Westinghouse

BHI energy **ENGINEERING CALCULATION**

Basement Fill Model: Calculation of Embedded Pipe DCGL Values

Oyster Creek Station

ENG-OCS-015

Revision: 1

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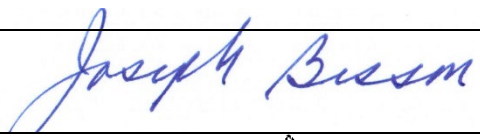
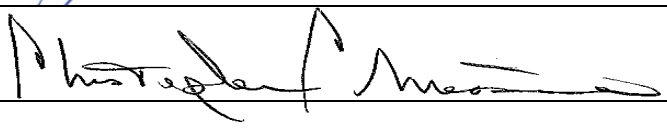
Prepared by	
Approved by	

1.0 PURPOSE

This calculation 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 Industrial Use (IU) scenario to support the assessment of below-grade concrete foundations.

2.0 APPLICABILITY

This calculation addresses only the development of BFM $DCGL_{ep}$ values for below grade concrete foundations at the Oyster Creek site.

3.0 REFERENCES

3.1 ENG-AP-02, *Verification of Software Operability*

3.2 ANL/EVS/TM-18/1, *RESRAD-Onsite 7.2 User's Guide*, April 2018

3.3 ENG-OCS-014, *Basement Fill Model: Probabilistic Analysis for Embedded Pipes Scenario*, Rev. 0

3.4 *Radionuclide Selection for DCGL Development-Oyster Creek Station Site Characterization Project*, January 2022

3.5 ENG-OCS-012, *Basement Fill Model: Probabilistic Analysis for Instantaneous Release Scenario Assuming Industrial Use Exposure Pathways*, Rev. 0.

3.6 *Oyster Creek Station Historical Site Assessment*, Rev. 2, November 2021

3.7 *Hydrogeologic Investigation Report*, GHD, January 2017

4.0 DISCUSSION

The operability of the RESRAD-Onsite 7.2 computer code was verified on each computer used for code executions in accordance with BHI Energy Engineering procedure ENG-AP-02, *Verification of Software Operability* [3.1]. The *RESRAD-Onsite 7.2 User's Guide* [3.2] was used as a reference for code use.

RESRAD-Onsite code executions were performed for each ROC identified for the OCS site. The probabilistic module of RESRAD-Onsite software was used to compute a "peak of the mean" (POM) dose, which was used to determine the DCGL values corresponding to the NRC dose criteria established in 10CFR20.1403 (i.e., 25 mrem/y). The DCGL value for each ROC was calculated as follows:

$DCGL(pCi/m^2)$ = (25 mrem/y)÷[(POM dose (mrem/y per pCi/g)*(fill concentration, pCi/g per 1 pCi/m^2)].

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. The configuration of CZ is shown in Figure 1.

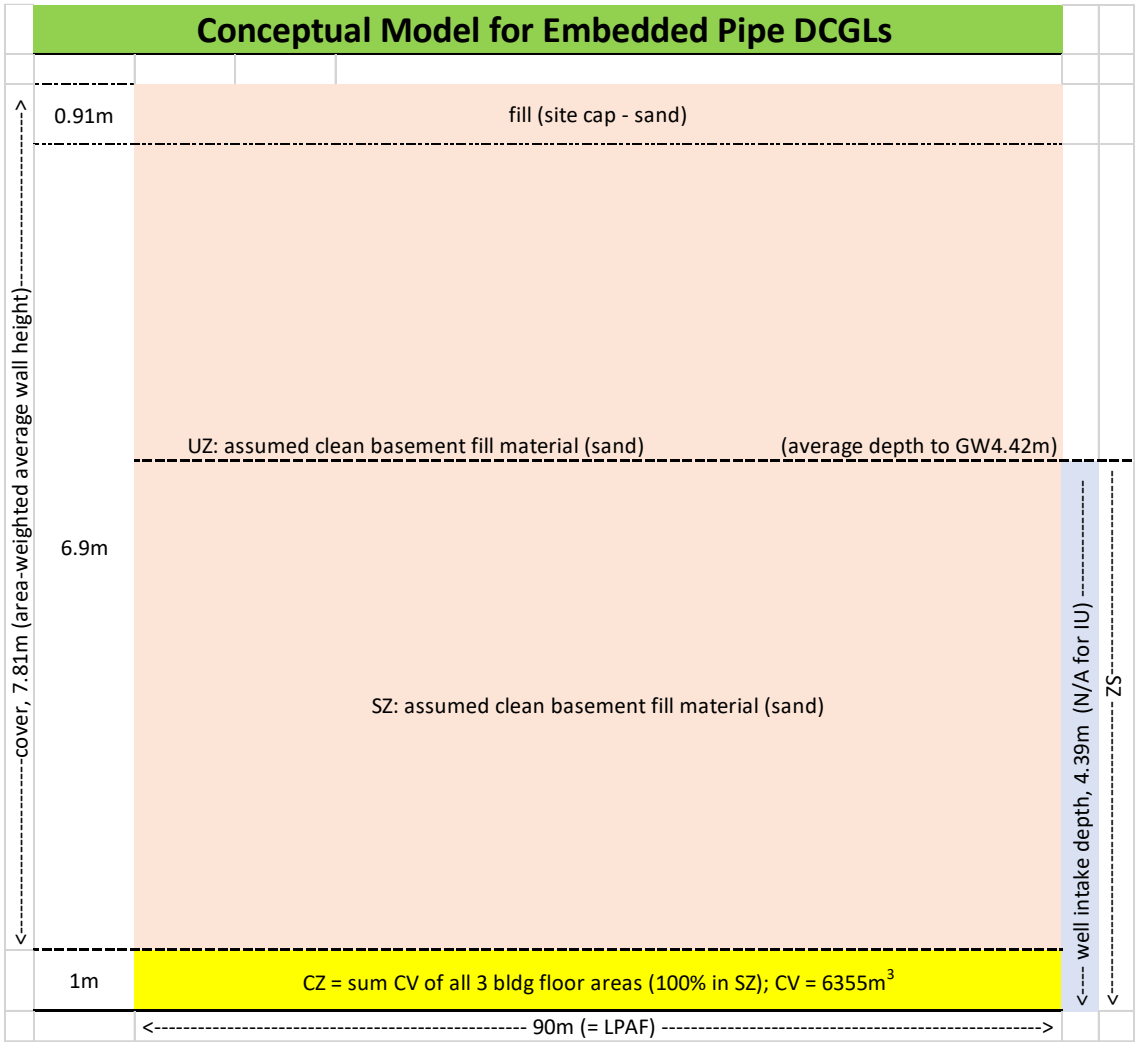


Figure 1: Conceptual Configuration of CV for Embedded Pipes (note: not to scale)

IU Scenario and Exposure Pathways

The Industrial Use Scenario assumes that the average member of the critical group is a hypothetical full-time industrial site worker assigned outdoor tasks and who also catches and consumes fish from the intake/discharge canal during off-hours. The pathways used to estimate human radiation exposure resulting from residual radioactivity in the soil for this scenario are:

- Direct external radiation exposure pathway
- Inhalation exposure pathway
- Ingestion exposure via aquatic food from the intake/discharge canal
- Inadvertent ingestion of contaminated soil

Accordingly, the $DCGL_{ep}$ values address the exposure pathways listed above. Input for these calculations include the reasonably conservative input values for RESRAD parameters identified as sensitive in Calculation ENG-OCS-0014 [3.3].

Radionuclide-of-concern (ROC)

A site-specific suite of potential ROCs has been identified for the OCS site [3.4]. OCS ROCs are listed in Table 1.

NOTE: RESRAD-Onsite 7.2 automatically accounts for progeny radionuclides with input for several of the OCS ROCs. Progeny radionuclides are also listed in Table 1. Table 1: Potential Radionuclides-of-Concern Identified for the OCS Site

ROC[a]	Progeny[b]	ROC[a]	Progeny[b]
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
Cs-137	---	Pu-239	Ac-227, Pa-231, U-235
Co-60	---	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	---		

[a] ROC = radionuclide-of-concern identified for the OCS site.
[b] Included automatically with input of parent ROC.

5.0 CALCULATIONS

5.1 The CV was calculated using the floor dimensions for the RB, TB, and ORB in Holtec-00045 Calc-001. The floor areas (m^2) are multiplied by 1m to obtain the total volume of fill material immediately adjacent at 1m to the floor surface and summed. Table 1 shows these calculations.

Unit conversion factor: 10.7639 ft^2 = 1m^2.

Table 2. Contaminated Volume Calculations

Building	Area (ft^2)*	Area (m^2)	Volume (m^3)
ORB	3519.6	327.0	327.0
RB	17424	1618.7	1618.7
TB	47464	4409.6	4409.6
Total CA	68407.6	**6355.3**	**6355.3**

*Building dimensions from Holtec-0045 Calc-001

CV (m^3) = ∑(floor surface areas, m^2) x (1m adjacent fill).

5.2 The cover above the CV consists of the planned 3ft site cap plus the unsaturated zone (UZ) and a portion of the saturated zone (SZ). Figure 1 shows the relationship of these components of the cover. The cover thickness was determined using the area-weighting approach shown below:

Site cap = 3 ft, or 0.91m (site soil - sand)

Below-grade wall heights from Holtec-0045 Calc-001:

ORB = 14.4 ft = 4.4m; RB = 43 ft = 13.1m; TB = 20.5 ft = 6.25m

Total cover thickness above ORB CV = 4.4m – 1m + 0.91m = 4.3m

Total cover thickness above RB CV = 13.1m – 1m + 0.91m = 13m

Total cover thickness above TB CV = 6.25m – 1m + 0.91m = 6.2m

Fractions of total area:

ORB: $327m^2/6355.3m^2 = 0.05$; RB: $1618.7m^2/6355.3m^2 = 0.25$; TB: $4409.6m^2/6355.3m^2 = 0.69$

Area-weighted cover thickness:

ORB: (0.05)(4.3m) = 0.22m

RB: (0.25)(13m) = 3.32m

TB: (0.69)(6.2m) = 4.27m

Total = **7.81m**

5.3 The CZ area and length parallel to aquifer flow (LPAF, a RESRAD-Onsite input parameter) are calculated from the CV, assuming a disk configuration with a thickness equal to 1m.

CZ Area (m^2) = CV (m^3)÷CVh (m) = πr^2

$6355.3\ m^3 \div 1\ m = \pi r^2$

6355.3 $m^2 = \pi r^2$ = CZ area

$2022.95\ m^2 = r^2$

44.98m = r, and 2r = diameter = 89.95m, rounded to **90m** = LPAF

5.4 Fraction of CV in the saturated zone (SZ) = 1.0 (CV covered by 7.81m site soil, which places it below the average groundwater depth of 4.42m [3.5]).

5.5 Sand is assumed as soil type for cover and fill material (consistent with soil type assumed in calculations for surface soil DCGL values and supported by information provided in the 2017 Hydrogeologic Investigation Report [3.7], the OCS HSA [3.6], and well installation logs). Distributions for Kd values, density, porosity, field capacity, and RESRAD "b" parameter for sand are taken from NURREG/CR-7267 and are applied in the probabilistic analyses.

5.6 Table 3 summarizes the input values/distribution and the reference source for each input parameter.

6.0 RESULTS

6.1 The calculated POM dose for each ROC is provided in column 2 of Table 4. The calculated POM doses from the RESRAD-Onsite 7.2 output reports are provided by ROC in Attachment 1.

6.2 Concentration in fill (C_f) in pCi/g per initial surface contamination = 1 pCi/m^2:

Pipe internal area by building:

RB = 1107.8 ft^2 = 102.9 m^2 (source: HOLTEC-00064 Calc-001)
TB = 3425.4 ft^2 = 318.2 m^2 (source: HOLTEC-00041 Calc-001 rev1)
ORB = 532.2 ft^2 = 49.2 m^2 (source: HOLTEC-00064 Calc-001)
Total = **470.6 m^2**

C_f = (initial pipe contamination)(pipe SA)÷(floor SA)(CV thickness)(soil density)(unit CF)

$= (pCi/m^2)(m^2) \div (m^2)(m)(g/cm^3)(10^6 cm^3/m^3) = pCi/g$

$= (1)(470.6) \div (6355.3)(1)(1.5105)(10^6) =$ **4.9E-08 pCi/g**.

Note: the median value for the sand density distribution from NUREG/CR-7267 is assumed as the value for soil density.

6.3 Column 3 of Table 4 provides the DCGL values corresponding to an annual dose equal to 25 mrem. The DCGL for each ROC was calculated from the POM dose using the following relationship:

$$DCGL(pCi/m^2) = (25\ mrem/y) \div (POM\ mrem/y\ per\ 1\ pCi/g) * (C_f, pCi/g\ per\ 1\ pCi/m^2)$$

Table 3. Input Values for RESRAD-Onsite Parameters

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
RESRAD Exposure Pathways										
External Gamma										Open
Inhalation										Open
Plant Ingestion										Close
Meat Ingestion										Close
Milk Ingestion										Close
Aquatic Foods										Open
Drinking Water										Close
Soil Ingestion										Open
Radon										Close
Parameter (unit)	**Type[a]**	**Priority[b]**	**Treatment[c]**	**Value/Distribution**	**Basis**	**Distribution's Statistical Parameters[d]**				**Median/ Mean**
						1	**2**	**3**	**4**	
Soil Concentrations										
Basic radiation dose limit (mrem/y)	P	3	D	25	10 CFR 20.1402	NR	NR	NR	NR	
Initial principal radionuclide (pCi/g)	P	2	D	1	Unit Value	NR	NR	NR	NR	
Distribution coefficient, k_d (values/distributions for **sand** soil type; assigned to contaminated zone (CZ) and saturated zone (SZ) (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 (CZ, SZ)	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 (CZ, SZ)	25th percentile value					
Cm-243	P	1	D	5.74E+02 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	ANL/EVS/TM-14/4	8.13	2.64	0.001	0.999	3400
Cm-244	P	1	D	5.74E+02 (CZ)	25th percentile value					
			S	Truncated lognormal-n (SZ)	ANL/EVS/TM-14/4	8.13	2.64	0.001	0.999	3400
Co-60	P	1	D	3.71E+01 (CZ, SZ)	25th percentile value					
Cs-137	P	1	D	1.58E+02 (CZ, SZ)	25th percentile value					
Eu-152	P	1	D	6.40E+01 (CZ, SZ)	25th percentile value					
Eu-154	P	1	D	6.40E+01 (CZ, SZ)	25th percentile value					
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)						
			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 (CZ, SZ)	25th percentile value					
Nb-94	P	1	D	5.86E+02 (CZ, SZ)	25th percentile value					
Ni-63	P	1	D	2.77E+01 (CZ, SZ)	25th percentile value					
Np-237	P	1	D	5.49E+00 (CZ, SZ)	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

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Pu-238	P	1	D	1.56E+02 (CZ, SZ)	25th percentile value					
Pu-239	P	1	D	1.56E+02 (CZ, SZ)	25th percentile value					
Pu-240	P	1	D	1.56E+02 (CZ, SZ)	25th percentile value					
Pu-241	P	1	D	1.57E+02 (CZ, SZ)	25th percentile value					
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	5.07E+00 (CZ, SZ)	25th percentile value					
Sr-90	P	1	D	6.58E+00 (CZ, SZ)	25th percentile value					
Tc-99	P	1	S	Truncated lognormal-n	ANL/EVS/TM-14/4	-3.22	1.1	0.001	0.999	0.04
Te-125m	P	1	S	Truncated lognormal-n (CZ) 4.79E+03 (SZ)	NUREG/CR-7267 75th percentile value	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
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										
Area of contaminated zone (m^2)	P	2	D	6355.3	Combined CV from RB, TB, and ORB.	NR	NR	NR	NR	
Thickness of contaminated zone (m)	P	2	D	1.0	Scenario assumption.	NR	NR	NR	NR	
Length parallel to aquifer flow (m)	P	2	D	90	Set to diameter of CZ.	NR	NR	NR	NR	
Does the initial contamination penetrate the water table?				Yes	Based on site features and RB dimensions.					
Contaminated fraction below water table			D	1.0	Entire CV assumed in SZ	NR	NR	NR	NR	
Cover and Contaminated Zone Hydrological Data										
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	Truncated Normal	Site soil type = sand (2017 *Hydrogeologic Investigation Report*). Input for density of fill material = NUREG/CR-7267 density distribution for site soil type - **sand**.	1.5105	0.159	0.001	0.999	1.5105

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
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)	NR	NR	NR	NR	
Density of contaminated zone (g/cm^3)	P	1	S D	Truncated Normal (all ROCs except H-3) 1.62E+00 (H-3)	Site soil type = sand (2017 *Hydrogeologic Investigation Report*). Input for density of fill material = NUREG/CR-7267 density distribution for site soil type - **sand**. 75th percentile value	1.5105	0.159	0.001	0.999	1.5105
Contaminated zone erosion rate (m/y)	P	2	D	6E-04	Assumed same as cover.	NR	NR	NR	NR	
Contaminated zone total porosity	P	2	S	Bounded Normal	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	NR	NR	NR	NR	
Contaminated zone hydraulic conductivity (m/y)	P	2	D	2741	2017 *Hydrogeologic Investigation Report*	NR	NR	NR	NR	
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	From *Regional and Site-Specific Absolute Humidity Data for Use in Tritium Dose Calculations*.	NR	NR	NR	NR	
Evapotranspiration coefficient	P	2	S D	Uniform (all ROCs except H-3) 6.87E-01 (H-3)	NUREG/CR-7267 distribution 75th percentile value	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	NR	NR	NR	NR	
Precipitation (m/y)	P	2	D	1.4	*Annual Report on the Meteological Program at Oyster Creek Generating Station* – average annual precipitation for 2015 through 2020	NR	NR	NR	NR	
Irrigation (m/y)	B	3	S	Uniform	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.	NR	NR	NR	NR	
Runoff coefficient	P	2	D	0.2	Value determined using methodology described in *Data Collection Handbook* and NUREG/CR-7267	NR	NR	NR	NR	

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Watershed area for nearby stream or pond (m^2)	P	3	D	1.01E+08	NJ-GeoWeb (NJDEP BGIS)	NR	NR	NR	NR	
Accuracy for water/soil computations	-	3	D	1.00E-03	RESRAD Default	NR	NR	NR	NR	
Saturated Zone Hydrological Data										
Density of saturated zone (g/cm^3)	P	1	S	Truncated Normal	NUREG/CR-7267 distribution for site soil type **-sand**	1.5105	0.159	0.001	0.999	1.5105
Saturated zone total porosity	P	1	S	Truncated Normal	NUREG/CR-7267 distribution for site soil type **-sand**	0.43	0.06	0.001	0.999	0.43
Saturated zone effective porosity	P	1	D	0.25	2017 *Hydrogeologic Investigation Report*	NR	NR	NR	NR	
Saturated zone field capacity	P	3	D	0.18	Value based on site-specific soil type **(sand)**; calculated using equation in NUREG/CR-7267	NR	NR	NR	NR	
Saturated zone hydraulic conductivity (m/y)	P	1	D	2741	2017 *Hydrogeologic Investigation Report*	NR	NR	NR	NR	
Saturated zone hydraulic gradient	P	2	D	3.25E-02 (all ROCs except H-3 and Tc-99)	75th percentile value					
			D	1.75E-02 (H-3)	25th percentile value					
			S	Uniform (Tc-99)	2017 *Hydrogeologic Investigation Report*	0.01	0.04			0.025
Saturated 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
Water table drop rate (m/y)	P	3	D	0	CZ in SZ	NR	NR	NR	NR	
Well pump intake depth (m below water table)	P	2	D	4.42	Set to the distance from the water table to the lower boundary of contamination in the aquifer at the downgradient edge of the contaminated zone. NOTE: no impact for IU scenario.	NR	NR	NR	NR	
Model: Nondispersion (ND) or Mass-Balance (MB)	P	3	D	ND	ND model recommended for contaminant areas >1,000 m^2	NR	NR	NR	NR	
Well pumping rate (m^3/y)	P	2	S	Uniform	Min, and max value based on site irrigation and general case parameter values presented in NUREG/CR-7267.	407	567			487
Unsaturated Zone Hydrological Data										
Number of unsaturated zone strata	P	3	D	0	UZ above CZ and is assumed part of cover.	NR	NR	NR	NR	
Unsat. zone 1, thickness (m)	P	1	D	N/A	Input not required when number of UZ = 0.					
Unsat. zone 1, soil density (g/cm^3)	P	2	S	N/A	Input not required when number of UZ = 0.					
Unsat. zone 1, total porosity	P	2	S	N/A	Input not required when number of UZ = 0.					
Unsat. zone 1, effective porosity	P	2	D	N/A	Input not required when number of UZ = 0.					

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Unsat. zone 1, field capacity	P	3	D	N/A	Input not required when number of UZ = 0.					
Unsat. zone 1, hydraulic conductivity (m/y)	P	2	D	N/A	Input not required when number of UZ = 0.					
Unsat. zone 1, soil-specific b parameter	P	2	S	N/A	Input not required when number of UZ = 0.					
Occupancy										
Inhalation rate (m^3/y)	B	3	D	8400	NUREG/CR-7267	NR	NR	NR	NR	
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	NR	NR	NR	NR	
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	0.03	Fraction of calendar year assuming 1h/work day for daily work breaks	NR	NR	NR	NR	
Fraction of time spent outdoors	B	3	D	0.2	Fraction of calendar year assuming 7h/work day for outside tasks	NR	NR	NR	NR	
Shape factor flag, external gamma	P	3	D	Circular	Circular contaminated zone assumed	NR	NR	NR	NR	
Ingestion, Dietary										
Fruits, vegetables, grain consumption (kg/y)	B	2	D	N/A	Input not required - plant ingestion pathway inactive	NR	NR	NR	NR	
Leafy vegetable consumption (kg/y)	B	3	D	N/A	Input not required - plant ingestion pathway inactive	NR	NR	NR	NR	
Milk consumption (L/y)	B	2	D	N/A	Input not required - milk ingestion pathway inactive	NR	NR	NR	NR	
Meat and poultry consumption (kg/y)	B	3	D	N/A	Input not required - meat ingestion pathway inactive	NR	NR	NR	NR	
Fish consumption (kg/y)	B	3	D	20.6	NUREG/CR-5512, Vol. 3	NR	NR	NR	NR	
Other seafood consumption (kg/y)	B	3	D	0.9	RESRAD Default	NR	NR	NR	NR	
Soil ingestion rate (g/yr)	B	2	D	Triangular	NUREG/CR-7267	NR	NR	NR	NR	
Drinking water intake (L/y)	B	2	D	N/A	Input not required – drinking water pathway inactive	NR	NR	NR	NR	
Contamination fraction of drinking water	P	3	D	N/A	Input not required – drinking water pathway inactive	NR	NR	NR	NR	
Contamination fraction of household water	P	3		N/A	Input not required – water pathway inactive					
Contamination fraction of livestock water	P	3	D	N/A	Input not required – drinking water/ingestion pathways inactive	NR	NR	NR	NR	
Contamination fraction of irrigation water	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Contamination fraction of aquatic food	P	2	D	6.09E-01 (all ROCs)	75th percentile value					
Contamination fraction of plant food	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Contamination fraction of meat	P	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Contamination fraction of milk	P	3	D	N/A	Input not required – milk ingestion pathway inactive	NR	NR	NR	NR	
Ingestion, Non-Dietary										
Livestock fodder intake for meat (kg/d)	M	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Livestock fodder intake for milk (kg/d)	M	3	D	N/A	Input not required – milk ingestion pathway inactive	NR	NR	NR	NR	
Livestock water intake for meat (L/d)	M	3	D	N/A	Input not required – water ingestion pathway inactive	NR	NR	NR	NR	
Livestock water intake for milk (L/d)	M	3	D	N/A	Input not required – milk ingestion pathway inactive	NR	NR	NR	NR	
Livestock soil intake (kg/d)	M	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Mass loading for foliar deposition (g/m^3)	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
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	N/A	Input not required – plant ingestion pathway inactive	0.3	4			1.85
Drinking water fraction from ground water	P	3	D	N/A	Input not required – drinking water ingestion pathway inactive	NR	NR	NR	NR	
Household water fraction from ground water	P	3		N/A	Input not required – drinking water pathway inactive					
Livestock water fraction from ground water	P	3	D	N/A	Input not required – drinking water/meat ingestion pathways inactive	NR	NR	NR	NR	
Irrigation fraction from ground water	P	3	D	N/A	Input not required – drinking water pathway inactive	NR	NR	NR	NR	
Wet weight crop yield for Non-Leafy (kg/m^2)	P	2	S	N/A	Input not required – plant ingestion pathway inactive	0.56	0.48	0.001	0.999	1.75
Wet weight crop yield for Leafy (kg/m^2)	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Wet weight crop yield for Fodder (kg/m^2)	P	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Growing Season for Non-Leafy (y)	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Growing Season for Leafy (y)	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Growing Season for Fodder (y)	P	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Translocation Factor for Non-Leafy	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Translocation Factor for Leafy	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Translocation Factor for Fodder	P	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Weathering Removal Constant for Vegetation (1/y)	P	2	S	N/A	Input not required – plant ingestion pathway inactive	5.1	18	84		33

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Wet Foliar Interception Fraction for Non-Leafy	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Wet Foliar Interception Fraction for Leafy	P	2	S	N/A	Input not required – plant ingestion pathway inactive	0.06	0.67	0.95		0.58
Wet Foliar Interception Fraction for Fodder	P	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Dry Foliar Interception Fraction for Non-Leafy	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Dry Foliar Interception Fraction for Leafy	P	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Dry Foliar Interception Fraction for Fodder	P	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Storage times of contaminated foodstuffs (days):										
Fruits, non-leafy vegetables, and grain	B	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Leafy vegetables	B	3	D	N/A	Input not required – plant ingestion pathway inactive	NR	NR	NR	NR	
Milk	B	3	D	N/A	Input not required – milk ingestion pathway inactive	NR	NR	NR	NR	
Meat and poultry	B	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Fish	B	3	D	7	RESRAD Default	NR	NR	NR	NR	
Crustacea and mollusks	B	3	D	7	RESRAD Default	NR	NR	NR	NR	
Well water	B	3	D	N/A	Input not required – drinking water pathway inactive	NR	NR	NR	NR	
Surface water	B	3	D	N/A	Input not required drinking water pathway inactive	NR	NR	NR	NR	
Livestock fodder	B	3	D	N/A	Input not required – meat ingestion pathway inactive	NR	NR	NR	NR	
Special Radionuclides (C-14)										
C-12 concentration in water (g/cm^3)	P	3	D	2.00E-05	RESRAD Default	NR	NR	NR	NR	
C-12 concentration in contaminated soil (g/g)	P	3	D	3.00E-02	RESRAD Default	NR	NR	NR	NR	
Fraction of vegetation carbon from soil	P	3	D	2.00E-02	RESRAD Default	NR	NR	NR	NR	
Fraction of vegetation carbon from air	P	3	D	9.80E-01	RESRAD Default	NR	NR	NR	NR	
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	NR	NR	NR	NR	
C-12 evasion flux rate from soil (1/s)	P	3	D	1.00E-10	RESRAD Default	NR	NR	NR	NR	
Fraction of grain in beef cattle feed	B	3	D	0.2500	NUREG/CR-7267	NR	NR	NR	NR	
Fraction of grain in milk cow feed	B	3	D	0.1000	NUREG/CR-7267	NR	NR	NR	NR	
Inhalation Dose Conversion Factors (mrem/pCi inhaled) from FGR11 (contained in RESRAD Dose Conversion Library)										

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Ingestion Dose Conversion Factors (mrem/pCi ingested) from FGR11 (contained in RESRAD Dose Conversion Library)										
Plant Transfer Factors (pCi/g plant)/(pCi/g soil) **Note: Plant ingestion pathway closed – input for plant transfer factors not required for Industrial Use dose calculations.**										
Meat Transfer Factors (pCi/kg)/(pCi/d) **Note: Meat ingestion pathway closed – input for meat transfer factors not required for Industrial Use dose calculations.**										
Milk Transfer Factors (pCi/L)/(pCi/d) **Note: Milk ingestion pathway closed – input for milk transfer factors not required for Industrial Use dose calculations.**										
Bioaccumulation (Transfer) 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	D	5.14E+02	75th percentile value					
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	D	1.35E+02	75th percentile value					
Cs-137	P	2	D	4.48E+03	75th percentile value					
Eu-152	P	2	D	3.95E+02	75th percentile value					
Eu-154	P	2	D	3.95E+02	75th percentile value					
Fe-55	P	2	D	5.90E+02	75th percentile value					
Gd-152	P	2	S	Lognormal-n	NUREG/CR-7267	3.4	1.1			3.0E+01
H-3	P	2	D	1.07E+00	75th percentile value					
Mn-54	P	2	S	Lognormal-n	NUREG/CR-7267	5.5	1.9			2.4E+02
Nb-94	P	2	D	6.27E+02	75th percentile value					
Ni-63	P	2	D	3.01E+01	75th percentile value					
Np-237	P	2	D	4.21E+01	75th percentile value					
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
Pu-238	P	2	D	4.32E+04	75th percentile value					
Pu-239	P	2	D	4.32E+04	75th percentile value					
Pu-240	P	2	D	4.32E+04	75th percentile value					
Pu-241	P	2	D	4.32E+04	75th percentile value					
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	D	1.00E+02	75th percentile value					
Sr-90	P	2	D	7.72E+00	75th percentile value					
Tc-99	P	2	D	4.21E+01	75th percentile value					
Te-12m	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
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										

Input Values for DCGL Calculations: OC BFM Embedded Pipe Scenario to Support the Industrial Use Compliance Scenario										
Number of points				32	RESRAD Default	NR	NR	NR	NR	
Spacing				log	RESRAD Default	NR	NR	NR	NR	
Time integration parameters										
Maximum number of points for dose				17	RESRAD Default	NR	NR	NR	NR	

Table 3 Notes:

[a] P = physical, B = behavioral, M = metabolic
[b] 1 = high-priority parameter, 2 = medium-priority parameter, 3 = low-priority parameter
[c] D = deterministic, S = stochastic
[d] Distributions Statistical Parameters:
Lognormal-n: 1= mean, 2 = standard deviation
Bounded lognormal-n: 1= mean, 2 = standard deviation, 3 = minimum, 4 = maximum
Truncated lognormal-n: 1= mean, 2 = standard deviation, 3 = lower quantile, 4 = upper quantile
Bounded normal: 1 = mean, 2 = standard deviation, 3 = minimum, 4 = maximum
Triangular: 1 = minimum, 2 = mode, 3 = maximum
Uniform: 1 = minimum, 2 = maximum
NR = not required

Table 4: $DCGL_{ep}$ Values by Radionuclide

ROC	Peak of Mean Dose (mrem/y)	$DCGL_{ep}$ (pCi/m^2)
Am-241	2.52E-03	2.02E+11
C-14	1.42E-01	3.59E+09
Cm-243	5.04E-04	1.01E+12
Cm-244	1.22E-03	4.18E+11
Co-60	6.42E-06	7.94E+13
Cs-137	1.15E-04	4.43E+12
Eu-152	3.86E-06	1.32E+14
Eu-154	3.94E-06	1.29E+14
Fe-55	5.53E-09	9.22E+16
H-3	7.40E-08	6.89E+15
Mn-54	2.11E-07	2.42E+15
Nb-94	3.52E-06	1.45E+14
Ni-63	2.79E-07	1.83E+15
NP-237	2.13E-02	2.39E+10
Pu-238	1.75E-01	2.91E+09
Pu-239	4.53E-01	1.13E+09
Pu-240	4.49E-01	1.14E+09
Pu-241	1.15E-05	4.43E+13
SB-125	9.87E-06	5.17E+13
Sr-90	1.10E-04	4.64E+12
Tc-99	4.97E-05	1.03E+13

NOTE: Review of the RESRAD reports shows that the POM doses are delivered solely through the aquatic food ingestion pathway. The contributions to total dose via the direct, inhalation, and inadvertent soil ingestion pathways are shown as zeros in the RESRAD reports. These small doses via the aquatic food pathway are likely over-estimations for doses that may be received by a person who ingests fish from the OC canal due primarily to (i) the conservative input for the contaminated fraction of aquatic food (0.609 vs 0.39 distribution mode) and fish transfer factors (75^{th} percentile values in sensitive ROC's distribution) and (ii) RESRAD modeling for the fish ingestion pathway (models a pond/lake, not a flowing canal).

Attachment 1

RESRAD-Onsite Results: Peak of the Mean Doses

Am-241 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  13:07  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Am241
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\AM241\BFM-IU-EP_DCGL_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             2.517E-03
```

C-14 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  14:39  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_C14
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\C14\BFM-IU-EP_DCGL_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            4.924E+00             1.422E-01
```

Cm-243 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  15:03  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Cm243
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\CM243\BFM-IU-EP_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            1.557E+02             5.040E-04
```

Cm-244 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  06:04  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Cm244
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\CM244\BFM-IU_EP_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             1.217E-03
```

Co-60 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  13:46  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Co60
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\CO60\BFM-IU-EP_DCGL_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            6.422E+00             6.418E-06
```

Cs-137 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  13:53  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Cs137
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\CS137\BFM-IU-EP_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            4.125E+01             1.148E-04
```

Eu-152 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  14:01  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Eu152
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\EU152\BFM-IU-EP_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            1.859E+01             3.861E-06
```

Eu-154 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  14:50  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Eu154
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\EU154\BFM-IU_EP_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            1.093E+01             3.943E-06
```

Fe-55 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  14:24  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Fe55
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\FE55\BFM-IU_EP_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            3.775E+00              5.528E-09
```

H-3 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  14:35  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_H3
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\H3\BFM-IU_EP_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              7.396E-08
```

Mn-54 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/08/2024  14:46  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IR_EP_DCGL_Mn54
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\OYSTER CREEK\INDUSTRIAL\BFM EMBEDDED PIPE\BILL\MN54\BFM-IU_EP_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            1.000E+00              2.112E-07
```

Nb-94 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  14:34  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Nb94
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\NB94\BFM-IU_EP_DCGL.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            4.507E+02              3.520E-06
```

Ni-63 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  14:12  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Ni63
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\NI63\BFM-IU_EP_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            2.424E+01              2.788E-07
```

Np-237 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/10/2024  06:42  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_IP_Np237
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\NP237\BFM-IU_EP_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            4.924E+00              2.126E-02
```

Pu-238 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/10/2024  08:52  Page  20
 Probabilistic results summary : BFM_IU_EP_DCGL_Pu238
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\PU238\IBFM-IU_EP_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              1.745E-01
```

Pu-239 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/10/2024  10:52  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Pu239
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\PU239\BFM-IU_EP_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           1.194E+02              4.531E-01
```

Pu-240 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/11/2024  14:48  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Pu240
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\PU240\BFM-IU_EP_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           1.194E+02              4.488E-01
```

Pu-241 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/11/2024  12:57  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Pu241
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\PU241\BFM-IU_EP_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           2.031E+02              1.151E-05
```

Sb-125 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  14:24  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Sb125
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\SB125\BFM-IU_EP_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           2.219E+00              9.874E-06
```

Sr-90 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/09/2024  14:55  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Sr90
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\SR90\BFM-IU_EP_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           4.924E+00              1.104E-04
```

Tc-99 Results:

```
RESRAD-ONSITE, Version 7.2      T« Limit = 30 days         01/11/2024  11:34  Page  20
 Probabilistic results summary : OCS BFM_Industrial Use_EP_DCGL_Tc99
 File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\EMBEDDED PIPE\TC99\BFM-IU_EP_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              4.965E-05
```