

Derived Concentration Guideline Levels for Argonne National Laboratory's Building 310 Area

Environmental Science Division

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phone (865) 576-8401

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prepared by
S. Kamboj and C. Yu
Environmental Science Division, Argonne National Laboratory

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NOTATION

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
Argonne	Argonne National Laboratory
CDF	cumulative distribution function
DCF	dose conversion factor
DCGL	derived concentration guideline level
DSR	dose-to-source (concentration) ratio
EBR	Experimental Breeder Reactor
EPA	U.S. Environmental Protection Agency
Kd	distribution coefficient
NRC	U.S. Nuclear Regulatory Commission
TRU	transuranic
WD	water-dependent
WI	water-independent
w/o	without

UNITS OF MEASURE

cal	calorie(s)	L	liter(s)
cm ³	cubic centimeter(s)		
		m	meter(s)
d	day(s)	m ²	square meter(s)
		mol	mole(s)
g	gram(s)	mrem	millirem
h	hour(s)	pCi	picocurie(s)
ha	hectare(s)		
		s	second(s)
K	kelvin		
kg	kilogram(s)	yr	year(s)
km	kilometer(s)		

1 INTRODUCTION

The derived concentration guideline level (DCGL) is the allowable residual radionuclide concentration that can remain in soil after remediation of the site without radiological restrictions on the use of the site. It is sometimes called the single radionuclide soil guideline or the soil cleanup criteria. This report documents the methodology, scenarios, and parameters used in the analysis to support establishing radionuclide DCGLs for Argonne National Laboratory's Building 310 area.

1.1 SITE DESCRIPTION

Argonne National Laboratory (Argonne) is located 43 km southwest of downtown Chicago in DuPage County, Illinois. The site occupies 607 ha and is mostly surrounded by the Waterfall Glen Forest Preserve, which is used mainly as a recreational area. The Argonne site contains a number of small ponds and streams. The primary drainage on the site is through Sawmill Creek that runs through the site and enters the Des Plaines River. Some southernmost parts of the site drain directly into the Des Plaines River.

1.2 BUILDING HISTORY

Building 310 was constructed in 1950 and is made of concrete and structural steel with a brick facing. The building was initially known as the Experimental Waste Processing, Storage, and Shipping Building. It consists of two main floors, a partial basement service floor, and a fan loft on the third floor. Two tunnels extend south from the service floor in Building 310 to the adjacent Building 306; one is for personnel, and the other is for a system of liquid waste transfer pipes. Building 306 was used for decontamination activities and waste management operations. Any liquid or airborne releases from Building 306 (especially to the north) could be reflected in soil contamination south of Building 310.

The major radionuclides potentially present in the soils surrounding Building 310 are, in general, expected to be the same as those within the building. Soil contamination likely occurred as a result of liquid spills and airborne releases from various rooms and laboratories while the building was being used to support projects at Argonne. Hence, it is necessary to consider the previous uses of Building 310 to identify those radionuclides most likely to be present and of concern in nearby soils.

Building 310 was initially used for experimental waste processing activities and the storage and shipment of radioactive wastes offsite. The overall goal of the experimental waste processing program for liquid and solid wastes conducted in this building was to reduce the waste volume that had to be shipped offsite for disposal. The service floor retention tank facility in Building 310 provided capacity for the storage of liquid radioactive wastes prior to processing in Building 306. Some of the liquid radioactive wastes in these retention tanks were processed in Building 310 as part of developing treatment techniques for liquid wastes, generally involving

solidification. The retention facility tanks also provided overflow capacity for contaminated liquid wastes that were initially received for processing in Building 306 through the liquid waste transfer pipes between the two buildings. On the basis of this history of operations, it is reasonable to expect that the same or a comparable mix of radionuclides would be present as residual contamination in both buildings.

Building 310 supported several additional projects, including acting as a staging area for dry waste that was being incinerated in a test facility at the site. The building was also used for a project involving the irradiation of food samples with spent nuclear fuel rods to study the effects of radiation on bacteria. It is expected that neither of these two projects would result in significant contamination of the building or nearby soils.

Building 310 was later expanded in the 1970s to provide support to the Experimental Breeder Reactor II (EBR-II) project, specifically the development and testing of prototypes for the EBR-II fuel cycle facility. The EBR-II facility was located at Argonne-West in Idaho, and Building 310 was generally used to house engineers and technicians supporting that project. The goal of the EBR-II project was demonstrating the recycle and reuse of the plutonium present in spent nuclear fuel.

Breeder reactors operate on the principal that more nuclear fuel (plutonium) is created than is used. Plutonium and uranium can only be recycled so many times in a nuclear reactor before the buildup of isotopes that absorb neutrons without causing fissions (neutron poisons) makes the fuel unusable. While detailed information on the specific activities conducted in Building 310 for the EBR-II project has not yet been found, it is possible that pilot-scale studies and experiments associated with spent nuclear fuel reprocessing and fuel assembly operations could have taken place in this building. Even if such activities were not conducted in Building 310, the radioactive contaminants associated with spent nuclear fuel were likely present in the radioactive wastes initially processed and staged in Buildings 310 and 306, as these activities were conducted at other facilities at Argonne at that time.

Reprocessing of spent fuel generally requires that the fuel rods be cut, dissolved in acids, and then processed to extract the useable materials from waste products. Such activities would result in the release of radionuclides with subsequent contamination of nearby areas with the fission products and actinides that are present in spent nuclear fuel. Neutron activation products in metal components would also likely be released by these activities, generally from the shearing of the fuel assemblies. The radioactive wastes generated by spent nuclear fuel reprocessing include fission and neutron activation products, as well as a number of transuranic (TRU) radionuclides such as plutonium and americium. As noted above, solid and liquid radioactive wastes associated with such operations were likely stored and possibly processed in Buildings 310 and 306.

Although a number of activities were conducted in Building 310 since 1950 (including using spent nuclear fuel as a source of gamma rays and providing support for the EBR-II project), it is expected that the radioactive waste processing activities previously conducted there would be the major source of contamination in the building. By inference, these same radionuclides would be expected to be present in nearby soils. The initial mission of Argonne

was largely reactor development and the management of spent nuclear fuel. The wastes processed in Buildings 310 and 306 are expected to be very similar to the types of wastes associated with the West Valley Site, which is currently undergoing remediation. The major radionuclides of concern identified for that site, as given in the Phase I Decommissioning Plan developed for the U.S. Nuclear Regulatory Commission (NRC), were reviewed and used to develop the list of radionuclides expected to be of concern in soils in the vicinity of Building 310.

Characterization of the service floor retention tank facility in Building 310 in the 1990s identified the major radionuclides in this area as Sr-90, Cs-137, Pu-239, Am-241, and notable quantities of uranium isotopes. This information is consistent with the assumption that the radionuclides expected to be present in this building are similar to those at the West Valley Site. This list is not inclusive of all radionuclides that could be encountered during characterization and remediation of Building 310 soils. A screening evaluation was performed to identify those radionuclides that could reasonably be expected to be present in Building 310 soils and to present the greatest hazards to human health in the future.

The results of the screening analysis are given in Table 1. The radionuclides in the first column of this table are the major radionuclides expected to be present in soils surrounding a spent nuclear fuel reprocessing plant (or a facility that handles comparable radioactive wastes) that could present a future hazard to human health and the environment. Subsequent screening was performed to reduce the list to a more tenable number for use with soils in the vicinity of Building 310.

Additional radionuclides are also likely to be present in Building 310 and the nearby soils, but these are expected to be present at lower activity concentrations or to present a lower hazard than those that were retained. These include hydrogen-3 (tritium), additional fission products such as various isotopes of europium, additional neutron activation products that may be present in activated metals (including the spent fuel cladding) such as Co-60 and several isotopes of nickel and iron, and additional TRU radionuclides.

Hydrogen-3 is not included here because of its relatively short half-life of 12.4 years. Fission and neutron activation products beyond those given in Table 1 (such as various isotopes of europium, nickel, and iron) were not included here because they generally have much smaller yields and shorter half-lives than those that were retained. These radionuclides would therefore have been produced in relatively low amounts, and much of the initial contamination would have since undergone significant radioactive decay. The exception is Co-60, which was detected as contamination within Building 310 and was retained as an indicator of possible activation product contamination. The prevalence of TRU radionuclides in spent nuclear fuel generally decreases as the atomic number increases, because they are largely produced by subsequent absorption of additional neutrons. The TRU radionuclides given here are those that are expected to be most prevalent and have the greatest potential for harm in the future.

TABLE 1 Screening Analysis for Radionuclides Present in Building 310 Soils

Radionuclide	Screening Result	Screening Rationale
Americium-241	Retained	Identified in previous characterization activities in Building 310
Carbon-14	Retained	Neutron activation product present in stainless steel cladding
Cobalt-60	Retained	An activation product observed as contamination within Building 310, retained as an indicator of possible activation product contamination
Curium-243	Eliminated	Expected to be less prevalent than other TRU radionuclides that pose a comparable or greater hazard to human health
Curium-244	Eliminated	Expected to be less prevalent than other TRU radionuclides that pose a comparable or greater hazard to human health
Cesium-137	Retained	Major fission product identified in characterization activities in Building 310
Iodine-129	Retained	Long-lived fission product that is mobile in the environment
Neptunium-237	Retained	TRU radionuclide present in relatively high concentrations in spent nuclear fuel
Plutonium-238	Retained	TRU radionuclide present in materials processed in Building 310 that would accompany Pu-239
Plutonium-239	Retained	TRU radionuclide present in materials processed in Building 310 that was identified in characterization activities in Building 310
Plutonium-240	Retained	TRU radionuclide present in materials processed in Building 310 that would accompany Pu-239
Plutonium-241	Eliminated	Less radiotoxic than the three plutonium isotopes that were retained (decays by beta-particle emission with a half-life of 14.4 years)
Strontium-90	Retained	Major fission product identified in characterization activities in Building 310
Technetium-99	Retained	Long-lived fission product that is mobile in the environment
Uranium-232	Eliminated	Expected to be less prevalent than the three uranium isotopes that were retained
Uranium-233	Eliminated	Expected to be less prevalent than the three uranium isotopes that were retained
Uranium-234	Retained	Component in the fuel elements initially charged to EBR-II
Uranium-235	Retained	Component in the fuel elements initially charged to EBR-II
Uranium-238	Retained	Component in the fuel elements initially charged to EBR-II

On the basis of this screening-level evaluation, the radionuclides addressed in this assessment are the following: Am-241, C-14, Co-60, Cs-137, I-129, Np-237, Pu-238, Pu-239, Pu-240, Sr-90, Tc-99, U-234, U-235, and U-238. Remedial actions for contaminated soils in the vicinity of Building 310 would be conducted in accordance with Argonne's as low as reasonably achievable (ALARA) policy, which would be protective of human health and the environment.

1.3 DERIVATION OF GUIDELINE LEVELS

The contaminants of concern identified for Building 310 are Am-241, C-14, Co-60, Cs-137, I-129, Np-237, Pu-238, Pu-239, Pu-240, Sr-90, Tc-99, U-234, U-235, and U-238 (Section 1.2). The soil guidelines for these radionuclides are calculated by using a dose constraint of 25 mrem/yr for all scenarios. It is assumed that the current industrial use of the site will continue, with an institutional control period of 100 years. All land use scenarios are described in Section 2. The soil guidelines are derived for all scenarios, and the results are presented in Section 4. The final DCGLs will be determined by the U.S. Department of Energy after taking other considerations into account, such as cost-benefit analysis, the ALARA policy, and their applicability to other portions of Argonne site.

2 SCENARIO DESCRIPTION

2.1 LAND USE CONSIDERATIONS

The current land use for the site after it is remediated is industrial use with institutional control. However, after the institutional control period ends, the site could be rezoned for other purposes, such as recreational use or residential use, or it could continue being used as an industrial use site. In developing DCGLs for the Building 310 area's residual soil radioactivity, four potential exposure scenarios are considered to cover all likely future land uses within a 1,000-year time frame. However, if the peak dose were to occur at a later time, the time frame for the analysis would be increased to 10,000 years. The four scenarios vary with respect to the type of land use and food source consumed. Two scenarios (industrial worker onsite and surface water use offsite) capture the dose to different receptors for the current land use conditions. The other two scenarios (recreational use and subsistence farming) capture the potential dose to different receptors after the institutional control period has ended. The industrial use scenario after the institutional control has ended will result in lower doses than those associated with current industrial use because the peak dose in the time frame of 1–10,000 years is used and also because, as a result of the radioactive decay of some short-lived radionuclides that exist onsite, the dose would be less after the institutional control period of 100 years. Therefore, the industrial scenario after the institutional control period has ended is not considered in this analysis. During the institutional control period, it is possible that contaminants may migrate to offsite locations by either surface runoff or wind erosion. Therefore, offsite residents may be exposed to onsite contamination during and after the institutional control period. This scenario is included in the DCGL analysis.

2.2 EXPOSURE SCENARIOS

Four scenarios are considered in the derivation of soil guidelines (DCGLs) for the Building 310 area. Two scenarios (Scenarios A and B) are current use scenarios. The other two scenarios (Scenarios C and D) are future use scenarios. These four scenarios are described in detail here. The pathways and parameters considered in these four scenarios are discussed in Section 2.3.

Scenario A (the current use onsite worker scenario) assumes continued industrial use of the site. Under this scenario, it is assumed that a receptor would work onsite either indoors or outdoors (a probability distribution representative of an onsite worker will be assigned to the time fraction spent onsite). It is also assumed that the worker will not ingest contaminated water, plant, fish, meat, or milk obtained from the site. It is assumed that the dose to the worker comes only from the residual contamination in the soil in the vicinity of Building 310.

Scenario B (the current use offsite resident scenario) assumes the use of surface water by a hypothetical offsite resident. Under this scenario, it is assumed that the contamination from surface runoff mixes with the storm water drainage and discharges to Sawmill Creek. A hypothetical offsite resident uses this surface water for irrigation and feeding livestock.

However, a public water supply is available in the area, and surface water is not used for drinking purposes. The exposure pathways considered are ingestion of plant food grown with the irrigation water from Sawmill Creek and ingestion of meat and milk from livestock that were fed with water from Sawmill Creek. The fish consumed by the resident are also caught from Sawmill Creek. It should be noted that currently very few people fish in Sawmill Creek or use the water for any purposes. Exposure to external radiation, inhalation of dust and radon, and incidental ingestion of soil are considered for this offsite resident scenario.

Scenario C (the likely future use scenario) assumes recreational use of the site. This scenario assumes that, after the institutional control period, the current forest preserve area bordering the site is expanded to include the Building 310 area. A hypothetical person (recreationist) camps on the remediated area for two weeks per year and is involved in recreational activities such as hiking, skiing, biking, and horseback riding. During this time period, it is assumed that all drinking water used by the hypothetical individual is drawn from the surface water (pond) that captures water from the surface runoff adjacent to the remediated area. Also the individual ingests fish taken from that pond. The site has clayey soil with low permeability and poor drainage; therefore, a pond that can capture surface water from runoff could easily be built. The recreationist does not ingest plant food growing in the area and also does not ingest milk from the livestock or wild animals raised in the area. However, part of the meat eaten is from the livestock or wild animals raised in the area.

Scenario D (possible but unlikely future use scenario) assumes residential use of the site after the institutional control period. For this scenario, it is assumed that after the institutional control of the site, the industrial activities end and the site is re-zoned for residential use. It is assumed that the site is used by a resident farmer. The resident farmer in this situation is exposed to direct external radiation; internal radiation from inhalation of contaminated dust; internal radiation from inhalation of radon and its progeny; and internal radiation from ingestion of water, plant foods, meat, milk, and fish and incidental ingestion of soil. All water used by the resident farmer for drinking, irrigation, and household usage is drawn from a deep well adjacent to the remediated area. The individual ingests fish caught from a nearby pond. A shallow well scenario is not considered because of the site's hydrogeological characteristics (Patton et al. 1990). Although a perched water table may exist onsite, the water yield of this groundwater system would be low and not capable of sustaining a resident farmer.

2.3 PATHWAYS AND KEY PARAMETERS

Potential radiation doses resulting from multiple exposure pathways are considered in this analysis for all exposure scenarios. These pathways include:

1. Direct exposure to external radiation from remediated soil material,
2. Internal radiation from inhalation of contaminated dust,
3. Internal radiation from inhalation of radon and its progeny,

4. Internal radiation from ingestion of plant foods grown in the remediated area and irrigated with an onsite water source,
5. Internal radiation from ingestion of meat from livestock raised onsite and fed with fodder grown in the remediated area and irrigated with water drawn from an onsite well or pond (the water ingested by livestock is also drawn from an onsite water source),
6. Internal radiation from ingestion of milk from livestock raised onsite and fed with fodder grown in the remediated area and irrigated with onsite well water or pond water (the water ingested by milk cows is also drawn from an onsite water source),
7. Internal radiation from ingestion of fish from a pond located downgradient from the decontaminated area,
8. Internal radiation from incidental ingestion of onsite soil,
9. Internal radiation from drinking water from an onsite water source (groundwater or surface water),
10. Internal radiation from ingestion of plant foods grown offsite and irrigated with contaminated surface water,
11. Internal radiation from ingestion of meat from livestock raised offsite and fed with fodder grown offsite but irrigated with contaminated creek water (the water ingested by livestock is also drawn from the creek),
12. Internal radiation from ingestion of milk from livestock raised offsite and fed with fodder grown offsite but irrigated with contaminated creek water (the water ingested by milk cow is also drawn from the creek), and
13. Ingestion of fish from an offsite surface water source.

Table 2 summarizes the applicable exposure pathways for all scenarios, and Table 3 lists the key parameters for the applicable exposure pathways.

TABLE 2 Summary of Applicable Exposure Pathways for Different Scenarios Considered for Argonne’s Building 310 Area

Exposure Pathway	Applicable Pathways			
	Current Use		Future Use	
	Scenario A ^a	Scenario B ^b	Scenario C ^c	Scenario D ^d
Direct external gamma exposure	Yes	Yes	Yes	Yes
Inhalation of dust	Yes	Yes	Yes	Yes
Inhalation of radon and its progeny	Yes	Yes	Yes	Yes
Ingestion of soil	Yes	Yes	Yes	Yes
Ingestion of plant foods grown onsite	No	No	No	Yes
Ingestion of meat from livestock raised onsite	No	No	Yes	Yes
Ingestion of milk from livestock raised onsite	No	No	No	Yes
Ingestion of fish from an onsite pond	No	No	Yes	Yes
Ingestion of water from a downgradient well	No	No	No	Yes
Ingestion of water from a nearby surface water source	No	No	Yes	No
Ingestion of plant foods grown offsite	No	Yes	No	No
Ingestion of meat from livestock raised offsite	No	Yes	No	No
Ingestion of milk from livestock raised offsite	No	Yes	No	No
Ingestion of fish from surface water source offsite	No	Yes	No	No

^a Industrial worker (current use onsite worker scenario): no consumption of plant food, meat, milk, water, and fish.

^b Offsite resident (current use offsite resident scenario): the water used for irrigation and feeding livestock as well as the fish ingested are taken from an offsite surface water body.

^c Recreationist (likely future use scenario): no consumption of plant food and milk.

^d Onsite resident (possible but unlikely future use scenario): all onsite pathways are included.

TABLE 3 List of Key Parameters for Applicable Exposure Pathways

Exposure Pathway	Key Parameters
Direct external gamma exposure	Time fraction spent onsite and external gamma shielding factor
Inhalation of dust	Inhalation rate, time fraction spent onsite, mass loading for inhalation, and indoor dust filtration factor
Inhalation of radon and its progeny	Time fraction spent onsite, radon diffusion coefficient, and emanation coefficient
Ingestion of soil	Soil ingestion rate and time spent onsite
Ingestion of plant foods grown onsite	Plant transfer factor, plant ingestion rate, water dilution factor, and release rate from the source
Ingestion of meat from livestock raised onsite	Plant transfer factor, meat transfer factor, meat ingestion rate, water dilution factor, and release rate from the source
Ingestion of milk from livestock raised onsite	Plant transfer factor, milk transfer factor, milk ingestion rate, water dilution factor, and release rate from the source
Ingestion of fish from a nearby pond	Fish bioaccumulation factor, aquatic food contaminated fraction, surface water dilution factor, and release rate from the source
Ingestion of water from a downgradient well	Water ingestion rate, infiltration rate, distribution coefficient (i.e., Kd) values (or leach rate) for contaminants, and hydrogeological parameters for the site
Ingestion of water from a nearby surface water source	Water ingestion rate, surface water dilution factor, and release rate from the source
Ingestion of plant foods grown offsite	Plant transfer factor, plant ingestion rate, surface water dilution factor, and release rate from the source
Ingestion of meat from livestock raised offsite	Plant transfer factor, meat transfer factor, meat ingestion rate, surface water dilution factor, and release rate from the source
Ingestion of milk from livestock raised offsite	Plant transfer factor, milk transfer factor, milk ingestion rate, surface water dilution factor, and release rate from the source
Ingestion of fish from surface water source offsite	Fish bioaccumulation factor, aquatic food contaminated fraction, surface water dilution factor, and release rate from the source

3 DOSE-TO-SOURCE CONCENTRATION RATIOS

Each scenario discussed in Section 2 was translated from its potential transport and environmental pathways into a specific set of parameter values. The RESRAD (onsite) and RESRAD-OFFSITE codes include many input parameters that can be classified as metabolic, behavioral, and physical parameters. The metabolic parameter represents a metabolic characteristic of the potential receptor, and its value is independent of the scenario but may be different for different population groups. Behavioral parameter values depend on the receptor's behavior in the scenario (e.g., parameter values for a recreationist scenario could be different from those for a subsistence farmer scenario). The physical parameters are source- and site-specific, and their values do not change for a different group of receptors. The analysis was done for an adult member of the population. For the behavioral parameters, scenario-specific, mean, or median values were used. For physical parameters, site-specific values (or distributions), whenever available, were used. If site-specific values were not available, RESRAD (onsite) default values were used. For probabilistic analysis, distributions from the NUREG/CR-6697 report (NRC 2000) were used.

Radionuclide dose-to-source (concentration) ratios (DSRs) were calculated from both probabilistic and deterministic analyses. Deterministic analysis uses a single value for each input parameter, resulting in a single dose output value. Probabilistic analysis uses parameter distributions to identify the variability and uncertainty in dose estimates resulting from variability and uncertainty in the input parameters. A probability distribution is specified for each input parameter with a distribution. A model is run repeatedly, using different values for each input parameter with a distribution for each run. Instead of producing a single model output (which results from a deterministic run), probabilistic analysis produces a set of outputs that are equal in number to the number of realizations selected (realizations are equal to the number of observations multiplied by the number of repetitions).

The RESRAD (onsite) computer code, Version 6.5 (Yu et al. 2001), was used for analyzing the industrial, recreational use, and onsite resident scenarios. The RESRAD-OFFSITE computer code, Version 2.6 (Yu et al. 2007), was used for analyzing the offsite resident scenario. The time frame considered in this analysis was 1,000 years. However, if the peak dose occurred at later time, the time frame for the analysis was increased to 10,000 years. Radioactive decay and ingrowth were considered in deriving dose/source concentration ratios. The various parameters used in the codes for probabilistic analysis are listed in the Appendix A. The various parameters used in the codes for deterministic analysis are listed in the Appendix B.

3.1 PROBABILISTIC ANALYSIS

The details of parameter selection are presented in Appendix A. Table A.1 lists all input parameter distributions/values used in the probabilistic dose analysis for different scenarios. Some of the parameters used in the analysis were radionuclide/element-specific (e.g., distribution coefficient or Kd values, transfer factors) and required multiple values because the analysis was

conducted for multiple radionuclides; therefore, the radionuclide- and element-specific parameters used in the analysis are listed in separate tables.

Parameter distributions for K_d values are listed in Tables A.2 and A.3. Parameter distributions for plant transfer factors, meat transfer factors, milk transfer factors, and fish and crustacean transfer factors are listed in Tables A.3–A.7, respectively. The distribution function notations used in the RESRAD (onsite) input parameter table (Table A.1) are listed in Table A.8.

Some of the input parameters are correlated. In cases for which a clear relationship exists between parameters, strong correlations were used as input to ensure proper pairing. These include the pairs for bulk density and total porosity (correlation coefficient of -0.99), bulk density and effective porosity (correlation coefficient of -0.99), and total porosity and effective porosity (correlation coefficient of 0.99). Table A.9 lists the correlations used in the analysis. A few parameter values and distributions that are scenario-specific and distinguish the scenarios from one another (such as intake rates and time spent onsite) are specified for each scenario. For those parameters not specified with a single value, the default probabilistic distribution was used. This results in a dose probability distribution (presented as the cumulative distribution function, CDF). The RESRAD-OFFSITE code requires many more parameters than the RESRAD (onsite) code; the additional input parameters for the RESRAD-OFFSITE analysis are listed in Table A.10.

Since the peak dose depends linearly on radionuclide concentration, the analysis was done for the unit concentration of each radionuclide for four scenarios. For this analysis, 4,500 input sets (1,500 observations and 3 repetitions) were generated. For each set of sampled parameter values, the peak dose in the time interval 0–1,000 years was calculated. Cumulative probabilities were estimated from the resulting dose distribution for each scenario.

Tables 4–17 (at the end of Section 3.1) provide total peak DSR percentiles (mrem/yr per pCi/g) for different exposure scenarios. Also listed in Tables 4–17 are the mean of the peaks DSR and the peak of the means DSR. The mean of the peaks DSR is always greater than or equal to the peak of the means DSR. However, if the peak DSRs occurred at the same time for all input sets analyzed, then there would not be any difference between the mean of the peaks DSR and peak of the means DSR. The peak DSRs from 4,500 realizations were analyzed, and the percentiles for different exposure pathways are provided in Appendix C. Water-independent (WI) and water-dependent (WD) pathways are distinguished by the extensions WI and WD, respectively. Tables C.1–C.14 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for the industrial use scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For Am-241, I-129, and Tc-99, external exposure and soil ingestion were the dominant exposure pathways. For C-14, only inhalation was the dominant exposure pathway. For Co-60, Cs-137, Np-237, Sr-90, U-235, and U-238, external exposure was the dominant exposure pathway. For Pu-238, Pu-239, and Pu-240, soil ingestion and inhalation were two dominant exposure pathways. For U-234, radon inhalation was the dominant exposure pathway.

Tables C.15–C.28 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for individual radionuclides in the offsite resident scenario. RESRAD-OFFSITE Version 2.6 was used in the analysis. For all radionuclides except Co-60, WD

pathways were dominant. For Am-241, C-14, Cs-137, and U-234, aquatic food ingestion resulted in the most dose. For Co-60, the external exposure pathway was dominant. For I-129, meat and milk resulted in the most dose. For Np-237, Pu-238, Pu-239, and Pu-240, fish and plant ingestion were dominant exposure pathways. For Sr-90 meat and fish ingestion resulted in the most dose. For Tc-99, plant, milk, and fish ingestion resulted in the most dose. For U-235 and U-238, external exposure and fish ingestion resulted in the most dose.

Tables C.29–C.42 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for individual radionuclides in the recreational use scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For C-14, I-129, Np-237, and Tc-99, WD pathways were dominant, and for other radionuclides (Am-241, Co-60, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, U-234, U-235, and U-238), WI pathways were dominant. For Am-241, Co-60, U-235, and U-238, external exposure was dominant. For C-14, I-129, Np-237, and Tc-99, aquatic food ingestion resulted in the most dose. For Cs-137, external exposure and meat ingestion resulted in the most dose. For Pu-238, Pu-239, and Pu-240, meat ingestion, soil ingestion, and inhalation were dominant exposure pathways. For Sr-90, meat ingestion resulted in the most dose. For U-234, meat ingestion and external exposure were dominant.

Tables C.43–C.56 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for individual radionuclides in the onsite resident scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For C-14, I-129, Np-237, and Tc-99, WD pathways were dominant, and for other radionuclides (Am-241, Co-60, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, U-234, U-235, and U-238), WI pathways were dominant. For Am-241, Pu-238, Pu-239, Pu-240, and Sr-90, plant ingestion was dominant. For C-14, aquatic food ingestion resulted in the most dose. For Co-60, external exposure was dominant. For Cs-137, external exposure, meat and plant ingestion resulted in the most dose. For I-129, Np-237, and Tc-99 water ingestion resulted in the most dose. For U-234, radon inhalation resulted in the most dose. For U-235, external exposure and plant ingestion resulted in the most dose. For U-238, water ingestion, plant ingestion, and external exposure resulted in the most dose.

Table 4 shows the total peak DSR percentiles of Am-241 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 5 shows the total peak DSR percentiles of C-14 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The current offsite resident (current use scenario) and recreational use (after the institutional control period of 100 years) would receive the highest dose.

Table 6 shows the total peak DSR percentiles of Co-60 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The industrial worker (current use scenario) would receive the highest dose.

Table 7 shows the total peak DSR percentiles of Cs-137 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The industrial worker (current use scenario) would receive the highest dose.

Table 8 shows the total peak DSR percentiles of I-129 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 9 shows the total peak DSR percentiles of Np-237 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 10 shows the total peak DSR percentiles of Pu-238 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 11 shows the total peak DSR percentiles of Pu-239 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 12 shows the total peak DSR percentiles of Pu-240 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 13 shows the total peak DSR percentiles of Sr-90 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 14 shows the total peak DSR percentiles of Tc-99 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 15 shows the total peak DSR percentiles of U-234 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 16 shows the total peak DSR percentiles of U-235 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 17 shows the total peak DSR percentiles of U-238 for different exposure scenarios considered in deriving DCGLs for the Building 310 area at Argonne. The future onsite resident (after the institutional control period of 100 years) would receive the highest dose.

Table 18 shows the peak of the means DSR, mean of the peaks DSR, and 95th percentile of the peaks DSR of each radionuclide for different scenarios. These values were used in deriving DCGLs. The scenario that results in the most dose from an individual radionuclide is highlighted.

TABLE 4 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Am-241 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	1.47E-03	2.16E-03	1.81E-03	2.96E-02
10%	4.06E-03	2.69E-03	1.96E-03	3.61E-02
15%	6.76E-03	3.32E-03	2.05E-03	4.05E-02
20%	9.42E-03	4.17E-03	2.11E-03	4.48E-02
25%	1.11E-02	4.91E-03	2.16E-03	4.91E-02
30%	1.21E-02	5.62E-03	2.22E-03	5.33E-02
35%	1.27E-02	6.21E-03	2.26E-03	5.75E-02
40%	1.33E-02	6.66E-03	2.31E-03	6.29E-02
45%	1.37E-02	6.92E-03	2.36E-03	6.81E-02
50%	1.43E-02	7.12E-03	2.40E-03	7.46E-02
55%	1.47E-02	7.31E-03	2.44E-03	8.03E-02
60%	1.52E-02	7.49E-03	2.49E-03	8.78E-02
65%	1.57E-02	7.69E-03	2.54E-03	9.62E-02
70%	1.62E-02	7.95E-03	2.58E-03	1.07E-01
75%	1.68E-02	8.26E-03	2.64E-03	1.20E-01
80%	1.75E-02	8.66E-03	2.71E-03	1.37E-01
85%	1.84E-02	9.24E-03	2.79E-03	1.61E-01
90%	1.97E-02	1.00E-02	2.89E-03	1.96E-01
95%	2.19E-02	1.19E-02	3.05E-03	2.68E-01
Mean of the peaks	1.35E-02	6.98E-03	2.40E-03	1.05E-01
Peak of the means	1.35E-02	6.87E-03	2.40E-03	1.05E-01

TABLE 5 Total Peak DSR Percentiles (mrem/yr per pCi/g) of C-14 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	2.22E-06	2.48E-04	0.00E+00	0.00E+00
10%	5.82E-06	3.76E-04	0.00E+00	0.00E+00
15%	1.02E-05	4.97E-04	0.00E+00	0.00E+00
20%	1.34E-05	6.40E-04	0.00E+00	0.00E+00
25%	1.53E-05	8.00E-04	0.00E+00	0.00E+00
30%	1.68E-05	9.86E-04	0.00E+00	0.00E+00
35%	1.79E-05	1.21E-03	0.00E+00	0.00E+00
40%	1.90E-05	1.47E-03	0.00E+00	0.00E+00
45%	2.02E-05	1.85E-03	0.00E+00	0.00E+00
50%	2.13E-05	2.36E-03	0.00E+00	0.00E+00
55%	2.23E-05	2.96E-03	0.00E+00	0.00E+00
60%	2.34E-05	3.89E-03	0.00E+00	0.00E+00
65%	2.45E-05	5.35E-03	0.00E+00	0.00E+00
70%	2.56E-05	7.94E-03	1.77E-17	0.00E+00
75%	2.70E-05	1.27E-02	4.24E-03	0.00E+00
80%	2.87E-05	2.31E-02	1.55E-02	0.00E+00
85%	3.05E-05	4.19E-02	5.45E-02	1.01E-03
90%	3.32E-05	8.49E-02	1.17E-01	3.45E-03
95%	3.73E-05	2.27E-01	2.50E-01	1.05E-02
Mean of the peaks	2.10E-05	5.95E-02	4.61E-02	3.36E-03
Peak of the means	2.10E-05	1.50E-02	1.58E-02	3.54E-03

TABLE 6 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Co-60 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	3.24E-01	7.92E-04	5.60E-07	3.32E-06
10%	9.57E-01	7.93E-04	7.51E-07	4.10E-06
15%	1.59E+00	7.93E-04	8.50E-07	4.61E-06
20%	2.22E+00	7.94E-04	9.01E-07	4.97E-06
25%	2.85E+00	7.94E-04	9.41E-07	5.28E-06
30%	2.96E+00	7.95E-04	9.64E-07	5.59E-06
35%	3.07E+00	7.96E-04	9.81E-07	5.93E-06
40%	3.17E+00	7.96E-04	9.93E-07	6.25E-06
45%	3.28E+00	7.97E-04	1.00E-06	6.61E-06
50%	3.39E+00	7.97E-04	1.01E-06	6.94E-06
55%	3.46E+00	7.98E-04	1.01E-06	7.32E-06
60%	3.53E+00	7.99E-04	1.02E-06	7.72E-06
65%	3.61E+00	8.00E-04	1.02E-06	8.20E-06
70%	3.67E+00	8.01E-04	1.03E-06	8.66E-06
75%	3.75E+00	8.03E-04	1.04E-06	9.17E-06
80%	3.95E+00	8.05E-04	1.05E-06	9.88E-06
85%	4.15E+00	8.08E-04	1.07E-06	1.08E-05
90%	4.36E+00	8.12E-04	1.10E-06	1.19E-05
95%	4.64E+00	9.01E-04	1.17E-06	1.40E-05
Mean of the peaks	3.11E+00	8.20E-04	9.65E-07	7.54E-06
Peak of the means	3.11E+00	8.01E-04	9.66E-07	7.54E-06

TABLE 7 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Cs-137 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	7.12E-02	2.69E-03	1.27E-02	7.02E-02
10%	2.09E-01	3.10E-03	1.33E-02	7.93E-02
15%	3.47E-01	3.45E-03	1.37E-02	8.78E-02
20%	4.85E-01	3.76E-03	1.42E-02	9.41E-02
25%	6.22E-01	4.08E-03	1.46E-02	1.00E-01
30%	6.46E-01	4.39E-03	1.51E-02	1.07E-01
35%	6.70E-01	4.71E-03	1.55E-02	1.14E-01
40%	6.93E-01	5.05E-03	1.60E-02	1.21E-01
45%	7.17E-01	5.41E-03	1.65E-02	1.28E-01
50%	7.41E-01	5.76E-03	1.71E-02	1.36E-01
55%	7.56E-01	6.13E-03	1.77E-02	1.43E-01
60%	7.71E-01	6.54E-03	1.83E-02	1.52E-01
65%	7.87E-01	7.07E-03	1.92E-02	1.61E-01
70%	8.02E-01	7.62E-03	2.00E-02	1.71E-01
75%	8.18E-01	8.38E-03	2.11E-02	1.83E-01
80%	8.62E-01	9.14E-03	2.25E-02	1.99E-01
85%	9.06E-01	1.03E-02	2.45E-02	2.23E-01
90%	9.51E-01	1.18E-02	2.76E-02	2.56E-01
95%	1.01E+00	1.49E-02	3.49E-02	3.17E-01
Mean of the peaks	6.78E-01	6.87E-03	1.95E-02	1.59E-01
Peak of the means	6.78E-01	6.88E-03	1.95E-02	1.59E-01

TABLE 8 Total Peak DSR Percentiles (mrem/yr per pCi/g) of I-129 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	3.70E-04	1.22E-02	1.45E-17	1.42E-06
10%	1.09E-03	3.01E-02	5.66E-12	5.00E-03
15%	1.77E-03	5.51E-02	5.75E-09	1.55E-01
20%	2.37E-03	8.14E-02	4.66E-07	8.83E-01
25%	2.75E-03	1.21E-01	7.19E-06	2.06E+00
30%	3.02E-03	1.59E-01	8.02E-05	3.27E+00
35%	3.25E-03	2.04E-01	5.41E-04	4.62E+00
40%	3.45E-03	2.64E-01	2.25E-03	5.92E+00
45%	3.65E-03	3.24E-01	6.31E-03	7.37E+00
50%	3.82E-03	4.02E-01	1.37E-02	9.37E+00
55%	3.98E-03	4.89E-01	2.56E-02	1.21E+01
60%	4.13E-03	5.85E-01	4.31E-02	1.50E+01
65%	4.29E-03	7.03E-01	6.71E-02	1.92E+01
70%	4.46E-03	8.73E-01	9.89E-02	2.46E+01
75%	4.67E-03	1.08E+00	1.38E-01	3.17E+01
80%	4.90E-03	1.38E+00	2.04E-01	4.11E+01
85%	5.15E-03	1.79E+00	3.18E-01	5.35E+01
90%	5.50E-03	2.37E+00	5.33E-01	7.18E+01
95%	6.15E-03	3.55E+00	1.13E+00	1.04E+02
Mean of the peaks	3.64E-03	9.30E-01	2.25E-01	2.51E+01
Peak of the means	3.64E-03	1.96E-01	7.12E-02	3.16E+00

TABLE 9 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Np-237 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	2.26E-02	8.32E-04	3.11E-08	5.48E-07
10%	6.53E-02	1.95E-03	1.80E-07	6.54E-06
15%	1.10E-01	2.36E-03	2.34E-04	8.01E-03
20%	1.50E-01	2.71E-03	5.14E-03	1.69E-01
25%	1.82E-01	3.13E-03	1.73E-02	3.90E-01
30%	2.03E-01	3.54E-03	2.88E-02	5.26E-01
35%	2.11E-01	4.14E-03	3.60E-02	6.50E-01
40%	2.19E-01	4.78E-03	3.88E-02	7.57E-01
45%	2.26E-01	5.49E-03	4.05E-02	8.72E-01
50%	2.33E-01	6.49E-03	4.21E-02	9.93E-01
55%	2.41E-01	7.83E-03	4.38E-02	1.15E+00
60%	2.47E-01	9.73E-03	4.59E-02	1.32E+00
65%	2.52E-01	1.24E-02	4.81E-02	1.54E+00
70%	2.57E-01	1.56E-02	5.14E-02	1.85E+00
75%	2.64E-01	2.01E-02	5.61E-02	2.23E+00
80%	2.73E-01	2.62E-02	6.42E-02	2.79E+00
85%	2.91E-01	3.70E-02	8.33E-02	3.70E+00
90%	3.07E-01	6.07E-02	1.31E-01	5.43E+00
95%	3.28E-01	1.17E-01	2.92E-01	1.04E+01
Mean of the peaks	2.15E-01	3.48E-02	9.41E-02	2.64E+00
Peak of the means	2.15E-01	9.30E-03	4.68E-02	1.11E+00

TABLE 10 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Pu-238 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	6.12E-04	8.84E-04	6.07E-04	1.42E-02
10%	1.65E-03	1.18E-03	6.87E-04	1.74E-02
15%	2.51E-03	1.37E-03	7.47E-04	2.00E-02
20%	3.24E-03	1.51E-03	8.00E-04	2.22E-02
25%	3.85E-03	1.65E-03	8.37E-04	2.48E-02
30%	4.36E-03	1.75E-03	8.72E-04	2.75E-02
35%	4.81E-03	1.88E-03	9.09E-04	3.03E-02
40%	5.21E-03	2.02E-03	9.42E-04	3.33E-02
45%	5.56E-03	2.15E-03	9.83E-04	3.65E-02
50%	5.92E-03	2.29E-03	1.02E-03	4.05E-02
55%	6.27E-03	2.47E-03	1.06E-03	4.43E-02
60%	6.65E-03	2.65E-03	1.11E-03	4.90E-02
65%	7.07E-03	2.89E-03	1.15E-03	5.36E-02
70%	7.54E-03	3.17E-03	1.20E-03	5.97E-02
75%	7.97E-03	3.49E-03	1.25E-03	6.82E-02
80%	8.46E-03	3.91E-03	1.32E-03	7.85E-02
85%	9.12E-03	4.62E-03	1.40E-03	9.26E-02
90%	1.00E-02	5.69E-03	1.49E-03	1.13E-01
95%	1.13E-02	8.18E-03	1.61E-03	1.56E-01
Mean of the peaks	5.98E-03	3.13E-03	1.06E-03	5.71E-02
Peak of the means	5.98E-03	3.12E-03	1.06E-03	5.71E-02

TABLE 11 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Pu-239 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	6.73E-04	1.04E-03	1.46E-03	3.39E-02
10%	1.81E-03	1.39E-03	1.66E-03	4.18E-02
15%	2.76E-03	1.64E-03	1.80E-03	4.76E-02
20%	3.57E-03	1.82E-03	1.92E-03	5.33E-02
25%	4.24E-03	1.97E-03	2.02E-03	5.98E-02
30%	4.79E-03	2.13E-03	2.10E-03	6.62E-02
35%	5.27E-03	2.29E-03	2.19E-03	7.26E-02
40%	5.72E-03	2.46E-03	2.27E-03	7.99E-02
45%	6.11E-03	2.60E-03	2.36E-03	8.80E-02
50%	6.51E-03	2.77E-03	2.45E-03	9.69E-02
55%	6.89E-03	2.96E-03	2.54E-03	1.07E-01
60%	7.30E-03	3.20E-03	2.65E-03	1.18E-01
65%	7.76E-03	3.44E-03	2.75E-03	1.30E-01
70%	8.27E-03	3.77E-03	2.87E-03	1.44E-01
75%	8.75E-03	4.15E-03	3.02E-03	1.64E-01
80%	9.28E-03	4.70E-03	3.18E-03	1.88E-01
85%	1.00E-02	5.39E-03	3.36E-03	2.23E-01
90%	1.10E-02	6.51E-03	3.56E-03	2.70E-01
95%	1.24E-02	9.05E-03	3.87E-03	3.73E-01
Mean of the peaks	6.56E-03	3.67E-03	2.54E-03	1.37E-01
Peak of the means	6.56E-03	3.55E-03	2.54E-03	1.37E-01

TABLE 12 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Pu-240 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	6.44E-04	1.90E-03	1.38E-03	3.33E-02
10%	1.61E-03	2.14E-03	1.55E-03	3.97E-02
15%	2.49E-03	2.33E-03	1.69E-03	4.62E-02
20%	3.28E-03	2.53E-03	1.79E-03	5.26E-02
25%	3.80E-03	2.75E-03	1.90E-03	5.88E-02
30%	4.33E-03	2.95E-03	1.98E-03	6.50E-02
35%	4.80E-03	3.16E-03	2.06E-03	7.12E-02
40%	5.22E-03	3.39E-03	2.14E-03	7.86E-02
45%	5.60E-03	3.64E-03	2.23E-03	8.66E-02
50%	5.97E-03	3.94E-03	2.32E-03	9.51E-02
55%	6.29E-03	4.25E-03	2.42E-03	1.05E-01
60%	6.67E-03	4.61E-03	2.51E-03	1.16E-01
65%	7.05E-03	5.00E-03	2.61E-03	1.28E-01
70%	7.48E-03	5.47E-03	2.73E-03	1.44E-01
75%	7.90E-03	6.04E-03	2.84E-03	1.62E-01
80%	8.37E-03	6.90E-03	2.98E-03	1.85E-01
85%	8.94E-03	8.07E-03	3.15E-03	2.18E-01
90%	9.68E-03	9.76E-03	3.38E-03	2.69E-01
95%	1.09E-02	1.42E-02	3.71E-03	3.71E-01
Mean of the peaks	5.92E-03	5.49E-03	2.41E-03	1.35E-01
Peak of the means	5.93E-03	5.49E-03	2.40E-03	1.35E-01

TABLE 13 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Sr-90 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	9.62E-04	8.35E-04	1.18E-04	4.42E-03
10%	2.84E-03	9.28E-04	9.18E-04	2.97E-02
15%	4.65E-03	1.01E-03	1.64E-03	5.30E-02
20%	6.54E-03	1.07E-03	2.31E-03	7.31E-02
25%	8.25E-03	1.14E-03	2.88E-03	9.77E-02
30%	8.72E-03	1.22E-03	3.51E-03	1.18E-01
35%	9.02E-03	1.28E-03	4.23E-03	1.44E-01
40%	9.35E-03	1.36E-03	4.93E-03	1.70E-01
45%	9.66E-03	1.43E-03	5.69E-03	2.04E-01
50%	9.94E-03	1.52E-03	6.56E-03	2.35E-01
55%	1.02E-02	1.60E-03	7.69E-03	2.79E-01
60%	1.04E-02	1.70E-03	9.24E-03	3.21E-01
65%	1.06E-02	1.82E-03	1.08E-02	3.72E-01
70%	1.09E-02	1.95E-03	1.28E-02	4.25E-01
75%	1.12E-02	2.13E-03	1.54E-02	5.03E-01
80%	1.16E-02	2.33E-03	1.86E-02	6.07E-01
85%	1.22E-02	2.62E-03	2.34E-02	7.50E-01
90%	1.29E-02	3.09E-03	3.09E-02	9.71E-01
95%	1.38E-02	3.99E-03	4.75E-02	1.44E+00
Mean of the peaks	9.15E-03	1.86E-03	1.35E-02	4.17E-01
Peak of the means	9.15E-03	1.70E-03	1.35E-02	4.17E-01

TABLE 14 Total Peak DSR Percentiles (mrem/yr per pCi/g) of Tc-99 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	3.44E-06	1.03E-04	5.78E-06	1.60E-05
10%	9.83E-06	2.50E-04	1.69E-05	4.02E-05
15%	1.62E-05	3.90E-04	3.34E-05	8.08E-05
20%	2.27E-05	5.63E-04	5.84E-05	1.58E-04
25%	2.65E-05	7.84E-04	9.76E-05	5.40E-04
30%	2.87E-05	1.02E-03	1.50E-04	1.68E-03
35%	3.04E-05	1.29E-03	2.16E-04	3.40E-03
40%	3.18E-05	1.53E-03	3.41E-04	5.71E-03
45%	3.30E-05	1.79E-03	4.72E-04	8.61E-03
50%	3.41E-05	2.03E-03	6.48E-04	1.29E-02
55%	3.54E-05	2.31E-03	8.73E-04	1.95E-02
60%	3.65E-05	2.59E-03	1.17E-03	2.79E-02
65%	3.77E-05	2.86E-03	1.50E-03	3.98E-02
70%	3.89E-05	3.18E-03	1.93E-03	5.62E-02
75%	4.02E-05	3.54E-03	2.49E-03	7.78E-02
80%	4.18E-05	4.02E-03	3.31E-03	1.03E-01
85%	4.38E-05	4.62E-03	4.36E-03	1.36E-01
90%	4.70E-05	5.50E-03	6.31E-03	1.83E-01
95%	5.18E-05	7.06E-03	1.07E-02	2.54E-01
Mean of the peaks	3.21E-05	2.59E-03	2.56E-03	5.68E-02
Peak of the means	3.21E-05	1.06E-03	9.62E-04	5.41E-02

TABLE 15 Total Peak DSR Percentiles (mrem/yr per pCi/g) of U-234 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	4.74E-03	1.29E-03	5.94E-04	2.74E-02
10%	1.20E-02	3.36E-03	1.38E-03	8.69E-02
15%	2.45E-02	6.01E-03	2.05E-03	1.50E-01
20%	4.04E-02	9.53E-03	2.88E-03	2.30E-01
25%	6.17E-02	1.35E-02	3.74E-03	3.38E-01
30%	9.04E-02	1.81E-02	4.58E-03	4.40E-01
35%	1.20E-01	2.19E-02	5.59E-03	5.52E-01
40%	1.53E-01	2.52E-02	6.64E-03	6.50E-01
45%	1.89E-01	2.77E-02	7.73E-03	7.48E-01
50%	2.28E-01	2.99E-02	8.66E-03	8.59E-01
55%	2.73E-01	3.21E-02	9.60E-03	9.50E-01
60%	3.11E-01	3.43E-02	1.04E-02	1.04E+00
65%	3.47E-01	3.66E-02	1.12E-02	1.12E+00
70%	3.84E-01	3.93E-02	1.21E-02	1.21E+00
75%	4.24E-01	4.17E-02	1.30E-02	1.28E+00
80%	4.60E-01	4.43E-02	1.42E-02	1.37E+00
85%	5.06E-01	4.73E-02	1.55E-02	1.46E+00
90%	5.68E-01	5.18E-02	1.73E-02	1.57E+00
95%	6.64E-01	5.76E-02	2.10E-02	1.75E+00
Mean of the peaks	2.65E-01	2.89E-02	1.00E-02	8.57E-01
Peak of the means	2.54E-01	2.57E-02	8.93E-03	8.09E-01

TABLE 16 Total Peak DSR Percentiles (mrem/yr per pCi/g) of U-235 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	1.69E-02	6.30E-04	6.68E-03	6.84E-02
10%	4.98E-02	1.06E-03	1.68E-02	1.35E-01
15%	8.11E-02	1.76E-03	2.18E-02	1.61E-01
20%	1.14E-01	2.71E-03	2.41E-02	1.81E-01
25%	1.41E-01	3.83E-03	2.52E-02	1.97E-01
30%	1.47E-01	5.02E-03	2.58E-02	2.13E-01
35%	1.54E-01	6.17E-03	2.62E-02	2.27E-01
40%	1.61E-01	7.04E-03	2.66E-02	2.41E-01
45%	1.67E-01	7.70E-03	2.69E-02	2.56E-01
50%	1.71E-01	8.45E-03	2.74E-02	2.72E-01
55%	1.75E-01	9.07E-03	2.79E-02	2.90E-01
60%	1.80E-01	9.68E-03	2.85E-02	3.08E-01
65%	1.84E-01	1.05E-02	2.92E-02	3.29E-01
70%	1.92E-01	1.15E-02	3.00E-02	3.52E-01
75%	2.00E-01	1.26E-02	3.08E-02	3.79E-01
80%	2.08E-01	1.37E-02	3.20E-02	4.14E-01
85%	2.18E-01	1.51E-02	3.31E-02	4.59E-01
90%	2.29E-01	1.67E-02	3.41E-02	5.21E-01
95%	2.65E-01	1.88E-02	3.58E-02	6.49E-01
Mean of the peaks	1.61E-01	8.70E-03	2.65E-02	3.31E-01
Peak of the means	1.52E-01	7.81E-03	2.51E-02	2.44E-01

TABLE 17 Total Peak DSR Percentiles (mrem/yr per pCi/g) of U-238 for Different Exposure Scenarios for the Building 310 Area

Percentile	Industrial Use	Offsite Resident	Recreational Use	Onsite Resident
5%	3.64E-03	4.28E-04	2.09E-03	2.41E-02
10%	1.06E-02	5.35E-04	4.87E-03	4.22E-02
15%	1.76E-02	6.24E-04	5.94E-03	4.90E-02
20%	2.45E-02	7.20E-04	6.27E-03	5.38E-02
25%	3.13E-02	8.07E-04	6.46E-03	5.86E-02
30%	3.28E-02	8.90E-04	6.63E-03	6.29E-02
35%	3.40E-02	9.83E-04	6.79E-03	6.75E-02
40%	3.52E-02	1.06E-03	6.97E-03	7.21E-02
45%	3.64E-02	1.15E-03	7.16E-03	7.69E-02
50%	3.75E-02	1.25E-03	7.36E-03	8.23E-02
55%	3.84E-02	1.36E-03	7.58E-03	8.74E-02
60%	3.93E-02	1.50E-03	7.87E-03	9.31E-02
65%	4.00E-02	1.68E-03	8.14E-03	9.99E-02
70%	4.08E-02	1.88E-03	8.52E-03	1.07E-01
75%	4.18E-02	2.12E-03	8.93E-03	1.16E-01
80%	4.38E-02	2.43E-03	9.42E-03	1.28E-01
85%	4.61E-02	2.84E-03	1.01E-02	1.47E-01
90%	4.84E-02	3.33E-03	1.11E-02	1.75E-01
95%	5.17E-02	3.93E-03	1.31E-02	2.47E-01
Mean of the peaks	3.45E-02	1.64E-03	7.90E-03	1.28E-01
Peak of the means	3.44E-02	1.16E-03	7.67E-03	8.94E-02

TABLE 18 DSRs (mrem/yr per pCi/g) at Peak of the Means, Mean of the Peaks, and 95th Percentile of the Peaks for Different Scenarios

Nuclide	Industrial Use			Offsite Resident			Recreational Use			Onsite Resident		
	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks
Am-241	1.35E-02	1.35E-02	2.19E-02	6.87E-03	6.98E-03	1.19E-02	2.40E-03	2.40E-03	3.05E-03	1.05E-01	1.05E-01	2.68E-01
C-14	2.10E-05	2.10E-05	3.73E-05	1.50E-02	5.95E-02	2.27E-01	1.58E-02	4.61E-02	2.50E-01	3.54E-03	3.36E-03	1.05E-02
Co-60	3.11E+00	3.11E+00	4.64E+00	8.01E-04	8.20E-04	9.01E-04	9.66E-07	9.65E-07	1.17E-06	7.54E-06	7.54E-06	1.40E-05
Cs-137	6.78E-01	6.78E-01	1.01E+00	6.88E-03	6.87E-03	1.49E-02	1.95E-02	1.95E-02	3.49E-02	1.59E-01	1.59E-01	3.17E-01
I-129	3.64E-03	3.64E-03	6.15E-03	1.96E-01	9.30E-01	3.55E+00	7.12E-02	2.25E-01	1.13E+00	3.16E+00	2.51E+01	1.04E+02
Np-237	2.15E-01	2.15E-01	3.28E-01	9.30E-03	3.48E-02	1.17E-01	4.68E-02	9.41E-02	2.92E-01	1.11E+00	2.64E+00	1.04E+01
Pu-238	5.98E-03	5.98E-03	1.13E-02	3.12E-03	3.13E-03	8.18E-03	1.06E-03	1.06E-03	1.61E-03	5.71E-02	5.71E-02	1.56E-01
Pu-239	6.56E-03	6.56E-03	1.24E-02	3.55E-03	3.67E-03	9.05E-03	2.54E-03	2.54E-03	3.87E-03	1.37E-01	1.37E-01	3.73E-01
Pu-240	5.93E-03	5.92E-03	1.09E-02	5.49E-03	5.49E-03	1.42E-02	2.40E-03	2.41E-03	3.71E-03	1.35E-01	1.35E-01	3.71E-01
Sr-90	9.15E-03	9.15E-03	1.38E-02	1.70E-03	1.86E-03	3.99E-03	1.35E-02	1.35E-02	4.75E-02	4.17E-01	4.17E-01	1.44E+00
Tc-99	3.21E-05	3.21E-05	5.18E-05	1.06E-03	2.59E-03	7.06E-03	9.62E-04	2.56E-03	1.07E-02	5.41E-02	5.68E-02	2.54E-01
U-234	2.54E-01	2.65E-01	6.64E-01	2.57E-02	2.89E-02	5.76E-02	8.93E-03	1.00E-02	2.10E-02	8.09E-01	8.57E-01	1.75E+00
U-235	1.52E-01	1.61E-01	2.65E-01	7.81E-03	8.70E-03	1.88E-02	2.51E-02	2.65E-02	3.58E-02	2.44E-01	3.31E-01	6.49E-01
U-238	3.44E-02	3.45E-02	5.17E-02	1.16E-03	1.64E-03	3.93E-03	7.67E-03	7.90E-03	1.31E-02	8.94E-02	1.28E-01	2.47E-01

3.2 DETERMINISTIC ANALYSIS

Details on the parameters selected for the deterministic analysis are presented in Appendix B. Table B.1 lists all input parameter values used in the deterministic dose analysis for different scenarios. Some of the parameters used in the analysis were radionuclide/element-specific (e.g., Kd values, transfer factors) and required multiple values because the analysis was conducted for multiple radionuclides. The parameter values used for these radionuclide- and element-specific analyses are listed in separate tables.

Parameter values for Kd, plant transfer factors, meat transfer factors, and milk transfer factors are listed in Table B.2. Parameter values for fish and crustacean transfer factors are listed in Table B.3. The RESRAD-OFFSITE code requires many more parameters than the RESRAD (onsite) code; the additional input parameters for the RESRAD-OFFSITE analysis are listed in Table B.4.

Tables 19–23 appear at the end of this section (Section 3.2). Table 19 lists the calculated maximum DSRs (mrem/yr per pCi/g) for different exposure pathways for the industrial use scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For Co-60, Cs-137, Np-237, Sr-90, U-235, and U-238, external exposure was the dominant exposure pathway. For Am-241, the external exposure, inhalation, and soil ingestion pathways contributed to the dose. For C-14, only inhalation was the dominant exposure pathway. For I-129 and Tc-99, soil ingestion and external exposure were the dominant exposure pathways. For Pu-238, Pu-239, and Pu-240, inhalation and soil ingestion were the two dominant exposure pathways. For U-234, radon inhalation at later time contributed significantly to the dose. For most radionuclides, the maximum DSR would occur immediately following remedial action. For U-234, the maximum DSR would occur at a later time as a result of the buildup of progeny. To check if the peak dose would occur after 1,000 years, the time frame for the analysis was extended to 10,000 years. Table 19 also lists the time of maximum DSR for each radionuclide.

Table 20 lists the calculated maximum DSRs for different exposure pathways for the offsite resident scenario. RESRAD-OFFSITE Version 2.6 was used for this analysis. For most radionuclides, WD pathways were dominant. For Am-241, Np-237, Pu-238, Pu-239, and Pu-240, fish and plant ingestion were dominant exposure pathways. For C-14, aquatic food ingestion resulted in the most dose. For Co-60, the external exposure pathway was dominant. For Cs-137, fish, meat, and milk ingestion resulted in the most dose. For I-129, milk ingestion resulted in the most dose. For Sr-90, U-234, U-235, and U-238, fish, meat, milk, and plant ingestion resulted in the most dose. For Tc-99, plant, fish, and milk ingestion resulted in the most dose. To check if the peak dose would occur after 1,000 years, the time frame for the analysis was extended to 10,000 years. Table 20 also lists the time of maximum DSR for each radionuclide.

Table 21 lists the maximum DSRs for different exposure pathways for the recreational use scenario. RESRAD (onsite) Version 6.5 was used in the analysis. The calculations were done for the time after the institutional control period of 100 years. Maximum DSRs would occur at 100 years (immediately after the institutional control period) for all radionuclides except U-234 and U-235. For U-234 and U-235, the maximum DSRs occur at later time as a result of the buildup of progeny. For C-14, I-129, and Tc-99, the maximum dose is from WD pathways

(such as ingestion of food irrigated by contaminated water, water ingestion, and fish ingestion). To check if the peak dose would occur after 1,000 years, the time frame for the analysis was extended to 10,000 years. Table 21 also lists the time of maximum DSR for each radionuclide.

Table 22 lists the maximum DSRs for different exposure pathways for the onsite resident scenario. RESRAD (onsite) Version 6.5 was used in the analysis. The calculations were done for the time after the institutional control period of 100 years. Maximum DSRs occur at 100 years (immediately after the institutional control period) for all radionuclides except Np-237, U-234, and U-235. For C-14, I-129, Np-237, and Tc-99, the maximum dose is from WD pathways (such as ingestion of food irrigated by contaminated water, water ingestion, and fish ingestion). To check if the peak dose would occur after 1,000 years, the time frame for the analysis was extended to 10,000 years. Table 22 also lists the time of maximum DSR for each radionuclide.

Table 23 shows the peak DSR of each radionuclide in different scenarios. These values were used in deriving DCGL values. The scenario that results in the most dose for an individual radionuclide is highlighted.

TABLE 19 Maximum DSRs for the Industrial (Current Use) Scenario for the Building 310 Area

Nuclide	Maximum DSR ^a (mrem/yr)/(pCi/g) for the Industrial Use Scenario				Time of Maximum DSR (yr)
	External Exposure	Inhalation	Radon	Ingestion of Soil	
Am-241	8.23E-03	6.60E-03	0.00E+00	6.16E-03	0.00E+00
C-14	3.66E-07	1.78E-05	0.00E+00	2.65E-06	0.00E+00
Co-60	3.10E+00	2.00E-06	0.00E+00	9.84E-05	0.00E+00
Cs-137	6.76E-01	2.65E-06	0.00E+00	3.96E-04	0.00E+00
I-129	2.05E-03	6.21E-06	0.00E+00	3.19E-03	0.00E+00
Np-237	2.19E-01	3.44E-03	0.00E+00	3.41E-03	0.00E+00
Pu-238	2.62E-05	7.54E-03	2.35E-13	7.06E-03	0.00E+00
Pu-239	5.74E-05	8.26E-03	0.00E+00	7.71E-03	0.00E+00
Pu-240	2.54E-05	8.26E-03	3.88E-24	7.71E-03	0.00E+00
Sr-90	8.69E-03	1.10E-05	0.00E+00	9.38E-04	0.00E+00
Tc-99	2.23E-05	8.41E-07	0.00E+00	1.86E-05	0.00E+00
U-234 ^{b,c}	2.79E-02	2.63E-04	4.30E-01	2.34E-03	4.39E+03
U-235	1.50E-01	5.86E-04	0.00E+00	1.46E-03	0.00E+00
U-238	3.35E-02	5.51E-04	2.72E-19	1.50E-03	0.00E+00

- ^a All values are reported to three significant figures. The maximum DSR occurs at time zero (immediately following remedial action) for all radionuclides except U-234.
- ^b The maximum DSR occurs at a later time as a result of the buildup of progeny.
- ^c For U-234, it is assumed that the worker spends all the time indoors in the contaminated area.

TABLE 20 Maximum DSRs for the Offsite Resident (Current Use) Scenario for the Building 310 Area

Nuclide	Maximum DSR ^a (mrem/yr)/(pCi/g) for Offsite Resident Scenario								Time of Maximum DSR (yr)
	External Exposure	Inhalation	Radon	Plant Ingestion	Meat Ingestion	Milk Ingestion	Soil Ingestion	Fish Ingestion	
Am-241	1.09E-06	6.57E-06	0.00E+00	1.32E-03	1.05E-05	1.56E-06	9.18E-07	6.69E-03	5.86
C-14	3.98E-10	0.00E+00	0.00E+00	8.02E-05	4.52E-05	4.57E-05	3.54E-09	3.38E-02	152
Co-60 ^b	7.12E-04	1.76E-09	0.00E+00	1.55E-05	4.73E-05	1.81E-05	1.74E-09	1.31E-04	0.98
Cs-137	2.20E-04	2.43E-09	0.00E+00	8.76E-05	4.07E-04	4.00E-04	3.74E-08	4.39E-03	3.91
I-129	1.11E-05	1.05E-14	0.00E+00	1.58E-01	1.76E-01	9.29E-01	2.12E-05	1.66E-01	91.8
Np-237	1.45E-03	6.02E-09	0.00E+00	4.88E-03	6.78E-04	1.21E-05	2.40E-05	9.56E-03	3368
Pu-238	2.79E-09	7.29E-06	1.99E-15	1.53E-03	2.44E-05	9.05E-07	8.70E-07	1.84E-03	4.88
Pu-239	1.10E-06	7.75E-06	0.00E+00	1.87E-03	3.66E-05	1.10E-06	1.74E-04	1.92E-03	1118
Pu-240	5.10E-09	8.29E-06	1.57E-20	1.74E-03	2.78E-05	1.03E-06	1.65E-06	2.10E-03	7.81
Sr-90	2.89E-06	9.73E-09	0.00E+00	2.74E-04	2.82E-04	2.43E-04	1.11E-07	3.94E-04	4.88
Tc-99	1.44E-07	2.02E-14	0.00E+00	2.70E-03	2.49E-05	7.19E-04	1.43E-07	5.74E-04	75.2
U-234	2.78E-03	4.75E-07	5.42E-05	2.28E-03	5.43E-04	3.56E-04	1.39E-04	3.68E-02	5404
U-235	4.00E-03	3.53E-06	0.00E+00	2.24E-03	5.78E-04	9.60E-05	2.22E-04	3.36E-03	5185
U-238	7.64E-04	4.29E-07	9.66E-08	3.92E-04	2.28E-05	1.15E-04	3.65E-05	1.6E-04	2553

^a All values are reported to three significant figures.

^b For Co-60, the dose is from both WI and WD pathways.

TABLE 21 Maximum DSRs for the Recreational (Likely Future Land Use) Scenario for the Building 310 Area

Nuclide	Maximum DSR ^a (mrem/yr)/(pCi/g) for Recreational Use Scenario							Time of Maximum DSR (yr)
	External Exposure	Inhalation	Radon	Water Ingestion	Meat Ingestion	Soil Ingestion	Fish Ingestion	
Am-241	1.18E-03	1.16E-03	0.00E+00	0.00E+00	3.05E-04	8.81E-04	0.00E+00	1.00E+02
C-14 ^b	0.00E+00	0.00E+00	0.00E+00	4.24E-17	7.52E-16	0.00E+00	6.58E-13	1.00E+02
Co-60	9.84E-07	7.81E-13	0.00E+00	0.00E+00	1.14E-08	3.12E-11	0.00E+00	1.00E+02
Cs-137	1.12E-02	5.38E-08	0.00E+00	0.00E+00	2.46E-03	6.55E-06	0.00E+00	1.00E+02
I-129 ^b	2.37E-10	8.83E-13	0.00E+00	8.14E-04	9.50E-05	3.69E-10	1.01E-02	1.00E+02
Np-237	2.72E-02	5.26E-04	0.00E+00	0.00E+00	4.11E-03	4.25E-04	0.00E+00	1.00E+02
Pu-238	2.00E-06	7.05E-04	1.50E-13	0.00E+00	3.72E-04	5.38E-04	0.00E+00	1.00E+02
Pu-239	9.59E-06	1.70E-03	0.00E+00	0.00E+00	8.92E-04	1.29E-03	0.00E+00	1.00E+02
Pu-240	4.21E-06	1.68E-03	7.77E-18	0.00E+00	8.85E-04	1.28E-03	0.00E+00	1.00E+02
Sr-90	1.16E-04	1.80E-07	0.00E+00	0.00E+00	5.02E-03	1.26E-05	0.00E+00	1.00E+02
Tc-99 ^b	2.58E-12	1.20E-13	0.00E+00	3.05E-06	5.70E-09	2.15E-12	1.90E-05	1.00E+02
U-234	7.28E-03	1.29E-04	4.04E-07	0.00E+00	3.14E-03	4.10E-04	0.00E+00	5.15E+03
U-235	2.09E-02	6.97E-04	0.00E+00	0.00E+00	8.85E-03	7.68E-04	0.00E+00	4.39E+03
U-238	5.58E-03	1.13E-04	1.81E-13	0.00E+00	6.05E-04	2.49E-04	0.00E+00	1.00E+02

^a All values are reported to three significant figures. The maximum DSR occurs at 100 years (immediately after the institutional control period) for all radionuclides except U-234 and U-235.

^b For C-14, I-129, and Tc-99, the maximum dose is from WD pathways (such as ingestion of food irrigated by contaminated water, water ingestion, and fish ingestion).

TABLE 22 Maximum DSRs for the Onsite Resident (Unlikely Future Land Use) Scenario for the Building 310 Area

Nuclide	Maximum DSR ^a (mrem/yr)/(pCi/g) for Onsite Resident Scenario									Time of Maximum DSR (yr)
	External Exposure	Inhalation	Radon	Water Ingestion	Plant Ingestion	Meat Ingestion	Milk Ingestion	Soil Ingestion	Fish Ingestion	
Am-241	1.72E-02	6.46E-03	0.00E+00	0.00E+00	5.47E-02	5.63E-04	3.21E-05	1.76E-02	0.00E+00	1.00E+02
C-14 ^b	0.00E+00	0.00E+00	0.00E+00	4.63E-14	6.49E-15	3.98E-15	6.24E-15	0.00E+00	3.45E-13	1.00E+02
Co-60	1.44E-05	4.35E-12	0.00E+00	0.00E+00	1.55E-07	8.34E-08	1.00E-08	6.23E-10	0.00E+00	1.00E+02
Cs-137	1.64E-01	3.00E-07	0.00E+00	0.00E+00	1.63E-02	1.42E-02	4.65E-03	1.31E-04	0.00E+00	1.00E+02
I-129 ^b	3.47E-09	4.92E-12	0.00E+00	8.71E-01	3.38E-02	4.28E-02	1.66E-01	7.37E-09	4.59E-03	1.00E+02
Np-237 ^{b,c}	2.61E-04	6.77E-06	0.00E+00	1.47E+00	5.76E-02	1.05E-02	1.42E-04	2.42E-03	1.83E-02	3.16E+03
Pu-238	2.92E-05	3.93E-03	1.75E-07	0.00E+00	3.34E-02	6.87E-04	1.04E-05	1.07E-02	0.00E+00	1.00E+02
Pu-239	1.40E-04	9.45E-03	0.00E+00	0.00E+00	8.00E-02	1.65E-03	2.35E-05	2.57E-02	0.00E+00	1.00E+02
Pu-240	6.15E-05	9.37E-03	1.15E-15	0.00E+00	7.94E-02	1.63E-03	2.33E-05	2.55E-02	0.00E+00	1.00E+02
Sr-90	1.70E-03	1.01E-06	0.00E+00	0.00E+00	2.34E-01	4.72E-02	1.40E-02	2.51E-04	0.00E+00	1.00E+02
Tc-99 ^b	3.78E-11	6.66E-13	0.00E+00	3.26E-03	2.89E-04	2.48E-06	6.42E-05	4.29E-11	8.77E-06	1.00E+02
U-234 ^c	9.42E-02	7.22E-04	1.25E+00	0.00E+00	4.20E-02	8.15E-03	3.68E-03	7.50E-03	0.00E+00	4.34E+03
U-235 ^c	3.40E-01	2.42E-03	0.00E+00	0.00E+00	1.07E-01	1.53E-02	2.51E-03	1.06E-02	0.00E+00	1.89E+03
U-238	8.16E-02	6.28E-04	2.11E-07	0.00E+00	3.87E-02	1.28E-03	3.13E-03	4.98E-03	0.00E+00	1.00E+02

- ^a All values are reported to three significant figures. The maximum DSR occurs at 100 years (immediately after the institutional control period) for all radionuclides.
- ^b For C-14, I-129, Np-237, and Tc-99, the maximum dose is from WD pathways (such as food ingestion irrigated by contaminated water, water ingestion, and fish ingestion).
- ^c The maximum dose occurs at later time as a result of the buildup of progeny.

TABLE 23 Total Peak DSRs for Different Scenarios for the Building 310 Area

Total Peak DSR ^a (mrem/yr)/(pCi/g) for Different Scenarios				
Nuclide	Industrial Use ^b	Offsite Resident ^b	Onsite Resident ^c	Recreational Use ^d
Am-241	2.10E-02	8.03E-03	9.66E-02	3.52E-03
C-14	2.08E-05	3.40E-02	4.08E-13	6.59E-13
Co-60	3.10E+00	9.25E-04	1.46E-05	9.95E-07
Cs-137	6.77E-01	5.51E-03	1.99E-01	1.37E-02
I-129	5.24E-03	1.43E+00	1.12E+00	1.10E-02
Np-237	2.25E-01	1.66E-02	1.56E+00	3.23E-02
Pu-238	1.46E-02	3.41E-03	4.88E-02	1.62E-03
Pu-239	1.60E-02	4.02E-03	1.17E-01	3.89E-03
Pu-240	1.60E-02	3.89E-03	1.16E-01	3.85E-03
Sr-90	9.63E-03	1.20E-03	2.97E-01	5.14E-03
Tc-99	4.17E-05	4.02E-03	3.63E-03	2.21E-05
U-234	4.60E-01	4.29E-02	1.41E+00	1.10E-02
U-235	1.53E-01	1.04E-02	4.78E-01	3.12E-02
U-238	3.56E-02	1.50E-03	1.30E-01	6.54E-03

^a All values are reported to three significant figures.

^b Current use scenario.

^c Future unlikely use scenario.

^d Future likely use scenario.

4 DERIVED CONCENTRATION GUIDELINE LEVELS

The DCGL is the concentration of residual radioactive material that can remain in the decontaminated area and still allow use of the area without radiological restrictions. Given a dose limit of H_{EL} for an individual, the DCGL for an individual radionuclide (i) can be calculated as

$$DCGL_i \text{ (pCi/g)} = H_{EL} \text{ (mrem/yr)} / DSR_i \text{ (mrem/yr per pCi/g)}$$

where DSR_i is the total dose-to-source concentration ratio. The total DSRs for probabilistic analysis at the peak of the means, mean of the peaks, and the 95th percentile of the peaks are listed in Table 18; for deterministic analysis, they are listed in Table 23 for different scenarios. The dose limit, H_{EL} , used in calculating DCGLs is 25 mrem/yr.

4.1 DCGLS BASED ON PROBABILISTIC ANALYSIS

Table 24 shows the DCGLs derived from different scenarios at the mean and 95th percentile of the peak DSRs based on a 25-mrem/yr dose. For some radionuclides, the current land use scenarios (industrial worker or offsite resident scenarios) resulted in the most restrictive DCGLs, and for others, the future land use (onsite resident) scenario resulted in the most restrictive DCGLs. The most restrictive DCGLs are highlighted in Table 24 and listed in the last column under the heading “Most Restrictive” for peak of the means, mean of the peaks, and 95th percentile of the peak DSRs.

4.2 DCGLS BASED ON DETERMINISTIC ANALYSIS

Table 25 shows the DCGLs derived from a deterministic analysis of different scenarios based on a 25-mrem/yr dose limit. For some radionuclides, the current land use scenarios (industrial worker or offsite resident scenarios) resulted in the most restrictive DCGLs, and for others, the future land use (onsite resident) scenario resulted in the most restrictive DCGLs. The most restrictive DCGL is highlighted in Table 25 and listed in the last column under the heading “Most Restrictive.”

4.3 SUMMARY DCGLS FOR BUILDING 310 AREA

Table 26 compares the DCGLs derived from a probabilistic analysis at peak of the means, mean of the peaks, 95th percentile of the peak DSRs and the DCGLs derived from deterministic analysis for Building 310 area at Argonne. Also listed in the last column of Table 26 are the proposed DCGLs for the 14 radionuclides analyzed. These proposed DCGLs are selected by considering the results from probabilistic and deterministic analyses and the DCGLs used for other Argonne sites (Kamboj and Yu 2011). The proposed DCGLs are reported to two significant figures.

TABLE 24 DCGLs (pCi/g) from Using Probabilistic Analysis at a 25-mrem/yr Dose Limit for the Building 310 Area

Nuclide	Industrial Use			Offsite Resident			Recreational Use			Onsite Resident			Most Restrictive		
	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks	Peak of the Means	Mean of the Peaks	95th % of the Peaks
Am-241	1.85E+03	1.85E+03	1.14E+03	3.64E+04	3.58E+03	2.10E+03	1.04E+04	1.04E+04	8.20E+03	2.38E+02	2.38E+02	9.33E+01	2.38E+02	2.38E+02	9.33E+01
C-14	1.19E+06	1.19E+06	6.70E+05	1.67E+03	4.20E+02	1.10E+02	1.58E+03	5.42E+02	1.00E+02	7.06E+03	7.44E+03	2.38E+03	1.58E+03	4.20E+02	1.00E+02
Co-60	8.04E+00	8.04E+00	5.39E+00	3.12E+04	3.05E+04	2.77E+04	2.59E+07	2.59E+07	2.14E+07	3.32E+06	3.32E+06	1.79E+06	8.04E+00	8.04E+00	5.39E+00
Cs-137	3.69E+01	3.69E+01	2.48E+01	3.63E+03	3.64E+03	1.68E+03	1.28E+03	1.28E+03	7.16E+02	1.57E+02	1.57E+02	7.89E+01	3.69E+01	3.69E+01	2.48E+01
I-129	6.87E+03	6.87E+03	4.07E+03	1.28E+02	2.69E+01	7.04E+00	3.51E+02	1.11E+02	2.21E+01	7.91E+00	9.96E-01	2.40E-01	7.91E+00	9.96E-01	2.40E-01
Np-237	1.16E+02	1.16E+02	7.62E+01	2.69E+03	7.18E+02	2.14E+02	5.34E+02	2.66E+02	8.56E+01	2.25E+01	9.47E+00	2.40E+00	2.25E+01	9.47E+00	2.40E+00
Pu-238	4.18E+03	4.18E+03	2.21E+03	8.01E+03	7.99E+03	3.06E+03	2.36E+04	2.36E+04	1.55E+04	4.38E+02	4.38E+02	1.60E+02	4.38E+02	4.38E+02	1.60E+02
Pu-239	3.81E+03	3.81E+03	2.02E+03	7.04E+03	6.81E+03	2.76E+03	9.84E+03	9.84E+03	6.46E+03	1.82E+02	1.82E+02	6.70E+01	1.82E+02	1.82E+02	6.70E+01
Pu-240	4.22E+03	4.22E+03	2.29E+03	4.55E+03	4.55E+03	1.76E+03	1.04E+04	1.04E+04	6.74E+03	1.85E+02	1.85E+02	6.74E+01	1.85E+02	1.85E+02	6.74E+01
Sr-90	2.73E+03	2.73E+03	1.81E+03	1.47E+04	1.34E+04	6.27E+03	1.85E+03	1.85E+03	5.26E+02	6.00E+01	6.00E+01	1.74E+01	6.00E+01	6.00E+01	1.74E+01
Tc-99	7.79E+05	7.79E+05	4.83E+05	2.36E+04	9.65E+03	3.54E+03	2.60E+04	9.77E+03	2.34E+03	4.62E+02	4.40E+02	9.84E+01	4.62E+02	4.40E+02	9.84E+01
U-234	9.84E+01	9.43E+01	3.77E+01	9.73E+02	8.65E+02	4.34E+02	2.80E+03	2.50E+03	1.19E+03	3.09E+01	2.92E+01	1.43E+01	3.09E+01	2.92E+01	1.43E+01
U-235	1.64E+02	1.55E+02	9.43E+01	3.20E+03	2.87E+03	1.33E+03	9.96E+02	9.43E+02	6.98E+02	1.02E+02	7.55E+01	3.85E+01	1.02E+02	7.55E+01	3.85E+01
U-238	7.27E+02	7.25E+02	4.84E+02	2.16E+04	1.52E+04	6.36E+03	3.26E+03	3.16E+03	1.91E+03	2.80E+02	1.95E+02	1.01E+02	2.80E+02	1.95E+02	1.01E+02

TABLE 25 DCGLs from Using Deterministic Analysis at a 25-mrem/yr Dose Limit for the Building 310 Area

DCGLs (pCi/g) from Deterministic Analysis at the 25-mrem/yr Dose Limit from Different Scenarios					
Nuclide	Current Use		Future Use		
	Industrial	Offsite Resident	Onsite Resident	Recreational	Most Restrictive
Am-241	1.19E+03	3.11E+03	2.59E+02	7.10E+03	2.59E+02
C-14	1.20E+06	7.36E+02	NA ^a	NA ^a	7.36E+02
Co-60	8.07E+00	2.70E+04	1.71E+06	2.51E+07	8.07E+00
Cs-137	3.70E+01	4.54E+03	1.26E+02	1.83E+03	3.70E+01
I-129	4.77E+03	1.75E+01	2.24E+01	2.28E+03	1.75E+01
Np-237	1.11E+02	1.51E+03	1.60E+01	7.75E+02	1.60E+01
Pu-238	1.71E+03	7.33E+03	5.13E+02	1.55E+04	5.13E+02
Pu-239	1.56E+03	6.23E+03	2.14E+02	6.44E+03	2.14E+02
Pu-240	1.56E+03	6.43E+03	2.16E+02	6.49E+03	2.16E+02
Sr-90	2.60E+03	2.09E+04	8.42E+01	4.86E+03	8.42E+01
Tc-99	5.99E+05	6.22E+03	6.89E+03	1.13E+06	6.22E+03
U-234	5.43E+01	5.83E+02	1.78E+01	2.28E+03	1.78E+01
U-235	1.64E+02	2.40E+03	5.23E+01	8.01E+02	5.23E+01
U-238	7.03E+02	1.67E+04	1.92E+02	3.82E+03	1.92E+02

^a DCGLs at specific activity limit.

TABLE 26 Summary of DCGLs for the Building 310 Area

Probabilistic DCGLs (pCi/g)					
Nuclide	At 95th	At Mean of the	At Peak of the	Deterministic	Proposed ^a
	Percentile of the				
Am-241	9.33E+01	2.38E+02	2.38E+02	2.59E+02	2.4E+02
C-14	1.00E+02	4.20E+02	1.58E+03	7.36E+02	5.4E+02
Co-60	5.39E+00	8.04E+00	8.04E+00	8.07E+00	8.0E+00
Cs-137	2.48E+01	3.69E+01	3.69E+01	3.70E+01	3.6E+01
I-129	2.40E-01	9.96E-01	7.91E+00	1.75E+01	7.9E+00
Np-237	2.40E+00	9.47E+00	2.25E+01	1.60E+01	1.6E+01
Pu-238	1.60E+02	4.38E+02	4.38E+02	5.13E+02	4.3E+02
Pu-239	6.70E+01	1.82E+02	1.82E+02	2.14E+02	1.8E+02
Pu-240	6.74E+01	1.85E+02	1.85E+02	2.16E+02	1.8E+02
Sr-90	1.74E+01	6.00E+01	6.00E+01	8.42E+01	6.0E+01
Tc-99	9.84E+01	4.40E+02	4.62E+02	6.22E+03	4.6E+02
U-234	1.43E+01	2.92E+01	3.09E+01	1.78E+01	1.7E+01
U-235	3.85E+01	7.55E+01	1.02E+02	5.23E+01	5.2E+01
U-238	1.01E+02	1.95E+02	2.80E+02	1.92E+02	1.9E+02

^a The proposed DCGLs are rounded to two significant figures.

The DCGLs listed in Table 26 are for a large, homogeneously contaminated area. When implementing the DCGLs for decontamination of a site, the sum of fractions rule applies, as follows: The sum of the radionuclide concentrations S_i remaining onsite for radionuclides i divided by their $DCGL_i$ should not be greater than unity; that is,

$$\sum_i S_i / DCGL_i \leq 1 .$$

5 REFERENCES

Kamboj, S., and C. Yu, 2011, *Derived Concentration Guideline Levels for Argonne National Laboratory's Building 330 Area*, ANL/EVS/TM/11-1, Argonne National Laboratory, Argonne, Ill.

NRC (U.S. Nuclear Regulatory Commission), 2000, *Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes*, NUREG/CR-6697 and ANL/EAD/TM-98, prepared by C. Yu et al., Argonne National Laboratory, Argonne, Ill., for NRC, Washington, D.C., Nov.

Patton, T.L., R.H. Pearl, and S.Y. Tsai, 1990, *Hydrological Conditions at the 800 Area at Argonne National Laboratory*, ANL/EAIS/TM-29, Argonne National Laboratory, Argonne, Ill., Aug.

Yu, C., et al., 2001, *User's Manual for RESRAD Version 6*, ANL/EAD-4, Argonne National Laboratory, Argonne, Ill.

Yu, C., et al., 2007, *User's Manual for RESRAD-OFFSITE Version 2*, ANL/EVS/TM/07-1, Argonne National Laboratory, Argonne, Ill.

APPENDIX A:

PARAMETERS USED FOR PROBABILISTIC ANALYSIS

Tables A.1–A.10 list all input parameter distributions or parameter values used in the probabilistic dose analysis for different exposure scenarios.

TABLE A.1 Parameter Values and Distributions Used in the Probabilistic Analysis of Different Scenarios^a

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Title					
Title	Scenario dependent	Scenario dependent	Scenario dependent	Scenario dependent	Scenario definition
Dose factor library	ICRP-60	ICRP-60	ICRP-60	ICRP-60	Dose conversion factors (DCFs) based on ICRP-60 (ICRP 1991) methodology (external from FGR-12 [Eckerman and Ryman 1993] and internal from ICRP-72 [ICRP 1996])
Cut-off half-life (180 d or 30 d)	30 d	30 d	30 d	30 d	RESRAD default
Number of points (32, 64, 128, 256, 512, 1,024)	32	32	32	32	RESRAD default
Linear spacing/log spacing	Log spacing	Log spacing	Log spacing	Log spacing	RESRAD default
Maximum no. of points for dose	17	17	17	17	RESRAD default
Maximum no. of points for risk	1	1	1	1	Using a smaller integration point will shorten the calculation time
Use line draw character (yes/no)	Yes	Yes	Yes	Yes	RESRAD default
Find peak pathway dose (yes/no)	Yes	Yes	Yes	Yes	
Save all files after each run (yes/no)	Yes	Yes	Yes	Yes	
Time integrated probabilistic risk (yes/no)	No	No	No	No	Dose-to-source ratio (DSR) is calculated
Calculation Parameters					
Basic radiation dose limit (mrem/yr)	25	25	25	25	Not used in DSR calculation
Times for calculation (yr)	1, 3, 10, 30, 100, 300, 1,000	1, 3, 10, 30, 100, 300, 1,000	100, 300, 1,000	100, 300, 1,000	Up to the time horizon for dose calculation
Source					
Nuclide concentration (pCi/g)	1	1	1	1	DSRs calculated
Transport Factors					
Distribution coefficient for all zones (cm ³ /g)	Tables A.2 and A.3	Tables A.2 and A.3	Tables A.2 and A.3	Tables A.2 and A.3	Distribution from Sheppard and Thibault (1990)
Number of unsaturated zones	1	1	1	1	RESRAD default
Time since placement of material (yr)	0	0	0	0	RESRAD default
Groundwater concentration (pCi/L)	0	0	0	0	RESRAD default
Leach rate (1/yr)	0	0	0	0	RESRAD default

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Solubility limit (mol/L)	0	0	0	0	RESRAD default
Use plant/soil ration (check box)	No	No	No	No	RESRAD default
Transfer Factors					
Plant transfer factor (wet-plant weight concentration, pCi/g/dry soil weight concentration, pCi/g)	NR ^d	Table A.4	Table A.4	NR	Distribution from NUREG/CR-6697 (NRC 2000)
Meat transfer factor (concentration in meat, pCi/g/rate of intake, pCi/d)	NR	Table A.5	Table A.5	Table A.5	Distribution from NUREG/CR-6697 (NRC 2000)
Milk transfer factor (concentration in milk, pCi/L/rate of intake, pCi/d)	NR	Table A.6	Table A.6	NR	Distribution from NUREG/CR-6697 (NRC 2000)
Fish transfer factor (concentration in fish, pCi/kg/concentration in water, pCi/L)	NR	Table A.7	Table A.7	Table A.7	Distribution from NUREG/CR-6697 (NRC 2000)
Crustacea transfer factor (concentration in crustacea, pCi/kg/concentration in water, pCi/L)	NR	Table A.7	Table A.7	Table A.7	RESRAD default
Contaminated Zone Parameters					
Area of contaminated zone (m ²)	10,000	10,000	10,000	10,000	Kamboj 2011; Matton 2011
Thickness of contaminated zone (m)	1	1	1	1	Kamboj 2011; Matton 2011
Length parallel to aquifer flow (m)	100	100	100	100	RESRAD default
Does the initial contamination penetrate the water table?	No	No	No	No	RESRAD default
Cover and Contaminated Zone Hydrological Data					
Cover depth (m)	0	0	0	0	No cover layer assumed
Density of cover material (g/cm ³)	NR	NR	NR	NR	Not required when cover depth equals zero
1. Cover erosion rate (m/yr)	NR	NR	NR	NR	Not required when cover depth equals zero

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Density of primary contaminated zone (g/cm ³)	TN ^{e,f} (1.696, 0.1855, 0.001, 0.999)	TN ^{e,f} (1.696, 0.1855, 0.001, 0.999)	TN ^{e,f} (1.696, 0.1855, 0.001, 0.999)	TN ^{e,f} (1.696, 0.1855, 0.001, 0.999)	Site-specific soil type (silty clay – Golchert et al. 2010) distribution
Contaminated zone erosion rate (m/yr)	1.65E-4	1.65E-4 ^g	1.65E-4	1.65E-4	To match the soil erosion of 1 ton/acre/yr in Illinois (NRCS 2010)
Contaminated zone total porosity	TN ^f (0.36, 0.07, 0.001, 0.999)	TN ^f (0.36, 0.07, 0.001, 0.999)	TN ^f (0.36, 0.07, 0.001, 0.999)	TN ^f (0.36, 0.07, 0.001, 0.999)	Site-specific soil type (silty clay – Golchert et al. 2010) distribution
Contaminated zone field capacity	0.2	0.2	0.2	0.2	RESRAD default
Contaminated zone hydraulic conductivity (m/yr)	0.32	0.32	0.32	0.32	Site-specific (Quinn 2010)
Contaminated zone b parameter	TLN ^f (2.29, 0.259,0.001, 0.999)	TLN ^f (2.29, 0.259,0.001, 0.999)	TLN ^f (2.29, 0.259,0.001, 0.999)	TLN ^f (2.29, 0.259,0.001, 0.999)	Site-specific soil type (silty clay – Golchert et al. 2010) distribution
Humidity in air (g/m ³)	8	8	8	8	Used only for H-3
Evapotranspiration coefficient	U(0.5, 0.75)	U(0.5, 0.75)	U(0.5, 0.75)	U(0.5, 0.75)	Distribution from NUREG/CR-6697 (NRC 2000)
Wind speed (m/s)	4.6	NR	4.6	4.6	Site-specific value for Chicago (NCDC 2010)
Precipitation rate (m/yr)	0.9177	0.9177	0.9177	0.9177	Site-specific value from Golchert et al. 2010
Irrigation rate (m/yr)	0.0	0.1	0.1	0.0	Site-specific (Argonne 1996)
Irrigation mode (overhead/ditch)	NR	NR	Overhead	NR	RESRAD default
Runoff coefficient	0.2	0.2	0.2	0.2	Site-specific for woodland (Yu et al. 2001, page E-7)
Watershed area for nearby stream or pond (m ²)	1,000,000	NR	1,000,000	1,000,000	RESRAD default
Accuracy for water/soil computation	0.001	NR	0.001	0.001	RESRAD default
Saturated Zone Hydrological Data					
Density of saturated zone (g/cm ³)	NR	TN(1.52, 0.230, 0.001, 0.999)	TN(1.52, 0.230, 0.001, 0.999)	TN(1.52, 0.230, 0.001, 0.999)	Generic soil type distribution
Saturated zone effective porosity	NR	TN(0.355, 0.0906, 0.001, 0.999)	TN(0.355, 0.0906, 0.001, 0.999)	TN(0.355, 0.0906, 0.001, 0.999)	Generic soil type distribution
Saturated zone total porosity	NR	TN(0.425, 0.0867, 0.001, 0.999)	TN(0.425, 0.0867, 0.001, 0.999)	TN(0.425, 0.0867, 0.001, 0.999)	Generic soil type distribution

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Saturated zone field capacity	NR	0.2	0.2	0.2	RESRAD default
Saturated zone hydraulic conductivity (m/yr)	NR	947	947	947	Site-specific (Argonne 1996)
Saturated zone b parameter	NR	NR	BLN(1.06, 0.66, 0.5, 30)	BLN(1.06, 0.66, 0.5, 30)	Generic soil type distribution
Saturated zone hydraulic gradient	NR	U(0.007, 0.023)	U(0.007, 0.023)	U(0.007, 0.023)	Site-specific (Patton et al. 1990)
Water table drop rate (m/yr)	NR	NR	0.001	0.001	RESRAD default
Well pump intake depth (m below water table)	NR	NR	5	5	Site-specific
Model for water transportation (nondispersion/mass-balance)	NR	NR	Nondispersion	Nondispersion	RESRAD default
Well pumping rate (m ³ /yr)	NR	NR	250	250	RESRAD default
Unsaturated zone parameters					
Thickness of unsaturated zone (m)	NR	13.9	13.9	13.9	Site-specific (48 ft – 1 m) (Quinn 2010)
Density of unsaturated zone (g/cm ³)	NR	TN ^f (1.696, 0.1855, 0.001, 0.999)	TN ^f (1.696, 0.1855, 0.001, 0.999)	TN ^f (1.696, 0.1855, 0.001, 0.999)	Site-specific soil type (silty clay) distribution
Unsaturated zone effective porosity	NR	TN ^f (0.289, 0.0735, 0.001, 0.999)	TN ^f (0.289, 0.0735, 0.001, 0.999)	TN ^f (0.289, 0.0735, 0.001, 0.999)	Site-specific soil type (silty clay) distribution
Unsaturated zone total porosity	NR	TN ^f (0.36, 0.07, 0.001, 0.999)	TN ^f (0.36, 0.07, 0.001, 0.999)	TN ^f (0.36, 0.07, 0.001, 0.999)	Site-specific soil type (silty clay) distribution
Unsaturated zone field capacity	NR	0.2	0.2	0.2	RESRAD default
Unsaturated zone hydraulic conductivity (m/yr)	NR	0.32	0.32	0.32	Site-specific (Quinn 2010)
Unsaturated zone b parameter	NR	TLN ^f (2.29, 0.259, 0.001, 0.999)	TLN ^f (2.29, 0.259, 0.001, 0.999)	TLN ^f (2.29, 0.259, 0.001, 0.999)	Site-specific soil type (silty clay) distribution
Occupancy, Inhalation, and External Gamma Parameters					
Inhalation rate (m ³ /yr)	11,400	8400	8400	14,000	Scenario-specific
Mass loading for inhalation (g/m ³)	Empirical	Empirical	Empirical	Empirical	NRC 2000
Exposure duration (yr)	25	30	30	30	Not used in DSR calculations
Indoor dust filtration factor	U(0.15, 0.95)	U(0.15, 0.95)	U(0.15, 0.95)	U(0.15, 0.95)	Distribution from NRC 2000
External gamma shielding factor	NR	BLN(-1.3, 0.59, 0.044, 1)	BLN(-1.3, 0.59, 0.044, 1)	NR	Distribution from NRC 2000

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Indoor time fraction	0/empirical	NR	0.6833	0	Scenario-specific (U.S. Environmental Protection Agency [EPA] Exposure Factors Handbook; for U-234 in the industrial scenario, empirical data for radon were used)
Outdoor time fraction	Empirical/0	NR	0.0833	0.0384	Scenario-specific (EPA exposure factor)
Shape of contaminated zone (circular/noncircular)	Circular	Circular	Circular	Circular	RESRAD default
Ingestion Pathway Dietary Data					
Fruit, vegetable and grain consumption (kg/yr)	NR	160	160	NR	Distribution from NRC 2000
Leafy vegetable consumption (kg/yr)	NR	14	14	NR	Distribution from NRC 2000
Milk consumption (L/yr)	NR	92	92	NR	Distribution from NRC 2000
Meat and poultry consumption (kg/yr)	NR	63	63	T(7.0, 19.0, 61)	Scenario-specific
Fish consumption (kg/yr)	NR	5.4	5.4	T(4.7, 12, 57)	Scenario-specific
Other sea food consumption (kg/yr)	NR	0.9	0.9	NR	RESRAD default
Soil ingestion (g/yr)	T(0, 18.3, 36.5)	T(0, 18.3, 36.5)	T(0, 18.3, 36.5)	T(0, 18.3, 36.5)	Distribution from NRC 2000
Drinking water intake (L/yr)	NR	510	510	1.4L/d ^g 14 = 19.6 L	Distribution from NRC 2000 and scenario-specific for recreation use
Drinking water contaminated fraction	NR	0	1	1	RESRAD default and for offsite receptor scenario, water is not contaminated
Household water contaminated fraction	1	1	1	NR	RESRAD default
Livestock water contaminated fraction	NR	1	1	1	RESRAD default
Irrigation water contaminated fraction	NR	1	1	1	RESRAD default
Aquatic food contaminated fraction	NR	0.5	0.5	0.5	Distribution from NRC 2000
Plant food contaminated fraction	NR	-1	-1	NR	Calculated by RESRAD from area factor
Meat contaminated fraction	NR	-1	-1	1	Scenario-specific
Milk contaminated fraction	NR	-1	-1	NR	Calculated by RESRAD from area factor

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Ingestion Pathway, Nondietary Data					
Livestock fodder intake for meat (kg/d)	NR	NR	68	10.6	RESRAD default or scenario-specific
Livestock fodder intake for milk (kg/d)	NR	NR	55	NR	RESRAD default
Livestock water intake for meat (L/d)	NR	50	50	6.4	RESRAD default or scenario-specific
Livestock water intake for milk (L/d)	NR	160	160	NR	RESRAD default
Livestock intake of soil for meat (kg/d)	NR	NR	0.5	0.5	RESRAD default
Livestock intake of soil for milk (kg/d)	NR	NR	0.5	NR	RESRAD default
Mass loading for foliar deposition (g/m ³)	NR	NR	0.0001	0.0001	RESRAD default
Depth of soil mixing layer (m)	T(0.0, 0.15, 0.6)	T(0.0, 0.15, 0.6)	T(0.0, 0.15, 0.6)	T(0.0, 0.15, 0.6)	Distribution from NRC 2000
Depth of roots (m)	NR	U(0.3, 1.0)	U(0.3, 1.0)	U(0.3, 1.0)	Upper bound equal to depth of contamination
Drinking water fraction from groundwater source	NR	0	1	0	Scenario-specific
Household water fraction from groundwater source	NR	0	1	NR	Scenario-specific
Livestock water fraction from groundwater source	NR	0	1	0	RESRAD default for resident farmer scenario and 0 for recreational use scenario because surface water is used by livestock
Irrigation water fraction from groundwater source	NR	0	1	0	RESRAD default
Plant Factors					
Wet weight crop yield for nonleafy vegetables (kg/m ²)	NR	TLN(0.56, 0.48, 0.001, 0.999)	TLN(0.56, 0.48, 0.001, 0.999)	NR	Distribution from NRC 2000
Length of growing season for nonleafy vegetables (yr)	NR	0.17	0.17	NR	RESRAD default
Translocation factor for nonleafy vegetables	NR	0.1	0.1	NR	RESRAD default
Weathering removal constant (1/yr)	NR	T(5.1, 18, 84)	T(5.1, 18, 84)	T(5.1, 18, 84)	Distribution from NRC 2000
Wet foliar interception fraction for nonleafy vegetables	NR	0.25	0.25	NR	RESRAD default

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Dry foliar interception fraction for nonleafy vegetables	NR	0.25	0.25	NR	RESRAD default
Wet weight crop yield for leafy vegetables (kg/m ²)	NR	1.5	1.5	NR	RESRAD default
Length of growing season for leafy vegetables (yr)	NR	0.25	0.25	NR	RESRAD default
Translocation factor for leafy vegetables	NR	1	1	NR	RESRAD default
Wet foliar interception fraction for leafy vegetables	NR	T(0.06, 0.67, 0.95)	T(0.06, 0.67, 0.95)	NR	Distribution from NRC 2000
Dry foliar interception fraction for leafy vegetables	NR	0.25	0.25	NR	RESRAD default
Wet weight crop yield for fodder (kg/m ²)	NR	NR	1.1	1.1	RESRAD default
Length of growing season for fodder (yr)	NR	NR	0.08	0.08	RESRAD default
Translocation factor for fodder	NR	NR	1	1	RESRAD default
Wet foliar interception fraction for fodder	NR	NR	0.25	0.25	RESRAD default
Dry foliar interception fraction for fodder	NR	NR	0.25	0.25	RESRAD default
Storage-Times-Before-Use Data					
Storage time for fruits, nonleafy vegetables and grain (d)	NR	14	14	NR	RESRAD default
Storage time for leafy vegetables (d)	NR	1	1	NR	RESRAD default
Storage time for milk (d)	NR	1	1	NR	RESRAD default
Storage time for meat (d)	NR	NR	20	182.5	RESRAD default for resident farmer and scenario-specific for recreational use
Storage time for fish (d)	NR	7	7	0	RESRAD default and scenario-specific for recreational use
Storage time for crustacea and mollusks (d)	NR	7	7	0	RESRAD default and scenario-specific for recreational use
Storage time for well water (d)	NR	1	1	NR	RESRAD default for resident farmer and not required for recreational use
Storage time for surface water (d)	NR	1	1	0	RESRAD default for resident farmer and 0 for recreational use

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Storage time for livestock fodder (d)	NR	NR	45	0	RESRAD default for resident farmer and scenario-specific for recreational use
Radon Data					
Cover total porosity	NR	NR	NR	NR	No cover
Cover volumetric water content	NR	NR	NR	NR	No cover
Cover radon diffusion coefficient	NR	NR	NR	NR	No cover
Total porosity of the house or building foundation	0.1	0.1	0.1	0.1	RESRAD default
Volumetric water content of the foundation	0.03	0.03	0.03	0.03	RESRAD default
Diffusion coefficient for radon gas in foundation material (m ² /s)	3E-07	3E-07	3E-07	3E-07	RESRAD default
Diffusion coefficient for radon gas in contaminated zone soil (m ² /s)	2E-06	2E-06	2E-06	2E-06	For site-specific soil type
Emanating power of radon-222	0.28	0.28	0.28	0.28	For site-specific soil type (Yu et al. 1993)
Radon vertical dimension of mixing (m)	2.0	2.0	2.0	2.0	RESRAD default
Average building air exchange rate (h ⁻¹)	0.5	0.5	0.5	0.5	RESRAD default
Height of building (room) (m)	2.5	2.5	2.5	2.5	RESRAD default
Building indoor area factor	0	0	0	0	RESRAD default
Bulk density of house or building foundation (g/cm ³)	2.4	2.4	2.4	2.4	RESRAD default
Thickness of house or building foundation (m)	0.15	0.15	0.15	0.15	RESRAD default
Building depth below ground surface (m)	-1	-1	-1	-1	RESRAD default
Carbon-14 Data					
C-12 concentration in local water (g/cm ³)	2E-5	2E-5	2E-5	2E-5	RESRAD default
C-12 concentration in contaminated soil (g/g)	0.03	0.03	0.03	0.03	RESRAD default
Fraction of vegetation carbon absorbed from soil	0.02	0.02	0.02	0.02	RESRAD default
Fraction of vegetation carbon absorbed from air	0.98	0.98	0.98	0.98	RESRAD default
Thickness of evasion layer of C-14 in soil (m)	0.3	0.3	0.3	0.3	RESRAD default
C-14 evasion flux rate from soil (s ⁻¹)	7E-7	7E-7	7E-7	7E-7	RESRAD default

TABLE A.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
C-12 evasion flux rate from soil (s ⁻¹)	1E-10	1E-10	1E-10	1E-10	RESRAD default
Grain fraction in beef cattle feed	0.8	0.8	0.8	0.8	RESRAD default
Grain fraction in milk cow feed	0.2	0.2	0.2	0.2	RESRAD default

^a RESRAD-OFFSITE code is used for analyzing offsite resident scenario, and RESRAD code is used for other scenarios. Extra parameters required for RESRAD-OFFSITE code are listed in Table A.10.

^b For offsite resident and residential farmer scenarios, the parameter values for leafy vegetable consumption, meat and poultry consumption, and fish consumption are RESRAD defaults. Parameter values for inhalation rate, indoor and outdoor time fractions, livestock fodder intake for meat, livestock water intake for meat, livestock intake of soil, plant food contaminated fraction, and meat contaminated fractions are RESRAD defaults and are calculated on the basis of the contaminated area; storage times for meat, fish, surface water, and livestock fodder are RESRAD defaults.

^c For the recreational use scenario, it is assumed that the individual would be involved in moderate activity onsite; therefore, an inhalation rate of moderate activity (1.6 m³/h) is assumed (EPA 1997). The parameter value for meat and poultry consumption is based on the assumption that a recreationist kills a deer and brings the catch home and uses its meat over the course of a year; the distribution is based on the game consumption statistics among households that hunt. For fish consumption, it is assumed that a recreationist catches a fish and consumes it the same day; distribution is based on the home-caught fish consumption statistics among households that fish. The parameter values for indoor and outdoor time fractions are from the scenario description. All meat consumed is assumed to be contaminated. For the storage time of meat, since the meat is consumed over the course of a year, an average storage time of 182.5 days is assumed. For the storage time of fish, since the fish is consumed on the same day, a storage time of zero days is assumed. Since the game animal uses fresh forage and surface water, a storage time of zero days is assumed for both parameters.

^d NR – value is not required for this scenario.

^e See Table A.8 for the notation used for the type of distribution.

^f It is assumed that the soil type is silty clay at the Building 310 area (Golchert et al. 2010), and distributions representative of silty clay soil are used.

^g Cover and management are changed to 0.0506 to get this erosion rate in the RESRAD-OFFSITE code.

**TABLE A.2 Parameter Distributions
Used in the Probabilistic Analysis for
the Contaminated Zone and
Unsaturated Zone Kd Values**

Kd (cm ³ /g) Distribution ^a			
Lognormal Distribution Parameters			
Element	μ	σ	exp(μ)
Ac	7.8	3.22 ^b	2,400
Am	9.0	2.6	8,400
C	0.8	0.8 ^c	1
Co	6.3	1.8	550
Cs	7.5	1.6	1,900
I	0.5	1.5	1
Np	4.0	3.8	55
Pa	7.9	3.22 ^b	2,700
Pb	6.3	2.76 ^b	550
Po	8.0	1.68 ^b	3,000
Pu	8.5	2.1	5,100
Ra	9.1	1.3	9,100
Sr	4.7	2.0	110
Tc	0.2	0.06	1
Th	8.6	2.6	5,800
U	7.3	2.9	1,600

Source: Sheppard and Thibault (1990)
unless noted otherwise

^a The distributions are for clayey soil, which is the site-specific soil type for the contaminated zone and unsaturated zone.

^b Value not available from Sheppard and Thibault (1990). The value used is default for generic soil type.

^c Value not available from Sheppard and Thibault (1990). The value used is default for sandy soil type.

**TABLE A.3 Parameter Distributions
Used in the Probabilistic Analysis for
the Saturated Zone Kd Values**

Kd (cm ³ /g) Distribution ^a			
Lognormal Distribution Parameters			
Element	μ	σ	exp(μ)
Ac	6.1	3.22 ^b	450
Am	7.6	2.6	1,900
C	1.1	0.8	5
Co	4.1	2.8	60
Cs	5.6	2.5	280
I	0.04	2.2	1
Np	1.4	1.7	5
Pa	6.3	3.22 ^b	550
Pb	5.6	2.76 ^b	270
Po	5.0	1.6	150
Pu	6.3	1.7	550
Ra	6.2	3.2	500
Sr	2.6	1.6	15
Tc	-2.0	1.8	0.1
Th	8.0	2.1	3,200
U	3.5	3.2	35

Source: Sheppard and Thibault (1990)
unless noted otherwise

^a The distributions are for sandy soil,
which is assumed to be the soil type for
the saturated zone.

^b Value not available from Sheppard and
Thibault (1990). The value used is
default for generic soil type.

TABLE A.4 Parameter Distributions Used in the Probabilistic Analysis for the Plant Transfer Factor

Plant Transfer Factor (wet plant concentration, pCi/g/dry soil concentration, pCi/g) Distribution			
Lognormal Distribution Parameters			
Element	μ	σ	$\exp(\mu)$
Ac	-6.91	1.1	1.0×10^{-3}
Am	-6.91	0.9	1.0×10^{-3}
C	-0.36	0.9	7.0×10^{-1}
Co	-2.53	0.9	8.0×10^{-2}
Cs	-3.22	1.0	4.0×10^{-2}
I	-3.91	0.9	2.0×10^{-2}
Np	-3.91	0.9	2.0×10^{-2}
Pa	-4.61	1.1	1.0×10^{-2}
Pb	-5.52	0.9	4.0×10^{-3}
Po	-6.9	0.9	1.0×10^{-3}
Pu	-6.91	0.9	1.0×10^{-3}
Ra	-3.22	0.9	4.0×10^{-2}
Sr	-1.20	1.0	3.0×10^{-1}
Tc	1.61	0.9	5.0×10^0
Th	-6.91	0.9	1.0×10^{-3}
U	-6.21	0.9	2.0×10^{-3}

Source: NRC (2000)

**TABLE A.5 Parameter Distributions
Used in the Probabilistic Analysis for
the Meat Transfer Factor**

Meat Transfer Factor (concentration in meat, pCi/g/rate of intake, pCi/d) Distribution			
Lognormal Distribution Parameters			
Element	μ	σ	$\exp(\mu)$
Ac	-10.82	1.0	1.0×10^{-5}
Am	-9.90	0.2	5.0×10^{-5}
C	-3.47	1	3.1×10^{-2}
Co	-3.51	1.0	3.0×10^{-2}
Cs	-3.00	0.4	5.0×10^{-2}
I	-3.22	0.4	1.2×10^{-2}
Np	-6.91	0.7	1.0×10^{-3}
Pa	-12.21	1.0	5.0×10^{-6}
Pb	-7.13	0.7	8.0×10^{-4}
Po	-5.30	0.7	5.0×10^{-3}
Pu	-9.21	0.2	1.0×10^{-4}
Ra	-6.91	0.7	1.0×10^{-3}
Sr	-4.61	0.4	1.0×10^{-2}
Tc	-9.21	0.7	1.0×10^{-4}
Th	-9.21	1.0	1.0×10^{-4}
U	-7.13	0.7	8.0×10^{-4}

Source: NRC (2000)

**TABLE A.6 Parameter Distributions
Used in the Probabilistic Analysis for
the Milk Transfer Factor**

Milk Transfer Factor (concentration in milk, pCi/L/rate of intake, pCi/d) Distribution			
Lognormal Distribution Parameters			
Element	μ	σ	$\exp(\mu)$
Ac	-13.12	0.9	2.0×10^{-6}
Am	-13.12	0.7	2.0×10^{-6}
C	-4.4	0.9	1.2×10^{-2}
Co	-6.21	0.7	2.0×10^{-3}
Cs	-4.61	0.5	1.0×10^{-2}
I	-4.61	0.5	1.0×10^{-2}
Np	-11.51	0.7	1.0×10^{-5}
Pa	-12.21	0.9	5.0×10^{-6}
Pb	-8.11	0.9	3.0×10^{-4}
Po	-7.82	0.7	4.0×10^{-4}
Pu	-13.82	0.5	1.0×10^{-6}
Ra	-6.91	0.5	1.0×10^{-3}
Sr	-6.21	0.5	2.0×10^{-3}
Tc	-6.91	0.7	1.0×10^{-3}
Th	-12.21	0.9	5.0×10^{-6}
U	-7.82	0.6	4.0×10^{-4}

Source: NRC (2000)

TABLE A.7 Parameter Values and Distributions Used in the Probabilistic Analysis for the Fish and Crustacea Transfer Factors

Element	Crustacea Transfer Factor (concentration in crustacea, pCi/kg/ concentration in water, pCi/L)	Fish Transfer Factor (concentration in fish, pCi/kg/concentration in water, pCi/L) Distributions		
		Lognormal Distribution Parameters		
		μ	σ	$\exp(\mu)$
Ac	1,000	2.7	1.1	15
Am	1,000	3.4	1.1	30
C	9,100	10.8	1.1	50,000
Co	200	5.7	1.1	300
Cs	100	7.6	0.7	2,000
I	5	3.7	1.1	40
Np	400	3.4	1.1	30
Pa	110	2.3	1.1	10
Pb	100	5.7	1.1	300
Po	20,000	4.6	1.1	100
Pu	100	3.4	1.1	30
Ra	250	3.9	1.1	50
Sr	100	4.1	1.1	60
Tc	5	3.0	1.1	20
Th	500	4.6	1.1	100
U	60	2.3	1.1	10

Source: NRC (2000)

**TABLE A.8 Notations Used in Input
Parameter Table A.1**

Notation	Type of Distribution
$TN(\mu, \sigma, a, b)^a$	Truncated normal
$TLN(\mu, \sigma, a, b)^b$	Truncated lognormal-N
$BLN(\mu, \sigma, a, b)^c$	Bounded lognormal-N
$U(a, b)^d$	Uniform
$LU(a, b)^e$	Log uniform
$T(a, c, b)^f$	Triangular
Continuous linear ^g	Empirical
Continuous log ^h	Empirical

^a For truncated normal distribution, μ is mean, σ is standard deviation, a is lower quantile, and b is upper quantile of the distribution.

^b For truncated lognormal-N distribution, μ is mean and σ is standard deviation of underlying normal distribution; a is lower quantile and b is upper quantile of the distribution.

^c For bounded lognormal-N distribution, μ is mean and σ is standard deviation of underlying normal distribution; a is minimum and b is maximum of the distribution.

^d For uniform distribution, a and b parameters represent the minimum and maximum values, respectively.

^e For log uniform distribution, a and b parameters represent the minimum and maximum values, respectively.

^f For triangular distribution, a is minimum, c is mode, and b is maximum of the distribution.

^g The continuous linear distribution is defined by the user for the N points, and the distribution is assumed to vary linearly between the cumulative distribution functions specified by the user for the N points.

^h The continuous log distribution is defined by the user for the N points, and the distribution is assumed to vary logarithmically between the cumulative distribution functions specified by the user for the N points.

TABLE A.9 Parameter Correlations for Probabilistic Analysis of Different Scenarios

Parameter 1	Parameter 2	Correlation Coefficient	Comments
Contaminated zone soil density	Contaminated zone total porosity	-0.99	The two parameters are strongly negatively correlated
Unsaturated zone soil density	Unsaturated zone total porosity	-0.99	The two parameters are strongly negatively correlated
Unsaturated zone soil density	Unsaturated zone effective porosity	-0.99	The two parameters are strongly negatively correlated
Saturated zone soil density	Saturated zone total porosity	-0.99	The two parameters are strongly negatively correlated
Saturated zone soil density	Saturated zone effective porosity	-0.99	The two parameters are strongly negatively correlated
Unsaturated zone total porosity	Unsaturated zone effective porosity	0.99	A correlation of 0.99 provides satisfactory pairing of sampling data
Saturated zone total porosity	Saturated zone effective porosity	0.99	A correlation of 0.99 provides satisfactory pairing of sampling data
Kd of U-234 in contaminated zone	Kd of U-238 in contaminated zone	0.99	The two parameters are strongly correlated.
Kd of U-234 in unsaturated zone	Kd of U-238 in unsaturated zone	0.99	The two parameters are strongly correlated.
Kd of U-234 in saturated zone	Kd of U-238 in saturated zone	0.99	The two parameters are strongly correlated.

TABLE A.10 Additional Input Parameters Used in the RESRAD-OFFSITE Probabilistic Analysis

Parameter	Value	Comment
Site Layout^a		
X dimension of primary contamination (m)	100	Total contaminated area = 10,000 m ²
Y dimension of primary contamination (m)	100	
Smaller X coordinate of the fruit, grain, nonleafy vegetable plots (m)	434.4	Closest distance to the site boundary
Larger X coordinate of the fruit, grain, nonleafy vegetable plots (m)	465.6	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller Y coordinate of the fruit, grain, nonleafy vegetable plots (m)	434	Closest distance to the site boundary
Larger Y coordinate of the fruit, grain, nonleafy vegetable plots (m)	466	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller X coordinate of the leafy vegetable plots (m)	434.4	Closest distance to the site boundary
Larger X coordinate of the leafy vegetable plots (m)	465.6	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller Y coordinate of the leafy vegetable plots (m)	468	Leafy vegetable plot is assumed to be next to the nonleafy vegetable plot
Larger Y coordinate of the leafy vegetable plots (m)	500	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller X coordinate of the pasture, silage growing area (m)	450	Close to the vegetable plots
Larger X coordinate of the pasture, silage growing area (m)	550	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller Y coordinate of the pasture, silage growing area (m)	500	Close to the vegetable plots
Larger Y coordinate of the pasture, silage growing area (m)	600	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller X coordinate of the grain fields (m)	500	Close to the vegetable plots
Larger X coordinate of the grain fields (m)	600	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller Y coordinate of the grain fields (m)	600	Close to the vegetable plots
Larger Y coordinate of the grain fields (m)	700	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller X coordinate of the dwelling site (m)	434.4	Closest distance to the site boundary
Larger X coordinate of the dwelling site (m)	465.6	The dwelling site is assumed to be 31.6 m × 31.6 m and have an area of 1,000 m ²
Smaller Y coordinate of the dwelling site (m)	400	Closest distance to the site boundary
Larger Y coordinate of the dwelling site (m)	432	The dwelling site is assumed to be 31.6 m × 31.6 m and have an area of 1,000 m ²
Smaller X coordinate of the surface water body	526.5	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas
Larger X coordinate of the surface water body	826.5	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas

TABLE A.10 (Cont.)

Parameter	Value	Comment
Smaller Y coordinate of the surface water body	356.8	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas
Larger Y coordinate of the surface water body	656.8	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas
Source Release and Deposition Velocity		
Deposition velocity (m/s)	0.001	For all radionuclides except I-129 (0.01)
Distribution Coefficients		
Sediment in surface water body (cm ³ /g)	Table A.2	
Fruit, grain, nonleafy vegetable fields (cm ³ /g)	Table A.2	
Leafy vegetable fields (cm ³ /g)	Table A.2	
Pasture, silage growing areas (cm ³ /g)	Table A.2	
Livestock feed grain fields (cm ³ /g)	Table A.2	
Offsite dwelling site (cm ³ /g)	Table A.2	
Transfer Factors		
Fruit, grain, nonleafy vegetable transfer factor	Table A.3	
Leafy vegetable transfer factor	Table A.3	
Pasture and silage transfer factor	Table A.3	
Livestock feed grain transfer factor	Table A.3	
Storage Time		
Storage time for pasture and silage (d)	1	Default
Storage time for livestock feed grain (d)	45	Default
Primary Contamination		
Deposition velocity of dust (m/s)	0.001	Default
Rainfall and runoff factor	160	Default
Slope-length-steepness factor	0.4	Default
Cover and management factor	0.0506	Adjusted to match site-specific erosion rate
Support practice factor	1	Default
Contaminated Zone		
Soil erodibility factor of contaminated zone	0.4	Default
Clean Cover		
Soil erodibility factor of clean cover	NR	No cover
Volumetric water content of clean cover	NR	No cover
Agriculture/Livestock Feed Growing/Offsite Dwelling Area Parameters		
Fraction of area directly over primary contamination for all fields	0	Receptor offsite

TABLE A.10 (Cont.)

Parameter	Value	Comment
Irrigation applied per year for all fields (m/yr)	0.1	Site specific
Evapotranspiration coefficient for all fields	U(0.5, 0.75)	Distribution
Runoff coefficient for all fields	U(0.1, 0.8)	Distribution
Depth of soil mixing layer or plow layer for all fields (m)	See Table A.1	
Volumetric water content for all fields	0.3	Default
Dry bulk density of soil for all fields (g/cm ³)	TN ^d (1.696, 0.1855, 0.001, 0.999)	Site-specific soil type (silty clay – Golchert et al. 2010) distribution from NRC 2000
Soil erodibility factor for all fields	0.4	Default
Slope-length-steepness factor for all fields	0.4	Default
Cover and management factor for all fields	0.0506	Adjusted to match site-specific erosion rate
Support practice factor for all fields	1	Default
Atmospheric Transport		
Release height (m)	1	Default
Release heat flux (cal/s)	0	Default
Anemometer height (m)	10	Default
Ambient temperature (K)	285	Default
AM atmospheric mixing height (m)	400	Default
PM atmospheric mixing height (m)	1,600	Default
Dispersion model coefficients	Pasquill-Gifford	Default
Wind speed terrain	Rural	Default
Elevation of offsite location, relative to ground level at primary contamination, for all fields (m)	0	Default
Grid spacing for areal integration (m)	10	Default
Joint frequency of wind speed and stability class for a 16-sector wind rose	Actual values from Chicago Midway	Site-specific
Unsaturated Zone Parameters		
Unsaturated zone longitudinal dispersivity (m)	0.1	Default
Saturated Zone Hydrological Data		
Thickness of saturated zone (m)	18.3	Default
Saturated zone longitudinal dispersivity to surface water body (m)	10	Default
Saturated zone horizontal lateral dispersivity to surface water body (m)	1	Default
Disperse vertically	Check box	Yes
Saturated zone vertical lateral dispersivity to surface water body (m)	0.06	Default
Depth of aquifer contributing to surface water body (m)	10	Default

TABLE A.10 (Cont.)

Parameter	Value	Comment
Surface Water Body		
Sediment deliver ratio	1	Default
Volume of surface water body (m ³)	150,000	Default
Mean residence time of water in surface water body (yr)	1	Default
Groundwater Transport Parameters		
Distance from downgradient edge of contamination to well in the direction parallel to aquifer flow (m)	-55	Site-specific
Distance from downgradient edge of contamination to surface water body in the direction parallel to aquifer flow (m)	256.8	Site-specific
Distance from downgradient edge of contamination to well in the direction perpendicular to aquifer flow (m)	-424	Site-specific
Distance from downgradient edge of contamination to the right edge of surface water body in the direction perpendicular to aquifer flow (m)	-150	Default
Distance from downgradient edge of contamination to the left edge of the surface water body in the direction perpendicular to aquifer flow (m)	150	Default
Main subzones in saturated zone	1	Default
Main subzones in each partially saturated zone	1	Default
Nuclide-specific retardation in all subzones, longitudinal dispersion in all but the subzone of transformation?	Yes	Default
Water Use		
Quantity of water consumed by an individual (L/yr)	See Table A.1	Household water not contaminated
Number of individuals in household who consume and use water	4	Default
Quantity of water for use indoors of dwelling per individual (L/d)	225	Household water not contaminated
Quantity of water for beef cattle (L/d)	50	Default
Number of beef cattle	2	Default
Quantity of water for dairy cows (L/d)	160	Default
Number of dairy cows	2	Default
Well pumping rate (m ³ /yr)	250	RESRAD default
Ingestion Rates		
Drinking water intake from affected area	0	Drinking water not contaminated
Fish intake from affected area	0.5	Default
Crustacea and mollusks intake from affected area	0.5	Default
Fruit, grain, nonleafy vegetables fraction from affected area	0.5	Default
Leafy vegetables fraction from affected area	0.5	Default
Meat fraction from affected area	0.5	50% of the meat consumed is from contaminated area

TABLE A.10 (Cont.)

Parameter	Value	Comment
Milk fraction from affected area	0.5	50% of the meat consumed is from contaminated area
Livestock intake		
Pasture and silage intake for beef cattle (kg/d)	14	Default
Grain intake for beef cattle (kg/d)	54	Default
Soil from pasture and silage intake for beef cattle (kg/d)	0.1	Default
Soil from grain intake for beef cattle (kg/d)	0.4	Default
Pasture and silage intake for dairy cows (kg/d)	44	Default
Grain intake for dairy cows (kg/d)	11	Default
Soil from pasture and silage intake for dairy cows (kg/d)	0.4	Default
Soil from grain intake for dairy cows (kg/d)	0.1	Default
Livestock Feed Factors (for Pasture and Silage, Grain)		
Wet weight crop yield (kg/m ²)	1.1, 0.7	Default
Duration of growing season (yr)	0.08, 0.17	Default
Foliage to food transfer coefficient	1, 0.1	Default
Weathering removal constant	20, 20	Default
Foliar interception factor for irrigation	0.25, 0.25	Default
Foliar interception factor for dust deposition	0.25, 0.25	Default
Root depth (m)	See Table A.1	Distribution from NUREG/CR-6697 (NRC 2000)
Occupancy Factors		
Indoor time fraction on primary contamination	0	
Outdoor time fraction on primary contamination	0	
Indoor time fraction on offsite dwelling site	0.5	
Outdoor time fraction on offsite dwelling site	0.1	
Time fraction in fruit, grain, and nonleafy vegetable fields	0.1	
Time fraction in leafy vegetable fields	0.1	
Time fraction in pasture and silage fields	0.1	
Time fraction in livestock grain fields	0.1	

^a All the areas (dwelling, agricultural areas) are assumed to be less than 350 m away from the contaminated area. This is a conservative assumption because the distance to the site boundary from the Building 310 area is greater than 350 m.

REFERENCES FOR APPENDIX A

Argonne (Argonne National Laboratory), 1996, *Interim Action Documentation Report: Decontamination and Demolition of the 317 Area South Vaults*, Argonne, Ill., May 31.

Eckerman, K.F., and J.C. Ryman, 1993, *External Exposure to Radionuclides in Air, Water, and Soil, Exposure to Dose Coefficients for General Application, Based on the 1987 Federal Radiation Protection Guidance*, EPA 402-R-93-076, Federal Guidance Report No. 12, prepared by Oak Ridge National Laboratory, Oak Ridge, Tenn., for U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1997, *Exposure Factor Handbook*, EPA/600/P-95/002Fa, Office of Research and Development, National Center for Environmental Assessment, Washington, D.C.

Golchert, N.W., T.M. Davis, and L.P. Moos, 2010, *Argonne Site Environmental Report for Calendar Year 2009*, ANL-10/02, Argonne National Laboratory, Argonne, Ill., Sept.

ICRP (International Commission on Radiological Protection), 1991, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Ann. ICRP 21(1-3), Pergamon Press, Oxford, England.

ICRP, 1996, *Age-Dependent Doses to Members of the Public from Intake of Radionuclides: Part 5, Compilation of Ingestion and Inhalation Coefficients*, ICRP Publication 72, Ann. ICRP 26(1), Pergamon Press, Oxford, England.

Kamboj, S., 2011, "Bldg. 310 RESRAD Analysis Project Status," intraoffice personal communication between Kamboj and R.L. Johnson (Argonne National Laboratory, Argonne, Ill.), Jan. 7.

Matton, P.B., 2011, "Bldg. 330 D&D Project—RESRAD, DCGLs, Clean-up Parameters," intraoffice personal communication between Matton and R.J. Johnson (Argonne National Laboratory, Argonne, Ill.), Jan. 14.

NCDC (National Climatic Data Center), 2010, "Average Wind Speed." Available at <http://1wf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html>.

NRC (U.S. Nuclear Regulatory Commission), 2000, *Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes*, NUREG/CR-6697 and ANL/EAD/TM-98, prepared by C. Yu et al., Argonne National Laboratory, Argonne, Ill., for U.S. Nuclear Regulatory Commission, Washington, D.C., Nov.

NRCS (Natural Resources Conservation Service), 2010, "Report Cards Are Out – Illinois NRI Gets Gold Star!," news release, May 25.

Patton, T.L., R.H. Pearl, and S.Y. Tsai, 1990, *Hydrological Conditions at the 800 Area at Argonne National Laboratory*, ANL/EAIS/TM-29, Argonne National Laboratory, Argonne, Ill., August.

Quinn, J., 2010, intraoffice personal communication between Quinn and S. Kamboj (Argonne National Laboratory, Argonne, Ill.), Nov. 12.

Sheppard, M.I., and D.H. Thibault, 1990, "Default Soil Solid/Liquid Partition Coefficients, K_ds, for Four Major Soil Types: A Compendium," *Health Physics* 59(4):471–482.

Yu, C., et al., 1993, *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8, Argonne National Laboratory, Argonne, Ill., April.

Yu, C., et al., 2001, *User's Manual for RESRAD Version 6*, ANL/EAD-4, Argonne National Laboratory, Argonne, Ill.

APPENDIX B:

PARAMETERS USED FOR DETERMINISTIC ANALYSIS

Tables B.1–B.4 list all input parameter distributions or parameter values used in the deterministic dose analysis for different user scenarios.

TABLE B.1 Parameter Values Used in the Deterministic Analysis of Different Scenarios^a

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Title					
Title	Scenario dependent	Scenario dependent	Scenario dependent	Scenario dependent	Scenario definition
Dose factor library	ICRP-60	ICRP-60	ICRP-60	ICRP-60	DCF's based on ICRP-60 (ICRP 1991) methodology (external from FGR-12 [Eckerman and Ryman 1993] and internal from ICRP-72 [ICRP 1996])
Cut-off half-life (180 d or 30 d)	30 d	30 d	30 d	30 d	RESRAD default
Number of points (32, 64, 128, 256, 512, 1024)	32	32	32	32	RESRAD default
Linear spacing/log spacing	Log spacing	Log spacing	Log spacing	Log spacing	RESRAD default
Maximum no. of points for dose	17	17	17	17	RESRAD default
Maximum no. of points for risk	1	1	1	1	Using a smaller integration point will shorten the calculation time
Use line draw character (yes/no)	Yes	Yes	Yes	Yes	RESRAD default
Find peak pathway dose (yes/no)	Yes	Yes	Yes	Yes	
Save all files after each run (yes/no)	Yes	Yes	Yes	Yes	
Time integrated probabilistic risk (yes/no)	No	No	No	No	Dose-to-source ratio (DSR) is calculated
Calculation Parameters					
Basic radiation dose limit (mrem/yr)	25	25	25	25	Not used in DSR calculation
Times for calculation (yr)	1, 3, 10, 30, 100, 300, 1,000	1, 2, 3, 4, 5, 6, 7, 8, 970	100, 300, 1,000	100, 300, 1,000	Up to the time horizon for dose calculation
Source					
Nuclide concentration (pCi/g)	1	1	1	1	DSRs calculated
Transport Factors					
Distribution coefficient for all zones (cm ³ /g)	Table B.2	Table B.2	Table B.2	Table B.2	Site-specific soil type
Number of unsaturated zones	1	1	1	1	RESRAD default
Time since placement of material (yr)	0	0	0	0	RESRAD default
Groundwater concentration (pCi/L)	0	0	0	0	RESRAD default
Leach rate (1/yr)	0	0	0	0	RESRAD default
Solubility limit (mol/L)	0	0	0	0	RESRAD default
Use plant/soil ration (check box)	No	No	No	No	RESRAD default

TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Transfer Factors					
Plant transfer factor (wet-plant weight concentration, pCi/g/dry soil weight concentration, pCi/g)	NR ^d	Table B.2	Table B.2	NR	RESRAD default
Meat transfer factor (concentration in meat, pCi/g/rate of intake, pCi/d)	NR	Table B.2	Table B.2	Table A.2	RESRAD default
Milk transfer factor (concentration in milk, pCi/L/rate of intake, pCi/d)	NR	Table B.2	Table B.2	NR	RESRAD default
Fish transfer factor (concentration in fish, pCi/Kg/concentration in water, pCi/L)	NR	Table B.3	Table B.3	Table A.3	RESRAD default
Crustacea transfer factor (concentration in crustacea, pCi/kg/concentration in water, pCi/L)	NR	Table B.3	Table B.3	Table A.3	RESRAD default
Contaminated Zone Parameters					
Area of contaminated zone (m ²)	10,000	10,000	10,000	10,000	Matton 2011; Kamboj 2011
Thickness of contaminated zone (m)	1	1	1	1	Matton 2011; Kamboj 2011
Length parallel to aquifer flow (m)	100	100	100	100	RESRAD default
Does the initial contamination penetrate the water table?	No	No	No	No	RESRAD default
Cover and Contaminated Zone Hydrological Data					
Cover depth (m)	0	0	0	0	No cover layer assumed
Density of cover material (g/cm ³)	NR	NR	NR	NR	Not required when cover depth equals zero
2. Cover erosion rate (m/yr)	NR	NR	NR	NR	Not required when cover depth equals zero
Density of primary contaminated zone (g/cm ³)	1.76	1.76	1.76	1.76	Site-specific (Argonne 1996)
Contaminated zone erosion rate (m/y)	1.65E-4	1.65E-4 ^e	1.65E-4	1.65E-4	To match the soil erosion of 1 ton/acre/yr at Illinois (NRCS 2010)
Contaminated zone total porosity	0.3	0.3	0.3	0.3	Site-specific (Argonne 1996)
Contaminated zone field capacity	0.2	0.2	0.2	0.2	RESRAD default

TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Contaminated zone hydraulic conductivity (m/yr)	0.32	0.32	0.32	0.32	Site-specific (Quinn 2010)
Contaminated zone b parameter	10.4	10.4	10.4	10.4	Site-specific soil type (silty clay) value from Yu et al. 1993 ^f
Humidity in air (g/m ³)	8	8	8	8	Used only for H-3
Evapotranspiration coefficient	0.65	0.65	0.65	0.65	Site-specific
Wind speed (m/s)	4.6	NR	4.6	4.6	Site-specific value for Chicago
Precipitation rate (m/yr)	0.9177	0.9177	0.9177	0.9177	Site-specific value from Golchert et al. 1010
Irrigation rate (m/yr)	0.0	0.1	0.1	0.0	Site-specific (Argonne 1996)
Irrigation mode (overhead/ditch)	NR	NR	Overhead	NR	RESRAD default
Runoff coefficient	0.2	0.2	0.2	0.2	Site-specific for woodland (Yu et al. 2001, page E-7)
Watershed area for nearby stream or pond (m ²)	1,000,000	NR	1,000,000	1,000,000	RESRAD default
Accuracy for water/soil computation	0.001	NR	0.001	0.001	RESRAD default
Saturated Zone Hydrological Data					
Density of saturated zone (g/cm ³)	NR	1.76	1.76	1.76	Site-specific (Argonne 1996)
Saturated zone effective porosity	NR	0.14	0.14	0.14	Site-specific
Saturated zone total porosity	NR	0.3	0.3	0.3	Site-specific (Argonne 1996)
Saturated zone field capacity	NR	0.14	0.14	0.14	Site-specific
Saturated zone hydraulic conductivity (m/yr)	NR	947	947	947	Site-specific (Argonne 1996)
Saturated zone b parameter	NR	4.38	4.38	4.38	Site-specific soil type
Saturated zone hydraulic gradient	NR	0.015	0.015	0.015	Site-specific (Patton et al. 1990)
Water table drop rate (m/yr)	NR	NR	0.001	0.001	RESRAD default
Well pump intake depth (m below water table)	NR	NR	5	5	Site-specific
Model for water transportation (nondispersion/mass-balance)	NR	NR	Nondispersion	Nondispersion	RESRAD default
Well pumping rate (m ³ /yr)	NR	NR	250	250	RESRAD default
Unsaturated Zone Parameters					
Thickness of unsaturated zone (m)	NR	13.9	13.9	13.9	Site-specific (48 ft – 1 m) (Quinn 2010) or scenario-specific
Density of unsaturated zone (g/cm ³)	NR	1.76	1.76	1.76	Site-specific (Argonne 1996)

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TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Unsaturated zone effective porosity	NR	0.2	0.2	0.2	Site-specific (Argonne 1996)
Unsaturated zone total porosity	NR	0.3	0.3	0.3	Site-specific (Argonne 1996)
Unsaturated zone field capacity	NR	0.2	0.2	0.2	RESRAD default
Unsaturated zone hydraulic conductivity (m/yr)	NR	0.32	0.32	0.32	Site-specific (Quinn 2010)
Unsaturated zone b parameter	NR	10.4	10.4	10.4	Site-specific soil type (silty clay) value from Yu et al. 1993
Occupancy, Inhalation, and External Gamma Parameters					
Inhalation rate (m ³ /yr)	11,400	8,400	8,400	14,000	Scenario-specific
Mass loading for inhalation (g/m ³)	1E-4	1E-4	1E-4	1E-4	RESRAD default
Exposure duration (yr)	25	30	30	30	Not used in DSR calculations
Indoor dust filtration factor	0.4	0.4	0.4	0.4	RESRAD default
External gamma shielding factor	NR	0.7	0.7	NR	RESRAD default
Indoor time fraction	0/0.2283	NR	0.6833	0	Scenario-specific
Outdoor time fraction	0.2283/0	NR	0.0833	0.0384	Scenario-specific
Shape of contaminated zone (circular/noncircular)	Circular	Circular	Circular	Circular	RESRAD default
Ingestion Pathway Dietary Data					
Fruit, vegetable and grain consumption (kg/yr)	NR	160	160	NR	RESRAD default
Leafy vegetable consumption (kg/yr)	NR	14	14	NR	RESRAD default
Milk consumption (L/yr)	NR	92	92	NR	RESRAD default
Meat and poultry consumption (kg/yr)	NR	63	63	19	RESRAD default and scenario-specific for recreational use
Fish consumption (kg/yr)	NR	5.4	5.4	12	RESRAD default and scenario-specific for recreational use
Other sea food consumption (kg/yr)	NR	0.9	0.9	NR	RESRAD default
Soil ingestion (g/yr)	36.5	36.5	36.5	36.5	RESRAD default
Drinking water intake (L/yr)	NR	510	510	1.4L/d ^g 14 = 19.6 L	RESRAD default and scenario-specific for recreational use
Drinking water contaminated fraction	NR	0	1	1	RESRAD default and for offsite receptor scenario, water is not contaminated

TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Household water contaminated fraction	1	1	1	NR	RESRAD default
Livestock water contaminated fraction	NR	1	1	1	RESRAD default
Irrigation water contaminated fraction	NR	1	1	1	RESRAD default
Aquatic food contaminated fraction	NR	0.5	0.5	0.5	Distribution from NRC 2000
Plant food contaminated fraction	NR	-1	-1	NR	Calculated by RESRAD from area factor
Meat contaminated fraction	NR	-1	-1	1	Scenario specific
Milk contaminated fraction	NR	-1	-1	NR	Calculated by RESRAD from area factor
Ingestion Pathway, Nondietary Data					
Livestock fodder intake for meat (kg/d)	NR	NR	68	10.6	RESRAD default or scenario-specific
Livestock fodder intake for milk (kg/d)	NR	NR	55	NR	RESRAD default
Livestock water intake for meat (L/d)	NR	50	50	6.4	RESRAD default or scenario-specific
Livestock water intake for milk (L/d)	NR	160	160	NR	RESRAD default
Livestock intake of soil for meat (kg/d)	NR	NR	0.5	0.5	RESRAD default
Livestock intake of soil for milk (kg/d)	NR	NR	0.5	NR	RESRAD default
Mass loading for foliar deposition (g/m ³)	NR	NR	0.0001	0.0001	RESRAD default
Depth of soil mixing layer (m)	0.15	0.15	0.15	0.15	RESRAD default
Depth of roots (m)	NR	0.9	0.9	0.9	RESRAD default
Drinking water fraction from groundwater source	NR	0	1	0	Scenario-specific
Household water fraction from groundwater source	NR	0	1	NR	Scenario-specific
Livestock water fraction from groundwater source	NR	0	1	0	RESRAD default for resident farmer scenario and 0 for recreational use scenario because surface water is used by livestock
Irrigation water fraction from groundwater source	NR	0	1	0	RESRAD default

TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Plant Factors					
Wet weight crop yield for nonleafy vegetables (kg/m ²)	NR	0.7	0.7	NR	RESRAD default
Length of growing season for nonleafy vegetables (yr)	NR	0.17	0.17	NR	RESRAD default
Translocation factor for nonleafy vegetables	NR	0.1	0.1	NR	RESRAD default
Weathering removal constant (1/yr)	NR	20	20	20	Distribution from NRC 2000
Wet foliar interception fraction for nonleafy vegetables	NR	0.25	0.25	NR	RESRAD default
Dry foliar interception fraction for nonleafy vegetables	NR	0.25	0.25	NR	RESRAD default
Wet weight crop yield for leafy vegetables (kg/m ²)	NR	1.5	1.5	NR	RESRAD default
Length of growing season for leafy vegetables (yr)	NR	0.25	0.25	NR	RESRAD default
Translocation factor for leafy vegetables	NR	1	1	NR	RESRAD default
Wet foliar interception fraction for leafy vegetables	NR	0.25	0.25	NR	RESRAD default
Dry foliar interception fraction for leafy vegetables	NR	0.25	0.25	NR	RESRAD default
Wet weight crop yield for fodder (kg/m ²)	NR	NR	1.1	1.1	RESRAD default
Length of growing season for fodder (yr)	NR	NR	0.08	0.08	RESRAD default
Translocation factor for fodder	NR	NR	1	1	RESRAD default
Wet foliar interception fraction for fodder	NR	NR	0.25	0.25	RESRAD default
Dry foliar interception fraction for fodder	NR	NR	0.25	0.25	RESRAD default
Storage-Times-Before-Use Data					
Storage time for fruits, nonleafy vegetables and grain (d)	NR	14	14	NR	RESRAD default
Storage time for leafy vegetables (d)	NR	1	1	NR	RESRAD default
Storage time for milk (d)	NR	1	1	NR	RESRAD default
Storage time for meat (d)	NR	NR	20	182.5	RESRAD default for resident farmer scenario and scenario-specific for recreational use

TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Storage time for fish (d)	NR	7	7	0	RESRAD default and scenario-specific for recreational use
Storage time for crustacea and mollusks (d)	NR	7	7	0	RESRAD default and scenario-specific for recreational use
Storage time for well water (d)	NR	1	1	NR	RESRAD default for resident farmer scenario and not required for recreational use scenario
Storage time for surface water (d)	NR	1	1	0	RESRAD default for resident farmer scenario and 0 for recreational use scenario
Storage time for livestock fodder (d)	NR	NR	45	0	RESRAD default for resident farmer scenario and scenario-specific for recreational use scenario
Radon Data^g					
Cover total porosity	NR	NR	NR	NR	No cover
Cover volumetric water content	NR	NR	NR	NR	No cover
Cover radon diffusion coefficient	NR	NR	NR	NR	No cover
Total porosity of the house or building foundation	0.1	0.1	0.1	0.1	RESRAD default
Volumetric water content of the foundation	0.03	0.03	0.03	0.03	RESRAD default
Diffusion coefficient for radon gas in foundation material (m ² /s)	3E-07	3E-07	3E-07	3E-07	RESRAD default
Diffusion coefficient for radon gas in contaminated zone soil (m ² /s)	2E-06	2E-06	2E-06	2E-06	RESRAD default (the value is representative of silty clay soil type)
Emanating power of radon-222	0.28	0.28	0.28	0.28	Clay soil type (Yu et al. 1993)
Radon vertical dimension of mixing (m)	2.0	2.0	2.0	2.0	RESRAD default
Average building air exchange rate (h ⁻¹)	0.5	0.5	0.5	0.5	RESRAD default
Height of building (room) (m)	2.5	2.5	2.5	2.5	RESRAD default
Building indoor area factor	0	0	0	0	RESRAD default
Bulk density of house or building foundation (g/cm ³)	2.4	2.4	2.4	2.4	RESRAD default
Thickness of house or building foundation (m)	0.15	0.15	0.15	0.15	RESRAD default
Building depth below ground surface (m)	-1	-1	-1	-1	RESRAD default

TABLE B.1 (Cont.)

Input Parameters	Current Use Scenarios		Future Use Scenarios		Comments
	Industrial Worker	Offsite Resident ^b	Resident Farmer ^b	Recreationist ^c	
Carbon-14 Data^g					
C-12 concentration in local water (g/cm ³)	2E-5	2E-5	2E-5	2E-5	RESRAD default
C-12 concentration in contaminated soil (g/g)	0.03	0.03	0.03	0.03	RESRAD default
Fraction of vegetation carbon absorbed from soil	0.02	0.02	0.02	0.02	RESRAD default
Fraction of vegetation carbon absorbed from air	0.98	0.98	0.98	0.98	RESRAD default
Thickness of evasion layer of C-14 in soil (m)	0.3	0.3	0.3	0.3	RESRAD default
C-14 evasion flux rate from soil (s ⁻¹)	7E-7	7E-7	7E-7	7E-7	RESRAD default
C-12 evasion flux rate from soil (s ⁻¹)	1E-10	1E-10	1E-10	1E-10	RESRAD default
Grain fraction in beef cattle feed	0.8	0.8	0.8	0.8	RESRAD default
Grain fraction in milk cow feed	0.2	0.2	0.2	0.2	RESRAD default

^a RESRAD-OFFSITE code is used for analyzing offsite resident scenario, and RESRAD (onsite) code is used for other scenarios. Extra parameters required for RESRAD-OFFSITE code are listed in Table B.4.

^b For offsite resident and residential farmer scenarios, the parameter values for food consumption are RESRAD defaults. The parameter values for inhalation rate and indoor and outdoor time fractions are scenario-specific. The parameter values for livestock fodder intake for meat, livestock water intake for meat, livestock intake of soil, plant food contaminated fraction, and meat contaminated fraction are code defaults and are calculated on the basis of the contaminated area. The parameter values for storage times for meat, fish, surface water, and livestock fodder are RESRAD defaults.

^c For the recreational use scenario, it is assumed that the individual would be involved in moderate activity onsite; therefore, an inhalation rate of moderate activity (1.6 m³/h) is assumed (EPA 1997). The parameter value for meat and poultry consumption is based on the assumption that a recreationist kills a deer and brings the catch home and uses its meat over the course of a year; the value is based on the game consumption statistics among households that hunt. For fish consumption, it is assumed that a recreationist catches a fish and consumes it the same day; the value is based on the home-caught fish consumption statistics among households that fish. The parameter values for indoor and outdoor time fractions are from the scenario description. All the meat consumed is assumed to be contaminated. For the storage time of meat, since the meat is consumed over the course of a year, an average storage time of 182.5 days is assumed. For the storage time of fish, since the fish is consumed on the same day, a storage time of zero days is assumed. Since the game animal uses fresh forage and surface water, a storage time of zero days is assumed for both parameters.

^d NR – value is not required for this scenario.

^e Cover and management are changed to 0.0506 to get site-specific erosion rate in RESRAD-OFFSITE areas.

^f It is assumed that the soil type is silty clay at the Argonne site, and values representative of silty clay soil are used.

^g All the parameters for radon (except radon emanation rate) and C-14 are kept at code default values.

TABLE B.2 Parameter Values Used in the Deterministic Analysis for the Kd, Plant, Meat, and Milk Transfer Factors

Element	Kd (cm ³ /g)		Plant Transfer Factor (pCi/kg)/(pCi/kg)	Meat Transfer Factor (pCi/kg)/(pCi/d)	Milk Transfer Factor (pCi/L)/(pCi/d)
	Saturated Zone ^a	Contaminated and Unsaturated Zone ^b			
Ac	450	2,400	2.5×10^{-3}	2.0×10^{-5}	2.0×10^{-5}
Am	1,900	8,400	1.0×10^{-3}	5.0×10^{-5}	2.0×10^{-6}
C	5	1	5.5×10^0	3.1×10^{-2}	1.2×10^{-2}
Co	60	550	8.0×10^{-2}	2.0×10^{-2}	2.0×10^{-3}
Cs	280	1,900	4.0×10^{-2}	3.0×10^{-2}	8.0×10^{-3}
I	1	1	2.0×10^{-2}	7.0×10^{-3}	1.0×10^{-2}
Np	5	55	2.0×10^{-2}	1.0×10^{-3}	5.0×10^{-6}
Pa	550	2,700	1.0×10^{-2}	5.0×10^{-3}	5.0×10^{-6}
Pb	270	550	1.0×10^{-2}	8.0×10^{-4}	3.0×10^{-4}
Po	150	3,000	1.0×10^{-3}	5.0×10^{-3}	3.4×10^{-4}
Pu	550	5,100	1.0×10^{-3}	1.0×10^{-4}	1.0×10^{-6}
Ra	500	9,100	4.0×10^{-2}	1.0×10^{-3}	1.0×10^{-3}
Sr	15	110	3.0×10^{-1}	8.0×10^{-3}	2.0×10^{-3}
Tc	0.1	1	5.0×10^0	1.0×10^{-4}	1.0×10^{-3}
Th	3,200	5,800	1.0×10^{-3}	1.0×10^{-4}	5.0×10^{-6}
U	35	1,600	2.5×10^{-3}	3.4×10^{-4}	6.0×10^{-4}

^a Based on sandy soil type from RESRAD data collection handbook or RESRAD default values for saturated zone.

^b Based on clay soil type from RESRAD data collection handbook or RESRAD default values for contaminated and unsaturated zone.

TABLE B.3 Parameter Values Used in the Deterministic Analysis for the Fish and Crustacea Transfer Factors

Element	Crustacea Transfer Factor (concentration in crustacea, pCi/kg/ concentration in water, pCi/L)	Fish Transfer Factor (concentration in crustacea, pCi/kg/ concentration in water, pCi/L)
Ac	1,000	15
Am	1,000	30
C	9,100	50,000
Co	200	300
Cs	100	2,000
I	5	40
Np	400	30
Pa	110	10
Pb	100	300
Po	20,000	100
Pu	100	30
Ra	250	50
Sr	100	60
Tc	5	20
Th	500	100
U	60	10

TABLE B.4 Additional Input Parameters Used in the RESRAD-OFFSITE Deterministic Analysis

Parameter	Value	Comment
Site Layout^a		
X dimension of primary contamination (m)	100	Total contaminated area = 10,000 m ²
Y dimension of primary contamination (m)	100	Total contaminated area = 10,000 m ²
Smaller X coordinate of the fruit, grain, nonleafy vegetable plots (m)	434.4	Closest distance to the site boundary
Larger X coordinate of the fruit, grain, nonleafy vegetable plots (m)	466	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller Y coordinate of the fruit, grain, nonleafy vegetable plots (m)	434	Closest distance to the site boundary
Larger Y coordinate of the fruit, grain, nonleafy vegetable plots (m)	466	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller X coordinate of the leafy vegetable plots (m)	434.4	Closest distance to the site boundary
Larger X coordinate of the leafy vegetable plots (m)	465.6	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller Y coordinate of the leafy vegetable plots (m)	468	Leafy vegetable plot is assumed to be next to the nonleafy vegetable plot
Larger Y coordinate of the leafy vegetable plots (m)	500	Assume the vegetable plot is 31.6 m × 31.6 m, with an area of 1,000 m ²
Smaller X coordinate of the pasture, silage growing area (m)	450	Close to the vegetable plots
Larger X coordinate of the pasture, silage growing area (m)	550	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller Y coordinate of the pasture, silage growing area (m)	500	Close to the vegetable plots
Larger Y coordinate of the pasture, silage growing area (m)	600	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller X coordinate of the grain fields (m)	500	Close to the vegetable plots
Larger X coordinate of the grain fields (m)	600	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller Y coordinate of the grain fields (m)	600	Close to the vegetable plots
Larger Y coordinate of the grain fields (m)	700	Assume the livestock feed area is 100 m × 100 m, with an area of 10,000 m ²
Smaller X coordinate of the dwelling site (m)	434.4	Closest distance to the site boundary
Larger X coordinate of the dwelling site (m)	465.6	The dwelling site is assumed to be 31.6 m × 31.6 m and have an area of 1,000 m ²
Smaller Y coordinate of the dwelling site (m)	400	Closest distance to the site boundary
Larger Y coordinate of the dwelling site (m)	432	The dwelling site is assumed to be 31.6 m × 31.6 m and have an area of 1,000 m ²
Smaller X coordinate of the surface water body	526.5	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas
Larger X coordinate of the surface water body	826.5	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas

TABLE B.4 (Cont.)

Parameter	Value	Comment
Smaller Y coordinate of the surface water body	356.8	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas
Larger Y coordinate of the surface water body	656.8	The surface water body is assumed to be close to the dwelling site and the vegetable and livestock feed areas
Source Release and Deposition Velocity		
Deposition velocity (m/s)	0.001	For all radionuclides except I-129 (0.01)
Distribution Coefficients		
Sediment in surface water body (cm ³ /g)	Table B.2	
Fruit, grain, nonleafy vegetable fields (cm ³ /g)	Table B.2	
Leafy vegetable fields (cm ³ /g)	Table B.2	
Pasture, silage growing areas (cm ³ /g)	Table B.2	
Livestock feed grain fields (cm ³ /g)	Table B.2	
Offsite dwelling site (cm ³ /g)	Table B.2	
Transfer Factors		
Fruit, grain, nonleafy vegetable transfer factor	Table B.2	
Leafy vegetable transfer factor	Table B.2	
Pasture and silage transfer factor	Table B.2	
Livestock feed grain transfer factor	Table B.2	
Storage Time		
Storage time for pasture and silage (d)	1	Default
Storage time for livestock feed grain (d)	45	Default
Primary Contamination		
Deposition velocity of dust (m/s)	0.001	Default
Rainfall and runoff factor	160	Default
Slope-length-steepness factor	0.4	Default
Cover and management factor	0.0506	Adjusted to match site-specific erosion rate
Support practice factor	1	Default
Contaminated Zone		
Soil erodibility factor of contaminated zone	0.4	Default
Clean Cover		
Soil erodibility factor of clean cover	NR	No cover
Volumetric water content of clean cover	NR	No cover
Agriculture/Livestock Feed Growing/Offsite Dwelling Area Parameters		
Fraction of area directly over primary contamination for all fields	0	Receptor offsite
Irrigation applied per year for all fields (m/yr)	0.1	Site specific

TABLE B.4 (Cont.)

Parameter	Value	Comment
Evapotranspiration coefficient for all fields	Table B.1	
Runoff coefficient for all fields	Table B.1	
Depth of soil mixing layer or plow layer for all fields (m)	Table B.1	
Volumetric water content for all fields	0.3	Default
Dry bulk density of soil for all fields (g/cm ³)	Table B.1	
Soil erodibility factor for all fields	0.4	Default
Slope-length-steepness factor for all fields	0.4	Default
Cover and management factor for all fields	0.0488	Adjusted to match site-specific erosion rate
Support practice factor for all fields	1	Default
Atmospheric Transport		
Release height (m)	1	Default
Release heat flux (cal/s)	0	Default
Anemometer height (m)	10	Default
Ambient temperature (K)	285	Default
AM atmospheric mixing height (m)	400	Default
PM atmospheric mixing height (m)	1,600	Default
Dispersion model coefficients	Pasquill-Gifford	Default
Wind speed terrain	Rural	Default
Elevation of offsite location relative to ground level at primary contamination for all fields (m)	0	Default
Grid spacing for areal integration (m)	10	Default
Joint frequency of wind speed and stability class for a 16-sector wind rose	Actual values from Chicago Midway	Site-specific
Unsaturated Zone Parameters		
Unsaturated zone longitudinal dispersivity (m)	0.1	Default
Saturated Zone Hydrological Data		
Thickness of saturated zone (m)	18.3	Site-specific
Saturated zone longitudinal dispersivity to surface water body (m)	10	Default
Saturated zone horizontal lateral dispersivity to surface water body (m)	1	Default
Disperse vertically	Check box	Yes
Saturated zone vertical lateral dispersivity to surface water body (m)	0.06	Default
Depth of aquifer contributing to surface water body (m)	10	Default
Surface Water Body		
Sediment deliver ratio	1	Default
Volume of surface water body (m ³)	150,000	Default

TABLE B.4 (Cont.)

Parameter	Value	Comment
Mean residence time of water in surface water body (yr)	1	Default
Groundwater Transport Parameters		
Distance from downgradient edge of contamination to well in the direction parallel to aquifer flow (m)	-1	Site-specific
Distance from downgradient edge of contamination to surface water body in the direction parallel to aquifer flow (m)	256.8	Site-specific
Distance from downgradient edge of contamination to well in the direction perpendicular to aquifer flow (m)	-424	Site-specific
Distance from downgradient edge of contamination to the right edge of surface water body in the direction perpendicular to aquifer flow (m)	-150	Default
Distance from downgradient edge of contamination to the left edge of the surface water body in the direction perpendicular to aquifer flow (m)	150	Default
Main subzones in saturated zone	1	Default
Main subzones in each partially saturated zone	1	Default
Nuclide-specific retardation in all subzones, longitudinal dispersion in all but the subzone of transformation?	Yes	Default
Water Use		
Quantity of water consumed by an individual (L/yr)	Table B.1	Household water not contaminated
Number of household individuals consuming and using water	4	Default
Quantity of water for use indoors of dwelling per individual (L/d)	225	Household water not contaminated
Quantity of water for beef cattle (L/d)	50	Default
Number of beef cattle	2	Default
Quantity of water for dairy cows (L/d)	160	Default
Number of dairy cows	2	Default
Well pumping rate (m ³ /yr)	NR	RESRAD default
Ingestion Rates		
Drinking water intake from affected area	0	Drinking water not contaminated
Fish intake from affected area	0.5	Default
Crustacea and mollusks intake from affected area	0.5	Default
Fruit, grain, nonleafy vegetables fraction from affected area	0.5	Default
Leafy vegetables fraction from affected area	0.5	Default
Meat fraction from affected area	0.5	50% of the meat consumed is from contaminated area
Milk fraction from affected area	0.5	50% of the meat consumed is from contaminated area

TABLE B.4 (Cont.)

Parameter	Value	Comment
Livestock Intake		
Pasture and silage intake for beef cattle (kg/d)	14	Default
Grain intake for beef cattle (kg/d)	54	Default
Soil from pasture and silage intake for beef cattle (kg/d)	0.1	Default
Soil from grain intake for beef cattle (kg/d)	0.4	Default
Pasture and silage intake for dairy cows (kg/d)	44	Default
Grain intake for dairy cows (kg/d)	11	Default
Soil from pasture and silage intake for dairy cows (kg/d)	0.4	Default
Soil from grain intake for dairy cows (kg/d)	0.1	Default
Livestock Feed Factors (for Pasture and Silage, Grain)		
Wet weight crop yield (kg/m ²)	1.1, 0.7	Default
Duration of growing season (yr)	0.08, 0.17	Default
Foliage to food transfer coefficient	1, 0.1	Default
Weathering removal constant	20, 20	Default
Foliar interception factor for irrigation	0.25, 0.25	Default
Foliar interception factor for dust deposition	0.25, 0.25	Default
Root depth (m)	Table B.1	
Occupancy Factors		
Indoor time fraction on primary contamination	0	Default
Outdoor time fraction on primary contamination	0	Default
Indoor time fraction on offsite dwelling site	0.5	Default
Outdoor time fraction on offsite dwelling site	0.1	Default
Time fraction in fruit, grain, and nonleafy vegetable fields	0.1	Default
Time fraction in leafy vegetable fields	0.1	Default
Time fraction in pasture and silage fields	0.1	Default
Time fraction in livestock grain fields	0.1	Default

^a All the areas (dwelling, agricultural areas) are assumed to be less than 350 m away from the contaminated area. This is a conservative assumption because the distance to the site boundary from the Building 310 area is greater than 350 m.

REFERENCES FOR APPENDIX B

Argonne (Argonne National Laboratory), 1996, *Interim Action Documentation Report: Decontamination and Demolition of the 317 Area South Vaults*, Argonne, Ill., May 31.

Eckerman, K.F., and J.C. Ryman, 1993, *External Exposure to Radionuclides in Air, Water, and Soil, Exposure to Dose Coefficients for General Application, Based on the 1987 Federal Radiation Protection Guidance*, EPA 402-R-93-076, Federal Guidance Report No. 12, prepared by Oak Ridge National Laboratory, Oak Ridge, Tenn., for U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1997, *Exposure Factor Handbook*, EPA/600/P-95/002Fa, Office of Research and Development, National Center for Environmental Assessment, Washington, D.C.

Golchert, N.W., T.M. Davis, and L.P. Moos, 2010, *Argonne Site Environmental Report for Calendar Year 2009*, ANL-10/02, Argonne National Laboratory, Argonne, Ill., September.

ICRP (International Commission on Radiological Protection), 1991, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Ann. ICRP 21(1-3), Pergamon Press, Oxford, England.

ICRP, 1996, *Age-Dependent Doses to Members of the Public from Intake of Radionuclides: Part 5, Compilation of Ingestion and Inhalation Coefficients*, ICRP Publication 72, Ann. ICRP 26(1), Pergamon Press, Oxford, England.

Kamboj, S., 2011, “Bldg. 310 RESRAD Analysis Project Status,” intraoffice personal communication between Kamboj and R.L. Johnson (Argonne National Laboratory, Argonne, Ill.), Jan. 7.

Matton, P.B., 2011, “Bldg. 330 D&D Project—RESRAD, DCGLs, Clean-up Parameters,” intraoffice personal communication between Matton and R.J. Johnson (Argonne National Laboratory, Argonne, Ill.), Jan. 14.

NRC (U.S. Nuclear Regulatory Commission), 2000, *Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes*, NUREG/CR-6697 and ANL/EAD/TM-98, prepared by C. Yu et al., Argonne National Laboratory, Argonne, Ill., for U.S. Nuclear Regulatory Commission, Washington, D.C., Nov.

NRCS (Natural Resources Conservation Service), 2010, “Report Cards Are Out—Illinois NRI Gets Gold Star!,” news release, May 25.

Patton, T.L., R.H. Pearl, and S.Y. Tsai, 1990, *Hydrological Conditions at the 800 Area at Argonne National Laboratory*, ANL/EAIS/TM-29, Argonne National Laboratory, Argonne, Ill., August.

Quinn, J., 2010, personal communication between Quinn and S. Kamboj (Argonne National Laboratory, Argonne, Ill.), Nov. 12.

Yu, C., et al., 1993, *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8, Argonne National Laboratory, Argonne, Ill., April.

Yu, C., et al., 2001, *User's Manual for RESRAD Version 6*, ANL/EAD-4, Argonne National Laboratory, Argonne, Ill.

APPENDIX C:

DETAILED PROBABILISTIC ANALYSIS RESULTS

Tables C.1–C.14 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for the industrial use scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For Co-60, Cs-137, Np-237, Sr-90, U-235, and U-238, external exposure was the dominant exposure pathway. For Am-241, I-129, and Tc-99, soil ingestion and external exposure were the dominant exposure pathways. For C-14, only inhalation was the dominant exposure pathway. For Pu-238, Pu-239, and Pu-240, soil ingestion and inhalation were two dominant exposure pathways. For U-234, radon inhalation was the dominant exposure pathway.

TABLE C.1 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Am-241 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	1.47E-03	8.66E-04	1.86E-04	2.76E-04
10%	4.06E-03	2.54E-03	4.46E-04	6.60E-04
15%	6.76E-03	4.23E-03	6.94E-04	1.00E-03
20%	9.42E-03	5.89E-03	9.35E-04	1.33E-03
25%	1.11E-02	7.57E-03	1.14E-03	1.65E-03
30%	1.21E-02	7.86E-03	1.30E-03	1.95E-03
35%	1.27E-02	8.15E-03	1.44E-03	2.27E-03
40%	1.33E-02	8.43E-03	1.57E-03	2.53E-03
45%	1.37E-02	8.72E-03	1.70E-03	2.78E-03
50%	1.43E-02	9.01E-03	1.82E-03	3.02E-03
55%	1.47E-02	9.20E-03	1.97E-03	3.26E-03
60%	1.52E-02	9.39E-03	2.14E-03	3.50E-03
65%	1.57E-02	9.58E-03	2.34E-03	3.73E-03
70%	1.62E-02	9.76E-03	2.53E-03	4.00E-03
75%	1.68E-02	9.95E-03	2.78E-03	4.31E-03
80%	1.75E-02	1.05E-02	3.07E-03	4.64E-03
85%	1.84E-02	1.10E-02	3.46E-03	5.04E-03
90%	1.97E-02	1.16E-02	3.99E-03	5.53E-03
95%	2.19E-02	1.23E-02	4.87E-03	6.27E-03
Mean	1.35E-02	8.26E-03	2.11E-03	3.09E-03
Min	1.08E-04	7.56E-05	1.14E-06	5.60E-06
Max	4.08E-02	1.71E-02	1.65E-02	1.15E-02

TABLE C.2 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for C-14 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	2.22E-06	3.91E-08	1.94E-06	1.19E-07
10%	5.82E-06	1.14E-07	5.28E-06	2.85E-07
15%	1.02E-05	1.89E-07	9.27E-06	4.35E-07
20%	1.34E-05	2.64E-07	1.20E-05	5.79E-07
25%	1.53E-05	3.37E-07	1.38E-05	7.13E-07
30%	1.68E-05	3.51E-07	1.50E-05	8.45E-07
35%	1.79E-05	3.65E-07	1.62E-05	9.74E-07
40%	1.90E-05	3.78E-07	1.72E-05	1.10E-06
45%	2.02E-05	3.90E-07	1.84E-05	1.20E-06
50%	2.13E-05	4.02E-07	1.93E-05	1.31E-06
55%	2.23E-05	4.12E-07	2.03E-05	1.41E-06
60%	2.34E-05	4.21E-07	2.14E-05	1.52E-06
65%	2.45E-05	4.28E-07	2.24E-05	1.61E-06
70%	2.56E-05	4.37E-07	2.36E-05	1.73E-06
75%	2.70E-05	4.47E-07	2.50E-05	1.86E-06
80%	2.87E-05	4.69E-07	2.64E-05	2.00E-06
85%	3.05E-05	4.93E-07	2.83E-05	2.18E-06
90%	3.32E-05	5.18E-07	3.11E-05	2.39E-06
95%	3.73E-05	5.54E-07	3.50E-05	2.71E-06
Mean	2.10E-05	3.69E-07	1.93E-05	1.34E-06
Min	1.45E-07	3.37E-09	1.35E-07	2.41E-09
Max	7.84E-05	7.68E-07	7.40E-05	5.03E-06

TABLE C.3 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Co-60 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation	
			w/o Radon	Soil Ingestion
5%	3.24E-01	3.24E-01	4.40E-08	4.25E-06
10%	9.57E-01	9.57E-01	1.13E-07	1.00E-05
15%	1.59E+00	1.59E+00	1.92E-07	1.62E-05
20%	2.22E+00	2.22E+00	2.49E-07	2.16E-05
25%	2.85E+00	2.85E+00	3.05E-07	2.65E-05
30%	2.96E+00	2.96E+00	3.48E-07	3.12E-05
35%	3.07E+00	3.07E+00	3.82E-07	3.59E-05
40%	3.17E+00	3.17E+00	4.14E-07	4.04E-05
45%	3.28E+00	3.28E+00	4.44E-07	4.48E-05
50%	3.39E+00	3.39E+00	4.77E-07	4.85E-05
55%	3.46E+00	3.46E+00	5.08E-07	5.23E-05
60%	3.53E+00	3.53E+00	5.39E-07	5.60E-05
65%	3.61E+00	3.61E+00	5.71E-07	6.01E-05
70%	3.67E+00	3.67E+00	6.05E-07	6.41E-05
75%	3.75E+00	3.75E+00	6.40E-07	6.90E-05
80%	3.95E+00	3.95E+00	6.80E-07	7.39E-05
85%	4.15E+00	4.15E+00	7.40E-07	8.01E-05
90%	4.36E+00	4.36E+00	8.31E-07	8.74E-05
95%	4.64E+00	4.64E+00	1.01E-06	9.96E-05
Mean	3.11E+00	3.11E+00	4.93E-07	4.94E-05
Min	2.83E-02	2.83E-02	6.67E-10	2.93E-08
Max	6.43E+00	6.43E+00	2.64E-06	1.81E-04

3. TABLE C.4 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Cs-137 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	7.12E-02	7.11E-02	7.46E-08	1.77E-05
10%	2.09E-01	2.08E-01	1.79E-07	4.24E-05
15%	3.47E-01	3.47E-01	2.79E-07	6.46E-05
20%	4.85E-01	4.85E-01	3.76E-07	8.58E-05
25%	6.22E-01	6.22E-01	4.58E-07	1.06E-04
30%	6.46E-01	6.46E-01	5.23E-07	1.26E-04
35%	6.70E-01	6.69E-01	5.77E-07	1.46E-04
40%	6.93E-01	6.93E-01	6.30E-07	1.63E-04
45%	7.17E-01	7.17E-01	6.84E-07	1.79E-04
50%	7.41E-01	7.40E-01	7.32E-07	1.94E-04
55%	7.56E-01	7.56E-01	7.90E-07	2.09E-04
60%	7.71E-01	7.71E-01	8.60E-07	2.25E-04
65%	7.87E-01	7.87E-01	9.37E-07	2.40E-04
70%	8.02E-01	8.02E-01	1.01E-06	2.58E-04
75%	8.18E-01	8.17E-01	1.12E-06	2.78E-04
80%	8.62E-01	8.62E-01	1.23E-06	2.98E-04
85%	9.06E-01	9.06E-01	1.39E-06	3.24E-04
90%	9.51E-01	9.51E-01	1.60E-06	3.56E-04
95%	1.01E+00	1.01E+00	1.96E-06	4.03E-04
Mean	6.78E-01	6.78E-01	8.46E-07	1.99E-04
Min	6.21E-03	6.20E-03	4.58E-10	3.60E-07
Max	1.40E+00	1.40E+00	6.61E-06	7.42E-04

TABLE C.5 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for I-129 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation	
			w/o Radon	Soil Ingestion
5%	3.70E-04	2.14E-04	1.36E-07	1.32E-04
10%	1.09E-03	6.26E-04	3.48E-07	3.24E-04
15%	1.77E-03	1.04E-03	5.84E-07	5.25E-04
20%	2.37E-03	1.43E-03	7.66E-07	6.95E-04
25%	2.75E-03	1.75E-03	9.34E-07	8.48E-04
30%	3.02E-03	1.91E-03	1.06E-06	1.00E-03
35%	3.25E-03	2.01E-03	1.17E-06	1.14E-03
40%	3.45E-03	2.08E-03	1.28E-06	1.29E-03
45%	3.65E-03	2.14E-03	1.36E-06	1.44E-03
50%	3.82E-03	2.20E-03	1.46E-06	1.56E-03
55%	3.98E-03	2.27E-03	1.56E-06	1.69E-03
60%	4.13E-03	2.33E-03	1.65E-06	1.81E-03
65%	4.29E-03	2.39E-03	1.76E-06	1.92E-03
70%	4.46E-03	2.45E-03	1.86E-06	2.07E-03
75%	4.67E-03	2.51E-03	1.97E-06	2.22E-03
80%	4.90E-03	2.61E-03	2.11E-06	2.39E-03
85%	5.15E-03	2.74E-03	2.30E-06	2.59E-03
90%	5.50E-03	2.91E-03	2.57E-06	2.83E-03
95%	6.15E-03	3.16E-03	3.15E-06	3.24E-03
Mean	3.64E-03	2.04E-03	1.52E-06	1.59E-03
Min	2.31E-05	1.68E-05	2.02E-09	9.66E-07
Max	1.01E-02	4.47E-03	8.27E-06	5.91E-03

TABLE C.6 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Np-237 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation	
			w/o Radon	Soil Ingestion
5%	2.26E-02	2.25E-02	7.84E-05	1.46E-04
10%	6.53E-02	6.43E-02	1.87E-04	3.48E-04
15%	1.10E-01	1.08E-01	3.09E-04	5.26E-04
20%	1.50E-01	1.48E-01	4.03E-04	7.10E-04
25%	1.82E-01	1.79E-01	4.85E-04	8.82E-04
30%	2.03E-01	2.00E-01	5.58E-04	1.04E-03
35%	2.11E-01	2.08E-01	6.27E-04	1.21E-03
40%	2.19E-01	2.16E-01	6.85E-04	1.35E-03
45%	2.26E-01	2.24E-01	7.37E-04	1.47E-03
50%	2.33E-01	2.30E-01	7.92E-04	1.61E-03
55%	2.41E-01	2.38E-01	8.42E-04	1.75E-03
60%	2.47E-01	2.44E-01	8.95E-04	1.88E-03
65%	2.52E-01	2.49E-01	9.49E-04	2.01E-03
70%	2.57E-01	2.55E-01	1.00E-03	2.17E-03
75%	2.64E-01	2.61E-01	1.07E-03	2.31E-03
80%	2.73E-01	2.70E-01	1.15E-03	2.52E-03
85%	2.91E-01	2.87E-01	1.26E-03	2.73E-03
90%	3.07E-01	3.03E-01	1.40E-03	3.01E-03
95%	3.28E-01	3.24E-01	1.68E-03	3.43E-03
Mean	2.15E-01	2.13E-01	8.19E-04	1.66E-03
Min	1.84E-03	1.83E-03	2.39E-06	6.32E-06
Max	4.63E-01	4.55E-01	4.12E-03	6.46E-03

TABLE C.7 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-238 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Radon (WI)	Soil Ingestion
5%	6.12E-04	2.76E-06	2.13E-04	1.01E-11	3.16E-04
10%	1.65E-03	8.08E-06	5.09E-04	2.50E-11	7.56E-04
15%	2.51E-03	1.35E-05	7.94E-04	4.50E-11	1.15E-03
20%	3.24E-03	1.88E-05	1.07E-03	7.21E-11	1.53E-03
25%	3.85E-03	2.41E-05	1.30E-03	9.43E-11	1.89E-03
30%	4.36E-03	2.50E-05	1.49E-03	1.19E-10	2.24E-03
35%	4.81E-03	2.60E-05	1.64E-03	1.41E-10	2.60E-03
40%	5.21E-03	2.69E-05	1.79E-03	1.62E-10	2.91E-03
45%	5.56E-03	2.78E-05	1.95E-03	1.81E-10	3.19E-03
50%	5.92E-03	2.87E-05	2.08E-03	2.03E-10	3.46E-03
55%	6.27E-03	2.93E-05	2.25E-03	2.24E-10	3.73E-03
60%	6.65E-03	2.99E-05	2.45E-03	2.48E-10	4.02E-03
65%	7.07E-03	3.05E-05	2.67E-03	2.74E-10	4.27E-03
70%	7.54E-03	3.11E-05	2.89E-03	3.05E-10	4.58E-03
75%	7.97E-03	3.17E-05	3.18E-03	3.37E-10	4.95E-03
80%	8.46E-03	3.34E-05	3.52E-03	3.76E-10	5.32E-03
85%	9.12E-03	3.52E-05	3.95E-03	4.23E-10	5.77E-03
90%	1.00E-02	3.69E-05	4.57E-03	4.90E-10	6.33E-03
95%	1.13E-02	3.93E-05	5.57E-03	6.08E-10	7.19E-03
Mean	5.98E-03	2.63E-05	2.41E-03	2.41E-10	3.54E-03
Min	2.74E-05	2.41E-07	1.30E-06	9.48E-14	6.42E-06
Max	2.76E-02	5.44E-05	1.88E-02	2.03E-09	1.32E-02

TABLE C.8 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-239 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	6.73E-04	6.04E-06	2.33E-04	3.45E-04
10%	1.81E-03	1.77E-05	5.58E-04	8.25E-04
15%	2.76E-03	2.94E-05	8.69E-04	1.26E-03
20%	3.57E-03	4.12E-05	1.17E-03	1.67E-03
25%	4.24E-03	5.28E-05	1.43E-03	2.06E-03
30%	4.79E-03	5.48E-05	1.63E-03	2.44E-03
35%	5.27E-03	5.68E-05	1.80E-03	2.84E-03
40%	5.72E-03	5.88E-05	1.97E-03	3.17E-03
45%	6.11E-03	6.08E-05	2.13E-03	3.48E-03
50%	6.51E-03	6.28E-05	2.28E-03	3.78E-03
55%	6.89E-03	6.41E-05	2.46E-03	4.07E-03
60%	7.30E-03	6.54E-05	2.68E-03	4.39E-03
65%	7.76E-03	6.67E-05	2.92E-03	4.66E-03
70%	8.27E-03	6.81E-05	3.16E-03	5.01E-03
75%	8.75E-03	6.94E-05	3.49E-03	5.40E-03
80%	9.28E-03	7.31E-05	3.85E-03	5.81E-03
85%	1.00E-02	7.69E-05	4.32E-03	6.30E-03
90%	1.10E-02	8.07E-05	5.00E-03	6.91E-03
95%	1.24E-02	8.59E-05	6.10E-03	7.85E-03
Mean	6.56E-03	5.75E-05	2.64E-03	3.87E-03
Min	3.02E-05	5.27E-07	1.43E-06	7.00E-06
Max	3.02E-02	1.19E-04	2.06E-02	1.44E-02

TABLE C.9 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-240 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Radon (WI)	Soil Ingestion
5%	6.44E-04	2.66E-06	1.84E-04	6.30E-16	3.43E-04
10%	1.61E-03	7.84E-06	4.81E-04	1.83E-15	8.10E-04
15%	2.49E-03	1.30E-05	7.80E-04	3.90E-15	1.27E-03
20%	3.28E-03	1.82E-05	1.01E-03	6.55E-15	1.70E-03
25%	3.80E-03	2.33E-05	1.22E-03	1.07E-14	2.06E-03
30%	4.33E-03	2.42E-05	1.41E-03	1.64E-14	2.41E-03
35%	4.80E-03	2.51E-05	1.57E-03	2.36E-14	2.81E-03
40%	5.22E-03	2.60E-05	1.69E-03	3.12E-14	3.16E-03
45%	5.60E-03	2.69E-05	1.83E-03	4.10E-14	3.48E-03
50%	5.97E-03	2.78E-05	1.95E-03	5.13E-14	3.78E-03
55%	6.29E-03	2.83E-05	2.08E-03	6.20E-14	4.08E-03
60%	6.67E-03	2.89E-05	2.21E-03	7.58E-14	4.38E-03
65%	7.05E-03	2.95E-05	2.36E-03	8.98E-14	4.69E-03
70%	7.48E-03	3.01E-05	2.50E-03	1.02E-13	5.05E-03
75%	7.90E-03	3.07E-05	2.67E-03	1.17E-13	5.39E-03
80%	8.37E-03	3.23E-05	2.87E-03	1.30E-13	5.81E-03
85%	8.94E-03	3.40E-05	3.12E-03	1.43E-13	6.25E-03
90%	9.68E-03	3.56E-05	3.50E-03	1.60E-13	6.91E-03
95%	1.09E-02	3.80E-05	4.15E-03	1.80E-13	7.79E-03
Mean	5.92E-03	2.54E-05	2.03E-03	6.80E-14	3.87E-03
Min	3.55E-05	2.36E-07	2.01E-06	6.14E-19	1.51E-06
Max	2.07E-02	5.25E-05	9.58E-03	3.48E-13	1.53E-02

TABLE C.10 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Sr-90 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	9.62E-04	9.03E-04	3.08E-07	4.18E-05
10%	2.84E-03	2.67E-03	7.35E-07	1.00E-04
15%	4.65E-03	4.42E-03	1.15E-06	1.53E-04
20%	6.54E-03	6.18E-03	1.55E-06	2.02E-04
25%	8.25E-03	7.91E-03	1.89E-06	2.51E-04
30%	8.72E-03	8.27E-03	2.16E-06	2.96E-04
35%	9.02E-03	8.58E-03	2.38E-06	3.44E-04
40%	9.35E-03	8.86E-03	2.60E-06	3.84E-04
45%	9.66E-03	9.17E-03	2.82E-06	4.22E-04
50%	9.94E-03	9.47E-03	3.03E-06	4.57E-04
55%	1.02E-02	9.68E-03	3.26E-06	4.94E-04
60%	1.04E-02	9.87E-03	3.55E-06	5.32E-04
65%	1.06E-02	1.01E-02	3.88E-06	5.66E-04
70%	1.09E-02	1.03E-02	4.20E-06	6.07E-04
75%	1.12E-02	1.05E-02	4.63E-06	6.54E-04
80%	1.16E-02	1.10E-02	5.11E-06	7.04E-04
85%	1.22E-02	1.16E-02	5.71E-06	7.62E-04
90%	1.29E-02	1.22E-02	6.63E-06	8.34E-04
95%	1.38E-02	1.30E-02	8.09E-06	9.52E-04
Mean	9.15E-03	8.68E-03	3.49E-06	4.69E-04
Min	7.80E-05	7.57E-05	1.90E-09	8.52E-07
Max	1.96E-02	1.80E-02	2.74E-05	1.76E-03

TABLE C.11 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Tc-99 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	3.44E-06	2.35E-06	2.37E-08	8.40E-07
10%	9.83E-06	6.91E-06	5.70E-08	2.00E-06
15%	1.62E-05	1.15E-05	8.88E-08	3.05E-06
20%	2.27E-05	1.61E-05	1.19E-07	4.06E-06
25%	2.65E-05	2.05E-05	1.46E-07	5.00E-06
30%	2.87E-05	2.14E-05	1.67E-07	5.90E-06
35%	3.04E-05	2.22E-05	1.84E-07	6.85E-06
40%	3.18E-05	2.30E-05	2.02E-07	7.71E-06
45%	3.30E-05	2.38E-05	2.17E-07	8.44E-06
50%	3.41E-05	2.45E-05	2.34E-07	9.17E-06
55%	3.54E-05	2.51E-05	2.52E-07	9.88E-06
60%	3.65E-05	2.56E-05	2.75E-07	1.06E-05
65%	3.77E-05	2.61E-05	2.99E-07	1.13E-05
70%	3.89E-05	2.66E-05	3.25E-07	1.21E-05
75%	4.02E-05	2.73E-05	3.58E-07	1.31E-05
80%	4.18E-05	2.85E-05	3.94E-07	1.41E-05
85%	4.38E-05	3.00E-05	4.42E-07	1.53E-05
90%	4.70E-05	3.16E-05	5.10E-07	1.67E-05
95%	5.18E-05	3.39E-05	6.23E-07	1.90E-05
Mean	3.21E-05	2.25E-05	2.70E-07	9.37E-06
Min	2.52E-07	2.01E-07	1.50E-10	1.72E-08
Max	8.21E-05	4.69E-05	2.13E-06	3.57E-05

TABLE C.12 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-234 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Radon (WI)	Radon (WD)	Soil Ingestion
5%	4.74E-03	9.68E-05	7.53E-06	4.49E-03	0.00E+00	8.54E-05
10%	1.20E-02	2.81E-04	1.60E-05	1.15E-02	0.00E+00	1.85E-04
15%	2.45E-02	5.40E-04	2.61E-05	2.38E-02	0.00E+00	2.97E-04
20%	4.04E-02	9.45E-04	3.40E-05	3.90E-02	0.00E+00	4.08E-04
25%	6.17E-02	1.46E-03	4.13E-05	5.97E-02	0.00E+00	5.02E-04
30%	9.04E-02	2.10E-03	4.90E-05	8.75E-02	0.00E+00	5.91E-04
35%	1.20E-01	2.83E-03	5.67E-05	1.17E-01	0.00E+00	6.78E-04
40%	1.53E-01	3.72E-03	6.53E-05	1.48E-01	0.00E+00	7.61E-04
45%	1.89E-01	4.69E-03	7.33E-05	1.84E-01	0.00E+00	8.43E-04
50%	2.28E-01	5.86E-03	8.17E-05	2.21E-01	0.00E+00	9.23E-04
55%	2.73E-01	6.96E-03	9.02E-05	2.63E-01	0.00E+00	1.01E-03
60%	3.11E-01	8.33E-03	9.95E-05	3.00E-01	0.00E+00	1.10E-03
65%	3.47E-01	9.66E-03	1.09E-04	3.35E-01	0.00E+00	1.18E-03
70%	3.84E-01	1.10E-02	1.20E-04	3.72E-01	0.00E+00	1.28E-03
75%	4.24E-01	1.29E-02	1.34E-04	4.09E-01	0.00E+00	1.39E-03
80%	4.60E-01	1.53E-02	1.52E-04	4.46E-01	0.00E+00	1.55E-03
85%	5.06E-01	1.76E-02	1.70E-04	4.89E-01	0.00E+00	1.75E-03
90%	5.68E-01	2.16E-02	1.99E-04	5.51E-01	9.60E-08	2.03E-03
95%	6.64E-01	2.83E-02	2.46E-04	6.42E-01	1.34E-06	2.47E-03
Mean	2.65E-01	8.92E-03	9.82E-05	2.56E-01	5.68E-07	1.04E-03
Min	1.78E-05	4.03E-07	1.21E-07	1.74E-05	0.00E+00	3.44E-06
Max	1.33E+00	8.87E-02	7.08E-04	1.277	1.27E-04	5.27E-03

TABLE C.13 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-235 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Soil Ingestion
5%	1.69E-02	1.68E-02	3.14E-05	1.18E-04
10%	4.98E-02	4.92E-02	7.06E-05	2.59E-04
15%	8.11E-02	8.05E-02	1.03E-04	3.85E-04
20%	1.14E-01	1.13E-01	1.28E-04	5.13E-04
25%	1.41E-01	1.40E-01	1.51E-04	6.14E-04
30%	1.47E-01	1.46E-01	1.78E-04	7.31E-04
35%	1.54E-01	1.53E-01	2.04E-04	8.30E-04
40%	1.61E-01	1.59E-01	2.37E-04	9.27E-04
45%	1.67E-01	1.66E-01	2.79E-04	1.03E-03
50%	1.71E-01	1.70E-01	3.40E-04	1.16E-03
55%	1.75E-01	1.74E-01	4.06E-04	1.31E-03
60%	1.80E-01	1.78E-01	4.84E-04	1.47E-03
65%	1.84E-01	1.82E-01	5.79E-04	1.68E-03
70%	1.92E-01	1.90E-01	6.93E-04	1.97E-03
75%	2.00E-01	1.98E-01	8.17E-04	2.35E-03
80%	2.08E-01	2.06E-01	9.55E-04	2.76E-03
85%	2.18E-01	2.15E-01	1.13E-03	3.28E-03
90%	2.29E-01	2.26E-01	1.34E-03	3.92E-03
95%	2.65E-01	2.60E-01	1.73E-03	5.01E-03
Mean	1.61E-01	1.59E-01	5.59E-04	1.69E-03
Min	1.39E-03	1.38E-03	1.36E-07	2.07E-06
Max	3.97E-01	3.90E-01	5.56E-03	1.13E-02

TABLE C.14 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-238 in Industrial Use Scenario

Percentile	All Pathways	External	Inhalation w/o Radon	Radon (WI)	Soil Ingestion
5%	3.64E-03	3.54E-03	1.22E-05	1.70E-11	6.50E-05
10%	1.06E-02	1.03E-02	3.35E-05	1.19E-10	1.51E-04
15%	1.76E-02	1.71E-02	5.28E-05	4.14E-10	2.37E-04
20%	2.45E-02	2.38E-02	6.74E-05	9.09E-10	3.22E-04
25%	3.13E-02	3.05E-02	8.16E-05	1.62E-09	4.04E-04
30%	3.28E-02	3.20E-02	9.43E-05	2.74E-09	4.79E-04
35%	3.40E-02	3.31E-02	1.04E-04	4.04E-09	5.43E-04
40%	3.52E-02	3.44E-02	1.13E-04	5.66E-09	6.08E-04
45%	3.64E-02	3.55E-02	1.22E-04	7.61E-09	6.70E-04
50%	3.75E-02	3.67E-02	1.30E-04	9.27E-09	7.34E-04
55%	3.84E-02	3.74E-02	1.39E-04	1.11E-08	7.92E-04
60%	3.93E-02	3.82E-02	1.48E-04	1.29E-08	8.52E-04
65%	4.00E-02	3.90E-02	1.58E-04	1.47E-08	9.17E-04
70%	4.08E-02	3.98E-02	1.68E-04	1.64E-08	9.77E-04
75%	4.18E-02	4.06E-02	1.78E-04	1.79E-08	1.05E-03
80%	4.38E-02	4.27E-02	1.89E-04	1.95E-08	1.13E-03
85%	4.61E-02	4.49E-02	2.06E-04	2.11E-08	1.23E-03
90%	4.84E-02	4.71E-02	2.29E-04	2.30E-08	1.35E-03
95%	5.17E-02	5.03E-02	2.68E-04	2.59E-08	1.53E-03
Mean	3.45E-02	3.36E-02	1.35E-04	1.06E-08	7.51E-04
Min	3.32E-04	3.18E-04	7.36E-09	2.49E-15	3.00E-06
Max	7.18E-02	7.00E-02	6.35E-04	4.52E-08	2.50E-03

Tables C.15–C.28 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for individual radionuclides in the offsite resident scenario. RESRAD-OFFSITE Version 2.6 was used in the analysis. For all radionuclides except Co-60, WD pathways were dominant, and for Co-60, the WI pathway was dominant. For Am-241, C-14, Cs-137, and U-234, aquatic food ingestion resulted in the most dose. For Np-237, Pu-238, Pu-239, and Pu-240, fish and plant ingestion were dominant exposure pathways. For Co-60, the external exposure pathway was dominant. For I-129, meat and milk resulted in the most dose. For Sr-90, fish, meat, and plant ingestion resulted in most dose. For Tc-99, plant and fish ingestion resulted in the most dose. For U-235 and U-238, external exposure and fish ingestion resulted in the most dose.

TABLE C.15 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Am-241 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	2.16E-03	2.72E-06	1.99E-03	1.21E-04	2.90E-06	3.07E-07	9.24E-07	9.69E-08	6.63E-06	5.17E-09	3.51E-11	1.72E-12	2.15E-10
10%	2.69E-03	5.72E-06	2.47E-03	1.62E-04	3.68E-06	4.41E-07	1.95E-06	9.70E-08	6.64E-06	6.08E-09	3.86E-11	2.24E-12	3.08E-10
15%	3.32E-03	8.77E-06	3.07E-03	2.00E-04	4.50E-06	5.44E-07	2.96E-06	9.70E-08	6.64E-06	6.76E-09	4.15E-11	2.66E-12	3.89E-10
20%	4.17E-03	1.18E-05	3.85E-03	2.35E-04	5.50E-06	6.53E-07	4.01E-06	9.70E-08	6.64E-06	7.40E-09	4.41E-11	3.02E-12	4.80E-10
25%	4.91E-03	1.46E-05	4.56E-03	2.68E-04	6.61E-06	7.47E-07	4.96E-06	9.70E-08	6.64E-06	8.02E-09	4.63E-11	3.43E-12	5.47E-10
30%	5.62E-03	1.69E-05	5.21E-03	2.97E-04	7.37E-06	8.52E-07	5.92E-06	9.70E-08	6.64E-06	8.68E-09	4.88E-11	3.80E-12	6.16E-10
35%	6.21E-03	1.94E-05	5.75E-03	3.30E-04	8.04E-06	9.51E-07	6.97E-06	9.70E-08	6.64E-06	9.27E-09	5.07E-11	4.21E-12	6.85E-10
40%	6.66E-03	2.19E-05	6.14E-03	3.58E-04	8.62E-06	1.05E-06	8.13E-06	9.70E-08	6.64E-06	9.83E-09	5.30E-11	4.63E-12	7.48E-10
45%	6.92E-03	2.41E-05	6.40E-03	3.86E-04	9.11E-06	1.17E-06	9.27E-06	9.70E-08	6.64E-06	1.05E-08	5.53E-11	5.07E-12	8.09E-10
50%	7.12E-03	2.62E-05	6.57E-03	4.15E-04	9.62E-06	1.29E-06	1.03E-05	9.70E-08	6.64E-06	1.12E-08	5.78E-11	5.59E-12	8.71E-10
55%	7.31E-03	2.78E-05	6.72E-03	4.50E-04	1.01E-05	1.45E-06	1.14E-05	9.70E-08	6.64E-06	1.19E-08	6.03E-11	6.10E-12	9.31E-10
60%	7.49E-03	2.93E-05	6.88E-03	4.88E-04	1.06E-05	1.61E-06	1.27E-05	9.70E-08	6.64E-06	1.27E-08	6.32E-11	6.76E-12	9.95E-10
65%	7.69E-03	3.07E-05	7.09E-03	5.27E-04	1.10E-05	1.77E-06	1.40E-05	9.70E-08	6.64E-06	1.35E-08	6.62E-11	7.40E-12	1.06E-09
70%	7.95E-03	3.22E-05	7.30E-03	5.64E-04	1.14E-05	1.95E-06	1.52E-05	9.70E-08	6.64E-06	1.45E-08	7.00E-11	8.06E-12	1.13E-09
75%	8.26E-03	3.33E-05	7.58E-03	6.18E-04	1.19E-05	2.22E-06	1.66E-05	9.70E-08	6.64E-06	1.54E-08	7.43E-11	9.02E-12	1.20E-09
80%	8.66E-03	3.47E-05	8.01E-03	6.75E-04	1.24E-05	2.50E-06	1.81E-05	9.70E-08	6.64E-06	1.67E-08	7.91E-11	1.01E-11	1.28E-09
85%	9.24E-03	3.61E-05	8.59E-03	7.46E-04	1.30E-05	2.89E-06	1.99E-05	9.70E-08	6.64E-06	1.86E-08	8.56E-11	1.16E-11	1.39E-09
90%	1.00E-02	3.78E-05	9.36E-03	8.68E-04	1.38E-05	3.42E-06	2.22E-05	9.70E-08	6.64E-06	2.12E-08	9.50E-11	1.37E-11	1.50E-09
95%	1.19E-02	4.02E-05	1.13E-02	1.06E-03	1.49E-05	4.56E-06	2.57E-05	9.70E-08	6.64E-06	2.56E-08	1.12E-10	1.79E-11	1.69E-09
Mean	6.98E-03	2.38E-05	6.49E-03	4.80E-04	9.24E-06	1.72E-06	1.14E-05	9.70E-08	6.64E-06	1.28E-08	6.37E-11	7.17E-12	8.95E-10
Min	1.49E-03	1.90E-07	1.42E-03	3.37E-05	1.64E-06	5.33E-08	4.81E-08	9.46E-08	6.47E-06	1.97E-09	2.27E-11	6.44E-13	1.13E-11
Max	1.08E-01	4.98E-05	1.08E-01	3.70E-03	2.14E-05	1.26E-05	3.97E-05	9.70E-08	6.64E-06	2.13E-07	3.07E-10	7.49E-11	2.43E-09

TABLE C.16 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for C-14 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	2.48E-04	4.57E-12	2.43E-04	4.02E-07	4.44E-07	1.03E-06	1.40E-11	1.27E-15	9.49E-07	2.40E-11	1.54E-11	2.95E-11	6.03E-16
10%	3.76E-04	6.03E-12	3.66E-04	5.31E-07	5.01E-07	1.06E-06	2.03E-11	1.31E-15	9.95E-07	3.04E-11	1.68E-11	3.07E-11	8.64E-16
15%	4.97E-04	7.71E-12	4.86E-04	7.40E-07	5.82E-07	1.09E-06	2.71E-11	1.34E-15	1.03E-06	3.72E-11	1.82E-11	3.15E-11	1.14E-15
20%	6.40E-04	9.77E-12	6.27E-04	1.04E-06	6.71E-07	1.12E-06	3.53E-11	1.38E-15	1.05E-06	4.49E-11	1.97E-11	3.23E-11	1.38E-15
25%	8.00E-04	1.19E-11	7.79E-04	1.36E-06	7.97E-07	1.15E-06	4.42E-11	1.42E-15	1.07E-06	5.40E-11	2.14E-11	3.29E-11	1.61E-15
30%	9.86E-04	1.38E-11	9.68E-04	1.71E-06	9.40E-07	1.18E-06	5.63E-11	1.47E-15	1.09E-06	6.51E-11	2.33E-11	3.36E-11	1.91E-15
35%	1.21E-03	1.57E-11	1.19E-03	2.07E-06	1.15E-06	1.23E-06	6.97E-11	1.52E-15	1.11E-06	8.00E-11	2.53E-11	3.43E-11	2.25E-15
40%	1.47E-03	1.75E-11	1.44E-03	2.55E-06	1.40E-06	1.29E-06	8.51E-11	1.57E-15	1.12E-06	9.45E-11	2.76E-11	3.50E-11	2.61E-15
45%	1.85E-03	2.04E-11	1.80E-03	3.21E-06	1.70E-06	1.39E-06	1.06E-10	1.63E-15	1.14E-06	1.08E-10	3.03E-11	3.56E-11	2.97E-15
50%	2.36E-03	3.00E-11	2.32E-03	4.26E-06	2.32E-06	1.69E-06	1.40E-10	1.66E-15	1.16E-06	1.19E-10	3.32E-11	3.63E-11	3.39E-15
55%	2.96E-03	6.93E-11	2.89E-03	6.15E-06	3.42E-06	2.99E-06	2.55E-10	1.69E-15	1.17E-06	1.34E-10	3.63E-11	3.71E-11	3.86E-15
60%	3.89E-03	1.46E-10	3.79E-03	1.07E-05	6.52E-06	5.74E-06	5.35E-10	1.72E-15	1.19E-06	1.49E-10	3.99E-11	3.79E-11	4.37E-15
65%	5.35E-03	2.68E-10	5.19E-03	1.94E-05	1.21E-05	1.16E-05	1.07E-09	1.74E-15	1.20E-06	1.65E-10	4.42E-11	3.87E-11	4.88E-15
70%	7.94E-03	5.22E-10	7.56E-03	3.54E-05	2.12E-05	2.25E-05	2.06E-09	1.77E-15	1.22E-06	1.84E-10	4.92E-11	3.97E-11	5.42E-15
75%	1.27E-02	9.98E-10	1.23E-02	7.13E-05	3.86E-05	4.26E-05	3.76E-09	1.79E-15	1.24E-06	2.11E-10	5.44E-11	4.09E-11	5.97E-15
80%	2.31E-02	1.74E-09	2.24E-02	1.37E-04	7.48E-05	7.08E-05	6.97E-09	1.82E-15	1.26E-06	2.39E-10	6.16E-11	4.26E-11	6.60E-15
85%	4.19E-02	3.28E-09	4.00E-02	3.03E-04	1.62E-04	1.33E-04	1.30E-08	1.85E-15	1.29E-06	2.76E-10	7.10E-11	4.45E-11	7.32E-15
90%	8.49E-02	6.40E-09	8.30E-02	6.75E-04	3.80E-04	2.92E-04	2.53E-08	1.88E-15	1.32E-06	3.42E-10	8.41E-11	4.76E-11	8.23E-15
95%	2.27E-01	1.40E-08	2.26E-01	2.26E-03	1.20E-03	6.93E-04	5.96E-08	1.94E-15	1.36E-06	4.79E-10	1.11E-10	5.36E-11	9.64E-15
Mean	5.95E-02	2.68E-09	5.89E-02	4.88E-04	2.43E-04	1.21E-04	1.16E-08	1.62E-15	1.16E-06	1.68E-10	4.59E-11	3.93E-11	4.09E-15
Min	4.91E-05	2.14E-12	4.66E-05	1.92E-07	3.40E-07	9.64E-07	4.29E-13	1.16E-15	7.82E-07	9.76E-12	1.22E-11	2.74E-11	1.81E-17
Max	9.51E+00	1.51E-07	9.51E+00	5.68E-02	3.86E-02	9.22E-03	6.30E-07	4.26E-15	1.55E-06	5.22E-09	1.39E-09	1.76E-09	8.85E-14

TABLE C.17 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Co-60 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	7.92E-04	6.63E-05	1.67E-05	1.79E-06	7.98E-06	3.10E-06	5.87E-10	7.85E-04	2.06E-09	8.75E-11	9.86E-11	2.68E-11	8.11E-14
10%	7.93E-04	7.02E-05	2.15E-05	2.07E-06	1.15E-05	4.01E-06	8.24E-10	7.85E-04	2.07E-09	1.02E-10	1.49E-10	3.50E-11	1.15E-13
15%	7.93E-04	7.26E-05	2.63E-05	2.34E-06	1.50E-05	4.75E-06	1.01E-09	7.85E-04	2.07E-09	1.14E-10	2.00E-10	4.17E-11	1.40E-13
20%	7.94E-04	7.45E-05	3.09E-05	2.53E-06	1.84E-05	5.47E-06	1.15E-09	7.85E-04	2.07E-09	1.25E-10	2.47E-10	4.83E-11	1.61E-13
25%	7.94E-04	7.63E-05	3.59E-05	2.72E-06	2.21E-05	6.17E-06	1.28E-09	7.85E-04	2.07E-09	1.36E-10	2.96E-10	5.49E-11	1.79E-13
30%	7.95E-04	7.80E-05	4.09E-05	2.92E-06	2.57E-05	6.95E-06	1.41E-09	7.85E-04	2.07E-09	1.47E-10	3.52E-10	6.15E-11	1.97E-13
35%	7.96E-04	7.94E-05	4.68E-05	3.10E-06	2.96E-05	7.56E-06	1.53E-09	7.85E-04	2.07E-09	1.58E-10	4.17E-10	6.77E-11	2.12E-13
40%	7.96E-04	8.08E-05	5.34E-05	3.27E-06	3.40E-05	8.34E-06	1.64E-09	7.85E-04	2.07E-09	1.68E-10	4.86E-10	7.47E-11	2.28E-13
45%	7.97E-04	8.20E-05	6.05E-05	3.46E-06	3.89E-05	9.06E-06	1.76E-09	7.85E-04	2.07E-09	1.81E-10	5.70E-10	8.22E-11	2.43E-13
50%	7.97E-04	8.35E-05	6.84E-05	3.65E-06	4.49E-05	1.00E-05	1.89E-09	7.85E-04	2.07E-09	1.94E-10	6.67E-10	9.16E-11	2.59E-13
55%	7.98E-04	8.49E-05	7.81E-05	3.87E-06	5.15E-05	1.11E-05	2.02E-09	7.85E-04	2.07E-09	2.07E-10	7.69E-10	1.00E-10	2.75E-13
60%	7.99E-04	8.66E-05	8.84E-05	4.12E-06	5.83E-05	1.21E-05	2.13E-09	7.85E-04	2.07E-09	2.21E-10	9.08E-10	1.11E-10	2.91E-13
65%	8.00E-04	8.82E-05	1.01E-04	4.41E-06	6.78E-05	1.33E-05	2.28E-09	7.85E-04	2.07E-09	2.36E-10	1.06E-09	1.23E-10	3.08E-13
70%	8.01E-04	9.02E-05	1.17E-04	4.72E-06	7.85E-05	1.47E-05	2.40E-09	7.85E-04	2.07E-09	2.57E-10	1.26E-09	1.36E-10	3.26E-13
75%	8.03E-04	9.23E-05	1.38E-04	5.10E-06	9.15E-05	1.64E-05	2.57E-09	7.85E-04	2.07E-09	2.79E-10	1.52E-09	1.55E-10	3.44E-13
80%	8.05E-04	9.54E-05	1.65E-04	5.56E-06	1.08E-04	1.85E-05	2.73E-09	7.85E-04	2.07E-09	3.07E-10	1.88E-09	1.80E-10	3.67E-13
85%	8.08E-04	9.92E-05	2.00E-04	6.16E-06	1.33E-04	2.13E-05	2.92E-09	7.85E-04	2.07E-09	3.41E-10	2.35E-09	2.13E-10	3.90E-13
90%	8.12E-04	1.06E-04	2.67E-04	7.05E-06	1.74E-04	2.54E-05	3.19E-09	7.85E-04	2.07E-09	4.01E-10	3.38E-09	2.67E-10	4.22E-13
95%	9.01E-04	1.23E-04	3.95E-04	8.64E-06	2.55E-04	3.29E-05	3.72E-09	7.85E-04	2.07E-09	5.01E-10	5.10E-09	3.88E-10	4.70E-13
Mean	8.20E-04	8.76E-05	1.22E-04	4.27E-06	7.80E-05	1.31E-05	2.01E-09	7.85E-04	2.07E-09	2.38E-10	1.52E-09	1.39E-10	2.67E-13
Min	7.87E-04	3.99E-05	7.87E-06	6.78E-07	1.71E-06	1.08E-06	1.87E-11	7.78E-04	2.05E-09	2.46E-11	2.19E-11	8.92E-12	2.69E-15
Max	5.17E-03	3.10E-04	4.78E-03	4.30E-05	2.73E-03	1.62E-04	2.43E-08	7.85E-04	2.07E-09	3.94E-09	1.13E-07	5.97E-09	2.60E-12

TABLE C.18 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Cs-137 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	2.69E-03	1.81E-04	1.31E-03	1.72E-05	3.22E-04	2.16E-04	2.45E-08	1.76E-04	2.67E-09	4.75E-10	1.47E-09	7.21E-10	1.61E-12
10%	3.10E-03	2.10E-04	1.71E-03	2.08E-05	3.76E-04	2.56E-04	3.48E-08	1.76E-04	2.67E-09	5.72E-10	1.72E-09	8.52E-10	2.27E-12
15%	3.45E-03	2.22E-04	2.03E-03	2.34E-05	4.18E-04	2.88E-04	4.39E-08	1.76E-04	2.67E-09	6.43E-10	1.94E-09	9.60E-10	2.84E-12
20%	3.76E-03	2.32E-04	2.31E-03	2.57E-05	4.56E-04	3.17E-04	5.04E-08	1.76E-04	2.67E-09	7.22E-10	2.14E-09	1.06E-09	3.27E-12
25%	4.08E-03	2.38E-04	2.62E-03	2.77E-05	4.91E-04	3.44E-04	5.70E-08	1.76E-04	2.67E-09	7.98E-10	2.32E-09	1.16E-09	3.66E-12
30%	4.39E-03	2.44E-04	2.90E-03	2.97E-05	5.25E-04	3.70E-04	6.26E-08	1.76E-04	2.67E-09	8.74E-10	2.50E-09	1.24E-09	3.99E-12
35%	4.71E-03	2.49E-04	3.19E-03	3.19E-05	5.54E-04	3.97E-04	6.81E-08	1.76E-04	2.67E-09	9.42E-10	2.70E-09	1.33E-09	4.31E-12
40%	5.05E-03	2.54E-04	3.50E-03	3.38E-05	5.87E-04	4.22E-04	7.31E-08	1.76E-04	2.67E-09	1.03E-09	2.92E-09	1.42E-09	4.59E-12
45%	5.41E-03	2.58E-04	3.87E-03	3.61E-05	6.22E-04	4.51E-04	7.80E-08	1.76E-04	2.67E-09	1.10E-09	3.14E-09	1.52E-09	4.88E-12
50%	5.76E-03	2.62E-04	4.21E-03	3.86E-05	6.55E-04	4.75E-04	8.29E-08	1.76E-04	2.67E-09	1.19E-09	3.37E-09	1.62E-09	5.16E-12
55%	6.13E-03	2.66E-04	4.60E-03	4.11E-05	6.92E-04	5.07E-04	8.75E-08	1.76E-04	2.67E-09	1.31E-09	3.63E-09	1.74E-09	5.48E-12
60%	6.54E-03	2.70E-04	5.04E-03	4.41E-05	7.28E-04	5.40E-04	9.25E-08	1.76E-04	2.67E-09	1.42E-09	3.94E-09	1.86E-09	5.75E-12
65%	7.07E-03	2.75E-04	5.50E-03	4.70E-05	7.73E-04	5.73E-04	9.84E-08	1.76E-04	2.67E-09	1.57E-09	4.25E-09	1.99E-09	6.04E-12
70%	7.62E-03	2.79E-04	6.08E-03	5.09E-05	8.19E-04	6.15E-04	1.04E-07	1.76E-04	2.67E-09	1.72E-09	4.63E-09	2.15E-09	6.42E-12
75%	8.38E-03	2.84E-04	6.75E-03	5.56E-05	8.73E-04	6.61E-04	1.11E-07	1.76E-04	2.67E-09	1.94E-09	5.08E-09	2.33E-09	6.81E-12
80%	9.14E-03	2.90E-04	7.60E-03	6.12E-05	9.39E-04	7.20E-04	1.18E-07	1.76E-04	2.67E-09	2.26E-09	5.67E-09	2.58E-09	7.21E-12
85%	1.03E-02	2.97E-04	8.70E-03	6.83E-05	1.02E-03	7.90E-04	1.27E-07	1.76E-04	2.67E-09	2.75E-09	6.57E-09	2.87E-09	7.73E-12
90%	1.18E-02	3.06E-04	1.03E-02	7.85E-05	1.14E-03	8.84E-04	1.38E-07	1.76E-04	2.67E-09	3.54E-09	8.06E-09	3.36E-09	8.42E-12
95%	1.49E-02	3.17E-04	1.34E-02	1.01E-04	1.31E-03	1.06E-03	1.53E-07	1.76E-04	2.67E-09	5.16E-09	1.14E-08	4.31E-09	9.31E-12
Mean	6.87E-03	2.58E-04	5.38E-03	4.74E-05	7.16E-04	5.35E-04	8.56E-08	1.76E-04	2.67E-09	1.84E-09	4.55E-09	1.99E-09	5.30E-12
Min	9.86E-04	4.90E-05	3.63E-04	6.18E-06	1.06E-04	6.61E-05	1.36E-09	1.75E-04	2.65E-09	2.00E-10	7.65E-10	3.55E-10	8.30E-14
Max	5.79E-02	3.91E-04	5.56E-02	8.40E-04	2.60E-03	2.20E-03	3.60E-07	1.76E-04	2.67E-09	5.23E-08	7.55E-08	3.10E-08	2.08E-11

TABLE C.19 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for I-129 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	1.22E-02	1.28E-07	6.49E-04	2.92E-04	5.17E-03	4.66E-03	9.22E-08	5.37E-12	4.91E-09	1.83E-08	6.16E-08	4.25E-08	3.21E-12
10%	3.01E-02	3.29E-07	1.64E-03	7.94E-04	1.23E-02	1.10E-02	2.53E-07	7.68E-12	4.92E-09	2.15E-08	7.20E-08	5.03E-08	4.79E-12
15%	5.51E-02	5.92E-07	2.96E-03	1.36E-03	2.25E-02	2.05E-02	4.67E-07	9.97E-12	4.92E-09	2.40E-08	7.93E-08	5.66E-08	6.69E-12
20%	8.14E-02	9.22E-07	4.76E-03	2.06E-03	3.39E-02	3.24E-02	6.84E-07	1.20E-11	4.93E-09	2.65E-08	8.58E-08	6.18E-08	8.28E-12
25%	1.21E-01	1.35E-06	6.62E-03	3.05E-03	4.73E-02	4.53E-02	9.88E-07	1.42E-11	4.94E-09	2.87E-08	9.19E-08	6.72E-08	1.01E-11
30%	1.59E-01	1.79E-06	9.21E-03	4.03E-03	6.64E-02	6.07E-02	1.37E-06	1.62E-11	4.95E-09	3.10E-08	9.81E-08	7.19E-08	1.20E-11
35%	2.04E-01	2.40E-06	1.22E-02	5.24E-03	8.68E-02	7.92E-02	1.85E-06	1.84E-11	4.97E-09	3.35E-08	1.03E-07	7.69E-08	1.41E-11
40%	2.64E-01	3.08E-06	1.58E-02	6.83E-03	1.08E-01	9.91E-02	2.41E-06	2.08E-11	4.98E-09	3.56E-08	1.09E-07	8.17E-08	1.60E-11
45%	3.24E-01	3.74E-06	2.05E-02	8.65E-03	1.37E-01	1.24E-01	3.04E-06	2.31E-11	5.00E-09	3.81E-08	1.15E-07	8.69E-08	1.88E-11
50%	4.02E-01	4.71E-06	2.60E-02	1.07E-02	1.70E-01	1.51E-01	3.80E-06	2.59E-11	5.02E-09	4.08E-08	1.21E-07	9.19E-08	2.15E-11
55%	4.89E-01	5.68E-06	3.36E-02	1.30E-02	2.07E-01	1.83E-01	4.70E-06	2.88E-11	5.03E-09	4.37E-08	1.28E-07	9.75E-08	2.43E-11
60%	5.85E-01	6.99E-06	4.28E-02	1.58E-02	2.53E-01	2.25E-01	5.75E-06	3.25E-11	5.05E-09	4.64E-08	1.35E-07	1.04E-07	2.81E-11
65%	7.03E-01	8.41E-06	5.43E-02	1.93E-02	3.02E-01	2.82E-01	7.29E-06	3.66E-11	5.06E-09	4.93E-08	1.42E-07	1.10E-07	3.24E-11
70%	8.73E-01	1.07E-05	7.02E-02	2.35E-02	3.73E-01	3.45E-01	9.31E-06	4.16E-11	5.08E-09	5.26E-08	1.51E-07	1.17E-07	3.75E-11
75%	1.08E+00	1.34E-05	9.32E-02	2.89E-02	4.70E-01	4.23E-01	1.16E-05	4.75E-11	5.09E-09	5.68E-08	1.61E-07	1.26E-07	4.51E-11
80%	1.38E+00	1.72E-05	1.23E-01	3.69E-02	5.98E-01	5.40E-01	1.54E-05	5.43E-11	5.11E-09	6.15E-08	1.73E-07	1.36E-07	5.35E-11
85%	1.79E+00	2.24E-05	1.71E-01	4.81E-02	7.66E-01	7.18E-01	2.09E-05	6.36E-11	5.13E-09	6.77E-08	1.86E-07	1.50E-07	6.42E-11
90%	2.37E+00	3.02E-05	2.53E-01	6.35E-02	1.07E+00	9.90E-01	3.00E-05	7.67E-11	5.14E-09	7.68E-08	2.06E-07	1.68E-07	8.14E-11
95%	3.55E+00	4.83E-05	4.45E-01	1.00E-01	1.58E+00	1.47E+00	4.83E-05	1.02E-10	5.16E-09	9.25E-08	2.38E-07	2.00E-07	1.16E-10
Mean	9.30E-01	1.23E-05	1.14E-01	2.53E-02	4.06E-01	3.85E-01	1.19E-05	3.71E-11	5.02E-09	4.59E-08	1.32E-07	1.03E-07	3.63E-11
Min	8.40E-04	2.98E-09	1.36E-05	2.00E-05	3.20E-04	2.00E-04	1.20E-09	1.91E-12	4.91E-09	6.57E-09	3.51E-08	2.15E-08	8.38E-14
Max	3.56E+01	4.49E-04	9.49E+00	5.66E-01	1.39E+01	1.42E+01	5.01E-04	5.91E-10	5.17E-09	5.11E-07	4.57E-07	3.88E-07	8.08E-10

TABLE C.20 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Np-237 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	8.32E-04	1.05E-05	6.41E-04	8.62E-05	3.14E-05	1.21E-06	7.58E-08	3.14E-05	3.28E-06	3.07E-09	1.71E-10	5.35E-12	3.95E-12
10%	1.95E-03	4.38E-05	1.44E-03	1.93E-04	5.41E-05	2.27E-06	3.14E-07	3.15E-05	3.30E-06	3.80E-09	2.26E-10	6.98E-12	7.34E-12
15%	2.36E-03	8.73E-05	1.60E-03	2.54E-04	7.43E-05	3.13E-06	7.27E-07	3.18E-05	3.33E-06	4.44E-09	2.77E-10	8.52E-12	1.11E-11
20%	2.71E-03	1.54E-04	1.73E-03	3.20E-04	9.40E-05	3.84E-06	1.28E-06	3.22E-05	3.37E-06	5.08E-09	3.23E-10	1.01E-11	1.47E-11
25%	3.13E-03	2.36E-04	1.85E-03	3.88E-04	1.16E-04	4.61E-06	1.97E-06	3.25E-05	3.40E-06	5.66E-09	3.74E-10	1.16E-11	1.97E-11
30%	3.54E-03	3.29E-04	2.02E-03	4.59E-04	1.39E-04	5.46E-06	2.69E-06	3.27E-05	3.42E-06	6.23E-09	4.31E-10	1.33E-11	2.66E-11
35%	4.14E-03	4.36E-04	2.22E-03	5.36E-04	1.63E-04	6.26E-06	3.59E-06	3.29E-05	3.44E-06	6.95E-09	4.86E-10	1.50E-11	3.70E-11
40%	4.78E-03	5.67E-04	2.45E-03	6.48E-04	1.92E-04	7.17E-06	4.67E-06	3.29E-05	3.45E-06	7.68E-09	5.51E-10	1.72E-11	5.05E-11
45%	5.49E-03	7.12E-04	2.73E-03	8.02E-04	2.25E-04	8.12E-06	5.92E-06	3.30E-05	3.45E-06	8.58E-09	6.28E-10	1.95E-11	6.91E-11
50%	6.49E-03	9.20E-04	3.17E-03	9.88E-04	2.64E-04	9.51E-06	7.32E-06	3.30E-05	3.45E-06	9.66E-09	7.19E-10	2.26E-11	9.12E-11
55%	7.83E-03	1.19E-03	3.68E-03	1.25E-03	3.20E-04	1.11E-05	9.35E-06	3.30E-05	3.46E-06	1.11E-08	8.46E-10	2.62E-11	1.17E-10
60%	9.73E-03	1.57E-03	4.32E-03	1.67E-03	3.84E-04	1.30E-05	1.24E-05	3.31E-05	3.46E-06	1.30E-08	9.76E-10	3.06E-11	1.50E-10
65%	1.24E-02	2.10E-03	5.33E-03	2.18E-03	4.68E-04	1.56E-05	1.67E-05	3.31E-05	3.46E-06	1.55E-08	1.16E-09	3.57E-11	1.93E-10
70%	1.56E-02	2.80E-03	6.73E-03	2.91E-03	5.90E-04	1.92E-05	2.29E-05	3.31E-05	3.46E-06	1.93E-08	1.41E-09	4.24E-11	2.43E-10
75%	2.01E-02	4.06E-03	9.38E-03	3.90E-03	7.84E-04	2.50E-05	3.18E-05	3.31E-05	3.46E-06	2.55E-08	1.77E-09	5.12E-11	3.13E-10
80%	2.62E-02	6.28E-03	1.35E-02	5.49E-03	1.08E-03	3.45E-05	4.68E-05	3.31E-05	3.46E-06	3.63E-08	2.38E-09	6.26E-11	4.30E-10
85%	3.70E-02	1.01E-02	2.12E-02	7.83E-03	1.60E-03	5.27E-05	7.30E-05	3.31E-05	3.46E-06	5.63E-08	3.34E-09	8.46E-11	6.32E-10
90%	6.07E-02	1.48E-02	3.88E-02	1.26E-02	2.73E-03	8.95E-05	1.16E-04	3.31E-05	3.46E-06	9.33E-08	4.98E-09	1.15E-10	1.01E-09
95%	1.17E-01	2.05E-02	8.35E-02	2.41E-02	6.04E-03	2.09E-04	1.84E-04	3.31E-05	3.46E-06	1.71E-07	9.62E-09	1.98E-10	2.35E-09
Mean	3.48E-02	4.47E-03	2.41E-02	6.21E-03	1.70E-03	6.03E-05	3.79E-05	3.27E-05	3.42E-06	3.67E-08	2.26E-09	5.09E-11	5.37E-10
Min	1.87E-04	5.10E-07	1.44E-04	1.26E-05	2.07E-06	8.76E-08	1.23E-09	3.14E-05	3.28E-06	8.75E-10	4.98E-11	1.71E-12	1.90E-13
Max	9.72E+00	1.61E-01	8.95E+00	7.43E-01	3.88E-01	7.11E-03	1.74E-03	3.39E-05	3.55E-06	1.39E-06	1.47E-07	1.32E-09	2.52E-08

TABLE C.21 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-238 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Radon-WD	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Radon	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	8.84E-04	1.40E-08	6.03E-04	1.33E-10	1.82E-04	9.05E-06	2.99E-07	7.24E-07	1.11E-10	7.58E-06	2.25E-10	4.95E-09	6.17E-11	1.26E-12	7.45E-11
10%	1.18E-03	1.64E-08	7.77E-04	3.25E-10	2.39E-04	1.24E-05	3.75E-07	1.11E-06	1.11E-10	7.58E-06	5.65E-10	5.85E-09	6.64E-11	1.47E-12	1.09E-10
15%	1.37E-03	1.77E-08	8.74E-04	4.88E-10	2.80E-04	1.49E-05	4.45E-07	1.46E-06	1.26E-10	7.58E-06	8.38E-10	6.61E-09	6.98E-11	1.65E-12	1.35E-10
20%	1.51E-03	1.86E-08	9.73E-04	6.19E-10	3.16E-04	1.68E-05	5.05E-07	1.85E-06	1.62E-10	7.58E-06	1.07E-09	7.28E-09	7.27E-11	1.81E-12	1.55E-10
25%	1.65E-03	1.95E-08	1.06E-03	7.08E-10	3.46E-04	1.81E-05	5.59E-07	2.17E-06	1.88E-10	7.58E-06	1.21E-09	7.85E-09	7.52E-11	1.95E-12	1.76E-10
30%	1.75E-03	2.04E-08	1.17E-03	7.74E-10	3.72E-04	1.92E-05	6.05E-07	2.46E-06	2.06E-10	7.58E-06	1.32E-09	8.45E-09	7.74E-11	2.09E-12	1.94E-10
35%	1.88E-03	2.12E-08	1.27E-03	8.17E-10	4.05E-04	2.01E-05	6.56E-07	2.72E-06	2.18E-10	7.58E-06	1.39E-09	9.01E-09	7.97E-11	2.23E-12	2.09E-10
40%	2.02E-03	2.21E-08	1.38E-03	8.45E-10	4.36E-04	2.10E-05	7.09E-07	3.04E-06	2.27E-10	7.58E-06	1.44E-09	9.70E-09	8.19E-11	2.37E-12	2.26E-10
45%	2.15E-03	2.29E-08	1.50E-03	8.68E-10	4.67E-04	2.20E-05	7.61E-07	3.32E-06	2.33E-10	7.58E-06	1.49E-09	1.03E-08	8.42E-11	2.52E-12	2.40E-10
50%	2.29E-03	2.37E-08	1.66E-03	8.84E-10	5.01E-04	2.27E-05	8.16E-07	3.58E-06	2.38E-10	7.58E-06	1.54E-09	1.09E-08	8.65E-11	2.67E-12	2.57E-10
55%	2.47E-03	2.44E-08	1.80E-03	8.96E-10	5.34E-04	2.35E-05	8.65E-07	3.87E-06	2.42E-10	7.58E-06	1.59E-09	1.17E-08	8.87E-11	2.83E-12	2.72E-10
60%	2.65E-03	2.50E-08	1.99E-03	9.05E-10	5.77E-04	2.42E-05	9.35E-07	4.14E-06	2.45E-10	7.58E-06	1.62E-09	1.25E-08	9.13E-11	3.01E-12	2.86E-10
65%	2.89E-03	2.57E-08	2.21E-03	9.11E-10	6.26E-04	2.51E-05	1.01E-06	4.40E-06	2.47E-10	7.58E-06	1.66E-09	1.33E-08	9.40E-11	3.20E-12	3.00E-10
70%	3.17E-03	2.64E-08	2.46E-03	9.16E-10	6.76E-04	2.60E-05	1.08E-06	4.74E-06	2.49E-10	7.58E-06	1.70E-09	1.43E-08	9.68E-11	3.42E-12	3.18E-10
75%	3.49E-03	2.73E-08	2.80E-03	9.20E-10	7.30E-04	2.69E-05	1.17E-06	5.07E-06	2.50E-10	7.58E-06	1.74E-09	1.55E-08	1.00E-10	3.66E-12	3.37E-10
80%	3.91E-03	2.83E-08	3.22E-03	9.25E-10	7.94E-04	2.80E-05	1.27E-06	5.41E-06	2.51E-10	7.58E-06	1.79E-09	1.69E-08	1.04E-10	3.97E-12	3.57E-10
85%	4.62E-03	2.93E-08	3.92E-03	9.36E-10	8.76E-04	2.93E-05	1.40E-06	5.88E-06	2.52E-10	7.58E-06	1.84E-09	1.87E-08	1.08E-10	4.35E-12	3.84E-10
90%	5.69E-03	3.08E-08	5.02E-03	9.61E-10	9.87E-04	3.09E-05	1.58E-06	6.45E-06	2.53E-10	7.58E-06	1.90E-09	2.09E-08	1.14E-10	4.89E-12	4.15E-10
95%	8.18E-03	3.31E-08	7.38E-03	1.01E-09	1.18E-03	3.34E-05	1.92E-06	7.34E-06	2.54E-10	7.58E-06	1.99E-09	2.52E-08	1.24E-10	5.80E-12	4.59E-10
Mean	3.13E-03	2.36E-08	2.53E-03	7.69E-10	5.72E-04	2.23E-05	9.19E-07	3.72E-06	2.12E-10	7.58E-06	1.40E-09	1.24E-08	8.92E-11	2.98E-12	2.60E-10
Min	3.37E-04	2.72E-09	2.13E-04	4.46E-12	6.07E-05	4.24E-06	8.48E-08	3.08E-08	1.10E-10	7.51E-06	6.34E-12	2.05E-09	4.61E-11	6.27E-13	6.05E-12
Max	4.32E-02	6.72E-08	4.25E-02	1.25E-09	3.09E-03	4.83E-05	3.72E-06	1.21E-05	2.56E-10	7.58E-06	2.37E-09	5.38E-08	3.31E-10	1.24E-11	8.37E-10

TABLE C.22 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-239 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	1.04E-03	1.50E-07	6.68E-04	2.32E-04	1.03E-05	3.22E-07	7.83E-06	6.93E-09	8.30E-06	9.77E-09	1.49E-10	2.60E-12	7.67E-10
10%	1.39E-03	2.33E-07	8.83E-04	3.29E-04	1.44E-05	4.31E-07	1.30E-05	6.93E-09	8.30E-06	1.18E-08	1.89E-10	3.26E-12	1.16E-09
15%	1.64E-03	2.97E-07	9.99E-04	3.93E-04	1.80E-05	5.08E-07	1.83E-05	6.93E-09	8.30E-06	1.35E-08	2.18E-10	3.77E-12	1.53E-09
20%	1.82E-03	3.55E-07	1.10E-03	4.48E-04	2.09E-05	5.77E-07	2.26E-05	6.93E-09	8.30E-06	1.50E-08	2.39E-10	4.22E-12	1.84E-09
25%	1.97E-03	4.16E-07	1.20E-03	5.02E-04	2.26E-05	6.45E-07	2.69E-05	6.93E-09	8.30E-06	1.65E-08	2.58E-10	4.65E-12	2.19E-09
30%	2.13E-03	4.71E-07	1.30E-03	5.49E-04	2.42E-05	7.14E-07	3.18E-05	6.93E-09	8.30E-06	1.80E-08	2.75E-10	5.04E-12	2.54E-09
35%	2.29E-03	5.31E-07	1.43E-03	5.91E-04	2.56E-05	7.71E-07	3.61E-05	6.93E-09	8.30E-06	1.95E-08	2.90E-10	5.45E-12	2.85E-09
40%	2.46E-03	5.83E-07	1.55E-03	6.37E-04	2.68E-05	8.25E-07	4.12E-05	6.93E-09	8.30E-06	2.09E-08	3.06E-10	5.85E-12	3.14E-09
45%	2.60E-03	6.41E-07	1.70E-03	6.85E-04	2.81E-05	8.92E-07	4.61E-05	6.93E-09	8.30E-06	2.21E-08	3.22E-10	6.30E-12	3.49E-09
50%	2.77E-03	6.93E-07	1.87E-03	7.38E-04	2.92E-05	9.60E-07	5.11E-05	6.93E-09	8.30E-06	2.37E-08	3.39E-10	6.80E-12	3.80E-09
55%	2.96E-03	7.39E-07	2.03E-03	7.86E-04	3.02E-05	1.02E-06	5.63E-05	6.93E-09	8.30E-06	2.54E-08	3.54E-10	7.33E-12	4.12E-09
60%	3.20E-03	7.77E-07	2.27E-03	8.44E-04	3.14E-05	1.09E-06	6.13E-05	6.93E-09	8.30E-06	2.76E-08	3.71E-10	7.93E-12	4.43E-09
65%	3.44E-03	8.17E-07	2.51E-03	9.06E-04	3.26E-05	1.17E-06	6.74E-05	6.93E-09	8.30E-06	2.98E-08	3.89E-10	8.53E-12	4.76E-09
70%	3.77E-03	8.54E-07	2.82E-03	9.71E-04	3.40E-05	1.26E-06	7.31E-05	6.93E-09	8.30E-06	3.22E-08	4.09E-10	9.21E-12	5.12E-09
75%	4.15E-03	8.89E-07	3.24E-03	1.05E-03	3.55E-05	1.35E-06	7.94E-05	6.93E-09	8.30E-06	3.50E-08	4.33E-10	1.01E-11	5.53E-09
80%	4.70E-03	9.24E-07	3.80E-03	1.14E-03	3.71E-05	1.47E-06	8.66E-05	6.93E-09	8.30E-06	3.86E-08	4.63E-10	1.11E-11	5.96E-09
85%	5.39E-03	9.59E-07	4.51E-03	1.25E-03	3.91E-05	1.63E-06	9.55E-05	6.93E-09	8.30E-06	4.34E-08	4.95E-10	1.21E-11	6.44E-09
90%	6.51E-03	1.00E-06	5.64E-03	1.42E-03	4.17E-05	1.86E-06	1.07E-04	6.93E-09	8.30E-06	5.15E-08	5.34E-10	1.39E-11	7.07E-09
95%	9.05E-03	1.06E-06	8.27E-03	1.75E-03	4.55E-05	2.21E-06	1.23E-04	6.93E-09	8.30E-06	6.64E-08	6.03E-10	1.65E-11	8.01E-09
Mean	3.67E-03	6.50E-07	2.87E-03	8.28E-04	2.89E-05	1.07E-06	5.61E-05	6.93E-09	8.30E-06	2.91E-08	3.53E-10	7.88E-12	3.99E-09
Min	3.32E-04	9.91E-09	1.95E-04	5.53E-05	4.34E-06	1.00E-07	3.31E-07	6.84E-09	8.19E-06	3.50E-09	5.98E-11	9.87E-13	8.48E-11
Max	7.18E-02	1.30E-06	7.04E-02	3.56E-03	6.86E-05	4.76E-06	1.94E-04	6.93E-09	8.30E-06	2.35E-07	1.00E-09	3.56E-11	1.25E-08

TABLE C.23 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-240 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Radon-WD	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Radon	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	1.90E-03	8.78E-08	1.13E-03	3.17E-17	4.41E-04	2.38E-05	5.88E-07	1.10E-05	5.52E-10	8.30E-06	7.78E-15	9.50E-09	1.45E-10	2.55E-12	8.30E-10
10%	2.14E-03	1.21E-07	1.30E-03	4.68E-17	5.15E-04	2.60E-05	6.99E-07	1.66E-05	5.52E-10	8.30E-06	1.22E-14	1.15E-08	1.85E-10	3.21E-12	1.20E-09
15%	2.33E-03	1.50E-07	1.44E-03	5.59E-17	5.80E-04	2.75E-05	7.88E-07	2.13E-05	5.52E-10	8.30E-06	1.53E-14	1.30E-08	2.13E-10	3.81E-12	1.61E-09
20%	2.53E-03	1.78E-07	1.60E-03	6.33E-17	6.36E-04	2.87E-05	8.74E-07	2.72E-05	5.52E-10	8.30E-06	1.74E-14	1.46E-08	2.39E-10	4.29E-12	2.05E-09
25%	2.75E-03	2.12E-07	1.78E-03	6.87E-17	6.86E-04	3.00E-05	9.50E-07	3.31E-05	5.52E-10	8.30E-06	1.93E-14	1.59E-08	2.63E-10	4.77E-12	2.57E-09
30%	2.95E-03	2.46E-07	1.94E-03	7.31E-17	7.35E-04	3.13E-05	1.03E-06	3.95E-05	5.52E-10	8.30E-06	2.09E-14	1.73E-08	2.82E-10	5.15E-12	3.02E-09
35%	3.16E-03	2.83E-07	2.15E-03	7.75E-17	7.87E-04	3.23E-05	1.11E-06	4.59E-05	5.52E-10	8.30E-06	2.24E-14	1.87E-08	3.02E-10	5.54E-12	3.60E-09
40%	3.39E-03	3.29E-07	2.35E-03	8.19E-17	8.36E-04	3.35E-05	1.18E-06	5.44E-05	5.52E-10	8.30E-06	2.37E-14	2.03E-08	3.19E-10	5.95E-12	4.15E-09
45%	3.64E-03	3.75E-07	2.58E-03	8.62E-17	8.91E-04	3.46E-05	1.28E-06	6.31E-05	5.52E-10	8.30E-06	2.51E-14	2.15E-08	3.35E-10	6.38E-12	4.71E-09
50%	3.94E-03	4.16E-07	2.82E-03	9.05E-17	9.54E-04	3.60E-05	1.36E-06	7.13E-05	5.52E-10	8.30E-06	2.64E-14	2.30E-08	3.52E-10	6.85E-12	5.28E-09
55%	4.25E-03	4.66E-07	3.10E-03	9.53E-17	1.02E-03	3.74E-05	1.45E-06	8.06E-05	5.52E-10	8.30E-06	2.78E-14	2.49E-08	3.71E-10	7.38E-12	6.03E-09
60%	4.61E-03	5.18E-07	3.42E-03	1.00E-16	1.08E-03	3.91E-05	1.56E-06	9.14E-05	5.52E-10	8.30E-06	2.92E-14	2.69E-08	3.87E-10	7.96E-12	6.85E-09
65%	5.00E-03	5.78E-07	3.82E-03	1.04E-16	1.15E-03	4.09E-05	1.67E-06	1.05E-04	5.52E-10	8.30E-06	3.04E-14	2.90E-08	4.07E-10	8.60E-12	7.74E-09
70%	5.47E-03	6.44E-07	4.28E-03	1.09E-16	1.24E-03	4.28E-05	1.79E-06	1.19E-04	5.52E-10	8.30E-06	3.20E-14	3.14E-08	4.26E-10	9.28E-12	8.65E-09
75%	6.04E-03	7.11E-07	4.84E-03	1.15E-16	1.33E-03	4.53E-05	1.95E-06	1.36E-04	5.52E-10	8.30E-06	3.36E-14	3.46E-08	4.50E-10	1.00E-11	9.71E-09
80%	6.90E-03	7.85E-07	5.61E-03	1.20E-16	1.46E-03	4.87E-05	2.16E-06	1.55E-04	5.52E-10	8.30E-06	3.56E-14	3.88E-08	4.75E-10	1.11E-11	1.09E-08
85%	8.07E-03	8.60E-07	6.72E-03	1.28E-16	1.61E-03	5.39E-05	2.41E-06	1.78E-04	5.52E-10	8.30E-06	3.80E-14	4.39E-08	5.02E-10	1.24E-11	1.22E-08
90%	9.76E-03	9.37E-07	8.49E-03	1.38E-16	1.85E-03	6.06E-05	2.78E-06	2.07E-04	5.52E-10	8.30E-06	4.10E-14	5.19E-08	5.41E-10	1.42E-11	1.41E-08
95%	1.42E-02	1.03E-06	1.28E-02	1.52E-16	2.27E-03	7.06E-05	3.40E-06	2.53E-04	5.52E-10	8.30E-06	4.54E-14	6.83E-08	5.96E-10	1.71E-11	1.71E-08
Mean	5.49E-03	4.78E-07	4.41E-03	9.16E-17	1.10E-03	3.99E-05	1.59E-06	9.45E-05	5.52E-10	8.30E-06	2.66E-14	2.91E-08	3.60E-10	7.98E-12	6.70E-09
Min	1.16E-03	2.26E-08	8.37E-04	1.69E-18	1.77E-04	1.62E-05	2.87E-07	5.24E-07	5.45E-10	8.20E-06	3.89E-16	4.29E-09	5.67E-11	8.38E-13	3.11E-11
Max	1.76E-01	1.48E-06	1.73E-01	2.17E-16	5.47E-03	1.40E-04	1.08E-05	5.46E-04	5.53E-10	8.30E-06	7.12E-14	2.83E-07	1.01E-09	3.69E-11	3.28E-08

TABLE C.24 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Sr-90 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	8.35E-04	9.80E-07	1.34E-04	7.27E-05	2.05E-04	1.20E-04	3.24E-08	2.09E-06	1.08E-08	2.46E-09	2.34E-09	7.32E-10	1.83E-12
10%	9.28E-04	1.27E-06	1.59E-04	8.92E-05	2.48E-04	1.43E-04	4.71E-08	2.11E-06	1.09E-08	3.20E-09	3.13E-09	9.52E-10	2.71E-12
15%	1.01E-03	1.50E-06	1.84E-04	1.02E-04	2.80E-04	1.62E-04	5.90E-08	2.12E-06	1.10E-08	3.87E-09	3.97E-09	1.15E-09	3.36E-12
20%	1.07E-03	1.71E-06	2.06E-04	1.14E-04	3.10E-04	1.78E-04	7.00E-08	2.12E-06	1.10E-08	4.46E-09	4.77E-09	1.37E-09	4.02E-12
25%	1.14E-03	1.91E-06	2.33E-04	1.26E-04	3.38E-04	1.93E-04	8.01E-08	2.12E-06	1.10E-08	5.15E-09	5.58E-09	1.59E-09	4.64E-12
30%	1.22E-03	2.08E-06	2.59E-04	1.39E-04	3.65E-04	2.07E-04	9.03E-08	2.13E-06	1.10E-08	5.87E-09	6.35E-09	1.85E-09	5.21E-12
35%	1.28E-03	2.23E-06	2.86E-04	1.52E-04	3.92E-04	2.22E-04	1.01E-07	2.13E-06	1.10E-08	6.71E-09	7.26E-09	2.08E-09	5.84E-12
40%	1.36E-03	2.38E-06	3.18E-04	1.69E-04	4.23E-04	2.37E-04	1.10E-07	2.13E-06	1.10E-08	7.58E-09	8.23E-09	2.38E-09	6.42E-12
45%	1.43E-03	2.51E-06	3.54E-04	1.86E-04	4.53E-04	2.52E-04	1.20E-07	2.13E-06	1.10E-08	8.72E-09	9.24E-09	2.70E-09	6.99E-12
50%	1.52E-03	2.61E-06	3.92E-04	2.02E-04	4.87E-04	2.69E-04	1.30E-07	2.13E-06	1.10E-08	9.82E-09	1.05E-08	3.04E-09	7.62E-12
55%	1.60E-03	2.71E-06	4.40E-04	2.24E-04	5.24E-04	2.88E-04	1.41E-07	2.13E-06	1.10E-08	1.12E-08	1.18E-08	3.52E-09	8.29E-12
60%	1.70E-03	2.81E-06	4.92E-04	2.48E-04	5.68E-04	3.06E-04	1.52E-07	2.13E-06	1.10E-08	1.28E-08	1.35E-08	3.99E-09	8.90E-12
65%	1.82E-03	2.90E-06	5.56E-04	2.76E-04	6.23E-04	3.30E-04	1.63E-07	2.13E-06	1.10E-08	1.44E-08	1.54E-08	4.53E-09	9.57E-12
70%	1.95E-03	3.00E-06	6.34E-04	3.12E-04	6.80E-04	3.55E-04	1.74E-07	2.13E-06	1.10E-08	1.66E-08	1.78E-08	5.27E-09	1.02E-11
75%	2.13E-03	3.11E-06	7.31E-04	3.57E-04	7.65E-04	3.84E-04	1.87E-07	2.13E-06	1.10E-08	1.96E-08	2.08E-08	6.18E-09	1.10E-11
80%	2.33E-03	3.21E-06	8.67E-04	4.30E-04	8.66E-04	4.20E-04	2.02E-07	2.13E-06	1.10E-08	2.37E-08	2.44E-08	7.40E-09	1.19E-11
85%	2.62E-03	3.34E-06	1.06E-03	5.19E-04	1.02E-03	4.67E-04	2.21E-07	2.13E-06	1.10E-08	2.95E-08	3.08E-08	9.06E-09	1.30E-11
90%	3.09E-03	3.49E-06	1.35E-03	6.71E-04	1.28E-03	5.46E-04	2.45E-07	2.13E-06	1.10E-08	3.86E-08	4.00E-08	1.22E-08	1.44E-11
95%	3.99E-03	3.70E-06	1.95E-03	1.01E-03	1.89E-03	6.77E-04	2.82E-07	2.13E-06	1.10E-08	5.93E-08	6.28E-08	1.87E-08	1.65E-11
Mean	1.86E-03	2.50E-06	6.49E-04	3.34E-04	7.18E-04	3.23E-04	1.40E-07	2.12E-06	1.10E-08	1.80E-08	1.93E-08	5.70E-09	8.17E-12
Min	3.60E-04	3.22E-07	7.43E-05	2.32E-05	8.90E-05	4.80E-05	2.25E-09	1.69E-06	8.78E-09	6.76E-10	5.37E-10	2.42E-10	1.31E-13
Max	3.53E-02	1.19E-05	1.21E-02	7.99E-03	3.15E-02	8.94E-03	1.01E-06	2.13E-06	1.10E-08	4.79E-07	1.08E-06	4.14E-07	4.31E-11

TABLE C.25 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Tc-99 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	1.03E-04	4.68E-09	9.77E-06	4.88E-05	6.78E-07	1.78E-05	1.65E-09	1.59E-09	8.28E-10	1.12E-10	4.95E-13	7.63E-12	4.35E-15
10%	2.50E-04	9.03E-09	2.18E-05	1.21E-04	1.76E-06	3.97E-05	3.65E-09	1.59E-09	8.31E-10	1.39E-10	6.94E-13	1.07E-11	6.23E-15
15%	3.90E-04	1.39E-08	3.59E-05	1.99E-04	2.87E-06	6.69E-05	5.68E-09	1.60E-09	8.33E-10	1.65E-10	8.80E-13	1.30E-11	7.58E-15
20%	5.63E-04	2.02E-08	5.29E-05	2.85E-04	4.16E-06	9.71E-05	8.34E-09	1.60E-09	8.35E-10	1.89E-10	1.04E-12	1.53E-11	8.68E-15
25%	7.84E-04	2.74E-08	7.27E-05	4.02E-04	5.66E-06	1.34E-04	1.12E-08	1.61E-09	8.37E-10	2.10E-10	1.21E-12	1.79E-11	9.70E-15
30%	1.02E-03	3.77E-08	9.33E-05	5.15E-04	7.54E-06	1.73E-04	1.45E-08	1.61E-09	8.38E-10	2.39E-10	1.39E-12	2.07E-11	1.05E-14
35%	1.29E-03	4.93E-08	1.20E-04	6.41E-04	9.16E-06	2.18E-04	1.84E-08	1.61E-09	8.40E-10	2.65E-10	1.59E-12	2.36E-11	1.15E-14
40%	1.53E-03	6.12E-08	1.47E-04	7.81E-04	1.10E-05	2.59E-04	2.28E-08	1.61E-09	8.42E-10	2.92E-10	1.81E-12	2.66E-11	1.23E-14
45%	1.79E-03	7.24E-08	1.74E-04	8.92E-04	1.30E-05	3.06E-04	2.77E-08	1.62E-09	8.44E-10	3.20E-10	2.06E-12	3.02E-11	1.31E-14
50%	2.03E-03	8.20E-08	2.07E-04	1.02E-03	1.53E-05	3.58E-04	3.21E-08	1.62E-09	8.45E-10	3.51E-10	2.28E-12	3.43E-11	1.38E-14
55%	2.31E-03	8.91E-08	2.44E-04	1.16E-03	1.76E-05	4.14E-04	3.71E-08	1.62E-09	8.47E-10	3.86E-10	2.57E-12	3.89E-11	1.46E-14
60%	2.59E-03	9.60E-08	2.97E-04	1.33E-03	2.01E-05	4.77E-04	4.22E-08	1.63E-09	8.49E-10	4.31E-10	2.92E-12	4.32E-11	1.54E-14
65%	2.86E-03	1.03E-07	3.59E-04	1.51E-03	2.32E-05	5.43E-04	4.78E-08	1.63E-09	8.51E-10	4.80E-10	3.36E-12	4.92E-11	1.63E-14
70%	3.18E-03	1.10E-07	4.24E-04	1.72E-03	2.72E-05	6.25E-04	5.34E-08	1.63E-09	8.52E-10	5.39E-10	3.86E-12	5.64E-11	1.73E-14
75%	3.54E-03	1.17E-07	5.18E-04	1.98E-03	3.19E-05	7.27E-04	5.96E-08	1.64E-09	8.54E-10	6.05E-10	4.47E-12	6.46E-11	1.82E-14
80%	4.02E-03	1.25E-07	6.50E-04	2.30E-03	3.81E-05	8.45E-04	6.67E-08	1.64E-09	8.56E-10	6.92E-10	5.31E-12	7.54E-11	1.95E-14
85%	4.62E-03	1.33E-07	8.48E-04	2.67E-03	4.60E-05	1.02E-03	7.49E-08	1.64E-09	8.57E-10	8.23E-10	6.37E-12	9.32E-11	2.07E-14
90%	5.50E-03	1.46E-07	1.19E-03	3.35E-03	5.97E-05	1.24E-03	8.47E-08	1.65E-09	8.59E-10	1.03E-09	8.02E-12	1.19E-10	2.22E-14
95%	7.06E-03	1.63E-07	1.82E-03	4.70E-03	8.63E-05	1.75E-03	1.00E-07	1.65E-09	8.61E-10	1.39E-09	1.18E-11	1.71E-10	2.49E-14
Mean	2.59E-03	7.80E-08	4.92E-04	1.53E-03	2.57E-05	5.48E-04	3.91E-08	1.62E-09	8.45E-10	5.01E-10	3.70E-12	5.54E-11	1.41E-14
Min	3.93E-06	3.55E-10	1.76E-07	1.74E-06	1.17E-08	5.68E-07	1.99E-11	1.56E-09	8.12E-10	3.54E-11	8.99E-14	1.49E-12	1.35E-16
Max	4.25E-02	2.36E-07	4.07E-02	2.62E-02	6.81E-04	1.36E-02	1.93E-07	1.67E-09	8.69E-10	5.23E-09	7.73E-11	2.54E-09	3.76E-14

TABLE C.26 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-234 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Radon-WD	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Radon	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	1.29E-03	1.17E-04	1.05E-03	1.20E-06	1.19E-04	4.49E-05	6.01E-05	1.99E-06	2.32E-07	6.46E-07	1.01E-06	2.60E-09	2.66E-10	2.28E-10	8.46E-11
10%	3.36E-03	3.09E-04	2.76E-03	3.17E-06	1.75E-04	7.53E-05	8.51E-05	5.30E-06	6.24E-07	6.49E-07	2.78E-06	4.09E-09	5.55E-10	3.86E-10	2.30E-10
15%	6.01E-03	6.15E-04	4.91E-03	5.72E-06	2.56E-04	1.11E-04	1.14E-04	1.07E-05	1.15E-06	6.50E-07	5.37E-06	6.22E-09	9.66E-10	5.84E-10	4.75E-10
20%	9.53E-03	9.18E-04	8.11E-03	9.66E-06	3.67E-04	1.60E-04	1.40E-04	1.60E-05	1.87E-06	6.50E-07	8.44E-06	9.98E-09	1.53E-09	8.01E-10	7.52E-10
25%	1.35E-02	1.32E-03	1.16E-02	1.40E-05	4.94E-04	2.19E-04	1.68E-04	2.13E-05	2.59E-06	6.50E-07	1.14E-05	1.49E-08	2.18E-09	1.13E-09	1.05E-09
30%	1.81E-02	1.76E-03	1.56E-02	1.84E-05	6.31E-04	2.79E-04	1.93E-04	2.71E-05	3.30E-06	6.50E-07	1.42E-05	2.05E-08	2.91E-09	1.41E-09	1.38E-09
35%	2.19E-02	2.10E-03	1.88E-02	2.24E-05	7.55E-04	3.37E-04	2.16E-04	3.37E-05	3.85E-06	6.50E-07	1.64E-05	2.58E-08	3.46E-09	1.66E-09	1.72E-09
40%	2.52E-02	2.35E-03	2.18E-02	2.57E-05	8.62E-04	3.80E-04	2.40E-04	4.04E-05	4.30E-06	6.50E-07	1.85E-05	2.99E-08	3.99E-09	1.92E-09	2.07E-09
45%	2.77E-02	2.61E-03	2.39E-02	2.80E-05	9.43E-04	4.17E-04	2.61E-04	4.56E-05	4.68E-06	6.51E-07	2.02E-05	3.33E-08	4.46E-09	2.16E-09	2.42E-09
50%	2.99E-02	2.84E-03	2.58E-02	3.03E-05	1.02E-03	4.52E-04	2.81E-04	5.27E-05	4.98E-06	6.51E-07	2.17E-05	3.65E-08	4.92E-09	2.39E-09	2.74E-09
55%	3.21E-02	3.06E-03	2.77E-02	3.24E-05	1.10E-03	4.84E-04	3.02E-04	5.93E-05	5.27E-06	6.67E-07	2.33E-05	3.93E-08	5.39E-09	2.61E-09	3.13E-09
60%	3.43E-02	3.30E-03	2.96E-02	3.44E-05	1.17E-03	5.21E-04	3.21E-04	6.71E-05	5.53E-06	7.33E-07	2.48E-05	4.22E-08	5.84E-09	2.89E-09	3.54E-09
65%	3.66E-02	3.59E-03	3.17E-02	3.65E-05	1.25E-03	5.54E-04	3.41E-04	7.57E-05	5.77E-06	7.81E-07	2.62E-05	4.52E-08	6.31E-09	3.19E-09	4.03E-09
70%	3.93E-02	3.89E-03	3.42E-02	3.88E-05	1.33E-03	5.90E-04	3.67E-04	8.66E-05	6.00E-06	8.12E-07	2.77E-05	4.80E-08	6.82E-09	3.50E-09	4.59E-09
75%	4.17E-02	4.27E-03	3.62E-02	4.10E-05	1.43E-03	6.29E-04	3.89E-04	9.85E-05	6.25E-06	8.43E-07	2.93E-05	5.07E-08	7.42E-09	3.90E-09	5.29E-09
80%	4.43E-02	4.71E-03	3.86E-02	4.33E-05	1.54E-03	6.73E-04	4.16E-04	1.13E-04	6.48E-06	8.66E-07	3.10E-05	5.40E-08	8.12E-09	4.40E-09	6.15E-09
85%	4.73E-02	5.28E-03	4.14E-02	4.63E-05	1.65E-03	7.19E-04	4.47E-04	1.33E-04	6.77E-06	8.89E-07	3.33E-05	5.83E-08	9.22E-09	5.11E-09	7.19E-09
90%	5.18E-02	5.97E-03	4.52E-02	4.98E-05	1.83E-03	7.84E-04	4.88E-04	1.63E-04	7.15E-06	9.15E-07	3.60E-05	6.35E-08	1.07E-08	6.02E-09	8.92E-09
95%	5.76E-02	6.89E-03	4.99E-02	5.46E-05	2.12E-03	8.95E-04	5.75E-04	2.10E-04	7.69E-06	9.43E-07	4.01E-05	7.17E-08	1.40E-08	8.20E-09	1.22E-08
Mean	2.89E-02	3.02E-03	2.51E-02	2.85E-05	1.03E-03	4.53E-04	2.98E-04	7.10E-05	4.44E-06	7.38E-07	2.08E-05	3.52E-08	5.70E-09	3.06E-09	3.87E-09
Min	7.07E-05	2.11E-06	3.51E-05	2.26E-08	7.45E-06	3.54E-06	7.83E-06	2.41E-08	5.36E-09	6.17E-07	0.00E+00	7.56E-10	3.24E-11	4.12E-11	2.15E-12
Max	2.31E-01	1.68E-02	2.12E-01	2.22E-04	7.81E-03	4.91E-03	7.01E-03	5.01E-04	1.02E-05	1.05E-06	6.22E-05	1.89E-07	1.49E-07	7.86E-08	3.02E-08

TABLE C.27 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-235 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	6.30E-04	1.85E-04	2.19E-04	1.17E-04	4.84E-05	3.88E-05	2.68E-06	1.78E-05	5.85E-07	2.59E-09	3.72E-10	1.69E-10	1.10E-10
10%	1.06E-03	3.81E-04	3.76E-04	1.86E-04	8.20E-05	4.96E-05	7.63E-06	1.79E-05	5.87E-07	4.43E-09	9.28E-10	2.42E-10	3.30E-10
15%	1.76E-03	6.49E-04	5.99E-04	2.72E-04	1.24E-04	5.79E-05	1.39E-05	1.79E-05	5.88E-07	7.48E-09	1.74E-09	3.08E-10	6.03E-10
20%	2.71E-03	9.54E-04	8.87E-04	3.99E-04	1.87E-04	6.57E-05	2.12E-05	1.79E-05	6.49E-07	1.25E-08	2.77E-09	3.91E-10	9.97E-10
25%	3.83E-03	1.25E-03	1.30E-03	5.39E-04	2.59E-04	7.32E-05	3.02E-05	1.79E-05	9.80E-07	1.86E-08	4.14E-09	4.73E-10	1.44E-09
30%	5.02E-03	1.52E-03	1.71E-03	7.03E-04	3.32E-04	8.00E-05	4.03E-05	1.79E-05	1.39E-06	2.51E-08	5.54E-09	5.76E-10	1.92E-09
35%	6.17E-03	1.74E-03	2.12E-03	8.62E-04	4.05E-04	8.95E-05	4.89E-05	1.79E-05	1.80E-06	3.23E-08	7.02E-09	6.72E-10	2.47E-09
40%	7.04E-03	1.95E-03	2.47E-03	9.78E-04	4.62E-04	9.88E-05	5.89E-05	1.79E-05	2.29E-06	3.88E-08	8.32E-09	7.89E-10	2.97E-09
45%	7.70E-03	2.19E-03	2.78E-03	1.08E-03	5.10E-04	1.07E-04	6.87E-05	1.79E-05	2.69E-06	4.39E-08	9.36E-09	9.12E-10	3.54E-09
50%	8.45E-03	2.43E-03	3.04E-03	1.18E-03	5.57E-04	1.16E-04	7.89E-05	1.79E-05	2.99E-06	4.84E-08	1.03E-08	1.06E-09	4.08E-09
55%	9.07E-03	2.74E-03	3.25E-03	1.28E-03	5.99E-04	1.27E-04	8.87E-05	1.79E-05	3.23E-06	5.24E-08	1.12E-08	1.24E-09	4.68E-09
60%	9.68E-03	3.22E-03	3.47E-03	1.37E-03	6.40E-04	1.38E-04	1.00E-04	1.88E-05	3.45E-06	5.69E-08	1.21E-08	1.42E-09	5.31E-09
65%	1.05E-02	3.83E-03	3.67E-03	1.48E-03	6.78E-04	1.51E-04	1.13E-04	1.97E-05	3.63E-06	6.07E-08	1.30E-08	1.68E-09	6.01E-09
70%	1.15E-02	4.72E-03	3.88E-03	1.58E-03	7.17E-04	1.67E-04	1.28E-04	2.04E-05	3.79E-06	6.54E-08	1.38E-08	1.98E-09	6.84E-09
75%	1.26E-02	5.87E-03	4.11E-03	1.69E-03	7.64E-04	1.85E-04	1.46E-04	2.09E-05	3.97E-06	6.99E-08	1.47E-08	2.34E-09	7.86E-09
80%	1.37E-02	7.34E-03	4.38E-03	1.80E-03	8.14E-04	2.08E-04	1.65E-04	2.12E-05	4.14E-06	7.47E-08	1.58E-08	2.83E-09	9.01E-09
85%	1.51E-02	8.94E-03	4.76E-03	1.96E-03	8.81E-04	2.37E-04	1.94E-04	2.15E-05	4.36E-06	8.08E-08	1.71E-08	3.51E-09	1.06E-08
90%	1.67E-02	1.07E-02	5.33E-03	2.19E-03	9.77E-04	2.78E-04	2.28E-04	2.18E-05	4.60E-06	8.80E-08	1.87E-08	4.53E-09	1.29E-08
95%	1.88E-02	1.28E-02	6.42E-03	2.57E-03	1.13E-03	3.69E-04	2.87E-04	2.21E-05	4.89E-06	1.02E-07	2.17E-08	6.38E-09	1.65E-08
Mean	8.70E-03	4.09E-03	2.98E-03	1.21E-03	5.51E-04	1.54E-04	1.01E-04	1.91E-05	2.68E-06	4.81E-08	1.03E-08	1.94E-09	5.51E-09
Min	4.77E-05	3.95E-06	1.65E-05	5.69E-06	3.73E-06	5.76E-06	8.27E-09	1.70E-05	5.58E-07	5.53E-10	4.04E-11	4.87E-11	6.56E-13
Max	4.16E-02	2.15E-02	1.94E-02	8.81E-03	6.37E-03	8.45E-03	6.20E-04	2.33E-05	6.03E-06	3.39E-07	1.52E-07	3.48E-08	3.70E-08

TABLE C.28 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-238 in Offsite Resident Scenario

Percentile	Total	External-WD	Fish	Radon-WD	Plant-WD	Meat-WD	Milk-WD	Soil-WD	External-WI	Inhalation	Radon	Plant-WI	Meat-WI	Milk-WI	Soil-WI
5%	4.28E-04	4.16E-05	1.22E-04	3.30E-10	8.23E-05	2.19E-05	3.92E-05	7.15E-07	7.14E-06	5.51E-07	1.84E-10	1.69E-09	1.56E-10	1.67E-10	3.55E-11
10%	5.35E-04	6.61E-05	1.46E-04	2.76E-09	1.02E-04	2.89E-05	4.94E-05	1.27E-06	7.17E-06	5.53E-07	1.57E-09	2.09E-09	2.48E-10	2.43E-10	6.63E-11
15%	6.24E-04	9.23E-05	1.70E-04	8.39E-09	1.17E-04	3.56E-05	5.90E-05	1.84E-06	7.18E-06	5.53E-07	5.20E-09	2.44E-09	3.43E-10	3.26E-10	9.92E-11
20%	7.20E-04	1.19E-04	1.89E-04	2.24E-08	1.31E-04	4.18E-05	6.73E-05	2.43E-06	7.18E-06	5.54E-07	1.30E-08	2.75E-09	4.55E-10	4.12E-10	1.35E-10
25%	8.07E-04	1.46E-04	2.10E-04	4.14E-08	1.44E-04	4.82E-05	7.49E-05	3.00E-06	7.18E-06	5.54E-07	2.50E-08	3.12E-09	5.69E-10	5.01E-10	1.71E-10
30%	8.90E-04	1.76E-04	2.30E-04	6.68E-08	1.58E-04	5.48E-05	8.32E-05	3.87E-06	7.18E-06	5.54E-07	3.80E-08	3.49E-09	7.07E-10	5.94E-10	2.21E-10
35%	9.83E-04	2.12E-04	2.48E-04	9.14E-08	1.71E-04	6.20E-05	9.10E-05	4.77E-06	7.18E-06	5.54E-07	4.92E-08	3.87E-09	8.53E-10	6.99E-10	2.72E-10
40%	1.06E-03	2.53E-04	2.66E-04	1.15E-07	1.84E-04	6.90E-05	9.97E-05	5.73E-06	7.18E-06	5.54E-07	6.00E-08	4.32E-09	1.02E-09	8.22E-10	3.25E-10
45%	1.15E-03	3.01E-04	2.86E-04	1.34E-07	1.98E-04	7.66E-05	1.08E-04	6.85E-06	7.19E-06	5.54E-07	7.02E-08	4.82E-09	1.22E-09	9.56E-10	3.90E-10
50%	1.25E-03	3.66E-04	3.06E-04	1.53E-07	2.12E-04	8.47E-05	1.18E-04	8.33E-06	7.19E-06	5.54E-07	7.86E-08	5.35E-09	1.43E-09	1.13E-09	4.74E-10
55%	1.36E-03	4.60E-04	3.30E-04	1.68E-07	2.26E-04	9.46E-05	1.28E-04	1.02E-05	7.19E-06	5.54E-07	8.73E-08	5.97E-09	1.67E-09	1.30E-09	5.94E-10
60%	1.50E-03	5.85E-04	3.53E-04	1.85E-07	2.44E-04	1.06E-04	1.39E-04	1.26E-05	7.19E-06	5.54E-07	9.55E-08	6.56E-09	1.94E-09	1.49E-09	7.56E-10
65%	1.68E-03	7.28E-04	3.81E-04	2.00E-07	2.65E-04	1.20E-04	1.52E-04	1.59E-05	7.19E-06	5.54E-07	1.05E-07	7.34E-09	2.32E-09	1.71E-09	9.56E-10
70%	1.88E-03	9.53E-04	4.14E-04	2.17E-07	2.84E-04	1.35E-04	1.69E-04	2.07E-05	7.19E-06	5.54E-07	1.14E-07	8.36E-09	2.75E-09	1.99E-09	1.24E-09
75%	2.12E-03	1.25E-03	4.51E-04	2.37E-07	3.14E-04	1.56E-04	1.86E-04	2.66E-05	7.19E-06	5.54E-07	1.24E-07	9.47E-09	3.26E-09	2.31E-09	1.65E-09
80%	2.43E-03	1.58E-03	4.93E-04	2.56E-07	3.48E-04	1.79E-04	2.12E-04	3.42E-05	7.19E-06	5.54E-07	1.35E-07	1.11E-08	3.91E-09	2.77E-09	2.09E-09
85%	2.84E-03	1.96E-03	5.61E-04	2.80E-07	3.89E-04	2.12E-04	2.45E-04	4.55E-05	7.19E-06	5.54E-07	1.49E-07	1.32E-08	4.95E-09	3.45E-09	2.71E-09
90%	3.33E-03	2.48E-03	6.87E-04	3.13E-07	4.62E-04	2.64E-04	2.86E-04	6.12E-05	7.19E-06	5.57E-07	1.68E-07	1.63E-08	6.42E-09	4.37E-09	3.74E-09
95%	3.93E-03	3.04E-03	9.59E-04	3.68E-07	6.20E-04	3.76E-04	3.80E-04	8.23E-05	7.23E-06	5.61E-07	1.95E-07	2.31E-08	9.77E-09	6.46E-09	4.97E-09
Mean	1.64E-03	8.33E-04	4.09E-04	1.56E-07	2.70E-04	1.34E-04	1.56E-04	2.05E-05	7.18E-06	5.54E-07	8.22E-08	8.02E-09	2.80E-09	1.96E-09	1.23E-09
Min	1.44E-05	1.12E-06	1.76E-05	1.94E-13	1.18E-05	2.42E-06	3.41E-06	2.85E-08	6.82E-06	5.26E-07	0.00E+00	5.73E-10	2.79E-11	3.94E-11	1.28E-12
Max	2.82E-02	4.81E-03	1.61E-02	1.15E-06	8.12E-03	6.03E-03	3.56E-03	2.14E-04	7.35E-06	5.70E-07	3.46E-07	1.13E-07	1.65E-07	2.81E-08	1.28E-08

Tables C.29–C.42 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for individual radionuclides in the recreational use scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For C-14, I-129, Np-237, and Tc-99, WD pathways were dominant; for the other radionuclides (Am-241, Co-60, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, U-234, U-235, and U-238), WI pathways were dominant. For Am-241, Co-60, U-235, and U-238, external exposure was dominant. For Pu-238, Pu-239, and Pu-240, meat ingestion, soil ingestion, and inhalation were dominant exposure pathways. For U-234, meat ingestion and external exposure were dominant. For C-14, I-129, Np-237, and Tc-99, aquatic food ingestion resulted in the most dose. For Cs-137, meat ingestion and external exposure resulted in the most dose. For Sr-90, meat ingestion resulted in the most dose.

TABLE C.29 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Am-241 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	1.00E-03	1.18E-04	1.78E-04	1.27E-04	0.00E+00	0.00E+00	0.00E+00	1.81E-03
10%	1.11E-03	1.63E-04	2.18E-04	1.84E-04	0.00E+00	0.00E+00	0.00E+00	1.96E-03
15%	1.14E-03	1.92E-04	2.51E-04	2.27E-04	0.00E+00	0.00E+00	0.00E+00	2.05E-03
20%	1.16E-03	2.12E-04	2.78E-04	2.64E-04	0.00E+00	0.00E+00	0.00E+00	2.11E-03
25%	1.17E-03	2.28E-04	3.01E-04	2.95E-04	0.00E+00	0.00E+00	0.00E+00	2.16E-03
30%	1.17E-03	2.47E-04	3.24E-04	3.25E-04	0.00E+00	0.00E+00	0.00E+00	2.22E-03
35%	1.17E-03	2.63E-04	3.49E-04	3.54E-04	0.00E+00	0.00E+00	0.00E+00	2.26E-03
40%	1.17E-03	2.80E-04	3.73E-04	3.81E-04	0.00E+00	0.00E+00	0.00E+00	2.31E-03
45%	1.18E-03	2.96E-04	3.99E-04	4.06E-04	0.00E+00	0.00E+00	0.00E+00	2.36E-03
50%	1.18E-03	3.13E-04	4.31E-04	4.29E-04	0.00E+00	0.00E+00	0.00E+00	2.40E-03
55%	1.18E-03	3.34E-04	4.60E-04	4.50E-04	0.00E+00	0.00E+00	0.00E+00	2.44E-03
60%	1.18E-03	3.59E-04	4.93E-04	4.73E-04	0.00E+00	0.00E+00	0.00E+00	2.49E-03
65%	1.18E-03	3.86E-04	5.27E-04	4.99E-04	0.00E+00	0.00E+00	0.00E+00	2.54E-03
70%	1.18E-03	4.12E-04	5.63E-04	5.27E-04	0.00E+00	0.00E+00	0.00E+00	2.58E-03
75%	1.18E-03	4.45E-04	6.03E-04	5.59E-04	0.00E+00	0.00E+00	0.00E+00	2.64E-03
80%	1.18E-03	4.88E-04	6.47E-04	5.92E-04	0.00E+00	0.00E+00	0.00E+00	2.71E-03
85%	1.18E-03	5.47E-04	6.98E-04	6.27E-04	5.86E-11	1.68E-09	1.23E-12	2.79E-03
90%	1.18E-03	6.13E-04	7.66E-04	6.72E-04	3.34E-09	9.40E-08	6.80E-11	2.89E-03
95%	1.18E-03	7.26E-04	8.80E-04	7.33E-04	4.30E-08	1.23E-06	9.07E-10	3.05E-03
Mean	1.14E-03	3.59E-04	4.67E-04	4.28E-04	6.01E-09	2.76E-07	1.81E-10	2.40E-03
Min	2.58E-08	2.78E-10	5.15E-09	5.46E-10	0.00E+00	0.00E+00	0.00E+00	5.24E-08
Max	1.18E-03	2.55E-03	1.46E-03	8.80E-04	2.24E-07	4.41E-05	1.58E-08	4.99E-03

TABLE C.30 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for C-14 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
15%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
35%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
45%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
55%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
60%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
65%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
70%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-21	1.71E-17	9.54E-22	1.77E-17
75%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E-07	4.23E-03	1.88E-07	4.24E-03
80%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.02E-07	1.55E-02	3.84E-07	1.55E-02
85%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.02E-07	5.45E-02	6.66E-07	5.45E-02
90%	6.11E-08	3.03E-06	6.00E-02	1.62E-07	1.48E-06	1.17E-01	1.17E-06	1.17E-01
95%	6.19E-08	3.90E-06	9.22E-02	2.56E-07	2.81E-06	2.50E-01	2.26E-06	2.50E-01
Mean	8.40E-09	5.08E-07	1.20E-02	3.04E-08	4.66E-07	4.61E-02	3.97E-07	4.61E-02
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	6.26E-08	9.13E-06	3.04E-01	4.30E-07	1.53E-05	1.14E+01	2.02E-05	1.14E+01

TABLE C.31 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Co-60 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	5.33E-07	6.21E-14	2.74E-09	3.53E-12	0.00E+00	0.00E+00	0.00E+00	5.60E-07
10%	7.17E-07	8.22E-14	4.50E-09	5.60E-12	0.00E+00	0.00E+00	0.00E+00	7.51E-07
15%	8.17E-07	1.02E-13	6.19E-09	7.09E-12	0.00E+00	0.00E+00	0.00E+00	8.50E-07
20%	8.69E-07	1.20E-13	8.08E-09	8.41E-12	0.00E+00	0.00E+00	0.00E+00	9.01E-07
25%	9.05E-07	1.30E-13	1.00E-08	9.70E-12	0.00E+00	0.00E+00	0.00E+00	9.41E-07
30%	9.30E-07	1.38E-13	1.20E-08	1.08E-11	0.00E+00	0.00E+00	0.00E+00	9.64E-07
35%	9.48E-07	1.46E-13	1.42E-08	1.17E-11	0.00E+00	0.00E+00	0.00E+00	9.81E-07
40%	9.62E-07	1.54E-13	1.67E-08	1.26E-11	0.00E+00	0.00E+00	0.00E+00	9.93E-07
45%	9.72E-07	1.63E-13	1.98E-08	1.35E-11	0.00E+00	0.00E+00	0.00E+00	1.00E-06
50%	9.81E-07	1.71E-13	2.36E-08	1.45E-11	0.00E+00	0.00E+00	0.00E+00	1.01E-06
55%	9.88E-07	1.80E-13	2.77E-08	1.53E-11	0.00E+00	0.00E+00	0.00E+00	1.01E-06
60%	9.93E-07	1.88E-13	3.23E-08	1.63E-11	0.00E+00	0.00E+00	0.00E+00	1.02E-06
65%	9.97E-07	1.97E-13	3.80E-08	1.72E-11	0.00E+00	0.00E+00	0.00E+00	1.02E-06
70%	1.00E-06	2.07E-13	4.57E-08	1.82E-11	0.00E+00	0.00E+00	0.00E+00	1.03E-06
75%	1.00E-06	2.16E-13	5.47E-08	1.92E-11	0.00E+00	0.00E+00	0.00E+00	1.04E-06
80%	1.01E-06	2.26E-13	6.87E-08	2.04E-11	0.00E+00	0.00E+00	0.00E+00	1.05E-06
85%	1.01E-06	2.40E-13	8.77E-08	2.18E-11	0.00E+00	0.00E+00	0.00E+00	1.07E-06
90%	1.01E-06	2.71E-13	1.21E-07	2.32E-11	0.00E+00	0.00E+00	0.00E+00	1.10E-06
95%	1.01E-06	3.08E-13	1.95E-07	2.56E-11	0.00E+00	0.00E+00	0.00E+00	1.17E-06
Mean	9.11E-07	1.78E-13	5.45E-08	1.45E-11	6.86E-14	3.11E-12	1.19E-13	9.65E-07
Min	7.27E-13	1.26E-19	6.30E-14	7.77E-18	0.00E+00	0.00E+00	0.00E+00	7.90E-13
Max	1.01E-06	7.69E-13	4.36E-06	3.19E-11	3.08E-10	1.40E-08	5.35E-10	5.31E-06

TABLE C.32 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Cs-137 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	9.79E-03	5.80E-09	1.90E-03	9.80E-07	0.00E+00	0.00E+00	0.00E+00	1.27E-02
10%	1.04E-02	7.82E-09	2.38E-03	1.42E-06	0.00E+00	0.00E+00	0.00E+00	1.33E-02
15%	1.07E-02	8.99E-09	2.84E-03	1.73E-06	0.00E+00	0.00E+00	0.00E+00	1.37E-02
20%	1.09E-02	9.87E-09	3.23E-03	2.01E-06	0.00E+00	0.00E+00	0.00E+00	1.42E-02
25%	1.10E-02	1.07E-08	3.67E-03	2.23E-06	0.00E+00	0.00E+00	0.00E+00	1.46E-02
30%	1.10E-02	1.15E-08	4.11E-03	2.46E-06	0.00E+00	0.00E+00	0.00E+00	1.51E-02
35%	1.11E-02	1.23E-08	4.51E-03	2.65E-06	0.00E+00	0.00E+00	0.00E+00	1.55E-02
40%	1.11E-02	1.31E-08	5.03E-03	2.85E-06	0.00E+00	0.00E+00	0.00E+00	1.60E-02
45%	1.11E-02	1.38E-08	5.52E-03	3.03E-06	0.00E+00	0.00E+00	0.00E+00	1.65E-02
50%	1.12E-02	1.46E-08	6.09E-03	3.21E-06	0.00E+00	0.00E+00	0.00E+00	1.71E-02
55%	1.12E-02	1.56E-08	6.61E-03	3.37E-06	0.00E+00	0.00E+00	0.00E+00	1.77E-02
60%	1.12E-02	1.67E-08	7.32E-03	3.55E-06	0.00E+00	0.00E+00	0.00E+00	1.83E-02
65%	1.12E-02	1.79E-08	8.15E-03	3.75E-06	0.00E+00	0.00E+00	0.00E+00	1.92E-02
70%	1.12E-02	1.92E-08	9.00E-03	3.94E-06	0.00E+00	0.00E+00	0.00E+00	2.00E-02
75%	1.13E-02	2.07E-08	1.01E-02	4.17E-06	0.00E+00	0.00E+00	0.00E+00	2.11E-02
80%	1.13E-02	2.26E-08	1.16E-02	4.40E-06	0.00E+00	0.00E+00	0.00E+00	2.25E-02
85%	1.13E-02	2.55E-08	1.35E-02	4.67E-06	0.00E+00	0.00E+00	0.00E+00	2.45E-02
90%	1.13E-02	2.87E-08	1.65E-02	5.00E-06	0.00E+00	0.00E+00	0.00E+00	2.76E-02
95%	1.13E-02	3.35E-08	2.38E-02	5.43E-06	0.00E+00	0.00E+00	0.00E+00	3.49E-02
Mean	1.09E-02	1.68E-08	8.62E-03	3.20E-06	0.00E+00	0.00E+00	0.00E+00	1.95E-02
Min	1.69E-04	3.90E-11	4.22E-05	4.19E-08	0.00E+00	0.00E+00	0.00E+00	2.11E-04
Max	1.13E-02	1.19E-07	1.80E-01	6.50E-06	0.00E+00	0.00E+00	0.00E+00	1.91E-01

TABLE C.33 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for I-129 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WD)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	2.74E-25	1.78E-28	2.60E-22	1.96E-25	0.00E+00	0.00E+00	0.00E+00	1.45E-17
10%	2.60E-20	1.81E-23	2.89E-17	1.71E-20	0.00E+00	0.00E+00	0.00E+00	5.66E-12
15%	1.51E-16	1.22E-19	1.75E-13	9.90E-17	0.00E+00	0.00E+00	0.00E+00	5.75E-09
20%	3.42E-14	3.32E-17	3.84E-11	2.71E-14	0.00E+00	0.00E+00	0.00E+00	4.66E-07
25%	3.11E-12	2.47E-15	3.18E-09	2.22E-12	0.00E+00	0.00E+00	0.00E+00	7.19E-06
30%	9.61E-11	7.91E-14	1.09E-07	6.10E-11	0.00E+00	0.00E+00	0.00E+00	8.02E-05
35%	1.71E-09	1.32E-12	1.65E-06	1.18E-09	0.00E+00	0.00E+00	0.00E+00	5.41E-04
40%	1.58E-08	1.26E-11	1.54E-05	1.04E-08	0.00E+00	0.00E+00	0.00E+00	2.25E-03
45%	1.03E-07	7.94E-11	9.15E-05	7.14E-08	3.67E-10	4.43E-09	3.23E-10	6.31E-03
50%	4.53E-07	3.69E-10	4.43E-04	3.06E-07	2.23E-06	2.67E-05	2.04E-06	1.37E-02
55%	1.81E-06	1.51E-09	1.65E-03	1.27E-06	1.28E-04	1.16E-03	1.19E-04	2.56E-02
60%	4.84E-06	4.07E-09	4.66E-03	3.28E-06	6.52E-04	5.69E-03	5.30E-04	4.31E-02
65%	1.36E-05	1.03E-08	1.24E-02	9.30E-06	1.50E-03	1.40E-02	1.13E-03	6.71E-02
70%	3.08E-05	2.55E-08	3.07E-02	2.17E-05	2.36E-03	2.81E-02	1.85E-03	9.89E-02
75%	6.94E-05	5.74E-08	6.55E-02	4.55E-05	3.50E-03	5.25E-02	3.05E-03	1.38E-01
80%	1.37E-04	1.12E-07	1.06E-01	8.83E-05	5.24E-03	1.01E-01	4.72E-03	2.04E-01
85%	2.69E-04	1.84E-07	1.56E-01	1.49E-04	9.35E-03	2.28E-01	7.79E-03	3.18E-01
90%	3.28E-04	2.60E-07	2.20E-01	2.27E-04	1.79E-02	4.63E-01	1.35E-02	5.33E-01
95%	3.50E-04	3.33E-07	3.23E-01	3.06E-04	3.82E-02	1.04E+00	2.99E-02	1.13E+00
Mean	6.90E-05	6.29E-08	6.22E-02	5.35E-05	6.00E-03	1.90E-01	5.13E-03	2.25E-01
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	3.66E-04	1.15E-06	1.77E+00	5.27E-04	1.48E-01	1.49E+01	2.86E-01	1.51E+01

TABLE C.34 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Np-237 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	4.73E-09	3.41E-10	1.92E-08	1.12E-09	0.00E+00	0.00E+00	0.00E+00	3.11E-08
10%	1.42E-08	1.01E-09	7.19E-08	3.33E-09	0.00E+00	0.00E+00	0.00E+00	1.80E-07
15%	3.96E-05	2.09E-07	9.99E-06	2.93E-07	0.00E+00	0.00E+00	0.00E+00	2.34E-04
20%	2.02E-03	7.76E-06	4.21E-04	1.31E-05	0.00E+00	0.00E+00	0.00E+00	5.14E-03
25%	8.87E-03	3.17E-05	1.39E-03	4.63E-05	0.00E+00	0.00E+00	0.00E+00	1.73E-02
30%	1.81E-02	6.02E-05	2.08E-03	8.10E-05	0.00E+00	0.00E+00	0.00E+00	2.88E-02
35%	2.52E-02	7.87E-05	2.80E-03	1.14E-04	0.00E+00	0.00E+00	0.00E+00	3.60E-02
40%	2.92E-02	9.77E-05	3.46E-03	1.43E-04	0.00E+00	0.00E+00	0.00E+00	3.88E-02
45%	3.15E-02	1.12E-04	4.23E-03	1.71E-04	0.00E+00	0.00E+00	0.00E+00	4.05E-02
50%	3.35E-02	1.22E-04	5.00E-03	1.97E-04	0.00E+00	0.00E+00	0.00E+00	4.21E-02
55%	3.46E-02	1.33E-04	5.92E-03	2.17E-04	0.00E+00	0.00E+00	0.00E+00	4.38E-02
60%	3.55E-02	1.42E-04	6.84E-03	2.40E-04	0.00E+00	0.00E+00	0.00E+00	4.59E-02
65%	3.60E-02	1.52E-04	7.78E-03	2.62E-04	0.00E+00	0.00E+00	0.00E+00	4.81E-02
70%	3.63E-02	1.63E-04	9.12E-03	2.86E-04	1.20E-06	3.45E-05	1.87E-08	5.14E-02
75%	3.65E-02	1.74E-04	1.05E-02	3.07E-04	7.06E-05	2.46E-03	1.45E-06	5.61E-02
80%	3.66E-02	1.85E-04	1.24E-02	3.34E-04	5.89E-04	1.93E-02	1.08E-05	6.42E-02
85%	3.67E-02	1.98E-04	1.53E-02	3.61E-04	1.63E-03	6.27E-02	2.84E-05	8.33E-02
90%	3.68E-02	2.17E-04	1.87E-02	3.95E-04	3.33E-03	1.17E-01	7.13E-05	1.31E-01
95%	3.68E-02	2.59E-04	2.69E-02	4.41E-04	6.92E-03	2.82E-01	1.86E-04	2.92E-01
Mean	2.46E-02	1.16E-04	8.11E-03	1.93E-04	1.40E-03	6.64E-02	4.08E-05	9.41E-02
Min	1.62E-10	1.41E-12	2.24E-12	4.64E-12	0.00E+00	0.00E+00	0.00E+00	2.07E-10
Max	3.76E-02	6.89E-04	1.90E-01	5.54E-04	1.26E-01	1.42E+01	5.13E-03	1.42E+01

TABLE C.35 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-238 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	1.78E-06	7.65E-05	6.21E-14	2.25E-04	7.97E-05	0.00E+00	0.00E+00	0.00E+00	6.07E-04
10%	1.90E-06	1.02E-04	7.85E-14	2.74E-04	1.15E-04	0.00E+00	0.00E+00	0.00E+00	6.87E-04
15%	1.94E-06	1.18E-04	9.13E-14	3.07E-04	1.43E-04	0.00E+00	0.00E+00	0.00E+00	7.47E-04
20%	1.96E-06	1.30E-04	1.01E-13	3.42E-04	1.65E-04	0.00E+00	0.00E+00	0.00E+00	8.00E-04
25%	1.97E-06	1.40E-04	1.10E-13	3.73E-04	1.84E-04	0.00E+00	0.00E+00	0.00E+00	8.37E-04
30%	1.98E-06	1.51E-04	1.19E-13	4.03E-04	2.02E-04	0.00E+00	0.00E+00	0.00E+00	8.72E-04
35%	1.99E-06	1.61E-04	1.29E-13	4.33E-04	2.19E-04	0.00E+00	0.00E+00	0.00E+00	9.09E-04
40%	1.99E-06	1.72E-04	1.39E-13	4.64E-04	2.35E-04	0.00E+00	0.00E+00	0.00E+00	9.42E-04
45%	2.00E-06	1.81E-04	1.49E-13	4.95E-04	2.51E-04	0.00E+00	0.00E+00	0.00E+00	9.83E-04
50%	2.00E-06	1.91E-04	1.59E-13	5.23E-04	2.64E-04	0.00E+00	0.00E+00	0.00E+00	1.02E-03
55%	2.00E-06	2.03E-04	1.69E-13	5.61E-04	2.77E-04	0.00E+00	0.00E+00	0.00E+00	1.06E-03
60%	2.00E-06	2.19E-04	1.81E-13	5.98E-04	2.92E-04	0.00E+00	0.00E+00	0.00E+00	1.11E-03
65%	2.00E-06	2.35E-04	1.91E-13	6.40E-04	3.06E-04	0.00E+00	0.00E+00	0.00E+00	1.15E-03
70%	2.00E-06	2.51E-04	2.06E-13	6.86E-04	3.23E-04	0.00E+00	0.00E+00	0.00E+00	1.20E-03
75%	2.00E-06	2.71E-04	2.22E-13	7.29E-04	3.41E-04	0.00E+00	0.00E+00	0.00E+00	1.25E-03
80%	2.00E-06	2.97E-04	2.42E-13	7.91E-04	3.61E-04	0.00E+00	0.00E+00	0.00E+00	1.32E-03
85%	2.00E-06	3.34E-04	2.66E-13	8.60E-04	3.83E-04	0.00E+00	0.00E+00	0.00E+00	1.40E-03
90%	2.00E-06	3.78E-04	3.06E-13	9.42E-04	4.11E-04	0.00E+00	0.00E+00	0.00E+00	1.49E-03
95%	2.00E-06	4.44E-04	3.63E-13	1.07E-03	4.47E-04	0.00E+00	0.00E+00	0.00E+00	1.61E-03
Mean	1.95E-06	2.20E-04	1.78E-13	5.73E-04	2.63E-04	1.47E-10	1.02E-09	1.56E-12	1.06E-03
Min	3.28E-10	1.23E-09	2.67E-15	9.70E-09	1.89E-09	0.00E+00	0.00E+00	0.00E+00	1.32E-08
Max	2.00E-06	1.55E-03	1.03E-12	1.95E-03	5.32E-04	2.86E-07	2.84E-06	2.77E-09	2.49E-03

TABLE C.36 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-239 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	8.56E-06	1.81E-04	5.41E-04	1.91E-04	0.00E+00	0.00E+00	0.00E+00	1.46E-03
10%	9.10E-06	2.48E-04	6.58E-04	2.77E-04	0.00E+00	0.00E+00	0.00E+00	1.66E-03
15%	9.32E-06	2.84E-04	7.39E-04	3.41E-04	0.00E+00	0.00E+00	0.00E+00	1.80E-03
20%	9.41E-06	3.14E-04	8.17E-04	3.94E-04	0.00E+00	0.00E+00	0.00E+00	1.92E-03
25%	9.48E-06	3.39E-04	8.91E-04	4.42E-04	0.00E+00	0.00E+00	0.00E+00	2.02E-03
30%	9.51E-06	3.66E-04	9.61E-04	4.83E-04	0.00E+00	0.00E+00	0.00E+00	2.10E-03
35%	9.54E-06	3.89E-04	1.03E-03	5.24E-04	0.00E+00	0.00E+00	0.00E+00	2.19E-03
40%	9.56E-06	4.13E-04	1.11E-03	5.63E-04	0.00E+00	0.00E+00	0.00E+00	2.27E-03
45%	9.58E-06	4.36E-04	1.18E-03	5.96E-04	0.00E+00	0.00E+00	0.00E+00	2.36E-03
50%	9.59E-06	4.61E-04	1.26E-03	6.31E-04	0.00E+00	0.00E+00	0.00E+00	2.45E-03
55%	9.60E-06	4.94E-04	1.35E-03	6.64E-04	0.00E+00	0.00E+00	0.00E+00	2.54E-03
60%	9.60E-06	5.28E-04	1.43E-03	7.00E-04	0.00E+00	0.00E+00	0.00E+00	2.65E-03
65%	9.61E-06	5.66E-04	1.53E-03	7.36E-04	0.00E+00	0.00E+00	0.00E+00	2.75E-03
70%	9.61E-06	6.06E-04	1.64E-03	7.72E-04	0.00E+00	0.00E+00	0.00E+00	2.87E-03
75%	9.62E-06	6.52E-04	1.75E-03	8.16E-04	0.00E+00	0.00E+00	0.00E+00	3.02E-03
80%	9.62E-06	7.13E-04	1.90E-03	8.65E-04	0.00E+00	0.00E+00	0.00E+00	3.18E-03
85%	9.62E-06	8.00E-04	2.06E-03	9.22E-04	0.00E+00	0.00E+00	0.00E+00	3.36E-03
90%	9.62E-06	9.02E-04	2.26E-03	9.87E-04	0.00E+00	0.00E+00	0.00E+00	3.56E-03
95%	9.62E-06	1.06E-03	2.56E-03	1.08E-03	0.00E+00	0.00E+00	0.00E+00	3.87E-03
Mean	9.38E-06	5.30E-04	1.37E-03	6.31E-04	1.82E-14	2.24E-13	3.38E-16	2.54E-03
Min	6.72E-08	1.24E-06	1.23E-05	2.42E-06	0.00E+00	0.00E+00	0.00E+00	1.82E-05
Max	9.62E-06	3.74E-03	4.63E-03	1.29E-03	2.78E-11	4.04E-10	7.19E-13	6.03E-03

TABLE C.37 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-240 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	3.75E-06	1.64E-04	4.42E-18	5.23E-04	1.92E-04	0.00E+00	0.00E+00	0.00E+00	1.38E-03
10%	4.00E-06	2.17E-04	5.51E-18	6.43E-04	2.74E-04	0.00E+00	0.00E+00	0.00E+00	1.55E-03
15%	4.08E-06	2.64E-04	5.95E-18	7.33E-04	3.37E-04	0.00E+00	0.00E+00	0.00E+00	1.69E-03
20%	4.13E-06	2.84E-04	6.22E-18	8.04E-04	3.95E-04	0.00E+00	0.00E+00	0.00E+00	1.79E-03
25%	4.16E-06	3.00E-04	6.42E-18	8.80E-04	4.39E-04	0.00E+00	0.00E+00	0.00E+00	1.90E-03
30%	4.17E-06	3.18E-04	6.58E-18	9.56E-04	4.82E-04	0.00E+00	0.00E+00	0.00E+00	1.98E-03
35%	4.18E-06	3.35E-04	6.76E-18	1.02E-03	5.21E-04	0.00E+00	0.00E+00	0.00E+00	2.06E-03
40%	4.19E-06	3.54E-04	6.89E-18	1.10E-03	5.56E-04	0.00E+00	0.00E+00	0.00E+00	2.14E-03
45%	4.20E-06	3.71E-04	7.02E-18	1.18E-03	5.91E-04	0.00E+00	0.00E+00	0.00E+00	2.23E-03
50%	4.20E-06	3.88E-04	7.16E-18	1.26E-03	6.27E-04	0.00E+00	0.00E+00	0.00E+00	2.32E-03
55%	4.21E-06	4.05E-04	7.27E-18	1.34E-03	6.58E-04	0.00E+00	0.00E+00	0.00E+00	2.42E-03
60%	4.21E-06	4.22E-04	7.40E-18	1.43E-03	6.94E-04	0.00E+00	0.00E+00	0.00E+00	2.51E-03
65%	4.21E-06	4.41E-04	7.53E-18	1.53E-03	7.30E-04	0.00E+00	0.00E+00	0.00E+00	2.61E-03
70%	4.21E-06	4.58E-04	7.65E-18	1.63E-03	7.69E-04	0.00E+00	0.00E+00	0.00E+00	2.73E-03
75%	4.22E-06	4.77E-04	7.78E-18	1.75E-03	8.15E-04	0.00E+00	0.00E+00	0.00E+00	2.84E-03
80%	4.22E-06	4.96E-04	7.94E-18	1.88E-03	8.63E-04	0.00E+00	0.00E+00	0.00E+00	2.98E-03
85%	4.22E-06	5.37E-04	8.11E-18	2.04E-03	9.15E-04	0.00E+00	0.00E+00	0.00E+00	3.15E-03
90%	4.22E-06	6.04E-04	8.34E-18	2.24E-03	9.78E-04	0.00E+00	0.00E+00	0.00E+00	3.38E-03
95%	4.22E-06	6.71E-04	8.69E-18	2.53E-03	1.06E-03	0.00E+00	0.00E+00	0.00E+00	3.71E-03
Mean	4.12E-06	4.04E-04	2.48E-17	1.36E-03	6.26E-04	5.98E-07	1.78E-05	1.18E-09	2.41E-03
Min	3.69E-09	3.19E-07	1.45E-19	5.48E-07	6.48E-07	0.00E+00	0.00E+00	0.00E+00	1.52E-06
Max	4.26E-06	1.58E-03	1.76E-14	4.71E-03	1.26E-03	4.53E-04	2.60E-02	9.22E-07	2.65E-02

TABLE C.38 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Sr-90 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	1.57E-06	6.82E-10	1.07E-04	8.55E-08	0.00E+00	0.00E+00	0.00E+00	1.18E-04
10%	1.49E-05	5.84E-09	8.34E-04	5.86E-07	0.00E+00	0.00E+00	0.00E+00	9.18E-04
15%	3.59E-05	1.19E-08	1.57E-03	1.24E-06	0.00E+00	0.00E+00	0.00E+00	1.64E-03
20%	5.40E-05	1.75E-08	2.21E-03	1.87E-06	0.00E+00	0.00E+00	0.00E+00	2.31E-03
25%	7.09E-05	2.30E-08	2.78E-03	2.45E-06	0.00E+00	0.00E+00	0.00E+00	2.88E-03
30%	8.41E-05	2.77E-08	3.40E-03	3.04E-06	0.00E+00	0.00E+00	0.00E+00	3.51E-03
35%	9.46E-05	3.21E-08	4.11E-03	3.60E-06	0.00E+00	0.00E+00	0.00E+00	4.23E-03
40%	1.03E-04	3.53E-08	4.78E-03	4.14E-06	0.00E+00	0.00E+00	0.00E+00	4.93E-03
45%	1.09E-04	3.88E-08	5.55E-03	4.62E-06	0.00E+00	0.00E+00	0.00E+00	5.69E-03
50%	1.14E-04	4.22E-08	6.44E-03	5.14E-06	0.00E+00	0.00E+00	0.00E+00	6.56E-03
55%	1.19E-04	4.57E-08	7.55E-03	5.55E-06	0.00E+00	0.00E+00	0.00E+00	7.69E-03
60%	1.22E-04	4.94E-08	9.10E-03	6.03E-06	0.00E+00	0.00E+00	0.00E+00	9.24E-03
65%	1.25E-04	5.36E-08	1.07E-02	6.52E-06	0.00E+00	0.00E+00	0.00E+00	1.08E-02
70%	1.28E-04	5.82E-08	1.27E-02	7.00E-06	0.00E+00	0.00E+00	0.00E+00	1.28E-02
75%	1.30E-04	6.41E-08	1.52E-02	7.50E-06	0.00E+00	0.00E+00	0.00E+00	1.54E-02
80%	1.31E-04	7.04E-08	1.85E-02	8.06E-06	0.00E+00	0.00E+00	0.00E+00	1.86E-02
85%	1.33E-04	7.87E-08	2.33E-02	8.76E-06	0.00E+00	0.00E+00	0.00E+00	2.34E-02
90%	1.33E-04	8.97E-08	3.08E-02	9.72E-06	0.00E+00	0.00E+00	0.00E+00	3.09E-02
95%	1.34E-04	1.13E-07	4.74E-02	1.07E-05	0.00E+00	0.00E+00	0.00E+00	4.75E-02
Mean	9.53E-05	4.72E-08	1.34E-02	5.15E-06	2.21E-07	1.35E-05	5.66E-08	1.35E-02
Min	0.00E+00	0.00E+00	4.49E-29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E-29
Max	1.35E-04	4.56E-07	5.62E-01	1.43E-05	1.01E-04	2.47E-02	2.84E-05	5.62E-01

TABLE C.39 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Tc-99 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WD)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	1.05E-13	1.14E-15	6.12E-12	3.41E-14	7.79E-07	4.17E-06	1.41E-09	5.78E-06
10%	2.34E-13	2.81E-15	1.57E-11	8.11E-14	1.76E-06	1.30E-05	4.07E-09	1.69E-05
15%	4.25E-13	5.20E-15	3.34E-11	1.58E-13	3.16E-06	2.78E-05	7.40E-09	3.34E-05
20%	7.26E-13	9.21E-15	6.30E-11	2.67E-13	4.95E-06	4.95E-05	1.23E-08	5.84E-05
25%	1.24E-12	1.62E-14	1.12E-10	4.43E-13	7.74E-06	8.31E-05	1.93E-08	9.76E-05
30%	1.97E-12	2.61E-14	1.88E-10	7.09E-13	1.17E-05	1.25E-04	3.05E-08	1.50E-04
35%	3.16E-12	4.17E-14	3.04E-10	1.17E-12	1.78E-05	1.80E-04	4.51E-08	2.16E-04
40%	5.01E-12	6.51E-14	5.03E-10	1.87E-12	2.68E-05	2.79E-04	6.95E-08	3.41E-04
45%	8.06E-12	1.05E-13	9.03E-10	3.06E-12	3.89E-05	3.97E-04	9.58E-08	4.72E-04
50%	1.36E-11	1.80E-13	1.63E-09	5.11E-12	5.52E-05	5.40E-04	1.30E-07	6.48E-04
55%	2.45E-11	3.38E-13	3.26E-09	9.62E-12	7.81E-05	7.46E-04	1.71E-07	8.73E-04
60%	5.72E-11	8.07E-13	1.14E-08	2.25E-11	1.06E-04	1.02E-03	2.28E-07	1.17E-03
65%	3.76E-10	6.00E-12	1.67E-07	1.50E-10	1.41E-04	1.33E-03	2.88E-07	1.50E-03
70%	3.75E-06	2.93E-08	7.50E-05	8.08E-07	1.79E-04	1.76E-03	3.52E-07	1.93E-03
75%	3.77E-06	3.75E-08	1.44E-04	1.18E-06	2.11E-04	2.30E-03	4.30E-07	2.49E-03
80%	3.79E-06	4.50E-08	2.21E-04	1.47E-06	2.33E-04	3.10E-03	5.34E-07	3.31E-03
85%	3.80E-06	5.33E-08	3.27E-04	1.69E-06	2.50E-04	4.16E-03	6.64E-07	4.36E-03
90%	3.81E-06	6.56E-08	4.93E-04	1.96E-06	2.65E-04	6.14E-03	8.70E-07	6.31E-03
95%	3.82E-06	8.47E-08	8.44E-04	2.32E-06	2.81E-04	1.05E-02	1.25E-06	1.07E-02
Mean	1.30E-06	1.94E-08	1.62E-04	5.45E-07	1.03E-04	2.46E-03	3.29E-07	2.56E-03
Min	1.71E-15	1.79E-17	5.18E-14	8.70E-16	0.00E+00	0.00E+00	0.00E+00	1.18E-09
Max	3.86E-06	2.43E-07	1.15E-02	3.12E-06	3.60E-04	1.28E-01	7.23E-06	1.29E-01

TABLE C.40 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-234 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	8.96E-06	6.25E-06	1.12E-09	4.43E-04	2.08E-05	0.00E+00	0.00E+00	0.00E+00	5.94E-04
10%	1.47E-05	1.35E-05	1.46E-09	8.51E-04	4.45E-05	0.00E+00	0.00E+00	0.00E+00	1.38E-03
15%	1.74E-05	1.73E-05	1.66E-09	1.16E-03	6.26E-05	0.00E+00	0.00E+00	0.00E+00	2.05E-03
20%	1.93E-05	2.10E-05	1.94E-09	1.52E-03	7.69E-05	0.00E+00	0.00E+00	0.00E+00	2.88E-03
25%	7.42E-04	2.32E-05	1.11E-07	1.85E-03	9.06E-05	0.00E+00	0.00E+00	0.00E+00	3.74E-03
30%	1.59E-03	2.51E-05	2.04E-07	2.14E-03	1.03E-04	0.00E+00	0.00E+00	0.00E+00	4.58E-03
35%	2.42E-03	2.70E-05	2.86E-07	2.49E-03	1.15E-04	0.00E+00	0.00E+00	0.00E+00	5.59E-03
40%	3.20E-03	2.88E-05	3.51E-07	2.85E-03	1.26E-04	0.00E+00	0.00E+00	0.00E+00	6.64E-03
45%	4.01E-03	3.06E-05	4.04E-07	3.23E-03	1.36E-04	0.00E+00	0.00E+00	0.00E+00	7.73E-03
50%	4.78E-03	3.24E-05	4.59E-07	3.61E-03	1.46E-04	0.00E+00	0.00E+00	0.00E+00	8.66E-03
55%	5.51E-03	3.43E-05	5.08E-07	4.05E-03	1.58E-04	0.00E+00	0.00E+00	0.00E+00	9.60E-03
60%	6.12E-03	3.60E-05	5.50E-07	4.53E-03	1.72E-04	0.00E+00	0.00E+00	0.00E+00	1.04E-02
65%	6.70E-03	3.78E-05	5.86E-07	5.03E-03	1.84E-04	0.00E+00	0.00E+00	0.00E+00	1.12E-02
70%	7.18E-03	3.96E-05	6.19E-07	5.61E-03	1.99E-04	0.00E+00	0.00E+00	0.00E+00	1.21E-02
75%	7.66E-03	4.21E-05	6.52E-07	6.36E-03	2.17E-04	0.00E+00	0.00E+00	0.00E+00	1.30E-02
80%	8.08E-03	4.55E-05	6.81E-07	7.20E-03	2.37E-04	0.00E+00	0.00E+00	0.00E+00	1.42E-02
85%	8.42E-03	4.90E-05	7.13E-07	8.38E-03	2.62E-04	3.27E-11	8.01E-09	1.32E-12	1.55E-02
90%	8.79E-03	5.38E-05	7.49E-07	1.00E-02	2.99E-04	3.96E-06	7.73E-05	6.50E-08	1.73E-02
95%	9.13E-03	6.66E-05	8.01E-07	1.29E-02	3.46E-04	4.74E-05	7.79E-04	8.24E-07	2.10E-02
Mean	4.46E-03	3.38E-05	4.06E-07	4.75E-03	1.61E-04	2.99E-05	1.22E-03	5.83E-07	1.00E-02
Min	1.34E-07	2.21E-09	3.64E-11	2.94E-08	5.26E-09	0.00E+00	0.00E+00	0.00E+00	1.73E-07
Max	1.01E-02	1.71E-04	1.01E-06	4.28E-02	5.78E-04	1.83E-02	2.46E+00	3.60E-04	2.46E+00

TABLE C.41 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-235 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	5.93E-03	6.05E-06	2.73E-04	1.85E-05	0.00E+00	0.00E+00	0.00E+00	6.68E-03
10%	1.51E-02	1.31E-05	4.68E-04	4.30E-05	0.00E+00	0.00E+00	0.00E+00	1.68E-02
15%	1.97E-02	1.78E-05	6.58E-04	6.13E-05	0.00E+00	0.00E+00	0.00E+00	2.18E-02
20%	2.21E-02	2.15E-05	8.18E-04	7.53E-05	0.00E+00	0.00E+00	0.00E+00	2.41E-02
25%	2.33E-02	2.38E-05	9.63E-04	8.92E-05	0.00E+00	0.00E+00	0.00E+00	2.52E-02
30%	2.40E-02	2.62E-05	1.10E-03	1.01E-04	0.00E+00	0.00E+00	0.00E+00	2.58E-02
35%	2.45E-02	2.86E-05	1.26E-03	1.12E-04	0.00E+00	0.00E+00	0.00E+00	2.62E-02
40%	2.48E-02	3.10E-05	1.44E-03	1.23E-04	0.00E+00	0.00E+00	0.00E+00	2.66E-02
45%	2.50E-02	3.34E-05	1.60E-03	1.33E-04	0.00E+00	0.00E+00	0.00E+00	2.69E-02
50%	2.51E-02	3.58E-05	1.78E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	2.74E-02
55%	2.52E-02	3.88E-05	1.98E-03	1.56E-04	0.00E+00	0.00E+00	0.00E+00	2.79E-02
60%	2.53E-02	4.38E-05	2.21E-03	1.71E-04	0.00E+00	0.00E+00	0.00E+00	2.85E-02
65%	2.54E-02	5.32E-05	2.44E-03	1.89E-04	0.00E+00	0.00E+00	0.00E+00	2.92E-02
70%	2.59E-02	7.89E-05	2.76E-03	2.14E-04	0.00E+00	0.00E+00	0.00E+00	3.00E-02
75%	2.71E-02	1.18E-04	3.16E-03	2.58E-04	0.00E+00	0.00E+00	0.00E+00	3.08E-02
80%	2.85E-02	1.58E-04	3.61E-03	3.65E-04	0.00E+00	0.00E+00	0.00E+00	3.20E-02
85%	2.97E-02	1.92E-04	4.22E-03	4.61E-04	0.00E+00	0.00E+00	0.00E+00	3.31E-02
90%	3.10E-02	2.28E-04	5.11E-03	5.67E-04	0.00E+00	0.00E+00	0.00E+00	3.41E-02
95%	3.20E-02	2.90E-04	6.87E-03	7.00E-04	2.08E-06	1.89E-05	6.08E-09	3.58E-02
mean	2.38E-02	8.33E-05	2.48E-03	2.23E-04	2.68E-06	7.82E-05	3.19E-08	2.65E-02
min	4.36E-11	1.55E-12	3.47E-13	1.03E-12	0.00E+00	0.00E+00	0.00E+00	4.66E-11
max	3.32E-02	7.65E-04	3.92E-02	1.25E-03	2.11E-03	7.96E-02	3.33E-05	8.25E-02

TABLE C.42 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-238 in Recreational Use Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Meat Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Meat Ingestion (WD)	All Pathways
5%	1.46E-03	3.96E-06	8.20E-14	2.77E-04	1.63E-05	0.00E+00	0.00E+00	0.00E+00	2.09E-03
10%	3.53E-03	1.01E-05	1.23E-13	5.05E-04	3.67E-05	0.00E+00	0.00E+00	0.00E+00	4.87E-03
15%	4.47E-03	1.30E-05	1.38E-13	6.72E-04	5.02E-05	0.00E+00	0.00E+00	0.00E+00	5.94E-03
20%	4.95E-03	1.59E-05	1.45E-13	8.13E-04	6.13E-05	0.00E+00	0.00E+00	0.00E+00	6.27E-03
25%	5.19E-03	1.82E-05	1.51E-13	9.46E-04	7.19E-05	0.00E+00	0.00E+00	0.00E+00	6.46E-03
30%	5.34E-03	1.94E-05	1.55E-13	1.09E-03	8.07E-05	0.00E+00	0.00E+00	0.00E+00	6.63E-03
35%	5.44E-03	2.06E-05	1.59E-13	1.27E-03	8.96E-05	0.00E+00	0.00E+00	0.00E+00	6.79E-03
40%	5.50E-03	2.19E-05	1.62E-13	1.41E-03	9.83E-05	0.00E+00	0.00E+00	0.00E+00	6.97E-03
45%	5.55E-03	2.31E-05	1.66E-13	1.59E-03	1.06E-04	0.00E+00	0.00E+00	0.00E+00	7.16E-03
50%	5.57E-03	2.44E-05	1.69E-13	1.77E-03	1.14E-04	0.00E+00	0.00E+00	0.00E+00	7.36E-03
55%	5.59E-03	2.57E-05	1.72E-13	1.98E-03	1.21E-04	0.00E+00	0.00E+00	0.00E+00	7.58E-03
60%	5.60E-03	2.69E-05	1.75E-13	2.24E-03	1.28E-04	0.00E+00	0.00E+00	0.00E+00	7.87E-03
65%	5.61E-03	2.83E-05	1.79E-13	2.50E-03	1.35E-04	0.00E+00	0.00E+00	0.00E+00	8.14E-03
70%	5.62E-03	2.97E-05	1.83E-13	2.87E-03	1.43E-04	0.00E+00	0.00E+00	0.00E+00	8.52E-03
75%	5.63E-03	3.11E-05	1.87E-13	3.26E-03	1.52E-04	0.00E+00	0.00E+00	0.00E+00	8.93E-03
80%	5.63E-03	3.27E-05	1.92E-13	3.74E-03	1.61E-04	0.00E+00	0.00E+00	0.00E+00	9.42E-03
85%	5.63E-03	3.48E-05	1.99E-13	4.40E-03	1.73E-04	0.00E+00	0.00E+00	0.00E+00	1.01E-02
90%	5.63E-03	3.90E-05	2.17E-13	5.35E-03	1.86E-04	0.00E+00	0.00E+00	0.00E+00	1.11E-02
95%	5.70E-03	4.42E-05	2.94E-09	7.25E-03	2.04E-04	0.00E+00	0.00E+00	0.00E+00	1.31E-02
Mean	5.02E-03	2.49E-05	2.44E-10	2.52E-03	1.12E-04	1.63E-05	2.79E-04	2.70E-07	7.90E-03
Min	8.35E-13	9.50E-15	2.27E-16	3.40E-13	3.68E-14	0.00E+00	0.00E+00	0.00E+00	1.23E-12
Max	5.78E-03	1.12E-04	4.26E-09	2.47E-02	2.50E-04	1.33E-02	1.79E-01	1.68E-04	1.78E-01

Tables C.43–C.56 show the peak DSR percentiles (mrem/yr per pCi/g) for different exposure pathways for individual radionuclides in the onsite resident scenario. RESRAD (onsite) Version 6.5 was used in the analysis. For C-14, I-129, Np-237, and Tc-99, WD pathways were dominant; for other radionuclides (Am-241, Co-60, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, U-234, U-235, and U-238), WI pathways were dominant. For Am-241, Pu-238, Pu-239, Pu-240, and Sr-90, plant ingestion was dominant. For C-14, aquatic food ingestion resulted in the most dose. For Co-60, external exposure was dominant. For Cs-137, external exposure, meat and plant ingestion resulted in the most dose. For I-129, Np-237, and Tc-99 water ingestion resulted in the most dose. For U-234, radon inhalation resulted in the most dose. For U-235, external exposure and plant ingestion resulted in the most dose. For U-238, water ingestion, plant ingestion, and external exposure resulted in the most dose.

TABLE C.43 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Am-241 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	4.45E-03	6.67E-04	1.13E-02	3.75E-04	9.85E-06	2.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E-02
10%	5.00E-03	9.09E-04	1.59E-02	4.14E-04	1.28E-05	3.66E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.61E-02
15%	5.44E-03	1.06E-03	2.00E-02	4.42E-04	1.54E-05	4.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.05E-02
20%	5.84E-03	1.20E-03	2.40E-02	4.64E-04	1.78E-05	5.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.48E-02
25%	6.20E-03	1.36E-03	2.81E-02	4.86E-04	2.01E-05	5.96E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.91E-02
30%	6.53E-03	1.53E-03	3.24E-02	5.04E-04	2.24E-05	6.55E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-02
35%	6.87E-03	1.70E-03	3.67E-02	5.23E-04	2.46E-05	7.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.75E-02
40%	7.24E-03	1.85E-03	4.16E-02	5.40E-04	2.70E-05	7.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-02
45%	7.61E-03	2.01E-03	4.68E-02	5.55E-04	2.96E-05	8.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.81E-02
50%	8.00E-03	2.18E-03	5.24E-02	5.72E-04	3.22E-05	8.57E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.46E-02
55%	8.41E-03	2.35E-03	5.92E-02	5.88E-04	3.51E-05	9.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.03E-02
60%	8.86E-03	2.55E-03	6.64E-02	6.06E-04	3.88E-05	9.47E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.78E-02
65%	9.40E-03	2.76E-03	7.46E-02	6.28E-04	4.24E-05	9.98E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.62E-02
70%	9.98E-03	2.99E-03	8.51E-02	6.49E-04	4.73E-05	1.05E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-01
75%	1.06E-02	3.26E-03	9.80E-02	6.77E-04	5.19E-05	1.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-01
80%	1.14E-02	3.59E-03	1.14E-01	7.03E-04	5.92E-05	1.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-01
85%	1.25E-02	4.08E-03	1.38E-01	7.44E-04	6.79E-05	1.25E-02	1.95E-07	2.20E-09	7.47E-09	1.23E-09	3.58E-11	1.61E-01
90%	1.40E-02	4.73E-03	1.72E-01	8.04E-04	8.06E-05	1.34E-02	5.21E-06	6.92E-08	2.01E-07	3.60E-08	9.94E-10	1.96E-01
95%	1.64E-02	5.87E-03	2.37E-01	8.98E-04	1.05E-04	1.46E-02	6.35E-05	7.90E-07	2.46E-06	4.25E-07	1.04E-08	2.68E-01
Mean	8.83E-03	2.57E-03	8.04E-02	5.95E-04	4.16E-05	8.54E-03	4.51E-03	1.13E-04	1.25E-04	1.48E-06	1.55E-07	1.05E-01
Min	1.40E-11	5.49E-12	2.30E-10	2.22E-12	1.35E-13	2.85E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-10
Max	2.37E-02	1.96E-02	2.19E+00	2.34E-03	4.19E-04	1.97E-02	4.68E+00	1.18E-01	9.48E-02	1.08E-03	1.04E-04	4.89E+00

TABLE C.44 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for C-14 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways	
5%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
10%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
15%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
20%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
25%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
30%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
35%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
40%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
45%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
50%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
55%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
60%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
65%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
70%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
75%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
80%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
85%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-04	5.95E-04	1.94E-05	8.11E-06	2.26E-05	1.01E-03
90%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.70E-04	2.46E-03	6.22E-05	2.52E-05	7.21E-05	3.45E-03
95%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-03	7.98E-03	1.35E-04	5.33E-05	1.51E-04	1.05E-02
Mean	7.48E-10	5.07E-08	3.01E-04	1.17E-04	4.00E-05	5.17E-09	1.91E-04	3.11E-03	2.19E-05	8.52E-06	2.40E-05	3.36E-03	
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Max	1.02E-06	5.13E-05	3.02E-01	1.17E-01	4.01E-02	7.72E-06	1.88E-02	3.00E+00	1.78E-03	7.99E-04	2.35E-03	3.00E+00	

TABLE C.45 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Co-60 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	2.99E-06	3.47E-13	2.60E-08	1.20E-08	1.45E-09	6.98E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E-06
10%	3.78E-06	4.79E-13	3.94E-08	2.08E-08	2.27E-09	1.11E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.10E-06
15%	4.20E-06	5.68E-13	5.14E-08	2.85E-08	2.97E-09	1.42E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E-06
20%	4.53E-06	6.53E-13	6.27E-08	3.60E-08	3.67E-09	1.69E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.97E-06
25%	4.85E-06	7.24E-13	7.44E-08	4.49E-08	4.42E-09	1.94E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.28E-06
30%	5.16E-06	8.07E-13	8.55E-08	5.52E-08	5.28E-09	2.15E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.59E-06
35%	5.44E-06	8.86E-13	9.74E-08	6.67E-08	6.18E-09	2.34E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E-06
40%	5.74E-06	9.57E-13	1.11E-07	7.95E-08	7.20E-09	2.52E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.25E-06
45%	6.04E-06	1.04E-12	1.26E-07	9.49E-08	8.24E-09	2.69E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.61E-06
50%	6.39E-06	1.13E-12	1.41E-07	1.13E-07	9.44E-09	2.88E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.94E-06
55%	6.75E-06	1.23E-12	1.59E-07	1.34E-07	1.08E-08	3.05E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.32E-06
60%	7.15E-06	1.32E-12	1.79E-07	1.61E-07	1.23E-08	3.21E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.72E-06
65%	7.56E-06	1.43E-12	2.03E-07	1.94E-07	1.44E-08	3.41E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.20E-06
70%	8.08E-06	1.54E-12	2.33E-07	2.34E-07	1.67E-08	3.60E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.66E-06
75%	8.63E-06	1.67E-12	2.69E-07	2.94E-07	1.96E-08	3.83E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.17E-06
80%	9.30E-06	1.82E-12	3.09E-07	3.69E-07	2.39E-08	4.08E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.88E-06
85%	1.01E-05	1.98E-12	3.75E-07	4.84E-07	2.91E-08	4.36E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-05
90%	1.13E-05	2.21E-12	4.69E-07	6.67E-07	3.79E-08	4.66E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-05
95%	1.33E-05	2.63E-12	6.49E-07	1.09E-06	5.87E-08	5.11E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-05
Mean	7.02E-06	1.27E-12	2.17E-07	2.83E-07	1.75E-08	2.89E-10	2.78E-13	7.84E-15	1.07E-14	4.07E-13	5.55E-15	7.54E-06
Min	3.95E-12	1.25E-18	7.19E-14	3.91E-14	1.02E-14	1.76E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.07E-12
Max	2.01E-05	6.50E-12	3.12E-06	1.07E-05	8.51E-07	6.32E-10	1.25E-09	3.53E-11	4.82E-11	1.83E-09	2.50E-11	2.20E-05

TABLE C.46 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Cs-137 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	4.31E-02	3.22E-08	3.03E-03	6.08E-03	1.47E-03	2.00E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.02E-02
10%	4.80E-02	4.36E-08	4.37E-03	7.97E-03	1.93E-03	2.81E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.93E-02
15%	5.20E-02	5.04E-08	5.60E-03	9.57E-03	2.37E-03	3.44E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.78E-02
20%	5.55E-02	5.70E-08	6.83E-03	1.12E-02	2.76E-03	3.98E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.41E-02
25%	5.90E-02	6.43E-08	8.07E-03	1.29E-02	3.15E-03	4.46E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-01
30%	6.23E-02	7.29E-08	9.35E-03	1.45E-02	3.61E-03	4.89E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-01
35%	6.55E-02	8.04E-08	1.07E-02	1.65E-02	4.07E-03	5.31E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-01
40%	6.89E-02	8.63E-08	1.22E-02	1.84E-02	4.60E-03	5.67E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-01
45%	7.22E-02	9.40E-08	1.40E-02	2.07E-02	5.12E-03	6.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
50%	7.64E-02	1.02E-07	1.58E-02	2.33E-02	5.79E-03	6.37E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-01
55%	8.02E-02	1.10E-07	1.79E-02	2.62E-02	6.49E-03	6.73E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-01
60%	8.46E-02	1.19E-07	2.03E-02	2.94E-02	7.34E-03	7.06E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-01
65%	8.95E-02	1.29E-07	2.32E-02	3.39E-02	8.31E-03	7.47E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-01
70%	9.48E-02	1.39E-07	2.68E-02	3.83E-02	9.43E-03	7.84E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E-01
75%	1.01E-01	1.51E-07	3.11E-02	4.40E-02	1.09E-02	8.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-01
80%	1.09E-01	1.66E-07	3.66E-02	5.17E-02	1.31E-02	8.79E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-01
85%	1.19E-01	1.89E-07	4.45E-02	6.23E-02	1.58E-02	9.33E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-01
90%	1.33E-01	2.21E-07	5.65E-02	8.16E-02	2.01E-02	9.98E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E-01
95%	1.55E-01	2.73E-07	8.11E-02	1.19E-01	2.90E-02	1.09E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.17E-01
Mean	8.42E-02	1.20E-07	2.60E-02	3.87E-02	9.63E-03	6.39E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-01
Min	2.59E-03	2.95E-10	5.07E-04	1.41E-03	2.54E-04	2.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.56E-03
Max	2.23E-01	9.13E-07	7.17E-01	1.21E+00	4.52E-01	1.29E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E+00

TABLE C.47 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for I-129 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	2.51E-19	2.54E-22	7.91E-17	1.01E-16	3.41E-17	5.18E-19	3.06E-29	0.00E+00	1.21E-30	1.12E-29	7.49E-30	1.42E-06
10%	7.11E-13	4.14E-16	1.42E-10	3.17E-10	6.84E-11	1.30E-12	2.54E-05	1.09E-07	9.86E-07	6.87E-06	4.40E-06	5.00E-03
15%	1.41E-09	1.17E-12	4.45E-07	6.66E-07	1.94E-07	2.72E-09	2.89E-02	1.18E-04	1.12E-03	8.29E-03	5.37E-03	1.55E-01
20%	2.65E-07	1.79E-10	7.59E-05	1.05E-04	2.97E-05	5.15E-07	3.97E-01	1.31E-03	1.54E-02	9.83E-02	6.75E-02	8.83E-01
25%	7.09E-06	5.31E-09	1.83E-03	3.00E-03	8.64E-04	1.34E-05	1.10E+00	3.54E-03	4.24E-02	2.92E-01	1.81E-01	2.06E+00
30%	7.91E-05	5.12E-08	2.59E-02	3.51E-02	1.10E-02	1.37E-04	1.93E+00	6.41E-03	7.46E-02	4.76E-01	3.36E-01	3.27E+00
35%	5.01E-04	3.19E-07	1.04E-01	1.92E-01	6.06E-02	7.79E-04	2.77E+00	9.71E-03	1.08E-01	6.95E-01	4.91E-01	4.62E+00
40%	1.27E-03	7.18E-07	1.75E-01	3.20E-01	9.76E-02	1.75E-03	3.69E+00	1.37E-02	1.43E-01	9.60E-01	6.50E-01	5.92E+00
45%	1.52E-03	9.81E-07	2.41E-01	4.11E-01	1.28E-01	2.56E-03	4.68E+00	1.94E-02	1.81E-01	1.25E+00	8.43E-01	7.37E+00
50%	1.70E-03	1.20E-06	3.01E-01	4.87E-01	1.55E-01	3.19E-03	6.03E+00	2.66E-02	2.33E-01	1.63E+00	1.10E+00	9.37E+00
55%	1.88E-03	1.40E-06	3.75E-01	5.77E-01	1.80E-01	3.83E-03	7.69E+00	3.61E-02	2.99E-01	2.03E+00	1.43E+00	1.21E+01
60%	2.03E-03	1.62E-06	4.49E-01	6.74E-01	2.11E-01	4.36E-03	9.72E+00	4.80E-02	3.75E-01	2.69E+00	1.85E+00	1.50E+01
65%	2.20E-03	1.84E-06	5.39E-01	7.64E-01	2.45E-01	4.84E-03	1.22E+01	6.17E-02	4.74E-01	3.48E+00	2.38E+00	1.92E+01
70%	2.37E-03	2.07E-06	6.52E-01	8.96E-01	2.84E-01	5.29E-03	1.59E+01	8.38E-02	6.14E-01	4.44E+00	2.99E+00	2.46E+01
75%	2.57E-03	2.28E-06	7.75E-01	1.04E+00	3.29E-01	5.77E-03	2.03E+01	1.12E-01	7.85E-01	5.83E+00	3.98E+00	3.17E+01
80%	2.81E-03	2.54E-06	9.22E-01	1.24E+00	3.92E-01	6.33E-03	2.65E+01	1.55E-01	1.03E+00	7.43E+00	5.10E+00	4.11E+01
85%	3.12E-03	2.86E-06	1.14E+00	1.51E+00	4.70E-01	6.86E-03	3.42E+01	2.21E-01	1.32E+00	9.88E+00	6.65E+00	5.35E+01
90%	3.53E-03	3.25E-06	1.45E+00	1.90E+00	5.85E-01	7.59E-03	4.64E+01	3.56E-01	1.79E+00	1.35E+01	9.32E+00	7.18E+01
95%	4.29E-03	3.92E-06	2.01E+00	2.63E+00	8.30E-01	8.47E-03	6.86E+01	6.46E-01	2.65E+00	2.06E+01	1.46E+01	1.04E+02
Mean	1.64E-03	1.41E-06	5.60E-01	7.62E-01	2.44E-01	3.34E-03	1.61E+01	1.47E-01	6.22E-01	4.78E+00	3.41E+00	2.51E+01
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	7.21E-03	1.17E-05	1.01E+01	1.25E+01	5.69E+00	1.10E-02	2.10E+02	1.52E+01	8.19E+00	1.12E+02	1.01E+02	3.34E+02

TABLE C.48 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Np-237 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	3.74E-08	2.52E-09	3.23E-07	3.34E-08	2.04E-08	2.64E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E-07
10%	1.97E-07	8.22E-09	1.95E-06	1.41E-07	6.84E-08	7.93E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.54E-06
15%	4.71E-04	2.22E-06	1.50E-03	5.98E-05	8.94E-07	9.75E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.01E-03
20%	2.33E-02	8.09E-05	4.87E-02	1.92E-03	2.49E-05	3.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-01
25%	8.83E-02	2.66E-04	1.28E-01	4.64E-03	5.80E-05	1.15E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.90E-01
30%	1.32E-01	4.05E-04	1.89E-01	6.53E-03	8.92E-05	1.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E-01
35%	1.52E-01	5.11E-04	2.48E-01	8.57E-03	1.18E-04	2.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.50E-01
40%	1.68E-01	5.96E-04	3.06E-01	1.07E-02	1.44E-04	3.09E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.57E-01
45%	1.82E-01	6.87E-04	3.67E-01	1.32E-02	1.70E-04	3.63E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.72E-01
50%	1.96E-01	7.79E-04	4.37E-01	1.56E-02	1.97E-04	4.14E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.93E-01
55%	2.11E-01	8.75E-04	5.18E-01	1.83E-02	2.29E-04	4.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E+00
60%	2.27E-01	9.74E-04	6.04E-01	2.13E-02	2.61E-04	4.97E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E+00
65%	2.44E-01	1.08E-03	6.98E-01	2.47E-02	3.05E-04	5.39E-03	3.94E-03	4.65E-05	1.52E-04	2.40E-05	8.56E-07	1.54E+00
70%	2.62E-01	1.19E-03	8.07E-01	2.87E-02	3.64E-04	5.81E-03	1.05E-01	1.25E-03	4.05E-03	6.30E-04	1.79E-05	1.85E+00
75%	2.83E-01	1.32E-03	9.45E-01	3.35E-02	4.37E-04	6.27E-03	5.66E-01	6.66E-03	2.18E-02	3.23E-03	9.24E-05	2.23E+00
80%	3.08E-01	1.46E-03	1.13E+00	4.06E-02	5.24E-04	6.77E-03	1.39E+00	1.62E-02	5.34E-02	9.21E-03	2.26E-04	2.79E+00
85%	3.38E-01	1.62E-03	1.38E+00	5.16E-02	6.46E-04	7.36E-03	2.56E+00	3.15E-02	9.87E-02	1.74E-02	4.74E-04	3.70E+00
90%	3.82E-01	1.84E-03	1.75E+00	6.57E-02	8.56E-04	8.03E-03	4.63E+00	5.54E-02	1.79E-01	3.38E-02	9.26E-04	5.43E+00
95%	4.58E-01	2.14E-03	2.48E+00	9.89E-02	1.22E-03	8.99E-03	9.52E+00	1.26E-01	3.67E-01	7.60E-02	2.11E-03	1.04E+01
Mean	1.98E-01	8.74E-04	7.36E-01	2.87E-02	3.58E-04	4.01E-03	1.79E+00	2.55E-02	6.91E-02	1.50E-02	4.11E-04	2.64E+00
Min	3.92E-10	4.21E-12	1.18E-10	3.18E-12	4.04E-13	1.12E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-09
Max	7.28E-01	5.40E-03	1.79E+01	6.83E-01	2.50E-02	1.13E-02	1.29E+02	5.03E+00	4.99E+00	2.36E+00	3.84E-02	1.37E+02

TABLE C.49 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-238 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Radon (WD)	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	7.67E-06	4.19E-04	8.08E-08	7.18E-03	4.69E-04	4.78E-06	1.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-02
10%	8.58E-06	5.69E-04	9.58E-08	9.90E-03	5.13E-04	5.71E-06	2.28E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E-02
15%	9.34E-06	6.59E-04	1.05E-07	1.25E-02	5.41E-04	6.46E-06	2.82E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-02
20%	9.94E-06	7.47E-04	1.11E-07	1.49E-02	5.68E-04	7.05E-06	3.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E-02
25%	1.05E-05	8.42E-04	1.16E-07	1.74E-02	5.93E-04	7.63E-06	3.67E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.48E-02
30%	1.11E-05	9.55E-04	1.21E-07	2.01E-02	6.13E-04	8.10E-06	4.03E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E-02
35%	1.18E-05	1.04E-03	1.27E-07	2.28E-02	6.33E-04	8.62E-06	4.37E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.03E-02
40%	1.24E-05	1.13E-03	1.31E-07	2.57E-02	6.54E-04	9.17E-06	4.68E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-02
45%	1.30E-05	1.23E-03	1.37E-07	2.89E-02	6.77E-04	9.76E-06	4.98E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.65E-02
50%	1.36E-05	1.33E-03	1.41E-07	3.25E-02	6.97E-04	1.03E-05	5.26E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.05E-02
55%	1.44E-05	1.44E-03	1.45E-07	3.65E-02	7.18E-04	1.10E-05	5.52E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.43E-02
60%	1.52E-05	1.56E-03	1.50E-07	4.09E-02	7.39E-04	1.16E-05	5.82E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-02
65%	1.60E-05	1.69E-03	1.56E-07	4.60E-02	7.65E-04	1.24E-05	6.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.36E-02
70%	1.70E-05	1.83E-03	1.62E-07	5.23E-02	7.93E-04	1.32E-05	6.47E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.97E-02
75%	1.82E-05	1.99E-03	1.70E-07	6.03E-02	8.22E-04	1.42E-05	6.81E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.82E-02
80%	1.96E-05	2.19E-03	1.77E-07	7.03E-02	8.63E-04	1.55E-05	7.21E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.85E-02
85%	2.14E-05	2.49E-03	1.87E-07	8.47E-02	9.10E-04	1.70E-05	7.66E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E-02
90%	2.37E-05	2.90E-03	1.99E-07	1.05E-01	9.80E-04	1.94E-05	8.21E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E-01
95%	2.76E-05	3.60E-03	2.21E-07	1.48E-01	1.08E-03	2.31E-05	8.92E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-01
Mean	1.51E-05	1.58E-03	1.44E-07	4.95E-02	7.28E-04	1.17E-05	5.25E-03	1.36E-07	9.78E-10	9.88E-17	5.22E-09	1.12E-09	1.41E-09	5.71E-02
Min	1.73E-09	4.82E-09	4.67E-09	1.46E-06	8.59E-08	3.59E-08	3.21E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-06
Max	3.97E-05	1.19E-02	3.51E-07	8.99E-01	3.63E-03	8.14E-05	1.07E-02	2.67E-04	3.52E-06	2.86E-13	1.03E-05	3.01E-06	3.26E-06	9.12E-01

TABLE C.50 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-239 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	3.69E-05	1.00E-03	1.68E-02	1.12E-03	1.05E-05	3.86E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.39E-02
10%	4.13E-05	1.37E-03	2.38E-02	1.23E-03	1.27E-05	5.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.18E-02
15%	4.47E-05	1.59E-03	3.00E-02	1.30E-03	1.44E-05	6.80E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.76E-02
20%	4.78E-05	1.80E-03	3.57E-02	1.36E-03	1.58E-05	7.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-02
25%	5.07E-05	2.03E-03	4.18E-02	1.42E-03	1.71E-05	8.80E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.98E-02
30%	5.34E-05	2.30E-03	4.80E-02	1.47E-03	1.83E-05	9.74E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.62E-02
35%	5.65E-05	2.51E-03	5.44E-02	1.52E-03	1.96E-05	1.05E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.26E-02
40%	5.93E-05	2.74E-03	6.15E-02	1.57E-03	2.08E-05	1.12E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.99E-02
45%	6.24E-05	2.97E-03	7.00E-02	1.62E-03	2.23E-05	1.19E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.80E-02
50%	6.55E-05	3.20E-03	7.83E-02	1.67E-03	2.37E-05	1.26E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-02
55%	6.89E-05	3.46E-03	8.76E-02	1.72E-03	2.51E-05	1.32E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-01
60%	7.26E-05	3.75E-03	9.92E-02	1.77E-03	2.66E-05	1.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-01
65%	7.67E-05	4.06E-03	1.11E-01	1.84E-03	2.85E-05	1.47E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-01
70%	8.16E-05	4.39E-03	1.26E-01	1.91E-03	3.05E-05	1.55E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-01
75%	8.70E-05	4.78E-03	1.45E-01	1.98E-03	3.28E-05	1.63E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E-01
80%	9.35E-05	5.26E-03	1.69E-01	2.06E-03	3.57E-05	1.73E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-01
85%	1.02E-04	6.00E-03	2.03E-01	2.18E-03	3.96E-05	1.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-01
90%	1.14E-04	6.97E-03	2.51E-01	2.35E-03	4.52E-05	1.97E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E-01
95%	1.33E-04	8.61E-03	3.52E-01	2.59E-03	5.44E-05	2.13E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E-01
Mean	7.23E-05	3.79E-03	1.19E-01	1.74E-03	2.69E-05	1.26E-02	6.47E-11	1.72E-13	2.49E-12	2.39E-13	3.84E-13	1.37E-01
Min	7.59E-07	9.27E-06	2.85E-04	1.19E-05	4.10E-07	1.46E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E-04
Max	1.91E-04	2.87E-02	2.15E+00	8.69E-03	1.91E-04	2.57E-02	1.61E-07	3.34E-10	6.19E-09	5.22E-10	5.42E-10	2.18E+00

TABLE C.51 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Pu-240 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Radon (WD)	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	1.61E-05	9.19E-04	6.31E-16	1.70E-02	1.11E-03	1.04E-05	3.81E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-02
10%	1.80E-05	1.20E-03	8.11E-16	2.37E-02	1.22E-03	1.25E-05	5.46E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.97E-02
15%	1.95E-05	1.40E-03	8.82E-16	2.97E-02	1.29E-03	1.42E-05	6.77E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.62E-02
20%	2.09E-05	1.57E-03	9.26E-16	3.57E-02	1.36E-03	1.56E-05	7.80E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E-02
25%	2.23E-05	1.73E-03	9.56E-16	4.15E-02	1.41E-03	1.69E-05	8.74E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.88E-02
30%	2.34E-05	1.88E-03	9.82E-16	4.75E-02	1.46E-03	1.83E-05	9.59E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.50E-02
35%	2.48E-05	2.08E-03	1.01E-15	5.41E-02	1.51E-03	1.96E-05	1.04E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.12E-02
40%	2.60E-05	2.26E-03	1.03E-15	6.10E-02	1.56E-03	2.08E-05	1.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.86E-02
45%	2.74E-05	2.42E-03	1.04E-15	6.91E-02	1.61E-03	2.21E-05	1.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.66E-02
50%	2.88E-05	2.63E-03	1.06E-15	7.78E-02	1.66E-03	2.35E-05	1.25E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.51E-02
55%	3.03E-05	2.80E-03	1.08E-15	8.70E-02	1.71E-03	2.50E-05	1.32E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E-01
60%	3.20E-05	3.01E-03	1.10E-15	9.78E-02	1.77E-03	2.66E-05	1.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-01
65%	3.37E-05	3.20E-03	1.12E-15	1.10E-01	1.82E-03	2.83E-05	1.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
70%	3.57E-05	3.42E-03	1.14E-15	1.25E-01	1.88E-03	3.04E-05	1.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-01
75%	3.82E-05	3.70E-03	1.16E-15	1.44E-01	1.96E-03	3.28E-05	1.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-01
80%	4.12E-05	4.02E-03	1.18E-15	1.67E-01	2.04E-03	3.56E-05	1.72E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01
85%	4.47E-05	4.40E-03	1.21E-15	1.99E-01	2.15E-03	3.92E-05	1.83E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E-01
90%	4.99E-05	4.94E-03	1.24E-15	2.49E-01	2.31E-03	4.45E-05	1.95E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.69E-01
95%	5.85E-05	5.83E-03	1.29E-15	3.51E-01	2.58E-03	5.34E-05	2.12E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-01
Mean	3.17E-05	2.89E-03	4.11E-15	1.18E-01	1.73E-03	2.66E-05	1.25E-02	7.34E-04	6.91E-06	9.15E-20	2.82E-05	5.08E-07	1.25E-08	1.35E-01
Min	4.92E-12	3.16E-11	3.07E-17	1.82E-09	2.96E-10	2.76E-10	2.11E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-09
Max	8.41E-05	1.38E-02	3.74E-12	2.07E+00	6.32E-03	1.42E-04	2.55E-02	1.25E+00	1.25E-02	1.45E-16	4.79E-02	7.74E-04	1.73E-05	2.10E+00

TABLE C.52 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Sr-90 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	1.35E-05	5.27E-09	3.13E-03	8.29E-04	1.96E-04	1.79E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.42E-03
10%	1.05E-04	3.67E-08	2.06E-02	5.19E-03	1.17E-03	1.27E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.97E-02
15%	2.37E-04	7.46E-08	3.82E-02	9.20E-03	2.26E-03	2.57E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.30E-02
20%	3.58E-04	1.06E-07	5.33E-02	1.34E-02	3.15E-03	3.85E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.31E-02
25%	4.44E-04	1.37E-07	7.15E-02	1.75E-02	4.14E-03	5.10E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.77E-02
30%	5.01E-04	1.69E-07	8.81E-02	2.17E-02	5.06E-03	6.22E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-01
35%	5.53E-04	1.91E-07	1.06E-01	2.65E-02	6.18E-03	7.26E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-01
40%	6.02E-04	2.17E-07	1.27E-01	3.17E-02	7.39E-03	8.34E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-01
45%	6.48E-04	2.45E-07	1.51E-01	3.79E-02	8.78E-03	9.28E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E-01
50%	6.92E-04	2.77E-07	1.74E-01	4.39E-02	1.04E-02	1.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E-01
55%	7.48E-04	3.07E-07	2.07E-01	5.06E-02	1.24E-02	1.10E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.79E-01
60%	7.99E-04	3.40E-07	2.37E-01	5.92E-02	1.46E-02	1.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-01
65%	8.54E-04	3.74E-07	2.77E-01	6.97E-02	1.69E-02	1.30E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.72E-01
70%	9.23E-04	4.16E-07	3.21E-01	8.25E-02	2.00E-02	1.39E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E-01
75%	9.90E-04	4.63E-07	3.75E-01	9.87E-02	2.40E-02	1.49E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.03E-01
80%	1.08E-03	5.15E-07	4.55E-01	1.19E-01	2.92E-02	1.61E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.07E-01
85%	1.18E-03	5.83E-07	5.69E-01	1.50E-01	3.67E-02	1.76E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.50E-01
90%	1.33E-03	6.92E-07	7.29E-01	1.94E-01	4.76E-02	1.93E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.71E-01
95%	1.59E-03	8.96E-07	1.06E+00	2.99E-01	7.58E-02	2.15E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E+00
Mean	7.37E-04	3.39E-07	3.11E-01	8.42E-02	2.08E-02	1.03E-04	2.75E-04	3.89E-06	1.15E-05	2.19E-05	1.15E-05	4.17E-01
Min	0.00E+00	0.00E+00	3.30E-29	8.02E-30	2.42E-30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.34E-29
Max	2.57E-03	2.91E-06	5.45E+00	1.95E+00	4.71E-01	2.85E-04	1.93E-01	3.40E-03	7.74E-03	1.77E-02	8.91E-03	7.38E+00

TABLE C.53 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for Tc-99 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	6.58E-13	7.02E-15	2.00E-08	4.44E-11	5.21E-10	6.19E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-05
10%	1.56E-12	1.75E-14	4.79E-08	1.12E-10	1.26E-09	1.56E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.02E-05
15%	2.89E-12	3.48E-14	9.25E-08	2.25E-10	2.57E-09	3.09E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.08E-05
20%	5.07E-12	5.84E-14	1.58E-07	3.97E-10	4.45E-09	5.25E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-04
25%	7.82E-12	9.38E-14	2.69E-07	6.72E-10	7.29E-09	8.72E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.40E-04
30%	1.26E-11	1.47E-13	4.40E-07	1.10E-09	1.26E-08	1.30E-11	1.41E-03	1.85E-06	1.27E-04	8.90E-07	2.34E-05	1.68E-03
35%	1.88E-11	2.36E-13	7.17E-07	1.71E-09	2.06E-08	2.02E-11	2.91E-03	5.19E-06	2.69E-04	2.00E-06	5.30E-05	3.40E-03
40%	2.97E-11	3.68E-13	1.13E-06	2.62E-09	3.40E-08	3.07E-11	5.03E-03	9.42E-06	4.57E-04	3.57E-06	8.96E-05	5.71E-03
45%	4.53E-11	5.64E-13	1.71E-06	4.10E-09	5.20E-08	4.63E-11	7.51E-03	1.48E-05	7.23E-04	5.83E-06	1.41E-04	8.61E-03
50%	7.16E-11	8.30E-13	2.66E-06	6.57E-09	7.82E-08	7.10E-11	1.13E-02	2.29E-05	1.11E-03	9.07E-06	2.11E-04	1.29E-02
55%	1.11E-10	1.32E-12	4.27E-06	1.07E-08	1.26E-07	1.13E-10	1.70E-02	3.39E-05	1.59E-03	1.32E-05	3.23E-04	1.95E-02
60%	1.70E-10	2.01E-12	6.58E-06	1.75E-08	2.02E-07	1.71E-10	2.43E-02	5.10E-05	2.33E-03	1.86E-05	4.81E-04	2.79E-02
65%	2.69E-10	3.34E-12	1.04E-05	2.68E-08	3.16E-07	2.71E-10	3.52E-02	7.30E-05	3.34E-03	2.56E-05	7.03E-04	3.98E-02
70%	4.23E-10	5.28E-12	1.64E-05	4.20E-08	5.09E-07	4.32E-10	4.95E-02	1.04E-04	4.72E-03	3.60E-05	9.62E-04	5.62E-02
75%	6.36E-10	8.24E-12	2.55E-05	6.56E-08	7.92E-07	7.00E-10	6.82E-02	1.57E-04	6.45E-03	5.07E-05	1.33E-03	7.78E-02
80%	1.00E-09	1.24E-11	4.15E-05	1.10E-07	1.29E-06	1.08E-09	8.97E-02	2.24E-04	8.70E-03	6.87E-05	1.82E-03	1.03E-01
85%	1.58E-09	1.97E-11	6.62E-05	1.78E-07	2.17E-06	1.71E-09	1.20E-01	3.31E-04	1.15E-02	9.34E-05	2.52E-03	1.36E-01
90%	2.77E-09	3.49E-11	1.16E-04	3.40E-07	3.80E-06	2.95E-09	1.61E-01	5.07E-04	1.55E-02	1.36E-04	3.72E-03	1.83E-01
95%	5.48E-09	7.28E-11	2.89E-04	8.67E-07	1.01E-05	6.14E-09	2.25E-01	9.41E-04	2.35E-02	2.22E-04	6.02E-03	2.54E-01
Mean	5.13E-07	7.46E-09	3.53E-03	1.11E-05	1.20E-04	5.76E-07	4.98E-02	2.08E-04	5.39E-03	4.77E-05	1.25E-03	5.68E-02
Min	1.08E-14	1.67E-16	3.36E-10	6.82E-13	1.34E-11	5.25E-15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E-07
Max	5.64E-05	1.82E-06	4.67E-01	3.90E-03	2.44E-02	5.69E-05	5.53E-01	1.38E-02	1.60E-01	1.58E-03	3.84E-02	6.38E-01

TABLE C.54 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-234 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Radon (WD)	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	7.42E-05	4.28E-05	1.27E-03	7.75E-03	1.02E-03	6.97E-04	4.73E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-02
10%	1.37E-03	8.57E-05	4.22E-02	1.52E-02	1.86E-03	1.19E-03	1.01E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.69E-02
15%	3.19E-03	1.09E-04	9.93E-02	1.95E-02	2.48E-03	1.49E-03	1.38E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E-01
20%	5.78E-03	1.25E-04	1.64E-01	2.34E-02	3.05E-03	1.76E-03	1.69E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.30E-01
25%	9.18E-03	1.42E-04	2.40E-01	2.70E-02	3.59E-03	2.01E-03	1.99E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E-01
30%	1.28E-02	1.59E-04	3.38E-01	3.08E-02	4.23E-03	2.28E-03	2.22E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E-01
35%	1.73E-02	1.76E-04	4.33E-01	3.47E-02	4.81E-03	2.51E-03	2.44E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.52E-01
40%	2.20E-02	1.90E-04	5.46E-01	3.83E-02	5.47E-03	2.73E-03	2.64E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.50E-01
45%	2.63E-02	2.09E-04	6.39E-01	4.23E-02	6.15E-03	2.93E-03	2.83E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E-01
50%	3.08E-02	2.26E-04	7.40E-01	4.65E-02	6.79E-03	3.18E-03	3.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.59E-01
55%	3.55E-02	2.43E-04	8.35E-01	5.10E-02	7.48E-03	3.43E-03	3.25E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-01
60%	3.93E-02	2.60E-04	9.16E-01	5.62E-02	8.29E-03	3.68E-03	3.51E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E+00
65%	4.38E-02	2.81E-04	9.92E-01	6.20E-02	9.13E-03	4.00E-03	3.75E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E+00
70%	4.79E-02	3.03E-04	1.08E+00	6.87E-02	1.01E-02	4.36E-03	4.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E+00
75%	5.29E-02	3.28E-04	1.15E+00	7.58E-02	1.12E-02	4.72E-03	4.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E+00
80%	5.87E-02	3.57E-04	1.23E+00	8.58E-02	1.25E-02	5.18E-03	4.70E-03	2.17E-28	6.49E-30	0.00E+00	8.96E-30	2.87E-30	2.91E-31	1.37E+00
85%	6.60E-02	3.96E-04	1.32E+00	9.73E-02	1.43E-02	5.75E-03	5.22E-03	1.20E-04	1.12E-06	1.15E-09	4.83E-06	8.08E-07	8.90E-07	1.46E+00
90%	7.65E-02	4.42E-04	1.42E+00	1.16E-01	1.67E-02	6.55E-03	5.93E-03	9.48E-03	5.48E-05	6.35E-07	3.65E-04	5.37E-05	6.25E-05	1.57E+00
95%	9.31E-02	5.24E-04	1.59E+00	1.57E-01	2.10E-02	8.09E-03	6.94E-03	9.37E-02	4.72E-04	5.82E-06	3.60E-03	5.32E-04	7.14E-04	1.75E+00
Mean	3.54E-02	2.50E-04	7.37E-01	6.05E-02	8.40E-03	3.63E-03	3.28E-03	4.18E-02	1.60E-04	2.64E-06	1.61E-03	2.97E-04	3.89E-04	8.57E-01
Min	9.99E-07	9.39E-09	3.64E-05	1.52E-06	1.60E-07	3.42E-08	1.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.39E-05
Max	1.87E-01	1.46E-03	2.32E+00	8.59E-01	7.03E-02	2.98E-02	1.05E-02	2.11E+01	8.08E-02	1.66E-03	8.13E-01	1.90E-01	1.41E-01	2.23E+01

TABLE C.55 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-235 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	4.75E-02	4.50E-05	8.05E-03	5.48E-04	3.96E-04	4.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.84E-02
10%	9.38E-02	8.64E-05	1.45E-02	9.10E-04	6.95E-04	9.39E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-01
15%	1.08E-01	1.17E-04	1.98E-02	1.16E-03	8.92E-04	1.35E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-01
20%	1.19E-01	1.45E-04	2.53E-02	1.36E-03	1.05E-03	1.74E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-01
25%	1.26E-01	1.75E-04	3.11E-02	1.55E-03	1.18E-03	2.04E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-01
30%	1.35E-01	2.10E-04	3.76E-02	1.77E-03	1.32E-03	2.34E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.13E-01
35%	1.44E-01	2.43E-04	4.44E-02	1.98E-03	1.45E-03	2.62E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-01
40%	1.53E-01	2.82E-04	5.18E-02	2.22E-03	1.60E-03	2.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-01
45%	1.62E-01	3.29E-04	6.05E-02	2.46E-03	1.74E-03	3.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E-01
50%	1.71E-01	3.97E-04	6.99E-02	2.70E-03	1.90E-03	3.59E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E-01
55%	1.81E-01	4.91E-04	7.81E-02	3.00E-03	2.07E-03	4.04E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-01
60%	1.92E-01	6.08E-04	8.89E-02	3.32E-03	2.23E-03	4.62E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-01
65%	2.04E-01	7.56E-04	1.01E-01	3.68E-03	2.45E-03	5.45E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-01
70%	2.16E-01	9.03E-04	1.17E-01	4.10E-03	2.70E-03	6.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E-01
75%	2.32E-01	1.08E-03	1.36E-01	4.58E-03	2.96E-03	7.50E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E-01
80%	2.51E-01	1.30E-03	1.61E-01	5.18E-03	3.29E-03	8.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-01
85%	2.77E-01	1.56E-03	1.97E-01	6.01E-03	3.78E-03	1.00E-02	4.02E-04	1.25E-06	1.54E-05	1.97E-07	2.49E-07	4.59E-01
90%	3.09E-01	1.91E-03	2.43E-01	7.28E-03	4.42E-03	1.18E-02	7.70E-03	3.54E-05	2.98E-04	7.97E-06	1.19E-05	5.21E-01
95%	3.64E-01	2.42E-03	3.48E-01	9.50E-03	5.70E-03	1.43E-02	5.29E-02	2.21E-04	2.04E-03	1.84E-04	2.54E-04	6.49E-01
Mean	1.86E-01	7.50E-04	1.12E-01	3.62E-03	2.33E-03	5.16E-03	3.87E-02	1.39E-04	1.49E-03	2.62E-04	3.48E-04	3.31E-01
Min	2.32E-06	2.59E-08	1.35E-06	1.71E-09	6.65E-10	2.43E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-06
Max	6.19E-01	6.54E-03	5.30E+00	6.92E-02	3.36E-02	2.48E-02	1.65E+01	6.07E-02	6.33E-01	1.67E-01	2.22E-01	1.74E+01

TABLE C.56 Peak DSR Percentiles (mrem/yr per pCi/g) for Different Exposure Pathways for U-238 in Onsite Resident Scenario

Percentile	External	Inhalation w/o Radon	Radon (WI)	Plant Ingestion (WI)	Meat Ingestion (WI)	Milk Ingestion (WI)	Soil Ingestion	Water Ingestion	Aquatic Foods	Radon (WD)	Plant Ingestion (WD)	Meat Ingestion (WD)	Milk Ingestion (WD)	All Pathways
5%	1.15E-02	3.19E-05	8.51E-08	3.86E-03	5.09E-04	4.43E-04	3.52E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-02
10%	2.00E-02	5.98E-05	1.11E-07	7.10E-03	8.72E-04	7.29E-04	7.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.22E-02
15%	2.31E-02	7.70E-05	1.25E-07	9.42E-03	1.17E-03	9.17E-04	1.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-02
20%	2.49E-02	9.07E-05	1.35E-07	1.17E-02	1.39E-03	1.07E-03	1.27E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.38E-02
25%	2.68E-02	1.03E-04	1.43E-07	1.40E-02	1.58E-03	1.20E-03	1.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.86E-02
30%	2.88E-02	1.15E-04	1.51E-07	1.64E-02	1.82E-03	1.33E-03	1.67E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-02
35%	3.06E-02	1.26E-04	1.58E-07	1.90E-02	2.05E-03	1.47E-03	1.84E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-02
40%	3.25E-02	1.39E-04	1.65E-07	2.16E-02	2.29E-03	1.62E-03	2.01E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.21E-02
45%	3.44E-02	1.50E-04	1.73E-07	2.43E-02	2.52E-03	1.77E-03	2.15E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.69E-02
50%	3.62E-02	1.63E-04	1.80E-07	2.76E-02	2.79E-03	1.92E-03	2.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.23E-02
55%	3.84E-02	1.77E-04	1.88E-07	3.12E-02	3.08E-03	2.09E-03	2.44E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.74E-02
60%	4.06E-02	1.93E-04	1.97E-07	3.55E-02	3.39E-03	2.28E-03	2.58E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.31E-02
65%	4.29E-02	2.07E-04	2.07E-07	4.01E-02	3.74E-03	2.49E-03	2.73E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.99E-02
70%	4.57E-02	2.22E-04	2.20E-07	4.58E-02	4.15E-03	2.75E-03	2.88E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-01
75%	4.90E-02	2.40E-04	2.36E-07	5.28E-02	4.61E-03	3.03E-03	3.06E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-01
80%	5.29E-02	2.60E-04	2.69E-07	6.25E-02	5.16E-03	3.38E-03	3.25E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-01
85%	5.79E-02	2.87E-04	4.78E-05	7.40E-02	5.97E-03	3.83E-03	3.48E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-01
90%	6.43E-02	3.19E-04	3.54E-03	9.31E-02	7.35E-03	4.47E-03	3.75E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-01
95%	7.54E-02	3.79E-04	6.48E-03	1.29E-01	9.70E-03	5.73E-03	4.09E-03	7.02E-02	1.57E-04	2.02E-08	2.70E-03	2.93E-04	4.02E-04	2.47E-01
Mean	3.92E-02	1.81E-04	7.26E-04	4.27E-02	3.66E-03	2.36E-03	2.27E-03	3.94E-02	1.57E-04	1.77E-07	1.52E-03	2.69E-04	3.46E-04	1.28E-01
Min	3.50E-12	9.81E-14	1.47E-10	6.74E-12	1.08E-12	3.18E-13	6.14E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-10
Max	1.12E-01	1.10E-03	1.16E-02	6.09E-01	5.67E-02	1.55E-02	5.00E-03	1.62E+01	2.35E-01	3.87E-04	6.24E-01	7.44E-02	1.17E-01	1.73E+01



Environmental Science Division

Argonne National Laboratory
9700 South Cass Avenue, Bldg. 240
Argonne, IL 60439-4847

www.anl.gov



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