758E-03	1.079E-02	1.599E-01	2.715E-01	2.714E-01
Co-60	Co-60	1.000E+00	4.989E-03	4.374E-03	1.339E-03	9.689E-09	0.000E+00
Cs-137	Cs-137	1.000E+00	2.000E-02	1.955E-02	1.588E-02	1.984E-03	1.842E-12

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	1.561E-03	1.481E-03	9.276E-04	8.593E-06	4.002E-26
Eu-152	Eu-152	2.792E-01	6.045E-04	5.738E-04	3.593E-04	3.329E-06	1.550E-26
Eu-152	ăDOSE(j)		2.165E-03	2.055E-03	1.287E-03	1.192E-05	5.552E-26
Gd-152	Eu-152	2.792E-01	7.514E-17	2.203E-16	1.237E-15	2.919E-15	2.886E-15
Eu-154	Eu-154	1.000E+00	3.045E-03	2.814E-03	1.385E-03	1.153E-06	0.000E+00
Eu-155	Eu-155	1.000E+00	4.695E-04	4.083E-04	1.161E-04	3.997E-10	0.000E+00
Nb-94	Nb-94	1.000E+00	2.546E-03	2.269E-03	8.043E-04	2.520E-08	0.000E+00
Pu-238	Pu-238	1.840E-09	8.831E-10	8.761E-10	8.159E-10	4.005E-10	3.249E-13
Pu-238	Pu-238	1.000E+00	4.799E-01	4.761E-01	4.434E-01	2.176E-01	1.766E-04
Pu-238	ăDOSE(j)		4.799E-01	4.761E-01	4.434E-01	2.176E-01	1.766E-04
U-234	Pu-238	1.000E+00	1.225E-07	3.660E-07	2.470E-06	1.673E-05	2.371E-05
U-234	U-234	1.000E+00	8.662E-02	8.659E-02	8.635E-02	8.398E-02	6.358E-02
U-234	U-238	9.999E-01	1.228E-07	3.682E-07	2.570E-06	2.393E-05	1.806E-04
U-234	ăDOSE(j)		8.662E-02	8.659E-02	8.635E-02	8.402E-02	6.378E-02
Th-230	Pu-238	1.000E+00	1.865E-12	1.303E-11	6.012E-10	4.370E-08	1.079E-06
Th-230	U-234	1.000E+00	1.978E-06	5.932E-06	4.147E-05	3.913E-04	3.387E-03
Th-230	U-238	9.999E-01	1.869E-12	1.308E-11	6.173E-10	5.546E-08	4.568E-06
Th-230	ăDOSE(j)		1.978E-06	5.932E-06	4.147E-05	3.914E-04	3.393E-03
Ra-226	Pu-238	1.000E+00	2.059E-16	3.082E-15	9.352E-13	6.771E-10	1.835E-07
Ra-226	U-234	1.000E+00	2.909E-10	2.036E-09	9.600E-08	8.537E-06	6.377E-04
Ra-226	U-238	9.999E-01	2.062E-16	3.092E-15	9.540E-13	8.110E-10	6.034E-07
Ra-226	ăDOSE(j)		2.909E-10	2.036E-09	9.600E-08	8.538E-06	6.385E-04
Pb-210	Pu-238	1.000E+00	8.386E-18	2.582E-16	4.742E-13	2.133E-09	1.129E-06
Pb-210	U-234	1.000E+00	1.479E-11	2.204E-10	6.360E-08	3.131E-05	3.955E-03
Pb-210	U-238	9.999E-01	8.396E-18	2.588E-16	4.818E-13	2.495E-09	3.629E-06
Pb-210	ăDOSE(j)		1.479E-11	2.204E-10	6.360E-08	3.132E-05	3.960E-03
Pu-240	Pu-240	1.000E+00	5.242E-01	5.241E-01	5.236E-01	5.183E-01	4.678E-01
Pu-241	Pu-241	1.000E+00	9.838E-03	9.376E-03	6.079E-03	7.982E-05	1.215E-23
Pu-241	Pu-241	2.450E-05	2.693E-07	2.566E-07	1.664E-07	2.185E-09	2.556E-28
Pu-241	ăDOSE(j)		9.838E-03	9.376E-03	6.079E-03	7.982E-05	1.215E-23
Sr-90	Sr-90	1.000E+00	4.745E-02	4.631E-02	3.721E-02	4.172E-03	1.310E-12
Tc-99	Tc-99	1.000E+00	9.536E-04	8.498E-04	3.013E-04	9.465E-09	0.000E+00
U-238	U-238	5.400E-05	4.274E-06	4.273E-06	4.261E-06	4.145E-06	3.146E-06
U-238	U-238	9.999E-01	8.444E-02	8.442E-02	8.419E-02	8.190E-02	6.216E-02
U-238	ăDOSE(j)		8.445E-02	8.442E-02	8.419E-02	8.190E-02	6.216E-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
Pa-231	U-235	1.000E+00	0.000E+00	2.115E-03	2.109E-02	2.050E-01	1.541E+00
Pa-231	äS(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	äS(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	äS(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	äS(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	äS(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	äS(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	äS(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	äS(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	äS(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
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	ΣS(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	ΣS(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	ΣS(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	ΣS(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	ΣS(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	ΣS(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	ΣS(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	ΣS(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01

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

RESCALC.EXE execution time = 4.97 seconds

Appendix G

Evaluation of Personnel Dose as a Result of Wound Exposure from Contaminated Soils

(7 Pages)

Wednesday, January 14, 2015

Evaluation of Personnel Dose as a Result of Wound Exposure from Contaminated Soils

Introduction

The National Council on Radiation Protection and Measurements (NCRP) report No. 156, *Development of a Biokinetic Model for Radionuclide Contaminated Wounds and Procedures for Their Assessment, Dosimetry and Treatment,* presents a biokinetic model for intakes of radionuclides via contaminated wounds. The report states that "radionuclide-contaminated wounds have potentially serious health consequences because a natural barrier to radionuclide penetration has been breached. As a result, the contaminating radionuclide has direct access to blood and extracellular fluids, and ultimately, to internal tissues and organs."

The companion paper "Dose Coefficients for Intakes of Radionuclides via Contaminated Wounds" provides the results of coupling the NCRP wound model with the International Commission on Radiological Protection (ICRP) systemic biokinetic models for 22 commonly encountered elements to generate tables of dose coefficients 38 radionuclides. These dose coefficients can be used to determine doses to personnel from radioactive materials deposited in wounds.

Discussion

Discussions with the U.S. Air Force (USAF) have resulted in an interest in calculating doses to military personnel that may result from wounds obtained during field exercises inadvertently conducted in radiologically contaminated areas on the Nevada Test and Training Range/Tonopah Test Range (NTTR/TTR). These areas have uranium and transuranic materials as the primary contaminants. The NTTR Small Boy site had a low fission yield; and the NTTR/TTR Double Tracks site and Clean Slate I, II, and III sites were safety experiments with no fission yield. The *Health Physics* journal article "Radionuclide Transport from Soil to Air, Native Vegetation, Kangaroo Rats and Grazing Cattle on the Nevada Test Site" reports that in areas where fission occurred, most of the radionuclides were incorporated into particles of silicate glass. The radioactivity occurred as either spherical glass particles (usually solid) or glass coatings (often containing gas voids) on sand particles or silicate glass that were sponge-like, highly porous, and very fragile. At sites where the nonfission explosions did not yield sufficiently high temperatures to produce silicate glass particles, the radioactivity occurred predominately as high-density oxide particles. The USAF has selected a Construction Worker scenario for the Double Tracks and Clean Slate II sites; and a Ground Troops scenario for the Clean Slate I, III, and Small Boy sites.

This evaluation will present information concerning the dose that personnel may receive from exposure to radioactive contamination in soil through a wound. The following are relevant excerpts from NCRP Report 156 that give some understanding of the process for calculating personnel doses from radioactive materials deposited in a wound:

- The vast majority of contaminated wounds have occurred in facilities involved in the production, fabrication, or maintenance of components for nuclear weapons; and the contaminants involved have been actinides (uranium, plutonium, and americium).

  - More than 90% of wounds have occurred in the hands and arms, primarily the fingers.
  - Almost 90% of wounds have involved mechanical damage, mostly punctures; chemical burns from acid solutions account for almost all the others, with relatively few thermal burns reported.

- Because of the high radiotoxicity of the transuranics in particular, the vast majority of workers who have experienced wounds contaminated with these radionuclides have undergone prompt medical intervention to minimize systemic uptake of the radionuclide. These interventions include surface decontamination such as scrubbing with various agents; surgical debridement or excision of the wound site; and therapy with appropriate chelating or blocking agents to increase the excretion rate of absorbed radionuclides and consequently reduce the radiation dose delivered to internal organs and tissues.
- The uptake of activity into the systemic circulation from a wound site is highly variable, depending on the physical and chemical form of the radionuclide, the depth of the wound and extent of tissue injury, the treatment given, and the time elapsed between injury and treatment. For example, for most wounds, excision (often repeated) can remove >90% of the initial activity from the wound site.
- In almost all cases of wounds contaminated with transuranics, the chelating agent zinc- or calcium-diethylene triamine pentaacetate acid (DTPA) is administered; it is effective for enhancing the excretion of soluble forms (e.g., nitrates) of these radionuclides from the body, **but is essentially ineffective in removing less-soluble forms such as oxides** (emphasis added).
- The general trend of radionuclide absorption from the abraded skin is the same as was observed for those same radionuclides applied to skin incisions or deposited in puncture wounds. The amounts of the individual radionuclides absorbed from an undisturbed skin abrasion are nearly the same as from a deeper cut (laceration). Therefore, the default fractions of early radionuclide absorption from a puncture wound, suggested for application to contaminated lacerations, can reasonably be applied to the case of contaminated abraded skin.
- Modeling the retention and translocation of radioelements deposited in wound sites as initially insoluble materials is more difficult than for soluble materials, because there are few suitable datasets from which model parameter estimates can be obtained. The consequence of this lack of data for deposited colloids, precipitates, particles, and fragments is that it is impractical to consider developing default groupings of radionuclides based on their chemical properties, such as was done with the radionuclides injected in initially soluble forms. The several wound retention equations predict that, if those solids were allowed to remain undisturbed for 10 years, the fractional amounts of actinide translocated from a wound site would be 3% of the implanted depleted uranium (DU) metal, 1.4% of the implanted plutonium metal, 0.25% of the plutonium and americium associated with the implanted fallout particles composed mainly of structural materials, and 0.13% of the plutonium and americium contained in the implanted fallout particles composed mainly of UO_2 or soil constituents.
- The wound model (Figure 4.4) was used to obtain sets of intercompartmental transfer rates that described wound retention and systemic absorption of actinides implanted as solid fragments (1 mm diameter) in simulated wounds in animals. Those transfer rates are recommended for use as analytical tools in investigations of accidental woundings with fragments of uranium or DU metal, plutonium metal, or minispheres of structural materials such as aluminum or steel contaminated with radionuclides.

The paper "Dose Coefficients for Intakes of Radionuclides via Contaminated Wounds" takes a further step of coupling the NCRP wound model with the ICRP systemic biokinetic models for 22 commonly encountered elements to generate tables of dose coefficients for 38 radionuclides. It includes examples for using the dose coefficients to generate derived reference guides and clinical decision guides. Effective dose coefficients are shown for the relevant radionuclidesfor all wound model categories as described. These values may be used to generate guides for wound intakes that will produce an effective or organ equivalent dose equal to some limit if no attempts are made to reduce the radionuclide content at the wound site or to accelerate radionuclide excretion.

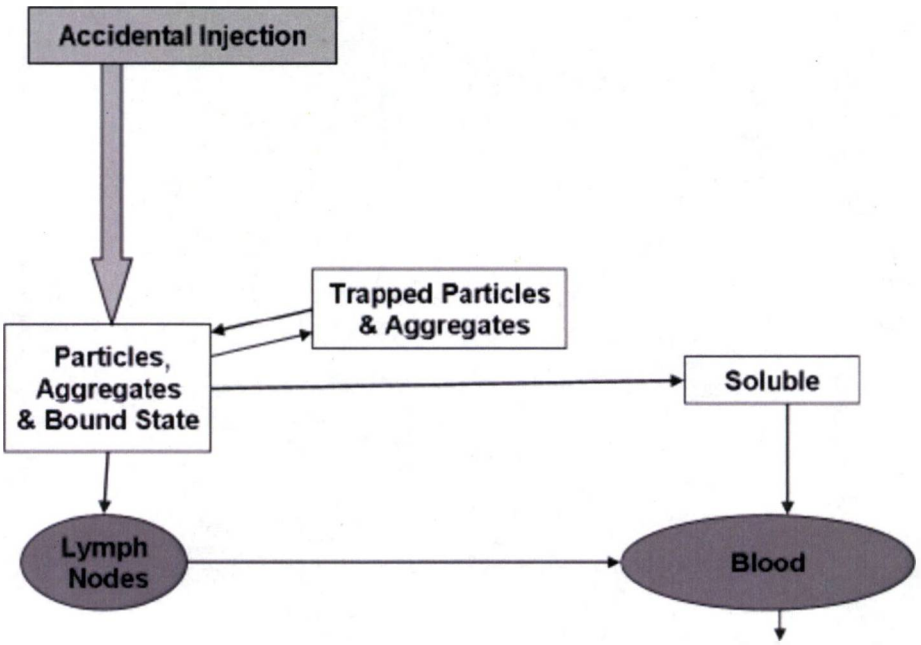

Fig. 4.4. Wound model for injection of particles into the PABS compartment.

Assumptions

Wound Scenario

As stated in the Discussion section, most wounds occur in the hands or arms. In industrial activities, puncture wounds to hands and fingers are the most likely. For field activities, lacerations and abrasions to hands and arms also seem likely. The size of the wound has a direct effect on the surface area where contaminated soil could be retained and thus be available for transport into the blood. For this evaluation, it is assumed that the wound site is a small cut or abrasion on an extremity such as a hand, forearm, foot, or lower leg.

It is presumed that initial first aid will remove visible debris from the wound, but there will be no excision of tissue. It is also assumed that no chelating agents will be administered.

The mass of material remaining in the wound is assumed to be 1 µg. The NCRP Report 156 includes some discussion of individuals with imbedded DU fragments with masses in the 100s of mg range. Because any visible fragments (presumably with masses in the mg and greater range) are removed, the mass of soil remaining in the wound would be in the µg range.

Radionuclides

Radionuclides that contribute significantly to internal dose typically emit α radiation. The relevant nuclides that are present in tests conducted at the NTTR/TTR by the DOE include ^{241}Am, ^{238}Pu, ^{239}Pu, ^{241}Pu, ^{234}U, ^{235}U, and ^{238}U.

Wound Model

The assumed wound model as stated in the Discussion section and shown in Figure 4.4 is for injected insoluble particles of silicate glass; glass coatings on sand particles; and/or high-density oxides, which are the most likely radioactive materials encountered at the NTTR/TTR.

Dose Determination

Dose conversion factors from "Dose Coefficients for Intakes of Radionuclides via Contaminated Wounds" are shown in Table 1. Column 3 of Table 1 shows a conversion of the coefficients from Sv·Bq^{-1} to mrem·pCi^{-1}.

Table 1: Dose Conversion Factors for the Particle Wound Model

Radionuclide	Effective Dose Coefficient (Sv·Bq^{-1})	Effective Dose Coefficient (mrem·pCi^{-1})
^{234}U	1.92E-06	7.10E-03
^{235}U	1.78E-06	6.59E-03
^{238}U	1.73E-06	6.40E-03
^{238}Pu	3.36E-04	1.24E+00
^{239}Pu	3.90E-04	1.44E+00
^{241}Pu	9.23E-06	3.42E-02
^{241}Am	3.23E-04	1.20E+00

The *Federal Facility Agreement and Consent Order* (FFACO) dose of interest is 25 mrem/yr. Using the dose conversion factors from Table 1, an intake activity that would result in a 25-mrem dose was calculated using Equation 1, and the results are shown in Table 2.

$$Intake\ activity = \frac{E_{50}}{EDC} \qquad \textit{Equation 1}$$

Where:
E_{50} = Effective dose (25 mrem)
EDC = Effective dose coefficient (mrem·pCi^{-1})

Table 2: Intake Activity Resulting in 25-mrem E_{50}

Radionuclide	Intake Activity (pCi)
^{234}U	3.52E+03
^{235}U	3.80E+03
^{238}U	3.91E+03
^{238}Pu	2.01E+01
^{239}Pu	1.73E+01
^{241}Pu	7.32E+02
^{241}Am	2.09E+01

Using the assumptions from above, the soil concentration that could produce a 25-mrem dose from 1 µg of soil for each radionuclide is calculated using Equation 2.

$$Soil\ Concentration = \frac{E_{50} * CF}{EDC * mass} \qquad \textit{Equation 2}$$

Where:
E_{50} = Effective dose (25 mrem)
CF = 1E+06 (unit conversion factor)
EDC = Effective dose coefficient (mrem·pCi^{-1})
mass = soil in wound (assumed 1 µg)

Table 3 shows the calculated soil concentrations that could produce an E_{50} of 25 mrem and has a comparison with the Construction Worker and Ground Troops scenarios residual radioactive material guidelines (RRMGs). Note that the soil concentration is inversely proportional to the mass of soil retained in the wound. If a larger mass is assumed, then the soil concentration would be reduced, For example, if 1 mg were retained in the wound, the resulting soil concentration for ^{239}Pu would be reduced to 1.73E+04 pCi·g^{-1}, which would be approximately 3 times the Construction Worker and Ground Troops scenario RRMGs.

The Construction Worker scenario assumes primarily outdoor construction activities that may include road construction/maintenance, underground utilities excavation, and/or target or other structure placement. A typical construction worker is anticipated to spend a maximum of 120 days per year at the site, and will spend an average of 6 hours outdoors and 2 hours indoors during the work day. In this scenario, soil may be disturbed up to a depth of 0.45 meters below the ground surface to account for the placement of structure footers and/or building foundations.

The Ground Troops scenario assumes 100 percent outdoor activities that may include performing light, moderate, and hard physical labor and periods at rest. This scenario assumes that the troops bivouac at the site. The maximum amount of time an individual ground troop could be deployed during any single mission or operation is 14 days, 24 hours per day, and will participate in 3 such deployments a year. This results in a total of 1,008 hours per year of potential exposure.

Table 3: Soil Concentration Resulting in 25-mrem E_{50}, and the Construction Worker and Ground Troops Scenario Internal Dose RRMGs

Radionuclide	Soil Concentration (pCi g^{-1})	Construction Worker Internal Dose RRMG (pCi g^{-1})	Ground Troops Internal Dose RRMG (pCi g^{-1})
^{234}U	3.52E+09	6.12E+04	2.89E+04
^{235}U	3.80E+09	6.68E+04	3.00E+04
^{238}U	3.91E+09	6.99E+04	2.96E+04
^{238}Pu	2.01E+07	5.86E+03	5.21E+03
^{239}Pu	1.73E+07	5.35E+03	4.77E+03
^{241}Pu	7.32E+08	2.77E+05	2.46E+05
^{241}Am	2.09E+07	6.70E+03	5.98E+03

Table 4 shows the calculated effective dose using Equation 3 that would result from a wound that was contaminated with 1 µg of the maximum measured soil concentrations at the Double Tracks and Clean Slate III locations.

$$E_{50} = SC * mass * EDC * CF \qquad \textit{Equation 3}$$

Where:
E_{50} = Effective dose
SC = Soil concentration (pCi·g^{-1})
$mass$ = Soil in wound (assumed 1 µg)
EDC = Effective dose coefficient (mrem·pCi^{-1})
CF = 1E-06 (unit conversion factor)

Table 4: Calculated E_{50} for a Wound Contaminated with the Maximum Soil Concentrations at Double Tracks and Clean Slate III

Radionuclide	Double Tracks Soil Concentration (pCi g^{-1})[a]	Double Tracks E_{50} (mrem)	Clean Slate III Soil Concentration (pCi g^{-1})[b]	Clean Slate III E_{50} (mrem)
^{234}U	1.45	1.0E-08	18.5	1.3E-07
^{235}U	ND[c]	NA[d]	6.8	4.5E-08
^{238}U	1.25	8.0E-09	31.1	2.0E-07
^{238}Pu	8.7	1.1E-05	93	1.2E-04
^{239}Pu	1,380	2.0E-03	27,700	4.0E-02
^{241}Pu	ND[c]	NA[d]	ND[c]	NA[d]
^{241}Am	65	7.8E-05	1,540	1.8E-03

[a]Maximum values for radionuclides at Double Tracks from sampling conducted in 2012.
[b]Maximum values for radionuclides at Clean Slate III from the sampling conducted in the late 1990s.
[c]Not detected
[d]Not applicable

Conclusions

The E_{50} from maximum known soil concentrations at the Double Tracks and Clean Slate III sites are insignificant as compared to the 25-mrem FFACO dose of interest.

The dose to an individual from a wound contaminated with radioactive soils is directly dependent on the amount of material remaining after first-aid measures have been completed. The soil concentration that would result in a dose of 25 mrem is inversely proportional to the mass of soil remaining in the wound. The Construction Worker and Ground Troops scenario RRMGs for the radionuclides of concern would be 3 to 5 orders of magnitude smaller than the soil concentrations that would result in a 25-mrem E_{50} from a wound based on a 1-µg deposition.

References

National Council on Radiation Protection and Measurements. *Development of a Biokinetic Model for Radionuclide-Contaminated Wounds and Procedures for Their Assessment, Dosimetry and Treatment*, NCRP Report No. 156. Bethesda, MD.

Toohey, R.E., L. Bertelli, S.L. Sugarman, A.L. Wiley, and D. M. Christensen. 2011. "Dose Coefficients for Intakes of Radionuclides via Contaminated Wounds." In *Health Physics*, Vol. 100(5): pp. 508–514.

Gilbert, R.O., J.H. Shinn, E.H. Essington, T. Tamura, E.M. Romney, K.S. Moore, and T.P. O'Farrell. 1988. "Radionuclide Transport from Soil to Air, Native Vegetation, Kangaroo Rats and Grazing Cattle on the Nevada Test Site." In *Health Physics*, Vol. 55(6): pp. 869–887.

Federal Facility Agreement and Consent Order. 1996 (as amended March 2010). Agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management.

Appendix H

Nevada Division of Environmental Protection Comments

(14 Pages)

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1.) 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): …".	
2.) 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 412 is clean closure. This presumption is based on the following: - Completion of the 1997 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 1997 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 2010 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)	
3.) 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."	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
4.) 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 QAP [NNSA/NSO, 2012c]). The following has been added at the end of the first paragraph of Section 2.2.1: "Data collected in the three site characterization events described in this subsection are presented as informational data, as defined in the *Soils Activity 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 Activity 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 Activity 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 Activity QAP (NNSA/NSO, 2012c). These data were used to bias removable contamination survey locations for the 2012	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
			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 the first paragraph in 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 Activity 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 412."	
5.) 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 Activity QAP.	
6.) Section 2.2.1, Pages 7-8, All Paragraphs		Each of the three 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 three site characterization phases were reported in the *Corrective Action Decision Document, Corrective Action Unit 412*; there are not separate reports for each phase. To clarify, the following was added to the last sentence of the first paragraph of Section 2.2.1, "The results of the three site characterization phases are found in the *Corrective Action Decision Document, Corrective Action Unit 412* (DOE/NV, 1997b)." Note: The following reference was added to Section 8.0: U.S. Department of Energy, Nevada Operations Office. 1997b. *Corrective Action Decision Document, Corrective Action Unit No. 412*, Rev. 1, DOE/NV--472. Las Vegas, NV.	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
7.) Section 2.2.3, Page 10, 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 added to the last sentence of Section 2.2.3, second paragraph, as follows, "The results of the KIWI survey are shown in Figure 2-1 (NSTec, 2009)."	
8.) Figure 2-1, Page 11		Confirm the KIWI survey was conducted in 1997: NDEP has an archival report showing an apparent post-remediation KIWI image dated November 1996.	Per the April 9, 2015, comment resolution meeting, this comment was withdrawn by NDEP.	
9.) Section 2.2.3, Page 10, 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 1997 KIWI survey, which was conducted at a height approximately 2.5 ft above the ground surface. Figure 2-2 shows the results of the 2006 aerial survey, which was conducted at a height approximately 50 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."	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
10.) Section 2.2.5.2, Page 15, 1st Paragraph		Is there a figure reference for this survey?	As a result of this comment and #11 and #12, 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 #11) and the locations of the 2012 sample plots (see comment #12), which coincide with the locations of the removable contamination surveys mentioned in this comment.	
11.) Figure 2-4, Page 16		- Add all the bulleted surface features identified in Section 2.2.5.3 - "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. - 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.	
12.) Section 2.2.5.4, Page 17, 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.	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
13.) Section 3.2.1.2, Page 22, 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 412.” - 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 last two sentences of the second 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 412 Closure Report. No changes were made to the document.	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
14.) Figure 3-2, Page 25		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 230 ft. bgs. - Is Vertical Transport intended below UXO? Very difficult to see. - If "CSI' refers to "Clean Slate I" 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 230 ft bgs)” - The vertical transport arrows beneath the UXO symbol were darkened. - The abbreviation “CSI” 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 CSI site is located on Cactus Flat, which is bordered by the Cactus and Kawich mountains (see Section B.2.2.4).	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
15.) Section 4.1, Page 27, 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 412 based on the history of the CSI experiment and on chemical analyses that were performed during previous investigations, as discussed in Section B.2.2.2.”	
16.) Section 4.4.1, Page 33, 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 412, consistent with its responsibilities under applicable law.”	
17.) Section B.2.2.4, Page B- 8, 1st Paragraph		Based on these DTW statements, showing DTW at CSI exactly at 230 bgs in Figure 2-1 may not appropriate for a 'conceptual' drawing.	See comment response to Comment #14.	
18.) Section B.2.2.5, 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?	Per the April 9, 2015, comment resolution meeting, this comment was withdrawn by NDEP.	

Nevada Environmental Management Operations Activity

DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
19.) 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 1997 data, the calculated inhalation dose to a receptor was 0.4 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 CSI site in 1997, the year when the interim corrective actions took place (Black and Townsend, 1998; NNSA/NSO, 2003)." Note: The following reference was added to Section B.9.0, *References*: Black, S.C, and Y.E. Townsend ed. 1998. *Nevada Test Site Annual Site Environmental Report for Calendar Year 1997*, DOE/NV/11718-231. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV: Bechtel Nevada.	
20.) 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, 1997a; 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, 1997a; NNSA/NSO, 2003)."	

Nevada Environmental Management Operations Activity

DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
21.) 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. 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: *-Clean Slate Corrective Action Investigation Plan* (DOE/NV, 1996) *- Corrective Action Decision Document, Corrective Action Unit No. 412* (DOE/NV, 1997c) *- Clean Slate 1 Corrective Action Plan* (DOE/NV, 1997a) *- Closure Report for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion* (NNSA/NSO, 2003) - 1997 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, 2013a) Note: The following reference was added to Section B.9.0, *References*: Navarro-Intera, LLC. 2013a. *Preliminary Investigation Results and Recommendation for CAUs 411, 412, 413, and 414*, Rev. 0, N-I/28091--052. Las Vegas, NV.	
22.) Section B.5.2, Page B-18, 1st Paragraph		3rd sentence: provide reference after, "GZ area."	Per the April 9, 2015, comment resolution meeting, this comment was withdrawn by NDEP.	

Nevada Environmental Management Operations Activity

DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
23.) Section D.2.16.2, Page D-22, 1st Paragraph		Last sentence: although not sensitive for CAU 412 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 D.2.16.1, *Model Response to Parameter*, lower values of precipitation provide lower RRMG values for the radionuclides present at CAU 412. 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.	
24.) Section 2.1, Page 6, 1st Paragraph		1. Sentence beginning with, "An area of...": to the extent possible, refine the date(s) when the site was fenced. 2. Sentence beginning with, "In 1997, an interim...": to the extent possible, briefly describe how and where contaminated soil and debris were disposed.	1. To clarify, the sixth, seventh, and eight sentences of Section 2.1 were revised to read, “After the test, metal and concrete debris was scraped from the ground surface and mounded at GZ, and the immediate area surrounding GZ was fenced (DOE/NV, 1996). As a result of a 1973 FIDLER survey, an outer fence was constructed that encompassed approximately 57 acres, including the area previously fenced (DOE/NV, 1997b). This outer fence is still intact and posted with “Contamination Area” signs.” 2. The following has been added after the last sentence of Section 2.1, “The soil and debris was disposed of as low-level radioactive waste at the NNSS (NNSA/NSO, 2003).”	
25.) Section 2.2, Page 7, 2nd Paragraph		1st sentence: seems to imply no investigation was conducted previously, although Section 2.2, 1st sentence says site was studied extensively.	The sentence was revised to read, “With the signing of the FFACO in 1996, the CSI site became subject to the FFACO site closure process, additional investigation of the site began, and CAU 412 was created.”	
26.) Section 2.2, Page 7, Table 2-1		Suggest re-title, for example, "FFACO Site Characterization Activities Between 2006 and 2012", i.e., has any applicable work been accomplished between 2012 and present?	The table title was revised to read, “Summary of CAU 412 Activities from 1996 to Present”.	

Nevada Environmental Management Operations Activity

DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
27.) Section 4.3, Page 28, 1st Paragraph		Last sentence: identify "the decision makers".	The sentence was revised to read, “If an unexpected condition indicates that conditions are significantly different than the corresponding CSM, the activity will be evaluated and NDEP will be notified.”	
28.) Section 4.4.1, Page 33, 1st Paragraph		Last sentence: identify, "regulators".	Per the April 9, 2015, comment resolution meeting, this comment was withdrawn by NDEP.	
29.) Section 4.3.5, Page 31, 1st. Paragraph		2nd Sentence: clarify briefly what it means to say soil data will be "validated", i.e., from Section 7.2.	The second sentence was revised to read, “All soil sample data used in making DQO decisions will conform to the requirements for decisional data as stipulated in the Soils Activity QAP (NNSA/NFO, 2012c).”	

Nevada Environmental Management Operations Activity
DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
30.) Section B.8.1, Page B-27, 2nd Paragraph		1st sentence: clarify why averaging TRS and aerial survey data (reducing spatial resolution?) was used to bias sample locations. Higher spatial resolution would appear to confer more accurately biased sample site selection.	To clarify, the first sentence of the second paragraph of Section B.8.1 was deleted and replaced with the following, "As explained in Section 6.2 of the Soils RBCA document (NNSA/NFO, 2014), the radiological survey data (aerial and KIWI) were averaged over every 1,000-m^2 area of the site. This provides data at the resolution equivalent to a minimal exposure area for the most exposed individual. These data were then used to identify areas to perform intensive ground surveys to bias sample locations to the areas of highest radioactivity." Note: The data from the KIWI and aerial surveys are in the form of isopleths. All values within the isopleths are equal to the value of the isopleth. Therefore, the resolution of the data is very poor to begin with. Producing a data point over each 1,000-m^2 area creates an intensive dataset that has higher resolution than the original data. Starting with datasets of point data is much preferable and much more precise, but only the isopleth data are available. As with every other site, the results of the 1,000-m^2 averaging is to find the areas with the highest relative values so that we can perform an intensive ground survey with the appropriate field instrument (e.g., FIDLER or PRM-470) to locate precisely the locations from which to sample (again, highest relative measurements).	

Nevada Environmental Management Operations Activity

DOCUMENT REVIEW SHEET

1. Document Title/Number:	Final Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 412: Clean Slate I Plutonium Dispersion, Tonopah Test Range, Nevada	**2. Document Date:**	1/21/2015
3. Revision Number:	0	**4. Originator/Organization:**	Navarro
5. Responsible NNSA/NFO Activity Lead:	Tiffany A. Lantow	**6. Date Comments Due:**	
7. Review Criteria:	Full		
8. Reviewer/Organization/Phone No:	Chris Andres and Scott Page, NDEP, (702) 486-2850 exts. 232 and 237	**9. Reviewer's Signature:**	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
31.) Section B.8.2.2, Page B-31, 1st Paragraph		Sentence beginning with, "Six random grab...": Consider samples also be taken from within soil mounds because surface sampling only assumes contamination heterogeneity which may not be correct; also plutonium activity is frequently associated with silt-sized particles easily moved by wind (T. Tamura, 1975) and erosion/runoff, which may have reduced surface Pu activity on the mound surfaces but left higher activity levels within.	The sampling approach for the soil mounds was modified to include the collection of one composite soil sample from the interior of each mound to verify the CSM assumption of homogeneity. In order to be consistent with the language in the main document, the second to last sentence in Section B.8.2.2 was revised to read, “Six random subsamples will be collected from the surface (0 to 5 cm [0 to 2 in.]) of each mound and composited. The surface composite soil sample will be analyzed for gamma spectroscopy, isotopic Pu, isotopic Am, isotopic U, and Pu-241.” In addition, the following was added after the last sentence of the paragraph: “One composite soil sample from the interior of each mound will also be collected to confirm the homogeneity of the mounds. For each mound, this sample will be collected at the same six random subsample locations at which the surface composite sample was collected, but at a depth of 15 to 30 cm (6 to 12 in.) below the surface of the mound. These interior soil samples will be analyzed for the same parameters as the surface composite soil samples.”	
32.) Section C.1.1, Page C-1, 3rd Paragraph		1. Sentence beginning with, "The evaluation concluded..."; use the commonly preferred spelling: "embedded". 2. Consider adding the special analysis described in this paragraph as an appendix because it appears to be an important part of dose calculation methodology.	1. The sentence was revised to read, “The evaluation concluded that the additional dose a potential receptor would receive from a wound embedded with contaminated soil from either a remediated or non-remediated site was insignificant when compared to the 25-mrem/yr action level.” 2. The wound evaluation was added as an appendix to the SAFER.	

Library Distribution List

	Copies
U.S. Department of Energy Office of Scientific and Technical Information P.O. Box 62 Oak Ridge, TN 37831-0062	1 (Uncontrolled, electronic copy)
Southern Nevada Public Reading Facility c/o Nuclear Testing Archive P.O. Box 98521, M/S 400 Las Vegas, NV 89193-8521	2 (Uncontrolled, electronic copies)
Manager, Northern Nevada FFACO Public Reading Facility c/o Nevada State Library & Archives 100 N Stewart Street Carson City, NV 89701-4285	1 (Uncontrolled, electronic copy)