

Appendix H

RESRAD-Build

Input Summary Tables

Table H-1
Westinghouse Specialty Metals Plant
RESRAD-Build Dose Assessment
Input Parameter Summary

				Exposure Scenario			
Parameter	Description	Units	Default Value	Building Occupant	Renovation Worker	Demolition Worker	Remarks
RESRAD-Build Filename				Blairsville Building Occupancy .bld	Blairsville Building Renovation 90.bld	Blairsville Building Demolition 60 Alt.bld	
Exposure Duration	Total length of time considered by the dose assessment, including intervals during which the receptor may be absent from the building or at the contaminated indoor location.	days	365	365.25	90	60	<p>The building occupancy scenario involves chronic exposure to an individual for full work year in the facility. A one-year exposure period of 365.25 days was used as per NUREG/CR-5512 V.1 Table 6.21.</p> <p>For the renovation worker scenario, a value of 90 days was used as suggested in the RESRAD-Build Manual , Section J.1.1 .</p> <p>For the Demolition worker scenario, a 60 day exposure period is assumed.</p>
Indoor Fraction	Fraction of the exposure duration that was spent by one or more receptors inside the building.	NA	0.50	0.267	0.267	0.267	A value of 97.4 days per year was obtained from NUREG/CR-5512 Volume 3 for the building occupancy scenario. This value was also used in NUREG/CR-6755, Table 4.2. 97.4 days per year / 365.25 days per year = 0.267. This value is appropriate for all three scenarios.
Evaluation time	Number of user-defined discrete exposure periods for which the dose calculations are performed	Years	1	1	1	1	
Number of Rooms	Number of rooms is the number of distinct air flow regions in the part of the building being modeled.	NA	1	1	1	1	A 1-room model was used to represent the building.
Deposition Velocity	Deposition velocity of particles injected into the air from the contaminated sources. The deposition velocity characterizes the rate at which the particles in the indoor air deposit on the surface.	m/s	1.000E-02	3.90E-04	3.90E-04	3.90E-04	For the Building Occupancy Scenario, a deposition velocity of 3.9E-04 was obtained from NUREG/CR-6755, Table 4.2. This value is the mean value from the probability distribution for the parameter. The same value was used for the renovation and demolition scenarios.

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Parameter	Description	Units	Default Value	Building Occupant	Renovation Worker	Demolition Worker	
Resuspension Rate	Rate at which the deposited material is resuspended in the air per unit time.	1/s	5.000E-06	6.26E-08	6.26E-08	6.26E-08	For the Building Occupancy Scenario, the resuspension rate of 6.26E-08 was obtained from Table 4.2 of NUREG/CR-6755. This is the median value from the default probability distribution for the parameter. The same value was used for the renovation and demolition scenarios.
Building Exchange Rate	Total volume of air in a building or room replaced by outside air per unit time.	1/h	0.80	1.52	1.52	1.52	The building exchange rate of 1.52 was obtained from Table 4.2 of NUREG/CR-6755. This is the median of the default probability distribution for the parameter.
Room Area	Footprint area of the room.	m ²	36	232	232	232	The floor of the building is 2500 square feet (232 square meters). The model assumes a square room/building therefore, the dimensions used for the model are 15.2 meters by 15.2 meters.
Room Height	Height of the room.	m	2.50	3.66	3.66	3.66	The height of the building is 12 feet (3.66 meters).
Radiological Units of Activity	Units of radiological activity	dpm/m ²	NA	dpm/m ²	dpm/m ²	dpm/m ²	disintegrations per minute
Radiological Units of Dose	Units of radiation dose	mrem	NA	mrem	mrem	mrem	Units coincide with NRC guideline of 25 mrem/yr
Number of Receptors	Number of receptors who are the subjects of the dose assessment.	NA	1	1	1	1	Dose calculated for one receptor.
Receptor Room	Room in which the receptor is located.	NA	1	1	1	1	A one-room model is used.
Receptor Location	Spatial coordinates of the point (x,y,z Cartesian coordinate system) occupied by the receptor	m	1,1,1	7.6, 7.6, 1	1, 7.6, 1	1, 7.6, 1	For the Building Occupancy Scenario, the dose assessment is calculated at 1 meter above the center of the floor. For the renovation and demolition scenarios, the receptor is assumed to be 1 meter from the wall.
ReceptorTime Fraction	Fraction of time spent by one or more receptors at a given location while inside the building.	NA	1	1	1	1	100 % of the time spent inside the building is spent at this location.

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Parameter	Description	Units	Default Value	Building Occupant	Renovation Worker	Demolition Worker	Remarks
Receptor Breathing Rate	Rate at which the exposed individual inhales air while at the specific receptor location.	m ³ /day	18.0	33.6	36.0	36.0	<p>For the building occupancy scenario, a breathing rate of 1.4 m³/hr was obtained from NUREG/CR-5512, Volume 3, Table 5.8. This rate represents an average inhalation rate for adults males engaged in light activity.</p> <p>For the renovation and demolition scenarios, a breathing rate of 1.5 m³/hr was selected from NUREG/CR-5512, Volume 3, Table 5.7. This rate represents a medium breathing rate for construction workers.</p> <p>Hourly rates obtained from NUREG/CR-5512 were converted to daily rates for modeling. See Table H-4 for supporting calculations.</p>
Receptor Indirect Ingestion Rate	Ingestion rate of deposited material for a receptor at a specified location inside a building. This rate represents the transfer of deposited contamination from building surfaces to the mouth via contact with hands, food, or other objects.	m ² /hr	1.000E-04	1.12E-04	1.12E-04	1.12E-04	<p>For the building occupancy scenario, an indirect ingestion rate of 1.12E-04 m²/hr was selected from NUREG-6755, Table 4.2. This value represents the mean value from the default probability distribution for the parameter.</p> <p>The same indirect ingestion rate was used for the renovation and demolition scenarios.</p>
Shielding Thickness all receptor/sources	Thickness of shielding material adjusted for orientation with respect to source	cm	0.000E+00	0.00E+00	0.00E+00	0.00E+00	No shielding is assumed between the source and the receptor.
Shielding Density all receptor/sources	Bulk density of shielding material	g/cc	2.400E+00	NA	NA	NA	No shielding is assumed between the source and the receptor.
Shielding Material all receptor/sources	Material between source and receptor	NA	concrete	NA	NA	NA	No shielding is assumed between the source and the receptor.
Number of Sources	Number of radioactive source locations to be considered in the dose assessment.	NA	NA	10	10	10	Floor, ceiling, four lower walls, four upper walls
Source Descriptions	Description of residual activity.	NA	NA	See Table H-2	See Table H-2	See Table H-2	
Source Room Number	Room in which the source is situated.	NA	1.000E+00	See Table H-2	See Table H-2	See Table H-2	

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				Exposure Scenario			Remarks
Parameter	Description	Units	Default Value	Building Occupant	Renovation Worker	Demolition Worker	
Source Type	Geometrical representation of the physical distribution of radioactive material within a source (i.e. volume, area, line or point).	NA	volume	See Table H-2	See Table H-2	See Table H-2	
Source Direction	Direction of the source relative to the three Cartesian coordinate axes. For a line source, the source direction is defined as the axis parallel to the line. For area and volume sources, the source direction is defined as the axis normal to the surface of the source.	NA	x	See Table H-2	See Table H-2	See Table H-2	
Source Location	Spacial position of the source centerpoint in three dimensional space relative to the origin.	m	0, 0, 0	See Table H-2	See Table H-2	See Table H-2	
Source Area	Extent of the contamination. It is the exposed area for a volume or area source, or it is the length for a line source.	m ²	36	See Table H-3	See Table H-3	See Table H-3	
Air release fraction for all sources	Amount of the contaminated material removed from the source that is released into the air in the respirable particulate range.	NA	0.100	0.357	0.357	0.357	The value 0.357 was obtained from NUREG/CR-6755, Table 4.2 . The value selected is the mean value from the default probability distribution for the parameter.
Direct ingestion rate for all sources	Incidental ingestion rate of contaminated material directly from the source.	1/h	0.000E+00	1.60E-07	1.60E-07	1.60E-07	Calculated from the default ingestion rate of 1.1E-04 m ² /hr in NUREG/CR-5512 building occupancy scenario. The ingestion rate of 1.1E-04 m ² /hr represents the average member of the screening group (Beyeler et al, 1999). The same rate was used for the renovation and demolition scenarios. See Table H-4 for supporting calculations.

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				Exposure Scenario			
Parameter	Description	Units	Default Value	Building Occupant	Renovation Worker	Demolition Worker	Remarks
Removable fraction for all sources	Fraction of a point, line or area source that can be removed. The balance of the source is assumed to remain fixed.	NA	0.50	0.022 for all sources	0.022 for sources 1, 2, 3, 4, 6, 7, 8, and 10. 0.2 for sources 5 and 9 (wall in closest proximity to receptor)	0.022 for sources 1, 2, 3, 4, 6, 7, 8, and 10. 0.5 for sources 5 and 9 (wall in closest proximity to receptor)	From Survey Unit 1-20, the most contaminated unit, the Beta DPM/100 cm ² is 228.08 on average. The maximum removable Beta DPM / cm ² is 5. A conservative removable fraction would be 5/228.08 = 0.022. This value was used for undisturbed sources. See Westinghouse Report #007 Appendix D for data. For the renovation scenario, a value of 0.2 was used for the wall in closest proximity to the receptor to account for disturbing one wall at a time during the 90 day exposure duration. For the demolition scenario, a value of 0.5 was used for the wall in closest proximity to the receptor to account for disturbing one wall at a time during the 60 day exposure duration. The higher removable fraction was used for the demolition scenario to account for greater disturbance
Source lifetime for all sources	Time over which the removable part of the source is (linearly) eroded. If the source is fixed and nothing will be eroded, enter 0 for the removable fraction and a nonzero value for this time.	days	365	10,000	10,000	10,000	The value 10,000 was obtained from NUREG/CR-6755, Table 4.2. This value is the most likely value from the default probability distribution.
Radionuclide activity for all sources	Activity (for a point source) or activity concentration (for volume, area, and line sources) of radionuclides distributed in a source.	dpm/m ²	2.22 of Co-60	See Table H-2	See Table H-2	See Table H-2	The dose due to unit activity on building surfaces (1/dpm/100 cm ²) is typically used so that the DCGLw can be determined by direct ratio. Converting to appropriate units for data entry, a value of 100 dpm/m ² was used for area sources.
Radon release fraction for all sources	Fraction of the total amount of radon produced by radium decay that escapes the surface of a contaminated material and is released to the air. This parameter applies to point line and area sources.	NA	0.1	0	0	0	The radon inhalation pathway is not considered relevant. Therefore, the radon release fraction was set a zero to suppress this pathway (NUREG/CR-6755, Section 4.2)

Table H-2
Westinghouse Specialty Metals Plant
RESRAD-Build Dose Assessment
Source Information Table

Source Number	Source Description ⁽¹⁾	Room Number	Source Type	Source Location (m)			Source Direction	Radionuclide Activity (dpm/m ²) ⁽²⁾			
				X	Y	Z		U-234	U-235	U-238	Total
1	Floor	1	Area	7.6	7.6	0.0	z	82	5	13	100
2	Ceiling	1	Area	7.6	7.6	3.7	z	82	5	13	100
3	Lower North Wall	1	Area	7.6	15.2	1.0	y	82	5	13	100
4	Lower South Wall	1	Area	7.6	0.0	1.0	y	82	5	13	100
5	Lower West Wall	1	Area	0.0	7.6	1.0	x	82	5	13	100
6	Lower East Wall	1	Area	15.2	7.6	1.0	x	82	5	13	100
7	Upper North Wall	1	Area	7.6	15.2	2.9	y	82	5	13	100
8	Upper South Wall	1	Area	7.6	0.0	2.9	y	82	5	13	100
9	Upper West Wall	1	Area	0.0	7.6	2.9	x	82	5	13	100
10	Upper East Wall	1	Area	15.2	7.6	2.9	x	82	5	13	100

(1) See Table H-3 for room geometry.

(2) 100 dpm/m² = 1 dpm/100 cm²

Table H-3
Westinghouse Specialty Metals Plant
Room Geometry

Approximate Room Dimensions			
	Cartesion Dimension	Dimension (ft)	Dimension (m)
Height	z	12	3.7
Length	x	50	15.2
Width	y	50	15.2

Area Calculations							
Source Number	Source Description	Room Number	Source Type	Length (m)	Width (m)	Height (m)	Area (m ²)
1	Floor	1	Area	15.2	15.2	0.0	232
2	Ceiling	1	Area	15.2	15.2	0.0	232
3	Lower North Wall	1	Area	15.2	0.0	2.0	30
4	Lower South Wall	1	Area	15.2	0.0	2.0	30
5	Lower West Wall	1	Area	15.2	0.0	2.0	30
6	Lower East Wall	1	Area	15.2	0.0	2.0	30
7	Upper North Wall	1	Area	15.2	0.0	1.7	25
8	Upper South Wall	1	Area	15.2	0.0	1.7	25
9	Upper West Wall	1	Area	15.2	0.0	1.7	25
10	Upper East Wall	1	Area	15.2	0.0	1.7	25
						Total	687

Table H-4
Westinghouse Specialty Metals Plant
RESRAD-Build Dose Assessment
Supporting Calculations

Direct Ingestion Rate for all Sources		
Ingestion Rate (Beyeler et al) (m ² /hr)	Total Source Area (m ²)	Direct Ingestion Rate (1/hr)
1.10E-04	687	1.60E-07

Receptor Breathing Rate			
	Breathing Rate (m ³ /hr)	Breathing Rate (m ³ /hr)	Reference
Building Occupancy	1.4	33.6	NUREG/CR-5512, V3, Table 5.8, average inhalation rate for adult males
Renovation Worker	1.5	36	NUREG/CR-5512, V3, Table 5.7, medium breathing rate for construction workers
Demolition Worker	1.5	36	NUREG/CR-5512, V3, Table 5.7, medium breathing rate for construction workers