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Corrective Action Investigation Plan for Corrective Action Unit 414: Clean Slate III Plutonium Dispersion (TTR) Tonopah Test Range, Nevada

Controlled Copy No.: ___
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September 2016

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/s/ Joseph P. Johnston 09/27/2016
Joseph P. Johnston, Navarro CO Date

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CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 414: CLEAN SLATE III PLUTONIUM DISPERSION (TTR) TONOPAH TEST RANGE, NEVADA

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

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CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 414:
CLEAN SLATE III PLUTONIUM DISPERSION (TTR)
TONOPAH TEST RANGE, NEVADA

Approved by: /s/ Tiffany A. Lantow Date: 09/26/2016

Tiffany A. Lantow
Soils Activity Lead

Approved by: /s/ Robert F. Boehlecke Date: 09/26/2016

Robert F. Boehlecke
Environmental Management Operations Manager

Table of Contents

Table of Contents *(Continued)*

Table of Contents *(Continued)*

Table of Contents *(Continued)*

Table of Contents (Continued)

List of Figures

List of Figures *(Continued)*

List of Tables

List of Acronyms and Abbreviations

Ac	Actinium
AEC	Atomic Energy Commission
AF	Area factor
Ag	Silver
Al	Aluminum
ALARA	As low as reasonably achievable
Am	Americium
amsl	Above mean sea level
ASTM	ASTM International
bgs	Below ground surface
CA	Contamination area
CAA	Corrective action alternative
CADD	Corrective action decision document
CAI	Corrective action investigation
CAIP	Corrective action investigation plan
CAS	Corrective action site
CAU	Corrective action unit
CFR	*Code of Federal Regulations*
cm	Centimeter
Cm	Curium
COC	Contaminant of concern
COPC	Contaminant of potential concern
cpm	Counts per minute
Cs	Cesium
CS	Clean Slate
CSI	Clean Slate I
CSII	Clean Slate II

List of Acronyms and Abbreviations *(Continued)*

CSIII	Clean Slate III
CSM	Conceptual site model
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
DQO	Data quality objective
DRI	Desert Research Institute
DT	Double Tracks
DU	Depleted uranium
EPA	U.S. Environmental Protection Agency
Eu	Europium
°F	Degrees Fahrenheit
FAL	Final action level
FD	Field duplicate
FFACO	*Federal Facility Agreement and Consent Order*
FIDLER	Field instrument for the detection of low-energy radiation
FSL	Field-screening level
FSR	Field-screening result
ft	Foot
GPS	Global Positioning System
GT	Ground Troops
GZ	Ground zero
HASL	Health and Safety Laboratory
HCA	High contamination area
HPGe	High-purity germanium
hr/day	Hours per day

List of Acronyms and Abbreviations *(Continued)*

hr/yr	Hours per year
IDW	Investigation-derived waste
in.	Inch
in./yr	Inches per year
K	Potassium
K_d	Distribution coefficient
LCL	Lower confidence limit
m	Meter
m^2	Square meter
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
MEI	Most exposed individual
mi	Mile
mi^2	Square mile
MOB	Multiples of background
mph	Miles per hour
mrem	Millirem
mrem/IA-yr	Millirem per Industrial Area year
mrem/GT-yr	Millirem per Ground Troops year
mrem/yr	Millirem per year
N/A	Not applicable
NAC	*Nevada Administrative Code*
NAD	North American Datum
NAEG	Nevada Applied Ecology Group
Nb	Niobium
ND	Not detected
NDEP	Nevada Division of Environmental Protection

List of Acronyms and Abbreviations *(Continued)*

NEPA	*National Environmental Policy Act*
NNSA/NFO	U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office
NNSS	Nevada National Security Site
NTTR	Nevada Test and Training Range
Pa	Protactinium
PAL	Preliminary action level
Pb	Lead
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
PET	Potential evapotranspiration
PI	Preliminary investigation
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
RBCA	Risk-based corrective action
RCRA	*Resource Conservation and Recovery Act*
RRMG	Residual radioactive material guideline
SG	Study Group
Sr	Strontium
SVOC	Semivolatile organic compound
TBD	To be determined
TCLP	Toxicity Characteristic Leaching Procedure
TED	Total effective dose

List of Acronyms and Abbreviations (Continued)

Th	Thorium
Tl	Thallium
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
$\mu Ci/m^3$	Microcuries per cubic meter
μCi/mL	Microcuries per milliliter

Executive Summary

Corrective Action Unit (CAU) 414 is located on the Tonopah Test Range, which is approximately 130 miles northwest of Las Vegas, Nevada, and approximately 40 miles southeast of Tonopah, Nevada. The CAU 414 site consists of the release of radionuclides to the surface and shallow subsurface from the conduct of the Clean Slate III (CSIII) storage–transportation test conducted on June 9, 1963. CAU 414 includes one corrective action site (CAS), TA-23-03CS (Pu Contaminated Soil).

The known releases at CAU 414 are the result of the atmospheric dispersal of contamination from the 1963 CSIII test. The CSIII test was a nonnuclear detonation of a nuclear device located inside a reinforced concrete bunker covered with 8 feet of soil. This test dispersed radionuclides, primarily uranium and plutonium, on the ground surface.

The presence and nature of contamination at CAU 414 will be evaluated based on information collected from a corrective action investigation (CAI). The investigation is based on the data quality objectives (DQOs) developed on June 7, 2016, by representatives of the Nevada Division of Environmental Protection; the U.S. Air Force; 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 develop and evaluate appropriate corrective action alternatives for CAU 414.

The CAI will include radiological surveys, geophysical surveys, collection and analyses of samples, and assessment of investigation results. The collection of soil samples will be accomplished using both probabilistic and judgmental sampling approaches. Radiological contamination will be evaluated based on a comparison of total effective dose at sample locations to the dose-based final action level that will be established in the Corrective Action Decision Document in accordance with the *Soils Risk-Based Corrective Action Evaluation Process* document. To facilitate site investigation and the evaluation of DQO decisions, the releases at CAU 414 have been divided into five study groups, as shown in Table ES-1. The CAI process will be conducted in accordance with the *Soils Activity Quality Assurance Plan*, which establishes requirements, technical planning, and general quality practices to be applied to this activity.

Table ES-1
CAU 414 Study Groups

Number	Name
1	Undisturbed Areas
2	Disturbed Areas
3	Drainages
4	Buried Debris
5	Potential Source Material

This Corrective Action Investigation Plan has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada; DOE, Environmental Management; U.S. Department of Defense; and DOE, Legacy Management. Under the *Federal Facility Agreement and Consent Order*, this Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains activity-specific information, including a site description, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 414: Clean Slate III Plutonium Dispersion (TTR).

This CAIP 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.

CAU 414 is located on the Tonopah Test Range (TTR), which is approximately 130 miles (mi) northwest of Las Vegas, Nevada, and approximately 40 mi southeast of Tonopah, Nevada. The TTR is located within the Nevada Test and Training Range (NTTR), which is administered by the U.S. Air Force (USAF). CAU 414 comprises one corrective action site (CAS), TA-23-03CS (Pu Contaminated Soil). The location of CAU 414 is shown on Figure 1-1. Because CAU 414 consists of a single CAS, the CAS nomenclature is generally not used in this CAIP. Instead, the CAS is referred to as the Clean Slate III (CSIII) site or CAU 414 throughout this document.

The corrective action investigation (CAI) at CAU 414 will include radiological surveys, geophysical surveys, collection and analyses of samples, and assessment of investigation results. Data will be obtained to support the evaluation of corrective action alternatives (CAAs) and waste management decisions.

1.1 Purpose

CAU 414 is being investigated because hazardous and/or radioactive contaminants have been released and may be present in concentrations that exceed risk-based corrective action (RBCA) levels. Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend CAAs for this CAU. Additional information will be generated by conducting a CAI before evaluating and selecting CAAs.

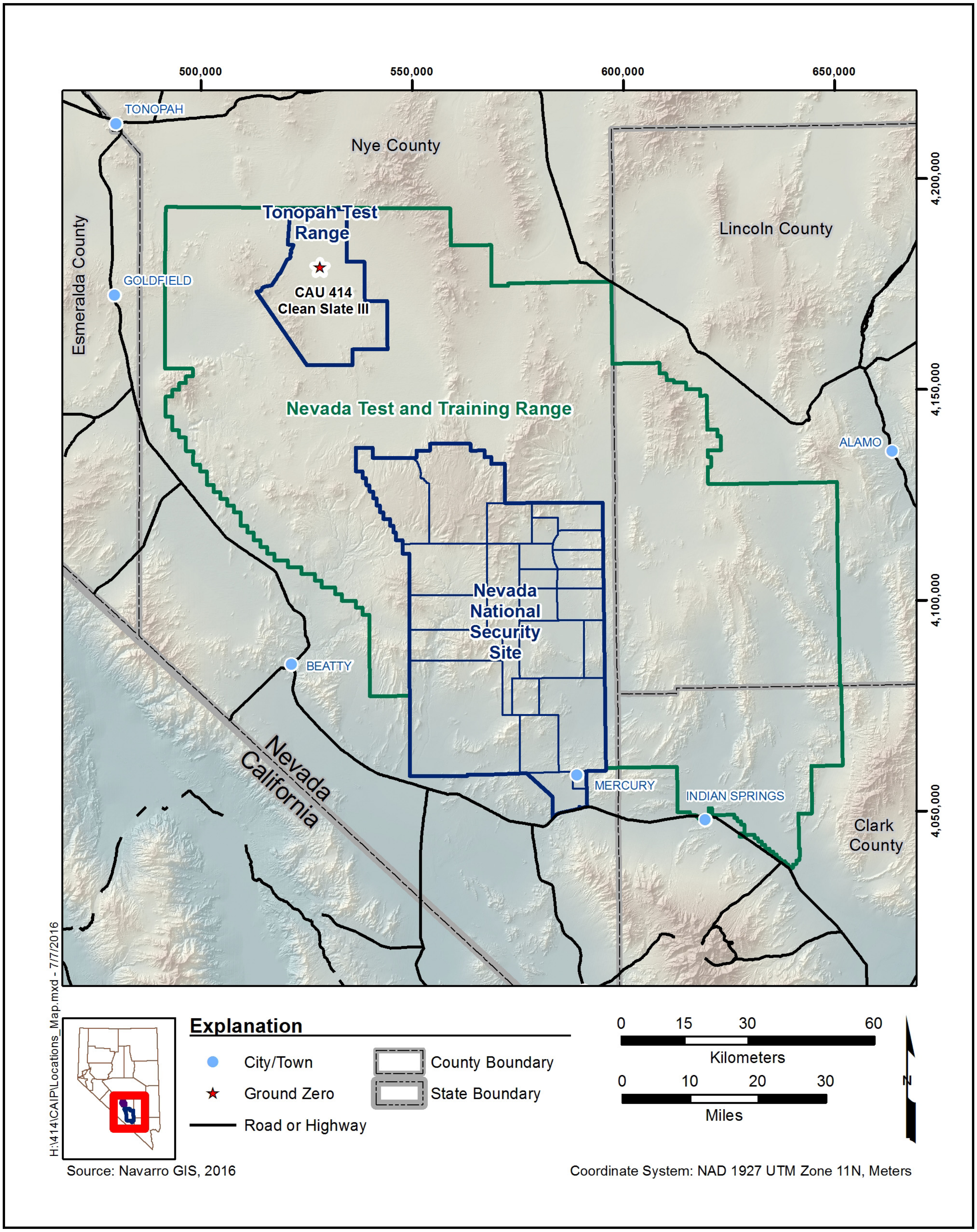

Figure 1-1
CAU 414 Location Map

1.1.1 CAU 414 History and Description

CAU 414 consists of the release of radionuclides to the surface and subsurface from a storage–transportation test conducted on June 9, 1963 (NNSA/NFO, 2015c). The operational history for CAU 414 is detailed in Section 2.2.

1.1.2 Data Quality Objective Summary

The data quality objectives (DQOs) for CAU 414 were developed at a meeting with the Nevada Division of Environmental Protection (NDEP); USAF; and the DOE, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) on June 7, 2016. The DQOs identified and defined the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 414. During the DQO discussions, the informational inputs or data needs to resolve problem statements and decision statements were documented. This CAIP describes the investigative approach developed to collect the necessary data identified in the DQO process. Discussions of the DQO methodology and the DQOs specific to CAU 414 are presented in Appendix A. A summary of the DQO process is provided below.

The DQO problem statement for CAU 414 is as follows: “Existing information on the nature and extent of contamination is insufficient to evaluate CAAs for CAU 414.” To address this problem, resolution of the decision statements presented in Section 3.4 is required. The informational inputs and data required to resolve the problem and decision statements were generated as part of the DQO process for this CAU and are documented in Appendix A. The CAU 414 CAI strategy includes using both judgmental and probabilistic sampling.

For judgmental sampling decisions, any contaminant associated with CAU 414 that is present at concentrations exceeding its corresponding final action level (FAL) will be defined as a contaminant of concern (COC). For probabilistic sampling decisions, any contaminant for which the 95 percent upper confidence limit (UCL) of the mean exceeds its corresponding FAL will be defined as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NFO, 2014).

A probabilistic sampling design will be used to collect samples from unbiased locations within a 100-square meter (m^2) area. Results from these locations will be used to infer a characteristic representative of the sampled area as a whole (i.e., representing the average of the entire area, not the maximum at any one location). The characteristic normally used to define contamination within an area is the 95 percent UCL of the mean dose. Implementation of the probabilistic sampling design is described in Section A.8.1.2.

A corrective action will be determined for any site containing a COC. The evaluation of the need for corrective action will include the potential for wastes that are present at the site to cause the future contamination of soil if the wastes were to be released (see Section 3.4).

A discussion on the risks associated with removable contamination is presented in the Soils Risk-Based Corrective Action (RBCA) document (NNSA/NFO, 2014). This discussion proposes the assumption that the removable contamination at any area that exceeds high contamination area (HCA) criteria has the potential to cause a dose exceeding the FAL even though the *in situ* contamination does not exceed the FAL. Therefore, it is assumed that areas that exceed HCA criteria require corrective action.

The DQOs for CAU 414 defined similarities in the conceptual site model (CSM) properties of the releases that would allow a common investigative approach (e.g., surface deposition of relatively immobile contaminants, migration and mixing of contaminants from previous activities, migration by surface water runoff in drainages). Based on these similarities, study groups were established to simplify the planning and investigation of various releases (Table 1-1). The study groups are described in Section 2.4. While the need for corrective action is evaluated for each release, investigation strategies are defined at the study group level, and CAAs are implemented at the FFACO CAS level.

Table 1-1
CAU 414 Study Groups

Number	Name
SG1	Undisturbed Areas
SG2	Disturbed Areas
SG3	Drainages
SG4	Buried Debris
SG5	Potential Source Material

PSM = Potential source material
SG = Study Group

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO process, the scope of the CAI for CAU 414 includes the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Conduct radiological surveys.
- Remove PSM and other debris for disposal.
- Conduct geophysical surveys.
- Perform radiological field screening.
- Measure *in situ* external dose rates using thermoluminescent dosimeters (TLDs).
- Collect and submit environmental samples for laboratory analyses.
- Collect quality control (QC) samples.

Soil and/or debris contamination originating from activities not identified in the CSM (see Section A.2.2) will not be considered as part of this CAU unless the CSM and the DQOs are modified to include the release. If not included in the CSM, contamination originating from these sources will not be considered for sample location selection and/or will not be considered COCs. If such contamination is present, the means for addressing the contamination will be documented in the corrective action decision document (CADD).

1.3 CAIP Contents

Section 1.0 presents the purpose and scope of this CAIP, while Section 2.0 provides background information about CAU 414. Objectives of the investigation, including the CSM, are presented in Section 3.0. Field investigation and sampling activities are discussed in Section 4.0, and waste management is discussed in Section 5.0. General field and laboratory quality assurance (QA) (including collection of QA samples) is presented in Section 6.0 and in the *Soils Activity Quality Assurance Plan* (QAP) (NNSA/NSO, 2012b). The activity schedule and records availability are discussed in Section 7.0, and Section 8.0 provides a list of references.

Appendix A provides a detailed discussion of the DQO methodology and the DQOs for CAU 414. Appendix B contains information on the activity organization. Appendix C presents information related to the development of hot spot criterion. Appendix D contains the RESRAD model output data for the hot spot criterion. Appendix E contains responses to NDEP comments on the draft version of this document.

2.0 Facility Description

The TTR is located in Nye County in southern Nevada, on the northwestern portion of the NTTR. The location of the TTR is indicated on Figure 1-1. The TTR, which occupies approximately 360 square miles (mi^2), is federally owned and access is restricted. The TTR is bordered on the south, east, and west sides by the NTTR and on the north side by sparsely populated public lands 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 26 mi west of the TTR boundary.

The general environmental setting of the TTR is described below. Where available, specific information relating to the CSIII site is included.

2.1 Physical Setting

The topography and terrain of the TTR is typical of the basin-and-range physiographic province of Nevada, Arizona, and Utah, consisting of numerous north–south trending linear mountain ranges separated by broad, flat-floored, and gently sloping valleys. The CSIII site is located in Cactus Flat, which is bordered by the Cactus Range to the west and the Kawich Range to the east (ERDA, 1975).

2.1.1 Topography and Terrain

The TTR is situated in the high desert region of south–central Nevada between two mountain ranges. Figure 2-1 shows the major topographic features of the area surrounding CAU 414. Along the west side of the TTR is the Cactus Range, a series of low rocky mountains with a peak elevation of about 7,500 feet [ft] above mean sea level (amsl). Along the eastern boundary is the Kawich Range with elevations ranging from 6,500 to 9,400 ft amsl. The highest elevations are found on Kawich Peak at 9,404 ft amsl and Cactus Peak at 7,482 ft amsl. The lowest elevation is found on the valley floor approximately midway between Cactus Flat and Gold Flat at 2,310 ft amsl (ERDA, 1975).

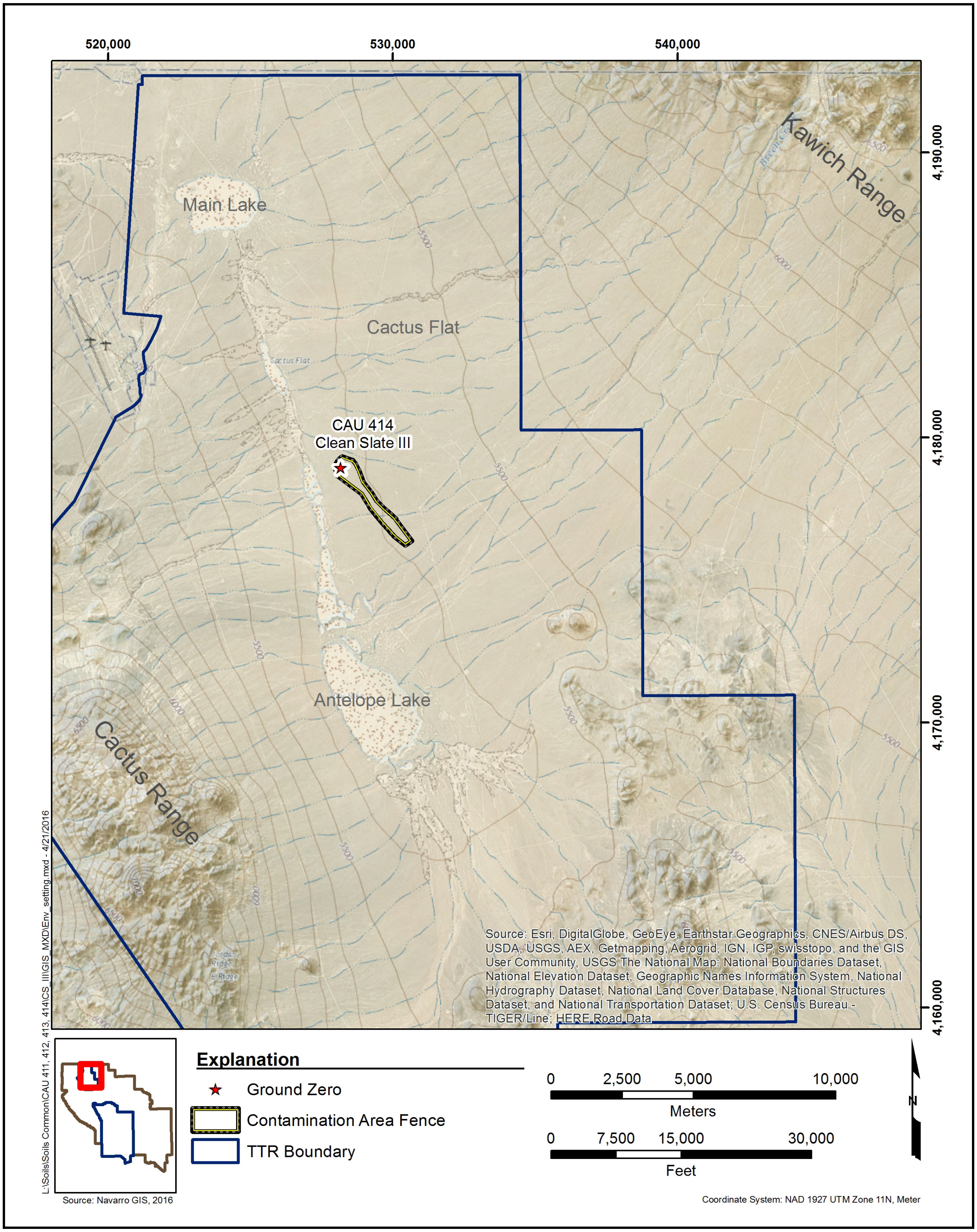

Figure 2-1
Topographical Features at CAU 414

2.1.2 Geology

The geology of the TTR comprises the following three major rock units (Ekren et al., 1971):

- Completely folded and faulted sedimentary rocks of Paleozoic age
- Volcanic tuffs, ashflows, and rhyolitic lavas of Tertiary age
- Alluvium of later Tertiary and Quaternary age derived from the surrounding exposures of Tertiary and Paleozoic rock

The Paleozoic sedimentary rocks comprise three major distinct sequences. The lower portion varies from 10,000 to 11,000 ft thick and is composed chiefly of quartzite, siltstone, and shale formations of late Precambrian to middle Cambrian in age. This is overlaid by a middle part that may be greater than 14,000 ft thick. This sequence is composed mostly of limestones and dolomites of middle Cambrian to Devonian in age. The upper portion of this sequence is estimated at more than 4,000 ft in thickness. This sequence represents sporadic depositional periods mostly during late Devonian and Mississippian time. The formations are mostly clastics composed of argillite, siltstone, quartzite, and conglomerate units. The Tertiary volcanic rocks are predominantly ash-flow tuffs and include some silicic lavas that erupted from five major volcanic centers and parts of two others. The thickness of the volcanic rocks is estimated to form a composite section of approximately 20,000 ft, with the age of rocks ranging from 27 million to 7 million years old.

Surficial deposits at the TTR consist of late Tertiary- and Quaternary-age fluvial deposits, alluvial fans, playa deposits, colluvium, and eolian deposits that veneer volcanic and sedimentary bedrock. Alluvium is transported from the tectonically developing highlands onto piedmont slopes and intermontane basins. The piedmont slopes are mosaics of dissected and undissected alluvial surfaces commonly veneered with eolian fines that are armored by desert pavement. The alluvium may attain thicknesses of more than 4,500 ft in the central portions of the valleys. Alluvium at the TTR is characteristic of young immature soils consisting of poorly graded sand with silt, gravel, and cobbles. The alluvium is deposited in series of coalescing fans that contain talus on the upper piedmont slopes varying to finer-grained material in the lowlands. The finest material, consisting of silt and clay, is deposited in the playas, normally situated at the lowest point in the flats. The lithology of the alluvium on the piedmont slopes closely reflects the adjacent bedrock. As the alluvium is transported to the lowlands, mixing with material from other fans occurs, making the lithology variable over relatively short distances.

The CSIII site is located on Cactus Flat, which is in the center of the TTR. Cactus Flat is a part of a larger area of interconnecting flats that form a large intermontane basin. Mountains surrounding Cactus Flat are the Kawich Range to the east, Gold Mountain to the south, and the Cactus Range to the west (Figure 2-1). The north side of Cactus Flat is open to other flats. Cactus Flat has little variation in elevation, with Main Lake, a playa at the north end, being close to the same elevation as Antelope Lake at the south end, approximately 5,330 ft amsl. The mountains surrounding Cactus Flat are highly complexed volcanic rock consisting of rhyolite, dacite, rhyodacite, quartz latite, and andesite lava flows; and intrusive masses, rhyolitic ashflows, and ash-fall tuffs. The volcanic rocks bordering Cactus Flat are of Tertiary age (Cornwall, 1972).

In the 1970s, a soil survey was completed that investigated soils in the vicinity of the Clean Slate (CS) and other plutonium (Pu)-contaminated sites. The results indicated that soils in the CSIII area consist of two soil types: gravelly sandy loam and gravelly loam (Leavitt, 1974). These soils formed in alluvium from rhyolite, quartzite, limestone, and tuffs. Soil is well drained with medium to slow runoff and permeability from 0.8 to 10.0 inches (in.) per hour (Leavitt, 1974).

2.1.3 Hydrogeology

Subsurface hydrologic data at the TTR are limited to information from water wells that were drilled to support TTR and NTTR activities. The water supply wells at the TTR were completed in the alluvium. The depth to groundwater at the TTR varies greatly, ranging from 0 ft where springs are present to over 400 ft. The uppermost aquifer, located in the alluvium, appears to be unconfined with no laterally continuous confining units (Ekren et al., 1971). Based on the three closest wells to the CSIII site, the average depth to groundwater is approximately 262 ft (N-I, 2013b).

No permanent surface water streams or lakes are present at the CSIII site. Two dry lake beds, Main Lake and Antelope Lake, are to the north–northwest and south of CAU 414, respectively. Ephemeral surface drainage across the CSIII site is generally to the west–southwest. Figure 2-1 shows the location of the CSIII site in relation to the two major dry lakes. The dry lakes retain surface water after heavy rains but are normally dry again within a few days due to evaporation. Two unnamed drainage channels, which ultimately flow into Antelope Lake, were identified in the southern portion of the CSIII site (see Section 2.4.3).

2.1.4 Climate and Meteorology

The climate and meteorology of the TTR can vary significantly over short distances due to complex orographic influences. Extremes of climate are exemplified by conditions on the high plateaus that support pine forests in contrast to the dry desert lake beds in valleys. The Sierra Nevada mountain range to the west blocks most Pacific-originated storms, and the intervening desert area to the east exhausts moisture from storms arising from that area. The infrequent storms that deposit substantial moisture usually come from the southwest in the form of summer thunderstorms. Annual precipitation at the TTR is 5 to 6 in. in Cactus Flat (French, 1985). Temperature over the valley floors is characterized by a large daily range due to nocturnal air drainage, which has a pronounced influence on nighttime temperatures. Diurnal temperature oscillations on the plateaus are much less than those in the valleys. Average temperatures for the warmest and coldest hours in January from the TTR weather station are 44 degrees Fahrenheit [°F] and 18 °F, respectively. Corresponding temperatures in July are 90 °F and 58 °F (Schaeffer, 1968). Winds at the TTR are generally light to moderate. In the winter, winds are more frequent than at other times of the year and are predominantly from the northwest. In the summer, the wind direction is predominantly south–southeast trending with the linear mountain ranges and at times creates strong dust devils in the valleys. The highest wind speeds occur in mid-afternoon in all seasons, especially in the spring, when dust storms are common (Schaeffer, 1968).

Meteorological stations have been operating at the Clean Slate I (CSI) and CSIII sites since 2011 and 2008, respectively. The CSIII station (installed in June 2008) and the CSI station (installed in May 2011) are located just outside the contamination area (CA) fences on the north perimeter of each site. For the period May 2008 through December 2012, the annual average precipitation at the CSIII site was 5.5 in. (Mizell et al., 2014). During the period of record at the CSI site (May 2011 through December 2012), the annual average precipitation was 3.7 in. At the CSI and CSIII monitoring locations, winds are most frequently from the south and southeast or the west and northwest. The average wind speeds range from 5 to 11 miles per hour (mph), with gusts from 25 to 31 mph. The strongest winds may occur during any time of the year and are typically associated with either winter/spring frontal storms or summer thunderstorms. Lighter breezes predominately occur at night and frequently come from nondominant directions; southerly oriented winds appear to occur somewhat more frequently during the summer, whereas northwesterly oriented winds appear to be slightly more common during the winter.

2.2 Operational History

The CSIII test was part of Operation Roller Coaster, a joint exercise conducted by the United Kingdom, the U.S. Department of Defense, and the Atomic Energy Commission (AEC) (predecessor agency to the DOE). The CSIII test was the last of four storage–transportation tests that constituted Operation Roller Coaster; the other tests were Double Tracks (DT), CSI, and Clean Slate II (CSII).

The CSIII site consists of a release of radionuclides to the ground surface from a storage–transportation test conducted on June 9, 1963 (NNSA/NFO, 2015c). This test was a detonation involving a combination of high explosives and nuclear material (Pu and depleted uranium [DU]) in a reinforced concrete bunker covered with 8 ft of soil. The objective of the test was to obtain data regarding the overall dispersion of Pu, and to study the efficiency of the concrete structure and overburden to entrain radionuclides. No fission yield was detected from the test (Shreve, 1965).

After the test, metal and concrete debris was scraped from the ground surface and mounded/buried at ground zero (GZ) (see Section 2.4.4). The area around GZ consisting of contaminated soil, concrete, and metal was then fenced to prevent access (Burnett et al., 1964). This square-shaped fence surrounded contamination with a mass concentration of 1,000 micrograms per square meter total transuranics (Hendricks, 1972) and was posted with "Alpha Contamination" signs (see Figure A.8-1).

In 1963, the burial area at GZ was excavated to recover pieces of buried metal debris for further study (DASA, 1963; Johnson, 1963). This activity involved the removal of the earth cover and extraction of the debris using heavy equipment and hand tools, where necessary. The historical account of this activity does not include a discussion of site restoration after excavation.

In 1973, the outermost fence at the CSIII site was constructed that encompassed approximately 410 acres, including the area previously fenced around GZ. This fence was established at a surface activity level of 40 picocuries per gram (pCi/g) total transuranics (Culp et al., 1994). This outer fence is currently posted with "Contamination Area" signs and is referred to as the "CA fence" throughout this document. Between 1969 and 1973, an additional irregular-shaped inner fence was established; however, the radiological criteria for this fence are unknown. Figure A.8-1 shows the two inner fences and the outer CA fence at the site.

2.3 Waste Inventory

The CSIII test dispersed Pu and uranium (U) isotopes to surface soil, and deposited contaminated debris from the test bunker and associated structures onto the ground surface. The volume of contaminated soil and debris is unknown. After the test, the area surrounding GZ was scraped, and radioactive debris (concrete, metal) and soil were buried near GZ (AEC/NVOO, 1964; Burnett et al., 1964). Based on the materials used in the CSIII test, the contaminated soil and debris deposited onto the ground surface and buried near GZ are presumed to contain Pu isotopes, DU, and americium (Am)-241 (a radioactive decay product).

2.4 Release Information

The known releases at CAU 414 are the result of the atmospheric deposition of radionuclides from the 1963 CSIII test. The CSIII test was a nonnuclear detonation of a nuclear device located inside a concrete bunker covered with 8 ft of soil. This test dispersed radionuclides on the ground surface. The only known source of contamination at CAU 414 is the 1963 CSIII test. As such, the CSM (detailed in Section 3.1) is based on the premise that releases of contamination at CAU 414 are all directly or indirectly associated with the test. Subsequent activities at the site immediately following the test and decades after have potentially redistributed soil contamination vertically and/or laterally. In addition, there is the potential that contamination has migrated through natural processes such as wind, precipitation, or surface water flow.

CAU 414 is located north of CAU 412 (CSI) and west of CAU 413 (CSII). These two CAUs were the locations of similar Pu dispersal tests conducted in 1963 that were also part of Operation Roller Coaster. CAU 414 is approximately 3.7 mi north–northwest of CAU 412 and 3.7 mi west of

CAU 413. There is no information that suggests contamination from CAUs 412 or 413 has impacted CAU 414.

The releases at CAU 414 were divided into five study groups based on similar CSM elements (e.g., surface deposition of relatively immobile contaminants, migration and mixing of contaminants from previous activities, migration by surface water runoff in drainages). The areas of the study groups cannot be delineated in figures, as they are conceptual (CSM) elements and not physical entities. An area that exceeds a FAL (DQO Decision II) will be resolved for each study group that exceeds a FAL. The information needed to define those areas will be collected in the CAI and presented in the CADD. The study groups are shown in Table 1-1. The releases specific to each study group are described in the following subsections.

2.4.1 SG1, Undisturbed Areas

This study group includes areas impacted by the release of radionuclides from the CSIII test, exclusive of the areas defined by other study groups. It is assumed that contamination from the CSIII test deposited at these locations has not been mechanically disturbed since the time of the test. These areas may contain contaminated surface and shallow subsurface soil. The only movement of contamination from the surface of SG1 is assumed to be attributable to natural processes, such as precipitation, wind, and surface water flow. Based on previous soil profile data, up to 97 percent of the total Pu activity deposited in soil by the CSIII test may be found within the top 2 in. (Gilbert et al., 1975; Essington et al., 1976; Wille, 1997).

The primary exposure routes to receptors from SG1 releases are ingestion and inhalation of contaminants in surface soil (internal dose). However, site workers may also be exposed to direct radiation by performing activities in proximity to radiologically contaminated soil or debris (external dose). Because of the nature of the CSIII test, it is expected that the internal dose component will be larger than the external dose component at the site (see Sections 2.5.5 and 2.5.6.3). Potential migration pathways from the releases include lateral dispersion via surface water runoff and wind erosion, and vertical migration via gravity and infiltration of surface water. Due to the high potential evapotranspiration (PET) at the TTR, it is expected that lateral migration will dominate over vertical migration at the CSIII site.

2.4.2 SG2, Disturbed Areas

This study group includes areas where post-test operations occurred, resulting in the potential redistribution of contamination originally deposited on the ground surface by the CSIII test. Due to the arid environment at the TTR, the regeneration of vegetation on land that has been disturbed is typically very slow. As a result, areas that were disturbed in preparation for the 1963 test and afterward can be readily identified in aerial photographs. This visual evidence, coupled with historical documentation of site operations, resulted in the identification of one area at CAU 414 where it is possible that contamination originally deposited on the ground surface by the test has been redistributed. This square area, which is surrounded by the innermost fence, is shown on Figure 2-2. This area was likely disturbed both pre- and post-test. Historical documents describe an area around GZ approximately 800 ft in diameter that was scraped and compacted in preparation for the CSIII test (AEC/NVOO, 1964). This area is clearly visible in a pre-test photograph (see top photograph in Figure 2-3) and is still visible in current aerial photographs of the GZ area (Figure 2-2). It is also documented that after the test, the area surrounding GZ was "bladed to a depth of several inches and out to a distance sufficient to encompass heavy throwout" from the test (AEC/NVOO, 1964). The debris and soil consolidated in this operation was then buried at GZ and covered with several feet of clean earth. The burial area was further disturbed in late 1963 when it was excavated to recover contaminated metal debris for additional study. The debris and soil that were buried and covered at GZ (i.e., subsurface contamination) are discussed as a separate release (SG4, Buried Debris) in Section 2.4.4. As a result of post-test activities, there is the potential that contamination within the innermost fence has been redistributed horizontally and/or vertically. The extent of such redistribution, however, is not documented; therefore, distinguishing between the pre-test and post-test disturbances is not possible. As a result, SG2 includes both pre- and post-test disturbed areas.

This study group also includes three other potentially disturbed areas: two approximately 900 ft north of GZ, and one approximately 500 ft northeast of GZ. The three areas were identified in a 1993 radiological survey report as target areas for the removal of soil in support of an offsite treatability study (Clark, 1993). These areas are shown in Figure 2-2. The planned volume of soil to be removed from the CSIII site was 40 barrels (approximately 10 tons), but there is no evidence that any soil was actually removed. Current aerial photographs do not show visible signs of surface disturbance in

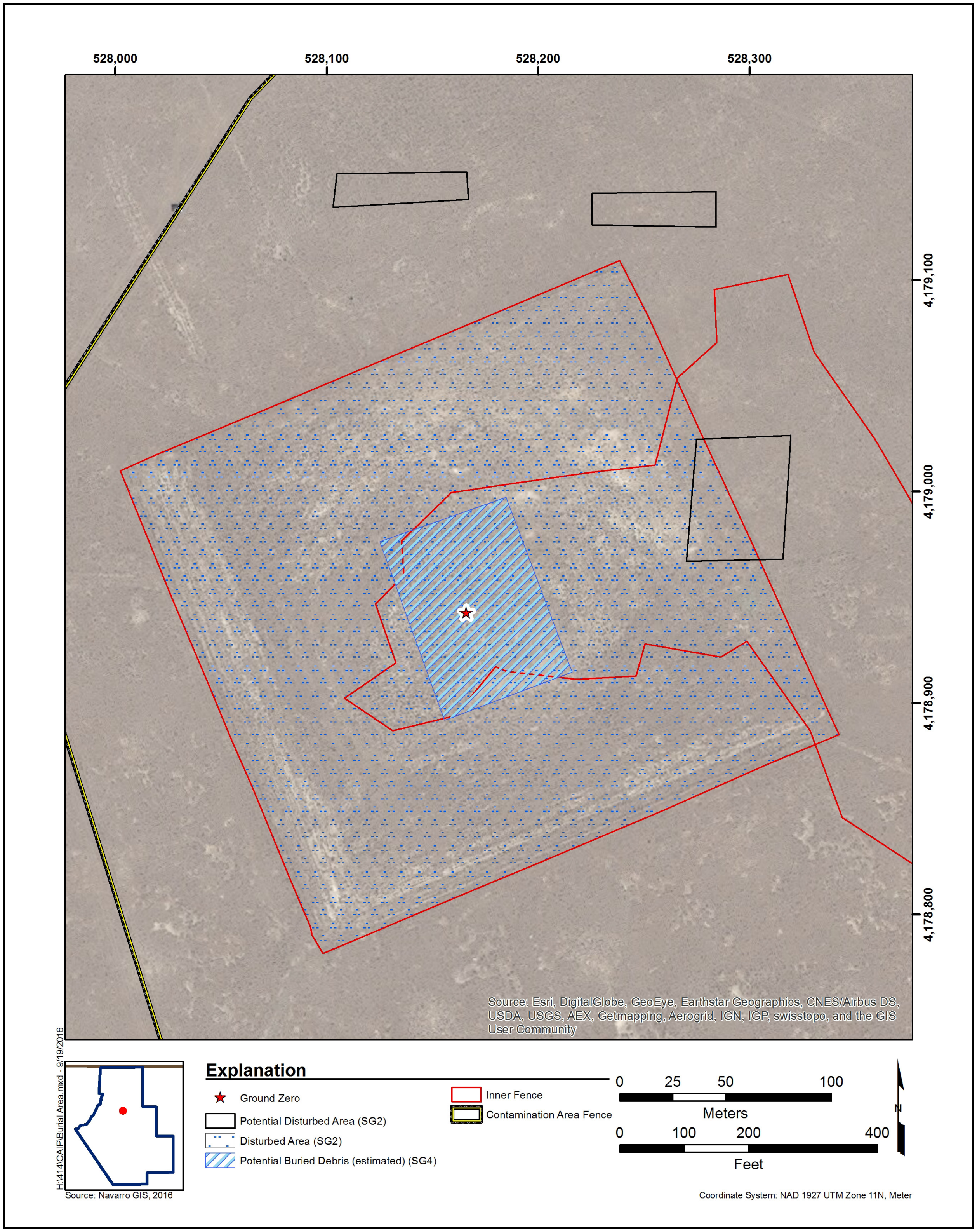

Figure 2-2
Potential Disturbed Areas and Potential Buried Debris

these target areas, nor does the 1996 KIWI radiological survey suggest the redistribution of contamination at these locations. Formal disposition of the materials is inconclusive, as there is no disposal documentation in the historical record. A 1996 volume reduction study report, however, presents the results of a volume reduction study performed on soil from areas on the Nevada National Security Site (NNSS) and TTR (Papelis et al., 1996). It is likely, but not definitive, that the TTR soil discussed in this report originated at the CSIII site and may have been the soil planned for removal in 1993. These three areas will be inspected during the CAI to determine whether they should be investigated as part of SG2 (see Section 4.2.4.2). For CAI planning purposes, it was assumed that these areas were disturbed and therefore were avoided during the selection of sample locations for other study groups (e.g., SG1).

The primary exposure routes and migration pathways for SG2 are the same as described for SG1.

2.4.3 SG3, Drainages

Two major drainage channels were identified at CAU 414 that transect the southern portion of the CA fenced area. The drainages are shown as a secondary feature of Figure 2-5 and do not necessarily represent the extent of SG3 releases. The drainage channels are visible on historical and present-day aerial photographs and were confirmed on the ground during previous site visits. If any drainage sample results in an exceedance of the FAL, the extent of the contamination that exceeds the FAL (DQO Decision II) will be defined and presented in the CADD. Surface water flows to the west–southwest across the gently sloping landscape within Cactus Flat.

Drainage channels may serve as transport mechanisms for contamination originally deposited on the ground surface during the CSIII test. Sedimentation areas are defined as those areas within drainage channels or surface water conveyances where sediment has visibly accumulated. The potential exists for contamination in these accumulation areas to have been buried over time by subsequent erosion events.

The primary exposure routes and migration pathways for SG3 are the same as described for SG1.

2.4.4 SG4, Buried Debris

This study group consists of the release of contaminants to subsurface soil from contaminated soil and debris buried at GZ after the CSIII test in 1963. Historical documents indicate that shortly after the test, the area around GZ was scraped of debris (e.g., concrete, metal) and soil to a depth of several inches (AEC/NVOO, 1964). Contaminated debris scattered out to a radius of 1,500 to 2,500 ft was collected and buried at GZ (AEC/NVOO, 1964; Burnett et al., 1964). The debris and soil were buried and covered with "several feet of clean earth" (AEC/NVOO, 1964). The approximate lateral extent of the buried debris area, based on a previous geophysical survey at the site, is shown on Figure 2-2.

In late 1963, the burial area at GZ was excavated to recover some of the buried metal debris for further study (DASA, 1963; Johnson, 1963). This involved the removal of the earth cover and extraction of the debris using heavy equipment (e.g., bulldozer, crane, wrecker) and hand tools (e.g., shovels) where necessary. The historical account of this activity does not include a discussion of site restoration after excavation; thus, it is not known whether uncontaminated soil was used to re-cover the burial area or if soil from the surrounding area was used.

A receptor may potentially be exposed to contaminated soil and/or debris on the surface of the buried debris location; in the subsurface, if the buried debris is exposed through excavation or digging; or over time by soil erosion. The primary exposure routes to receptors are ingestion and inhalation of contaminants in soil (internal dose), and direct radiation from contaminated soil and debris (external dose). Potential migration pathways for contaminants from buried debris and soil include vertical migration via gravity and precipitation; and lateral migration if contamination is exposed, via surface water runoff, erosion, and/or wind.

2.4.5 SG5, PSM

This study group consists of PSM that may be identified during the CAI. The extent of PSM (DQO Decision II) will be defined in the CAI and presented in the CADD. For the purposes of this document, PSM is defined as a material present at a site that contains radiological and/or chemical contaminants that, if released, could cause the surrounding soil to contain a COC (NNSA/NFO, 2014). PSM may include debris (e.g., concrete pieces, metal fragments, drums) and historical or recent spills (e.g., diesel spill from onsite generator).

A historical document describing the CSII and CSIII tests states "...great numbers of concrete and metal debris [were] thrown up to 2,500 ft (with the highest concentrations of debris east of the ground zeros as a result of jetting through the doorways, which were the weakest part of the bunker structure)..." (Burnett et al., 1964). The area inside the innermost GZ fence (i.e., square fenced area) was cleared of surface debris immediately following the 1963 CSIII test (Section 2.4.2). However, environmental monitoring of the CSIII site in the years after the test recorded the presence of highly contaminated debris east and northwest of the inner GZ area fence (Glora and Brown, 1964; Glora and Aoki, 1965 and 1966; REECo, 1966). As part of a CAI completed in 1996 (see Section 2.5), the area within a 330-ft radius of GZ was surveyed with radiological instruments and all identified metal debris was removed.

In 2016, a debris investigation was conducted at CAU 414 to identify pieces of contaminated debris and areas of elevated soil radioactivity outside the CA fence (see Section 2.5.10). Debris identified at the site includes concrete and metal pieces of the test bunker and associated support structures (e.g., instrument towers) that were ejected or thrown out from GZ during the test explosion (see Figure 2-4 post-test photograph). A receptor may potentially be exposed to contaminated debris on the ground surface or in the shallow subsurface. The primary exposure routes to receptors are ingestion and inhalation of contaminants in surface soil (internal dose), and direct radiation from contaminated soil and debris (external dose).

The exposure routes to receptors from PSM not yet identified at the site will vary based on the nature of the debris or spill identified, but may include ingestion and inhalation of contaminants, dermal contact with contaminants, and direct radiation (for radiological contaminants) by performing activities in proximity to the PSM. Potential migration pathways may include vertical migration through the soil underlying the debris or impacted by the spill and horizontal migration via surface water runoff, erosion, and/or wind.

2.5 Investigative Background

The CSIII site was studied extensively in the years after the test and well into the 1970s. Studies included ground-based and aerial radiological surveys, and collection and analysis of soil and vegetation samples. In 1996, the CSIII site became subject to the FFACO, and a relatively comprehensive investigation (herein referred to as the 1996 CAI) was completed in 1996 and 1997 in accordance with the *Clean Slate Corrective Action Investigation Plan*, Rev. 0 (DOE/NV, 1996). The scope of the 1996 CAI included all three CS sites on the TTR (CSI, CSII, and CSIII). In 1998, further action at the CSIII site was suspended because concurrence could not be reached regarding future land use at the site, a final corrective action level, and the parameters used to determine the corrective action level. DOE discussions with USAF (as landowner) and NDEP (as regulator) continued in the years following.

The following is a list of FFACO and supporting documents drafted in the 1990s in support of CAU 414 site closure. Relevant information from these documents is referenced throughout this CAIP, as appropriate:

FFACO documents

- *Clean Slate Corrective Action Investigation Plan*, Rev. 0 (DOE/NV, 1996). Final document, approved by NDEP.

Supporting documents

- *Cost/Risk/Benefit Analysis of Alternative Cleanup Requirements for Plutonium-Contaminated Soils On or Near the Nevada Test Site* (DOE/NV, 1995).
- *Clean Slate Soils Disposal Options Cost Analysis, Corrective Action Units 412, 413 and 414* (DOE/NV, 1997a).
- *Clean Slate Transportation and Human Health Risk Assessment* (DOE/NV, 1997b).
- *Radiological Dose Assessment for Residual Radioactive Material in Soil at the Clean Slate Sites 1, 2, and 3, Tonopah Test Range* (DOE/NV, 1997c).

Due to the length of time that has transpired since the 1996 CAI; the turnover of DOE, NDEP, and USAF personnel involved in the project; and the successful use of an RBCA approach at other Soils Activity sites, the NNSA/NFO decided to recommence the FFACO closure process with the development of new DQOs and this site-specific CAIP.

Table 2-1 and the following subsections summarize relevant CSIII studies and indicate how the data from each study were used in the development of the DQOs for CAU 414. Further details of these studies may be found in the documents referenced in the following subsections.

Table 2-1
Chronological Summary of Relevant Studies at CAU 414

Activities	Year	Work Completed	Data Use
Operation Roller Coaster	1963 1964	Pu distribution studies/mapping	Informational Data
Environmental Surveillance Radiation Surveys	1964–1969	Ground-based alpha radiation surveys	Informational Data
Particle Size Studies	1963 1996	Pu associated with particle size	Informational Data
NAEG Studies	1975	FIDLER surveys, soil and vegetation sampling, depth profile sampling	Informational Data
TTR Annual Sampling	1993	Soil sampling	Informational Data
1996 CAI	1996–1997	Radiological surveys (KIWI, HPGe detector, FIDLER), soil sampling, depth profile sampling, treatability testing, geophysical surveys at GZ	Decision-Supporting Data (soil sample and KIWI survey data only); Informational Data (all other data)
Aerial Radiation Surveys	2006	Aerial radiation surveys	Decision-Supporting Data
Radiological Posting Compliance Survey	2010	Swipe sampling for removable contamination, *in situ* radiological measurements	Informational Data
Preliminary Investigation	2012	Visual surveys, FIDLER surveys, removable contamination surveys	Decision-Supporting Data (FIDLER data only); Informational Data (all other data)
Meteorological and Airborne Particulate Monitoring	2008–2012	Monitoring of airborne particulates, ambient gamma radiation, and meteorological conditions	Informational Data
Debris Investigation	2016	FIDLER surveys, removable contamination surveys, visual surveys	Decision-Supporting Data (FIDLER data only); Informational Data (all other data)

FIDLER = Field instrument for the detection of low-energy radiation
HPGe = High-purity germanium
NAEG = Nevada Applied Ecology Group

2.5.1 Operation Roller Coaster

Soil contamination in the vicinity of the CSIII site resulted from activities that were part of Operation Roller Coaster. The objective of the CSIII test was to obtain data pertaining to dispersion of Pu from a simulated, nonnuclear detonation of a nuclear weapon inside a structure. Pre- and post-test photographs of the CSIII site are presented in Figures 2-3 and 2-4, respectively. Figure 2-3 presents the test bunker viewed from the east (top photograph) and north (bottom photograph). The top

Figure 2-3
Pre-test Photographs of the CSIII Structure (1963)

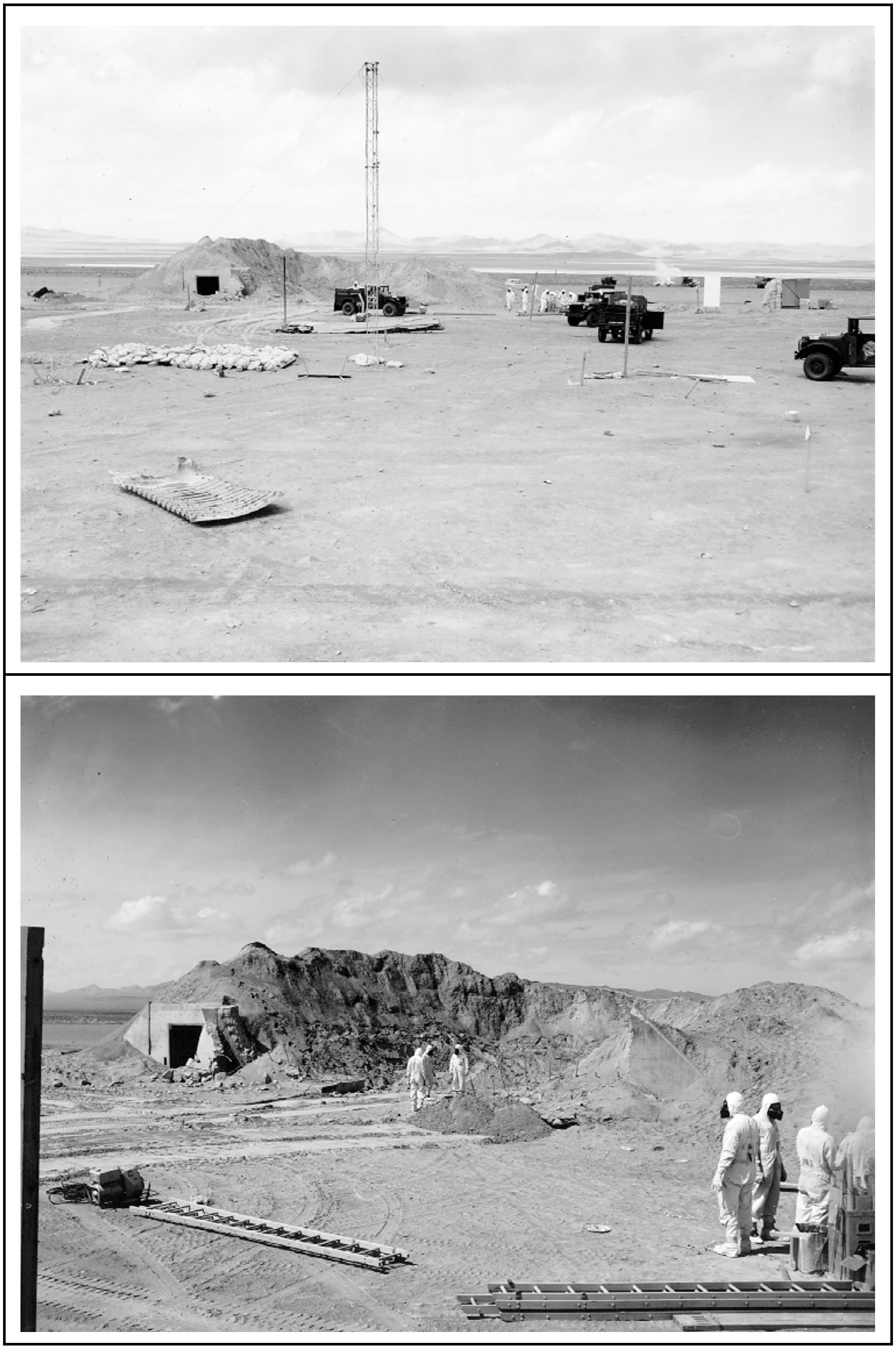

Figure 2-4
Post-test Photographs of the CSIII GZ Area (1963)

photograph has a clear view of one of the instrument towers; the bottom photograph shows the arming and firing building in the foreground. Figure 2-4 shows two post-test views of the test bunker looking west–southwest. The top figure shows one of the instrument towers, sandbagged instruments, and the arming and firing building to the right of the bunker.

The CSIII test involved several experiments that included air measurements, soil deposition and fallout sampling, micrometeorological measurements, surface measurements, special particulate analyses, and the effects of soil scavenging, among others (Dick et al., 1963). Much of the data collected in these experiments are specific to the experiment objectives, and are not directly applicable to site characterization or closure.

In accordance with the Soils Activity QAP (NNSA/NSO, 2012b), the quality required of a dataset will be determined by its intended use in decision making. The CSIII experiment data were considered when developing the CSM, identifying contaminants of potential concern (COPCs), and reviewing the general distribution of radiological contaminants at CAU 414. Because the quality of these data is unknown, the data collected during and shortly after the CSIII test are considered informational data.

2.5.2 Environmental Surveillance Radiation Surveys

Historical documents were identified that present the results of semiannual and annual surveillance activities at the four Operation Roller Coaster sites for the years 1964, 1965, 1966, 1968, and 1969 (Glora and Brown, 1964; Glora and Aoki, 1965 and 1966; REECo, 1966, 1968, and 1969). Surveillance activities were conducted to determine the radiological conditions at the sites and included collecting air, water, and vegetation samples; and conducting alpha radiation surveys. At the CSIII site, alpha radiation surveys were conducted east of the inner fence surrounding GZ out to 500 ft. These surveys identified contaminated concrete debris with “relatively fixed activity” (REECo, 1966). The present-day CA fence at the CSIII site encompasses this eastern area surveyed in the mid-1960s.

The alpha radiation survey maps were used in the design of the CAI to identify the general area (i.e., east of GZ) to be investigated for the presence of ejected debris. However, because the quality of these data are unknown, the data collected in the environmental surveillance efforts are considered informational data and will not be used to support or make DQO decisions.

2.5.3 Particle Size Studies

At the time of the CS and DT tests in 1963, a study was conducted by the Defense Atomic Support Agency to determine physical and chemical properties of particulate fallout resulting from the high-explosive detonations of nuclear weapons containing Pu. This included particle size analyses of fallout material (including soil) and the mass of Pu associated with each particle size fraction. The particulate fallout samples from the DT, CSI, and CSII tests were distributed in a pattern downwind of the detonation point at distances ranging from 100 to 10,000 ft. Results of the samples at each site were fairly consistent across sites and distances, with an average of more than 93 percent of Pu in particle sizes greater than 11 microns in diameter (U.S. Naval Radiological Defense Laboratory, 1965).

In 1996, a scoping study was conducted by IT Corporation to look at the feasibility of implementing attrition scrubbing and wet screening on CS soils to reduce potential corrective action waste volumes. Particle size separations were conducted on several samples collected from CSI, CSII, and CSIII. The Pu activity associated with each particle size fraction was then determined. This study concluded that attrition scrubbing and wet screening would not reduce potential waste volumes as in all but two of the separations before attrition, there was more Pu activity in the larger than 150-micron fraction than in the less than 150-micron material. The smallest particle size separation that was done by this study was 75 microns. Approximately 87 percent of the Pu activity was in the larger than 75-micron fraction of the soils studied (McKinley, 1996). The data from both of these studies are considered informational data and were not used directly in the development of the CAI sample design.

2.5.4 NAEG Studies

The NAEG conducted studies of Pu, U, Am, and other radionuclides in the environment on and near testing sites of nuclear devices from July 1970 to September 1986. About 540 reports and papers were prepared during this 16-year effort. The findings of the NAEG were published in the *Summary of the Nevada Applied Ecology Group and Correlative Programs* (Friesen, 1992). This report effectively traces Pu from its introduction into the environment and movement in the ecosystem to the development of potential cleanup techniques.

Two NAEG studies of particular interest to CAU 414 include the collection of *in situ* radiation measurements using a FIDLER and discrete soil sample collection to determine the distribution of contamination (Gilbert et al., 1975; Gilbert, 1993) and the collection of soil profile samples to determine the percentage of Pu in depth intervals from 0 to 10 in. (Essington et al., 1976). The FIDLER and soil sample data from the first study were reviewed and are consistent with the general distribution of contamination at the CSIII site as shown in the 1996 KIWI and the 2006 aerial surveys. The second study involved the collection of soil samples from four locations in areas of varying surface Pu activity. This study demonstrated that 97 percent of Pu activity was in the top 5 centimeters (cm) of soil with Pu activity generally decreasing with depth (Essington et al., 1976). These data were considered when determining a suitable depth for sample collection during the CAI. The data from both of these NAEG studies are considered informational data and were not directly used in the development of the CAI sample design.

2.5.5 TTR Baseline and Annual Sampling

In 1993, as part of a baseline soil sampling effort at TTR, 19 surface soil samples were collected around the CA fence perimeter at CSIII (Culp et al., 1994). The samples were collected at varying distances outside the fence and were analyzed for gross alpha/beta, total U, isotopic Pu and Am-241, and gamma spectroscopy. The results for Pu-239/240 ranged from 0.27 to 380 pCi/g and Am-241 ranged from 0.11 to 12 pCi/g. In general, the highest activities were from the samples collected closest (approximately 20 ft) to the CA fence.

Soil sampling has been performed at the TTR as part of annual surveillance activities at the CS sites for several years. A single soil sample has been collected annually from outside the perimeter fence at the CSIII site to assess radiological contamination since 1993. The soil sample was collected east of the CA fence at the southern end of the site.

The baseline and annual soil sampling data are of limited use for site characterization because all the sample locations are outside the CA fence. However, these data provide a general idea of the level of contamination outside the CA fence. These sample data were not directly used in the design of the CAI and serve as informational data.

2.5.6 1996/1997 CAI Activities

Investigation activities were performed at the CAU 414 site in 1996 and 1997 in accordance with the *Clean Slate Corrective Action Investigation Plan,* Rev. 0 (DOE/NV, 1996). The data collected during this 1996 CAI that were used in support of the DQOs developed for this CAIP are summarized in the following subsections.

2.5.6.1 KIWI Radiation Survey

In situ radiation surveys using an array of six mobile sodium iodide detectors (i.e., the KIWI system) were conducted at the CSIII site to define the horizontal extent of the radiological contaminants. The KIWI system has an approximate 3-ft-width-by-10-ft-length field of view, and at the 60-kiloelectron-volt energy range, the detectors are collimated. The KIWI survey covered approximately 100 percent of the inside of the CA fence and a 33-ft perimeter outside the fence.

The full extent of the KIWI survey data is presented in Figure 2-5. The KIWI survey results show a radioactivity distribution in the area around GZ where some areas close to GZ appear less contaminated than areas further from GZ. A close-up of the KIWI survey in the GZ area is shown in Figure 2-6. Relatively uniform contamination levels that decrease with increasing distance from GZ would be expected if no post-test disturbance of the area had occurred. As discussed in Sections 2.4.2 and 2.4.4, however, soil and debris in the area around GZ was scraped and buried after the test. In addition, the burial area was excavated in late 1963 to collect contaminated metal debris for further study (Section 2.2). Thus, it is highly probable that the contamination pattern observed in the survey is attributable to the redistribution of contamination during post-test activities.

The KIWI data meet the definition of decision-supporting data in accordance with the Soils Activity QAP (NNSA/NSO, 2012b). These data were used to guide the selection of biased sampling locations.

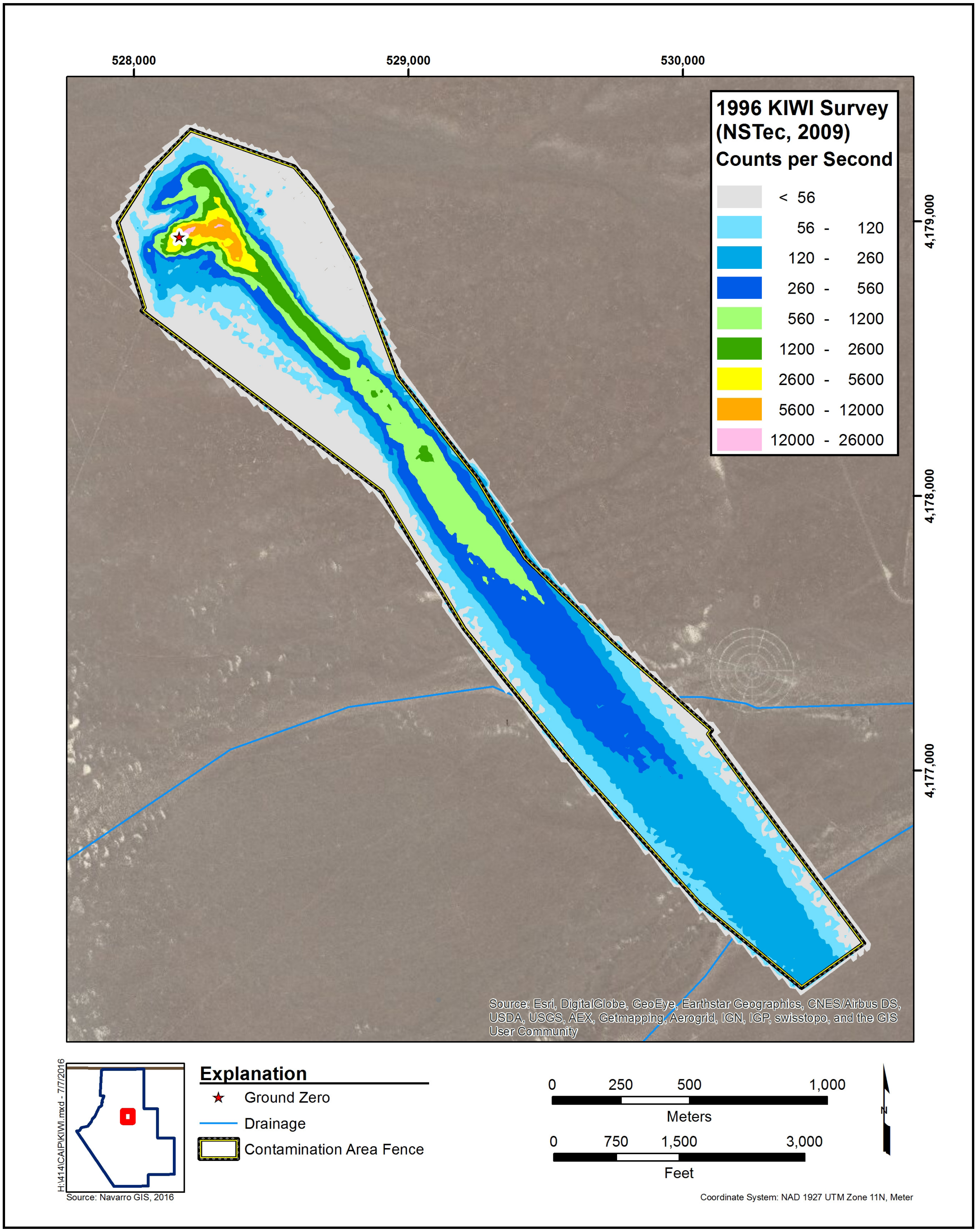

Figure 2-5
KIWI Survey of CAU 414

2.5.6.2 Depth Profiling

In order to characterize the vertical extent of site contaminants, *in situ* measurements were collected using an HPGe detector system at 14 locations (D1 through D14). Figure 2-6 presents the locations where depth measurements were collected; Table 2-2 presents the net Am-241 depth profile measurements. These results indicate that the maximum contamination is in the surface profile and largely confined to between 2 and 3 in., with the Am-241 activity generally decreasing with increasing depth. Depth profile sampling in the vicinity of GZ was not conducted during the 1996 CAI.

The soil profile data are considered informational data and were considered with other soil profile data in determining a suitable depth at which to collect soil samples during the CAI.

2.5.6.3 Soil Sampling

Soil samples were collected to meet various objectives, including site characterization, treatability studies, geotechnical studies, and waste characterization. Sample analyses were tailored to the sampling objectives and were not uniform for all soil samples. This section focuses on the soil samples collected for site characterization purposes and provides a summary of the results of the other sampling objectives.

Soil sampling during the 1996 CAI was conducted in two phases. The first phase included the collection of a total of 13 surface soil samples (including one field duplicate [FD]) from the locations shown in Figure 2-7. These samples were collected from 0 to 3 in. below ground surface (bgs) and were analyzed for gross alpha and beta, Am-241, isotopic Pu and U, toxicity characteristic leaching procedure (TCLP) metals, TCLP volatile organic compounds (VOCs), TCLP semivolatile organic compounds (SVOCs), TCLP herbicides and pesticides, and polychlorinated biphenyls (PCBs). Table 2-3 presents a summary of radiological results for the 13 surface soil samples collected during the first sampling phase at CSIII. The Pu-239/240 activity ranged from 2.28 pCi/g to 27,700 pCi/g and the Am-241 activity ranged from 1.46 pCi/g to 1,540 pCi/g. During the second sampling phase, nine additional soil samples were collected (CSS30076 to CSS30084, including one FD) and were analyzed for TCLP metals, TCLP VOCs, TCLP SVOCs, and TCLP herbicides and pesticides. No

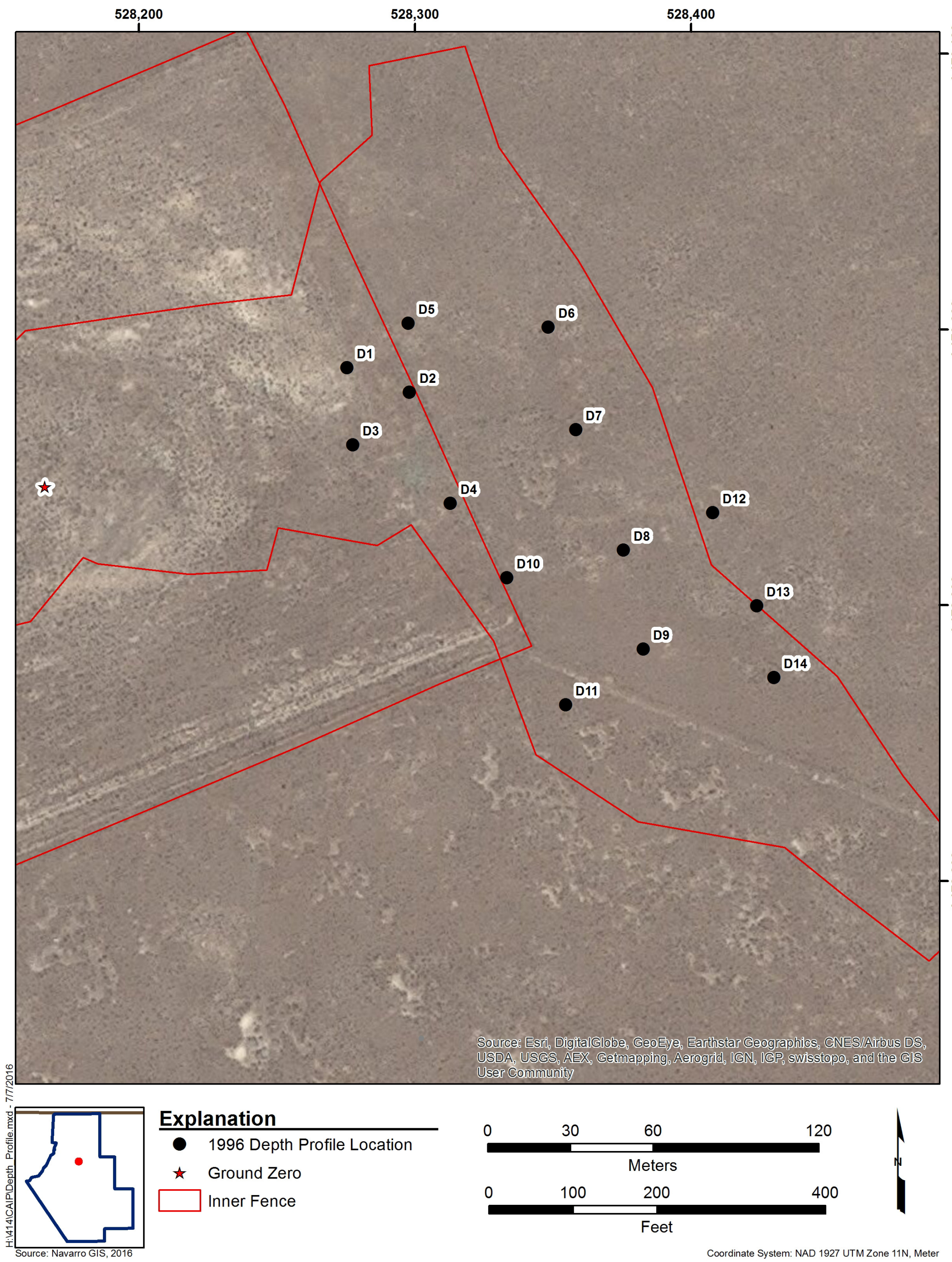

Figure 2-6
Depth Profile Locations at CAU 414

Table 2-2
Depth Profile HPGe Measurements at CAU 414
(Page 1 of 2)

Location ID	Depth (in.)	Net Counts per 5 minutes Am-241	Notes
D1	0	798	None
	1	5	<MDA
D2	0	2,733	None
	2	176	<MDA
D3	0	820	None
	1	267	None
	1.5	16	<MDA
D4	0	799	None
	1.5	21	<MDA
D5	0	1,078	None
	1.5	266	None
	2	286	None
	2.5	156	<MDA
D6	0	613	None
	1	300	None
	2.5	131	<MDA
	3.5	153	<MDA
	4.5	29	<MDA
D7	0	541	None
	1	107	<MDA
	2.5	Negative	<MDA
D8	0	1,049	None
	2	231	<MDA
	3.5	189	<MDA
	4.5	149	<MDA
	6.5	Negative	<MDA
D9	0	1,661	None
	1.5	545	None
	2.5	Negative	<MDA

Table 2-2
Depth Profile HPGe Measurements at CAU 414
(Page 2 of 2)

Location ID	Depth (in.)	Net Counts per 5 minutes Am-241	Notes
D10	0	711	None
	1.5	177	<MDA
	3	47	<MDA
D11	0	1,324	None
	1.5	Negative	<MDA
D12	0	172	<MDA
	2	84	<MDA
D13	0	188	<MDA
	1.5	84	<MDA
D14	0	38	<MDA
	1.5	85	<MDA

MDA = Minimum detectable activity

chemical constituents were detected above regulatory levels. No radiological analyses were performed on the second-phase samples.

The radiological data from the soil samples collected in the 1996 CAI were classified as decision-supporting data and were considered in the identification of COPCs and the selection of sample locations for the CAI. The chemical data from these samples are considered informational data and are not presented herein.

2.5.6.4 Geophysical Surveys

Magnetic and electromagnetic surveys were performed during the 1996 CAI to characterize the GZ mound area. The results of the electromagnetic conductivity survey are presented in Figure 2-8. The results of the surveys indicated the presence of buried materials that are likely remnants of the concrete bunker that housed the CSIII device and/or other test instrumentation. No other burial areas were identified at the CSIII site.

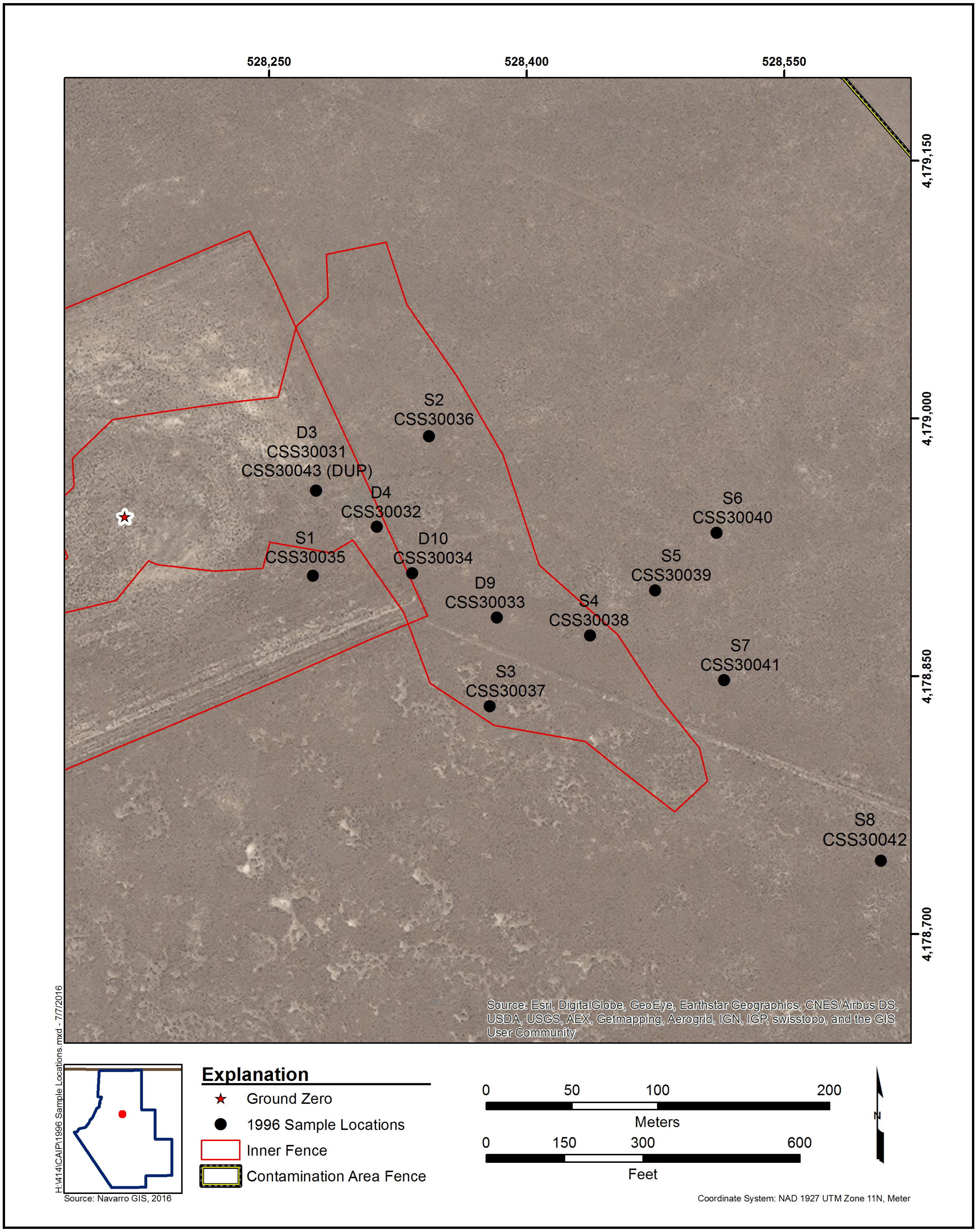

Figure 2-7
1996 CAI Sample Locations and Numbers

Table 2-3
Summary of Soil Sample Radiological Analytical Results
1996 CAI

Sample Number	Sample Location	Am-241	Pu-238	Pu-239/240	U-234	U-235/236	U-238
		pCi/g					
CSS30031	D3	1,540	--	27,700	-3.12	0	31.1
CSS30043 (FD)		574	93	10,400	17	-0.9	6.7
CSS30032	D4	151	26	2,070	0.75	-0.17	1.9
CSS30033	D9	21.5	9.3	1,090	2.18	0.3	3.62
CSS30034	D10	84.2	-228	2,140	18.5	6.8	5.5
CSS30035	S1	63.8	7.31	1,030	2.16	-0.09	1.39
CSS30036	S2	380	15	6,190	4.94	-0.8	13.1
CSS30037	S3	38.7	3.36	493	0.88	0	1.32
CSS30038	S4	4.04	1.15	2.28	1.95	0.34	-0.17
CSS30039	S5	39.3	2.3	488	3.31	-0.46	5.09
CSS30040	S6	11.2	0.5	152	1.41	-0.31	2.31
CSS30041	S7	10.3	1.5	218	1.53	0.58	1.99
CSS30042	S8	1.46	--	7.58	1.97	-0.63	0.94

-- = Not detected.

Historical records provide results of the survey; however, the geospatial data are not available. Therefore, these survey data are considered informational data, and are not of sufficient quality to support or make DQO decisions.

2.5.7 Aerial Radiation Surveys

Aerial radiological surveys were conducted at the CSIII site in 1977, 1993, and 2006. Although the surveys are in general agreement with one another with regard to general contamination distribution across the site, each subsequent survey was conducted at lower altitudes, which resulted in the 2006 survey results showing the best resolution. Therefore, only the 2006 aerial data were considered in the development of the CAI design for CSIII. The 2006 survey was flown at an altitude of 50 ft (the 1993 survey was flown at 100 ft), with flight lines approximately 75 ft apart. The aerial radiation

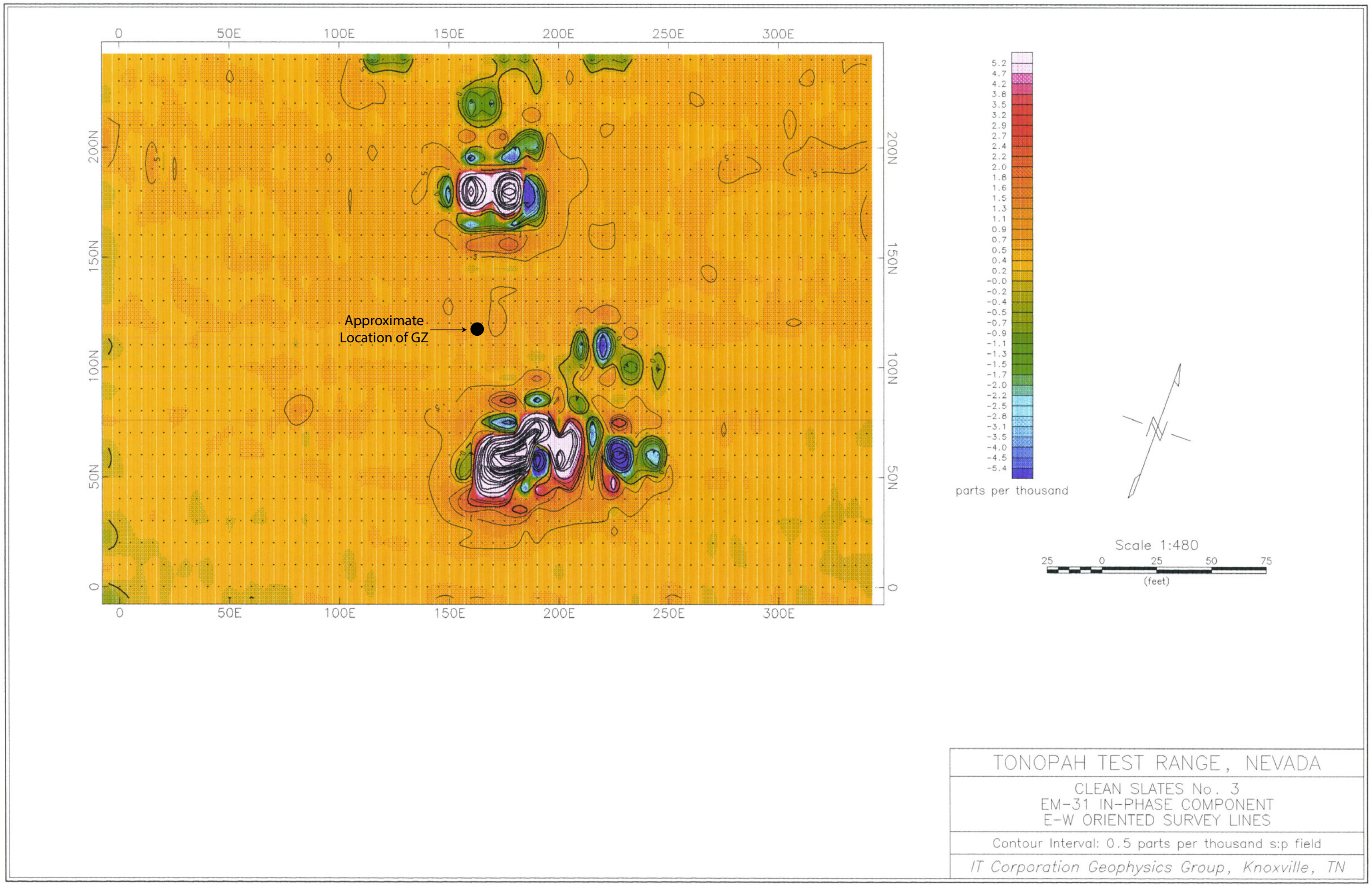

Figure 2-8
1996 CAI Geophysical Results
Source: Modified from IT, 1996

surveys provide spectral information that is used to differentiate ranges of isotopic signatures. This allows the separate mapping of Am-241, which is used as an indicator of the presence of Pu.

The full extent of the 2006 survey data is shown on Figure 2-9. As evidenced in this figure, the radioactivity in the area around GZ is not uniform, and some areas close to GZ appear less contaminated than areas further away. This pattern is also evident in the ground-based KIWI survey results and is believed to be the result of post-test activities (Section 2.5.6.1).

The data from the 2006 aerial radiation survey meet the definition of decision-supporting data, as defined in the Soils Activity QAP (NNSA/NSO, 2012b). The radiation survey data were considered in the selection of sampling locations for the CAI.

2.5.8 Radiological Posting Compliance Survey

In the fall of 2010, a radiological control posting compliance survey was performed at the four Operation Roller Coaster sites, including the CSIII site (NSTec, 2011). The purpose of this survey was to determine whether the existing postings and associated boundaries were compliant with the DOE Occupational Radiation Protection Program requirements found in 10 *Code of Federal Regulations* (CFR) 835 (CFR, 2016). The survey 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 fence by the 2006 aerial radiation surveys at each site. Figure 2-10 presents the 2010 removable contamination survey locations at CAU 414. 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 CSIII 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). The removable contamination data collected in the posting compliance investigation are informational data. These data were used to assess the removable contamination conditions outside the CA fence at the site.

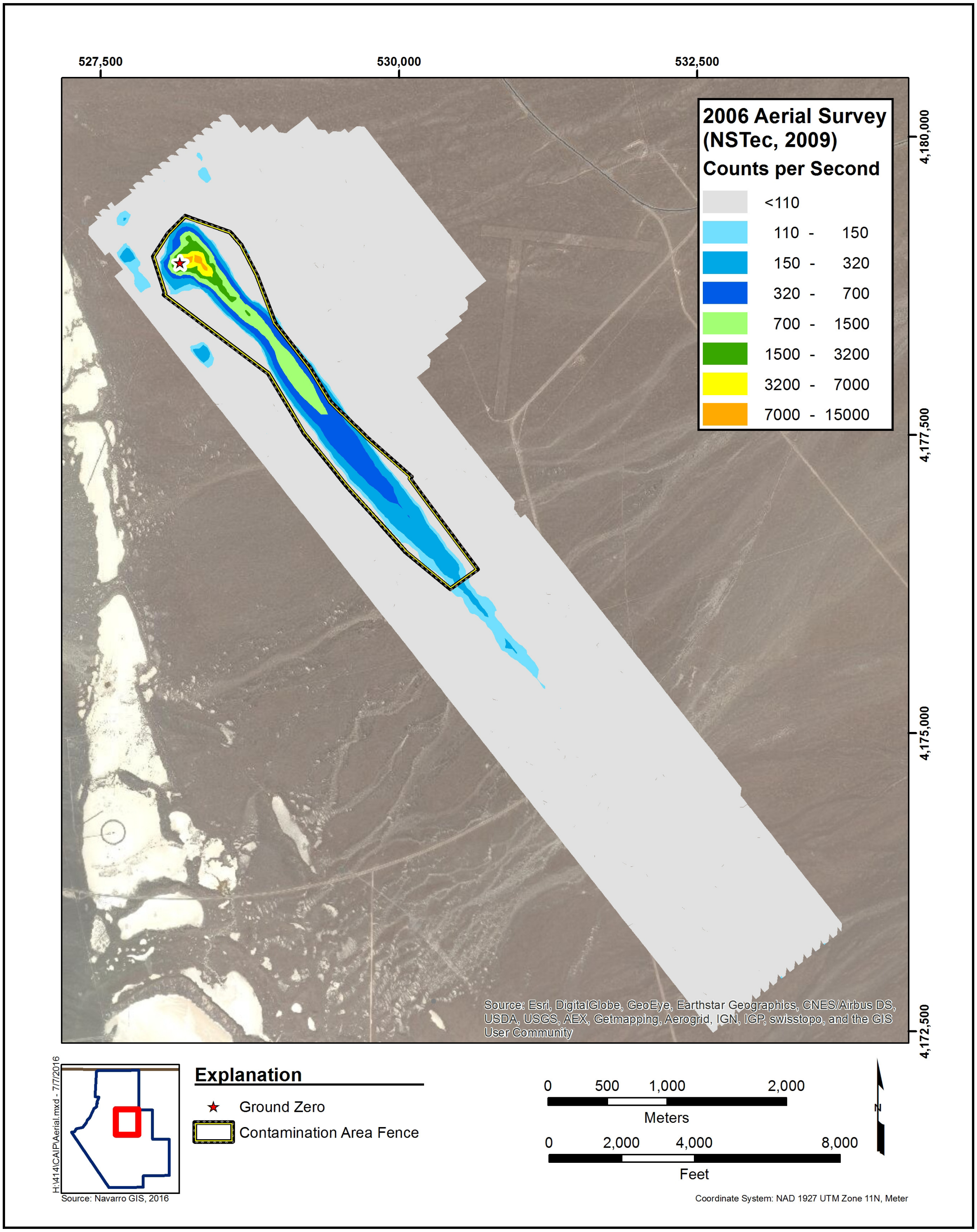

Figure 2-9
Aerial Radiation Survey Results

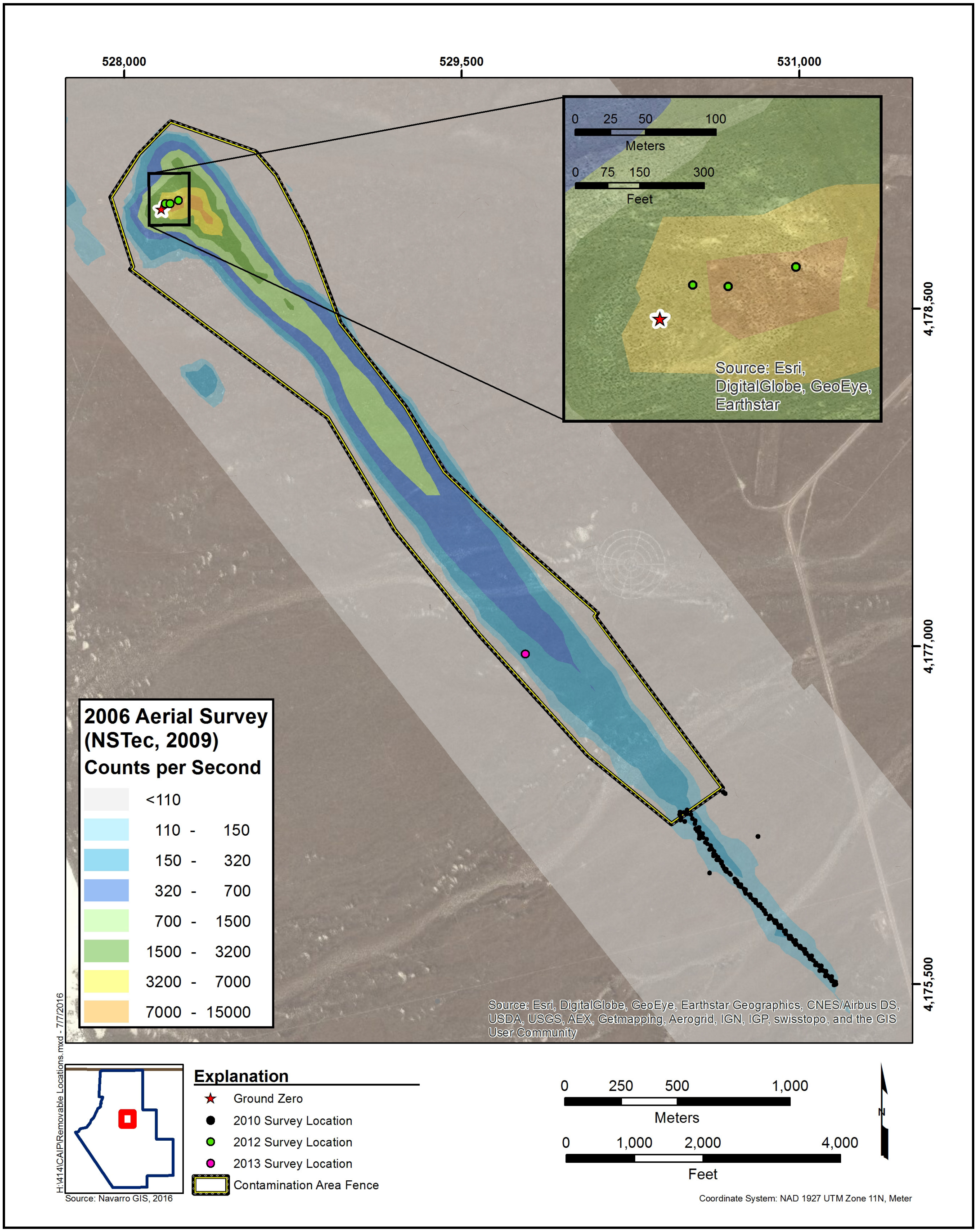

Figure 2-10
Removable Contamination Survey Locations at CAU 414

2.5.9 Preliminary Investigation

In the summer of 2012, additional investigation work referred to as the "preliminary investigation" (PI) was completed at the CSIII site. The PI fieldwork included visual surveys and ground-based radiological surveys. The radiological surveys included continuous scanning surveys using a FIDLER instrument and limited removable contamination surveys. A summary of the PI 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, Nevada Test and Training Range and Tonopah Test Range, Nevada* report (N-I, 2013a).

2.5.9.1 FIDLER Survey

As part of the 2012 PI, FIDLER surveys were conducted inside and outside the CA fence and at select locations on the periphery of the 2006 aerial survey flight path. The FIDLER surveys (conducted at a height of approximately 3 ft) displayed better spatial resolution than the 2006 aerial survey (conducted at a height of approximately 50 ft), as indicated by the detection of small pieces of debris and other localized areas of elevated radioactivity that were not evident in the aerial survey. The FIDLER surveys provide a general distribution of radiological contamination consistent with the 2006 aerial and 1996 KIWI surveys.

Subsequent to the 2012 PI, additional FIDLER data were collected in 2015 and 2016 to provide better coverage of the CSIII site and to identify areas of radioactively elevated debris and soil as part of the debris investigation (see Section 2.5.10). FIDLER survey data are captured in the field as discrete data points that coincide with the path that was walked/driven by the field technician. While these data are useful in identifying points of elevated radioactivity, they do not present the spatial distribution of contamination over the survey area. Using an inverse distance weighted interpolation technique, the discrete data points were processed to generate a continuous spatial distribution (i.e., interpolated surface), which is more comparable with other spatial datasets (e.g., aerial survey data). This interpolated surface provides estimated values for areas in between data points while largely maintaining the original data point values (i.e., limiting the impact of averaging data over an area). However, small anomalous areas or points of higher radioactivity (i.e., hot spots) were removed before the interpolative surface was created. This interpolative surface was used to represent contamination levels associated with the CSM element of atmospheric deposition of aerosolized contaminants (see Section 3.1.3). For the CSM element of atmospheric deposition of contaminated debris (see Section 3.1.3), the discrete hot spot survey values that were removed to create the interpolative surface were subsequently added to the interpolative surface. The combination of these two processes results in a dataset that represents both the general distribution of contamination and distinct areas of elevated radioactivity. Figure 2-11 presents the interpolated surface for CAU 414 and are a composite of FIDLER data collected in 2012, 2015, and 2016. This interpolated surface is qualitative data until it is correlated to quantitative data, at which time it can be used as semi-quantitative data.

The PI radiological survey data meet the definition of decision-supporting data, as defined in the Soils Activity QAP (NNSA/NSO, 2012b). The FIDLER data were used to guide the selection of sample locations for the CAU 414 CAI, specifically to locate areas of elevated radioactivity and/or radioactive debris.

2.5.9.2 Removable Contamination Survey

Removable contamination surveys were conducted at three locations within the innermost fences near GZ at the CSIII site (Figure 2-10). These locations were selected based on elevated FIDLER readings. A 100-m^2 area was selected at each location within which nine swipe samples were collected. Survey results indicated removable alpha contamination at two of the three locations that exceed the HCA criterion of 2,000 dpm/100 cm^2. The maximum removable alpha contamination level detected at each location was 4,500, 3,500, and 401 dpm/100 cm^2.

In 2013, a removable contamination survey was also conducted in the area immediately surrounding a large rocket motor present in the southern portion of the CA fenced area (see Section 2.5.9.3). Nine removable contamination swipe samples were collected from the soil surrounding the rocket motor to determine radiological conditions before removal of the rocket motor (Figure 2-10). The maximum swipe sample result was 8.7 dpm/100 cm^2 removable alpha contamination, which is below the posting criteria for a CA (20 dpm/100 cm^2).

The removable contamination survey data collected during the PI are categorized as informational data. These data were used to assess the removable contamination conditions at select locations inside the CA fence.

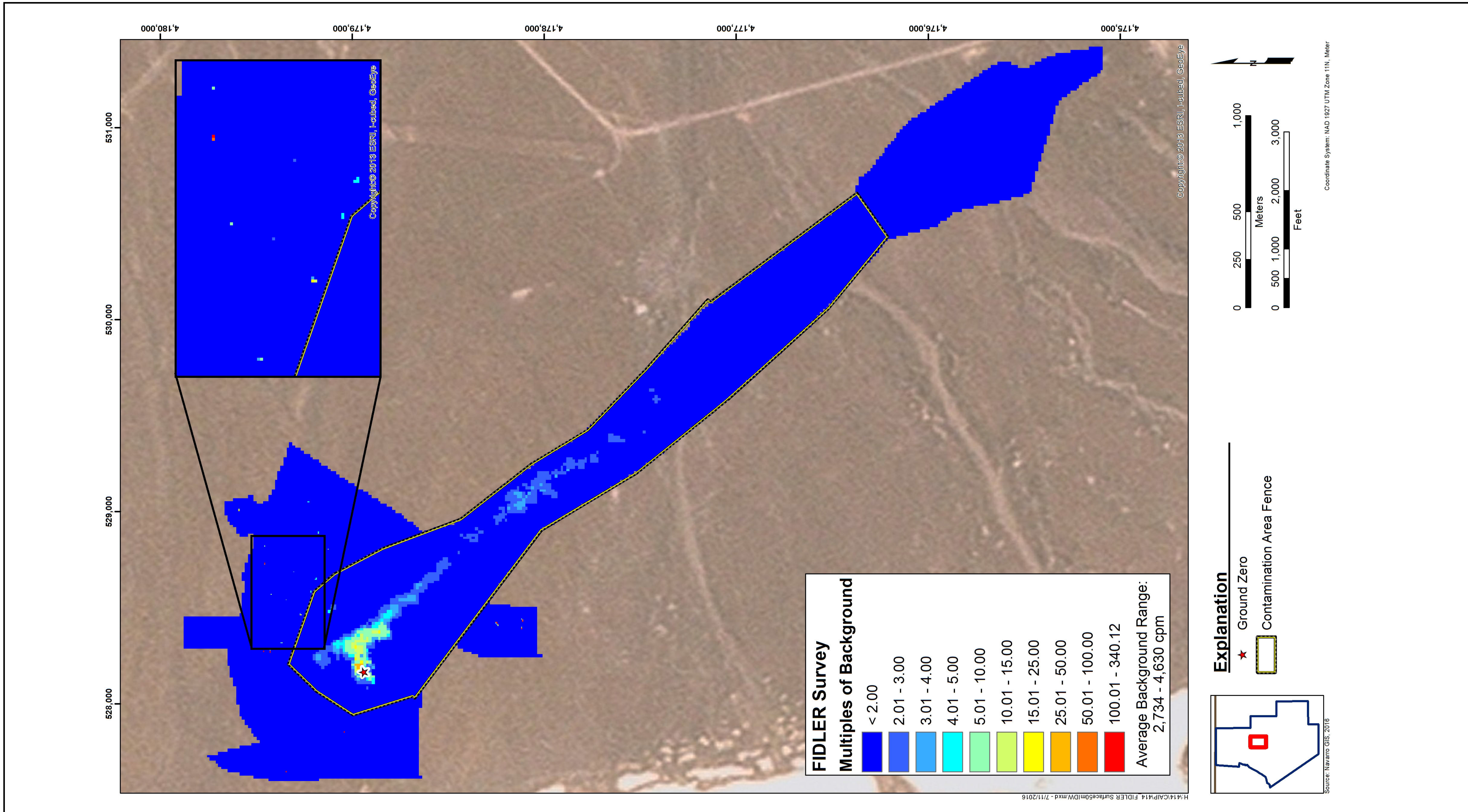

Figure 2-11
FIDLER Survey Results
(Composite of 2012, 2015, and 2016 Data)

2.5.9.3 Visual Survey

Visual surveys were conducted inside the CA fence and around the fence perimeter. The information collected during the PI visual survey is considered informational data, and will not be used to support or make DQO decisions. The following surface features were noted during the PI:

- One unexploded ordnance (UXO) item
- PSM and waste items

UXO Item. A large partially buried UXO item was noted during the 2012 PI. The item was located inside the CA fence in the southern portion of the CSIII site (Figure 2-10). In 2013, explosives experts determined the item to be an expended rocket motor. Ten grab soil samples and nine removable contamination swipe samples were collected before removal of the rocket motor to document existing radiological conditions in the area and support development of a removal plan. The removable contamination samples are discussed in Section 2.5.9.2. Five of the grab soil samples, including one FD, were collected immediately surrounding the rocket motor; the other five samples were collected at varying intervals up to approximately 600 ft from the item. All of the soil samples were analyzed for gamma spectroscopy; Pu-241; and isotopic Pu, Am, and U. The sample results are presented in Table 2-4. The analytical data collected as part of the UXO investigation are considered informational data and were not used in the design of the CAI. The rocket motor was removed in May 2013 and ultimately disposed as non-hazardous, non-radioactive waste in 2014.

PSM and Waste Items. The PI also noted several abandoned containers and surface debris located just inside the CA fence in the northwest portion of the site. This material included two sample coolers filled with soil and water samples, three plastic buckets filled with concrete cores, one 55-gallon drum, and a pile of surface debris (metal scrap, wood). In 2014, all of this material was removed from CAU 414 and combined with waste material from the CAU 413 (CSII site) for offsite disposal. A summary of these activities and the waste disposal documentation are provided in Appendix F of the CAU 413 CAIP (NNSA/NFO, 2016).

Table 2-4
Summary of Soil Sample Radiological Analytical Results
UXO Investigation

Sample Number	Sample Location	Am-241	Pu-238	Pu-239/240	Pu-241	U-234	U-235/236	U-238
		(pCi/g)						
AB4R001	R1	16.5 (J)	ND	47.9	ND	0.77	ND	0.985
AB4R002 (FD)	R1	13.9 (J)	0.407	22	ND	0.981	ND	1.45
AB4R003	R2	18.6	2.52	371	58.6	0.857	ND	1.06
AB4R004	R3	16.1	1.55	243	39.9	0.959	ND	0.917
AB4R005	R4	10.5 (J)	21.5	3,380	504	1.06	ND	1.05
AB4R006	R5	7.23 (J)	0.0432	7.9	2.09	0.875	ND	1.01
AB4R007	R6	13.1	1.52	223	40.6	0.897	0.0541 (J)	1.2
AB4R008	R7	15.3 (J)	ND	13.1	ND	0.995	ND	0.865
AB4R009	R8	16.3 (J)	0.115	11.3	ND	0.97	0.0794 (J)	1.13

ND = Not detected

J = Estimated value.

2.5.10 Debris Investigation

In 2016, a debris investigation was conducted in the northern portion of the CSIII site outside the CA fence. This investigation was prompted by the identification of radioactively contaminated concrete and metal debris outside the CA fence at CAU 413 (CSII) and historical site-specific radiation surveys completed in the years following the CSIII test (Section 2.5.2). Because the CSII and CSIII tests were similar in design (i.e., both tests involved devices exploded inside reinforced concrete bunkers covered with soil), there was a potential for contaminated concrete and metal debris to be present outside the CA fence at CAU 414. In order to assess potential personnel hazards outside the fence in a timely manner, the debris investigation at CSIII was conducted immediately following completion of the debris investigation at CAU 413 (CSII).

The debris investigation at CAU 414 was focused on areas outside the CA fence that were noted in the historical records (east and northwest of GZ) and three isolated areas of detected radioactivity shown in the 2006 aerial survey (on the western side of the CA fence). Visual and FIDLER surveys were conducted of these areas and the results recorded using the Global Positioning System (GPS)

(Figure 2-12). A piece of concrete debris identified at the site is shown in Figure 2-13. Similar to that observed at CAU 413 (CSII site), a faded black substance fused to the surface of the concrete is visible in the photograph. Also visible are the indentations from a section of steel reinforcing bar. The radiological measurements of this black substance are much higher than portions of the debris that are free of the substance. It is likely that this black substance contains Pu and DU that was fused to the bunker concrete as a result of the CSIII test and thrown from GZ during the explosion.

2.5.11 Meteorological and Airborne Particulate Monitoring

From 1996 to 1997, the TTR maintained a continuous air monitoring station in Area 3 of TTR to determine compliance with federal regulations for hazardous air pollutants. Area 3 of the TTR is approximately 5 mi northwest of the CSIII site. This year-long study estimated a dose of 0.024 millirem per year (mrem/yr) to a member of the public working at the TTR Airport from the diffuse sources of Pu and Am attributed to the CS sites (Culp et al., 1998). The average air concentration, in microcuries per milliliter (μCi/mL), were 4.1×10^{-18} for Am-241, 1.6×10^{-18} for Pu-238, and 9.5×10^{-19} for Pu-239/240.

Air monitoring at a single location approximately 2,400 meters (m) northwest of the CSIII GZ was conducted by the NNSS management and operating contractor from 1996 through 2000 (Black and Townsend, 1997, 1998, and 1999; Townsend and Grossman, 2000 and 2001). Data were analyzed for gross alpha, gross beta, gamma spectroscopy, and isotopic Pu. Because this monitoring station was included as part of a wide network of air samplers on NNSS, the data were reported in summary tables and were not evaluated on a site-specific basis. The highest Pu-238 and Pu-239/240 values detected over this five-year period were 0.78×10^{-18} μCi/mL and 7.2×10^{-18} μCi/mL.

In 1997, the Desert Research Institute (DRI) published the results of Pu analyses of ambient airborne particulate matter from the CS sites (Bowen, 1997). A single air monitoring station located approximately 2 mi west–northwest of the CSIII site was operated from 1996 through 1997. Filter samples from the station were composited over a three-month period and analyzed for Pu. Of the four composite samples, one sample (February through April 1996) had Pu-239/240 detected above the detection limit. The maximum estimated internal dose for inhaled Pu-239/240 was 0.26 millirem (mrem) (91-day period) for this sample.

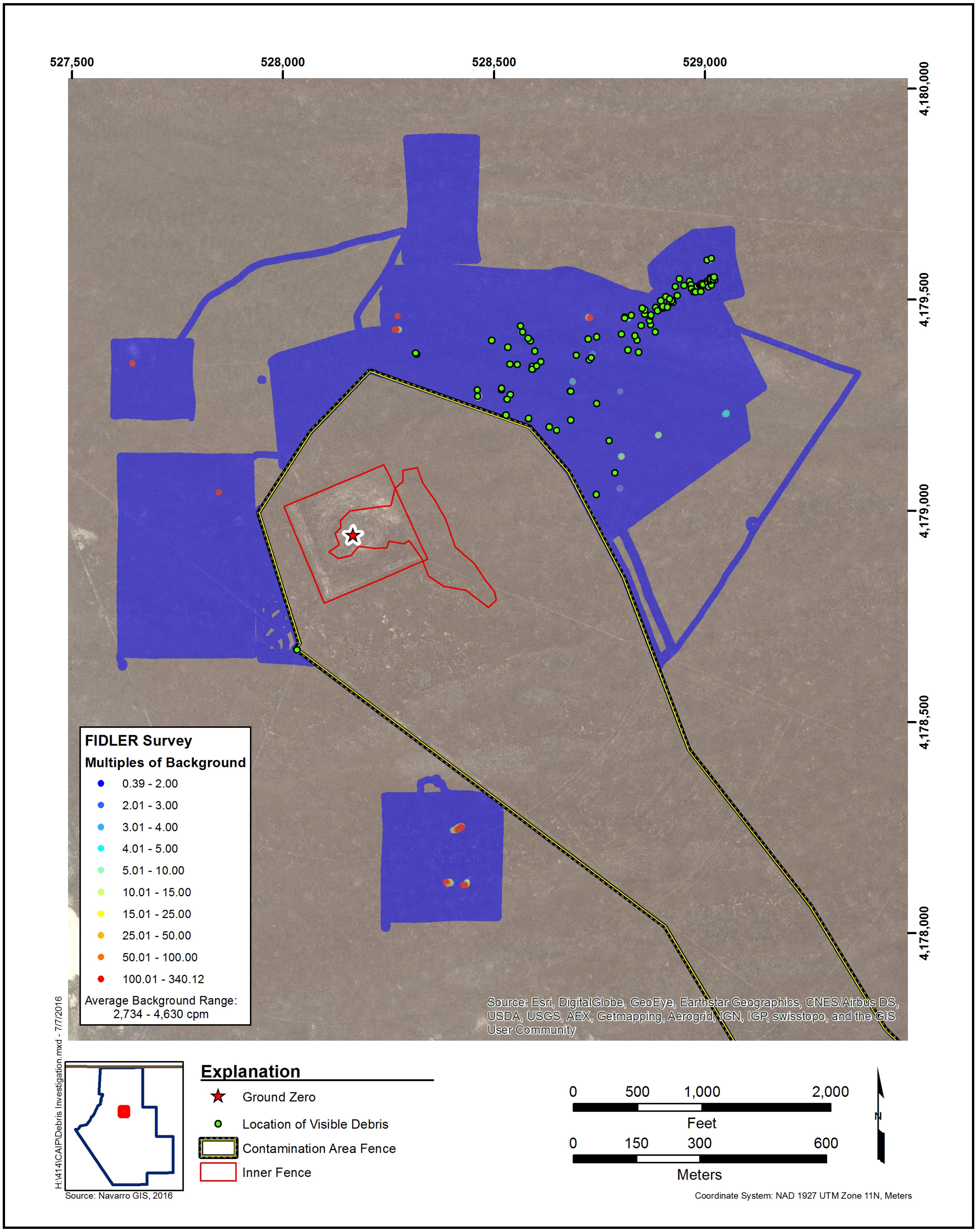

Figure 2-12
Visual and FIDLER Survey Debris Investigation

Figure 2-13
Concrete Debris at CAU 414

In 2014, DRI published a report (Mizell et al., 2014) on the results of three monitoring stations installed at the TTR to measure environmental conditions. Two of the monitoring stations, one located near the TTR airport and the other at the CSIII site, were installed in 2008; the third station was installed at the CSI site in 2011. The report includes data collected through 2012. The CSI and CSIII stations are located east of Antelope Lake on Cactus Flat. The stations collect data pertaining to meteorological conditions, radiological characteristics of suspended airborne particulates, and ambient gamma radiation. With the exception of cesium detections attributable to worldwide fallout, the gamma spectroscopy analyses of airborne particulates detected only naturally occurring radionuclides. The report concludes there is no indication that wind is transporting gamma-emitting radionuclides from the CS sites. Monitoring at the three stations is ongoing.

A resuspension study was conducted at the CSIII site from October 1990 to August 1991. The only information identified regarding this study consists of a one-page summary that concludes that for a one-month period (November through December 1990), the air concentration at the CSIII site was estimated using indirect methods at 2.7×10^{-12} µCi/m^3 (Shinn, 1992) (2.7×10^{-18} µCi/mL).

These air monitoring data demonstrate concentrations of contaminants in the airborne pathway that would not result in significant dose levels. The data are considered informational data and were used to support the CSM premise that wind transport is not a significant migration pathway.

2.5.12 National Environmental Policy Act

The *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (NNSA/NSO, 2013) includes site investigation activities such as those proposed for CAU 414.

In accordance with the NNSA/NFO *National Environmental Policy Act* (NEPA) Compliance Program, a NEPA checklist will be completed before beginning site investigation activities at CAU 414. This checklist requires NNSA/NFO activity personnel to evaluate their proposed activities against a list of potential impacts that include, but are not limited to, air quality, chemical use, waste generation, noise level, historical and cultural features, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the NNSA/NFO NEPA Compliance Officer.

3.0 Objectives

This section presents an overview of the DQOs for CAU 414 and formulation of the CSM. Also presented is a summary listing of the COPCs, the preliminary action levels (PALs), and the process used to establish FALs. Additional details and figures depicting the CSM are located in Appendix A.

3.1 Conceptual Site Model

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 for CAU 414 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 (e.g., soil, debris) and COPCs.

Figure A.2-1 depicts a representation of the conceptual pathways to receptors from CAU 414 sources. Figure A.2-2 depicts a graphical representation of the CSM. If evidence of contamination that is not consistent with the presented CSM is identified during CAI 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, decision makers listed in Section A.2.1 will be notified and given the opportunity to comment on and/or concur with the recommendation.

3.1.1 Land-Use and Exposure Scenario

In consultation with the USAF and NDEP, a Ground Troops (GT) land use scenario was determined applicable to the CAU 414 site (Cornish, 2014). The most exposed individual (MEI) 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 this individual bivouacs at the CAU 414 site. The maximum amount of time the individual could be deployed during any single mission or operation is 14 days, 24 hours per day (hr/day), and will participate in three such deployments a year. This results in a total of 1,008 hours per year (hr/yr) of potential exposure. The MEI receives an internal dose through incidental ingestion of surface and subsurface soil and inhalation of soil particulates, and an external dose by external irradiation. It is assumed the MEI does not obtain drinking water from the site. Using the GT exposure scenario assumptions, residual radioactive material guidelines (RRMGs) specific to CAU 414 were calculated using the RESRAD computer code (Yu et al., 2001). The RRMGs are radionuclide-specific activities, in pCi/g, 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 of the CAU 412 SAFER Plan (NNSA/NFO, 2015b). Where possible, site-specific data were used for model input.

At the request of the CAU 414 stakeholders, the impact a wound may have on total dose to a receptor was evaluated and is presented in Appendix G of the CAU 412 SAFER Plan (NNSA/NFO, 2015b).

3.1.2 Contaminant Sources

The contaminant source for CAU 414 is the CSIII test conducted in 1963. The test dispersed nuclear material to soil on the ground surface and to contaminated pieces of the bunker and test device (concrete and metal debris).

3.1.3 Release Mechanisms

The CSM assumes two primary release mechanisms for the dispersal of contaminants from the CSIII test: (1) the test explosion and (2) post-test disturbance of contaminated soil and debris.

Based on post-test observations of contaminant distribution, it is thought that the radionuclide test material (Pu and DU) was present in the following three physical phases (due to varying temperatures to which it was subjected during the chemical detonation):

1. *Solid phase that did not melt but was dispersed by the blast.* Most of the mass of this phase was deposited near GZ with concentrations diminishing rapidly with distance.

2. *Liquid phase that was subjected to sufficient temperatures to melt but not vaporize the test material.* Most of this liquid phase rapidly solidified as it came into contact with the surrounding, and somewhat cooler, bunker materials. This resulted in a surface coating on concrete and metal debris, which were subsequently thrown from the blast. Much of this debris had sufficient mass to be ejected to a considerate distance from GZ in the direction of the blast.

3. *Gaseous phase that was subjected to sufficient temperatures to vaporize the test material.* Most of this phase condensed in the resulting aerial plume onto dust particles as it cooled, forming a vitreous coating. These particles subsequently precipitated out of the plume in the direction of the predominant wind direction at the time.

These three phases are discussed in detail in Section A.2.2.2.

Post-test activities included the consolidation and burial of contaminated soil and debris near GZ shortly after the test and the recovery of metal debris from the burial location some months later. These activities redistributed, or had the potential to redistribute, contamination originally deposited on the ground surface by the CSIII test. The location near GZ where contaminated soil and debris were buried shortly after the test was reportedly covered with clean soil. Some months later, metal debris was removed from this area. It is not known whether the remaining material was re-covered with clean soil. As a result, it is possible that contaminated soil and/or debris is present on the surface at the burial location. This location of buried debris (SG4) is the only known area at the CSIII site at which contaminated material was buried.

Based on soil profile data from previous investigations, including data presented in Table 2-2, the CSM assumes that subsurface contamination is not present at any of the disturbed areas within SG2 with activities higher than that of the surface. This assumption is based on the premise that the objective of the ground disturbance activities was not to bury contamination but to remove it from the ground surface (e.g., to consolidate contaminated material for burial). Therefore, the contamination initially deposited on the surface would have been mixed with less contaminated soil in the shallow subsurface, forming a deeper and less concentrated layer of contamination from the surface to the depth of disturbance. Investigation of the SG2 release mechanism is discussed in Section A.8.2.1.

3.1.4 Migration Pathways

Migration pathways include the lateral migration of potential contaminants as a result of airborne (wind) dispersion, surface water runoff, and mechanical disturbance of soils. Vertical migration pathways for contaminants include infiltration of surface water and precipitation, and mechanical disturbance of surface and subsurface soils. The migration of Pu in all pathways is primarily due to the migration of soil particles upon which they are adsorbed (see Section A.2.2.5). This, coupled with the high PET rate of the TTR (see Section A.2.2.4), indicate that the vertical migration pathway is not a significant pathway for the consideration of potential dose to a receptor at CAU 414.

The CSIII test resulted in the airborne dispersal of Pu and DU to the surface soil. Onsite monitoring of airborne particles has been conducted at the meteorological stations at the CSI and CSIII sites since 2011 and 2008, respectively. With the exception of cesium (Cs)-134 and -137 attributed to the 2011 Fukushima event, the gamma spectroscopy analyses detected only naturally occurring radionuclides in airborne soil particulate samples throughout the monitoring period (Mizell et al., 2014). Therefore, the air pathway is not considered to be a significant migration pathway for the consideration of potential dose to a receptor at CAU 414.

Contaminants present in drainage systems are subject to much higher transport rates than contaminants present in other surface areas. The drainage channels/ephemeral washes at the CSIII site are generally dry but are subject to infrequent stormwater flows. These stormwater flow events provide an intermittent mechanism for both lateral and vertical transport of contaminants. Contaminated sediments entrained by these stormwater events would be carried by the drainage channel flow to locations where the flowing water loses energy and the sediments drop out. These locations are readily identifiable as sedimentation areas. Surface water flows to the west in the direction of Antelope Lake through drainage channels that transect the southern portion of the CSIII site (Figure 2-5).

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high PET (58 to 69 in.), and limited annual precipitation for this region (6 in.), percolation of infiltrated precipitation at the CSIII site does not provide a significant mechanism for vertical migration of contaminants to groundwater (French, 1983 and 1985). The average depth to groundwater at the CSIII site is 262 ft bgs (N-I, 2013b).

Mechanical disturbance and redistribution of contaminated surface and/or subsurface soil is another likely migration pathway/transport mechanism at the site. Documented post-test operations involved the collection and burial of surface soil and debris immediately following the CSIII test and excavation of metal debris months after burial. These post-test activities are further discussed in Sections 2.4.2 and 2.4.4.

Migration is influenced by the chemical characteristics of the contaminants and the physical characteristics of the vadose zone material. The contaminant characteristics of the major contaminants that contribute to dose (Pu and Am) are very low solubility and very high adsorption potential (see Section A.2.2.5). The gravelly sandy loam and sandy loam soils at CAU 414 (Leavitt, 1974) show moderate permeability, porosity, and water-holding capacity; low organic content; and relatively high adsorption potential. In general, contaminants with low solubility and high affinity for soil are expected to be found relatively close to release points.

3.1.5 Exposure Points

The exposure points are associated with the various elements of the CSM. Each CSM element has a potential for exposure to contaminants in the surface soil. The disturbed areas, drainages, and buried debris CSM elements also have the potential for subsurface contamination that could be a source of exposure for any activities that involve ground disturbance. For the PSM element of the CSM, an additional evaluation is made for the potential exposure to point sources of contamination. This evaluation (presented in Appendix C) considers the need for corrective action for small areas that may contain unacceptably high concentrations of residual radioactive material (i.e., hot spots) even though they do not cause a dose that exceeds the FAL (due to averaging over the 1,000-m^2 exposure area as prescribed in the Soils RBCA document [NNSA/NFO, 2014]).

3.1.6 Exposure Routes

Exposure routes to potential site receptors include ingestion; inhalation; and dermal contact from disturbance of, or direct contact with, contaminated soil and/or debris. Receptors may also be exposed to direct ionizing radiation by performing activities in proximity to radioactive materials. Due to the internal radiation hazards presented by Pu and Am, the inhalation or ingestion of contaminated material presents the greatest exposure hazard to a receptor.

3.1.7 Additional Information

Information concerning topography, geology, climatic conditions, and hydrogeology at CAU 414 is presented in Section 2.1 as it pertains to the investigation. This information has been addressed in the CSM and will be considered during the evaluation of CAAs, as applicable. Climatic and site conditions (e.g., surface and subsurface soil descriptions) as well as specific structure descriptions will be recorded during the CAI. Areas of erosion and deposition within the drainages will be qualitatively evaluated to provide additional information on potential offsite migration of contamination.

3.2 Contaminants of Potential Concern

The COPCs for CAU 414 are defined as the contaminants reasonably expected at the site that could contribute to a dose or risk exceeding FALs. 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 COPCs for CAU 414 are as follows:

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

Historical records indicate that the CSIII test device contained Pu, DU, and Am-241 (AEC/NVOO, 1964; Menker et al., 1966).

Samples collected at CAU 414 will be submitted to the laboratory for the analyses specified in Table A.2-2. The analytes that are reported by the laboratory for each of these analytical methods are presented in Table A.2-3.

3.3 Preliminary Action Levels

NNSA/NFO uses an RBCA process to evaluate the need for 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." For the evaluation of corrective actions, the FALs are established as the necessary remedial standard.

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., 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 and 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 CAAs. All analytical 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 414 CADD. The RBCA process used to establish FALs is described in the Soils RBCA document (NNSA/NFO, 2014).

This RBCA process includes a provision for conducting an interim remedial action if necessary and appropriate. The decision to conduct an interim action may be made at any time during the investigation and at any level (tier) of analysis. Evaluation of DQO decisions will be based on conditions at the site after any interim actions are completed. Any interim actions conducted will be reported in the CADD.

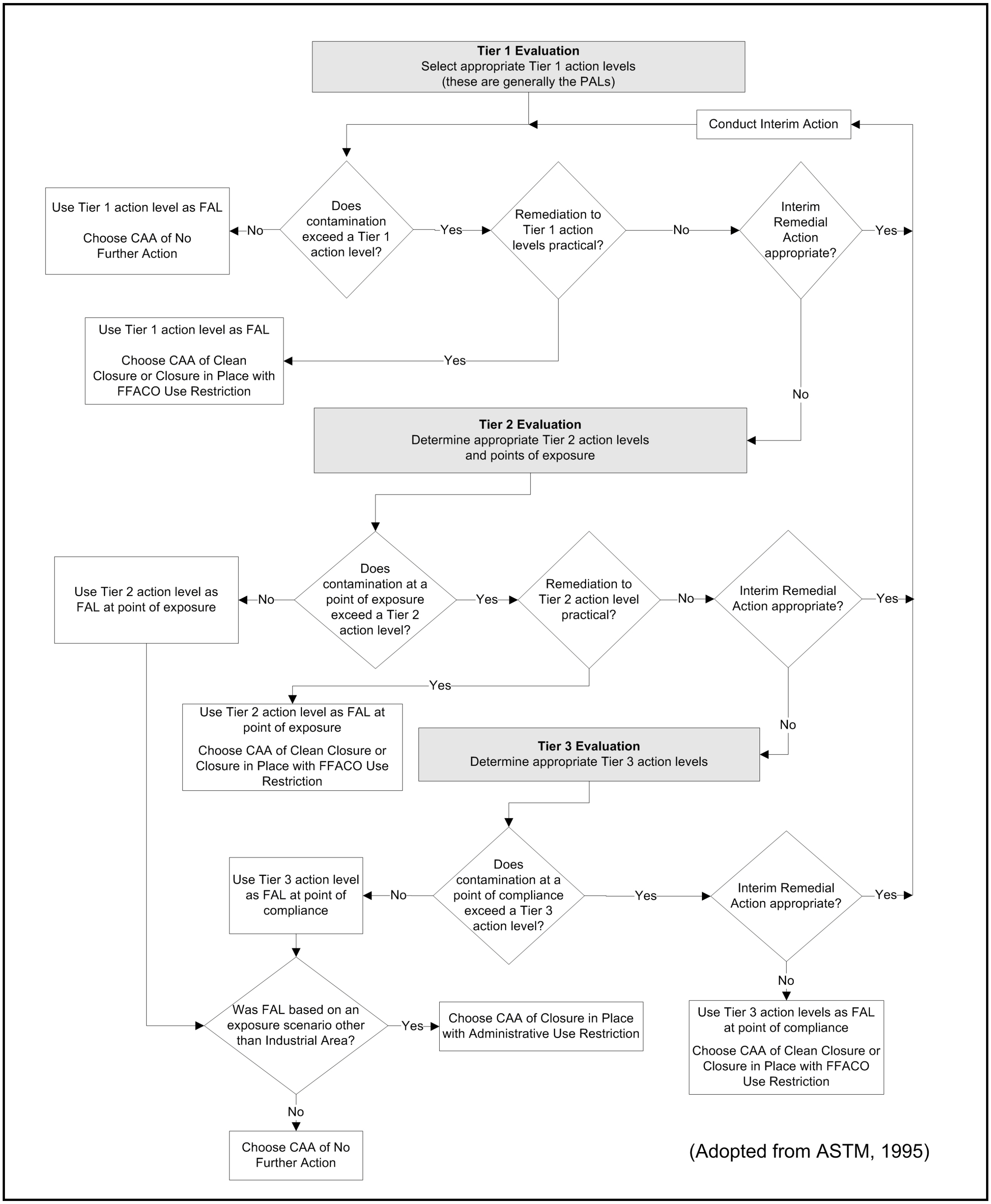

Figure 3-1
RBCA Decision Process

3.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the U.S. Environmental Protection Agency (EPA) Region 9 Regional Screening Levels for chemical contaminants in industrial soils (EPA, 2015). Background concentrations for *Resource Conservation and Recovery Act* (RCRA) metals will be used instead of screening levels when natural background concentrations exceed the screening level. Background is considered the average concentration plus two standard deviations of the average concentration for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the NTTR (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999).
For detected chemical COPCs without established screening levels, the protocol used by EPA Region 9 in establishing screening levels (or similar) will be used to establish PALs. If used, this process will be documented in the CADD. If, after implementation of corrective actions, contamination remains in place that is less than the site-specific exposure scenario based FAL but exceeds 25 mrem/yr based on the Industrial Area exposure scenario, an administrative use restriction will be implemented to prevent future industrial use of the area.

3.3.2 Radiological PAL

The radiological 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 USAF. In consultation with stakeholders, the GT exposure scenario was determined applicable to CAU 414 (Cornish, 2014). Thus, the PAL is a total effective dose (TED) of 25 mrem/yr, based upon the GT exposure scenario. The TED is calculated as the sum of external dose and internal dose. Because of the nature of the CSIII test, it is expected that the internal dose component will be larger than the external dose component in soils at the site. External dose is calculated from TLD measurements. Internal dose is determined by comparing analytical results from soil samples to RRMGs that are 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 pCi/g 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 input parameters used in the RESRAD calculation of RRMGs for the GT exposure scenario and the associated RRMGs were presented in the CAU 412 SAFER Plan (NNSA/NFO, 2015b).

In order to address removable contamination that may be encountered at CAU 414, it will be assumed that a potential offsite dose to a receptor will exceed the dose-based FAL if removable contamination is present that exceeds the HCA criterion of 2,000 dpm/100 cm^2 alpha contamination (NNSA/NFO, 2014). The HCA criterion is a numeric threshold for removable alpha contamination that is used in the DOE Occupational Radiation Protection Program (CFR, 2016) to determine area posting requirements. For removable contamination, it is assumed that if this threshold is exceeded, the dose-based FAL is also exceeded and corrective action is required. Thus, in order to determine whether corrective action is necessary at CAU 414, radiological dose as well as removable contamination levels must be considered. A discussion on the risks associated with removable radioactive contamination is presented in the Soils RBCA document (NNSA/NFO, 2014).

3.4 DQO Process Discussion

This section contains a summary of the DQO process that is presented in Appendix A. 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 (e.g., no further action, clean closure, or closure in place).

The DQO strategy for CAU 414 was developed at a meeting on June 7, 2016. DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and design a data collection program that will satisfy these purposes. During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 414 is as follows: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend CAAs for CAU 414." To address this problem statement, resolution of the following decision statements is required:

- **Decision I.** "Does any location exceed the FALs?" If a COC is detected, then Decision II must be resolved. For judgmental sampling decisions, any contaminant that is present at concentrations exceeding its corresponding FAL will be defined as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NFO, 2014).

- **Decision II.** "Is there sufficient information to evaluate potential CAAs?" Sufficient information is defined to include the following:
  - The lateral and vertical extent of contamination at levels exceeding the FAL
  - The information needed to estimate potential remediation waste types and volumes

For a judgmental sampling design (i.e., biased sampling), any analytical result for a COPC above the FAL will result in that COPC being designated as a COC. For a probabilistic sampling design (i.e., unbiased sampling), 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. The presence of a COC would require a corrective action. The evaluation of the need for corrective action will include the potential for wastes that are present at the site to contain contaminants that, if released, could cause the surrounding soil to contain COCs. Such a waste will be evaluated using the PSM criteria listed in the Soils RBCA document (NNSA/NFO, 2014) to determine the need for corrective action.

The informational inputs and data required to resolve the problem statement and the decision statements were generated as part of the DQO process for CAU 414 and are documented in Appendix A. The information necessary to resolve the DQO decisions will be generated for CAU 414 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).

A probabilistic sampling design will be used to collect samples from unbiased locations within an area that can be readily defined by distinct characteristics where the assumed distribution of contamination is relatively uniform. Results from these locations will be used to infer a characteristic representative of the sampled area as a whole (i.e., representing the average of the entire area, not the maximum at any one location). The characteristic normally used to define contamination within an area is the 95 percent UCL of the mean concentration or dose.

Protection against false negative decision errors are provided by the following:

- *Judgmental sampling* when contamination concentrations or dose levels from locations of the greatest degree of the selected biasing factor are used to make decisions for a larger area (e.g., a release site).

- *Probabilistic sampling* when the 95 percent UCL of the mean concentration or dose is used to make decisions for the defined sampling area.

Decisions are even more conservative when probabilistic results (i.e., 95 percent UCL) from biased locations are used to make a decision on the presence of COCs for the entire release site. This is typically the case when the 95 percent UCL of contamination at a sample plot located in the area of the highest radiation survey values are used to resolve the decision on the presence of COCs (i.e., Decision I).

For SG1, Undisturbed Areas, the DQO process resulted in an assumption that TED exceeds the FAL. It was also assumed for SG4, Buried Debris, that the contaminated debris and soil buried near GZ after the CSIII test exceeds the FAL. Thus, Decision I for these two releases is resolved, and Decision II must be evaluated for each. For all other study groups, Decision I and Decision II, as appropriate, must be evaluated.

For laboratory data, the data quality indicators (DQIs) of precision, accuracy, representativeness, comparability, completeness, and sensitivity needed to satisfy DQO requirements are discussed in Section 6.2. Laboratory data will be assessed in the investigation report to confirm or refute the CSM and determine whether the DQO data needs were met.

4.0 Field Investigation

This section contains a description of the activities to be conducted to gather and document information from the CAU 414 field investigation.

4.1 Technical Approach

The information necessary to satisfy the DQO data needs will be generated for CAU 414 by collecting and analyzing samples generated during a field investigation. To determine whether COCs are present at the site (Decision I), a judgmental sampling approach will be implemented in which samples are collected from biased locations. For sample plot locations, each Decision I sample plot will generate a TED value for the judgmental decision that represents the population of doses within the 100-m^2 area of the sample plot. This representative TED value will be determined using a probabilistic sampling design to generate a 95 percent UCL of the average TED within the plot area. For grab sample locations, DQO decisions will be based on a direct comparison of sample results to the FAL. The TED will be calculated using the methodologies described in the Soils RBCA document (NNSA/NFO, 2014).

The extent of COC contamination portion of Decision II will be resolved using one of the methods listed in Section A.4.1. The extent of radiological COC contamination decision (Decision II) will be a probabilistic decision determined by correlating TED and radiological survey values as described in the Soils RBCA document. A correlation of calculated TED to radiation survey values at corresponding locations will be used to establish a radiation survey value corresponding to the FAL. This method will only be used if the correlation between TED and the survey values has a coefficient of determination (r^2) greater than 0.8. The statistical relationship among the correlated values can then be used to estimate a 95 percent lower confidence limit (LCL) of the correlation. The radiation survey value that intersects the LCL of the correlation at the TED value of 25 mrem/yr under the GT exposure scenario will be used as the radiation survey isopleth that defines the extent of contamination.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered. Significant modifications must be justified and documented before implementation. If an unexpected condition indicates that conditions are significantly different from the CSM, the activity will be rescoped, and the identified decision makers will be notified.

4.2 Field Activities

Field activities at CAU 414 will include site preparation, radiation surveys, geophysical surveys, sample collection, and site restoration.

4.2.1 Site Preparation Activities

Site preparation activities to be conducted before the start of environmental sampling may include relocating or removing surface debris, constructing site exclusion zones, and providing sanitation facilities.

4.2.2 Radiation Surveys

Radiation surveys conducted during the CAI will consist of mobile surveys using the FIDLER and/or removable contamination surveys.

4.2.2.1 FIDLER Surveys

Radiation surveys using a FIDLER instrument may be conducted within the CA fence to ensure high confidence in the interpolated surface and the resulting dose boundary. The FIDLER instrument will also be used to perform localized surveys before soil sample plot and grab sample locations are established.

4.2.2.2 Removable Contamination Surveys

Removable contamination surveys will be conducted to determine removable contamination levels in soil and on individual pieces of PSM (e.g., concrete, metal fragments).

4.2.3 Geophysical Surveys

Geophysical surveys using an EM-31 and/or EM-61 system will be conducted in the vicinity of the GZ area to determine the vertical and lateral extent of the Buried Debris release (SG4). The approximate area of the survey is shown in Figure 4-1.

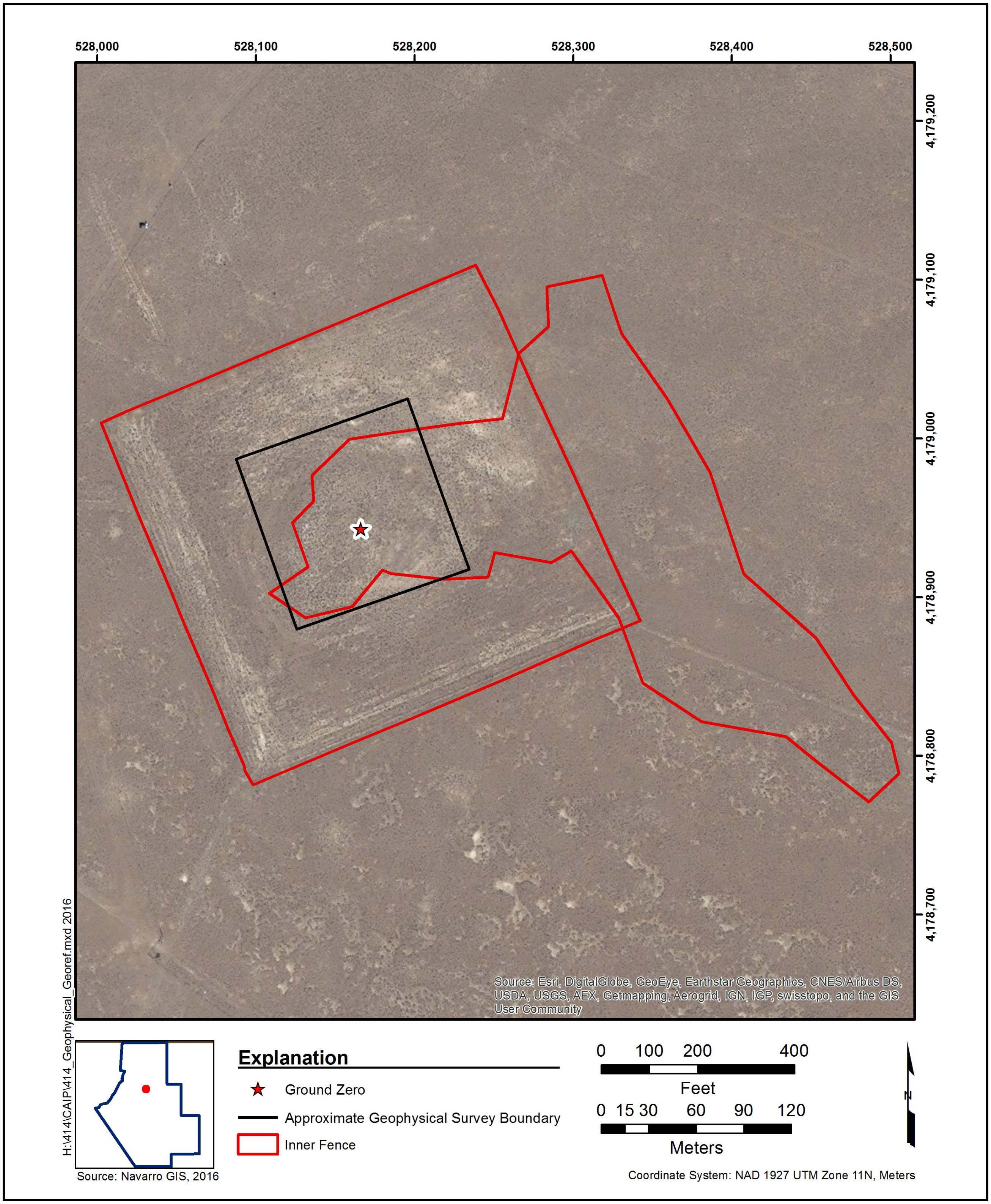

Figure 4-1
Proposed Geophysical Survey Location

4.2.4 Sample Location Selection

Rationale for selecting areas for sampling is discussed in the following subsections. For all investigations, if a spatial boundary is reached, the CSM is shown to be inadequate, or the Site Supervisor determines that extent sampling needs to be reevaluated, then work will be temporarily suspended; NDEP will be notified; and the investigation strategy will be reevaluated.

The sampling strategy and the proposed locations of biased samples are presented in Appendix A. The number, location, and spacing of step-outs may be modified as warranted by site conditions to achieve DQO criteria. Where sampling locations are modified, the justification for these modifications will be documented in the investigation report.

4.2.4.1 SG1, Undisturbed Areas

As agreed to in the DQO meeting with the CAU 414 stakeholders, it is assumed that the radiological dose-based FAL is exceeded in SG1. Thus, Decision I is resolved (i.e., corrective action is required at the site). Decision II will be addressed by placing soil sample plots and TLDs to determine the extent of COCs that exceed the FAL of 25 mrem/yr using the GT exposure scenario. Sample locations were selected using the 1996 KIWI survey results and available FIDLER data. These radiation survey data were reviewed to identify sample locations that present varying dose levels. Using a range of dose levels is recommended to establish a correlation of dose to radiation survey values, as explained in the Soils RBCA document (NNSA/NFO, 2014). The NAEG data (FIDLER and Pu-239/240 analytical results) and the limited results of the FIDLER survey completed in 2012 were also reviewed to ensure the sample locations were placed at appropriate locations. The proposed sample locations are shown in Figure A.8-1.

The need for corrective action based on the presence of removable contamination will be assessed by collecting removable contamination samples from random locations at the soil sample plots located inside the CA fence. Additional removable contamination data may be collected at the discretion of the Site Supervisor to better define removable contamination conditions within the CA fence. These data, combined with removable contamination data from previous investigations, will be compared to the HCA criterion to determine whether an assumption of corrective action is required (Section 3.3.2).

4.2.4.2 SG2, Disturbed Areas

The primary sampling objective for SG2 is to determine whether mechanical movement of contaminated soil resulted in the presence of buried contamination that exceeds the FALs. Buried contamination is defined as contamination that was originally deposited on the surface and then subsequently covered with less contaminated material. To determine whether buried contamination is present, a minimum of one sample location will be evaluated within the square disturbed area surrounding GZ. The proposed sample location is shown on Figure A.8-3 and is collocated with a SG1 soil sample plot. The three potentially disturbed areas (Section 2.4.2) will be visually inspected for obvious differences in vegetation density from surrounding undisturbed areas and indications of top soil removal (e.g., uneven surfaces, depressed areas). If any of these three areas appear disturbed, or if any other disturbed areas are identified during the CAI, each area will be sampled at a minium of one sample location. A FIDLER survey will be conducted within the visual extent of the disturbed area, and sample locations will be biased to the location of highest FIDLER results. Existing FIDLER data are limited, so where no survey data were available, the sample location will be placed in the approximate center of the disturbed area or at the location of highest radiation as determined by FIDLER readings collected during the CAI.

Disturbed area soil samples will be screened for contamination at depth and evaluated in accordance with the criteria presented in Section A.8.2.1. It will be conservatively assumed that the highest TED from either surface or subsurface samples will be used to resolve DQO decisions. If a subsurface sample results in a higher internal dose than a surface sample, a TLD-equivalent external dose will be calculated for the subsurface sample as described in Section A.8.2.1.

If buried contamination in excess of the FALs is present at a disturbed area sample location, it will be assumed that the entire visibly disturbed area contains buried contamination in excess of the FALs.

4.2.4.3 SG3, Drainages

For SG3, Decision I (whether any location exceeds the FALs) will be made using sample results from biased locations under a judgmental sampling design. Aerial photographs and visual surveys at the site were used to identify two major drainage channels that transect the southern portion of the CA fence at CAU 414 (Figure 2-5). The two drainage channels will be visually surveyed inside and outside the CA fence to locate sedimentation areas. The first and second visible accumulation areas within the CA fence in each drainage channel will be sampled. The FIDLER instrument will be used to bias the sample locations within each sedimentation area to the location of highest radioactivity readings. Additionally, the first and second visible accumulation areas downgradient of the CA fence in each drainage channel will also be sampled. Sedimentation area soil samples will be screened for contamination at depth and evaluated in accordance with the criteria presented in Section A.8.2.1.

It will be conservatively assumed that the highest TED from either surface or subsurface samples will be used to resolve DQO decisions. If a subsurface sample results in a higher internal dose than a surface sample, a TLD-equivalent external dose will be calculated for the subsurface sample as described in Section A.8.2.1. If a COC is found in a sediment accumulation area, additional sedimentation areas will be sampled until at least two consecutive, downgradient sedimentation areas are found that do not contain a COC. Decision II will be resolved by the assumption that the entire volume of sediment where a COC is identified is contaminated above the FAL (i.e., 25 millirem per Ground Troops year [mrem/GT-yr]).

4.2.4.4 SG4, Buried Debris

As agreed to in the DQO meeting with the CAU 414 stakeholders, it is assumed that the contaminated debris and soil buried in the GZ area exceeds the dose-based FAL. Thus, Decision I is resolved (i.e., COCs are present in the subsurface). Decision II will be resolved by conducting electromagnetic surveys in the GZ area. These data will be reviewed in conjunction with the geophysical survey data collected during the 1996 CAI (Section 2.5.6.4), to estimate the volume and extent of buried debris and soil.

4.2.4.5 SG5, PSM

The SG5 investigation will address PSM that is discovered during the CAI and PSM that has already been identified through historical records or previous visual surveys (e.g., concrete and metal pieces of the test bunker [Section 2.5.10]). PSM identified during the CAI may include historical or recent spills (e.g., diesel spill from generator) or debris (e.g., lead bricks, drums). Sample locations for PSM will be determined based upon the likelihood of a contaminant release resulting in soil contamination exceeding a FAL. These locations will be selected based on one or more of the biasing factors listed in Section A.8.5. The bunker debris (Section 2.5.10) is not assumed to exceed the FAL but will be assessed for its potential to exceed the FAL using the hot spot criterion described in Appendix C.

Depending on the size and nature of the release, a determination will be made whether a grab soil sample(s) will be collected (e.g., directly underneath a piece of debris) or a composite soil sample(s) of the impacted area (e.g., stained area) will be collected. If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals based on biasing factors to a depth where the biasing factors are no longer present.

Decision II judgmental samples will be collected in a triangular pattern around the area containing a COC at distances based on site conditions, process knowledge, and biasing factors. If a COC extends beyond the initial step-outs, Decision II samples will be collected from incremental step-outs. A sample collected in each step-out direction (lateral or vertical) that does not exceed the FALs, will define extent of contamination in that direction.

4.2.5 Sample Collection

The CAU 414 sampling program will consist of the following activities:

- Collect soil samples from locations as described in Section 4.2.4.
- Collect required QC samples.
- Collect waste management samples as necessary.
- Collect external dose measurements by placing TLDs at the sample plots and drainage sample locations.
- Collect background external dose measurements by placing TLDs at locations unaffected by the CSIII test.
- Collect removable contamination samples from locations as described in Section 4.2.4.
- Record GPS coordinates for each environmental sample location.

A probabilistic sampling approach will be implemented at SG1, where sample plots are to be established at judgmental locations. Each sample from a sample plot will consist of soil collected from the surface to a depth of 5 cm at nine randomly located subsample locations within the plot (see Section A.8.1.2). External dose will be determined at each sample plot using TLDs. 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).

At locations where buried contamination may be present (SG2 and SG3), a judgmental sampling approach will be implemented. Subsurface soil samples will be collected from 5-cm depth intervals up to 30 cm or until native material is encountered to determine if buried contamination is present (see Section A.8.2.1). Each sample will be screened with an alpha/beta detector. The surface sample will be submitted for analysis. Additionally, if the field-screening result (FSR) for any depth sample exceeds the FSR of the surface sample by greater than 20 percent, the depth sample with the highest screening value at each sample location will be submitted for analysis. If the field-screening level (FSL) is not exceeded in any depth sample, only the surface sample will be submitted for analysis. Two TLDs will be placed at each drainage sample location in SG3, one at a height of approximately 1 m (3.3 ft) and the other at a height of approximately 0.3 m (1 ft).

Samples will not be collected at SG4 because it is assumed that the FAL has been exceeded.

A judgmental sampling approach will also be implemented at SG5. The number and location of PSM samples will be determined based on the type of release and any biasing factors present. Section A.8.0 provides additional detail on sampling at study group locations.

TLDs will be placed at background locations in the vicinity of CAU 414 to measure natural sources of radiation (e.g., cosmic, terrestrial). Four background TLDs will be placed at locations that are representative of the general area but beyond the influence of the CAU 414 release. The proposed background TLD locations are shown in Figure 4-2.

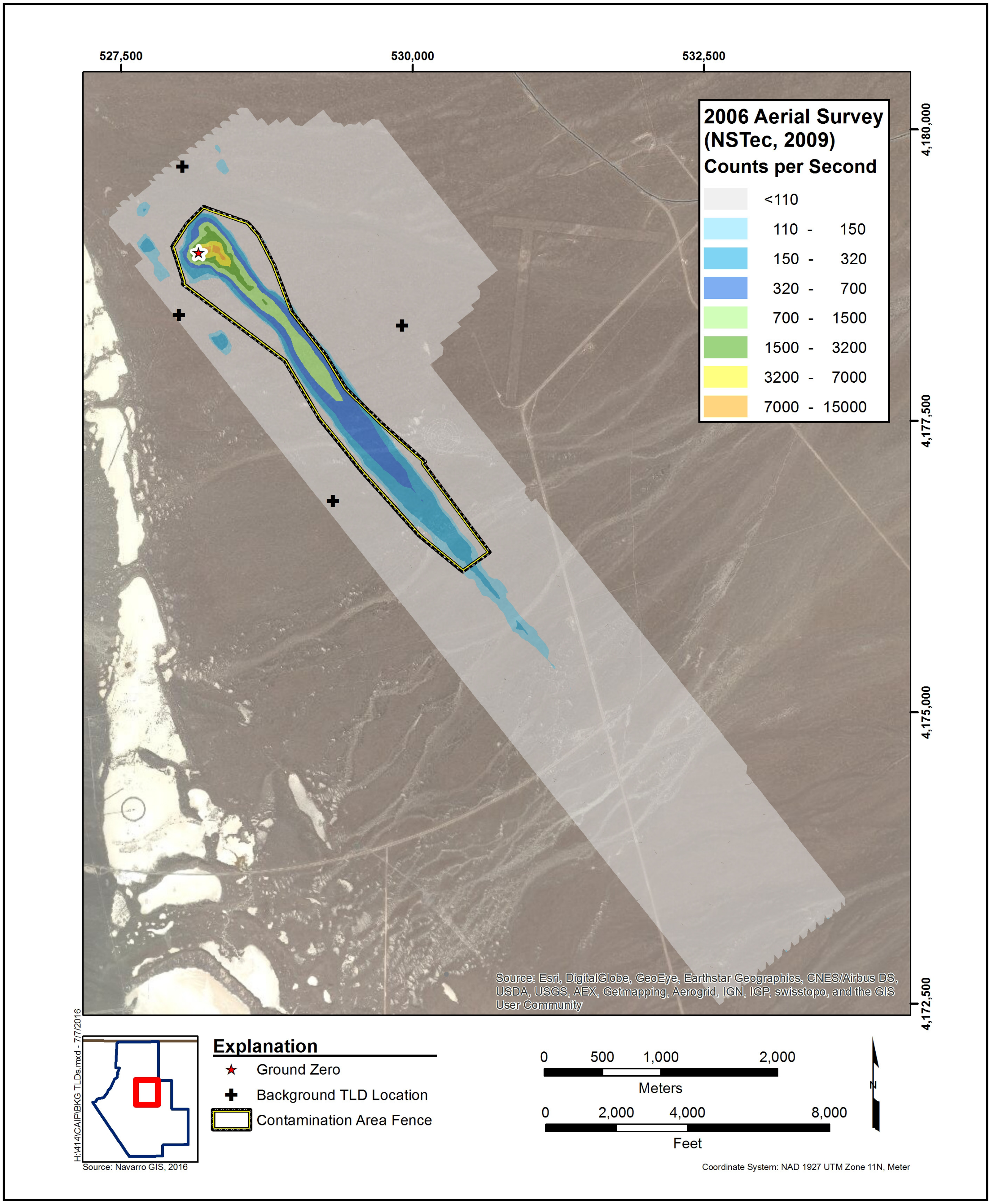

Figure 4-2
Proposed Background TLD Locations

4.2.6 Sample Management

The laboratory requirements (i.e., minimum detectable concentrations [MDCs], precision, and accuracy) to be used when analyzing the COPCs are presented in the Soils Activity QAP (NNSA/NSO, 2012b). The analytical program for CAU 414 is presented in Table A.2-2. All sampling activities and QC requirements for field and laboratory environmental sampling will be conducted in compliance with the Soils Activity QAP.

4.3 Site Restoration

Upon completion of CAI and waste management activities, the following actions will be implemented:

- All equipment, wastes, debris, and materials associated with the CAI will be removed from the site.
- All CAI-related signage and fencing (unless part of a corrective action) will be removed from the site.
- Site will be inspected to ensure restoration activities have been completed.

5.0 Waste Management

Waste generated during the CAU 414 field investigation 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 measurements, and analytical results from investigation and waste samples. Waste types that may be generated during the CAI include industrial, hydrocarbon, and low-level radioactive waste. Hazardous, PCB, and mixed wastes are not anticipated to be generated during the CAI at the CSIII site.

Disposable sampling equipment and personal protective equipment (PPE) are considered potentially contaminated waste only by virtue of contact with potentially contaminated 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.

Conservative estimates of total waste contaminant concentrations may be made based on the mass of the waste, the amount of contaminated soil contained in the waste, and the maximum concentration of contamination found in the soil. The following sections discuss how the field investigation will be conducted to minimize the generation of waste, what waste streams are expected to be generated, and how investigation-derived waste (IDW) will be managed.

5.1 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 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.

5.2 Potential Waste Streams

The anticipated waste streams to be generated during the CAU 414 field investigation include industrial and low-level radioactive IDW. Hydrocarbon wastes may also be generated as a result of a spill or leak from onsite equipment. The waste streams may be in the form of disposable sampling equipment, PPE, debris (metal, concrete), and potentially small volumes of soil.

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

5.3 IDW Management

The onsite management and ultimate disposition of wastes will be determined based on a determination of the waste type (e.g., industrial, low-level, hazardous, hydrocarbon, mixed), or the combination of waste types. A determination of the waste type will be guided by several factors, including, but not limited to, the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/screening results, and/or radiological survey/swipe results.

5.3.1 Industrial Waste

Industrial solid waste, if generated, 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. The most commonly generated industrial solid waste includes disposable sampling equipment and PPE that will be collected in plastic bags, and marked in accordance with requirements.

5.3.2 Hydrocarbon Waste

Hydrocarbon solid waste, if generated, will be managed on site in a drum or other appropriate container until fully characterized and in accordance with the State of Nevada regulations.

5.3.3 Low-Level Waste

Low-level radioactive waste, 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 NNSS Waste Acceptance Criteria (NNSA/NFO, 2015a). Potential radioactive waste containers will be staged and managed in a designated radioactive material area.

6.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a CAA for CAU 414. All characterization activities, including those related to TLD measurements, will be conducted in accordance with the Soils Activity QAP (NNSA/NSO, 2012b) and the Soils RBCA document (NNSA/NFO, 2014), which define rigorous data quality requirements.

6.1 QC Sampling 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. As determined in the DQO process, the minimum frequency of collecting and analyzing QC samples for this investigation is as follows:

- **Radiological samples**
  - FDs for grab samples (1 per 20 environmental samples)
- **Chemical samples (if collected)**
  - FDs for grab samples (1 per 20 environmental samples)
  - Trip blanks (1 per sample cooler containing VOC environmental samples)

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, 2012b).

6.2 Laboratory/Analytical Quality Assurance

As stated in the DQOs (see Appendix A), and except where noted, laboratory analytical quality data will be used for making DQO decisions. The Soils Activity QAP (NNSA/NSO, 2012b) defines and establishes data quality criteria for analytical data that are evaluated in three defined steps:

4. Data Verification
5. Data Validation
6. 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 is 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 DQIs, which are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. DQIs include the following:

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

These DQI criteria are defined in the Soils QAP (NNSA/NSO, 2012b). The data from the CAU 414 CAI will be assessed for usability using the DQI criteria and the results presented in the CADD.

A data quality assessment (DQA) will be performed to determine whether the data meet the DQO requirements of the investigation and the performance criteria for the DQIs. 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 the DQA will be documented in the CADD. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

7.0 Duration and Records Availability

7.1 Duration

Field and analytical activities will require approximately 160 days to complete.

7.2 Records Availability

Historical information and documents referenced in this plan are retained in the NNSA/NFO activity 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.

8.0 References

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Appendix A

Data Quality Objectives

A.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 414 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 414 CAI will be based on the DQOs presented in this appendix as developed by representatives of USAF, NDEP, and NNSA/NFO. The seven steps of the DQO process presented in Section A.2.0 through A.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.

A.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 hazard to be investigated.

The problem statement for CAU 414 is as follows: "Existing information on the nature and extent of contamination is insufficient to evaluate CAAs for CAU 414."

A.2.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, USAF, and NNSA/NFO. The DQO planning team met on June 7, 2016, for the DQO meeting.

A.2.2 Conceptual Site Model

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

The CSM was developed for CAU 414 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs.

The CSM consists of the following:

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

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

If additional elements are identified during the CAI that are outside the scope of the CSM, the situation will be reviewed and a recommendation will be made as to how to proceed. In such cases, NDEP will be notified and given the opportunity to comment on, or concur with, the recommendation.

Table A.2-1 provides information on CSM elements that will be used throughout the remaining steps of the DQO process. Figure A.2-1 depicts a representation of the conceptual pathways to receptors from CAU 414 sources. Figure A.2-2 depicts a graphical representation of the CSM.

A.2.2.1 Contaminant Sources

The contaminant source for CAU 414 is the CSIII test conducted in 1963. The test dispersed nuclear material to soil on the ground surface and to contaminated pieces of the bunker and test device (concrete and metal debris).

The most likely locations of the contamination and releases to the environment are surface and shallow subsurface soils to which radionuclides were dispersed by the test; debris ejected from the bunker structure to the ground surface; and soil and debris buried at the GZ area after the test.

Table A.2-1
CSM Description of Elements for Each Study Group in CAU 414
(Page 1 of 2)

Number	1	2	3	4	5
Description	**Undisturbed Areas**	**Disturbed Areas**	**Drainages**	**Buried Debris**	**PSM**
Site Status	Inactive and/or abandoned				
Exposure Scenario	Ground Troops				
Sources of Potential Contamination	Radionuclides from CSIII storage–transportation test				
Location of Contamination/ Release Point	Surface soil surrounding and downwind of GZ			Subsurface soil at GZ	Surface soil
Amount Released	Classified				
Affected Media	Surface and shallow subsurface soil		Surface and shallow subsurface soil; sediments	Subsurface soil and debris in GZ burial mound	Surface and subsurface soil and debris
Potential Contaminants	Pu-238, Pu-239/240, Pu-241, Am-241, U-234, U-235, U-238				
Transport Mechanisms	Lateral transport of contamination through drainage channels and overland flow is a major driving force for migration of surface contaminants. Wind may also contribute to lateral transport through resuspension and redistribution of windborne contaminants. Mechanical disturbance during post-test operations may also serve to displace or redistribute contaminants. Percolation/infiltration of precipitation through soil is a minor force for contaminant migration.				

Table A.2-1
CSM Description of Elements for Each Study Group in CAU 414
(Page 2 of 2)

Number	1	2	3	4	5
Description	**Undisturbed Areas**	**Disturbed Areas**	**Drainages**	**Buried Debris**	**PSM**
Migration Pathways	Lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils.				
Lateral and Vertical Extent of Contamination	Contamination is expected to have been initially contiguous to the release points. Concentrations are expected to generally decrease with distance and depth from the source. Lateral and vertical extent of contamination exceeding the FAL is assumed to be within the spatial boundaries. Groundwater contamination is not expected.				
Exposure Pathways	The potential for contamination exposure is limited to personnel conducting military operations, periodic inspections or radiological surveys, and UXO retrieval operations. These human receptors may be exposed to COCs through oral ingestion or inhalation of soil and/or debris due to inadvertent or intended disturbance of these materials, or irradiation by contaminated materials.				

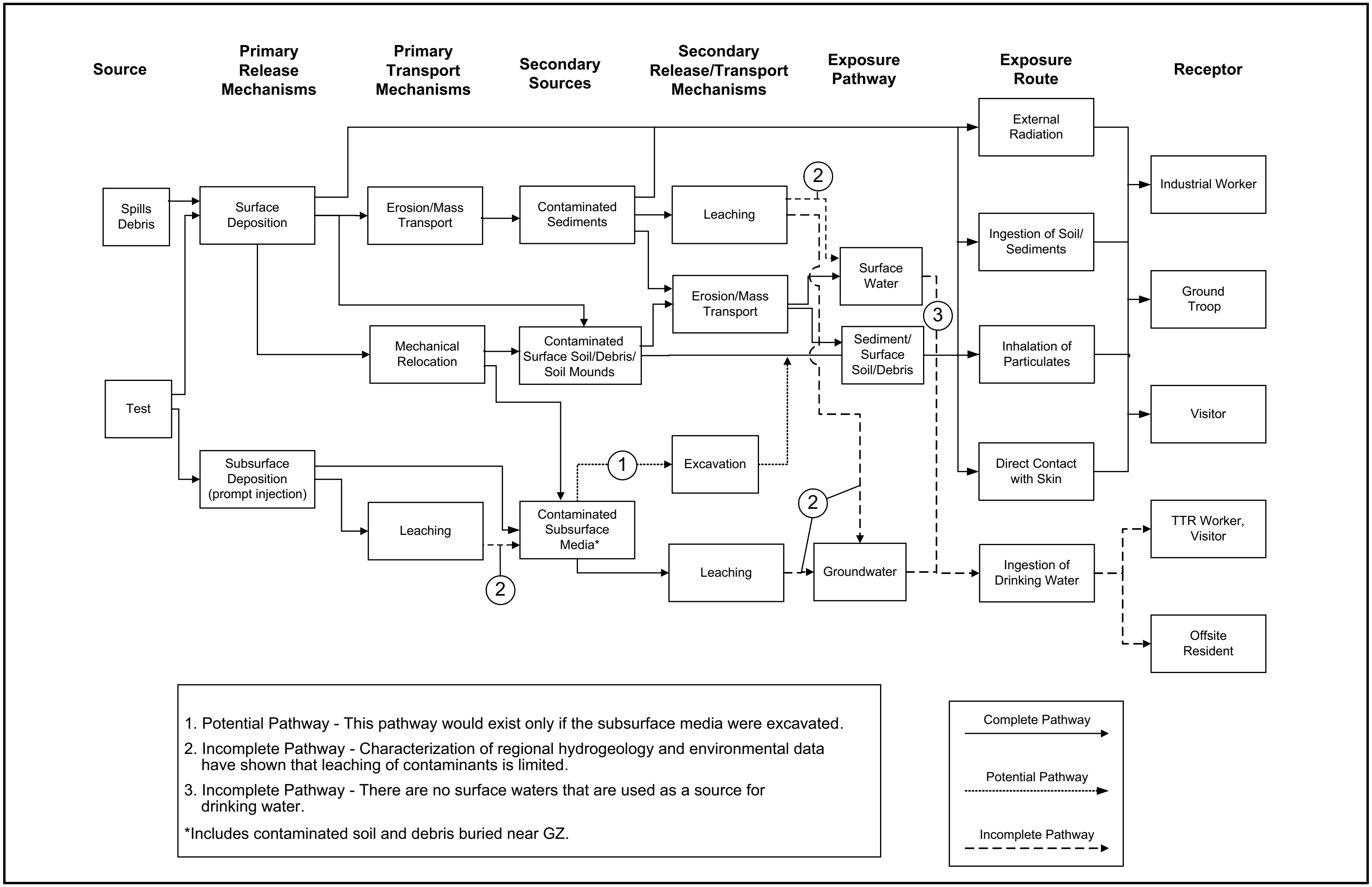

Figure A.2-1
CSM Flowchart for CAU 414

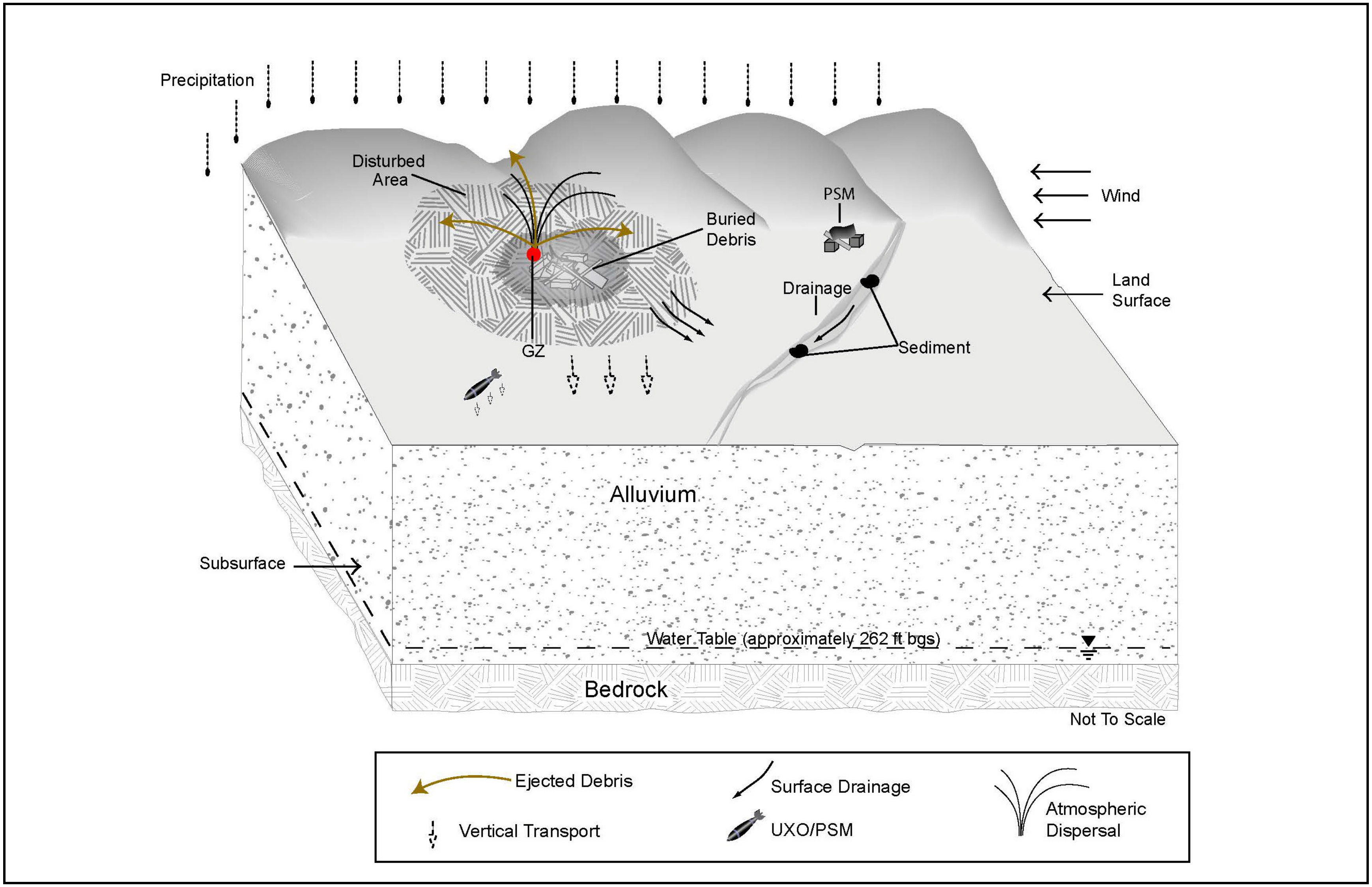

Figure A.2-2
CSM for CAU 414

A.2.2.2 Release Mechanisms

The CSM assumes two primary release mechanisms for the dispersal of contaminants from the CSIII test: (1) the test explosion and (2) post-test disturbance of contaminated soil and debris.

Based on post-test observations of contaminant distribution, it is thought that the radionuclide test material (Pu and DU) was present in the following three physical phases (due to varying temperatures to which it was subjected during the chemical detonation):

1. *Solid phase that did not melt but was dispersed by the blast.* Most of the mass of this phase was deposited near GZ with concentrations diminishing rapidly with distance.

2. *Liquid phase that was subjected to sufficient temperatures to melt but not vaporize the test material.* Most of this liquid phase rapidly solidified as it came into contact with the surrounding, and somewhat cooler, bunker materials. This resulted in a surface coating on concrete and metal debris, which were subsequently thrown from the blast. Much of this debris had sufficient mass to be ejected to a considerate distance from GZ in the direction of the blast.

3. *Gaseous phase that was subjected to sufficient temperatures to vaporize the test material.* Most of this phase condensed in the resulting aerial plume onto dust particles as it cooled, forming a vitreous coating. These particles subsequently precipitated out of the plume in the direction of the predominant wind direction at the time.

The solid phase of the nuclear test material was deposited primarily in the direction of the chemical explosive blast. Much of this phase was removed directly following the test and in subsequent removal activities (Section 2.2). As previous investigations have not detected remaining pieces of nuclear test material at the site, contamination in this fraction is not considered to be a significant contributor to dose.

The liquid phase of the nuclear test material was melted during the chemical explosion and was plated onto bunker materials. Some of this material was removed directly following the test and in subsequent removal activities, while some of the material was ejected as debris up to 2,500 ft from GZ. This debris had sufficient mass to be relatively unaffected by wind as they were ejected which resulted in a distribution pattern and direction consistent with the chemical explosive blast (Figure 2-12). Some pieces of the highly contaminated debris have a faded black substance on one side of the debris. Based on field readings of this surface, it is likely that this black substance contains

Pu and DU that were fused to the bunker concrete as the liquid portion of the contaminant release. Field observations suggest that radiological contamination is not distributed evenly on individual debris pieces, or within the ejecta area (i.e., some pieces are contaminated; others are not). It is assumed that the more highly contaminated debris surfaces represent pieces of the bunker interior that may have been exposed to molten metal from the test device during detonation.

The gaseous phase of the nuclear test material was vaporized during the chemical explosion and condensed onto aerosolized soil particles in the aerial plume. Although the aerial plume was initially ejected by the chemical explosive blast to the northeast, its precipitation of the entrained particles was mainly toward the southeast associated with the wind direction at the time of the test (Figure 2-5). The resulting soil contamination plume generally decreases in activity with increased distance from GZ, except in areas near GZ that were disturbed by post-test activities. A non-contiguous pattern may be seen in both the ground-based KIWI survey (Figure 2-5) and the 2006 aerial survey (Figure 2-9). As discussed in Sections 2.4.2 and 2.4.4, soil and debris in the area around GZ was scraped and buried after the test. In addition, the burial area was excavated in late 1963 to collect contaminated metal debris for further study (Section 2.2). Thus, it is highly probable that the contamination distribution observed in the radiation surveys around GZ is attributable to the redistribution of contaminated soil during post-test activities.

Post-test activities included the consolidation and burial of contaminated soil and debris near GZ shortly after the test, and the recovery of metal debris from the burial location some months later. These activities redistributed, or had the potential to redistribute, contamination originally deposited on the ground surface by the CSIII test. The location near GZ where contaminated soil and debris were buried shortly after the test was reportedly covered with clean soil. However, it is not known whether the area was re-covered with clean soil after the metal debris was removed some months later. As a result, it is possible that contaminated soil and/or debris is present on the surface at the burial location. This location of buried debris (SG4) is the only known area at the CSIII site at which contaminated material was buried.

Based on soil profile data from previous investigations, including data presented in Table 2-2, the CSM assumes that subsurface contamination is not present at any of the disturbed areas within SG2 with activities higher than that of the surface. This assumption is based on the premise that the objective of the ground disturbance activities was not to bury contamination, but to remove it from the ground surface (e.g., to consolidate contaminated material for burial). Therefore, the contamination initially deposited on the surface would have been mixed with less contaminated soil in the shallow subsurface, forming a deeper and less concentrated layer of contamination from the surface to the depth of disturbance. Investigation of the SG2 release mechanism is discussed in Section A.8.2.1.

A.2.2.3 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.

Based on the nature of the releases identified in Section 2.4 and the previous investigation results discussed in Section 2.5, the COPCs for CAU 414 are as follows:

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

Historical records indicate that the CSIII test device contained Pu, DU, and Am-241 (AEC/NVOO, 1964; Menker et al., 1966). There are no historical records indicating that RCRA constituents were either present or released at the CSIII site (DOE/NV, 1996). Thus, no chemical COPCs are identified for CAU 414.

Table A.2-2 details the analytical program for CAU 414 samples. Table A.2-3 presents the analytes that are reported by the laboratory for each of these analytical methods.

Table A.2-2
Analytical Program[a]

Analyses	SGs 1, 2, and 3	SG5[b]
Inorganic COPCs		
RCRA Metals	--	TBD
Hexavalent Chromium	--	TBD
Organic COPCs		
VOCs	--	TBD
SVOCs	--	TBD
Radionuclide COPCs		
Gamma Spectroscopy	X	TBD
Isotopic U	X	TBD
Isotopic Pu	X	TBD
Isotopic Am	X	TBD
Pu-241	X	TBD

[a]The collection and analyses of samples of the Buried Debris release (SG4) is not anticipated.
[b]Analyses for PSM will be determined on a case-by-case basis considering any biasing factors present (e.g., elevated radioactivity, associated waste) and professional judgment.

TBD = To be determined

X = Required analytical method as described in Soils Activity QAP (NNSA/NSO, 2012)
-- = Not required

A.2.2.4 Site Characteristics

The CSIII 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) amsl. The gravelly sandy loam soils at CAU 414 (Leavitt, 1974) show moderate permeability, porosity, and water-holding capacity; low organic content; and relatively high adsorption potential. Annual precipitation at the TTR is 13 to 15 cm (5 to 6 in.) in Cactus Flat, and the PET ranges from 58 to 69 in. (French, 1983 and 1985). Average temperatures for the warmest and coldest hours in January from the TTR weather station are 44 °F and 18 °F, respectively. Corresponding temperatures in July are 90 °F and 58 °F (Schaeffer, 1968).

Table A.2-3
Analytes Reported Per Method

Organic COPCs				Inorganic COPCs	Radionuclide COPCs	
Method 8260[a]		**Method 8270[a]**		**Method 6010[a]**	**Method Ga-01[b]**	**Method U-02[b]**
VOCs		**SVOCs**		**RCRA Metals**	**Gamma Spec**	**Isotopic U**
1,1,1,2-Tetrachloroethane	Carbon tetrachloride	1,4-Dioxane	Bis(2-ethylhexyl)phthalate	Arsenic	Ac-228	U-234
1,1,1-Trichloroethane	Chlorobenzene	2,3,4,6-Tetrachlorophenol	Butyl benzyl phthalate	Barium	Ag-108m	U-235
1,1,2,2-Tetrachloroethane	Chloroethane	2,4,5-Trichlorophenol	Carbazole	Beryllium	Al-26	U-238
1,1,2-Trichloroethane	Chloroform	2,4,6-Trichlorophenol	Chrysene	Cadmium	Am-241	
1,1-Dichloroethane	Chloromethane	2,4-Dimethylphenol	Di-n-butyl phthalate	Chromium	Cm-243	**Method Pu-02[b]**
1,1-Dichloroethene	Chloroprene	2,4-Dinitrotoluene	Di-n-octyl phthalate	Lead	Co-60	**Isotopic Pu**
1,2,4-Trichlorobenzene	cis-1,2-Dichloroethene	2-Chlorophenol	Dibenzo(a,h)anthracene	Selenium	Cs-137	Pu-238
1,2,4-Trimethylbenzene	Dibromochloromethane	2-Methylnaphthalene	Dibenzofuran	Silver	Eu-152	Pu-239/240
1,2-Dibromo-3-chloropropane	Dichlorodifluoromethane	2-Methylphenol	Dimethyl phthalate		Eu-154	**Method Am-01[b]**
1,2-Dichlorobenzene	Ethyl methacrylate	2-Nitrophenol	Fluoranthene	**Method 7196[a]**	Eu-155	**Isotopic Am**
1,2-Dichloroethane	Ethylbenzene	3-Methylphenolc (m-cresol)	Fluorene	Chromium VI	K-40	Am-241
1,2-Dichloropropane	Isobutyl alcohol	4-Methylphenolc (p-cresol)	Hexachlorobenzene		Nb-94	Am-243
1,3,5-Trimethylbenzene	Isopropylbenzene	4-Chloroaniline	Hexachlorobutadiene		Pa-233	
1,3-Dichlorobenzene	Methacrylonitrile	4-Nitrophenol	Hexachloroethane		Pb-212	
1,4-Dichlorobenzene	Methyl methacrylate	Acenaphthene	Indeno(1,2,3-cd)pyrene		Pb-214	
2-Butanone	Methylene chloride	Acenaphthylene	n-Nitroso-di-n-propylamine		Th-229	
2-Chlorotoluene	n-Butylbenzene	Aniline	Naphthalene		Th-234	
2-Hexanone	n-Propylbenzene	Anthracene	Nitrobenzene		Tl-208	
4-Isopropyltoluene	sec-Butylbenzene	Benzo(a)anthracene	Pentachlorophenol		U-235	
4-Methyl-2-pentanone	Styrene	Benzo(a)pyrene	Phenanthrene			
Acetone	tert-Butylbenzene	Benzo(b)fluoranthene	Phenol		**Lab-Specific Methods[c]**	
Acetonitrile	Tetrachloroethene	Benzo(g,h,i)perylene	Pyrene		Pu-241	
Allyl chloride	Toluene	Benzo(k)fluoranthene	Pyridine			
Benzene	Total xylenes	Benzoic acid	Diethyl phthalate			
Bromodichloromethane	Trichloroethene	Benzyl alcohol				
Bromoform	Trichlorofluoromethane					
Bromomethane	Vinyl acetate					
Carbon disulfide	Vinyl chloride					

[a]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2015b)
[b]*The Procedures Manual of the Environmental Measurements Laboratory*, which includes HASL-300 Methods (DOE, 1997)
[c]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
Ac = Actinium
Ag = Silver
Al = Aluminum
Cm = Curium
Co = Cobalt
Eu = Europium
K = Potassium
Nb = Niobium
Pa = Protactinium
Pb = Lead
Th = Thorium
Tl = Thallium

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 Flat, 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 wells to the CSIII site is 262 ft bgs (N-I, 2013).

No permanent surface water streams or lakes are present at the CSIII site. Several dry lake beds (playas) exist at the TTR, most notably Main and Antelope Lakes on Cactus Flat. Surface water flows to the west in the direction of Antelope Lake through drainage channels that transect the CSIII site. The lake beds 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. Two drainage channels were identified at the CSIII site during previous investigations (Section 2.4.3).

Additional information on the environmental setting of the CSIII site may be found in Section 2.1 and in the *Clean Slate Corrective Action Investigation Plan*, Rev. 0 (DOE/NV, 1996).

A.2.2.5 Contaminant Characteristics

The characteristics of the major contaminants that contribute to dose at CAU 414 (Pu and Am) are very low solubility and very high adsorption potential. In general, contaminants with low solubility and high affinity for media are expected to be found relatively close to release points. This is demonstrated by the high distribution coefficient (K_d) values reported in many studies for Pu and Am. Studies reported by the EPA, RESRAD, and Sheppard and Thibault clearly show that K_d values for Pu and Am are related to soil texture, pH, and organic matter (EPA, 2004; Yu et al., 2001; Sheppard and Thibault, 1990; NNSA/NSO, 2004). In general, K_d values increase with decreasing particle size. For both Pu and Am, K_d values strongly increase with higher pH values within the common pH range for agricultural soils. In general, lower levels of organic matter are associated with higher K_d values. For the site-specific conditions present at the CSIII site with relatively high pH and low organic content (Leavitt, 1974), K_d values for Pu and Am would be expected to be even higher than those reported in the studies. However, the more conservative default K_d values for Pu and Am were used in the RESRAD modeling to establish the CAU 414 RRMGs.

Based on the conclusions of a travel-time analysis conducted for the CSIII site, the radionuclide contaminants at CAU 414 are highly adsorbed on the valley-fill alluvial materials and generally do not move with the groundwater (N-I, 2013). As a result, it is predicted that CAU 414 contaminants will not reach the shallow groundwater table below the site for thousands of years. The travel-time analysis was based primarily on regional groundwater models using conservative input parameters.

A.2.2.6 Migration Pathways

Migration pathways include the lateral migration of potential contaminants as a result of airborne (wind) dispersion, surface water runoff, and mechanical disturbance of soils. Vertical migration pathways for contaminants include infiltration of surface water and precipitation, and mechanical disturbance of surface and subsurface soils. The migration of Pu in all pathways is primarily due to the migration of soil particles upon which they are adsorbed (Section A.2.2.5). This, coupled with the high PET rate of the TTR (Section A.2.2.4), indicates that the lateral pathway will dominate over the vertical at CAU 414.

The CSIII test resulted in the airborne dispersal and deposition of contaminants on the surface soil around CSIII. Wind events (including dust devils) entrain, mix, and disperse soil particles within their path. As the areas affected by these events are much larger than the area impacted by CSIII releases, soil from the entire affected area (both uncontaminated and contaminated) is mixed and dispersed. This results in slightly lower contaminant concentrations across the contaminated area and slightly higher contaminant concentrations in the uncontaminated areas. The net effect of this phenomenon is that the area where contamination exceeds the FAL could become slightly smaller. This CSM element assumption is supported by several studies monitoring airborne particles in the vicinity of the CS sites (Section 2.5.11). These studies have not detected any significant concentrations of contaminants originating from the release sites.

Contaminants present in drainage systems are subject to much higher transport rates than contaminants present in other surface areas. The drainage channels/ephemeral washes at the CSIII site are generally dry but are subject to infrequent stormwater flows. These stormwater flow events provide an intermittent mechanism for both lateral and vertical transport of contaminants. Contaminated sediments entrained by these stormwater events would be carried by the drainage channel flow to locations where the flowing water loses energy and the sediments drop out. These locations are readily identifiable as sedimentation areas. Surface water flows to the west in the direction of Antelope Lake through drainage channels that transect the CSIII site (Figure 2-1).

Percolation of infiltrated precipitation serves as a driving force for downward migration of contaminants. However, very little of the infiltrated precipitation is available for percolation due to the high evaporative demand (PET of 58 to 69 inches per year [in./yr]) and the limited amount of annual precipitation for this region (6 in./yr) (French, 1983 and 1985). Therefore, percolation of infiltrated precipitation at the CSIII site does not provide a significant mechanism for vertical migration of any contaminant to groundwater. In addition, as the major contaminants at the CSIII site (Pu and Am) are highly adsorptive to the soil (Section A.2.2.5) and have been shown not to have migrated more than a few inches in the last 50 years (Section 2.5), there is no potential for groundwater to be impacted by CSIII releases. Based on historical soil profile data collected in the 1970s (Essington et al., 1976; Gilbert et al., 1975) and 1990s (NNSA/NSO, 2004), it is estimated that up to 97 percent of the Pu activity is present in the top 5 cm of soil at CAU 414. Therefore, migration to groundwater is not considered to be a viable pathway in the CSM.

Mechanical disturbance and redistribution of contaminated surface and/or subsurface soil is another likely migration pathway/transport mechanism at the site. Documented post-test operations involved the collection and burial of surface soil and debris immediately following the CSIII test and excavation of metal debris months after burial. These post-test activities are further discussed in Sections 2.4.2 and 2.4.4.

Migration is influenced by the chemical characteristics of the contaminants and the physical characteristics of the vadose zone material. The contaminant characteristics of the major contaminants that contribute to dose (Pu and Am) are very low solubility and very high adsorption potential. In general, these contaminants with low solubility and high affinity for media, are expected to be found relatively close (horizontally and vertically) to release points.

A.2.2.7 Exposure Scenario

In consultation with the USAF and NDEP, a GT land use scenario was determined applicable to the CAU 414 site (Cornish, 2014). The MEI 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 414 site. The maximum amount of time this MEI could be deployed during any single mission or operation is 14 days, 24 hr/day, and will participate in three such deployments a year. This results in a total of 1,008 hr/yr of potential exposure. The MEI receives an internal dose through incidental ingestion of surface and subsurface soil and inhalation of soil particulates, and an external dose by external irradiation. It is assumed the MEI does not obtain drinking water from the site.

For the PSM element of the CSM, an additional evaluation is made for the potential exposure to point sources of contamination. This evaluation (presented in Appendix C) considers the need for corrective action for small areas that may contain unacceptably high concentrations of residual radioactive material (i.e., hot spots) even though they do not cause a dose that exceeds the FAL (due to averaging over the 1,000-m^2 exposure area as prescribed in the Soils RBCA Evaluation Process (NNSA/NFO, 2014).

A.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).

A.3.1 Decision Statements

The Decision I statement is as follows: "Does any location exceed the FALs?" Any contaminant that is present (or is assumed to be present) at concentrations exceeding its corresponding FAL will be defined as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NFO, 2014).

The Decision II statement is as follows: "Is there sufficient information to evaluate CAAs?" Sufficient information is defined to include to following:

- The lateral and vertical extent of COC contamination
- The information needed to predict potential remediation waste types and volumes
- Any other information needed to evaluate the feasibility of remediation alternatives

For radiological contaminants, the presence of contamination at levels exceeding the FAL is defined as the condition where the most exposed worker has the potential to receive a TED of at least 25 mrem/GT-yr.

For SG1, Undisturbed Areas, the DQO process resulted in an assumption that TED within the CA fence exceeds the FAL. It was also assumed for SG4, Buried Debris, that the contaminated debris and associated soil exceeds the FALs. Thus, Decision I for these releases is resolved, and Decision II must be evaluated for each.

If sufficient information is not available to evaluate CAAs, then site conditions will be reevaluated and additional samples will be collected (as long as the scope of the investigation is not exceeded and any CSM assumption has not been shown to be incorrect).

A.3.2 Alternative Actions to the Decisions

The following subsections identify actions that may be taken to resolve the DQO decisions depending on the possible outcomes of the investigation.

A.3.2.1 Alternative Actions to Decision I

If the FALs are not exceeded at any study group, then further assessment of the study group is not required. If the FALs are exceeded at any study group, then the extent of COC contamination will be defined according to the criteria established in Section A.4.1, and any other information needed to evaluate CAAs for that study group will be collected.

A.3.2.2 Alternative Actions to Decision II

If the lateral and vertical extent of COC contamination have not been defined for radiological contamination, then additional samples will be collected until a coefficient of determination (or r^2) greater than 0.8 can be established between TED values and radiation survey values. If a valid correlation cannot be established using this criterion, the lateral and vertical extent of COC contamination will be defined by bounding locations where the TED is less than the FAL. If sample analytical results are not sufficient to predict potential remediation waste types, then additional waste characterization samples will be collected. If available information is not sufficient to evaluate potential CAAs, then additional information will be collected. Otherwise, collection of additional information is not required.

A.4.0 Step 3 - Identify Information Inputs

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

A.4.1 Information Needs

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

- Samples must be collected in areas most likely to contain a COC.
- Samples must represent contamination at the sampled location.
- The analytical suite selected must be sufficient to identify any COCs present in the samples.

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

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

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

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

If additional information is needed to evaluate CAAs, additional samples will be collected and analyzed.

A.4.2 Sources of Information

Information to satisfy Decision I and Decision II will be generated by collecting environmental samples. These 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. Only validated data from analytical laboratories will be used to make DQO decisions. Sample collection and handling activities will follow standard procedures.

A.4.2.1 Sample Locations

Design of the sampling approaches for the CAU 414 releases must ensure that the data collected are sufficient for selection of CAAs (EPA, 2002). Samples collected should either be from locations that most likely contain a COC, if present (judgmental), or from locations that properly represent overall contamination at the study group (probabilistic). These sample locations, therefore, can be selected by means of either biasing factors used in judgmental sampling or randomly using a probabilistic sampling design. The implementation of a judgmental approach for sample location selection, and of a probabilistic sampling approach for CAU 414 are discussed in Section A.7.2.

A.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., precision, and accuracy) for soil samples are provided in the Soils Activity QAP (NNSA/NSO, 2012).

A.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.

A.5.1 Target Populations of Interest

The population of interest to resolve Decision I is contaminant concentrations exceeding a FAL at any location or area within the CAU. The populations of interest to resolve Decision II are as follows:

- The extent of COC contamination using one of the methods described in Section A.4.1
- Investigation waste and potential remediation waste characteristics

A.5.2 Spatial Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination that can be supported by the CSM. These boundaries were agreed to in the DQO meeting with the CAU 414 stakeholders. The spatial boundaries for the five SGs are as follows:

- **SG1, Undisturbed Areas.** 6 in. (vertical), 5 mi (lateral)
- **SG2, Disturbed Areas.** 12 in. (vertical), visual extent (lateral)
- **SG3, Drainages.** Visual depth of sedimentation (vertical), 2 mi (lateral)
- **SG4, Buried Debris.** 10 ft (vertical), 400-ft radius from GZ (lateral)
- **SG5, PSM.** 4 in. (vertical), 1.5 mi (lateral)

COCs identified beyond these boundaries may indicate a flaw in the CSM and may require reevaluation of the CSM before the investigation can continue.

A.5.3 Practical Constraints

No practical constraints that would prevent completion of CAI activities were identified at the CSIII 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.

A.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 release and defined for each SG. A COC detected at any release location will cause the determination that the location 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 release. Resolution of Decision II requires this contiguous area to be bounded laterally and vertically.

A.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 a decision rule.

A.6.1 Population Parameters

Population parameters are defined for judgmental and probabilistic sampling designs in the following subsections. Population parameters are the parameters compared to action levels.

A.6.1.1 Judgmental Sampling Design

The judgmental design will be implemented as described in the Soils RBCA document (NNSA/NFO, 2014). For radiological contaminants, the population parameter is the calculated TED from each location. For SG5 (PSM), an additional population parameter is the FIDLER multiples of background (MOB) reading at each location that will be compared to the corresponding (soil or debris) hot spot criterion listed in Appendix C. For chemical contaminants, the population parameter is the observed concentration of each contaminant from each individual analytical sample. Each sample result will be compared to the FALs to determine the appropriate resolution to Decision I and Decision II. A single sample result for any contaminant exceeding a FAL would cause a determination that a corrective action is required (for Decision I), or that the extent of COC contamination is not bounded (for Decision II).

A.6.1.2 Probabilistic Sampling Design

For probabilistic sampling results, the population parameter is the true TED over the area of the sample plot. Resolution of DQO decisions associated with the probabilistic sampling design 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 than 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 (Section 4.1). By definition, there will be a 95 percent probability that the true TED is less than the 95 percent UCL of the calculated TED.

For Decision I, the 95 percent UCL will be used to compare with the FAL. For Decision II, the 95 percent LCL of the regression will be used to determine the radiological survey value that corresponds to 25 mrem/yr of TED. The computation of appropriate confidence limits will be accomplished as described in the Soils RBCA document (NNSA/NFO, 2014).

A.6.2 Action Levels

The PALs presented in this section are to be 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.

The FALs will be established using the RBCA process described in the Soils RBCA document (NNSA/NFO, 2014). This process conforms with 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 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.” For the evaluation of corrective actions, the FALs are established as the necessary remedial standard. The RBCA process as described in the Soils RBCA document (NNSA/NSO, 2012) defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses. The definition of the FALs, the comparison of laboratory results to the FALs, and the evaluation of potential corrective actions will be included in the CAU 414 CADD.

A.6.2.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the Region 9 Regional Screening Levels for chemical contaminants in industrial soils (EPA, 2015a). Background concentrations for RCRA metals will be used instead of screening levels when natural background concentrations exceed the screening level. Background is considered the average concentration plus two standard deviations of the average concentration for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the NTTR (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established screening levels, the protocol used by EPA Region 9 in establishing screening levels (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

A.6.2.2 Radiological PAL

The radiological 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 USAF. In consultation with stakeholders, the GT exposure scenario was determined applicable to CAU 414 (Cornish, 2014). Thus, the PAL is a TED of 25 mrem/yr, based upon the GT exposure scenario. The TED is calculated as the sum of external dose and internal dose. Because of the nature of the CSIII test, it is expected that the internal dose component will be larger than the external dose component in soils at the site. External dose is calculated from TLD measurements. Internal dose is determined by comparing analytical results from soil samples to RRMGs that are 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 pCi/g 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 input parameters used in the RESRAD calculation of RRMGs for the GT exposure scenario and the associated RRMGs were presented in the CAU 412 CAIP (DOE/NV, 1996). The process for determining the hot spot threshold for radiologcally contaminated PSM in SG5 and the calculated RRMGs are presented in Appendix C.

In order to address removable contamination that may be encountered at CAU 414, it will be assumed that a potential offsite dose to a receptor will exceed the dose-based FAL if removable contamination is present that exceeds the HCA criterion of 2,000 dpm/100 cm^2 alpha contamination (NNSA/NFO, 2014). The HCA criterion is a numeric threshold for removable alpha contamination that is used in the DOE Occupational Radiation Protection Program (CFR, 2016) to determine area posting requirements. For removable contamination, it is assumed that if this threshold is exceeded, the dose-based FAL is also exceeded and corrective action is required. Thus, in order to determine whether corrective action is necessary at CAU 414, radiological dose as well as removable contamination levels must be considered. A discussion on the risks associated with removable radioactive contamination is presented in the Soils RBCA document (NNSA/NFO, 2014).

A.6.3 Decision Rules

The decision rule applicable to both Decision I and Decision II is as follows:

- If contamination levels are inconsistent with the CSM or extends beyond the spatial boundaries identified in Section A.5.2, then work will be suspended and the investigation strategy will be reconsidered, else the decision will be to continue sampling.

The decision rules for Decision I are as follows:

- If the population parameter of any COPC in the Decision I population of interest (defined in Step 4) exceeds the corresponding FAL, then Decision II will be resolved and a corrective action will be determined, else no further action will be necessary for that COPC in that population.

- If a waste is present that, if released, has the potential to cause future soil contamination at levels exceeding a FAL, then a corrective action will be determined, else no further action will be necessary.

The decision rule for Decision II is as follows:

- If the spatial extent of any COC has not been defined, then additional samples will be collected, else no further investigation will be necessary. If sufficient information is not available to determine potential remediation waste types and evaluate the feasibility of remediation alternatives, additional waste characterization samples will be collected, else no further investigation will be necessary.

A.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.

The sampling design for the sample plots includes elements of both judgmental and probabilistic sampling. Each sample plot location is selected based on biasing factors (i.e., results of aerial and ground-based radiological surveys), which is typical of a judgmental sampling approach. The sample design within the sample plot is probabilistic in nature because the sample locations within the plot are free from bias, 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 sample plot as a whole are based.

A.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 judgmental sampling results will be established qualitatively by the following:

- Developing a CSM that is agreed to by decision maker participants during the DQO process.
- Testing the validity of the CSM based on investigation results.
- Evaluating the quality of data based on DQI parameters.

A.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.

A.7.2.1 False-Negative Decision Error for Judgmental Sampling

In judgmental sampling, the selection of the number and location of samples is based on knowledge of the feature or condition under investigation and on professional judgment (EPA, 2002). Judgmental sampling conclusions about the target population depend upon the validity and accuracy of professional judgment.

The false-negative decision error (where consequences are more severe) 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 a COC if present anywhere within the release. For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of a COC.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COC 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 a COC (supplemented by unbiased samples where appropriate). A biased sampling strategy will be used to target areas with the highest potential to contain a COC, if it is present anywhere in the release. Sample locations will be determined based on process knowledge, previously acquired data, or the field-screening and biasing factors listed in Section A.4.2.1.

Decision II samples must be collected in areas that represent the lateral and vertical extent of contamination. 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.

For grab sample locations, individual sample results, rather than an average concentration, will be used to compare to FALs. Adequate representativeness of the entire target population may not be a requirement in developing a sampling design. If good prior information about the target site of interest is available, then the sampling may be designed to collect samples only from areas known to have the highest concentration levels on the target site. If the observed concentrations from these samples are below the action level, then a decision can be made that the site contains safe levels of the contaminant without the samples being truly representative of the entire area (EPA, 2006).

The field-screening methods and biasing factors (see Section A.8.5) will be used to further ensure that appropriate sampling locations are selected to meet these criteria. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the populations of interest as defined in Section A.5.1.

To satisfy the second criterion, Decision I soil samples will be analyzed for the radiological parameters listed in Section 3.2. Decision II soil samples will be analyzed for unbounded COCs. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (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) in the investigation report.

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

To provide information for the assessment of the DQIs of precision and accuracy, the following QC samples will be collected:

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

A.7.2.2 False-Negative Decision Error for Probabilistic Sampling

The false-negative decision error rate goal was established by the DQO meeting participants at 5 percent. Upon validation of the analytical results, statistical parameters will be calculated for each significant COPC identified at each site. Protection against a false-negative decision error is contingent upon the following:

- Population distribution
- Sample size
- Actual variability
- Measurement error

Control of the false-negative decision error for probabilistic sampling designs is accomplished by ensuring that the following requirements are met for each of the significant COPCs:

- A sufficient sample size was collected.
- The actual standard deviation is calculated.
- Analyses conducted were sufficient to detect contamination exceeding FALs.

A.7.3 False-Positive Decision Error

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

False-positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted in accordance with established and 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 blanks (1 per VOC sampling event)

For probabilistic sampling, 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 A.7.2 for probabilistic sampling designs.

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

Step 7 of the DQO process selects and documents a design that will produce data that exceeds performance or acceptance criteria. The sampling design for the CSIII CAI site includes collection of soil, TLD, and removable radioactive contamination samples. The location of 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.

To facilitate site investigation and the evaluation of DQO decisions, the releases at CAU 414 have been divided into five study groups presented in Table 1-1. The study groups are summarized in the following subsections and described in detail in Section 2.4.

A.8.1 SG1, Undisturbed Areas

SG1 includes those areas not impacted by post-test operations. It is assumed that contamination from the CSIII test deposited on the ground surface at these locations has not been mechanically disturbed since the time of the test.

A.8.1.1 Decision I

As agreed to in the DQO meeting with the CAU 414 stakeholders, it is assumed that the dose-based FAL is exceeded in SG1. Thus, Decision I is resolved (i.e., COCs are present at the site), and Decision II must be addressed.

Removable contamination data will be collected during the CAI from the soil sample plots located inside the CA fence. These data, combined with removable contamination data from previous investigations, will be compared to the HCA criterion to determine whether corrective action is necessary.

A.8.1.2 Decision II

Soil sample plots and TLDs will be placed to determine the extent of COCs that exceed the FAL of 25 mrem/yr using the GT exposure scenario. Sample locations were selected using the 1996 KIWI survey results and available FIDLER data. These radiation survey data were reviewed to identify sample locations that present varying dose levels. Using a range of dose levels is recommended to establish a correlation of dose to radiation survey values, as explained in the Soils RBCA document (NNSA/NSO, 2014). A minimum of 10 soil sample plots will be established in areas of varying contamination levels identified by the KIWI and FIDLER surveys. Where possible, locations were selected outside drainage channels (SG3), away from the burial area near GZ (SG4), and outside potential disturbed areas. Three proposed sample locations, however, are located within the inner fence, which was disturbed after the CSIII test. The proposed sample locations are presented in Figure A.8-1.

Sample Plots. The probabilistic sampling scheme will be implemented to select sample locations within each sample plot. Randomly selected subsample locations will be based on a random start, triangular pattern (NNSA/NSO, 2014). 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 A.8-2).
- The entire volume of the composited material collected will be submitted to the laboratory for analysis. Soil samples will be analyzed for isotopic Pu, Am, and U; Pu-241; and gamma spectroscopy.

TLDs. 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 Appendix D of the CAU 412 SAFER Plan

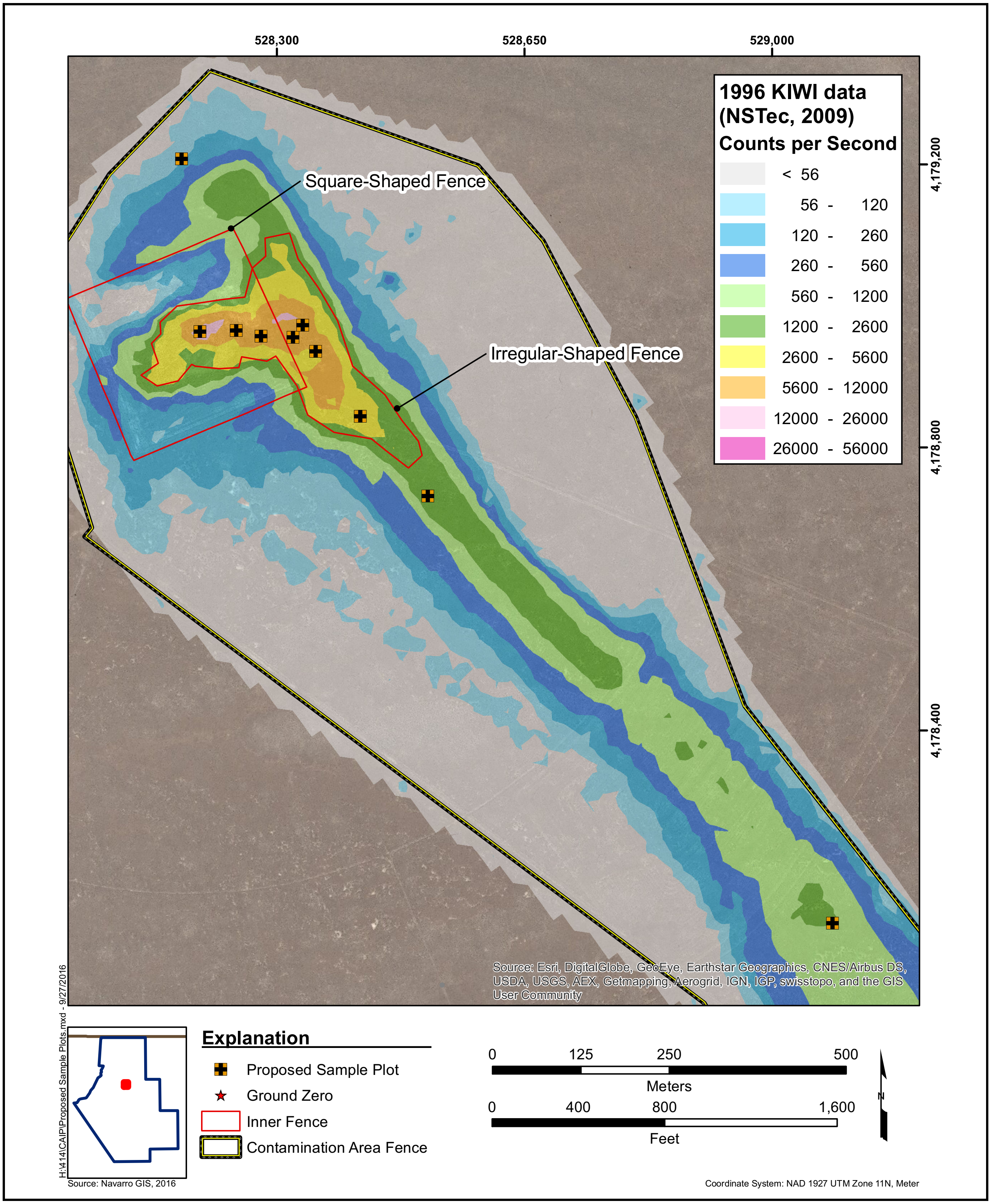

Figure A.8-1
Sample Plot and TLD Locations for SG1, Undisturbed Areas

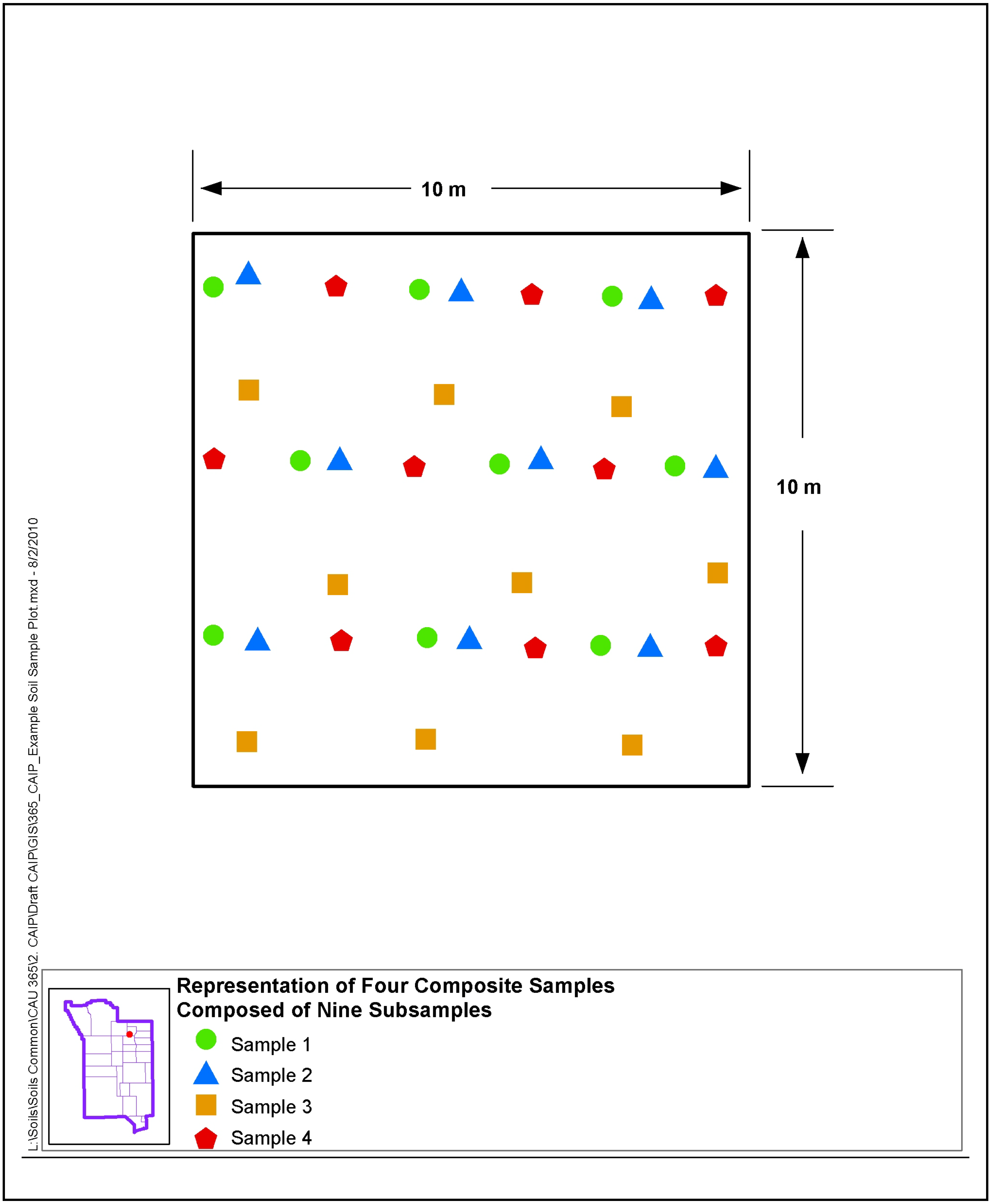

Figure A.8-2
Sample Plot Subsample Locations

(NNSA/NFO, 2015), the GT exposure scenario includes an 8-hr/day resting period, which could involve sleeping at or near the ground surface.

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.

A.8.2 SG2, Disturbed Areas

SG2 includes those locations where it is likely that contamination originally deposited by the test was redistributed by activities that occurred immediately after, and in the years following, the test (e.g., post-test cleanup). One disturbed area, and three potentially disturbed areas, were identified at CAU 414 using historical information and aerial photographs.

A.8.2.1 Decision I

The presence and nature of contamination decision (Decision I) will be a judgmental decision determined using sample results from biased locations under a judgmental sampling design. Individual sample results, rather than an average concentration, will be used to compare to FALs. Therefore, statistical methods to generate site characteristics will not be needed.

The primary sampling objective for SG2 is to determine if buried contamination exists. To determine whether buried contamination exists, one sample location will be evaluated within the square disturbed area surrounding GZ (Figure A.8-3). It is assumed that the mechanical disturbance in this area (e.g., scraping or grading) was relatively uniform, so that the redistribution of contamination would not be preferential. The 1996 KIWI survey was used to bias this sample location to the location of highest surface radiation. This location coincides with one of the proposed sample plot/TLD locations discussed in Section A.8.1.2. If the three potentially disturbed areas (as discussed in Section 2.4.2) are confirmed, or if any other disturbed areas are identified during the CAI, each area will be sampled at a minium of one sample location. These sample locations will be biased to the location of highest surface radiation based on available FIDLER survey results or as determined by FIDLER readings collected during the CAI. If no radiological biasing factor is identified, the sample location will be placed in the approximate center of the disturbed area. The judgmental sample locations may need to be modified during the CAI based on field conditions, but only if the modified locations meet the decision needs and criteria stipulated in these DQOs.

In order to determine whether buried contamination exists, samples will be screened and submitted for analysis as follows:

- At each sample location, a sample will be collected from each 5-cm depth interval up to 30 cm bgs or until native material is encountered.
- Each sample will be field screened with an alpha/beta detection instrument and compared to the established background FSL for the site.
- If the depth sample with the highest FSR is greater than the FSL, but not significantly different (at least 20 percent difference) than the FSR of the surface sample, then only the surface sample will be submitted for analysis. If the FSR is greater than the FSL and greater than 20 percent higher than the surface sample, then both the surface sample and the depth sample with the highest FSR will be submitted for analysis.
- If the FSL is not exceeded in any depth sample, then only the surface sample will be submitted for analysis.

At sample locations where no TLD results are available (such as subsurface locations), a TLD equivalent external dose will be calculated by multiplying the RESRAD-derived external dose by a correction factor. This correction factor was developed to account for an observed difference between RESRAD-derived external dose and TLD readings as described in the Soils RBCA document (NNSA/NFO, 2014). The correction factor was derived by evaluating previous data from Soils Activity sites where both TLD and RESRAD-derived external dose data were available. Evaluation of this data showed good correlation between these paired data with a weighted average correction factor of 1.58 for average TLD values and 1.69 for 95 percent UCL TLD values. The correlation of TLD dose to RESRAD external dose is presented in Figure A.8-4. This evaluation also demonstrated that this correction factor was not influenced by the type of release (e.g., weapons test or safety experiment) or the amount of activity present (NNSA/NFO, 2016). However, it demonstrated that at very low external dose levels (as external doses approached zero), the relationship between RESRAD-derived external dose and TLD external dose had no correlation. Attempting to use site-specific data to correct RESRAD-derived external dose at sites where external dose is low can result in erratic and erroneous results. Therefore, all RESRAD-derived external doses were increased

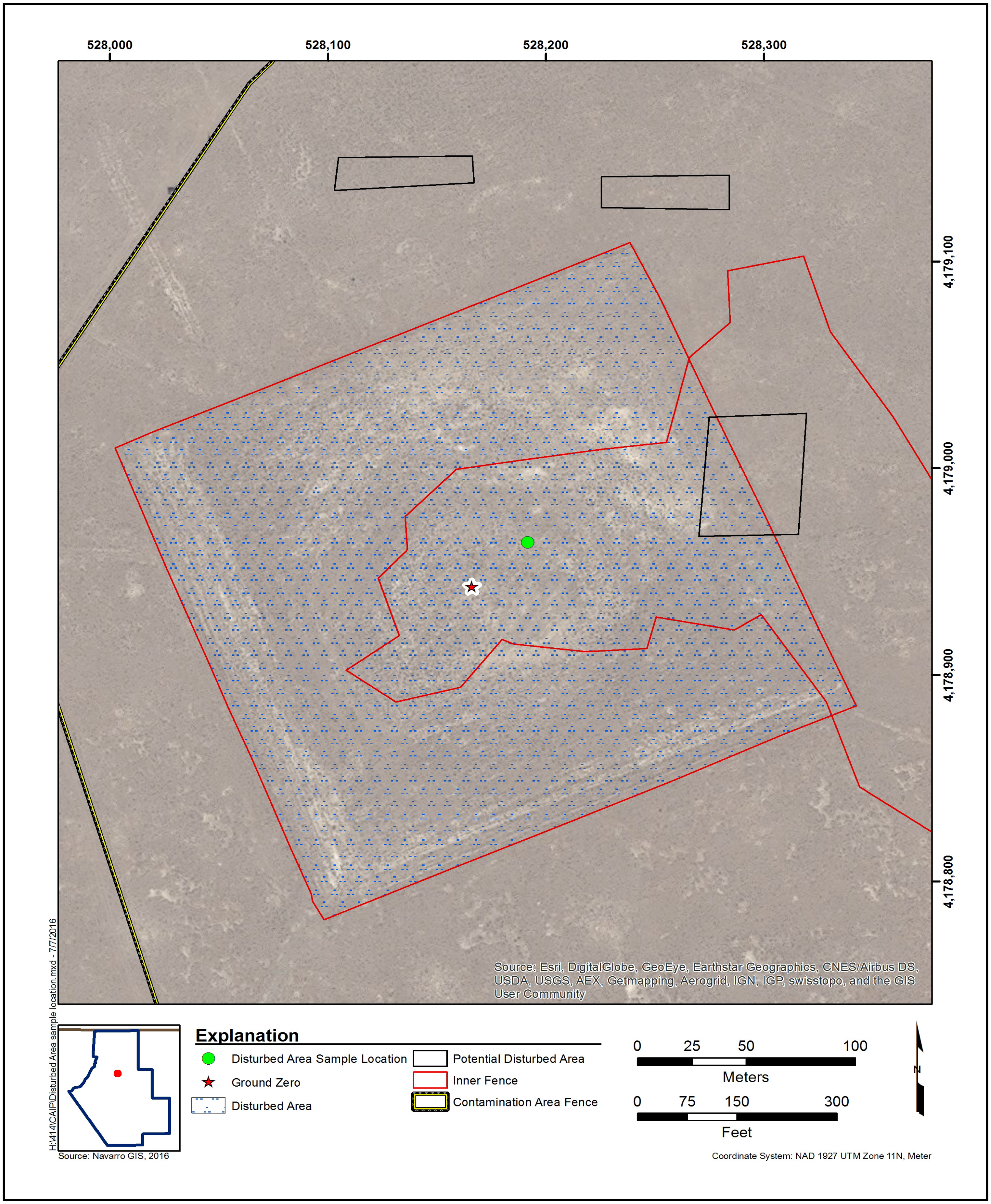

Figure A.8-3
Sample Location for SG2, Disturbed Areas

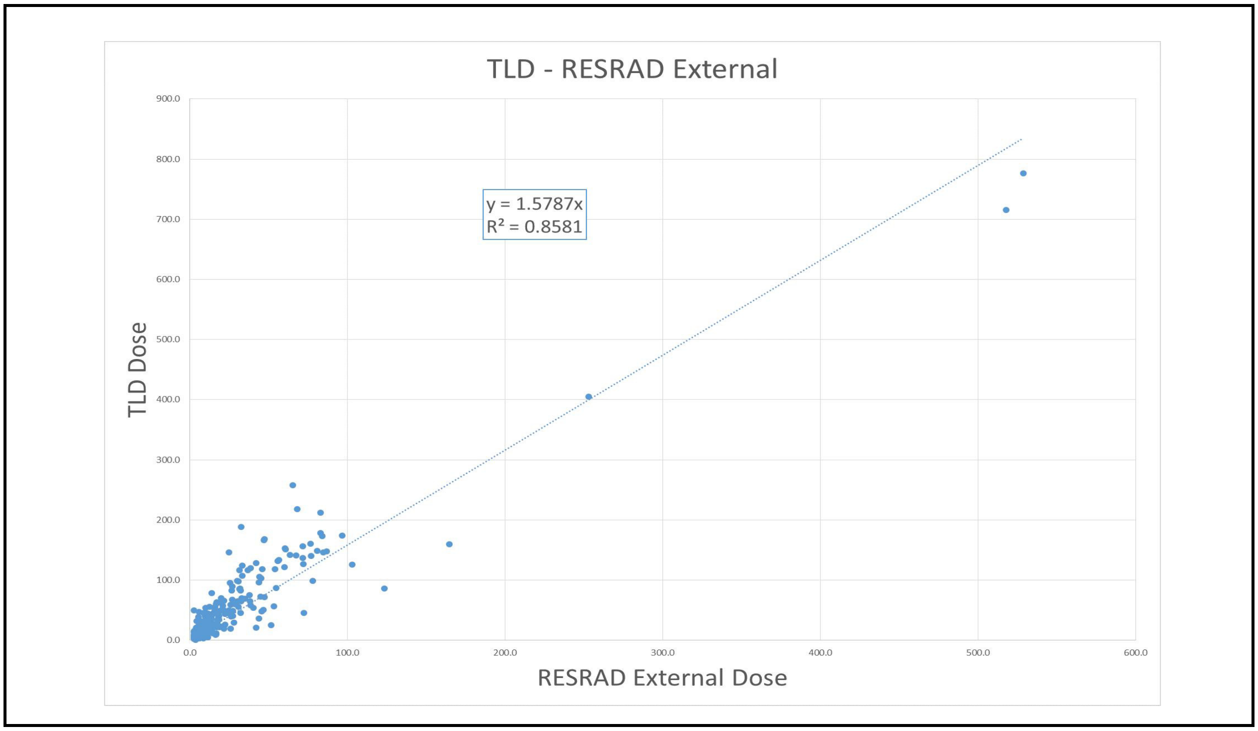

Figure A.8-4
Correlation of TLD Dose to RESRAD External Dose

using the correction factors. Soil samples from SG2 will be analyzed for gamma spectroscopy; isotopic Pu, Am, and U; and Pu-241.

The highest TED from either surface or subsurface samples will be used to resolve DQO decisions for this study group.

A.8.2.2 Decision II

If buried contamination in excess of the FALs is present at any of the disturbed areas, it will be assumed that the entire visibly disturbed area contains buried contamination in excess of the FALs. The extent of any visibly disturbed area that exceeds a FAL will be defined in the CADD.

A.8.3 SG3, Drainages

SG3 consists of sedimentation areas within drainage channels or surface water conveyances where sediment has visibly accumulated. These channels may serve as transport mechanisms for contamination originally deposited on the ground surface during the CSIII test. The potential also exists for contamination in these accumulation areas to have been buried over time by subsequent erosion events.

A.8.3.1 Decision I

The presence and nature of contamination decision (Decision I) will be determined using sample results from biased locations under a judgmental sampling design. Aerial photographs and visual surveys at the site identified two major drainage channels that transect the CA fence in the southern portion of CAU 414 (Figure 2-5). The two drainage channels will be visually surveyed inside and outside the CA fence to locate sedimentation areas. The first and second visible accumulation areas within the CA fence will be sampled. Additionally, the first and second visible accumulation areas downgradient of the CA fence will also be sampled. The purpose of sampling at these locations is to determine whether contaminants are migrating outside the radiologically controlled area (i.e., the CA fence). Within each sedimentation area, a FIDLER survey will be conducted and the sample location selected at the highest radiological reading. Samples from SG3 will be analyzed for gamma spectroscopy; isotopic Pu, Am, and U; and Pu-241. Two TLDs will be placed at each drainage sample location, one at a height of approximately 1 m (3.3 ft) and the other at a height of approximately 0.3 m (1 ft).

At each sample location, samples will be screened for buried contamination using the method described in Section A.8.2.1. The highest TED from either surface or subsurface samples will be used to resolve DQO decisions for this study group.

A.8.3.2 Decision II

If a COC is found in a sediment accumulation area, additional sedimentation areas will be sampled until at least two consecutive, downgradient sedimentation areas are found that do not contain a COC. Decision II will be resolved by the assumption that the entire volume of sediment where a COC was identified is contaminated above the FAL.

A.8.4 SG4, Buried Debris

This study group includes the contaminated debris and soil that were buried at GZ after the CSIII test. Historical documents indicate that after the detonation, contaminated debris (e.g., concrete, metal) and fragments scattered out to a radius of 1,500 to 2,500 ft were collected and buried at GZ (AEC/NVOO, 1964; Burnett et al., 1964). In addition, several inches of contaminated soil was scraped from the GZ area and buried. The approximate lateral extent of the buried debris area, based on previous geophysical survey data, is shown on Figure 2-2.

A.8.4.1 Decision I

As agreed to in the DQO meeting with the CAU 414 stakeholders, it is assumed that the contaminated debris and soil buried in the GZ area exceeds the dose-based FAL. Thus, Decision I is resolved (i.e., COCs are present at the site), and Decision II must be addressed.

A.8.4.2 Decision II

To define the vertical and lateral extent of the buried debris release, electromagnetic surveys will be conducted in the GZ area at the suspected location of the burial area. These data will be reviewed in conjunction with the geophysical survey data collected during 1996 site characterization activities (Section 2.5.6.4) to estimate the volume and extent of buried debris and soil.

A.8.5 SG5, PSM

PSM is defined as a material present at a site that contains radiological or chemical contaminants that, if released, could cause the surrounding environmental media to contain a COC (NNSA/NFO, 2014). This study group includes existing PSM identified through historical documents and verified in previous site visits (Section 2.4.5), and PSM not yet identified (e.g., historic spills, drums) that may be discovered during the CAI.

Sample locations for PSM will be determined based upon the likelihood of a contaminant release and the presence of the following biasing factors:

- *Stains.* Any spot or area on the soil surface that may indicate the presence of a potentially hazardous liquid.

- *Radiological survey anomalies.* Radiological survey results that are significantly higher than the surrounding area.
- *Drums, containers, equipment, or debris.* Materials that contain or may have contained hazardous or radioactive substances.
- Visual indicators such as discoloration, textural discontinuities, disturbance of native soils, or any other indication of potential contamination.
- *Other biasing factors.* Factors not previously defined that become evident during the CAI.

A.8.5.1 Decision I

Non-radiological PSM sample results will be evaluated against the criteria listed in the Soils RBCA document (NNSA/NFO, 2014) to determine the need for corrective action. If there is a potential for the soil to contain a COC, a grab soil sample(s) may be collected directly underneath the debris or a composite soil sample(s) of the impacted area may be collected. If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals based on biasing factors to a depth where the biasing factors are no longer present. Judgmental sample locations may need to be modified based on field conditions, but only if the modified locations meet the decision needs and criteria stipulated in these DQOs. Sample analyses may be determined based on the biasing factors present and the type of PSM and will be justified in the CADD.

For radiological PSM, a FIDLER radiation survey value expressed in terms of MOB will be collected at each radiological debris PSM location where the FIDLER MOB survey value exceeds one-half of the hot spot criterion for debris, as described in Appendix C. This will be compared to the hot spot criterion corresponding to a dose of 25 mrem/yr calculated using the GT scenario and the hot spot RRMGs presented in Appendix C.

A.8.5.2 Decision II

If non-radiological PSM is identified visually, the extent of the PSM will be defined as the physical extent of the PSM (e.g., debris). If biasing factors exist, Decision II judgmental samples will be collected from locations where PSM was identified. In general, sample locations will be arranged in a triangular pattern around the area containing PSM at distances based on site conditions, process knowledge, and biasing factors. If a COC extends beyond the initial step-outs, Decision II samples will be collected from incremental step-outs. Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Decision I location and the depth of the incremental step-outs will be based on the deepest contamination observed at any location within the release. A sample collected in each step-out direction (lateral or vertical) that does not exceed the FALs will define extent of contamination in that direction.

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Appendix B

Activity Organization

B.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 C

Development of Hot Spot Criterion

C.1.0 Development of Hot Spot Criterion

C.1.1 Analogous Sites

Based on process knowledge of the similarity of operations and source material for the Operation Roller Coaster tests, it was expected that the contaminant radionuclide mixtures (and contributions to dose) would be equivalent for each of these tests. To confirm this expectation, an evaluation was conducted of the analytical results of soil samples collected at each site. The results of this evaluation are shown in Figures C.1-1 and C.1-2. Figure C.1-1 shows that the average dose for these sites is very different due to the remediation of the DT and CSI sites. However, as shown in Figure C.1-2, the relative contribution to dose of the detected radionuclides at each site is essentially identical, with Pu-239/240 contributing 89 percent of the dose, Am-241 contributing 9 percent of the dose, and U-238 contributing 1 percent of the dose. These three radionuclides account for 99 percent of the dose with all other detected radionuclide contaminants combined contributing about 1 percent of the dose.

The uniformity of the Operation Roller Coaster sites can facilitate the evaluation of the DT and CSI sites by using data from the CSII site to draw inferences from the DT and CSI data. Where radiological contaminant activities are low, such as at the DT and CSI sites (approaching background levels), the radiological survey instrument readings and activities reported by radiochemical analyses are influenced by fluctuations in natural background. Using only the site-specific data could make inferences on radionuclide ratios and relative dose contributions imprecise and unreliable. Values that are significantly above background, such as at the CSII site, are minimally affected by variations in background, allowing interpretation of the data to be much more reliable.

C.1.2 Radiological Hot Spot Criterion

The purpose of this section is to evaluate the need for corrective action for small areas that may contain unacceptably high concentrations of residual radioactive material (i.e., hot spots) even though they do not cause a dose that exceeds the FAL (due to averaging over the 1,000-m^2 exposure area as prescribed in the Soils RBCA document [NNSA/NFO, 2014]). These hot spots are identified by radiological site survey values that are nominally above a value correlated to the FAL and that are anomalous to the surrounding area. This approach is based on the Hot Spot Criterion for Field

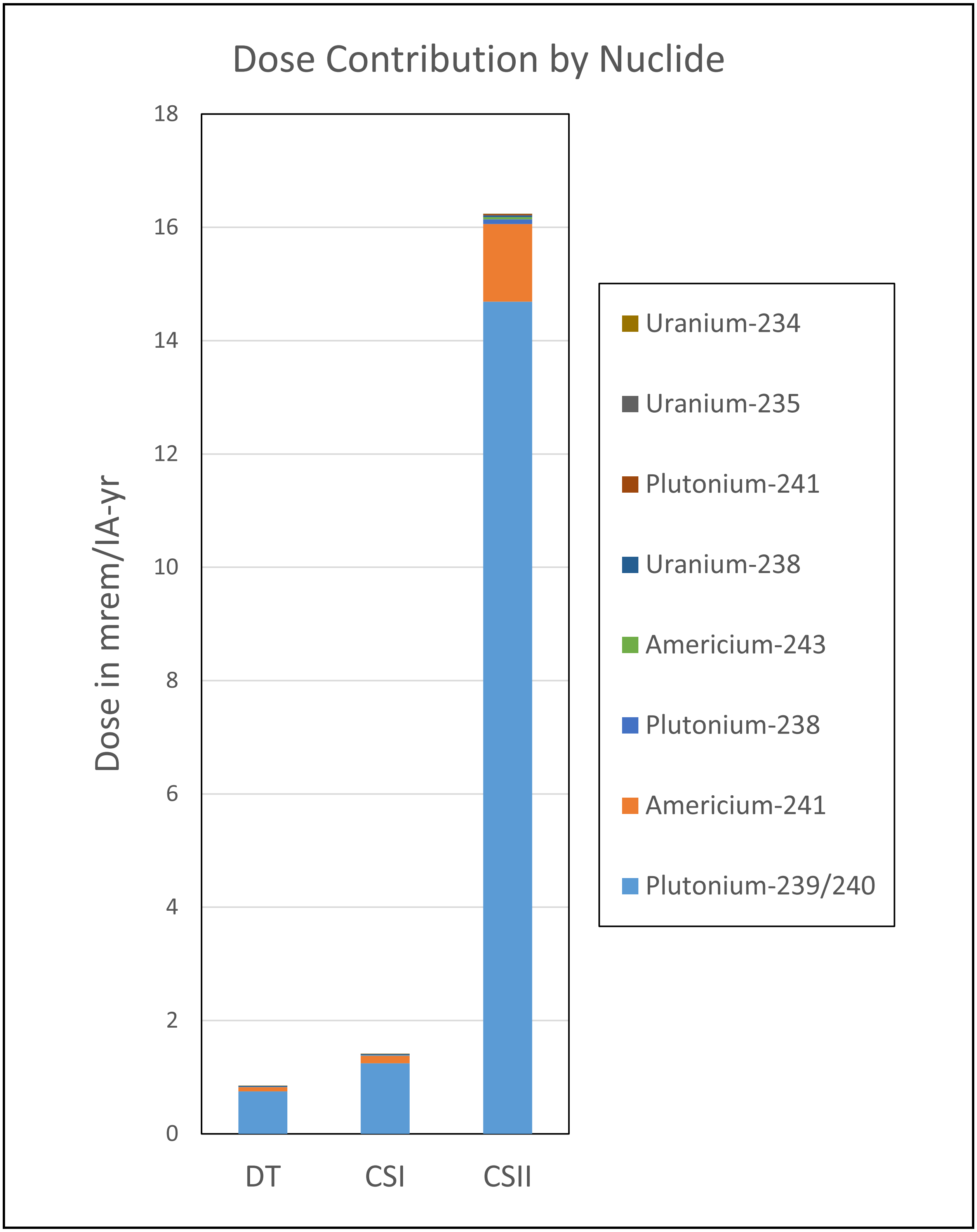

Figure C.1-1
Average Dose Contribution of Radionuclides from Operation Roller Coaster Sites

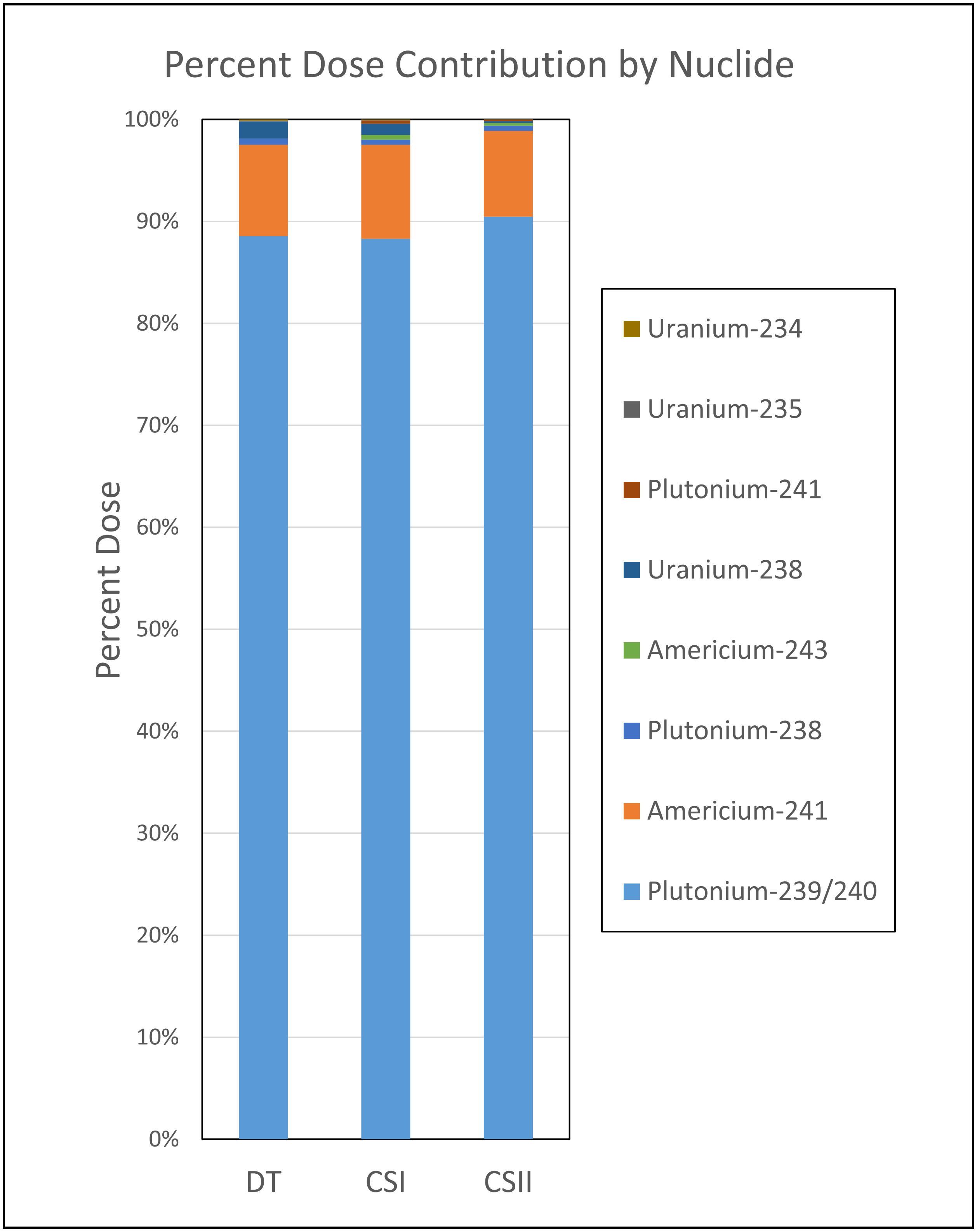

Figure C.1-2
Percent Dose Contribution of Radionuclides from Operation Roller Coaster Sites

Application in Section 3.3.2 of the User's Manual for RESRAD Version 6 (Yu et al., 2001), which states the following:

> *The derivation of remedial action criteria generally assumes homogeneous contamination of large areas (several hundred square meters or more), and the derived concentration guide is stated in terms of concentrations averaged over a 100-m² area. Because of this averaging process, hot spots can exist within these 100-m² areas that contain radionuclide concentrations significantly higher than the authorized limit. Therefore, the presence of hot spots could potentially pose a greater risk of exposure to individuals using the site than the risk associated with homogeneous contamination. To ensure that individuals are adequately protected and to ensure that the ALARA process is satisfied, the following hot spot criterion must be applied, along with the general criterion for homogeneous contamination.*

This process produces a hot spot criterion that represents the dose from residual radioactivity in a small area of elevated activity. The hot spot criterion will be a FIDLER radiation survey value expressed in terms of MOB that corresponds to a dose of 25 mrem/yr calculated using the GT scenario and the hot spot RRMGs. hot spot doses were calculated using hot spot RRMGs derived with RESRAD by changing the area of contaminated zone parameter to represent the area of the hot spot. All other RESRAD parameters would not be changed from those used to produce the corresponding site-specific area-based RRMGs in accordance with the Soils RBCA document (NNSA/NFO, 2014). These GT hot spot RRMGs are presented in Table C.1-1. To maintain conservatism in the process, the User's Manual for RESRAD Version 6 (Yu et al., 2001) stipulates that the minimum hot spot area to be used for development of the hot spot RRMGs will be 1 m^2, and any hot spot exceeding 30 times the area-based FAL will be assumed to require corrective action.

The FIDLER MOB value corresponding to the area-based FAL was calculated using a correlation of FIDLER radiation survey MOB measurements to collocated GT TED values from the CSII site. The GT TED at each sample location is paired with a FIDLER MOB value for the same location. These data pairs are used to derive the correlation of dose to survey. The relationship between MOB and GT TED was determined from the slope of the regression from the paired data. This correlation is shown in Figure C.1-3. As prescribed by the Soils RBCA document (NNSA/NFO, 2014), the required data quality for a correlation is a correlation coefficient greater than 0.8. The correlation coefficient of the paired data meets this criterion (0.9017), and the resulting linear formula can be used to describe this relationship. Based on this correlation, the FIDLER MOB value corresponding to the area-based FAL

Table C.1-1
GT Hot Spot RRMGs (pCi/g)

Radionuclide	TED	Internal
Ag-108m	7.21E+02	1.13E+08
Al-26	4.75E+02	1.63E+08
Am-241	2.40E+04	4.83E+04
Am-243	4.53E+03	4.82E+04
Cm-243	8.03E+03	6.79E+04
Cm-244	8.20E+04	8.26E+04
Co-60	5.08E+02	1.21E+08
Cs-137	1.97E+03	6.15E+07
Eu-152	1.05E+03	1.04E+08
Eu-154	9.83E+02	8.23E+07
Eu-155	2.06E+04	6.38E+08
Nb-94	7.53E+02	9.15E+07
Np-237	4.71E+03	9.25E+04
Pu-238	4.20E+04	4.22E+04
Pu-239	3.84E+04	3.85E+04
Pu-240	3.84E+04	3.85E+04
Pu-241	1.91E+06	1.99E+06
Sr-90	2.37E+05	1.88E+07
Tc-99	3.01E+07	3.32E+08
Th-232	1.25E+04	4.15E+04
U-233	4.15E+05	4.77E+05
U-234	4.56E+05	4.87E+05
U-235	6.78E+03	5.38E+05
U-238	3.63E+04	3.36E+05

Np = Neptunium
Sr = Strontium
Tc = Technetium

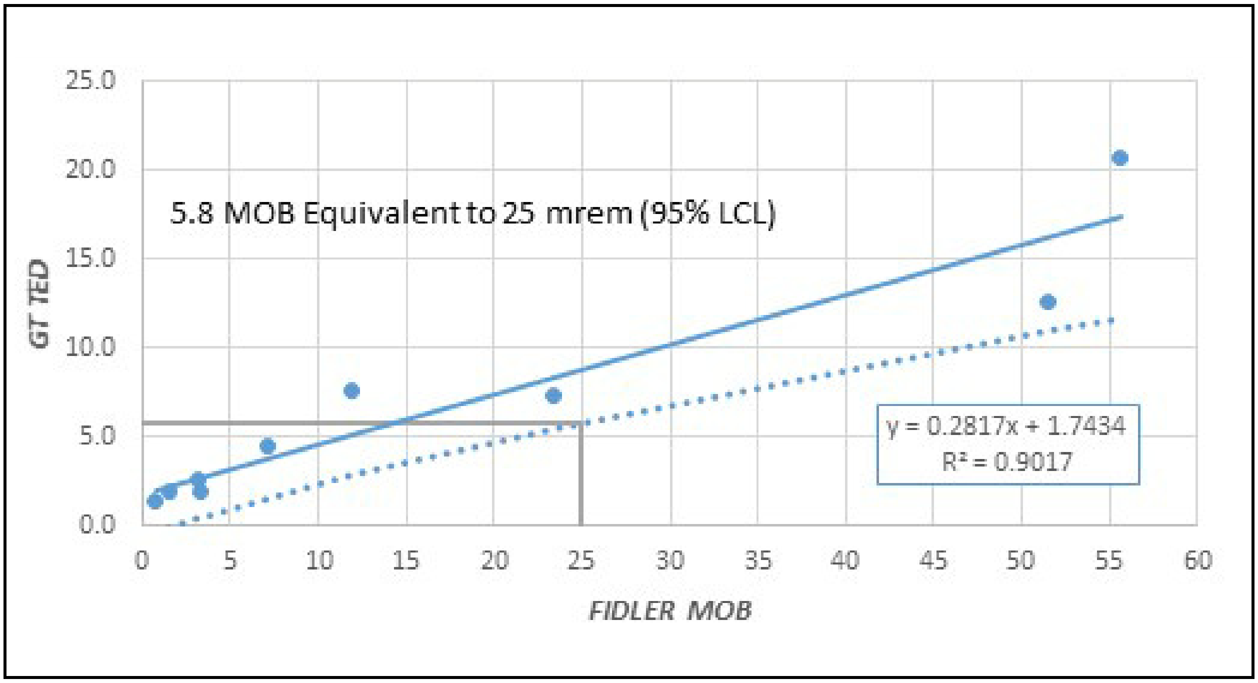

Figure C.1-3
Correlation of FIDLER MOB to GT TED

is 5.8 MOB. Therefore, any hot spot exceeding 174 MOB (30 times the area-based FAL) would require corrective action.

The hot spot criterion for soil was generated in accordance with *Dose Modeling and Statistical Assessment of Hot Spots for Decommissioning Applications* (Abelquist, 2008), which stipulates the use of an area factor (AF). The AF is the magnitude by which the concentration within the small area of elevated activity (hot spot) can exceed the area-based action level while maintaining compliance with the FAL. The AF is computed by taking the ratio of the doses generated by RESRAD for the default area of contamination (10,000 m^2) to that generated by RESRAD for the hot spot area (1 m^2). If the area-based action level is multiplied by this AF, the contamination in the hot spot area delivers the same calculated dose. Therefore, as shown in Table C.1-2, the AF was calculated as the average of the ratios of area-based TED to hot spot TED from nine CSII locations using the GT exposure scenario. As the area-based MOB criterion is 5.8 and the hot spot AF is 8.38, the resulting hot spot MOB criterion is 48.6. This value is defined as the hot spot criterion for soil. FIDLER MOB values below this conservative threshold screening value (hot spot criterion for soil) will be considered to be below 25 mrem/yr, and no further action will be required. FIDLER MOB values above the

Table C.1-2
GT Hot Spot FIDLER MOB Criterion

Sample	Hot Spot TED	Area-Based TED	Ratio
413C08	0.39	3.29	8.54
413C11x	6.33	51.49	8.14
413C09	0.08	0.76	9.02
413C10	0.18	1.57	8.58
413C16	0.38	3.19	8.38
413C15	0.85	7.08	8.32
413C13	1.46	11.92	8.17
413C14	2.87	23.44	8.15
413C12	6.83	55.61	8.14
Average			8.38
Area-Based MOB Criterion			5.8
Hot Spot-Based MOB Criterion			48.6

conservative threshold screening value are considered to exceed the radiological FAL, and corrective action is required.

An additional consideration is given for radiological hot spots that are composed of debris. As debris is too large to be inhaled or ingested, only the portion of the radioactivity that is removable will be considered for internal dose.

A hot spot criterion for debris is developed by scaling the hot spot criterion for soil based on the percent reduction in dose due to considering only the removable fraction on debris for internal dose. The external dose fraction is not reduced. To calculate the percent reduction in dose from debris, the site-specific internal and external dose fractions and the percent removable contamination from the debris must be determined. The fraction of internal dose for the GT scenario was determined from the relative contributions of internal and external dose from the CSII data using the GT hot spot RRMGs presented in Table C.1-1. The relative contributions of the exposure pathways are shown in Table C.1-3. These fractions include an adjustment using the external dose correction factor presented in Section A.8.2.1. The resulting internal dose fraction is 91 percent of TED. As shown in

Table C.1-3
RESRAD GT Exposure Pathways Relative Contribution to Dose

External Dose Fraction	Internal Dose Fraction
9%	91%

Table C.1-4, the conservative 95 percent UCL of the average percent removable contamination from the CSIII site is approximately 0.76 percent of the total contamination. Using the following formula, the reduction in the hot spot soil dose is calculated as the internal dose fraction (0.91) multiplied by the removable fraction (0.0076) plus the external dose fraction (0.09). The resulting fraction of the hot spot soil dose is 0.097:

$$\textit{fraction of the hot spot soil dose} = (\textit{removable fraction} \times \textit{internal fraction}) + \textit{external fraction}$$

Table C.1-4
Removable Alpha Contamination on Debris (dpm/100 cm^2)
(Page 1 of 2)

Identifier	Total Alpha	Removable Alpha	Percent Removable	Description
O10-11	300,000	1,300	0.43%	Rebar
Q9-01	320,000	600	0.19%	Concrete
N14-03	330,000	2,000	0.61%	2 Pieces Concrete
L12-01	340,000	500	0.15%	Concrete
Q9-12/14	350,000	4,000	1.14%	Concrete
L12-07	360,000	3,600	1.00%	Concrete
J11-03	400,000	500	0.13%	Concrete/Soil
L11-03	500,000	2,600	0.52%	Concrete
N14-02	530,000	600	0.11%	Concrete
P9-05	700,000	4,000	0.57%	Concrete
L12-2/6/8	730,000	1,500	0.21%	Steel
L12-09	750,000	2,500	0.33%	Concrete
J11-04	770,000	6,500	0.84%	Concrete, small pieces
M13-03	800,000	2,400	0.30%	2 Pieces Concrete
M11-03	800,000	13,000	1.63%	Concrete
P9-03	850,000	8,400	0.99%	Concrete

Table C.1-4
Removable Alpha Contamination on Debris (dpm/100 cm^2)
(Page 2 of 2)

Identifier	Total Alpha	Removable Alpha	Percent Removable	Description
J11-02	1,400,000	4,000	0.29%	Concrete
N15-01	1,700,000	4,500	0.26%	Concrete and Soil
L11-07	2,000,000	1,800	0.09%	Concrete
P9-01	2,100,000	10,000	0.48%	Concrete
L10-01	2,200,000	5,400	0.25%	Concrete
Q9-05	2,400,000	16,000	0.67%	Concrete
O12-01	3,000,000	18,500	0.62%	Concrete
K12-1&3	3,300,000	3,000	0.09%	Concrete
J11-01	3,300,000	12,000	0.36%	Concrete
L11-02/more	3,300,000	100,000	3.03%	Hot Spot with Lots of Concrete
Q9-16/18	3,400,000	37,000	1.09%	Concrete
O13-02	3,500,000	7,200	0.21%	Concrete and Soil
P10-03	3,500,000	21,000	0.60%	Concrete
P10-01/12	3,500,000	45	0.00%	Concrete
Average			0.57%	N/A
Standard Deviation			0.60%	N/A
95% UCL			0.76%	N/A

N/A = Not applicable

The fraction of the hot spot soil dose is then used to scale the hot spot soil criterion MOB value, resulting in the value for the hot spot debris criterion. This is done by dividing the hot spot soil criterion MOB by the fraction of the hot spot soil dose. This resulted in a hot spot debris criterion of 501 MOB (48.6 MOB / 0.097). Because this criterion exceeds the hot spot limit, the hot spot limit will be used for debris.

The resulting criteria used to evaluate hot spot contamination at the CSIII site are presented in Table C.1-5.

Table C.1-5
CSIII GT Criteria

Criterion Type	Criterion Value
Area-Based FAL	5.8 MOB
Hot Spot Limit	174 MOB (30 times the area-based FAL)
Hot Spot Soil	48.6 MOB
Hot Spot Debris	174 MOB

C.2.0 References

Abelquist, E.W. 2008. *Dose Modeling and Statistical Assessment of Hot Spots for Decommissioning Applications.* University of Tennessee, Knoxville, Ph.D dissertation.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field 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-Rev. 1. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2016. *Closure Report for Corrective Action Unit 411: Double Tracks Plutonium Dispersion (Nellis), Nevada Test and Training Range, Nevada*, Rev. 0, DOE/NV--1547. 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 7.0 released in April 2014.)

Appendix D

RESRAD Model Output for Hot Spot Criteria RRMGs

(84 Pages)

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	2.104E+00	2.035E+00	DCF2(1)
B-1	Ag-108m+D	1.369E-04	1.369E-04	DCF2(2)
B-1	Al-26	7.400E-05	7.400E-05	DCF2(3)
B-1	Am-241	3.552E-01	3.552E-01	DCF2(4)
B-1	Am-243+D	3.552E-01	3.552E-01	DCF2(5)
B-1	Cm-243	2.553E-01	2.553E-01	DCF2(6)
B-1	Cm-244	2.109E-01	2.109E-01	DCF2(8)
B-1	Co-60	1.147E-04	1.147E-04	DCF2(11)
B-1	Cs-137+D	1.443E-04	1.443E-04	DCF2(12)
B-1	Eu-152	1.554E-04	1.554E-04	DCF2(13)
B-1	Eu-154	1.961E-04	1.961E-04	DCF2(15)
B-1	Eu-155	2.553E-05	2.553E-05	DCF2(16)
B-1	Gd-152	7.030E-02	7.030E-02	DCF2(17)
B-1	Nb-94	1.813E-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	3.697E-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	3.526E-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	3.552E-02	3.552E-02	DCF2(37)
B-1	U-234	3.478E-02	3.478E-02	DCF2(38)
B-1	U-235+D	3.145E-02	3.145E-02	DCF2(39)
B-1	U-236	3.219E-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	1.295E-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	1.258E-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	1.184E-06	1.184E-06	DCF3(16)
D-1	Gd-152	1.517E-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	2.627E-03	2.627E-03	DCF3(20)
D-1	Pb-210+D	6.998E-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	1.776E-05	1.776E-05	DCF3(27)
D-1	Pu-241+D	2.057E-05	1.776E-05	DCF3(28)
D-1	Ra-226+D	1.037E-03	1.036E-03	DCF3(29)
D-1	Ra-228+D	2.555E-03	2.553E-03	DCF3(30)
D-1	Sr-90+D	1.136E-04	1.036E-04	DCF3(31)
D-1	Tc-99	2.368E-06	2.368E-06	DCF3(32)
D-1	Th-228+D	5.301E-04	2.664E-04	DCF3(33)
D-1	Th-229+D	2.269E-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	1.887E-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	1.813E-04	1.813E-04	DCF3(38)
D-1	U-235+D	1.752E-04	1.739E-04	DCF3(39)
D-1	U-236	1.739E-04	1.739E-04	DCF3(40)
D-1	U-238	1.665E-04	1.665E-04	DCF3(41)
D-1	U-238+D	1.791E-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+00	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	1.000E+00	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	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+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	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

Contaminated Zone Dimensions	
Area:	1.00 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):	2.567E+01	2.369E+01	1.415E+01	7.144E+00	6.540E+00
M(t):	1.027E+00	9.475E-01	5.661E-01	2.858E-01	2.616E-01

Maximum TDOSE(t): 2.567E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	3.468E+00	0.1351	1.873E-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-06	0.0000
Al-26	5.263E+00	0.2051	1.015E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.134E-06	0.0000
Am-241	5.228E-02	0.0020	5.153E-02	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.102E-04	0.0000
Am-243	5.005E-01	0.0195	5.157E-02	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.117E-04	0.0000
Cm-243	2.747E-01	0.0107	3.663E-02	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.302E-04	0.0000
Cm-244	2.382E-04	0.0000	3.005E-02	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.829E-04	0.0000
Co-60	4.922E+00	0.1918	1.561E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.948E-06	0.0000
Cs-137	1.270E+00	0.0495	2.072E-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-05	0.0000
Eu-152	2.377E+00	0.0926	2.199E-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-06	0.0000
Eu-154	2.543E+00	0.0991	2.739E-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-06	0.0000
Eu-155	1.216E-01	0.0047	3.460E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.638E-07	0.0000
Nb-94	3.320E+00	0.1294	2.487E-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-06	0.0000
Np-237	5.041E-01	0.0196	2.687E-02	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-04	0.0000
Pu-238	2.506E-04	0.0000	5.888E-02	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.558E-04	0.0000
Pu-239	1.872E-04	0.0000	6.448E-02	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.883E-04	0.0000
Pu-240	2.251E-04	0.0000	6.448E-02	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-04	0.0000
Pu-241	5.139E-05	0.0000	1.247E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.523E-06	0.0000
Sr-90	1.041E-02	0.0004	8.574E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.710E-05	0.0000
Tc-99	7.548E-05	0.0000	6.598E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.389E-07	0.0000
Th-232	1.396E-01	0.0054	5.976E-02	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.208E-04	0.0000
U-233	7.797E-04	0.0000	5.164E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.924E-05	0.0000
U-234	3.546E-04	0.0000	5.051E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.609E-05	0.0000
U-235	3.640E-01	0.0142	4.568E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.352E-05	0.0000
U-238	6.448E-02	0.0025	4.302E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.516E-05	0.0000
Total	2.520E+01	0.9818	4.648E-01	0.0181	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.161E-03	0.0001

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	3.468E+00	0.1351
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	5.263E+00	0.2051
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	1.041E-01	0.0041
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.524E-01	0.0215
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	3.115E-01	0.0121
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	3.048E-02	0.0012
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	4.922E+00	0.1918
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	1.270E+00	0.0495
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	2.377E+00	0.0926
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	2.543E+00	0.0991
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	1.216E-01	0.0047
Nb-94	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.321E+00	0.1294
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	5.312E-01	0.0207
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	5.948E-02	0.0023
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	6.506E-02	0.0025
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.509E-02	0.0025
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.306E-03	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	1.054E-02	0.0004
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.301E-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	1.998E-01	0.0078
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.023E-03	0.0002
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.481E-03	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	3.686E-01	0.0144
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	6.886E-02	0.0027
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.567E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	3.074E+00	0.1298	1.660E-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-06	0.0000
Al-26	4.691E+00	0.1980	9.047E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.576E-06	0.0000
Am-241	5.216E-02	0.0022	5.140E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.095E-04	0.0000
Am-243	5.000E-01	0.0211	5.152E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.115E-04	0.0000
Cm-243	2.681E-01	0.0113	3.575E-02	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.246E-04	0.0000
Cm-244	2.293E-04	0.0000	2.893E-02	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.760E-04	0.0000
Co-60	4.316E+00	0.1822	1.369E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.338E-06	0.0000
Cs-137	1.241E+00	0.0524	2.024E-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-05	0.0000
Eu-152	2.256E+00	0.0952	2.088E-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-06	0.0000
Eu-154	2.351E+00	0.0992	2.531E-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-06	0.0000
Eu-155	1.057E-01	0.0045	3.009E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.033E-07	0.0000
Nb-94	2.959E+00	0.1249	2.216E-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-06	0.0000
Np-237	5.041E-01	0.0213	2.687E-02	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-04	0.0000
Pu-238	2.486E-04	0.0000	5.841E-02	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.530E-04	0.0000
Pu-239	1.872E-04	0.0000	6.448E-02	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-04	0.0000
Pu-240	2.251E-04	0.0000	6.447E-02	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-04	0.0000
Pu-241	1.307E-04	0.0000	1.269E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.655E-06	0.0000
Sr-90	1.016E-02	0.0004	8.368E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.597E-05	0.0000
Tc-99	6.726E-05	0.0000	5.880E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.367E-07	0.0000
Th-232	4.629E-01	0.0195	6.146E-02	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.428E-04	0.0000
U-233	8.457E-04	0.0000	5.176E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.930E-05	0.0000
U-234	3.545E-04	0.0000	5.050E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.607E-05	0.0000
U-235	3.639E-01	0.0154	4.568E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.353E-05	0.0000
U-238	6.446E-02	0.0027	4.301E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.514E-05	0.0000
Total	2.322E+01	0.9803	4.639E-01	0.0196	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.263E-03	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.074E+00	0.1298
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	4.691E+00	0.1980
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	1.039E-01	0.0044
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.519E-01	0.0233
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	3.041E-01	0.0128
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	2.934E-02	0.0012
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	4.316E+00	0.1822
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	1.241E+00	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	2.256E+00	0.0952
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	2.351E+00	0.0992
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	1.057E-01	0.0045
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	2.959E+00	0.1249
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	5.311E-01	0.0224
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	5.901E-02	0.0025
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	6.506E-02	0.0027
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	6.509E-02	0.0027
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	1.408E-03	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	1.029E-02	0.0004
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.398E-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	5.249E-01	0.0222
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.101E-03	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	5.480E-03	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	3.685E-01	0.0156
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	6.884E-02	0.0029
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	2.369E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	1.038E+00	0.0733	5.604E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.007E-06	0.0000
Al-26	1.663E+00	0.1175	3.208E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.622E-06	0.0000
Am-241	5.106E-02	0.0036	5.032E-02	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.030E-04	0.0000
Am-243	4.962E-01	0.0351	5.114E-02	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.092E-04	0.0000
Cm-243	2.154E-01	0.0152	2.874E-02	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-04	0.0000
Cm-244	1.626E-04	0.0000	2.055E-02	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.250E-04	0.0000
Co-60	1.321E+00	0.0934	4.190E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.328E-06	0.0000
Cs-137	1.008E+00	0.0712	1.644E-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-05	0.0000
Eu-152	1.413E+00	0.0998	1.307E-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-06	0.0000
Eu-154	1.157E+00	0.0817	1.246E-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-06	0.0000
Eu-155	3.005E-02	0.0021	8.553E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.146E-07	0.0000
Nb-94	1.049E+00	0.0741	7.856E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.878E-07	0.0000
Np-237	5.038E-01	0.0356	2.685E-02	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.721E-04	0.0000
Pu-238	2.315E-04	0.0000	5.440E-02	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.287E-04	0.0000
Pu-239	1.871E-04	0.0000	6.446E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.881E-04	0.0000
Pu-240	2.248E-04	0.0000	6.441E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.878E-04	0.0000
Pu-241	6.888E-04	0.0000	1.418E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.547E-06	0.0000
Sr-90	8.161E-03	0.0006	6.723E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.694E-05	0.0000
Tc-99	2.385E-05	0.0000	2.085E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.967E-07	0.0000
Th-232	3.305E+00	0.2335	7.906E-02	0.0056	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.257E-03	0.0001
U-233	1.439E-03	0.0001	5.278E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.989E-05	0.0000
U-234	3.543E-04	0.0000	5.040E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.588E-05	0.0000
U-235	3.629E-01	0.0256	4.580E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.359E-05	0.0000
U-238	6.429E-02	0.0045	4.289E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.493E-05	0.0000
Total	1.369E+01	0.9672	4.607E-01	0.0325	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.825E-03	0.0003

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	1.038E+00	0.0733
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	1.663E+00	0.1175
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	1.017E-01	0.0072
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.477E-01	0.0387
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	2.443E-01	0.0173
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	2.084E-02	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	1.321E+00	0.0934
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	1.008E+00	0.0712
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	1.413E+00	0.0998
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	1.157E+00	0.0817
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	3.005E-02	0.0021
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	1.049E+00	0.0741
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	5.309E-01	0.0375
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	5.496E-02	0.0039
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	6.503E-02	0.0046
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	6.502E-02	0.0046
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	2.116E-03	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	8.265E-03	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	2.623E-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	3.385E+00	0.2392
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.797E-03	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	5.470E-03	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	3.676E-01	0.0260
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	6.865E-02	0.0049
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	1.415E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	1.995E-05	0.0000	1.078E-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-11	0.0000
Al-26	5.226E-05	0.0000	1.008E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.098E-11	0.0000
Am-241	4.128E-02	0.0058	4.067E-02	0.0057	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E-04	0.0000
Am-243	4.594E-01	0.0643	4.751E-02	0.0067	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.872E-04	0.0000
Cm-243	2.411E-02	0.0034	3.284E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.062E-05	0.0000
Cm-244	5.783E-06	0.0000	8.266E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.019E-06	0.0000
Co-60	9.560E-06	0.0000	3.031E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.609E-12	0.0000
Cs-137	1.259E-01	0.0176	2.055E-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-06	0.0000
Eu-152	1.309E-02	0.0018	1.211E-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-08	0.0000
Eu-154	9.634E-04	0.0001	1.037E-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-09	0.0000
Eu-155	1.035E-07	0.0000	2.945E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.948E-13	0.0000
Nb-94	3.286E-05	0.0000	2.461E-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-11	0.0000
Np-237	5.011E-01	0.0701	2.671E-02	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.712E-04	0.0000
Pu-238	1.137E-04	0.0000	2.670E-02	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.614E-04	0.0000
Pu-239	1.866E-04	0.0000	6.425E-02	0.0090	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.868E-04	0.0001
Pu-240	2.225E-04	0.0000	6.375E-02	0.0089	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.839E-04	0.0001
Pu-241	1.432E-03	0.0002	1.420E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.552E-06	0.0000
Sr-90	9.150E-04	0.0001	7.538E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.142E-06	0.0000
Tc-99	7.492E-10	0.0000	6.550E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.319E-12	0.0000
Th-232	5.160E+00	0.7223	9.110E-02	0.0128	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.650E-03	0.0002
U-233	7.249E-03	0.0010	6.280E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.563E-05	0.0000
U-234	4.158E-04	0.0001	4.945E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.410E-05	0.0000
U-235	3.544E-01	0.0496	5.021E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.625E-05	0.0000
U-238	6.254E-02	0.0088	4.174E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.291E-05	0.0000
Total	6.754E+00	0.9454	3.866E-01	0.0541	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.634E-03	0.0005

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	1.995E-05	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	5.226E-05	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	8.219E-02	0.0115
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.072E-01	0.0710
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	2.741E-02	0.0038
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	8.374E-04	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	9.560E-06	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	1.259E-01	0.0176
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	1.309E-02	0.0018
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	9.634E-04	0.0001
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.035E-07	0.0000
Nb-94	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.286E-05	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	5.280E-01	0.0739
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	2.698E-02	0.0038
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	6.482E-02	0.0091
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	6.436E-02	0.0090
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	0.0004
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	9.267E-04	0.0001
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.240E-10	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	5.253E+00	0.7353
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	1.362E-02	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	5.435E-03	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	3.595E-01	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	6.679E-02	0.0093
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.144E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Al-26	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-241	4.964E-03	0.0008	4.836E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.912E-05	0.0000
Am-243	2.125E-01	0.0325	2.311E-02	0.0035	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.397E-04	0.0000
Cm-243	2.254E-06	0.0000	7.375E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.441E-07	0.0000
Cm-244	5.581E-07	0.0000	1.599E-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-07	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	1.169E-10	0.0000	1.908E-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-15	0.0000
Eu-152	6.095E-23	0.0000	3.453E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.154E-18	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	4.749E-01	0.0726	2.535E-02	0.0039	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.626E-04	0.0000
Pu-238	1.723E-06	0.0000	2.318E-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-07	0.0000
Pu-239	1.808E-04	0.0000	6.217E-02	0.0095	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.744E-04	0.0001
Pu-240	2.009E-04	0.0000	5.755E-02	0.0088	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.465E-04	0.0001
Pu-241	1.738E-04	0.0000	1.694E-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-06	0.0000
Sr-90	2.873E-13	0.0000	2.367E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.301E-15	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	5.159E+00	0.7888	9.108E-02	0.0139	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.649E-03	0.0003
U-233	5.478E-02	0.0084	1.442E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.317E-04	0.0000
U-234	5.590E-03	0.0009	4.136E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.293E-05	0.0000
U-235	2.824E-01	0.0432	9.023E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.877E-05	0.0000
U-238	4.747E-02	0.0073	3.178E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.549E-05	0.0000
Total	6.242E+00	0.9544	2.953E-01	0.0451	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.053E-03	0.0005

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-108m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Al-26	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.829E-03	0.0015
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.357E-01	0.0360
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	7.645E-05	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	1.614E-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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.169E-10	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	3.475E-16	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Nb-94	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.004E-01	0.0765
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	2.506E-05	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	6.273E-02	0.0096
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	5.810E-02	0.0089
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	3.442E-04	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	2.910E-13	0.0000
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.252E+00	0.8030
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.933E-02	0.0106
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	9.789E-03	0.0015
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	2.915E-01	0.0446
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.071E-02	0.0078
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.540E+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	3.468E-02	3.074E-02	1.038E-02	1.995E-07	0.000E+00
Al-26	Al-26	1.000E+00	5.263E-02	4.691E-02	1.663E-02	5.226E-07	0.000E+00
Am-241	Am-241	1.000E+00	1.041E-03	1.039E-03	1.017E-03	8.218E-04	9.766E-05
Am-241	Np-237+D	1.000E+00	8.596E-10	2.576E-09	1.784E-08	1.534E-07	6.326E-07
Am-241	U-233	1.000E+00	1.412E-17	9.875E-17	4.632E-15	3.911E-13	1.920E-11
Am-241	Th-229+D	1.000E+00	4.681E-20	7.017E-19	2.158E-16	1.773E-13	1.003E-10
Am-241	∑DSR(j)		1.041E-03	1.039E-03	1.017E-03	8.219E-04	9.829E-05
Am-243+D	Am-243+D	1.000E+00	5.524E-03	5.519E-03	5.476E-03	5.070E-03	2.345E-03
Am-243+D	Pu-239	1.000E+00	9.367E-09	2.809E-08	1.958E-07	1.801E-06	1.233E-05
Am-243+D	U-235+D	1.000E+00	1.742E-17	1.219E-16	5.745E-15	5.074E-13	3.559E-11
Am-243+D	Pa-231	1.000E+00	3.957E-23	5.933E-22	1.830E-19	1.547E-16	1.092E-13
Am-243+D	Ac-227+D	1.000E+00	1.907E-24	5.878E-23	1.091E-19	5.537E-16	7.488E-13
Am-243+D	∑DSR(j)		5.524E-03	5.519E-03	5.477E-03	5.072E-03	2.357E-03
Cm-243	Cm-243	2.400E-03	7.477E-06	7.297E-06	5.862E-06	6.561E-07	2.025E-16
Cm-243	Am-243+D	2.400E-03	6.176E-10	1.832E-09	1.149E-08	4.408E-08	2.251E-08
Cm-243	Pu-239	2.400E-03	6.996E-16	4.862E-15	2.137E-13	1.056E-11	1.113E-10
Cm-243	U-235+D	2.400E-03	9.772E-25	1.458E-23	4.267E-21	2.308E-18	3.080E-16
Cm-243	Pa-231	2.400E-03	1.777E-30	5.484E-29	1.033E-25	5.791E-22	9.085E-19
Cm-243	Ac-227+D	2.400E-03	7.149E-32	4.466E-30	5.024E-26	1.875E-21	6.210E-18
Cm-243	∑DSR(j)		7.478E-06	7.299E-06	5.874E-06	7.002E-07	2.263E-08
Cm-243	Cm-243	9.976E-01	3.108E-03	3.033E-03	2.437E-03	2.727E-04	8.417E-14
Cm-243	Pu-239	9.976E-01	9.272E-09	2.752E-08	1.732E-07	6.999E-07	7.419E-07
Cm-243	U-235+D	9.976E-01	1.728E-17	1.201E-16	5.288E-15	2.664E-13	3.499E-12
Cm-243	Pa-231	9.976E-01	3.929E-23	5.862E-22	1.718E-19	9.415E-17	1.451E-14
Cm-243	Ac-227+D	9.976E-01	1.895E-24	5.818E-23	1.037E-19	3.576E-16	1.018E-13
Cm-243	∑DSR(j)		3.108E-03	3.033E-03	2.437E-03	2.734E-04	7.419E-07
Cm-244	Cm-244	1.350E-06	4.114E-10	3.959E-10	2.805E-10	8.944E-12	9.707E-27
Cm-244	Cm-244	4.950E-08	1.508E-11	1.452E-11	1.029E-11	3.279E-13	3.559E-28
Cm-244	Pu-240	4.950E-08	1.687E-15	4.975E-15	2.952E-14	8.658E-14	7.988E-14
Cm-244	∑DSR(j)		1.509E-11	1.452E-11	1.032E-11	4.145E-13	7.988E-14
Cm-244	Cm-244	1.000E+00	3.047E-04	2.933E-04	2.078E-04	6.625E-06	7.190E-21
Cm-244	Pu-240	1.000E+00	3.407E-08	1.005E-07	5.963E-07	1.749E-06	1.614E-06
Cm-244	U-236	1.000E+00	2.587E-17	1.791E-16	7.583E-15	3.015E-13	3.255E-12
Cm-244	Th-232	1.000E+00	3.837E-27	5.709E-26	1.626E-23	7.408E-21	1.006E-18
Cm-244	Ra-228+D	1.000E+00	3.129E-27	9.441E-26	1.429E-22	2.093E-19	3.407E-17
Cm-244	Th-228+D	1.000E+00	2.739E-28	1.604E-26	1.021E-22	2.959E-19	5.148E-17
Cm-244	∑DSR(j)		3.048E-04	2.934E-04	2.084E-04	8.374E-06	1.614E-06

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	4.922E-02	4.316E-02	1.321E-02	9.560E-08	0.000E+00
Cs-137+D	Cs-137+D	1.000E+00	1.270E-02	1.241E-02	1.008E-02	1.259E-03	1.169E-12
Eu-152	Eu-152	7.208E-01	1.713E-02	1.626E-02	1.018E-02	9.434E-05	4.394E-25
Eu-152	Eu-152	2.792E-01	6.636E-03	6.300E-03	3.944E-03	3.654E-05	1.702E-25
Eu-152	Gd-152	2.792E-01	9.047E-20	2.653E-19	1.489E-18	3.515E-18	3.475E-18
Eu-152	∑DSR(j)		6.636E-03	6.300E-03	3.944E-03	3.654E-05	3.475E-18
Eu-154	Eu-154	1.000E+00	2.543E-02	2.351E-02	1.157E-02	9.634E-06	1.547E-36
Eu-155	Eu-155	1.000E+00	1.216E-03	1.057E-03	3.005E-04	1.035E-09	0.000E+00
Nb-94	Nb-94	1.000E+00	3.321E-02	2.959E-02	1.049E-02	3.286E-07	0.000E+00
Np-237+D	Np-237+D	1.000E+00	5.312E-03	5.311E-03	5.309E-03	5.280E-03	5.003E-03
Np-237+D	U-233	1.000E+00	1.308E-10	3.925E-10	2.743E-09	2.582E-08	2.181E-07
Np-237+D	Th-229+D	1.000E+00	5.783E-13	4.048E-12	1.911E-10	1.725E-08	1.489E-06
Np-237+D	∑DSR(j)		5.312E-03	5.311E-03	5.309E-03	5.280E-03	5.004E-03
Pu-238	Pu-238	1.840E-09	1.094E-12	1.086E-12	1.011E-12	4.963E-13	4.027E-16
Pu-238	Pu-238	1.000E+00	5.948E-04	5.901E-04	5.496E-04	2.698E-04	2.188E-07
Pu-238	U-234	1.000E+00	7.749E-11	2.316E-10	1.563E-09	1.059E-08	1.500E-08
Pu-238	Th-230	1.000E+00	2.334E-15	1.630E-14	7.521E-13	5.467E-11	1.350E-09
Pu-238	Ra-226+D	1.000E+00	1.719E-17	2.573E-16	7.807E-14	5.652E-11	1.532E-08
Pu-238	Pb-210+D	1.000E+00	3.866E-22	1.190E-20	2.186E-17	9.836E-14	5.206E-11
Pu-238	∑DSR(j)		5.948E-04	5.901E-04	5.496E-04	2.698E-04	2.506E-07
Pu-239	Pu-239	1.000E+00	6.506E-04	6.506E-04	6.503E-04	6.482E-04	6.273E-04
Pu-239	U-235+D	1.000E+00	1.815E-12	5.445E-12	3.805E-11	3.587E-10	3.069E-09
Pu-239	Pa-231	1.000E+00	5.496E-18	3.846E-17	1.815E-15	1.629E-13	1.323E-11
Pu-239	Ac-227+D	1.000E+00	3.307E-19	4.926E-18	1.419E-15	6.910E-13	9.307E-11
Pu-239	∑DSR(j)		6.506E-04	6.506E-04	6.503E-04	6.482E-04	6.273E-04
Pu-240	Pu-240	4.950E-08	3.222E-11	3.222E-11	3.218E-11	3.186E-11	2.876E-11
Pu-240	Pu-240	1.000E+00	6.509E-04	6.509E-04	6.502E-04	6.436E-04	5.810E-04
Pu-240	U-236	1.000E+00	7.390E-13	2.217E-12	1.549E-11	1.455E-10	1.200E-09
Pu-240	Th-232	1.000E+00	1.459E-22	1.021E-21	4.821E-20	4.358E-18	3.815E-16
Pu-240	Ra-228+D	1.000E+00	1.479E-22	2.163E-21	5.257E-19	1.274E-16	1.292E-14
Pu-240	Th-228+D	1.000E+00	1.541E-23	4.411E-22	4.299E-19	1.824E-16	1.953E-14
Pu-240	∑DSR(j)		6.509E-04	6.509E-04	6.502E-04	6.436E-04	5.810E-04

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	1.217E-05	1.160E-05	7.521E-06	9.876E-08	1.504E-26
Pu-241	Am-241	1.000E+00	8.220E-07	2.412E-06	1.359E-05	2.850E-05	3.421E-06
Pu-241	Np-237+D	1.000E+00	4.541E-13	3.134E-12	1.283E-10	4.138E-09	2.098E-08
Pu-241	U-233	1.000E+00	5.607E-21	8.321E-20	2.310E-17	8.851E-15	6.221E-13
Pu-241	Th-229+D	1.000E+00	1.490E-23	4.578E-22	8.264E-19	3.474E-15	3.176E-12
Pu-241	∑DSR(j)		1.299E-05	1.401E-05	2.111E-05	2.860E-05	3.442E-06
Pu-241+D	Pu-241+D	2.450E-05	6.792E-08	6.473E-08	4.197E-08	5.511E-10	8.391E-29
Pu-241+D	Np-237+D	2.450E-05	2.074E-14	6.092E-14	3.473E-13	8.645E-13	8.256E-13
Pu-241+D	U-233	2.450E-05	3.420E-22	2.361E-21	9.733E-20	3.393E-18	3.533E-17
Pu-241+D	Th-229+D	2.450E-05	1.136E-24	1.687E-23	4.708E-21	1.913E-18	2.362E-16
Pu-241+D	∑DSR(j)		6.792E-08	6.473E-08	4.197E-08	5.519E-10	8.259E-13
Sr-90+D	Sr-90+D	1.000E+00	1.054E-04	1.029E-04	8.265E-05	9.267E-06	2.910E-15
Tc-99	Tc-99	1.000E+00	8.301E-07	7.398E-07	2.623E-07	8.240E-12	0.000E+00
Th-232	Th-232	1.000E+00	5.993E-04	5.993E-04	5.993E-04	5.993E-04	5.991E-04
Th-232	Ra-228+D	1.000E+00	1.196E-03	3.405E-03	1.481E-02	2.061E-02	2.061E-02
Th-232	Th-228+D	1.000E+00	2.028E-04	1.244E-03	1.844E-02	3.132E-02	3.131E-02
Th-232	∑DSR(j)		1.998E-03	5.249E-03	3.385E-02	5.253E-02	5.252E-02
U-233	U-233	1.000E+00	5.984E-05	5.982E-05	5.965E-05	5.801E-05	4.385E-05
U-233	Th-229+D	1.000E+00	3.967E-07	1.190E-06	8.315E-06	7.814E-05	6.495E-04
U-233	∑DSR(j)		6.023E-05	6.101E-05	6.797E-05	1.362E-04	6.933E-04
U-234	U-234	1.000E+00	5.481E-05	5.479E-05	5.464E-05	5.314E-05	4.023E-05
U-234	Th-230	1.000E+00	2.474E-09	7.422E-09	5.188E-08	4.895E-07	4.238E-06
U-234	Ra-226+D	1.000E+00	2.429E-11	1.700E-10	8.014E-09	7.126E-07	5.324E-05
U-234	Pb-210+D	1.000E+00	6.819E-16	1.016E-14	2.932E-12	1.444E-09	1.823E-07
U-234	∑DSR(j)		5.481E-05	5.480E-05	5.470E-05	5.435E-05	9.789E-05
U-235+D	U-235+D	1.000E+00	3.686E-03	3.685E-03	3.675E-03	3.575E-03	2.713E-03
U-235+D	Pa-231	1.000E+00	1.674E-08	5.021E-08	3.505E-07	3.260E-06	2.440E-05
U-235+D	Ac-227+D	1.000E+00	1.341E-09	9.300E-09	3.996E-07	1.722E-05	1.775E-04
U-235+D	∑DSR(j)		3.686E-03	3.685E-03	3.676E-03	3.595E-03	2.915E-03
U-238	U-238	5.400E-05	2.457E-09	2.456E-09	2.449E-09	2.383E-09	1.808E-09
U-238+D	U-238+D	9.999E-01	6.886E-04	6.884E-04	6.865E-04	6.678E-04	5.069E-04
U-238+D	U-234	9.999E-01	7.768E-11	2.330E-10	1.626E-09	1.514E-08	1.143E-07
U-238+D	Th-230	9.999E-01	2.338E-15	1.636E-14	7.723E-13	6.939E-11	5.715E-09
U-238+D	Ra-226+D	9.999E-01	1.721E-17	2.581E-16	7.964E-14	6.771E-11	5.037E-08
U-238+D	Pb-210+D	9.999E-01	3.871E-22	1.193E-20	2.221E-17	1.150E-13	1.673E-10
U-238+D	∑DSR(j)		6.886E-04	6.884E-04	6.865E-04	6.679E-04	5.071E-04

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

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

Nuclide (i)	t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Ag-108m	7.209E+02	8.133E+02	2.409E+03	1.253E+08	*2.609E+13
Al-26	4.750E+02	5.330E+02	1.503E+03	4.784E+07	*1.921E+10
Am-241	2.401E+04	2.407E+04	2.459E+04	3.042E+04	2.544E+05
Am-243	4.526E+03	4.530E+03	4.565E+03	4.929E+03	1.061E+04
Cm-243	8.024E+03	8.222E+03	1.023E+04	9.119E+04	3.270E+07
Cm-244	8.203E+04	8.522E+04	1.200E+05	2.985E+06	1.549E+07
Co-60	5.079E+02	5.793E+02	1.892E+03	2.615E+08	*1.132E+15
Cs-137	1.969E+03	2.015E+03	2.481E+03	1.985E+04	2.138E+13
Eu-152	1.052E+03	1.108E+03	1.770E+03	1.910E+05	*1.765E+14
Eu-154	9.830E+02	1.064E+03	2.161E+03	2.595E+06	*2.639E+14
Eu-155	2.056E+04	2.365E+04	8.319E+04	2.416E+10	*4.652E+14
Nb-94	7.529E+02	8.448E+02	2.383E+03	7.608E+07	*1.875E+11
Np-237	4.707E+03	4.707E+03	4.709E+03	4.735E+03	4.996E+03
Pu-238	4.203E+04	4.236E+04	4.549E+04	9.267E+04	9.977E+07
Pu-239	3.843E+04	3.843E+04	3.844E+04	3.857E+04	3.986E+04
Pu-240	3.841E+04	3.841E+04	3.845E+04	3.885E+04	4.303E+04
Pu-241	1.914E+06	1.776E+06	1.182E+06	8.740E+05	7.263E+06
Sr-90	2.372E+05	2.430E+05	3.025E+05	2.698E+06	*1.365E+14
Tc-99	3.012E+07	3.379E+07	9.530E+07	*1.697E+10	*1.697E+10
Th-232	1.251E+04	4.763E+03	7.385E+02	4.759E+02	4.760E+02
U-233	4.151E+05	4.098E+05	3.678E+05	1.836E+05	3.606E+04
U-234	4.561E+05	4.562E+05	4.570E+05	4.600E+05	2.554E+05
U-235	6.782E+03	6.784E+03	6.802E+03	6.954E+03	8.576E+03
U-238	3.630E+04	3.632E+04	3.642E+04	3.743E+04	4.930E+04

*At specific activity limit

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

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ag-108m	1.000E+02	0.000E+00	3.468E-02	7.209E+02	3.468E-02	7.209E+02
Al-26	1.000E+02	0.000E+00	5.263E-02	4.750E+02	5.263E-02	4.750E+02
Am-241	1.000E+02	0.000E+00	1.041E-03	2.401E+04	1.041E-03	2.401E+04
Am-243	1.000E+02	0.000E+00	5.524E-03	4.526E+03	5.524E-03	4.526E+03
Cm-243	1.000E+02	0.000E+00	3.115E-03	8.024E+03	3.115E-03	8.024E+03
Cm-244	1.000E+02	0.000E+00	3.048E-04	8.203E+04	3.048E-04	8.203E+04
Co-60	1.000E+02	0.000E+00	4.922E-02	5.079E+02	4.922E-02	5.079E+02
Cs-137	1.000E+02	0.000E+00	1.270E-02	1.969E+03	1.270E-02	1.969E+03
Eu-152	1.000E+02	0.000E+00	2.377E-02	1.052E+03	2.377E-02	1.052E+03
Eu-154	1.000E+02	0.000E+00	2.543E-02	9.830E+02	2.543E-02	9.830E+02
Eu-155	1.000E+02	0.000E+00	1.216E-03	2.056E+04	1.216E-03	2.056E+04
Nb-94	1.000E+02	0.000E+00	3.321E-02	7.529E+02	3.321E-02	7.529E+02
Np-237	1.000E+02	0.000E+00	5.312E-03	4.707E+03	5.312E-03	4.707E+03
Pu-238	1.000E+02	0.000E+00	5.948E-04	4.203E+04	5.948E-04	4.203E+04
Pu-239	1.000E+02	0.000E+00	6.506E-04	3.843E+04	6.506E-04	3.843E+04
Pu-240	1.000E+02	0.000E+00	6.509E-04	3.841E+04	6.509E-04	3.841E+04
Pu-241	1.000E+02	56.2 ± 0.1	3.037E-05	8.231E+05	1.306E-05	1.914E+06
Sr-90	1.000E+02	0.000E+00	1.054E-04	2.372E+05	1.054E-04	2.372E+05
Tc-99	1.000E+02	0.000E+00	8.301E-07	3.012E+07	8.301E-07	3.012E+07
Th-232	1.000E+02	112.1 ± 0.2	5.253E-02	4.759E+02	1.998E-03	1.251E+04
U-233	1.000E+02	1.000E+03	6.933E-04	3.606E+04	6.023E-05	4.151E+05
U-234	1.000E+02	1.000E+03	9.789E-05	2.554E+05	5.481E-05	4.561E+05
U-235	1.000E+02	0.000E+00	3.686E-03	6.782E+03	3.686E-03	6.782E+03
U-238	1.000E+02	0.000E+00	6.886E-04	3.630E+04	6.886E-04	3.630E+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	3.468E+00	3.074E+00	1.038E+00	1.995E-05	0.000E+00
Al-26	Al-26	1.000E+00	5.263E+00	4.691E+00	1.663E+00	5.226E-05	0.000E+00
Am-241	Am-241	1.000E+00	1.041E-01	1.039E-01	1.017E-01	8.218E-02	9.766E-03
Am-241	Pu-241	1.000E+00	8.220E-05	2.412E-04	1.359E-03	2.850E-03	3.421E-04
Am-241	∑DOSE(j)		1.042E-01	1.041E-01	1.030E-01	8.503E-02	1.011E-02
Np-237	Am-241	1.000E+00	8.596E-08	2.576E-07	1.784E-06	1.534E-05	6.326E-05
Np-237	Np-237	1.000E+00	5.312E-01	5.311E-01	5.309E-01	5.280E-01	5.003E-01
Np-237	Pu-241	1.000E+00	4.541E-11	3.134E-10	1.283E-08	4.138E-07	2.098E-06
Np-237	Pu-241	2.450E-05	2.074E-12	6.092E-12	3.473E-11	8.645E-11	8.256E-11
Np-237	∑DOSE(j)		5.312E-01	5.311E-01	5.309E-01	5.280E-01	5.003E-01
U-233	Am-241	1.000E+00	1.412E-15	9.875E-15	4.632E-13	3.911E-11	1.920E-09
U-233	Np-237	1.000E+00	1.308E-08	3.925E-08	2.743E-07	2.582E-06	2.181E-05
U-233	Pu-241	1.000E+00	5.607E-19	8.321E-18	2.310E-15	8.851E-13	6.221E-11
U-233	Pu-241	2.450E-05	3.420E-20	2.361E-19	9.733E-18	3.393E-16	3.533E-15
U-233	U-233	1.000E+00	5.984E-03	5.982E-03	5.965E-03	5.801E-03	4.385E-03
U-233	∑DOSE(j)		5.984E-03	5.982E-03	5.965E-03	5.803E-03	4.407E-03
Th-229	Am-241	1.000E+00	4.681E-18	7.017E-17	2.158E-14	1.773E-11	1.003E-08
Th-229	Np-237	1.000E+00	5.783E-11	4.048E-10	1.911E-08	1.725E-06	1.489E-04
Th-229	Pu-241	1.000E+00	1.490E-21	4.578E-20	8.264E-17	3.474E-13	3.176E-10
Th-229	Pu-241	2.450E-05	1.136E-22	1.687E-21	4.708E-19	1.913E-16	2.362E-14
Th-229	U-233	1.000E+00	3.967E-05	1.190E-04	8.315E-04	7.814E-03	6.495E-02
Th-229	∑DOSE(j)		3.967E-05	1.190E-04	8.315E-04	7.816E-03	6.509E-02
Am-243	Am-243	1.000E+00	5.524E-01	5.519E-01	5.476E-01	5.070E-01	2.345E-01
Am-243	Cm-243	2.400E-03	6.176E-08	1.832E-07	1.149E-06	4.408E-06	2.251E-06
Am-243	∑DOSE(j)		5.524E-01	5.519E-01	5.476E-01	5.070E-01	2.345E-01
Pu-239	Am-243	1.000E+00	9.367E-07	2.809E-06	1.958E-05	1.801E-04	1.233E-03
Pu-239	Cm-243	2.400E-03	6.996E-14	4.862E-13	2.137E-11	1.056E-09	1.113E-08
Pu-239	Cm-243	9.976E-01	9.272E-07	2.752E-06	1.732E-05	6.999E-05	7.419E-05
Pu-239	Pu-239	1.000E+00	6.506E-02	6.506E-02	6.503E-02	6.482E-02	6.273E-02
Pu-239	∑DOSE(j)		6.506E-02	6.506E-02	6.507E-02	6.507E-02	6.403E-02
U-235	Am-243	1.000E+00	1.742E-15	1.219E-14	5.745E-13	5.074E-11	3.559E-09
U-235	Cm-243	2.400E-03	9.772E-23	1.458E-21	4.267E-19	2.308E-16	3.080E-14
U-235	Cm-243	9.976E-01	1.728E-15	1.201E-14	5.288E-13	2.664E-11	3.499E-10
U-235	Pu-239	1.000E+00	1.815E-10	5.445E-10	3.805E-09	3.587E-08	3.069E-07
U-235	U-235	1.000E+00	3.686E-01	3.685E-01	3.675E-01	3.575E-01	2.713E-01
U-235	∑DOSE(j)		3.686E-01	3.685E-01	3.675E-01	3.575E-01	2.713E-01
Pa-231	Am-243	1.000E+00	3.957E-21	5.933E-20	1.830E-17	1.547E-14	1.092E-11
Pa-231	Cm-243	2.400E-03	0.000E+00	5.446E-27	1.033E-23	5.791E-20	9.085E-17
Pa-231	Cm-243	9.976E-01	3.929E-21	5.862E-20	1.718E-17	9.415E-15	1.451E-12
Pa-231	Pu-239	1.000E+00	5.496E-16	3.846E-15	1.815E-13	1.629E-11	1.323E-09

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

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Pa-231	U-235	1.000E+00	1.674E-06	5.021E-06	3.505E-05	3.260E-04	2.440E-03
Pa-231	∑DOSE(j)		1.674E-06	5.021E-06	3.505E-05	3.260E-04	2.440E-03
Ac-227	Am-243	1.000E+00	1.907E-22	5.878E-21	1.091E-17	5.537E-14	7.488E-11
Ac-227	Cm-243	2.400E-03	0.000E+00	4.459E-28	5.024E-24	1.875E-19	6.210E-16
Ac-227	Cm-243	9.976E-01	1.895E-22	5.818E-21	1.037E-17	3.576E-14	1.018E-11
Ac-227	Pu-239	1.000E+00	3.307E-17	4.926E-16	1.419E-13	6.910E-11	9.307E-09
Ac-227	U-235	1.000E+00	1.341E-07	9.300E-07	3.996E-05	1.722E-03	1.775E-02
Ac-227	∑DOSE(j)		1.341E-07	9.300E-07	3.996E-05	1.722E-03	1.775E-02
Cm-243	Cm-243	2.400E-03	7.477E-04	7.297E-04	5.862E-04	6.561E-05	2.025E-14
Cm-243	Cm-243	9.976E-01	3.108E-01	3.033E-01	2.437E-01	2.727E-02	8.417E-12
Cm-243	∑DOSE(j)		3.115E-01	3.041E-01	2.443E-01	2.734E-02	8.438E-12
Cm-244	Cm-244	1.350E-06	4.114E-08	3.959E-08	2.805E-08	8.944E-10	9.707E-25
Cm-244	Cm-244	4.950E-08	1.508E-09	1.452E-09	1.029E-09	3.279E-11	3.559E-26
Cm-244	∑DOSE(j)		4.265E-08	4.104E-08	2.908E-08	9.272E-10	1.006E-24
Pu-240	Cm-244	4.950E-08	1.687E-13	4.975E-13	2.952E-12	8.658E-12	7.988E-12
Pu-240	Pu-240	4.950E-08	3.222E-09	3.222E-09	3.218E-09	3.186E-09	2.876E-09
Pu-240	∑DOSE(j)		3.222E-09	3.222E-09	3.221E-09	3.194E-09	2.884E-09
Cm-244	Cm-244	1.000E+00	3.047E-02	2.933E-02	2.078E-02	6.625E-04	7.190E-19
Pu-240	Cm-244	1.000E+00	3.407E-06	1.005E-05	5.963E-05	1.749E-04	1.614E-04
U-236	Cm-244	1.000E+00	2.587E-15	1.791E-14	7.583E-13	3.015E-11	3.255E-10
U-236	Pu-240	1.000E+00	7.390E-11	2.217E-10	1.549E-09	1.455E-08	1.200E-07
U-236	∑DOSE(j)		7.390E-11	2.217E-10	1.549E-09	1.458E-08	1.204E-07
Th-232	Cm-244	1.000E+00	3.837E-25	5.709E-24	1.626E-21	7.408E-19	1.006E-16
Th-232	Pu-240	1.000E+00	1.459E-20	1.021E-19	4.821E-18	4.358E-16	3.815E-14
Th-232	Th-232	1.000E+00	5.993E-02	5.993E-02	5.993E-02	5.993E-02	5.991E-02
Th-232	∑DOSE(j)		5.993E-02	5.993E-02	5.993E-02	5.993E-02	5.991E-02
Ra-228	Cm-244	1.000E+00	3.129E-25	9.441E-24	1.429E-20	2.093E-17	3.407E-15
Ra-228	Pu-240	1.000E+00	1.479E-20	2.163E-19	5.257E-17	1.274E-14	1.292E-12
Ra-228	Th-232	1.000E+00	1.196E-01	3.405E-01	1.481E+00	2.061E+00	2.061E+00
Ra-228	∑DOSE(j)		1.196E-01	3.405E-01	1.481E+00	2.061E+00	2.061E+00
Th-228	Cm-244	1.000E+00	2.739E-26	1.604E-24	1.021E-20	2.959E-17	5.148E-15
Th-228	Pu-240	1.000E+00	1.541E-21	4.411E-20	4.299E-17	1.824E-14	1.953E-12
Th-228	Th-232	1.000E+00	2.028E-02	1.244E-01	1.844E+00	3.132E+00	3.131E+00
Th-228	∑DOSE(j)		2.028E-02	1.244E-01	1.844E+00	3.132E+00	3.131E+00
Co-60	Co-60	1.000E+00	4.922E+00	4.316E+00	1.321E+00	9.560E-06	0.000E+00
Cs-137	Cs-137	1.000E+00	1.270E+00	1.241E+00	1.008E+00	1.259E-01	1.169E-10

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	1.713E+00	1.626E+00	1.018E+00	9.434E-03	4.394E-23
Eu-152	Eu-152	2.792E-01	6.636E-01	6.300E-01	3.944E-01	3.654E-03	1.702E-23
Eu-152	∑DOSE(j)		2.377E+00	2.256E+00	1.413E+00	1.309E-02	6.095E-23
Gd-152	Eu-152	2.792E-01	9.047E-18	2.653E-17	1.489E-16	3.515E-16	3.475E-16
Eu-154	Eu-154	1.000E+00	2.543E+00	2.351E+00	1.157E+00	9.634E-04	0.000E+00
Eu-155	Eu-155	1.000E+00	1.216E-01	1.057E-01	3.005E-02	1.035E-07	0.000E+00
Nb-94	Nb-94	1.000E+00	3.321E+00	2.959E+00	1.049E+00	3.286E-05	0.000E+00
Pu-238	Pu-238	1.840E-09	1.094E-10	1.086E-10	1.011E-10	4.963E-11	4.027E-14
Pu-238	Pu-238	1.000E+00	5.948E-02	5.901E-02	5.496E-02	2.698E-02	2.188E-05
Pu-238	∑DOSE(j)		5.948E-02	5.901E-02	5.496E-02	2.698E-02	2.188E-05
U-234	Pu-238	1.000E+00	7.749E-09	2.316E-08	1.563E-07	1.059E-06	1.500E-06
U-234	U-234	1.000E+00	5.481E-03	5.479E-03	5.464E-03	5.314E-03	4.023E-03
U-234	U-238	9.999E-01	7.768E-09	2.330E-08	1.626E-07	1.514E-06	1.143E-05
U-234	∑DOSE(j)		5.481E-03	5.479E-03	5.464E-03	5.317E-03	4.036E-03
Th-230	Pu-238	1.000E+00	2.334E-13	1.630E-12	7.521E-11	5.467E-09	1.350E-07
Th-230	U-234	1.000E+00	2.474E-07	7.422E-07	5.188E-06	4.895E-05	4.238E-04
Th-230	U-238	9.999E-01	2.338E-13	1.636E-12	7.723E-11	6.939E-09	5.715E-07
Th-230	∑DOSE(j)		2.474E-07	7.422E-07	5.188E-06	4.896E-05	4.245E-04
Ra-226	Pu-238	1.000E+00	1.719E-15	2.573E-14	7.807E-12	5.652E-09	1.532E-06
Ra-226	U-234	1.000E+00	2.429E-09	1.700E-08	8.014E-07	7.126E-05	5.324E-03
Ra-226	U-238	9.999E-01	1.721E-15	2.581E-14	7.964E-12	6.771E-09	5.037E-06
Ra-226	∑DOSE(j)		2.429E-09	1.700E-08	8.014E-07	7.128E-05	5.330E-03
Pb-210	Pu-238	1.000E+00	3.866E-20	1.190E-18	2.186E-15	9.836E-12	5.206E-09
Pb-210	U-234	1.000E+00	6.819E-14	1.016E-12	2.932E-10	1.444E-07	1.823E-05
Pb-210	U-238	9.999E-01	3.871E-20	1.193E-18	2.221E-15	1.150E-11	1.673E-08
Pb-210	∑DOSE(j)		6.819E-14	1.016E-12	2.932E-10	1.444E-07	1.825E-05
Pu-240	Pu-240	1.000E+00	6.509E-02	6.509E-02	6.502E-02	6.436E-02	5.810E-02
Pu-241	Pu-241	1.000E+00	1.217E-03	1.160E-03	7.521E-04	9.876E-06	1.504E-24
Pu-241	Pu-241	2.450E-05	6.792E-06	6.473E-06	4.197E-06	5.511E-08	8.354E-27
Pu-241	∑DOSE(j)		1.224E-03	1.167E-03	7.563E-04	9.931E-06	1.512E-24
Sr-90	Sr-90	1.000E+00	1.054E-02	1.029E-02	8.265E-03	9.267E-04	2.910E-13
Tc-99	Tc-99	1.000E+00	8.301E-05	7.398E-05	2.623E-05	8.240E-10	0.000E+00
U-238	U-238	5.400E-05	2.457E-07	2.456E-07	2.449E-07	2.383E-07	1.808E-07
U-238	U-238	9.999E-01	6.886E-02	6.884E-02	6.865E-02	6.678E-02	5.069E-02
U-238	∑DOSE(j)		6.886E-02	6.884E-02	6.865E-02	6.678E-02	5.069E-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
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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
Pa-231	Am-243	1.000E+00	0.000E+00	1.000E-17	9.965E-15	9.629E-12	6.888E-09
Pa-231	Cm-243	2.400E-03	0.000E+00	5.608E-25	5.357E-21	3.593E-17	5.732E-14
Pa-231	Cm-243	9.976E-01	0.000E+00	9.917E-18	9.385E-15	5.873E-12	9.160E-10
Pa-231	Pu-239	1.000E+00	0.000E+00	1.042E-12	1.040E-10	1.019E-08	8.351E-07

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Pa-231	U-235	1.000E+00	0.000E+00	2.115E-03	2.109E-02	2.050E-01	1.541E+00
Pa-231	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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 =   4.78 seconds

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	2.104E+00	2.035E+00	DCF2(1)
B-1	Ag-108m+D	1.369E-04	1.369E-04	DCF2(2)
B-1	Al-26	7.400E-05	7.400E-05	DCF2(3)
B-1	Am-241	3.552E-01	3.552E-01	DCF2(4)
B-1	Am-243+D	3.552E-01	3.552E-01	DCF2(5)
B-1	Cm-243	2.553E-01	2.553E-01	DCF2(6)
B-1	Cm-244	2.109E-01	2.109E-01	DCF2(8)
B-1	Co-60	1.147E-04	1.147E-04	DCF2(11)
B-1	Cs-137+D	1.443E-04	1.443E-04	DCF2(12)
B-1	Eu-152	1.554E-04	1.554E-04	DCF2(13)
B-1	Eu-154	1.961E-04	1.961E-04	DCF2(15)
B-1	Eu-155	2.553E-05	2.553E-05	DCF2(16)
B-1	Gd-152	7.030E-02	7.030E-02	DCF2(17)
B-1	Nb-94	1.813E-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	3.697E-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	3.526E-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	3.552E-02	3.552E-02	DCF2(37)
B-1	U-234	3.478E-02	3.478E-02	DCF2(38)
B-1	U-235+D	3.145E-02	3.145E-02	DCF2(39)
B-1	U-236	3.219E-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	1.295E-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	1.258E-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	1.184E-06	1.184E-06	DCF3(16)
D-1	Gd-152	1.517E-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	2.627E-03	2.627E-03	DCF3(20)
D-1	Pb-210+D	6.998E-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	1.776E-05	1.776E-05	DCF3(27)
D-1	Pu-241+D	2.057E-05	1.776E-05	DCF3(28)
D-1	Ra-226+D	1.037E-03	1.036E-03	DCF3(29)
D-1	Ra-228+D	2.555E-03	2.553E-03	DCF3(30)
D-1	Sr-90+D	1.136E-04	1.036E-04	DCF3(31)
D-1	Tc-99	2.368E-06	2.368E-06	DCF3(32)
D-1	Th-228+D	5.301E-04	2.664E-04	DCF3(33)
D-1	Th-229+D	2.269E-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	1.887E-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	1.813E-04	1.813E-04	DCF3(38)
D-1	U-235+D	1.752E-04	1.739E-04	DCF3(39)
D-1	U-236	1.739E-04	1.739E-04	DCF3(40)
D-1	U-238	1.665E-04	1.665E-04	DCF3(41)
D-1	U-238+D	1.791E-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+00	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

Contaminated Zone Dimensions	
Area:	1.00 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):	4.680E-01	4.672E-01	4.645E-01	3.903E-01	2.983E-01
M(t):	1.872E-02	1.869E-02	1.858E-02	1.561E-02	1.193E-02

Maximum TDOSE(t): 4.680E-01 mrem/yr   at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Ag-108m	0.000E+00	0.0000	1.873E-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-06	0.000
Al-26	0.000E+00	0.0000	1.015E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.134E-06	0.000
Am-241	0.000E+00	0.0000	5.153E-02	0.1101	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.102E-04	0.000
Am-243	0.000E+00	0.0000	5.157E-02	0.1102	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.117E-04	0.000
Cm-243	0.000E+00	0.0000	3.663E-02	0.0783	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.302E-04	0.000
Cm-244	0.000E+00	0.0000	3.005E-02	0.0642	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.829E-04	0.000
Co-60	0.000E+00	0.0000	1.561E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.948E-06	0.000
Cs-137	0.000E+00	0.0000	2.072E-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-05	0.000
Eu-152	0.000E+00	0.0000	2.199E-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-06	0.000
Eu-154	0.000E+00	0.0000	2.739E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.987E-06	0.000
Eu-155	0.000E+00	0.0000	3.460E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.638E-07	0.000
Nb-94	0.000E+00	0.0000	2.487E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.494E-06	0.000
Np-237	0.000E+00	0.0000	2.687E-02	0.0574	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-04	0.000
Pu-238	0.000E+00	0.0000	5.888E-02	0.1258	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.558E-04	0.000
Pu-239	0.000E+00	0.0000	6.448E-02	0.1378	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.883E-04	0.000
Pu-240	0.000E+00	0.0000	6.448E-02	0.1378	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-04	0.000
Pu-241	0.000E+00	0.0000	1.247E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.523E-06	0.000
Sr-90	0.000E+00	0.0000	8.574E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.710E-05	0.000
Tc-99	0.000E+00	0.0000	6.598E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.389E-07	0.000
Th-232	0.000E+00	0.0000	5.976E-02	0.1277	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.208E-04	0.000
U-233	0.000E+00	0.0000	5.164E-03	0.0110	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.924E-05	0.000
U-234	0.000E+00	0.0000	5.051E-03	0.0108	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.609E-05	0.000
U-235	0.000E+00	0.0000	4.568E-03	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.352E-05	0.000
U-238	0.000E+00	0.0000	4.302E-03	0.0092	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.516E-05	0.000
Total	0.000E+00	0.0000	4.648E-01	0.9932	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.161E-03	0.006

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	2.209E-05	0.000
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	1.529E-05	0.000
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	5.184E-02	0.110
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.188E-02	0.110
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	3.686E-02	0.078
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	3.024E-02	0.064
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	2.056E-05	0.000
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	4.068E-05	0.000
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	2.411E-05	0.000
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	3.037E-05	0.000
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	3.924E-06	0.000
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	2.736E-05	0.000
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	2.704E-02	0.057
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	5.923E-02	0.126
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	6.487E-02	0.138
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	6.487E-02	0.138
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	1.255E-03	0.002
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	1.328E-04	0.000
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	7.537E-06	0.000
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	6.018E-02	0.128
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.244E-03	0.011
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	5.127E-03	0.011
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	4.641E-03	0.009
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.378E-03	0.009
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	4.680E-01	1.000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Ag-108m	0.000E+00	0.0000	1.660E-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-06	0.000
Al-26	0.000E+00	0.0000	9.047E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.576E-06	0.000
Am-241	0.000E+00	0.0000	5.140E-02	0.1100	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.095E-04	0.000
Am-243	0.000E+00	0.0000	5.152E-02	0.1103	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.115E-04	0.000
Cm-243	0.000E+00	0.0000	3.575E-02	0.0765	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.246E-04	0.000
Cm-244	0.000E+00	0.0000	2.893E-02	0.0619	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.760E-04	0.000
Co-60	0.000E+00	0.0000	1.369E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.338E-06	0.000
Cs-137	0.000E+00	0.0000	2.024E-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-05	0.000
Eu-152	0.000E+00	0.0000	2.088E-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-06	0.000
Eu-154	0.000E+00	0.0000	2.531E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.761E-06	0.000
Eu-155	0.000E+00	0.0000	3.009E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.033E-07	0.000
Nb-94	0.000E+00	0.0000	2.216E-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-06	0.000
Np-237	0.000E+00	0.0000	2.687E-02	0.0575	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-04	0.000
Pu-238	0.000E+00	0.0000	5.841E-02	0.1250	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.530E-04	0.000
Pu-239	0.000E+00	0.0000	6.448E-02	0.1380	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-04	0.000
Pu-240	0.000E+00	0.0000	6.447E-02	0.1380	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.882E-04	0.000
Pu-241	0.000E+00	0.0000	1.269E-03	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.655E-06	0.000
Sr-90	0.000E+00	0.0000	8.368E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.597E-05	0.000
Tc-99	0.000E+00	0.0000	5.880E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.367E-07	0.000
Th-232	0.000E+00	0.0000	6.146E-02	0.1316	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.428E-04	0.001
U-233	0.000E+00	0.0000	5.176E-03	0.0111	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.930E-05	0.000
U-234	0.000E+00	0.0000	5.050E-03	0.0108	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.607E-05	0.000
U-235	0.000E+00	0.0000	4.568E-03	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.353E-05	0.000
U-238	0.000E+00	0.0000	4.301E-03	0.0092	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.514E-05	0.000
Total	0.000E+00	0.0000	4.639E-01	0.9930	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.263E-03	0.007

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	1.958E-05	0.000
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	1.362E-05	0.000
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	5.171E-02	0.110
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.184E-02	0.111
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	3.598E-02	0.077
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	2.911E-02	0.062
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	1.802E-05	0.000
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	3.975E-05	0.000
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	2.289E-05	0.000
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	2.807E-05	0.000
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	3.412E-06	0.000
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	2.439E-05	0.000
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	2.704E-02	0.057
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	5.877E-02	0.125
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	6.487E-02	0.138
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	6.486E-02	0.138
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	1.277E-03	0.002
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	1.297E-04	0.000
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	6.717E-06	0.000
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	6.200E-02	0.132
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.255E-03	0.011
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	5.126E-03	0.011
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	4.642E-03	0.009
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.376E-03	0.009
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	4.672E-01	1.000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Ag-108m	0.000E+00	0.0000	5.604E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.007E-06	0.000
Al-26	0.000E+00	0.0000	3.208E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.622E-06	0.000
Am-241	0.000E+00	0.0000	5.032E-02	0.1083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.030E-04	0.000
Am-243	0.000E+00	0.0000	5.114E-02	0.1101	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.092E-04	0.000
Cm-243	0.000E+00	0.0000	2.874E-02	0.0619	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-04	0.000
Cm-244	0.000E+00	0.0000	2.055E-02	0.0442	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.250E-04	0.000
Co-60	0.000E+00	0.0000	4.190E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.328E-06	0.000
Cs-137	0.000E+00	0.0000	1.644E-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-05	0.000
Eu-152	0.000E+00	0.0000	1.307E-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-06	0.000
Eu-154	0.000E+00	0.0000	1.246E-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-06	0.000
Eu-155	0.000E+00	0.0000	8.553E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.146E-07	0.000
Nb-94	0.000E+00	0.0000	7.856E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.878E-07	0.000
Np-237	0.000E+00	0.0000	2.685E-02	0.0578	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.721E-04	0.000
Pu-238	0.000E+00	0.0000	5.440E-02	0.1171	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.287E-04	0.000
Pu-239	0.000E+00	0.0000	6.446E-02	0.1388	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.881E-04	0.000
Pu-240	0.000E+00	0.0000	6.441E-02	0.1387	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.878E-04	0.000
Pu-241	0.000E+00	0.0000	1.418E-03	0.0031	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.547E-06	0.000
Sr-90	0.000E+00	0.0000	6.723E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.694E-05	0.000
Tc-99	0.000E+00	0.0000	2.085E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.967E-07	0.000
Th-232	0.000E+00	0.0000	7.906E-02	0.1702	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.257E-03	0.002
U-233	0.000E+00	0.0000	5.278E-03	0.0114	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.989E-05	0.000
U-234	0.000E+00	0.0000	5.040E-03	0.0109	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.588E-05	0.000
U-235	0.000E+00	0.0000	4.580E-03	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.359E-05	0.000
U-238	0.000E+00	0.0000	4.289E-03	0.0092	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.493E-05	0.000
Total	0.000E+00	0.0000	4.607E-01	0.9918	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.825E-03	0.008

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	6.611E-06	0.000
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	4.830E-06	0.000
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	5.062E-02	0.109
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.145E-02	0.110
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	2.892E-02	0.062
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	2.068E-02	0.044
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.518E-06	0.000
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	3.228E-05	0.000
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	1.433E-05	0.000
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	1.381E-05	0.000
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	9.700E-07	0.000
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	8.644E-06	0.000
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	2.703E-02	0.058
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	5.473E-02	0.117
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	6.485E-02	0.139
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	6.479E-02	0.139
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	1.427E-03	0.003
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	1.042E-04	0.000
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	2.382E-06	0.000
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	8.032E-02	0.172
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.358E-03	0.011
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	5.116E-03	0.011
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	4.653E-03	0.010
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.364E-03	0.009
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	4.645E-01	1.000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Ag-108m	0.000E+00	0.0000	1.078E-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-11	0.000
Al-26	0.000E+00	0.0000	1.008E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.098E-11	0.000
Am-241	0.000E+00	0.0000	4.067E-02	0.1042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E-04	0.000
Am-243	0.000E+00	0.0000	4.751E-02	0.1217	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.872E-04	0.000
Cm-243	0.000E+00	0.0000	3.284E-03	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.062E-05	0.000
Cm-244	0.000E+00	0.0000	8.266E-04	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.019E-06	0.000
Co-60	0.000E+00	0.0000	3.031E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.609E-12	0.000
Cs-137	0.000E+00	0.0000	2.055E-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-06	0.000
Eu-152	0.000E+00	0.0000	1.211E-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-08	0.000
Eu-154	0.000E+00	0.0000	1.037E-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-09	0.000
Eu-155	0.000E+00	0.0000	2.945E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.948E-13	0.000
Nb-94	0.000E+00	0.0000	2.461E-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-11	0.000
Np-237	0.000E+00	0.0000	2.671E-02	0.0684	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.712E-04	0.000
Pu-238	0.000E+00	0.0000	2.670E-02	0.0684	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.614E-04	0.000
Pu-239	0.000E+00	0.0000	6.425E-02	0.1646	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.868E-04	0.001
Pu-240	0.000E+00	0.0000	6.375E-02	0.1633	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.839E-04	0.001
Pu-241	0.000E+00	0.0000	1.420E-03	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.552E-06	0.000
Sr-90	0.000E+00	0.0000	7.538E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.142E-06	0.000
Tc-99	0.000E+00	0.0000	6.550E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.319E-12	0.000
Th-232	0.000E+00	0.0000	9.110E-02	0.2334	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.650E-03	0.004
U-233	0.000E+00	0.0000	6.280E-03	0.0161	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.563E-05	0.000
U-234	0.000E+00	0.0000	4.945E-03	0.0127	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.410E-05	0.000
U-235	0.000E+00	0.0000	5.021E-03	0.0129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.625E-05	0.000
U-238	0.000E+00	0.0000	4.174E-03	0.0107	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.291E-05	0.000
Total	0.000E+00	0.0000	3.866E-01	0.9907	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.634E-03	0.009

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	1.271E-10	0.000
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	1.518E-10	0.000
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	4.091E-02	0.104
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	4.780E-02	0.122
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	3.305E-03	0.008
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	8.316E-04	0.002
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	3.992E-11	0.000
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	4.034E-06	0.000
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	1.328E-07	0.000
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	1.151E-08	0.000
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	3.340E-12	0.000
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	2.708E-10	0.000
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	2.688E-02	0.068
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	2.686E-02	0.068
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	6.463E-02	0.165
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	6.413E-02	0.164
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	1.429E-03	0.003
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	1.168E-05	0.000
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	7.482E-11	0.000
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	9.275E-02	0.237
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.366E-03	0.016
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	5.019E-03	0.012
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	5.097E-03	0.013
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.247E-03	0.010
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	3.903E-01	1.000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Ag-108m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000
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	0.000
Am-241	0.000E+00	0.0000	4.836E-03	0.0162	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.912E-05	0.000
Am-243	0.000E+00	0.0000	2.311E-02	0.0775	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.397E-04	0.000
Cm-243	0.000E+00	0.0000	7.375E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.441E-07	0.000
Cm-244	0.000E+00	0.0000	1.599E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.626E-07	0.000
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	0.000
Cs-137	0.000E+00	0.0000	1.908E-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-15	0.000
Eu-152	0.000E+00	0.0000	3.453E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.154E-18	0.000
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	0.000
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	0.000
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	0.000
Np-237	0.000E+00	0.0000	2.535E-02	0.0850	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.626E-04	0.000
Pu-238	0.000E+00	0.0000	2.318E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.538E-07	0.000
Pu-239	0.000E+00	0.0000	6.217E-02	0.2084	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.744E-04	0.001
Pu-240	0.000E+00	0.0000	5.755E-02	0.1929	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.465E-04	0.001
Pu-241	0.000E+00	0.0000	1.694E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.020E-06	0.000
Sr-90	0.000E+00	0.0000	2.367E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.301E-15	0.000
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	0.000
Th-232	0.000E+00	0.0000	9.108E-02	0.3053	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.649E-03	0.005
U-233	0.000E+00	0.0000	1.442E-02	0.0483	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.317E-04	0.000
U-234	0.000E+00	0.0000	4.136E-03	0.0139	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.293E-05	0.000
U-235	0.000E+00	0.0000	9.023E-03	0.0302	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.877E-05	0.000
U-238	0.000E+00	0.0000	3.178E-03	0.0107	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.549E-05	0.000
Total	0.000E+00	0.0000	2.953E-01	0.9898	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.053E-03	0.010

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Ag-108m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000
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	0.000
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	4.865E-03	0.016
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.325E-02	0.077
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	7.420E-05	0.000
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	1.608E-04	0.000
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	0.000
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	3.746E-15	0.000
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	3.475E-16	0.000
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	0.000
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	0.000
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	0.000
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	2.551E-02	0.085
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	2.333E-05	0.000
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	6.255E-02	0.209
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	5.790E-02	0.194
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	1.704E-04	0.000
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	3.668E-15	0.000
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	0.000
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	9.273E-02	0.310
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	1.455E-02	0.048
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.199E-03	0.014
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	9.122E-03	0.030
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.234E-03	0.010
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	2.983E-01	1.000

*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	2.209E-07	1.958E-07	6.611E-08	1.271E-12	0.000E+00
Al-26	Al-26	1.000E+00	1.529E-07	1.362E-07	4.830E-08	1.518E-12	0.000E+00
Am-241	Am-241	1.000E+00	5.184E-04	5.171E-04	5.062E-04	4.091E-04	4.862E-05
Am-241	Np-237+D	1.000E+00	4.376E-11	1.311E-10	9.081E-10	7.810E-09	3.220E-08
Am-241	U-233	1.000E+00	1.236E-17	8.643E-17	4.054E-15	3.423E-13	1.680E-11
Am-241	Th-229+D	1.000E+00	7.723E-21	1.158E-19	3.560E-17	2.925E-14	1.655E-11
Am-241	∑DSR(j)		5.184E-04	5.171E-04	5.062E-04	4.091E-04	4.865E-05
Am-243+D	Am-243+D	1.000E+00	5.188E-04	5.183E-04	5.143E-04	4.762E-04	2.202E-04
Am-243+D	Pu-239	1.000E+00	9.340E-09	2.801E-08	1.953E-07	1.796E-06	1.230E-05
Am-243+D	U-235+D	1.000E+00	2.194E-19	1.535E-18	7.233E-17	6.388E-15	4.480E-13
Am-243+D	Pa-231	1.000E+00	1.908E-23	2.862E-22	8.824E-20	7.460E-17	5.265E-14
Am-243+D	Ac-227+D	1.000E+00	4.868E-25	1.500E-23	2.785E-20	1.413E-16	1.911E-13
Am-243+D	∑DSR(j)		5.188E-04	5.184E-04	5.145E-04	4.780E-04	2.325E-04
Cm-243	Cm-243	2.400E-03	8.847E-07	8.634E-07	6.936E-07	7.763E-08	2.396E-17
Cm-243	Am-243+D	2.400E-03	5.801E-11	1.721E-10	1.079E-09	4.140E-09	2.115E-09
Cm-243	Pu-239	2.400E-03	6.976E-16	4.848E-15	2.131E-13	1.053E-11	1.109E-10
Cm-243	U-235+D	2.400E-03	1.230E-26	1.835E-25	5.372E-23	2.906E-20	3.878E-18
Cm-243	Pa-231	2.400E-03	8.571E-31	2.645E-29	4.980E-26	2.793E-22	4.382E-19
Cm-243	Ac-227+D	2.400E-03	1.825E-32	1.140E-30	1.282E-26	4.784E-22	1.585E-18
Cm-243	∑DSR(j)		8.847E-07	8.636E-07	6.947E-07	8.178E-08	2.226E-09
Cm-243	Cm-243	9.976E-01	3.677E-04	3.589E-04	2.883E-04	3.227E-05	9.959E-15
Cm-243	Pu-239	9.976E-01	9.245E-09	2.744E-08	1.727E-07	6.979E-07	7.397E-07
Cm-243	U-235+D	9.976E-01	2.176E-19	1.512E-18	6.657E-17	3.354E-15	4.405E-14
Cm-243	Pa-231	9.976E-01	1.895E-23	2.827E-22	8.285E-20	4.541E-17	6.999E-15
Cm-243	Ac-227+D	9.976E-01	4.837E-25	1.485E-23	2.645E-20	9.125E-17	2.599E-14
Cm-243	∑DSR(j)		3.677E-04	3.589E-04	2.885E-04	3.297E-05	7.397E-07
Cm-244	Cm-244	1.350E-06	4.082E-10	3.928E-10	2.783E-10	8.874E-12	9.631E-27
Cm-244	Cm-244	4.950E-08	1.497E-11	1.440E-11	1.021E-11	3.254E-13	3.531E-28
Cm-244	Pu-240	4.950E-08	1.681E-15	4.958E-15	2.942E-14	8.628E-14	7.961E-14
Cm-244	∑DSR(j)		1.497E-11	1.441E-11	1.023E-11	4.117E-13	7.961E-14
Cm-244	Cm-244	1.000E+00	3.023E-04	2.910E-04	2.062E-04	6.573E-06	7.134E-21
Cm-244	Pu-240	1.000E+00	3.396E-08	1.002E-07	5.943E-07	1.743E-06	1.608E-06
Cm-244	U-236	1.000E+00	2.460E-17	1.703E-16	7.210E-15	2.867E-13	3.095E-12
Cm-244	Th-232	1.000E+00	3.807E-27	5.665E-26	1.613E-23	7.350E-21	9.985E-19
Cm-244	Ra-228+D	1.000E+00	1.467E-29	4.427E-28	6.700E-25	9.816E-22	1.597E-19
Cm-244	Th-228+D	1.000E+00	2.066E-30	1.210E-28	7.698E-25	2.232E-21	3.883E-19
Cm-244	∑DSR(j)		3.024E-04	2.911E-04	2.068E-04	8.316E-06	1.608E-06

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	2.056E-07	1.802E-07	5.518E-08	3.992E-13	0.000E+00
Cs-137+D	Cs-137+D	1.000E+00	4.068E-07	3.975E-07	3.228E-07	4.034E-08	3.746E-17
Eu-152	Eu-152	7.208E-01	1.738E-07	1.650E-07	1.033E-07	9.570E-10	4.457E-30
Eu-152	Eu-152	2.792E-01	6.732E-08	6.391E-08	4.001E-08	3.707E-10	1.726E-30
Eu-152	Gd-152	2.792E-01	9.047E-20	2.653E-19	1.489E-18	3.515E-18	3.475E-18
Eu-152	∑DSR(j)		6.732E-08	6.391E-08	4.001E-08	3.707E-10	3.475E-18
Eu-154	Eu-154	1.000E+00	3.037E-07	2.807E-07	1.381E-07	1.151E-10	1.847E-41
Eu-155	Eu-155	1.000E+00	3.924E-08	3.412E-08	9.700E-09	3.340E-14	0.000E+00
Nb-94	Nb-94	1.000E+00	2.736E-07	2.439E-07	8.644E-08	2.708E-12	0.000E+00
Np-237+D	Np-237+D	1.000E+00	2.704E-04	2.704E-04	2.703E-04	2.688E-04	2.547E-04
Np-237+D	U-233	1.000E+00	1.145E-10	3.435E-10	2.400E-09	2.260E-08	1.909E-07
Np-237+D	Th-229+D	1.000E+00	9.541E-14	6.678E-13	3.153E-11	2.847E-09	2.457E-07
Np-237+D	∑DSR(j)		2.704E-04	2.704E-04	2.703E-04	2.688E-04	2.551E-04
Pu-238	Pu-238	1.840E-09	1.090E-12	1.081E-12	1.007E-12	4.943E-13	4.010E-16
Pu-238	Pu-238	1.000E+00	5.923E-04	5.877E-04	5.473E-04	2.686E-04	2.179E-07
Pu-238	U-234	1.000E+00	7.248E-11	2.166E-10	1.462E-09	9.903E-09	1.403E-08
Pu-238	Th-230	1.000E+00	2.295E-15	1.603E-14	7.396E-13	5.376E-11	1.327E-09
Pu-238	Ra-226+D	1.000E+00	2.555E-20	3.825E-19	1.160E-16	8.402E-14	2.277E-11
Pu-238	Pb-210+D	1.000E+00	2.363E-22	7.276E-21	1.336E-17	6.013E-14	3.183E-11
Pu-238	∑DSR(j)		5.923E-04	5.877E-04	5.473E-04	2.686E-04	2.333E-07
Pu-239	Pu-239	1.000E+00	6.487E-04	6.487E-04	6.485E-04	6.463E-04	6.255E-04
Pu-239	U-235+D	1.000E+00	2.285E-14	6.855E-14	4.791E-13	4.516E-12	3.864E-11
Pu-239	Pa-231	1.000E+00	2.651E-18	1.855E-17	8.754E-16	7.855E-14	6.380E-12
Pu-239	Ac-227+D	1.000E+00	8.441E-20	1.257E-18	3.621E-16	1.763E-13	2.375E-11
Pu-239	∑DSR(j)		6.487E-04	6.487E-04	6.485E-04	6.463E-04	6.255E-04
Pu-240	Pu-240	4.950E-08	3.211E-11	3.211E-11	3.207E-11	3.175E-11	2.866E-11
Pu-240	Pu-240	1.000E+00	6.487E-04	6.486E-04	6.479E-04	6.413E-04	5.790E-04
Pu-240	U-236	1.000E+00	7.027E-13	2.108E-12	1.473E-11	1.383E-10	1.141E-09
Pu-240	Th-232	1.000E+00	1.447E-22	1.013E-21	4.784E-20	4.325E-18	3.786E-16
Pu-240	Ra-228+D	1.000E+00	6.935E-25	1.014E-23	2.465E-21	5.972E-19	6.059E-17
Pu-240	Th-228+D	1.000E+00	1.162E-25	3.327E-24	3.242E-21	1.376E-18	1.473E-16
Pu-240	∑DSR(j)		6.487E-04	6.486E-04	6.479E-04	6.413E-04	5.790E-04

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	1.214E-05	1.157E-05	7.501E-06	9.848E-08	1.500E-26
Pu-241	Am-241	1.000E+00	4.092E-07	1.201E-06	6.767E-06	1.419E-05	1.703E-06
Pu-241	Np-237+D	1.000E+00	2.312E-14	1.595E-13	6.534E-12	2.107E-10	1.068E-09
Pu-241	U-233	1.000E+00	4.908E-21	7.283E-20	2.022E-17	7.746E-15	5.445E-13
Pu-241	Th-229+D	1.000E+00	2.458E-24	7.553E-23	1.363E-19	5.732E-16	5.239E-13
Pu-241	∑DSR(j)		1.255E-05	1.277E-05	1.427E-05	1.429E-05	1.704E-06
Pu-241+D	Pu-241+D	2.450E-05	2.979E-10	2.839E-10	1.841E-10	2.417E-12	3.681E-31
Pu-241+D	Np-237+D	2.450E-05	1.056E-15	3.101E-15	1.768E-14	4.401E-14	4.203E-14
Pu-241+D	U-233	2.450E-05	2.993E-22	2.067E-21	8.518E-20	2.969E-18	3.092E-17
Pu-241+D	Th-229+D	2.450E-05	1.875E-25	2.784E-24	7.767E-22	3.157E-19	3.898E-17
Pu-241+D	∑DSR(j)		2.979E-10	2.839E-10	1.841E-10	2.461E-12	4.210E-14
Sr-90+D	Sr-90+D	1.000E+00	1.328E-06	1.297E-06	1.042E-06	1.168E-07	3.668E-17
Tc-99	Tc-99	1.000E+00	7.537E-08	6.717E-08	2.382E-08	7.482E-13	0.000E+00
Th-232	Th-232	1.000E+00	5.947E-04	5.947E-04	5.947E-04	5.947E-04	5.945E-04
Th-232	Ra-228+D	1.000E+00	5.609E-06	1.597E-05	6.944E-05	9.666E-05	9.663E-05
Th-232	Th-228+D	1.000E+00	1.530E-06	9.386E-06	1.391E-04	2.362E-04	2.361E-04
Th-232	∑DSR(j)		6.018E-04	6.200E-04	8.032E-04	9.275E-04	9.273E-04
U-233	U-233	1.000E+00	5.237E-05	5.235E-05	5.221E-05	5.077E-05	3.838E-05
U-233	Th-229+D	1.000E+00	6.545E-08	1.963E-07	1.372E-06	1.289E-05	1.072E-04
U-233	∑DSR(j)		5.244E-05	5.255E-05	5.358E-05	6.366E-05	1.455E-04
U-234	U-234	1.000E+00	5.127E-05	5.125E-05	5.111E-05	4.970E-05	3.763E-05
U-234	Th-230	1.000E+00	2.433E-09	7.298E-09	5.101E-08	4.814E-07	4.168E-06
U-234	Ra-226+D	1.000E+00	3.610E-14	2.526E-13	1.191E-11	1.059E-09	7.913E-08
U-234	Pb-210+D	1.000E+00	4.169E-16	6.211E-15	1.793E-12	8.826E-10	1.115E-07
U-234	∑DSR(j)		5.127E-05	5.126E-05	5.116E-05	5.019E-05	4.199E-05
U-235+D	U-235+D	1.000E+00	4.641E-05	4.639E-05	4.626E-05	4.501E-05	3.416E-05
U-235+D	Pa-231	1.000E+00	8.074E-09	2.421E-08	1.690E-07	1.572E-06	1.177E-05
U-235+D	Ac-227+D	1.000E+00	3.423E-10	2.373E-09	1.020E-07	4.395E-06	4.529E-05
U-235+D	∑DSR(j)		4.641E-05	4.642E-05	4.653E-05	5.097E-05	9.122E-05
U-238	U-238	5.400E-05	2.359E-09	2.358E-09	2.352E-09	2.288E-09	1.736E-09
U-238+D	U-238+D	9.999E-01	4.377E-05	4.376E-05	4.364E-05	4.245E-05	3.222E-05
U-238+D	U-234	9.999E-01	7.266E-11	2.179E-10	1.521E-09	1.416E-08	1.069E-07
U-238+D	Th-230	9.999E-01	2.299E-15	1.609E-14	7.594E-13	6.823E-11	5.620E-09
U-238+D	Ra-226+D	9.999E-01	2.558E-20	3.837E-19	1.184E-16	1.006E-13	7.487E-11
U-238+D	Pb-210+D	9.999E-01	2.366E-22	7.294E-21	1.358E-17	7.033E-14	1.023E-10
U-238+D	∑DSR(j)		4.377E-05	4.376E-05	4.364E-05	4.247E-05	3.233E-05

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

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

Nuclide (i)	t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Ag-108m	1.131E+08	1.277E+08	3.781E+08	1.967E+13	*2.609E+13
Al-26	1.636E+08	1.835E+08	5.176E+08	*1.921E+10	*1.921E+10
Am-241	4.823E+04	4.834E+04	4.938E+04	6.111E+04	5.139E+05
Am-243	4.819E+04	4.823E+04	4.859E+04	5.231E+04	1.075E+05
Cm-243	6.782E+04	6.949E+04	8.645E+04	7.565E+05	3.369E+07
Cm-244	8.268E+04	8.589E+04	1.209E+05	3.006E+06	1.554E+07
Co-60	1.216E+08	1.387E+08	4.531E+08	6.262E+13	*1.132E+15
Cs-137	6.146E+07	6.290E+07	7.744E+07	6.197E+08	*8.704E+13
Eu-152	1.037E+08	1.092E+08	1.744E+08	1.883E+10	*1.765E+14
Eu-154	8.231E+07	8.905E+07	1.810E+08	2.173E+11	*2.639E+14
Eu-155	6.371E+08	7.326E+08	2.577E+09	*4.652E+14	*4.652E+14
Nb-94	9.136E+07	1.025E+08	2.892E+08	*1.875E+11	*1.875E+11
Np-237	9.245E+04	9.246E+04	9.250E+04	9.300E+04	9.800E+04
Pu-238	4.221E+04	4.254E+04	4.568E+04	9.307E+04	1.071E+08
Pu-239	3.854E+04	3.854E+04	3.855E+04	3.868E+04	3.997E+04
Pu-240	3.854E+04	3.854E+04	3.858E+04	3.898E+04	4.318E+04
Pu-241	1.992E+06	1.958E+06	1.752E+06	1.750E+06	1.467E+07
Sr-90	1.882E+07	1.928E+07	2.400E+07	2.140E+08	*1.365E+14
Tc-99	3.317E+08	3.722E+08	1.050E+09	*1.697E+10	*1.697E+10
Th-232	4.154E+04	4.032E+04	3.113E+04	2.695E+04	2.696E+04
U-233	4.768E+05	4.757E+05	4.666E+05	3.927E+05	1.718E+05
U-234	4.876E+05	4.877E+05	4.887E+05	4.981E+05	5.954E+05
U-235	5.386E+05	5.386E+05	5.372E+05	4.905E+05	2.741E+05
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

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

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ag-108m	1.000E+02	0.000E+00	2.209E-07	1.131E+08	2.209E-07	1.131E+08
Al-26	1.000E+02	0.000E+00	1.529E-07	1.636E+08	1.529E-07	1.636E+08
Am-241	1.000E+02	0.000E+00	5.184E-04	4.823E+04	5.184E-04	4.823E+04
Am-243	1.000E+02	0.000E+00	5.188E-04	4.819E+04	5.188E-04	4.819E+04
Cm-243	1.000E+02	0.000E+00	3.686E-04	6.782E+04	3.686E-04	6.782E+04
Cm-244	1.000E+02	0.000E+00	3.024E-04	8.268E+04	3.024E-04	8.268E+04
Co-60	1.000E+02	0.000E+00	2.056E-07	1.216E+08	2.056E-07	1.216E+08
Cs-137	1.000E+02	0.000E+00	4.068E-07	6.146E+07	4.068E-07	6.146E+07
Eu-152	1.000E+02	0.000E+00	2.411E-07	1.037E+08	2.411E-07	1.037E+08
Eu-154	1.000E+02	0.000E+00	3.037E-07	8.231E+07	3.037E-07	8.231E+07
Eu-155	1.000E+02	0.000E+00	3.924E-08	6.371E+08	3.924E-08	6.371E+08
Nb-94	1.000E+02	0.000E+00	2.736E-07	9.136E+07	2.736E-07	9.136E+07
Np-237	1.000E+02	0.000E+00	2.704E-04	9.245E+04	2.704E-04	9.245E+04
Pu-238	1.000E+02	0.000E+00	5.923E-04	4.221E+04	5.923E-04	4.221E+04
Pu-239	1.000E+02	0.000E+00	6.487E-04	3.854E+04	6.487E-04	3.854E+04
Pu-240	1.000E+02	0.000E+00	6.487E-04	3.854E+04	6.487E-04	3.854E+04
Pu-241	1.000E+02	40.20 ± 0.08	1.570E-05	1.592E+06	1.255E-05	1.992E+06
Sr-90	1.000E+02	0.000E+00	1.328E-06	1.882E+07	1.328E-06	1.882E+07
Tc-99	1.000E+02	0.000E+00	7.537E-08	3.317E+08	7.537E-08	3.317E+08
Th-232	1.000E+02	102.8 ± 0.2	9.275E-04	2.695E+04	6.018E-04	4.154E+04
U-233	1.000E+02	1.000E+03	1.455E-04	1.718E+05	5.244E-05	4.768E+05
U-234	1.000E+02	0.000E+00	5.127E-05	4.876E+05	5.127E-05	4.876E+05
U-235	1.000E+02	1.000E+03	9.122E-05	2.741E+05	4.641E-05	5.386E+05
U-238	1.000E+02	0.000E+00	4.378E-05	*3.361E+05	4.378E-05	*3.361E+05

*At specific activity limit

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	2.209E-05	1.958E-05	6.611E-06	1.271E-10	0.000E+00
Al-26	Al-26	1.000E+00	1.529E-05	1.362E-05	4.830E-06	1.518E-10	0.000E+00
Am-241	Am-241	1.000E+00	5.184E-02	5.171E-02	5.062E-02	4.091E-02	4.862E-03
Am-241	Pu-241	1.000E+00	4.092E-05	1.201E-04	6.767E-04	1.419E-03	1.703E-04
Am-241	∑DOSE(j)		5.188E-02	5.183E-02	5.130E-02	4.233E-02	5.032E-03
Np-237	Am-241	1.000E+00	4.376E-09	1.311E-08	9.081E-08	7.810E-07	3.220E-06
Np-237	Np-237	1.000E+00	2.704E-02	2.704E-02	2.703E-02	2.688E-02	2.547E-02
Np-237	Pu-241	1.000E+00	2.312E-12	1.595E-11	6.534E-10	2.107E-08	1.068E-07
Np-237	Pu-241	2.450E-05	1.056E-13	3.101E-13	1.768E-12	4.401E-12	4.203E-12
Np-237	∑DOSE(j)		2.704E-02	2.704E-02	2.703E-02	2.688E-02	2.547E-02
U-233	Am-241	1.000E+00	1.236E-15	8.643E-15	4.054E-13	3.423E-11	1.680E-09
U-233	Np-237	1.000E+00	1.145E-08	3.435E-08	2.400E-07	2.260E-06	1.909E-05
U-233	Pu-241	1.000E+00	4.908E-19	7.283E-18	2.022E-15	7.746E-13	5.445E-11
U-233	Pu-241	2.450E-05	2.993E-20	2.067E-19	8.518E-18	2.969E-16	3.092E-15
U-233	U-233	1.000E+00	5.237E-03	5.235E-03	5.221E-03	5.077E-03	3.838E-03
U-233	∑DOSE(j)		5.237E-03	5.235E-03	5.221E-03	5.079E-03	3.857E-03
Th-229	Am-241	1.000E+00	7.723E-19	1.158E-17	3.560E-15	2.925E-12	1.655E-09
Th-229	Np-237	1.000E+00	9.541E-12	6.678E-11	3.153E-09	2.847E-07	2.457E-05
Th-229	Pu-241	1.000E+00	2.458E-22	7.553E-21	1.363E-17	5.732E-14	5.239E-11
Th-229	Pu-241	2.450E-05	1.875E-23	2.784E-22	7.767E-20	3.157E-17	3.898E-15
Th-229	U-233	1.000E+00	6.545E-06	1.963E-05	1.372E-04	1.289E-03	1.072E-02
Th-229	∑DOSE(j)		6.545E-06	1.963E-05	1.372E-04	1.290E-03	1.074E-02
Am-243	Am-243	1.000E+00	5.188E-02	5.183E-02	5.143E-02	4.762E-02	2.202E-02
Am-243	Cm-243	2.400E-03	5.801E-09	1.721E-08	1.079E-07	4.140E-07	2.115E-07
Am-243	∑DOSE(j)		5.188E-02	5.183E-02	5.143E-02	4.762E-02	2.202E-02
Pu-239	Am-243	1.000E+00	9.340E-07	2.801E-06	1.953E-05	1.796E-04	1.230E-03
Pu-239	Cm-243	2.400E-03	6.976E-14	4.848E-13	2.131E-11	1.053E-09	1.109E-08
Pu-239	Cm-243	9.976E-01	9.245E-07	2.744E-06	1.727E-05	6.979E-05	7.397E-05
Pu-239	Pu-239	1.000E+00	6.487E-02	6.487E-02	6.485E-02	6.463E-02	6.255E-02
Pu-239	∑DOSE(j)		6.487E-02	6.487E-02	6.488E-02	6.488E-02	6.385E-02
U-235	Am-243	1.000E+00	2.194E-17	1.535E-16	7.233E-15	6.388E-13	4.480E-11
U-235	Cm-243	2.400E-03	1.230E-24	1.835E-23	5.372E-21	2.906E-18	3.878E-16
U-235	Cm-243	9.976E-01	2.176E-17	1.512E-16	6.657E-15	3.354E-13	4.405E-12
U-235	Pu-239	1.000E+00	2.285E-12	6.855E-12	4.791E-11	4.516E-10	3.864E-09
U-235	U-235	1.000E+00	4.641E-03	4.639E-03	4.626E-03	4.501E-03	3.416E-03
U-235	∑DOSE(j)		4.641E-03	4.639E-03	4.626E-03	4.501E-03	3.416E-03
Pa-231	Am-243	1.000E+00	1.908E-21	2.862E-20	8.824E-18	7.460E-15	5.265E-12
Pa-231	Cm-243	2.400E-03	0.000E+00	2.607E-27	4.980E-24	2.793E-20	4.382E-17
Pa-231	Cm-243	9.976E-01	1.895E-21	2.827E-20	8.285E-18	4.541E-15	6.999E-13
Pa-231	Pu-239	1.000E+00	2.651E-16	1.855E-15	8.754E-14	7.855E-12	6.380E-10

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	8.074E-07	2.421E-06	1.690E-05	1.572E-04	1.177E-03
Pa-231	∑DOSE(j)		8.074E-07	2.421E-06	1.690E-05	1.572E-04	1.177E-03
Ac-227	Am-243	1.000E+00	4.868E-23	1.500E-21	2.785E-18	1.413E-14	1.911E-11
Ac-227	Cm-243	2.400E-03	0.000E+00	1.133E-28	1.282E-24	4.784E-20	1.585E-16
Ac-227	Cm-243	9.976E-01	4.837E-23	1.485E-21	2.645E-18	9.125E-15	2.599E-12
Ac-227	Pu-239	1.000E+00	8.441E-18	1.257E-16	3.621E-14	1.763E-11	2.375E-09
Ac-227	U-235	1.000E+00	3.423E-08	2.373E-07	1.020E-05	4.395E-04	4.529E-03
Ac-227	∑DOSE(j)		3.423E-08	2.373E-07	1.020E-05	4.395E-04	4.529E-03
Cm-243	Cm-243	2.400E-03	8.847E-05	8.634E-05	6.936E-05	7.763E-06	2.396E-15
Cm-243	Cm-243	9.976E-01	3.677E-02	3.589E-02	2.883E-02	3.227E-03	9.959E-13
Cm-243	∑DOSE(j)		3.686E-02	3.597E-02	2.890E-02	3.235E-03	9.983E-13
Cm-244	Cm-244	1.350E-06	4.082E-08	3.928E-08	2.783E-08	8.874E-10	9.631E-25
Cm-244	Cm-244	4.950E-08	1.497E-09	1.440E-09	1.021E-09	3.254E-11	3.531E-26
Cm-244	∑DOSE(j)		4.231E-08	4.072E-08	2.885E-08	9.199E-10	9.984E-25
Pu-240	Cm-244	4.950E-08	1.681E-13	4.958E-13	2.942E-12	8.628E-12	7.961E-12
Pu-240	Pu-240	4.950E-08	3.211E-09	3.211E-09	3.207E-09	3.175E-09	2.866E-09
Pu-240	∑DOSE(j)		3.211E-09	3.211E-09	3.210E-09	3.183E-09	2.874E-09
Cm-244	Cm-244	1.000E+00	3.023E-02	2.910E-02	2.062E-02	6.573E-04	7.134E-19
Pu-240	Cm-244	1.000E+00	3.396E-06	1.002E-05	5.943E-05	1.743E-04	1.608E-04
U-236	Cm-244	1.000E+00	2.460E-15	1.703E-14	7.210E-13	2.867E-11	3.095E-10
U-236	Pu-240	1.000E+00	7.027E-11	2.108E-10	1.473E-09	1.383E-08	1.141E-07
U-236	∑DOSE(j)		7.027E-11	2.108E-10	1.473E-09	1.386E-08	1.145E-07
Th-232	Cm-244	1.000E+00	3.807E-25	5.665E-24	1.613E-21	7.350E-19	9.985E-17
Th-232	Pu-240	1.000E+00	1.447E-20	1.013E-19	4.784E-18	4.325E-16	3.786E-14
Th-232	Th-232	1.000E+00	5.947E-02	5.947E-02	5.947E-02	5.947E-02	5.945E-02
Th-232	∑DOSE(j)		5.947E-02	5.947E-02	5.947E-02	5.947E-02	5.945E-02
Ra-228	Cm-244	1.000E+00	1.467E-27	4.427E-26	6.700E-23	9.816E-20	1.597E-17
Ra-228	Pu-240	1.000E+00	6.935E-23	1.014E-21	2.465E-19	5.972E-17	6.059E-15
Ra-228	Th-232	1.000E+00	5.609E-04	1.597E-03	6.944E-03	9.666E-03	9.663E-03
Ra-228	∑DOSE(j)		5.609E-04	1.597E-03	6.944E-03	9.666E-03	9.663E-03
Th-228	Cm-244	1.000E+00	2.047E-28	1.210E-26	7.698E-23	2.232E-19	3.883E-17
Th-228	Pu-240	1.000E+00	1.162E-23	3.327E-22	3.242E-19	1.376E-16	1.473E-14
Th-228	Th-232	1.000E+00	1.530E-04	9.386E-04	1.391E-02	2.362E-02	2.361E-02
Th-228	∑DOSE(j)		1.530E-04	9.386E-04	1.391E-02	2.362E-02	2.361E-02
Co-60	Co-60	1.000E+00	2.056E-05	1.802E-05	5.518E-06	3.992E-11	0.000E+00
Cs-137	Cs-137	1.000E+00	4.068E-05	3.975E-05	3.228E-05	4.034E-06	3.746E-15

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	1.738E-05	1.650E-05	1.033E-05	9.570E-08	4.065E-28
Eu-152	Eu-152	2.792E-01	6.732E-06	6.391E-06	4.001E-06	3.707E-08	1.575E-28
Eu-152	∑DOSE(j)		2.411E-05	2.289E-05	1.433E-05	1.328E-07	5.640E-28
Gd-152	Eu-152	2.792E-01	9.047E-18	2.653E-17	1.489E-16	3.515E-16	3.475E-16
Eu-154	Eu-154	1.000E+00	3.037E-05	2.807E-05	1.381E-05	1.151E-08	0.000E+00
Eu-155	Eu-155	1.000E+00	3.924E-06	3.412E-06	9.700E-07	3.340E-12	0.000E+00
Nb-94	Nb-94	1.000E+00	2.736E-05	2.439E-05	8.644E-06	2.708E-10	0.000E+00
Pu-238	Pu-238	1.840E-09	1.090E-10	1.081E-10	1.007E-10	4.943E-11	4.010E-14
Pu-238	Pu-238	1.000E+00	5.923E-02	5.877E-02	5.473E-02	2.686E-02	2.179E-05
Pu-238	∑DOSE(j)		5.923E-02	5.877E-02	5.473E-02	2.686E-02	2.179E-05
U-234	Pu-238	1.000E+00	7.248E-09	2.166E-08	1.462E-07	9.903E-07	1.403E-06
U-234	U-234	1.000E+00	5.127E-03	5.125E-03	5.111E-03	4.970E-03	3.763E-03
U-234	U-238	9.999E-01	7.266E-09	2.179E-08	1.521E-07	1.416E-06	1.069E-05
U-234	∑DOSE(j)		5.127E-03	5.125E-03	5.111E-03	4.973E-03	3.775E-03
Th-230	Pu-238	1.000E+00	2.295E-13	1.603E-12	7.396E-11	5.376E-09	1.327E-07
Th-230	U-234	1.000E+00	2.433E-07	7.298E-07	5.101E-06	4.814E-05	4.168E-04
Th-230	U-238	9.999E-01	2.299E-13	1.609E-12	7.594E-11	6.823E-09	5.620E-07
Th-230	∑DOSE(j)		2.433E-07	7.298E-07	5.102E-06	4.815E-05	4.175E-04
Ra-226	Pu-238	1.000E+00	2.555E-18	3.825E-17	1.160E-14	8.402E-12	2.277E-09
Ra-226	U-234	1.000E+00	3.610E-12	2.526E-11	1.191E-09	1.059E-07	7.913E-06
Ra-226	U-238	9.999E-01	2.558E-18	3.837E-17	1.184E-14	1.006E-11	7.487E-09
Ra-226	∑DOSE(j)		3.610E-12	2.526E-11	1.191E-09	1.059E-07	7.923E-06
Pb-210	Pu-238	1.000E+00	2.363E-20	7.276E-19	1.336E-15	6.013E-12	3.183E-09
Pb-210	U-234	1.000E+00	4.169E-14	6.211E-13	1.793E-10	8.826E-08	1.115E-05
Pb-210	U-238	9.999E-01	2.366E-20	7.294E-19	1.358E-15	7.033E-12	1.023E-08
Pb-210	∑DOSE(j)		4.169E-14	6.211E-13	1.793E-10	8.827E-08	1.116E-05
Pu-240	Pu-240	1.000E+00	6.487E-02	6.486E-02	6.479E-02	6.413E-02	5.790E-02
Pu-241	Pu-241	1.000E+00	1.214E-03	1.157E-03	7.501E-04	9.848E-06	1.500E-24
Pu-241	Pu-241	2.450E-05	2.979E-08	2.839E-08	1.841E-08	2.417E-10	0.000E+00
Pu-241	∑DOSE(j)		1.214E-03	1.157E-03	7.501E-04	9.849E-06	1.500E-24
Sr-90	Sr-90	1.000E+00	1.328E-04	1.297E-04	1.042E-04	1.168E-05	3.668E-15
Tc-99	Tc-99	1.000E+00	7.537E-06	6.717E-06	2.382E-06	7.482E-11	0.000E+00
U-238	U-238	5.400E-05	2.359E-07	2.358E-07	2.352E-07	2.288E-07	1.736E-07
U-238	U-238	9.999E-01	4.377E-03	4.376E-03	4.364E-03	4.245E-03	3.222E-03
U-238	∑DOSE(j)		4.378E-03	4.376E-03	4.364E-03	4.245E-03	3.222E-03

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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(j):		1.000E+02	9.997E+01	9.969E+01	9.698E+01	7.361E+01
Pa-231	Am-243	1.000E+00	0.000E+00	1.000E-17	9.965E-15	9.629E-12	6.888E-09
Pa-231	Cm-243	2.400E-03	0.000E+00	5.608E-25	5.357E-21	3.593E-17	5.732E-14
Pa-231	Cm-243	9.976E-01	0.000E+00	9.917E-18	9.385E-15	5.873E-12	9.160E-10
Pa-231	Pu-239	1.000E+00	0.000E+00	1.042E-12	1.040E-10	1.019E-08	8.351E-07

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+01	1.000E+02	1.000E+03
Pa-231	U-235	1.000E+00	0.000E+00	2.115E-03	2.109E-02	2.050E-01	1.541E+00
Pa-231	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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	∑S(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 = 3.77 seconds

Appendix E

Nevada Division of Environmental Protection Comments

(13 Pages)

NEVADA ENVIRONMENTAL MANAGEMENT OPERATIONS ACTIVITY
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3. Revision Number: 1	4. Originator/Organization: Nevada Division of Environmental Protection
5. Responsible DOE NNSA/NFO Activity Lead: T. Lantow	6. Date Comments Due:
7. Review Criteria:	
8. Reviewer/Organization Phone No.: NDEP	9. Reviewer's Signature:

10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response
1.	2.2, Page 12, NA		Suggest including further environmental restoration details at CSIII in operational history and if they are significant enough, consider adding these activities to the CSM (see comment #8). Clarify in this section, then extend the clarification to all figures showing the "inner", "outermost", "area around GZ" fences, see also comment 3 (i.e., suggest label fences).	All of the pertinent operational history of CSIII from the available documentation is already contained in this section. The fences are shown on several figures within the document and are simply shown as a point of reference to the reader. The fences are not pertinent to the CAI. However, to clarify for the reader, the following changes/edits have been made: 1. The last sentence of the third paragraph in Section 2.2 was revised: "This square-shaped fence surrounded contamination with a mass concentration of 1,000 micrograms per square meter total transuranics (Hendricks, 1972) and was posted with "Alpha Contamination" signs (see Figure A.8-1)." 2. The 2nd to the last sentence in fifth paragraph of Section 2.2 was revised: "Between 1969 and 1973, an additional irregular-shaped inner fence was established; however, the radiological criteria for this fence are unknown." Figure A.8-1 was revised with the addition of labels for the 2 inner fences.
2.	2.4, Page 14, Paragraph 1		Beginning with the sentence, "To facilitate site investigation and evaluation….," there is no discussion on how the study group areas were chosen. Suggest including a short description on how the study groups were chosen.	The rationale for the study group approach is provided when the concept is first introduced (Section 1.1.2, last paragraph). The first sentence of the last paragraph of Section 2.4 was replaced with the following: "The releases at CAU 414 were divided into five study groups based on similar CSM elements (e.g., surface deposition of relatively immobile contaminants, migration and mixing of contaminants from previous activities, migration by surface water runoff in drainages). The areas of the study groups cannot be delineated in figures, as they are conceptual (CSM) elements and not physical entities. An area that exceeds a FAL (DQO Decision II) will be resolved for each study group that exceeds a FAL. The information needed to define those areas will be collected in the CAI and presented in the CADD. The study groups are shown in Table 1-1."

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10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response
3.	2.4.1, Page 14, NA		Suggest including or modify a figure to show the CAU with the study group areas annotated (see comment #4); please include the clarified fencing nomenclature in relation to the SGs on this added/modified figure as discussed in comment 1 (i.e., the requested figure should show the SGs extent and all fences within this CAU).	The following text was inserted into the last paragraph of Section 2.4: "The areas of the study groups cannot be delineated in figures, as they are conceptual (CSM) elements and not physical entities. An area that exceeds a FAL (DQO Decision II) will be resolved for each study group that exceeds a FAL. The information needed to define those areas will be collected in the CAI and presented in the CADD." See comment response # 2.
4.	2.4.1, Page 14, Paragraph 1		Does the entire area inside the CA fence but excluded by the boundaries shown in Fig. 2-2 comprise SG1? There is no figure reference to SG1 (see comment 1).	The CA fence has no relevance to areas that meet the description of SG1. Refer to comment response #3 in regards to extent for SG1. Revised Figure 2-2 for clarity as follows: 1. Retitled as "Potential Disturbed Areas and Potential Buried Debris" 2. Revised legend; insert "(SG2)" for Potential Disturbed Area, and Disturbed Area; Revised legend; renamed "Buried Debris (estimated)" as "Potential Buried Debris (estimated) (SG4)"
5.	2.4.2, Page 15, Paragraph 2		Sentence beginning with, "These three areas will be inspected…." what are the criteria used to determine inclusion/exclusion for these three areas? Will there be any additional terrestrial rad surveys in additional to visual inspections on these 3 areas? Clarify.	Refer to Section 4.2.4.2. The criteria for inclusion in SG2 are defined in this section and consist of (1) obvious differences in vegetation density or (2) indications of top soil removal (e.g., uneven surfaces, depressed areas). Additionally, "A FIDLER survey will be conducted within the visual extent of the disturbed area, and sample locations will be biased to the location with the highest FIDLER results." To clarify, a reference to Section 4.2.4.2 was added following the sentence: "These three areas will be inspected during the CAI to determine whether they should be investigated as part of SG2 (see Section 4.2.4.2).
6.	2.4.2, Page 15, Paragraph 2		1st sentence: substitute the word "around" with (for example) "…potentially disturbed areas, two approximately 900 feet north of GZ, and one approximately 500 feet northeast of GZ."	Replaced the 1st sentence of Section 2.4.2, paragraph 2 with the following: "This study group also includes three other potentially disturbed areas: two approximately 900 ft north of GZ, and one approximately 500 ft northeast of GZ."

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7.	2.4.2, Page 15, Paragraph 2		4th sentence: Was the soil removal done in 1993? Is there an offsite/onsite disposal record? Removal of 10 tons of soil in the early 1990s in such an arid area would likely leave persistent imagery evidence which is not apparent in figures.	No offsite or onsite disposal records for this soil were identified. There is no direct evidence that soil was removed from these three areas in 1993. As stated in this paragraph, there is no visual indicator of disturbance in the aerial photographs, nor do radiological surveys suggest contaminant redistribution in these areas. To clarify, the following text was inserted: "Formal disposition of the materials is inconclusive, as there is no disposal documentation in the historical record", following: "Current aerial photographs…..at these locations. "
8.	Figure 2-2, Page 16		Action: add text to annotate highlighted figure (e.g., define SG2 and SG4).	See comment response #4.
9.	2.4.2, Page 17, Paragraph 1		Describe extent of SG3 (how far west of the CA boundary?); add description of SG3 flow direction/slope and assess suspected connection with Antelope playa in light of contaminant transport and planned field investigation; Fig. 2-5: Re-title to indicate it illustrates SG3, and add such explanation to legend.	To clarify, the following changes were made to the document: 1. Revised the 1st paragraph of Section 2.4.3 as follows: "Two major drainage channels were identified at CAU 414 that transect the southern portion of the CA fenced area. The drainages are shown as a secondary feature of Figure 2-5 and do not necessarily represent the extent of SG3 releases. The drainage channels are visible on historical and present-day aerial photographs and were confirmed on the ground during previous site visits. If any drainage sample results in an exceedance of the FAL, the extent of the contamination that exceeds the FAL (DQO Decision II) will be defined and presented in the CADD. 2. The flow direction of surface water at CAU 414 is west–southwest, as stated in Section 2.1.3, Hydrogeology. For clarity, the following was added to the end of the first paragraph in Section 2.4.3: "Surface water flows to the west–southwest across the gently sloping landscape within Cactus Flat." 3. Revised the last sentence of Section 2.1.3 as follows: "Two unnamed drainage channels, which ultimately flow into Antelope Lake, were identified in the southern portion of the CSIII site (see Section 2.4.3).

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10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response
10	2.4.5, Page 18, Paragraph 2		The section does not state the location and extent of assumed SG5 PSM (i.e., inside and/or outside CA fence, down range, etc.) and it does not provide an associated fig. reference illustrating SG5 PSM.	The following sentence was added to the beginning of Section 2.4.5: "This study group consists of PSM that may be identified during the CAI. The extent of PSM (DQO Decision II) will be defined in the CAI and presented in the CADD..."
11	Table 2-2, Page 30		The 'Qualifier' column needs clarification and discussion with respect to the data set.	Revised the Column entitled "Qualifier" to "Notes".
12	2.5.9.1, Page 39, Paragraph 1		Beginning with the sentence, "The combination of these…" the qualitative nature of this combined data set needs to be addressed (e.g., "The interpolative surface is a qualitative data set that represents the general distribution of observed radiation levels").	This is a conservative technique used to preserve values that may be associated with a separate and distinct population of particles that may have a different distribution than that of the underlying soil contamination. To clarify, the last sentence of paragraph 2 in Section 2.5.9.1 was corrected as follows; deleted the typographical error "Small areas or points of", and added the following sentence to the end of this paragraph: "This interpolated surface is qualitative data until it is correlated to quantitative data, at which time it can be used as semi-quantitative data."
13	2.5.9.1, Page 39, Paragraph 2		Per the Soils Activity QAP Rev. 1, Section 2.6 Decision-Supporting Data Collection. "When decision supporting data are used, limitations and explanations of data quality must be presented in the applicable FFACO reports." Beginning with the sentence, "The PI radiological survey data meet…," please include the required data limitations and explanations of data quality with respect to FIDLER data as has been done with recently modified sections for related CAUs.	The Soils QAP differentiates between FFACO planning documents and FFACO report documents. As required in the Soils QAP, the limitations and explanations of data quality will be provided in the applicable FFACO report document. The CAIP is an FFACO planning document. This is consistent with recent planning documents for related CAUs (e.g., CAU 413 CAIP). No changes were made to the document.

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14	2.5.9.3, Page 41		Indicate the character of the visual survey data (e.g., decisional, decision-supporting, or informational).	This is provided in the Investigative Background section for completeness purposes. It is not intended to be used to resolve any DQO decision. To clarify, the following sentence was added after the 1st sentence of Section 2.5.9.3: "The information collected during the PI visual survey is considered informational data, and will not be used to support or make DQO decisions."
15	2.5.10, Page 43, Paragraph 2		Refer to CAU 413 CAIP, Sec. 2.4.6, p.22: add similar discussion about receptor.	As in the CAU 413 CAIP, this information is provided in Section 2.4.5, within the release Information section. No changes were made to the document.
16	2.5.11, Page 43, Paragraph 1		Beginning with the sentence, "This year-long study estimated…," the cited estimated dose is not based on the same breathing rate as used in the GT scenario; provide a short discussion on the difference between the dose cited and the receptor for which it was calculated and discussion on how this supports the GT scenario.	The sentence was replaced with the following: "This year-long study estimated a dose of 0.024 millirem per year (mrem/yr) to a member of the public working at the TTR Airport from the diffuse sources of Pu and Am attributed to the CS sites (Culp et al., 1998). The average air concentration, in microcuries per milliliter (μCi/mL), were 4.1 x 10^{-18} for Am-241, 1.6 x 10^{-18} for Pu-238, and 9.5 x 10^{-19} for Pu-239/240."
17	2.5.11, Page 43, Paragraph 2		The sentence beginning with, "Air monitoring at a single location northwest…," describe this air sampler distance from the CSIII site so the discussion is similar to the other discussions with respect to air monitoring.	The referenced sentence was replaced with the following: "Air monitoring at a single location approximately 2,400 meters (m) northwest of the CSIII GZ was conducted by the NNSS management and operating contractor from 1996 through 2000 (Black and Townsend, 1997, 1998, and 1999; Townsend and Grossman, 2000 and 2001)."
18	2.5.11, Page 43, Paragraph 2		The sentence beginning with, "The highest Pu-238 and Pu-239 values…," references Pu-238 and Pu-239 as concentration. The previous paragraph discussed air monitoring data as dose making historical comparison difficult. Provide an estimated dose equivalent for the concentration data with explanatory text.	See response to comment #16.

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19	2.5.11, Page 45, Paragraph 1		This paragraph presents the data in mrem as the CEDE in the sentence beginning with, "The maximum estimated committed…" The previous discussions provided historical data in units of mrem/yr and uCi/ml, which confuses the issue. This historical data is presented with no discussion or analysis as to how it supports CAIP actions. Clarify what CEDE is, since this introduces the term and clarify how these data compare to other historical air monitoring data sets.	A detailed study showing trends in historical air concentrations cannot be done, as different measurements in different locations are not comparable, are very episodic, and are very close to zero. Any comparison would not be valid and would not contribute to the resolution of any DQO decision. For clarity, "CEDE" was revised to "internal dose". The last sentence of Section 2.5.11 was replaced with the following: "These air monitoring data demonstrate concentrations of contaminants in the airborne pathway that would not result in significant dose levels. The data are considered informational data and were used to support the CSM premise that wind transport is not a significant migration pathway."
20	2.5.11, Page 45, Paragraph 2		Identify the DRI station number (401?) for readers interested in further detail contained in Mizell, 2014.	The identification of the station numbers is irrelevant to this section in the document. Interested readers are referred to DRI's published report (e.g., Mizell et al., 2014). No change was made to the document.
21	2.5.11, Page 45, Figure 2-13		Since focus of the PSM Debris discussion is "plated" concrete, it seems appropriate to replace this image with one showing dark, fused material on concrete similar to that in CAU 413 CAIP, Fig. 2-4, p. 23.	A review of photos indicated that this is the best available photograph. To clarify, the 3rd sentence in the last paragraph of Section 2.5.10 was replaced with the following: "Similar to that observed at CAU 413 (CSII site), a faded black substance fused to the surface of the concrete is visible in the photograph. Also visible are the indentations from a section of steel reinforcing bar."

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22	2.5.11, Page 46, Paragraph 2		Beginning with the sentence, "A resuspension study was conducted at the CSIII…," does the source document provide additional information about air concentration of radionuclide(s)? Suggest review source document and include radionuclide information if available. If not available, please include a clarifying discussion, since other historical air monitoring data references specific radionuclides.	See response to comment #19.
23	3.1.1, Page 48, Paragraph 1		3rd sentence: File header shown on 1st page RESRAD output in Appendix D as, "CS I_ Ground Troops TED". Were there any significant differences between model inputs used for CS I and CS III? Or were the CSI inputs simply rerun for CSIII and the file name not changed? Clarify.	The RESRAD input parameters for the Ground Troops exposure scenario are the same for CSI and CSIII. The file name was changed in Appendix D to reflect CSIII.
24	3.3.2, Page 55, Paragraph 2		Editorial: typographical error at the beginning of the sentence, "Tin order to address…"	The text has been corrected.
25	4.2.3, Page 60, Paragraph 1		2nd sentence: A brief interpretation of the meaning of the geophysical survey results shown in Fig. 4-1 is required.	Section 2.5.6.4 provides an interpretation of the 1996 geophysical data. To clarify further, the last sentence of Section 2.5.6.4 was replaced with the following: "Historical records provide results of the survey; however, the geospatial data are not available. Therefore, these survey data are considered informational data, and are not of sufficient quality to support or make DQO decisions." Removed the 1996 geophysical survey results and the associated legend from Figure 4-1, as they are not relevant to the purpose of the figure.

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26	4.2.3, Page 61, Figure 4-1		a) Legend: Does the black boundary show planned limit of proposed EM-31/EM-61 survey? Does the shaded inset show 1996 survey results? Unclear. b) Scale bar in upper right difficult to read/interpret; the color-coded details of the 1996 survey are impossible to see. c) Is the detail shown in Fig.2-8 the same as shown here? d) If this figure also shows 1996 survey data, then it should probably be re-titled to reflect this.	a) Yes, to clarify, the last sentence of Section 4.2.3 was replaced with, "The approximate area of the survey is shown in Figure 4-1." The black boundary shows the approximate geophysical survey boundary, as described in the legend. b) The scale bar and the detail from the 1996 geophysical survey were removed (see comment response #25). c/d) The 1996 geophysical survey was removed from Figure 4-1, as it is provided in Figure 2-8.
27	4.2.4.5, Page 64, Paragraph 1		Clarify if all bunker concrete/steel debris items located are assumed to exceed FAL and will be/have been removed.	To clarify, the following was inserted at the end of the 1st paragraph in Section 4.2.4.5: "The bunker debris (Section 2.5.10) is not assumed to exceed the FAL but will be assessed for its potential to exceed the FAL using the hot spot criterion described in Appendix C."
28	4.3, Page 68, Paragraph 1		2nd bullet: Clarify this action does not include the existing CA fence and signage.	This action does not include the removal of any existing signs or fencing, only signs or fencing that are placed to implement the CAI. No changes were made to the document.
29	A.8.2.2, Page A-36, Paragraph 1		"visibly disturbed area" is probably not a sufficiently precise qualifier if removal actions were to be undertaken; consider revising (for example) "and potential disturbed areas as shown in Fig. A.8-3.	The following sentence was added to the end of Section A.8.2.2: "The extent of any visibly disturbed area that exceeds a FAL will be defined in the CADD."
30	C.1.1, Page C-1, Figure C.1-1		Informative figure, but difficult to differentiate color legend blocks due to their very small size. Revise if possible.	Figure was revised for clarity.

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10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response
31	C.1.2, Page C-2		Editorial: Be consistent on how "hot-spot" is presented in the following text. Some instances it is separated by a hyphen and other instances it is not.	The document has been edited for consistency ("hot spot").
32	C.1.2, Page C-3, Paragraph 1		Last sentence: since this is the first introduction of this please provide a discussion explaining why hot spots exceeding 30 times the area-based FAL will require corrective action by including a discussion on 30 times the area based FAL and how it is protective.	The RESRAD User's Manual does not specify how this number was derived. It appears that it was intended to be a limit. As this is more conservative (lower) than the calculated hot spot criteria for debris, the limit value will be used as the hot spot criteria for debris. No changes were made to the document.

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33	C.1.2, Page C-4, Paragraph 2		Beginning with the sentence, "Based on this correlation, the FIDLER MOB…." Figure C.1-3 is based on 9 data points, and extrapolation beyond the range of the regression model is risky since the data fit is unknown; please include a discussion as to why extrapolation of data beyond the regression range is acceptable.	Extrapolation of the data is questionable, so the approach was changed to that used by MARSSIM. The following text was inserted as a replacement to the referenced paragraph up to and including the referenced sentence: "The hot spot criterion for soil was generated in accordance with *Dose Modeling and Statistical Assessment of Hot Spots for Decommissioning Applications* (Abelquist, 2008), which stipulates the use of an area factor (AF). The AF is the magnitude by which the concentration within the small area of elevated activity (hot spot) can exceed the area-based action level while maintaining compliance with the FAL. The AF is computed by taking the ratio of the doses generated by RESRAD for the default area of contamination (10,000 m^2) to that generated by RESRAD for the hot spot area (1 m^2). If the area-based action level is multiplied by this AF, the contamination in the hot spot area delivers the same calculated dose. Therefore, as shown in Table C.1-2, the AF was calculated as the average of the ratios of area-based TED to hot spot TED from nine CSII locations using the GT exposure scenario. As the area-based MOB criterion is 5.8 and the hot spot AF is 8.38, the resulting hot spot MOB criterion is 48.6." Figure C.1-3 was replaced with the following table:

GT Hot Spot FIDLER MOB Criterion

Sample	Hot Spot TED	Area-Based TED	Ratio
413C08	0.39	3.29	8.54
413C11x	6.33	51.49	8.14
413C09	0.08	0.76	9.02
413C10	0.18	1.57	8.58
413C16	0.38	3.19	8.38
413C15	0.85	7.08	8.32
413C13	1.46	11.92	8.17
413C14	2.87	23.44	8.15
413C12	6.83	55.61	8.14
Hot Spot Area Factor			8.38
Area-Based MOB Criterion			5.8
Hot Spot-Based MOB Criterion			48.6

34	Figure C.1-2, Page C-5		Label x and Y axes.	The X and Y axes labeled for clarity.
35	Figure C.1-3, Page C-5		Label x and Y axes.	Figure C.1-3 was deleted (see response to comment #33).
36	C.1.2, Page C-6, Paragraph 1		Beginning with the sentence, "An additional consideration…" the benefit that would be gained by having a separate hot-spot criteria for debris is not obvious. This also seems to infer that debris below the hot-spot criterion could be left in place.	This information is included for technical completeness to aid potential future users of the information. As debris is not inhalable or ingestible, only the removable portion of the contamination provides an internal dose. Hence, debris exceeding the hot spot criterion for soil could potentially be left in place. No changes were made to the document.

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NEVADA ENVIRONMENTAL MANAGEMENT OPERATIONS ACTIVITY
DOCUMENT REVIEW SHEET

1. Document Title/Number: Corrective Action Investigation Plan for Corrective Action Unit 414: Clean Slate III Plutonium Dispersion (TTR) Tonopah Test Range, Nevada Draft	2. Document Date: July 2016
3. Revision Number: 1	4. Originator/Organization: Nevada Division of Environmental Protection
5. Responsible DOE NNSA/NFO Activity Lead: T. Lantow	6. Date Comments Due:
7. Review Criteria:	
8. Reviewer/Organization Phone No.: NDEP	9. Reviewer's Signature:

10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response
37	Table C.1-3, Page C-6		What is the character of this data set (e.g., decisional, decision-supporting, informational) considering the large uncertainties associated with it? The determination of total activity and removable activity is affected by several factors such as: consistent surface to detector distance, temporal conditions, debris surface geometry and surface structure, swipe media, swipe area, pressure applied homogeneity or inhomogeneity of the surface activity distribution. Given this, please provide data character and discuss sources of uncertainty associated with data.	The numerical values do have the measurement issues listed in your comment. However, the data were collected using a standard process used industry-wide sufficient to make regulatory decisions and directly compare to limits published in the RadCon Manual. However, as these data are not used here to directly compare to any action level, they are not considered to be decision quality data. They do support the conceptual element that only a portion of the radioactivity on the debris is removable and available for internal exposure. The relative difference between the readings of the individual debris items and the swipe media provides a useful measure of what portion of the contamination could be transferred to a receptor and subsequently ingested or inhaled. While there is variability that cannot be quantified, it is controlled by using the same method with the same instrument and the same operator. Uncertainty is also taken into account by conservatively using the 95% UCL of the removability percentage. No changes were made to the document.

In addition, the following changes were made to the document:

The following changes were made in response to a USAF AFSEC request that text be added in an expansion of the discussion about the solid, liquid, and gaseous phases; and to clarify that particulate matter that is dispersed to great distances by prevailing winds were dominated by plutonium that was originally in the gaseous phase.

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3.1.3, 2nd paragraph		The 2nd paragraph was replaced with the following text: "Based on post-test observations of contaminant distribution, it is thought that the radionuclide test material (Pu and DU) was present in the following three physical phases (due to varying temperatures to which it was subjected during the chemical detonation): (1) Solid phase that did not melt but was dispersed by the blast. Most of the mass of this phase was deposited near GZ with concentrations diminishing rapidly with distance. (2) Liquid phase that was subjected to sufficient temperatures to melt but not vaporize the test material. Most of this liquid phase rapidly solidified as it came into contact with the surrounding, and somewhat cooler, bunker materials. This resulted in a surface coating on concrete and metal debris, which were subsequently thrown from the blast. Much of this debris had sufficient mass to be ejected to a considerable distance from GZ in the direction of the blast. (3) Gaseous phase that was subjected to sufficient temperatures to vaporize the test material. Most of this phase condensed in the resulting aerial plume onto dust particles as it cooled, forming a vitreous coating. These particles subsequently precipitated out of the plume in the direction of the predominant wind direction at the time. These three phases are discussed in detail in Section A.2.2.2."	
A.2.2.2, page A-8, 2nd and 3rd paragraphs		The 2nd and 3rd paragraphs were replaced with the following text: "Based on post-test observations of contaminant distribution, it is thought that the radionuclide test material (Pu and DU) was present in the following three physical phases (due to varying temperatures to which it was subjected during the chemical detonation): (1) *Solid phase that did not melt but was dispersed by the blast.* Most of the mass of this phase was deposited near GZ with concentrations diminishing rapidly with distance. (2) *Liquid phase that was subjected to sufficient temperatures to melt but not vaporize the test material.* Most of this liquid phase rapidly solidified as it came into contact with the surrounding, and somewhat cooler, bunker materials. This resulted in a surface coating on concrete and metal debris, which were subsequently thrown from the blast. Much of this debris had sufficient mass to be ejected to a considerable distance from GZ in the direction of the blast. (3) *Gaseous phase that was subjected to sufficient temperatures to vaporize the test material.* Most of this phase condensed in the resulting aerial plume onto dust particles as it cooled, forming a vitreous coating. These particles subsequently precipitated out of the plume in the direction of the predominant wind direction at the time. The solid phase of the nuclear test material was deposited primarily in the direction of the chemical explosive blast. Much of this phase was removed directly following the test and in subsequent removal activities (Section 2.2). As previous investigations have not detected remaining pieces of nuclear test material at the site, contamination in this fraction is not considered to be a significant contributor to dose."	

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A.2.2.2, page A-9, 1st paragraph		The 1st paragraph was replaced with the following text: "The gaseous phase of the nuclear test material was vaporized during the chemical explosion and condensed onto aerosolized soil particles in the aerial plume. Although the aerial plume was initially ejected by the chemical explosive blast to the northeast, its precipitation of the entrained particles was mainly toward the southeast associated with the wind direction at the time of the test (Figure 2-5). The resulting soil contamination plume generally decreases in activity with increased distance from GZ, except in areas near GZ that were disturbed by post-test activities. A non-contiguous pattern may be seen in both the ground-based KIWI survey (Figure 2-5) and the 2006 aerial survey (Figure 2-9). As discussed in Sections 2.4.2 and 2.4.4, soil and debris in the area around GZ was scraped and buried after the test. In addition, the burial area was excavated in late 1963 to collect contaminated metal debris for further study (Section 2.2). Thus, it is highly probable that the contamination distribution observed in the radiation surveys around GZ is attributable to the redistribution of contaminated soil during post-test activities."	
A.8.2.1, page A-36, last paragraph		The following text was inserted before the last paragraph, as this information was missing from the Draft document: "At sample locations where no TLD results are available (such as subsurface locations), a TLD equivalent external dose was calculated by multiplying the RESRAD-derived external dose by a correction factor. This correction factor was developed to account for an observed difference between RESRAD-derived external dose and TLD readings as described in the Soils RBCA document (NNSA/NFO, 2014). The correction factor was derived by evaluating previous data from Soils Activity sites where both TLD and RESRAD-derived external dose data were available. Evaluation of these data showed good correlation between the paired data with a weighted average correction factor of 1.58 for average TLD values and 1.69 for 95 percent UCL TLD values. The correlation of TLD dose to RESRAD external dose is presented in Figure A.8-4. This evaluation also demonstrated that this correction factor was not influenced by the type of release (e.g., weapons test or safety experiment) or the amount of activity present (NNSA/NFO, 2016). However, it demonstrated that at very low external dose levels (as external doses approached zero), the relationship between RESRAD-derived external dose and TLD external dose had no correlation. Attempting to use site-specific data to correct RESRAD-derived external dose at sites where external dose is low can result in erratic and erroneous results. Therefore, all RESRAD-derived external doses were increased using the correction factors."	
A.8.5.1, page A-40, last paragraph		The last paragraph was replaced with following text to provide additional clarification: "For radiological PSM, a FIDLER radiation survey value expressed in terms of MOB will be collected at each radiological debris PSM location where the FIDLER MOB survey value exceeds one-half of the hot spot criterion for debris, as described in Appendix C. This will be compared to the hot-spot criterion corresponding to a dose of 25 mrem/yr calculated using the GT scenario and the hot spot RRMGs presented in Appendix C."	
Appendix C		The hot spot criteria values were adjusted slightly based on the change in calculation presented in response to comment #33.	
Throughout the document		There were also several minor editorial corrections.	

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