BFM $DCGL_{ep}$ Values Assuming the Residential Scenario Without Drinking Water

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1 Introduction

This report documents the development of Basement Fill Model (BFM) derived concentration guideline levels values for embedded pipes ($DCGL_{ep}$) applying the exposure pathways assumed for the Residential scenario, except the drinking water pathway. The Residential Scenario is considered a "less likely but plausible" exposure scenario for the OCNGS site.

The residential scenario assumes that the OCNGS site is transitioned to a residential neighborhood consisting of single-family houses with enough land area to support a backyard garden. The critical receptor is a hypothetic individual who resides on the site year-round (i.e., does not leave the site for offsite employment), ingests garden vegetables grown in a backyard garden, and ingests aquatic food from the canal which is assumed to remain after license termination. The developer of the residential neighborhood is assumed to have connected each residential structure to the currently available municipal water supply making municipal water the source for all drinking water and household water use. However, the critical receptor is assumed to have installed a well to use untreated groundwater for the sole purpose of irrigating the backyard garden. The area of the backyard garden is 650 ft^2, which is equal to the average garden size in NJ. Shielding due to the newly developed asphalt neighborhood roads and driveways is ignored. Additionally, there is no meat- or milk-producing livestock onsite.

Five RESRAD exposure pathways are assumed open: external gamma, inhalation, plant ingestion, aquatic foods, and soil ingestion. Closed RESRAD exposure pathways are meat, milk, drinking water, and radon.

BFM Embedded Pipe (EP) Scenario: The BFM $DCGL_{ep}$ values are based on a scenario which assumes an instantaneous release of residual internal surface radioactivity in embedded pipes to 1m of fill directly above the concrete floors of the 3 below-grade building foundations targeted to remain onsite at license termination: Reactor Building (RB), Turbine Building (TB), and Old Radwaste Building (ORB). The contaminated volumes (CV) from the 3 foundations are summed and the summed CV is modeled as the contaminated zone (CZ), which is assumed covered by site soil and located entirely in the saturated zone. The walls and floors of the below-grade structures are assumed not to impede groundwater flow or migration of residual contamination. A full description of the conceptual model for the embedded pipe scenario, as well as the derivations of input for RESRAD-Onsite, is provided in ENG-OCS-015 [1]. The conceptual model for embedded pipes is shown in Figure 1.

The DCGL values developed in this document correspond to the NRC dose criteria established in 10CFR20.1403 (i.e., 25 mrem/y).

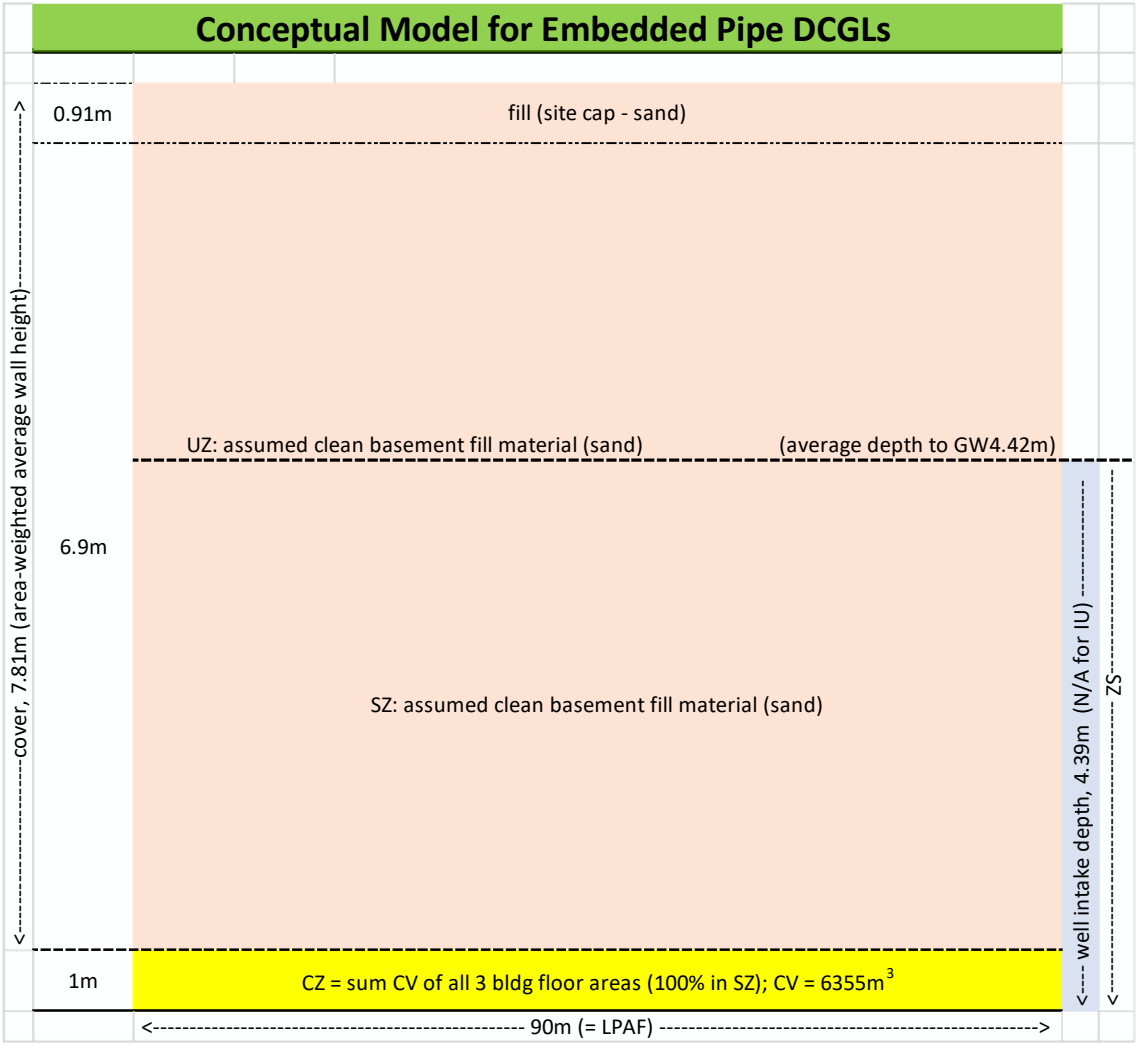

Figure 1: Conceptual Configuration for Embedded Pipes

2 Input

The area of the backyard garden = 650 ft^2 (60.4 m^2).

Input for the annual dietary fraction of aquatic food from the canal is equal to 0.61, the 75th percentile value from ENG-OCS-008 [2].

Irrigation rate (IR_r) for the garden is determined using equation 3.4.2 in ANL/EVS/TM-14/4 [3]:

$$IRr = (ETr/Ce)-(1-Cr)(Pr)$$

Where:

ETr = estimated Evapotranspiration Rate (m/y) = 0.6 (see Figure 3.3.1 in ANL/EVS/TM-14/4)

Pr = the Precipitation Rate (m/y) = 1.4 (OCNGS site met data; see ENG-OCS-007 [4])

Ce = Evapotranspiration Coefficient distribution applied (NUREG-6697 [5], min value = 0.5, max value = 0.75)

Cr = the Runoff Coefficient = 0.2 (determined in ENG-OCS-007)

The maximum and minimum values for IR_r are:

Variable	Use of Min Ce Value	Use of Max Ce Value
ETr (m/y)	0.6	0.6
Pr (m/y)	1.4	1.4
Cr	0.2	0.2
Ce	0.5	0.75
IRr (m/y)	0.08	-0.32, assumed = 0

A uniform distribution with minimum and maximum value equal to 0.0 and 0.08, respectively, and a mean equal to 0.04 m/y was assigned as input for this parameter.

The well pumping rate and the contaminated fraction of plant food (f_p) were adjusted for the size of the backyard garden.

f_p = min (A/2000m^2, 0.5), from NUREG/CR-7267 [6], Table C-13.

f_p = 60.4m^2/2000m^2 = 0.03

Ground Water Use Component (general case)	Minimum Water Use, m^3/y	Maximum Water Use, m^3/y
Household (family of 4), m^3/y	0	0
Livestock, m^3/y	0	0
Irrigation Water, m^3/y = f_p x I_r x 60.4	0	0.146
Contaminated fraction (fp)	0.03	0.03
Irrigation Rate (IR_r), m/y	0.0	0.08
Drinking Water, m^3/y	0	0
Total, m^3/y	0	0.146

The input defining the CZ taken from ENG-OCS-015):

Contaminated volume (6355.3 m^3) forming the CZ:

CZ thickness = 1m

CZ area = 6355.3 m^2

Length parallel to aquifer flow = 90m

Fraction CZ in saturated zone = 1.0

Cover thickness = 7.81m

A site-specific suite of potential radionuclides-of-concern (ROCs) has been identified for the OCNGS site [7] and is listed in Table 1. RESRAD-Onsite 7.2 automatically accounts for progeny radionuclides with input for several of the ROCs. Progeny radionuclides are also listed in Table 1.

Table 1: Radionuclides of Concern Identified for the OCNGS Site

ROC	Progeny	ROC	Progeny
Am-241	Np-237, Th-229, U-233	Nb-94	---
C-14	---	Ni-63	---
Cm-243	Ac-227, Am-243, Pa-231, Pu-239, U-235	Np-237	Th-229, U-233
Cm-244	Pu-240, Ra-228, Th-228, Th-232, U-236	Pu-238	Pb-210, Po-210, Ra-226, Th-230, U-234
Co-60	---	Pu-239	Ac-227, Pa-231, U-235
Cs-137	---	Pu-240	Ra-228, Th-228, Th-232, U-236
Eu-152	Gd-152	Pu-241	Am-241, Np-237, Th-229, U-233
Eu-154	---	Sb-125	Te-125m
Fe-55	---	Sr-90	---
H-3	---	Tc-99	---
Mn-54	---		

Input values and their basis for all RESRAD-ONSITE parameters are provided in Table 2.

Table 2: Input Values for RESRAD-Onsite Parameters

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations
BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water

Parameter (unit)	Type	Priority	Treatment	Value/Distribution	Basis	Distribution's Statistical Parameters				Median/ Mean
						1	2	3	4	
Soil Concentrations										
Basic radiation dose limit (mrem/y)	P	3	D	25	10 CFR 20.1402					
Initial principal radionuclide (pCi/g)	P	2	D	1	Unit Value					
Distribution coefficients (sand soil type assigned to contaminated and saturated zones) (cm^3/g)										
Ac-227	P	1	S	Truncated lognormal-n	NUREG/CR-7267	7.44	1.1	0.001	0.999	1700
Am-241	P	1	D	2.69E+02	25th percentile value					
Am-243	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	6.91	1.95	0.001	0.999	1000
C-14	P	1	D	6.13E+00	25th percentile value					
Cm-243	P	1	D S	5.74E+02 (CZ) Truncated lognormal-n (SZ)	25th percentile value ANL/EVS/TM-14/4	8.13	2.64	0.001	0.999	3400
Cm-244	P	1	D S	5.74E+02 (CZ) Truncated lognormal-n (SZ)	25th percentile value ANL/EVS/TM-14/4	8.13	2.64	0.001	0.999	3400
Co-60	P	1	D	3.71E+01	25th percentile value					
Cs-137	P	1	D S	1.58E+02 (CZ) Truncated lognormal-n (SZ)	25th percentile value ANL/EVS/TM-14/4	6.27	1.79	0.001	0.999	530
Eu-152	P	1	D	6.40E+01	25th percentile value					
Eu-154	P	1	D	6.40E+01	25th percentile value					

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	Type	Priority	Treatment	Value/Distribution	Basis	Distribution's Statistical Parameters				Median/ Mean
						1	2	3	4	
Fe-55	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	5.77	0	0.001	0.999	320
Gd-152	P	1	S	Truncated lognormal-n	NUREG/CR-7267	1.61	3.22	0.001	0.999	5
H-3	P	1	D	4.30E-03 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	NUREG/CR-7267	-2.81	0.5	0.001	0.999	0.06
Mn-54	P	1	D	1.66E+02	25th percentile value					
Nb-94	P	1	D	5.86E+02 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	NUREG/CR-7267	7.31	1.39	0.001	0.999	1500
Ni-63	P	1	D	2.76E+01	25th percentile value					
Np-237	P	1	D	5.49E+00	25th percentile value					
Pa-231	P	1	S	Truncated lognormal-n	NUREG/CR-7267	7.6	1.1	0.001	0.999	2000
Pb-210	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	5.39	1.39	0.001	0.999	220
Po-210	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	4.61	1.79	0.001	0.999	100
Pu-238	P	1	D	1.56E+02	25th percentile value					
Pu-239	P	1	D	1.56E+02	25th percentile value					
Pu-240	P	1	D	1.56E+02	25th percentile value					
Pu-241	P	1	D	1.56E+02 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	ANL/EVS/TM-14/4	5.99	1.39	0.001	0.999	400
Ra-226	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	8.04	2.08	0.001	0.999	3100
Ra-228	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	8.04	2.08	0.001	0.999	3100
Sb-125	P	1	D	5.08E+00 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	ANL/EVS/TM-14/4	2.83	1.79	0.001	0.999	17
Sr-90	P	1	D	6.58E+00	25th percentile value					
Tc-99	P	1	D	1.90E-02 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	ANL/EVS/TM-14/4	-3.22	1.1	0.001	0.999	0.04
Te-125m	P	1	D	6.28E+01 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	ANL/EVS/TM-14/4	6.31	3.22	0.001	0.999	550
Th-228	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	6.55	2.4	0.001	0.999	700
Th-229	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	6.55	2.4	0.001	0.999	700
Th-230	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	6.55	2.4	0.001	0.999	700
Th-232	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	6.55	2.4	0.001	0.999	700
U-233	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	4.7	2.48	0.001	0.999	110
U-234	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	4.7	2.48	0.001	0.999	110
U-235	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	4.7	2.48	0.001	0.999	110
U-236	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	4.7	2.48	0.001	0.999	110

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Initial concentration of radionuclides present in groundwater (pCi/l)	P	3	D	0	Ground water uncontaminated	NR	NR	NR	NR	
Calculation Times										
Time since placement of material (y)	P	3	D	0		NR	NR	NR	NR	
Time for calculations (y)	P	3	D	0, 1, 3, 10, 30, 100, 300, 1000	RESRAD Default	NR	NR	NR	NR	
Contaminated Zone										
Cover depth (m)	P	2	D	7.81	Area-weighted value for bldg wall heights.	NR	NR	NR	NR	
Cover density (g/cm^3)	P	2	S	Bounded Normal	Site soil type = sand (OCNGS *Hydrogeologic Investigation Report*). Input for density of fill material = NUREG/CR-7267 density distribution for site soil type - sand.	1.5105	0.159	1.019	2.002	
Cover erosion rate (m/y)	P	2	D	6E-04	Assumed final site grade is level. Input for erosion rate = NUREG/CR-7267 erosion rate for site with shallow slope (i.e., relatively level)					
Area of contaminated zone (m^2)	P	2	D	6355.3	Combined CV from RB, TB, and ORB.					
Thickness of contaminated zone (m)	P	2	D	1.0	Scenario assumption					
Length parallel to aquifer flow (m)	P	2	D	90	Diameter of CV					
Does the initial contamination penetrate the water table?				Yes	CV below the average depth to groundwater					
Contaminated fraction below the water table				1.0	Entire CV in SZ					
Cover and Contaminated Zone Hydrological Data										
Density of contaminated zone (g/cm^3)	P	1	D S	1.62E+00 (H-3, Tc-99) Bounded Normal (all other ROCs)	75th percentile value NUREG/CR-7267 distribution for site soil type - sand.	1.5105	0.159	1.019	2.002	1.5105
Contaminated zone erosion rate (m/y)	P	2	D	6E-04	NUREG/CR-7267; assumed erosion rate for site with shallow slope (i.e., relatively level)					
Contaminated zone total porosity	P	2	D S	3.90E-01 (H-3) Bounded Normal (all other ROCs)	25th percentile value NUREG/CR-7267 distribution for site soil type -sand	0.43	0.06	0.2446	0.6154	0.43
Contaminated zone field capacity	P	3	D	0.18	Value based on site-specific soil type (sand); calculated using equation in NUREG/CR-7267					

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Contaminated zone hydraulic conductivity (m/y)	P	2	D	2741	2017 *Hydrogeologic Investigation Report*					
Contaminated zone b parameter	P	2	S	Bounded Log Normal n	NUREG/CR-7267 distribution for site soil type - sand	- 0.0253	0.216	0.501	1.90	0.975
Humidity in air (g/m^3)	P	3	D	6.6	Figure 1 in *Regional and Site-Specific Absolute Humidity Data for Use in Tritium Dose Calculations*					
Evapotranspiration coefficient	P	2	S	Uniform	NUREG/CR-7267	0.5	0.75	NR	NR	0.625
Average annual wind speed (m/s)	P	2	D	3.13	Internet search: https://www.windfinder.com/windstatistics/oyster_creek_barnegat_bay					
Precipitation (m/y)	P	2	D	1.4	*Annual Report on the Meteorological Program at Oyster Creek Generating Station* – average annual precipitation for 2015 through 2020					
Irrigation (m/y)	B	3	D	6.00E-02 (Am-241, Cm-243/244, Cs-137, Fe-55, H-3, Nb-94, Ni-63, Pu-238/239/240/241, Tc-99) Uniform (C-14, Co-60, Eu-152/154, Mn-54, Np-237, Sb-125, Sr-90)	75th percentile value Distribution determined using methodology described in *Data Collection Handbook* and NUREG/CR-6697.	0	0.08			0.04
Irrigation mode	B	3	D	Overhead	Overhead irrigation is common practice for crops in U.S.					
Runoff coefficient	P	2	D	0.2	Value determined using methodology described in *Data Collection Handbook* and NUREG/CR-7267					
Watershed area for nearby stream or pond (m^2)	P	3	D	1.01E+08	NJ-GeoWeb (NJDEP BGIS)					
Accuracy for water/soil computations	-	3	D	1.00E-03	RESRAD Default					
Saturated Zone Hydrological Data										
Density of saturated zone (g/cm^3)	P	1	S	Bounded Normal	NUREG/CR-7267 Table C-1, distribution for site soil type -sand	1.5105	0.159	1.019	2.002	1.5105
Saturated zone total porosity	P	1	S	Bounded Normal	NUREG/CR-7267 distribution for site soil type -sand	0.43	0.06	0.2446	0.6154	0.43
Saturated zone effective porosity	P	1	D	0.25	OCNGS *Hydrogeologic Investigation Report*					

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Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Saturated zone field capacity	P	3	D	0.18	Value based on site-specific soil type (sand); calculated using equation in NUREG/CR-7267					
Saturated zone hydraulic conductivity (m/y)	P	1	D	2741	OCNGS *Hydrogeologic Investigation Report*					
Saturated zone hydraulic gradient	P	2	D S	1.75E-02 (H-3, Tc-99) Uniform (all other ROCs)	25th percentile value OCNGS *Hydrogeologic Investigation Report*	0.01	0.04			0.025
Saturated zone b parameter	P	2		---	Input not required					
Water table drop rate (m/y)	P	3	D	0	CZ in SZ					
Well pump intake depth (m below water table)	P	2	D	4.39	Distance from the water table to the lower boundary of contamination in the aquifer at the down gradient edge of the CZ.					
Model: Nondispersion (ND) or Mass-Balance (MB)	P	3	D	ND	ND model recommended for contaminant areas >1,000 m^2					
Well pumping rate (m^3/y)	P	2	D	0.146	Maximum irrigation value based on general case parameter values.					
Unsaturated Zone Hydrological Data										
Number of unsaturated zone strata	P	3	D	0	CZ directly under cover material					
Occupancy										
Inhalation rate (m^3/y)	B	3	D	8400	NUREG/CR-7267					
Mass loading for inhalation (g/m^3)	P	2	S	Continuous linear	NUREG/CR-7267					2.3E-5
Exposure duration	B	3	D	30	RESRAD Default					
Indoor dust filtration factor	P	2	S	Uniform	NUREG/CR-7267	0.15	0.95			0.55
Shielding factor, external gamma	P	2	S	Bounded lognormal-n	NUREG/CR-7267	-1.3	0.59	0.044	1	0.2725
Fraction of time spent indoors	B	3	D	0.6571	NUREG/CR-5512, Vol. 3					
Fraction of time spent outdoors	B	3	D	0.1181	NUREG/CR-5512, Vol. 3 (outdoors + gardening)					
Shape factor flag, external gamma	P	3	D	Circular	RESRAD Default - Circular contaminated zone assumed					
Ingestion, Dietary										
Fruits, vegetables, grain consumption (kg/y)	B	2	D	112	NUREG/CR-5512, Vol. 3 (other vegetables + fruits + grain)					
Leafy vegetable consumption (kg/y)	B	3	D	21.4	NUREG/CR-5512, Vol. 3					

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Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Milk consumption (L/y)	B	2	D	233	NUREG/CR-5512, Vol. 3					
Meat and poultry consumption (kg/y)	B	3	D	65.1	NUREG/CR5512, Vol. 3 (beef + poultry)					
Fish consumption (kg/y)	B	3	D	20.6	NUREG/CR-5512, Vol. 3					
Other seafood consumption (kg/y)	B	3	D	0.9	RESRAD Default					
Soil ingestion rate (g/yr)	B	2	D	18.26	NUREG/CR-5512, Vol. 3					
Drinking water intake (L/y)	B	2	D	0	Municipal water supply					
Contamination fraction of drinking water	P	3	D	0	Input not used – pathway closed					
Contamination fraction of household water	P	3		NA						
Contamination fraction of livestock water	P	3	D	0	No livestock on site					
Contamination fraction of irrigation water	P	3	D	1	GW used for irrigation					
Contamination fraction of aquatic food	P	2	D	0.61	Same fraction that was assigned to IU critical receptor					
Contamination fraction of plant food	P	3	D	0.03	Based on size of garden					
Contamination fraction of meat	P	3	D	0	No livestock					
Contamination fraction of milk	P	3	D	0	No livestock					
Ingestion, Non-Dietary										
Livestock fodder intake for meat (kg/d)	M	3	D	27.1	NUREG/CR5512, beef cattle + poultry + layer hen					
Livestock fodder intake for milk (kg/d)	M	3	D	63.2	NUREG/CR5512, forage + grain + hay					
Livestock water intake for meat (L/d)	M	3	D	50.6	NUREG/CR5512, beef cattle + poultry + layer hen					
Livestock water intake for milk (L/d)	M	3	D	60	NUREG/CR5512					
Livestock soil intake (kg/d)	M	3	D	0.5	RESRAD Default					
Mass loading for foliar deposition (g/m^3)	P	3	D	4.00E-04	NUREG/CR-5512, gardening					
Depth of soil mixing layer (m)	P	2	S	Triangular	NUREG/CR-7267	0	0.15	0.6		0.23
Depth of roots (m)	P	1	S	Uniform	NUREG/CR-7267	0.3	4			1.85
Drinking water fraction from ground water	P	3	D	1	RESRAD Default - all water assumed to be supplied from groundwater					

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Household water fraction from ground water (if used)	P	3		NA						
Livestock water fraction from groundwater	P	3	D	0	No livestock					
Irrigation fraction from groundwater	P	3	D	1	GW used to irrigate garden					
Wet weight crop yield for Non-Leafy (kg/m^2)	P	2	D	1.27E+00 (Fe-55, Nb-94, Pu-238)	25th percentile value					
			S	Truncated lognormal-n (all other ROCs)	NUREG/CR-7267	0.56	0.48	0.001	0.999	1.75
Wet weight crop yield for Leafy (kg/m^2)	P	3	D	2.88921	NUREG/CR-5512					
Wet weight crop yield for Fodder (kg/m^2)	P	3	D	1.8868	NUREG/CR-5512					
Growing Season for Non-Leafy (y)	P	3	D	0.246	NUREG/CR-5512					
Growing Season for Leafy (y)	P	3	D	0.123	NUREG/CR-5512					
Growing Season for Fodder (y)	P	3	D	0.082	NUREG/CR-5512					
Translocation Factor for Non-Leafy	P	3	D	0.1	NUREG/CR-5512					
Translocation Factor for Leafy	P	3	D	1	NUREG/CR-5512					
Translocation Factor for Fodder	P	3	D	1	NUREG/CR-5512					
Weathering Removal Constant for Vegetation (1/y)	P	2	D	2.15E+01 (Am-241, Cm-243, Fe-55, Nb-94, Pu-238/239/240)	25th percentile value					
			S	Triangular (all other ROCs)	NUREG/CR-7267	5.1	18	84		33
Wet Foliar Interception Fraction for Non-Leafy	P	3	D	0.35	NUREG/CR-5512					
Wet Foliar Interception Fraction for Leafy	P	2	D	7.00E-01 (Fe-55, Nb-94, Pu-238/239/240)						
			S	Triangular (all other ROCs)	NUREG/CR-7267	0.06	0.67	0.95		0.58
Wet Foliar Interception Fraction for Fodder	P	3	D	0.35	NUREG/CR-5512					
Dry Foliar Interception Fraction for Non-Leafy	P	3	D	0.35	NUREG/CR-5512					
Dry Foliar Interception Fraction for Leafy	P	3	D	0.35	NUREG/CR-5512					
Dry Foliar Interception Fraction for Fodder	P	3	D	0.35	NUREG/CR-5512					
Storage times of contaminated foodstuffs (days):										

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Fruits, non-leafy vegetables, and grain	B	3	D	14	NUREG/CR-5512					
Leafy vegetables	B	3	D	1	NUREG/CR-5512					
Milk	B	3	D	1	NUREG/CR-5512					
Meat and poultry	B	3	D	20	NUREG/CR-5512 (holdup period for beef)					
Fish	B	3	D	7	RESRAD Default					
Crustacea and mollusks	B	3	D	7	RESRAD Default					
Well water	B	3	D	1	RESRAD Default					
Surface water	B	3	D	1	RESRAD Default					
Livestock fodder	B	3	D	45	RESRAD Default					
Special Radionuclides (C-14)										
C-12 concentration in water (g/cm^3)	P	3	D	2.00E-05	RESRAD Default					
C-12 concentration in contaminated soil (g/g)	P	3	D	3.00E-02	RESRAD Default					
Fraction of vegetation carbon from soil	P	3	D	2.00E-02	RESRAD Default					
Fraction of vegetation carbon from air	P	3	D	9.80E-01	RESRAD Default					
C-14 evasion layer thickness in soil (m)	P	2	S	Triangular	NUREG/CR-7267	0.2	0.3	0.6		0.3
C-14 evasion flux rate from soil (1/s)	P	3	D	7.00E-07	RESRAD Default					
C-12 evasion flux rate from soil (1/s)	P	3	D	1.00E-10	RESRAD Default					
Fraction of grain in beef cattle feed	B	3	D	0.2500	NUREG/CR-7267					
Fraction of grain in milk cow feed	B	3	D	0.1000	NUREG/CR-7267					
Inhalation Dose Conversion Factors (mrem/pCi inhaled) from FGR11 (contained in RESRAD Dose Conversion Library)										
Ingestion Dose Conversion Factors (mrem/pCi ingested) from FGR11 (contained in RESRAD Dose Conversion Library)										
Plant Transfer Factors (pCi/g plant)/(pCi/g soil)										
Ac-227	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	1.1	0.001	0.999	1.0E-03
Am-241	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Am-243	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
C-14	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-0.4	0.9	0.001	0.999	6.7E-01
Cm-243	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Cm-244	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Co-60	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-2.5	0.9	0.001	0.999	8.0E-02
Cs-137	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-3.2	1.0	0.001	0.999	4.0E-02
Eu-152	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	1.1	0.001	0.999	2.0E-03
Eu-154	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	1.1	0.001	0.999	2.0E-03
Fe-55	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	Type	Priority	Treatment	Value/Distribution	Basis	Distribution's Statistical Parameters				Median/ Mean
						1	2	3	4	
Gd-152	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	1.1	0.001	0.999	2.0E-03
H-3	P	1	S	Truncated lognormal-n	NUREG/CR-7267	1.6	1.1	0.001	0.999	5.0E+00
Mn-54	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-1.2	0.9	0.001	0.999	3.0E-01
Nb-94	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-4.6	1.0	0.001	0.999	2.0E-03
Ni-63	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-3.0	0.9	0.001	0.999	5.0E-02
Np-237	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-3.9	0.9	0.001	0.999	2.0E-02
Pa-231	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-4.6	1.1	0.001	0.999	1.0E-02
Pb-210	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-5.5	0.9	0.001	0.999	4.0E-03
Po-210	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Pu-238	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Pu-239	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Pu-240	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Pu-241	P	1	D	1.80E-03	75th percentile value					
Ra-226	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-3.2	0.9	0.001	0.999	4.0E-02
Ra-228	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-3.2	0.9	0.001	0.999	4.0E-02
Sb-125	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-4.6	1.0	0.001	0.999	1.0E-02
Sr-90	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-1.2	1.0	0.001	0.999	3.0E-01
Tc-99	P	1	D	9.07E+00	75th percentile value					
Te-125m	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-3.1	1.0	0.001	0.999	1.0E-01
Th-228	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Th-229	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Th-230	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
Th-232	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.9	0.9	0.001	0.999	1.0E-03
U-233	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	0.9	0.001	0.999	2.0E-03
U-234	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	0.9	0.001	0.999	2.0E-03
U-235	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	0.9	0.001	0.999	2.0E-03
U-236	P	1	S	Truncated lognormal-n	NUREG/CR-7267	-6.2	0.9	0.001	0.999	2.0E-03
Meat Transfer Factors (pCi/kg)/(pCi/d)			**NOTE: Input not used – meat ingestion pathway is closed**							
Ac-227	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-10.82	1.0	0.001	0.999	2.0E-05
Am-241	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.90	0.4	0.001	0.999	5.0E-05
Am-243	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.90	0.4	0.001	0.999	5.0E-05
C-14	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-3.47	1.0	0.001	0.999	3.1E-02
Cm-243	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-10.82	1.0	0.001	0.999	2.0E-05
Cm-244	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-10.82	1.0	0.001	0.999	2.0E-05
Co-60	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.75	0.8	0.001	0.999	4.3E-04
Cs-137	P	2	D	4.01E-02	75th percentile value					
Eu-152	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.21	1.0	0.001	0.999	2.0E-03
Eu-154	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.21	1.0	0.001	0.999	2.0E-03
Fe-55	P	2	D	1.83E-02	75th percentile value					
Gd-152	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.21	1.0	0.001	0.999	2.0E-03
H-3	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-4.42	1.0	0.001	0.999	1.2E-02
Mn-54	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.91	0.7	0.001	0.999	1.0E-03

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	Type	Priority	Treatment	Value/Distribution	Basis	Distribution's Statistical Parameters				Median/ Mean
						1	2	3	4	
Nb-94	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.82	0.9	0.001	0.999	1.0E-06
Ni-63	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-5.3	0.9	0.001	0.999	5.0E-03
Np-237	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.91	0.7	0.001	0.999	1.0E-03
Pa-231	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-12.21	1.0	0.001	0.999	5.0E-06
Pb-210	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.26	0.9	0.001	0.999	7.0E-04
Po-210	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-5.3	0.7	0.001	0.999	5.0E-03
Pu-238	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.72	3.2	0.001	0.999	1.1E-06
Pu-239	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.72	3.2	0.001	0.999	1.1E-06
Pu-240	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.72	3.2	0.001	0.999	1.1E-06
Pu-241	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.72	3.2	0.001	0.999	1.1E-06
Ra-226	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.91	0.7	0.001	0.999	1.0E-03
Ra-228	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.91	0.7	0.001	0.999	1.0E-03
Sb-125	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.91	0.9	0.001	0.999	1.0E-03
Sr-90	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.65	1.1	0.001	0.999	1.3E-03
Tc-99	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.21	0.7	0.001	0.999	1.0E-04
Te-125m	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-4.96	0.9	0.001	0.999	7.0E-03
Th-228	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-8.38	1.1	0.001	0.999	2.3E-04
Th-229	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-8.38	1.1	0.001	0.999	2.3E-04
Th-230	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-8.38	1.1	0.001	0.999	2.3E-04
Th-232	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-8.38	1.1	0.001	0.999	2.3E-04
U-233	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.85	0.5	0.001	0.999	3.9E-04
U-234	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.85	0.5	0.001	0.999	3.9E-04
U-235	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.85	0.5	0.001	0.999	3.9E-04
U-236	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.85	0.5	0.001	0.999	3.9E-04
Milk Transfer Factors (pCi/L)/(pCi/d)			**NOTE: Input not used – milk ingestion pathway is closed**							
Ac-227	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.12	0.9	0.001	0.999	2.0E-06
Am-241	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.12	0.7	0.001	0.999	2.0E-06
Am-243	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.12	0.7	0.001	0.999	2.0E-06
C-14	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-4.4	0.9	0.001	0.999	1.2E-02
Cm-243	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.12	0.9	0.001	0.999	2.0E-06
Cm-244	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.12	0.9	0.001	0.999	2.0E-06
Co-60	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.12	0.7	0.001	0.999	1.1E-04
Cs-137	P	2	D	7.37E-03	75th percentile value					
Eu-152	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.72	0.9	0.001	0.999	6.0E-05
Eu-154	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.72	0.9	0.001	0.999	6.0E-05
Fe-55	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-10.26	0.7	0.001	0.999	3.5E-05
Gd-152	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-9.72	0.9	0.001	0.999	6.0E-05
H-3	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-4.6	0.9	0.001	0.999	1.0E-02
Mn-54	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-10,1	1.6	0.001	0.999	4.1E-05
Nb-94	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.12	0.7	0.001	0.999	2.0E-06
Ni-63	P	2	D	3.21E-02	75th percentile value					
Np-237	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-11.51	0.7	0.001	0.999	1.0E-05

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	Type	Priority	Treatment	Value/Distribution	Basis	Distribution's Statistical Parameters				Median/ Mean
						1	2	3	4	
Pa-231	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-12.21	0.9	0.001	0.999	5.0E-06
Pb-210	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-8.11	0.9	0.001	0.999	3.0E-04
Po-210	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-8.47	0.6	0.001	0.999	2.1E-04
Pu-238	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.82	0.5	0.001	0.999	1.0E-06
Pu-239	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.82	0.5	0.001	0.999	1.0E-06
Pu-240	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.82	0.5	0.001	0.999	1.0E-06
Pu-241	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-13.82	0.5	0.001	0.999	1.0E-06
Ra-226	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.88	0.8	0.001	0.999	3.8E-04
Ra-228	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.88	0.8	0.001	0.999	3.8E-04
Sb-125	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-10.18	0.9	0.001	0.999	3.8E-05
Sr-90	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.65	0.5	0.001	0.999	1.3E-03
Tc-99	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.91	0.7	0.001	0.999	1.0E-03
Te-125m	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-7.99	0.9	0.001	0.999	3.4E-04
Th-228	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-12.21	0.9	0.001	0.999	5.0E-06
Th-229	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-12.21	0.9	0.001	0.999	5.0E-06
Th-230	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-12.21	0.9	0.001	0.999	5.0E-06
Th-232	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-12.21	0.9	0.001	0.999	5.0E-06
U-233	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.32	1.3	0.001	0.999	1.8E-03
U-234	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.32	1.3	0.001	0.999	1.8E-03
U-235	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.32	1.3	0.001	0.999	1.8E-03
U-236	P	2	S	Truncated lognormal-n	NUREG/CR-7267	-6.32	1.3	0.001	0.999	1.8E-03
Bioaccumulation Factors for Fish ((pCi/kg)/(pCi/L))										
Ac-227	P	2	S	Lognormal-n	NUREG/CR-7267	3.2	1.1			2.5E+01
Am-241	P	2	S	Lognormal-n	NUREG/CR-7267	5.5	1.1			2.4E+02
Am-243	P	2	S	Lognormal-n	NUREG/CR-7267	5.5	1.1			2.4E+02
C-14	P	2	D	9.28E+05	75th percentile value					
Cm-243	P	2	S	Lognormal-n	NUREG/CR-7267	3.4	1.1			3.0E+01
Cm-244	P	2	S	Lognormal-n	NUREG/CR-7267	3.4	1.1			3.0E+01
Co-60	P	2	S	Lognormal-n	NUREG/CR-7267	4.3	0.9			7.4E+01
Cs-137	P	2	S	Lognormal-n	NUREG/CR-7267	7.8	0.9			2.4E+03
Eu-152	P	2	S	Lognormal-n	NUREG/CR-7267	4.9	1.6			1.3E+02
Eu-154	P	2	S	Lognormal-n	NUREG/CR-7267	4.9	1.6			1.3E+02
Fe-55	P	2	S	Lognormal-n	NUREG/CR-7267	5.1	1.9			1.6E+02
Gd-152	P	2	S	Lognormal-n	NUREG/CR-7267	3.4	1.1			3.0E+01
H-3	P	2	S	Lognormal-n	NUREG/CR-7267	0	0.1			1.0E+00
Mn-54	P	2	S	Lognormal-n	NUREG/CR-7267	5.5	1.9			2.4E+02
Nb-94	P	2	S	Lognormal-n	NUREG/CR-7267	5.7	1.1			3.0E+02
Ni-63	P	2	S	Lognormal-n	NUREG/CR-7267	3.0	0.6			2.0E+01
Np-237	P	2	S	Lognormal-n	NUREG/CR-7267	3.0	1.1			2.0E+01
Pa-231	P	2	S	Lognormal-n	NUREG/CR-7267	2.3	1.1			1.0E+01
Pb-210	P	2	S	Lognormal-n	NUREG/CR-7267	3.2	1.1			2.5E+02
Po-210	P	2	S	Lognormal-n	NUREG/CR-7267	3.6	1.5			3.7E+01

Values and Bases for RESRAD-Onsite Parameters for DCGL Calculations BFM Embedded Pipe - Residential Scenario Exposure Pathways Without Drinking Water										
Parameter (unit)	**Type**	**Priority**	**Treatment**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters**				**Median/ Mean**
						1	**2**	**3**	**4**	
Pu-238	P	2	S	Lognormal-n	NUREG/CR-7267	10.0	1.0			2.2E+04
Pu-239	P	2	S	Lognormal-n	NUREG/CR-7267	10.0	1.0			2.2E+04
Pu-240	P	2	S	Lognormal-n	NUREG/CR-7267	10.0	1.0			2.2E+04
Pu-241	P	2	S	Lognormal-n	NUREG/CR-7267	10.0	1.0			2.2E+04
Ra-226	P	2	S	Lognormal-n	NUREG/CR-7267	1.4	1.9			4.1E+00
Ra-228	P	2	S	Lognormal-n	NUREG/CR-7267	1.4	1.9			4.1E+00
Sb-125	P	2	S	Lognormal-n	NUREG/CR-7267	3.6	1.5			3.7E+01
Sr-90	P	2	S	Lognormal-n	NUREG/CR-7267	1.1	1.4			3.0E+00
Tc-99	P	2	S	Lognormal-n	NUREG/CR-7267	3.0	1.1			2.0E+01
Te-125m	P	2	S	Lognormal-n	NUREG/CR-7267	5.0	0.4			1.5E+02
Th-228	P	2	S	Lognormal-n	NUREG/CR-7267	4.6	1.1			9.9E+01
Th-229	P	2	S	Lognormal-n	NUREG/CR-7267	4.6	1.1			9.9E+01
Th-230	P	2	S	Lognormal-n	NUREG/CR-7267	4.6	1.1			9.9E+01
Th-232	P	2	S	Lognormal-n	NUREG/CR-7267	4.6	1.1			9.9E+01
U-233	P	2	S	Lognormal-n	NUREG/CR-7267	0.0	2.5			1.0E+00
U-234	P	2	S	Lognormal-n	NUREG/CR-7267	0.0	2.5			1.0E+00
U-235	P	2	S	Lognormal-n	NUREG/CR-7267	0.0	2.5			1.0E+00
U-236	P	2	S	Lognormal-n	NUREG/CR-7267	0.0	2.5			1.0E+00
Bioaccumulation Factors for Crustacea/ Mollusks ((pCi/kg)/(pCi/L)) RESRAD default value for each radionuclide applied										
Graphics Parameters										
Number of points				32	RESRAD Default					
Spacing				log	RESRAD Default					
Time integration parameters										
Maximum number of points for dose				17	RESRAD Default					

3 Results

The $DCGL_{ep}$ value for each ROC was calculated as follows:

$$DCGL_{ep,i} = (25) \div [(POM_i) * (C_f)].$$

Where:

$DCGL_{ep,i}$ = embedded pipe DCGL value for ROC "i", pCi/m^2

25 = the NRC radiological criterion for unrestricted release, mrem/y

POM_i = the calculated POM value for ROC "i", mrem/y per pCi/g

C_f = Concentration in fill, pCi/g per 1 pCi/m^2 initial surface contamination

And C_f is calculated as follows:

$C_f = (P_c)(P_{sa}) \div ((F_s)(CZ_t)(D_s)(CF))$

Where:

C_f = concentration in fill, pCi/g per 1 pCi/m^2 initial surface contamination

P_c = the initial pipe surface contamination, 1 pCi/m^2 (ENG-OCS-015)

P_{sa} = pipe internal surface area, 470.6 m^2 (ENG-OCS-015)

F_{sa} = floor surface area, 6355.3 m^2 (ENG-OCS-015)

CZ_t = thickness of the CZ, 1m (ENG-OCS-015)

D_s = soil density, 1.5105 g/cm^3 (ENG-OCS-015)

CF = unit conversion factor, $10^6 cm^3/1m^3$

$C_f = (1)(470.6) \div ((6355.3)(1)(1.5105)(10^6)) = 4.9E\text{-}08$ pCi/g per 1 pCi/m^2 initial surface contamination

The RESRAD-Onsite POM doses and the $DCGL_{ep}$ values are provided by ROC in Table 3.

Table 3: $DCGL_{ep}$ Values by ROC

ROC	Peak of Mean Dose (mrem/y)	$DCGL_{ep}$ (pCi/m^2)	ROC	Peak of Mean Dose (mrem/y)	$DCGL_{ep}$ (pCi/m^2)
Am-241	3.12E-03	1.63E+11	Nb-94	3.04E-06	1.68E+14
C-14	1.20E-01	4.25E+09	Ni-63	2.17E-06	2.35E+14
Cm-243	5.25E-04	9.71E+11	Np-237	7.04E-02	7.25E+09
Cm-244	8.74E-04	5.84E+11	Pu-238	1.18E-01	4.31E+09
Co-60	4.50E-05	1.13E+13	Pu-239	3.27E-01	1.56E+09
Cs-137	8.25E-05	6.19E+12	Pu-240	3.24E-01	1.58E+09
Eu-152	7.50E-06	6.80E+13	Pu-241	1.61E-03	3.17E+11
Eu-154	9.57E-06	5.33E+13	Sb-125	3.04E-05	1.68E+13
Fe-55	2.53E-07	2.02E+15	Sr-90	1.76E-03	2.90E+11
H-3	3.00E-05	1.70E+13	Tc-99	1.70E-03	3.01E+11
Mn-54	9.48E-07	5.38E+14			

4 References

1. ENG-OCS-015, *Basement Fill Model: Calculation of Embedded Pipe DCGL Values*, March 6, 2024
2. ENG-OCS-008, *Derived Concentration Guideline Levels Values for Soil – Industrial Use - Oyster Creek Station*, July 26, 2023
3. ANL/EVS/TM-14/4, *Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil and Building Structures*, September 2015
4. ENG-OCS-007, RESRAD-Onsite Probabilistic Analysis - Industrial Use Scenario Oyster Creek Station, July 25 2023
5. NUREG/CR-6697, *Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes*, Nov. 2000
6. NUREG/CR-7267, *Default Parameter Values and Distribution in RESRAD-ONSITE V7.2, RESRAD-BUILD V3.5, and RESRAD-OFFSITE V4.0 Computer Codes*, Feb. 2020
7. TSD 25-032, *Radionuclides of Concern in Support of the Oyster Creek Station License Termination Plan*, Revision 0

Pages from the RESRAD-Onsite reports showing the POM dose values by radionuclide:

Am-241

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/05/2025  14:21  Page  20
 Probabilistic results summary : OC BFM Embedded Pipes_Residential_Am-241
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\AM241\BFMEP-RESIDENTIAL_AM241.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           2.031E+02              3.124E-03
```

C-14

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  09:52  Page  20
 Probabilistic results summary : OC BFM Embedded Pipes_Residential_C14
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\C14\BFM EP-RES_C14.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           6.422E+00              1.200E-01
```

CM-243

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  02:45  Page  20
 Probabilistic results summary : OC BFM Embedded Pipes_Residential_Cm-243
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\CM243\BFMEP-RESIDENTIAL DCGL_CM243.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           0.000E+00              5.252E-04
```

Cm-244

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/05/2025  20:25  Page  20
Probabilistic results summary : OC BFM EP_Residential_DCGL_Cm-244
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\CM244\BFMEP-RESIDENTIAL DCGL_CM244.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           1.557E+02              8.742E-04
```

Co-60

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  10:21  Page  20
 Probabilistic results summary : OC BFM Embedded Pipes_Residential_Co60 DW off
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RF_CO60.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           0.000E+00              4.498E-05
```

Cs-137

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  10:34  Page  20
 Probabilistic results summary : OC BFM EP Residential DCGL_Cs137
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL DCGL_CS137.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           1.859E+01              8.247E-05
```

Eu-152

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  10:43  Page  20
 Probabilistic results summary : OC BFM EP Res DCGL_Eu152
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP RESIDENTIAL DCGL_EU152.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                          Years                 mrem/yr
          1           8.377E+00              7.500E-06
```

Eu-154

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  10:52  Page  20
 Probabilistic results summary : OC BFM EP_Residential_DCGL_Eu154
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL_DCGL_EU154.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           2.219E+00              9.574E-06
```

Fe-55

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:00  Page  20
 Probabilistic results summary : OC BFM EP residential_DCGL__Fe55
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP RESIDENTIAL DCGL FE55.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           0.000E+00              2.532E-07
```

H-3

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:08  Page  20
 Probabilistic results summary : OC BFM EP_residential DCGL_H3
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP RESIDENTIAL DCGL H3.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           0.000E+00              2.997E-05
```

Mn-54

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:17  Page  20
 Probabilistic results summary : OC BFM EP Residential_DCGL_Mn54
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL DCGL_MN54.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           0.000E+00              9.479E-07
```

Nb-94

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:23  Page  20
 Probabilistic results summary : OC BFM Embedded Pipes_Residential_DCGLNb94
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL DCGL_NB94.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           3.455E+02              3.042E-06
```

Ni-63

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:29  Page  20
 Probabilistic results summary : OC BFM Embedded Pipes_Residential_DCGL_Ni63
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP_RESIDENTIAL_DCGL_NI63.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           1.425E+01              2.168E-06
```

Np-237

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/05/2025  15:05  Page  20
 Probabilistic results summary : OC BFM EP_Residential_DCGL_Np237
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\NP237\BFMEP-RESIDENTIAL_DCGL_NP237.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                        Years                 mrem/yr
          1           3.775E+00              7.041E-02
```

Pu-238

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/05/2025  15:31  Page  20
 Probabilistic results summary : OC BFM EP Residential_DCGL_Pu238
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\PU238\BFMEP-RESIDENTIAL_DCGL_PU238.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           9.152E+01               1.184E-01
```

Pu-239

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/05/2025  16:53  Page  20
 Probabilistic results summary : OC BFM EP Residential_DCGL_Pu239
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\PU239\BFMEP-RESIDENTIAL_DCGL_PU239.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           1.557E+02               3.266E-01
```

Pu-240

```
Probabilistic results summary : OC BFM EP Residential_DCGL_Pu240
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\BFM EMBEDDED PIPE - RESIDENTIAL\PU240\BFMEP_RESIDENTIAL_DCGL_PU240.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           1.557E+02               3.238E-01
```

Pu-241

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/11/2025  11:57  Page  20
 Probabilistic results summary : OC BFM EP_Residential_DCGL_Pu-241 DW off
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL_DCGL_PU241.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           3.162E+01               1.612E-03
```

Sb-125

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:39  Page  20
 Probabilistic results summary : OC BFM EP_Resoidential_DCGL_SB125
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL_DCGL_SB125.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           0.000E+00               3.404E-05
```

Sr-90

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:48  Page  20
 Probabilistic results summary : OC BFM EP Residential_DCGL_Sr90
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP-RESIDENTIAL_DCGL_SR90.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           3.775E+00               1.761E-03
```

Tc-99

```
1RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         09/06/2025  11:55  Page  20
 Probabilistic results summary : OC BFM EP Residential_DCGL_Tc99
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\TEST\BFMEP RESIDENTIAL_DCGL_TC99.RAD
                  Peak of the mean dose (averaged over observations) at graphical times
 Repetition     Time of peak mean dose     Peak mean dose
                       Years                   mrem/yr
          1           0.000E+00               1.697E-03
```