Attachment H33: RESRAD 7.0 Inputs Parameters that differ from defaults

RESRAD Parameter (Units)	Default	Value	Comment/Reference
Area of contaminated zone (m2)	1.00E+04	varies	Area Specific
Thickness of contaminated zone (m)	2.00E+00	1.00E+00	Assumed surface soil contaminated zone thickness.
Length parallel to aquifer flow (m)	1.00E+02	1.65E+02	Selected to achieve site specific groundwater dilution factor of 0.2, based on DEIS groundwater model correlation. Only applicable for non-dispersion model.
Time since placement of material (y)	0.00E+00	0.00E+00	Only non-zero if Kd values are not available. (Site-specific Kds are available).
Cover depth (m)	0.00E+00	0.00E+00	No cover considered.
Density of cover material (g/cm3)	0.00E+00	not used	No cover considered.
Cover depth erosion rate (m/y)	0.00E+00	not used	No cover considered.
Density of contaminated zone (g/cm3)	1.50E+00	1.70E+00	WVNSCO 1993a and WVNSCO 1993c.
Contaminated zone erosion rate (m/y)	1.00E-03	0.00E+00	Assumed for no source depletion.
Contaminated zone total porosity	4.00E-01	3.60E-01	WVNSCO 1993c.
Contaminated zone field capacity	2.00E-01	2.00E-01	WVNSCO 1993c.
Contaminated zone hydraulic conductivity (m/y)	1.00E+01	1.40E+02	Average for Sand and Gravel Thick Bedded Unit (4.43E-03 cm/s from Table 3-19) divided by 10 to provide vertical conductivity that accounts for potential anisotropy (DEIS Appendix E, Table E-3).
Contaminated zone b parameter	5.30E+00	1.40E+00	Yu, et al. 2000, Att. C table 3.5-1, mean for loamy sand (ln(mean)=0.305).
Average annual wind speed (m/sec)	2.00E+00	2.60E+00	WVNSCO 1993d.
Humidity in air (g/m3)	8.00E+00	not used	Applicable for tritium exposures only.
Evapotranspiration coefficient	5.00E-01	7.80E-01	Evapotranspiration and runoff coefficients selected to achieve infiltration rate of 0.26 m/y.
Precipitation (m/y)	1.00E+00	1.16E+00	WVNSCO 1993d.
Irrigation (m/y)	2.00E-01	4.70E-01	Beyeler, et al. 1999.
	2.00E-01	0.00E+00	Not applicable for non-farming scenario.
Irrigation mode	overhead	overhead	Site-specific.
Runoff coefficient	2.00E-01	4.10E-01	Runoff and evapotranspiration coefficients selected to achieve infiltration rate of 0.26 m/y.
Watershed area for nearby stream or pond (m2)	1.00E+06	1.37E+07	Based on drainage area of site of 13.7 km2 or ~5.2 mi2 for Buttermilk Creek.
Accuracy for water/soil computations	1.00E-03	1.00E-03	Default assumed.
Saturated zone density (g/cm3)	1.50E+00	1.70E+00	WVNSCO 1993a and WVNSCO 1993c.
Saturated zone total porosity	4.00E-01	3.60E-01	WVNSCO 1993c.
Saturated zone effective porosity	2.00E-01	2.50E-01	WVNSCO 1993c.
Saturated zone field capacity	2.00E-01	2.00E-01	WVNSCO 1993c.
Saturated zone hydraulic conductivity (m/y)	1.00E+02	1.40E+03	Average for Sand and Gravel Thick Bedded Unit (4.43E-03 cm/s from Table 3-19)
Saturated zone hydraulic gradient	2.00E-02	3.00E-02	WVNSCO 1993b.
Saturated zone b parameter	5.30E+00	1.40E+00	Yu, et al. 2000, Att. C table 3.5-1, mean for loamy sand (ln(mean)=0.305).
Water table drop rate (m/y)	1.00E-03	0.00E+00	Site Specific.
Well pump intake depth (m below water table)	1.00E+01	5.00E+00	Assumption based on site hydrogeology and site-specific groundwater dilution factor. Only applicable to non-dispersion model.
Model: Non-dispersion (ND) or Mass-Balance (MB)	ND	ND	Applicable to areas >1,000 m2 (Yu, et.al. 2001, p.E-18)
	MB	MB	Applicable to areas <1,000 m2 (Yu, et. al. 2001, pE-18)

RESRAD Parameter (Units)	Default	Value	Comment/Reference
Well pumping rate (m3/y)	2.50E+02	5.72E+03	Based on 2.9 m3/y drinking water (2 L/d per 4 people for 365 days), 329 m3/y household water (225 L/d per 4 people for 365 day), 385 m3/y livestock watering (5 beef cattle at 50 L/d, 5 milk cows 160 L/d) and 5,000 m3/y for irrigation of 10,000 m2 (at rate of 0.5 m/y) from Yu, et al. 2000, Attachment C, Section 3.10.
Number of unsaturated zone strata	1.00E+00	1.00E+00	Assumed.
Unsaturated zone thickness (m)	4.00E+00	2.00E+00	Site specific.
Unsaturated zone soil density (g/cm3)	1.50E+00	1.70E+00	WVNSCO 1993a and WVNSCO 1993c.
Unsaturated zone total porosity	4.00E-01	3.60E-01	WVNSCO 1993c.
Unsaturated zone effective porosity	2.00E-01	2.50E-01	WVNSCO 1993c.
Unsaturated zone field capacity	2.00E-01	2.00E-01	WVNSCO 1993c.
Unsaturated zone hydraulic conductivity (m/y)	1.00E+01	1.40E+02	Average for Sand and Gravel Thick Bedded Unit (4.43E-03 cm/s from Table 3-19) divided by 10 to provide vertical conductivity that accounts for potential anisotropy (DEIS Appendix E, Table E-3).
Unsaturated zone b parameter	5.30E+00	1.40E+00	Yu, et al. 2000, Att. C table 3.5-1, mean for loamy sand (ln(mean)=0.305).
Distribution coefficients – radionuclides			
Contaminated zone (mL/g)	varies	Site specific	See distribution coefficients table.
Unsaturated zone 1 (mL/g)	varies	Site specific	See distribution coefficients table.
Saturated zone (mL/g)	varies	Site specific	See distribution coefficients table.
Plant Transfer Factor	varies	Chemical-specific	Default values assumed.
Fish Transfer Factor	Varies	Chemical-specific	Default values assumed.
Leach rate (1/y)	varies	not used	Using site-specific Kd values instead of assigning leach rate.
Solubility constant	varies	not used	Using site-specific Kd values instead of assigning solubility constant.
Inhalation rate (m3/y)	8.40E+03	8.40E+03	Beyeler, et al. 1999.
Mass loading for inhalation (g/m3)	1.00E-04	1.48E-05	Beyeler, et al. 1999. Based on relative time fractions and mean dust loadings. Assumes 288 hours of active farming per year.
Exposure duration (y)	3.00E+01	1.00E+00	Yearly dose estimates calculated.
Filtration factor, inhalation	4.00E-01	1.00E+00	Beyeler, et. al. 1999.
Shielding factor, external gamma	7.00E-01	2.73E-01	Yu, et al. 2000, Att. C Figure 7.10-1, mean of distribution approximates a frame house with slab or basement.
Fraction of time spent indoors	5.00E-01	6.60E-01	Yu, et al. 2000, Att. C Figure 7.6-2, value represents ~50th percentile of distribution.
	5.00E-01	0.00E+00	Assumed.
Fraction of time spent outdoors	2.50E-01	2.50E-01	RESRAD default value used.
Shape factor flag, external gamma	1.00E+00	1.00E+00	RESRAD default.
Fruits, vegetables and grain consumption (kg/y)	1.60E+02	1.12E+02	Beyeler, et al. 1999.
Leafy vegetable consumption (kg/y)	1.40E+01	2.10E+01	Beyeler, et al. 1999.
Milk consumption (L/y)	9.20E+01	2.33E+02	Beyeler, et al. 1999.
Meat and poultry consumption (kg/y)	6.30E+01	6.50E+01	Beyeler, et al. 1999.
Fish consumption (kg/y)	5.40E+00	9.00E+00	Exposure Factors Handbook (EPA, 1999). The value represents the 95th percentile of fish consumption by recreational anglers

RESRAD Parameter (Units)	Default	Value	Comment/Reference
Other seafood consumption (kg/y)	9.00E-01	0.00E+00	Assumes only fish consumed from the stream
Soil ingestion rate (g/y)	3.65E+01	1.83E+01	Yu, et al. 2000, Att C. Figure 5.6-1, value represents mean of distribution for resident farmer (50 mg/d).
Drinking water intake (L/y)	5.10E+02	7.30E+02	Beyeler, et al. 1999.
Contamination fraction of drinking water	1.0	1.0	Assumed. For streambed sediment, this is 100% of incidental ingestion.
Contamination fraction of household water	1.0	1.0	Assumed.
Contamination fraction of livestock water	1.0	1.0	Assumed.
Contamination fraction of groundwater	1.0	0	All water ingested is from surface water.
Contamination fraction of irrigation water	1.0	1.0	Assumed.
Contamination fraction of aquatic food	1.0	1.0	Assumed.
Contamination fraction of plant food	-1	1.0	Assumes all ingestion is from the contaminated source.
Contamination fraction of meat	-1	1.0	Assumes all ingestion is from the contaminated source.
Contamination fraction of milk	-1	1.0	Assumes all ingestion is from the contaminated source.
Livestock fodder intake for meat (kg/day)	6.80E+01	2.73E+01	Beyeler, et al. 1999.
Livestock fodder intake for milk (kg/day)	5.50E+01	6.42E+01	Beyeler, et al. 1999.
Livestock water intake for meat (L/day)	5.00E+01	5.00E+01	Beyeler, et al. 1999, assumed for venison exposure to sediment source.
Livestock water intake for milk (L/day)	1.60E+02	1.60E+02	RESRAD default value used.
Livestock soil intake (kg/day)	5.00E-01	5.00E-01	RESRAD default, assumed for venison exposure to sediment source.
Mass loading for foliar deposition (g/m3)	1.00E-04	4.00E-04	Beyeler, et al. 1999.
Depth of soil mixing layer (m)	1.50E-01	1.50E-01	Beyeler, et al. 1999.
Depth of roots (m)	9.00E-01	9.00E-01	RESRAD default, represents crops with short growing seasons.
Drinking water fraction from ground water	1.0	1.0	Assumed.
Household water fraction from ground water	1.0	1.0	Assumed.
Livestock water fraction from ground water	1.0	1.0	Assumed.
Irrigation fraction from ground water	1.0	1.0	Assumed.
Wet weight crop yield for non-leafy (kg/m2)	7.00E-01	1.75E+00	Yu, et al. 2000, Att. C Figure 6.5-1 value is mean of distribution.
Wet weight crop yield for leafy (kg/m2)	1.50E+00	1.50E+00	RESRAD default.
Wet weight crop yield for fodder (kg/m2)	1.10E+00	1.10E+00	RESRAD default.
Growing season for non-leafy (years)	1.70E-01	1.70E-01	RESRAD default.
Growing season for leafy (years)	2.50E-01	2.50E-01	RESRAD default.
Growing season for fodder (years)	8.00E-02	8.00E-02	RESRAD default.
Translocation factor for non-leafy	1.00E-01	1.00E-01	RESRAD default.
Translocation factor for leafy	1.00E+00	1.00E+00	RESRAD default.
Translocation factor for fodder	1.00E+00	1.00E+00	RESRAD default.
Dry foliar interception fraction for non-leafy	2.50E-01	2.50E-01	RESRAD default.

RESRAD Parameter (Units)	Default	Value	Comment/Reference
Dry foliar interception fraction for leafy	2.50E-01	2.50E-01	RESRAD default.
Dry foliar interception fraction for fodder	2.50E-01	2.50E-01	RESRAD default.
Wet foliar interception fraction for non-leafy	2.50E-01	2.50E-01	RESRAD default.
Wet foliar interception fraction for leafy	2.50E-01	6.70E-01	Yu, et al. 2000, Att. C Figure 6.7-1 represent the most likely value.
Wet foliar interception fraction for fodder	2.50E-01	2.50E-01	RESRAD default.
Weathering removal constant (1/y)	2.00E+01	1.80E+01	Yu, et al. 2000, Att. C Figure 6.6-1 represent the most likely value

Radionuclide	RESRAD Default (mL/g)	Surface Soil DCGL Contaminated Zone (mL/g)	Subsurface Soil DCGL Contaminated Zone (mL/g)	Sediment DCGL Contaminated Zone (mL/g)	Unsaturated[2] Zone (mL/g)	Saturated[3] Zone (mL/g)
Principal Elements						
Americium	20	1900[4]	4000[5]	4000[5]	1900[4]	1900[4]
		(420 - 111,000)	(420 - 111,000)	(420 - 111,000)	(420 - 111,000)	(420 - 111,000)
Carbon	0	5[4]	7[5]	7[5]	5[4]	5[4]
		(0.7 - 12)	(0.7 - 12)	(0.7 - 12)	(0.7 - 12)	(0.7 - 12)
Curium[6]	calculated	6760	6760	6760	6760	6760
		(780 – 22,970)	(780 – 22,970)	(780 – 22,970)	(780 – 22,970)	(780 – 22,970)
Cesium	4600	280[4]	480[5]	480[5]	280[4]	280[4]
		(48 - 4800)	(48 - 4800)	(48 - 4800)	(48 - 4800)	(48 - 4800)
Iodine	calculated	1[4]	2[7]	2[7]	1[4]	1[4]
		(0.4 - 3.4)	(0.4 - 3.4)	(0.4 - 3.4)	(0.4 - 3.4)	(0.4 - 3.4)
Neptunium	calculated	2.3[8]	3[5]	3[5]	2.3[8]	2.3[8]
		(0.5 - 5.2)	(0.5 - 5.2)	(0.5 - 5.2)	(0.5 - 5.2)	(0.5 - 5.2)
Plutonium	2000	2600[8]	3000[5]	3000[5]	2600[8]	2600[8]
		(5 - 27,900)	(5 - 27,900)	(5 - 27,900)	(5 - 27,900)	(5 - 27,900)
Strontium	30	5[9]	15[5]	15[5]	5[9]	5[9]
		(1 - 32)	(1 - 32)	(1 - 32)	(1 - 32)	(1 - 32)
Technetium	0	0.1[4]	4.1[7]	4.1[7]	0.1[4]	0.1[4]
		(0.01 - 4.1)	(1 - 10)	(1 - 10)	(0.01 - 4.1)	(0.01 - 4.1)
Uranium	50	35[4]	10[9]	10[9]	35[4]	35[4]
		(10 - 350)	(1 - 100)	(1 - 100)	(10 - 350)	(10 - 350)
Progeny Elements[10]						
Actinium	20	1740	1740	1740	1740	1740
Lead	100	2400	2400	2400	2400	2400
Protactinium	50	2040	2040	2040`	2040	2040
Radium	70	3550	3550	3550	3550	3550
Thorium	60,000	5890	5890	5890	5890	5890

(1)   Sources of K_d values considered included Table 3-20; NUREG-5512 (Beyeler, et al. 1999), Table 6.7; RESRAD User's Guide (Yu, et al. 2001), Tables E-3, E-4; Sheppard, et. al. 2006, and Sheppard and Thibault 1990. Values in parentheses are the bounds used in the sensitivity evaluation, selected considering site-specific and literature values to reflect a reasonable range.

(2)   Sediment model assumes no unsaturated zone. Values used for surface and subsurface soil evaluation only.

(3)   Values presented here are those used for surface soil DCGLs based on the non-dispersion model.

(4)   From Sheppard and Thibault 1990, for sand.

(5)   Site specific value for the unweathered Lavery till (see Section 3.7.8, Table 3-20).

(6)   Beyeler, et. al. 1999

(7)   Site specific value for the Lavery till (see Section 3.7.8, Table 3-20).

(8)   Site specific value for the sand and gravel unit (see Section 3.7.8, Table 3-20).

(9)   Site specific data (Dames and Moore 1995a, 1995b). The Sr-90 value of 5 mL/g is consistent with the value used in the Decommissioning EIS.

(10)   Progeny K_ds were not included in the sensitivity analysis; DEIS values were used in all cases.