Table D-9: Average Soil Exposure Point Concentrations from 0 to 4 ft During Period Year 0 to Year 25

Soil (0 to 4 ft)
Average concentration from 0 to 4 ft during period year 0 to year 25 (based on radioactive decay)
(pCi/g)

COPC	CFA-04	CFA-07	CFA-08D	CFA-08STP	CFA-10	CFA-12	CFA-13	CFA-15	CFA-17/47	CFA-42	CFA-05	CFA-26	CFA-46	CFA-52
Ac-228														
Ag-108m						ND								
Am-241						ND	4.96E-02							
Ba-133						ND								
Bi-212														
Bi-214														
Cs-137	3.43E-01		1.36E+02			ND								
Eu-152						ND								
Pb-212														
Pu-238														
Pu-239/240			4.24E-01											
Ra-226							2.28E+00	2.21E+00						
Tl-208														
U-234	2.57E+00													
U-235	3.58E-01		3.44E-01			ND	4.83E-01							
U-238	3.47E+00					ND	2.21E+00							
Zr-95							1.35E-03							

Notes:

ND: Chemical is a COPC for this site, but was not detected in the 0 to 4 foot depth interval.

Blank: Chemical is not a COPC for this site.

Table D-10: Average Soil Exposure Point Concentrations from 0 to 0.5 ft During Period Year 100 to Year 125

	Soil (0 to 0.5 ft) Average concentration from 0 to 0.5 ft during period year 100 to year 125 (based on radioactive decay) (pCi/g)													
COPC	CFA-04	CFA-07	CFA-08D	CFA-08STP	CFA-10	CFA-12	CFA-13	CFA-15	CFA-17/47	CFA-42	CFA-05	CFA-26	CFA-46	CFA-52
Ac-228														
Ag-108m						ND								
Am-241						ND	ND							
Ba-133						ND								
Bi-212														
Bi-214														
Cs-137	3.91E-02		1.30E+01			ND								
Eu-152						ND								
Pb-212														
Pu-238														
Pu-239/240			2.89E+00											
Ra-226	1.21E+00						ND	ND						
Tl-208														
U-234	4.28E+00													
U-235	1.70E-01		2.21E-01			ND	ND							
U-238	4.24E+00					ND	ND							
Zr-95							ND							

Notes:

ND: Chemical is a COPC for this site, but was not detected in the 0 to 4 foot depth interval.

Blank: Chemical is not a COPC for this site.

Table D-11: Average Soil Exposure Point Concentrations from 0 to 4 ft During Period Year 100 to Year 125

Soil (0 to 4 ft)
Average concentration from 0 to 4 ft during period year 100 to year 125 (based on radioactive decay)
(pCi/g)

COPC	CFA-04	CFA-07	CFA-08D	CFA-08STP	CFA-10	CFA-12	CFA-13	CFA-15	CFA-17/47	CFA-42	CFA-05	CFA-26	CFA-46	CFA-52
Ac-228														
Ag-108m						ND								
Am-241						ND	4.22E-02							
Ba-133						ND								
Bi-212														
Bi-214														
Cs-137	3.46E-02		1.37E+01			ND								
Eu-152						ND								
Pb-212														
Pu-238														
Pu-239/240			4.22E-01											
Ra-226							2.18E+00	2.12E+00						
Tl-208														
U-234	2.57E+00													
U-235	3.58E-01		3.44E-01			ND	4.83E-01							
U-238	3.47E+00					ND	2.21E+00							
Zr-95							1.30E-175							

Notes:

ND: Chemical is a COPC for this site, but was not detected in the 0 to 4 foot depth interval.

Blank: Chemical is not a COPC for this site.

Table D-12a: Average Soil Exposure Point Concentrations from 0 to 10 ft During Period Year 100 to Year 130

12/3/98,
3:06 PM

Soil (0 to 10 ft)
Average radionuclide soil concentrations from 0 to 10 feet during period year 100 to year 130 (assuming radioactive decay)
(pCi/g)

COPC	CFA-04	CFA-05	CFA-07	CFA-08D	CFA-08STP	CFA-10	CFA-12	CFA-13	CFA-15	CFA-17/47	CFA-42	CFA-26	CFA-46	CFA-52
Ac-228														
Ag-108m			ND				1.55E-01							
Am-241							2.32E+00	2.88E-02						
Ba-133							5.36E-05							
Bi-212														
Bi-214														
Cs-137	2.48E-02		ND	6.47E+00			9.17E+00							
Eu-152							3.91E-03							
Pb-212														
Pu-238			ND											
Pu-239/240				1.69E-01										
Ra-226	2.50E+00				ND			2.80E+00	1.92E+00					
Tl-208														
U-234	1.97E+00													
U-235	1.60E-01			2.22E-01	ND		2.82E-01	3.01E-01						
U-238	2.17E+00						2.15E+00	1.41E+00						
Zr-95								4.33E-176						

Notes:
ND: Chemical is a COPC for this site, but was not detected in the 0 to 10 foot depth interval.
Blank: Chemcial is not a COPC for this site.

Table D-12b: Average Soil Exposure Point Concentrations from 0 to 10 ft During Year 100

12/3/98,
3:09 PM

Soil (0 to 10 ft)
Radionuclide soil concentration from 0 to 10 feet during period year 100 for homegrown produce (assuming radioactive decay)
(pCi/g)

COPC	CFA-04	CFA-05	CFA-07	CFA-08D	CFA-08STP	CFA-10	CFA-12	CFA-13	CFA-15	CFA-17/47	CFA-42	CFA-26	CFA-46	CFA-52
Ac-228														
Ag-108m			ND				1.68E-01							
Am-241							2.37E+00	2.95E-02						
Ba-133							1.23E-04							
Bi-212														
Bi-214														
Cs-137	3.43E-02		ND	8.95E+00			1.27E+01							
Eu-152							7.63E-03							
Pb-212														
Pu-238			ND											
Pu-239/240				1.69E-01										
Ra-226	2.52E+00				ND			2.81E+00	1.93E+00					
Tl-208														
U-234	1.97E+00													
U-235	1.60E-01			2.22E-01	ND		2.82E-01	3.01E-01						
U-238	2.17E+00						2.15E+00	1.41E+00						
Zr-95								5.15E-174						

Notes:
ND: Chemical is a COPC for this site, but was not detected in the 0 to 10 foot depth interval.
Blank: Chemcial is not a COPC for this site.

Table D-13: Concentrations of COPCs in Homegrown Produce at Year 100

	Homegrown produce at year 100 (mg/kg or pCi/g)													
COPC	CFA-04	CFA-05	CFA-07	CFA-08D	CFA-08STP	CFA-10	CFA-12	CFA-13	CFA-15	CFA-17/47	CFA-42	CFA-26	CFA-46	CFA-52
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254	1.06E-02	1.14E-03	--	6.71E-03	--	5.96E-04	--	5.96E-02	--	--	--	--	--	--
Aroclor-1260	--	--	--	--	--	2.53E-04	--	--	--	--	--	--	--	--
Arsenic	1.79E-02	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	5.96E-02	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	0.00E+00	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--	--	--	1.20E-02	--	7.40E-05	--	--	--	--
Chlorodifluoromethane	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04	1.49E-04
Di-n-butylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	ND	--	--	4.95E+00	--	7.82E+00	--	--	--	--	--	--
Mercury	4.41E+01	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--	4.08E-04	ND	--	--	--
Phenol	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ac-228	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ag-108m	--	--	ND	--	--	--	3.96E-02	--	--	--	--	--	--	--
Am-241	--	--	--	--	--	--	1.12E-02	1.40E-04	--	--	--	--	--	--
Ba-133	--	--	--	--	--	--	3.81E-06	--	--	--	--	--	--	--
Bi-212	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bi-214	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cs-137	1.81E-03	--	ND	4.74E-01	--	--	6.72E-01	--	--	--	--	--	--	--
Eu-152	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.17E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05
Pb-212	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pu-238	--	--	ND	--	--	--	--	--	--	--	--	--	--	--
Pu-239/240	--	--	--	1.90E-05	--	--	--	--	--	--	--	--	--	--
Ra-226	2.50E-02	--	--	--	ND	--	--	2.80E-02	1.92E-02	--	--	--	--	--
Tl-208	--	--	--	--	--	--	--	--	--	--	--	--	--	--
U-234	1.20E-03	--	--	--	--	--	--	--	--	--	--	--	--	--
U-235	9.77E-05	--	--	1.35E-04	ND	--	1.72E-04	1.84E-04	--	--	--	--	--	--
U-238	1.33E-03	--	--	--	--	--	1.32E-03	8.60E-04	--	--	--	--	--	--
Zr-95	--	--	--	--	--	--	--	8.05E-179	--	--	--	--	--	--

Notes:

--: Chemical is not a COPC for this site or is not detected in the 0 to 10 foot depth interval.

ND: Chemical is a COPC but it was not detected in the 0 to 10 ft depth interval.

Table D-14. Dermal Permeabilities.

COPC	Dermal Permeability (K^w_p) (cm/hr)[a]	
Aroclor-1254	7.57E-01	2a
Aroclor-1260	8.49E-01	2a
Arsenic	1.00E-03	1
Benzo(a)anthracene	8.60E-01	2a
Benzo(b)fluoranthene	1.39E+00	2a
Benzo(g,h,i)perylene	1.62E+00	2a
Chlorodifluoromethane	1.93E-02	2a
Di-n-butylphthalate	3.30E-02	2
Lead	1.00E-03	2
Mercury	1.00E-03	1
Phenanthrene	2.30E-01	2
Phenol	5.50E-03	2
Tetrachloroethene	4.80E-02	2
1,1,1-Trichloroethane	1.70E-02	2
Ac-228	1.00E-03	1
Ag-108m	1.00E-03	1
Am-241	1.00E-03	1
Ba-133	1.00E-03	1
Bi-212	1.00E-03	1
Bi-214	1.00E-03	1
Cs-137	1.00E-03	1
Eu-152	1.00E-03	1
Pb-212	1.00E-03	1
Pu-238	1.00E-03	1
Pu-239/240	1.00E-03	1
Ra-226	1.00E-03	1
Tl-208	1.00E-03	1
U-234	1.00E-03	1
U-235	1.00E-03	1
U-238	1.00E-03	1
Zr-95	1.00E-03	1

Notes:

[a] Calculated using the equation: $\log K_p = -2.72+0.71\log K_{ow}-0.0061MW$ (USEPA, 1992).

[b] Based on value for m-xylene.

Reference:

[1] Becker, 1995

[2] U.S. Environmental Protection Agency, 1992, Dermal Exposure Assessment: Principles and Applications, Office of Health and Environmental Assessment, Washington, D.C., EPA/600/8-91/011B, January.

Table D-15: Air Pathway COPC Concentrations - Current Occupational Scenario

COPC	Area Weighted Average Soil Concentration (mg/kg or pCi/g)	COPC Concentration in Fugitive Dust [a] (mg/m^3 or pCi/m^3)	COPC Concentration in Air (Volatiles) (mg/m^3)
Aroclor-1254	1.25E+00	1.38E-08	NA
Aroclor-1260	4.01E-02	4.41E-10	NA
Arsenic	1.98E+00	2.18E-08	NA
Benzo(g,h,i)perylene	--	--	NA
Benzo(a)anthracene	--	--	NA
Benzo(b)fluoranthene	--	--	NA
Lead	1.02E+02	1.12E-06	NA
Mercury	4.67E+01	5.14E-07	NA
Phenanthrene	--	--	--
Ac-228	--	--	NA
Ag-108m	--	--	NA
Am-241	--	--	NA
Ba-133	--	--	NA
Bi-212	--	--	NA
Bi-214	--	--	NA
Cs-137	9.10E+01	1.00E-03	NA
Eu-152	--	--	NA
Pb-212	--	--	NA
Pu-238	--	--	NA
Pu-239/240	2.05E+00	2.25E-05	NA
Ra-226	3.31E-01	3.65E-06	NA
Tl-208	--	--	NA
U-234	1.12E+00	1.24E-05	NA
U-235	2.01E-01	2.21E-06	NA
U-238	1.11E+00	1.22E-05	NA
Zr-95	--	--	NA

Notes:

[a] Based on non-volatile COPCs present in the 0 to 0.5 foot depth interval at CFA-04, CFA-08D, and CFA-10. The total area of these sites is 26,201.5 m^2 (282,058 ft^2).

--: Not calculated because COPC was not detected in the 0 to 0.5 foot depth interval.

NA: Not applicable, COPC is not volatile.

Table D-16: Air Pathway COPC Concentrations - Future Occupational Scenario

COPC	Area Weighted Averag Soil Concentration (mg/kg or pCi/g)	COPC Concentration in Fugitive Dust [a] (mg/m^3 or pCi/m^3)	COPC Concentration in Air (Volatiles) (mg/m^3)
Aroclor-1254	1.25E+00	1.38E-08	NA
Aroclor-1260	4.01E-02	4.41E-10	NA
Arsenic	1.98E+00	2.18E-08	NA
Benzo(g,h,i)perylene	--	--	NA
Benzo(a)anthracene	--	--	NA
Benzo(b)fluoranthene	--	--	NA
Lead	1.02E+02	1.12E-06	NA
Mercury	4.67E+01	5.14E-07	NA
Phenanthrene	--	--	--
Ac-228	--	--	NA
Ag-108m	--	--	NA
Am-241	--	--	NA
Ba-133	--	--	NA
Bi-212	--	--	NA
Bi-214	--	--	NA
Cs-137	9.17E+00	1.01E-04	NA
Eu-152	--	--	NA
Pb-212	--	--	NA
Pu-238	--	--	NA
Pu-239/240	2.04E+00	2.25E-05	NA
Ra-226	3.17E-01	3.49E-06	NA
Tl-208	--	--	NA
U-234	1.12E+00	1.23E-05	NA
U-235	2.01E-01	2.21E-06	NA
U-238	1.11E+00	1.22E-05	NA
Zr-95	--	--	NA

Notes:

[a] Based on non-volatile COPCs present in the 0 to 0.5 foot depth interval at CFA-04, CFA-08D, and CFA-10 The total area of these sites is 26,201.5 m2 (282,058 ft2).

--: Not calculated because COPC was not detected in the 0 to 0.5 foot depth interval.

NA: Not applicable, COPC is not volatile.

Table D-17: Air Pathway COPC Concentrations - Future Residential Scenario

12/3/98
3:15 PM

COPC	Area Weighted Average Soil Concentration Includes Radioactive Decay (mg/kg or pCi/g)	COPC Concentration in Fugitive Dust [a] (mg/m^3 or pCi/m^3)	COPC Concentration in Air (Volatiles) [b] (mg/m^3)
1,1,1-Trichloroethane	--	--	--
Aroclor-1254	8.28E-01	9.11E-09	NA
Aroclor-1260	1.86E-03	2.05E-11	NA
Arsenic	2.90E+00	3.19E-08	NA
Benzo(a)anthracene	2.79E-03	3.07E-11	NA
Benzo(b)fluoranthene	1.30E-03	1.43E-11	NA
Benzo(g,h,i)perylene	2.35E-03	2.59E-11	NA
Chlorodifluoromethane	--	--	--
Di-n-butylphthalate	--	--	NA
Lead	4.96E+00	5.45E-08	NA
Mercury	1.79E+01	1.97E-07	NA
Phenanthrene	--	--	3.29E-08
Phenol	--	--	NA
Tetrachloroethene	--	--	--
Ac-228	--	--	NA
Ag-108m	7.35E-05	8.08E-10	NA
Am-241	1.13E-03	1.24E-08	NA
Ba-133	2.54E-08	2.80E-13	NA
Bi-212	--	--	NA
Bi-214	--	--	NA
Cs-137	4.26E+00	4.68E-05	NA
Eu-152	1.86E-06	2.04E-11	NA
Pb-212	--	--	NA
Pu-238	--	--	NA
Pu-239/240	1.11E-01	1.22E-06	NA
Ra-226	6.12E-01	6.74E-06	NA
Tl-208	--	--	NA
U-234	4.80E-01	5.28E-06	NA
U-235	1.85E-01	2.03E-06	NA
U-238	5.31E-01	5.84E-06	NA
Zr-95	3.84E-179	4.22E-184	NA

Notes:

--: Not calculated because COPC was not detected in the 0 to 10 foot depth interval.

NA: Not applicable, COPC is not volatile.

[a] Based on non-volatile COPCs present in the 0 to 10 foot depth interval at CFA-04, CFA-08D, CFA-10, CFA-12, CFA-13, CFA-15, and CFA-17/47. The total area of these sites is 2.82E+04 m2 (3.036E+5ft2).

[b] Based on volatile COPCs present in the 0 to 10 foot depth interval at CFA-17/47. The total area of this site is 1,962 m2 (21,121 ft2).

Table D-18. GWSCREEN parameters and the values used for transport modeling.

Variable	Parameter Description	Value[a]	Units
L	Source length parallel to aquifer flow direction	site-specific	m
W	Source width perpendicular to aquifer flow direction	site-specific	m
D_s	Thickness of source	site-specific	m
I	Infiltration rate (Darcy flux)	0.1	m/yr
v_a	Aquifer pore velocity	570	m/yr
θ_s	Volumetric water content in source	0.3	unitless
θ_u	Volumetric water content in unsaturated zone	0.3	unitless
ρ_s	Bulk density at source	1.5	g/cm^3
ρ_u	Bulk density in unsaturated zone	1.9	g/cm^3
ρ_a	Bulk density of aquifer	1.9	g/cm^3
K_{ds}	Adsorption coefficient in source	contaminant-specific	mL/g
K_{du}	Adsorption coefficient in unsaturated zone	contaminant-specific	mL/g
K_{da}	Adsorption coefficient in aquifer	contaminant-specific	mL/g
η	Porosity of aquifer	0.1	unitless
T	Depth to aquifer below contamination zone	site-specific	m
α_L	Dispersivity in the direction of aquifer flow	9	m
α_T	Dispersivity perpendicular to direction of flow	4	m
Q_I	Initial contaminant mass or activity	site- and contaminant-specific	mg or Ci
$t_{1/2}$	Half-life of contaminant	contaminant-specific	y
EWST	Equivalent well screen thickness	15	m
X	Distance from source to receptor, parallel to flow	site-specific	m
Y	Distance from source to receptor, perpendicular to flow	site-specific	m

a. Values are default Track 2 numbers unless otherwise noted.

b. Source length and width derivation is described in text.

c. The thickness of the source volume is based on predicted leached depth, as described in text.

d. Sorption coefficients are, in this analysis, identical for source, unsaturated, and saturated zones.

e. Depth to aquifer is the cumulative vadose zone interbed thickness for each site.

f. Distance from source to receptor is unique for each source/receptor, based on location of ten receptors at downgradient edge of this system.

Table D-19. COPC total masses or activities in soil (sources to groundwater).

Contaminant	Modeled Decay Product[a]	Half-life (yr)	Sorption Coefficient Kd (mL/g)[b]	Total Inventory in Soil to be Transported to Groundwater (mg or Ci)
Ac-228		7.00E-04	0.00E+00	7.84E-02
	Th-228			2.87E-05
Ag-108m		1.27E+02	9.00E+01	4.80E-05
Am-241		4.32E+02	3.40E+02	3.38E-02
	Np-237			6.96E-06
Ba-133		1.05E+01	5.00E+01	4.73E-06
Bi-212		1.15E-04	1.00E+02	7.64E-02
	Pb-208[c]			4.38E-24
Bi-214		3.80E-05	1.00E+02	6.32E-02
	Pb-210			1.14E-07
Cs-137		3.02E+01	5.00E+02	7.63E+00
Eu-152		1.36E+01	0.00E+00	6.53E-05
Pb-212		1.21E-03	1.00E+02	8.03E-02
	Pb-208			4.85E-23
Pu-238		8.78E+01	2.20E+01	7.12E-04
	U-234			2.55E-07
Pu-239/240		2.41E+04	2.20E+01	1.44E-02
Ra-226		1.60E+03	1.00E+02	2.95E-01
Tl-208		5.80E-06	0.00E+00	7.32E-02
	Pb-208			2.12E-25
U-234		2.45E+05	6.00E+00	1.17E-01
U-235		7.04E+08	6.00E+00	5.93E-02
U-238		4.47E+09	6.00E+00	1.30E-01
Arsenic		n/a[d]	3.00E+00	7.49E+08
Benzo(a)anthracene		N/a	1.19E+03	3.58E+05
Benzo(b)fluoranthene		N/a	3.69E+03	1.67E+05
Benzo(g,h,i)perylene		N/a	4.74E+03	2.98E+05
Chlorodifluoromethane		N/a	1.73E-01	6.98E+05
Di-n-butylphthalate		N/a	1.02E+02	3.42E+06
Lead		N/a	1.00E+02	5.12E+09
Mercury		N/a	1.00E+02	5.53E+09

Table D-19. (continued).

Contaminant	Modeled Decay Product[a]	Half-life (yr)	Sorption Coefficient Kd (mL/g)[b]	Total Inventory in Soil to be Transported to Groundwater (mg or Ci)
Phenanthrene		N/a	4.23E+01	8.11E+04
Phenol		N/a	8.64E-02	2.16E+05
Tetrachloroethene		N/a	7.89E-01	9.50E+02
1,1,1-Trichloroethane		N/a	3.27E-01	2.92E+02
TPH-diesel		N/a	1.78E+00	6.77E+10
TPH-gasoline			1.40E+00	4.90E+10
TPH-heating oil		N/a	1.78E+00	2.47E+11

a. Some parent radionuclides have relatively short half-lives and high sorption coefficients. For these (Ac-228, Am-241, Bi-214, and Pu-238), the first daughter product of these (Th-228, Np-237, Pb-210, and U-234, respectively) was modeled.

Daughter product inventories for these were obtained from the relationship of activity and half-life:

$(\text{Activity})_{\text{daughter}} = (\text{Activity})_{\text{parent}} * [(\text{half-life})_{\text{parent}}/(\text{half-life})_{\text{daughter}}]$

b. For radionuclide contaminants with extremely short half-lives (i.e., less than 1.0 yr), the COCs are assumed to decay entirely to stable products before exiting the system. These contaminants were converted from parent curies to stable product milligrams (Pb-208 for thorium series decay chain COCs and Mo-95 for Zr-95). The Pb-208 totals were added to the stable lead inventory for these sites before modeling. Mo-95 inventory was deemed insignificant for the groundwater pathway.

c. Pb-208 is a stable form of elemental lead. The short-lived parent curies were converted to milligrams of Pb-208, which was added to the total lead inventory.

d. Half-life refers to radiological decay. Here, non-radiological COCs are considered to be free of any decay-type loss mechanisms.

Table D-20. Groundwater concentrations predicted for WAG 4 for the 100–130 year timeframe.

Contaminant	Modeled Decay Product[a]	Peak Concentration[b] (mg/L or pCi/L)	Time (yr) at Peak Concentration
Ac-228 (Th-228)[c]		0.00E+00	n/a[d]
Ag-108m		0.00E+00	n/a[d]
Am-241 (Np-237)[c]		3.47E-05	2.64E+03
	U-233	3.31E-07	
	Th-229	2.31E-09	
Ba-133		0.00E+00	n/a[d]
Bi-212 (Pb-208)[e]		n/a[e]	n/a[e]
Bi-214 (Pb-210)[c]		0.00E+00	n/a[d]
Cs-137		0.00E+00	n/a[d]
Eu-152		4.79E-03	4.11E+01
Pb-212 (Pb-208)[e]		n/a[e]	n/a[e]
Pu-238 (U-234)[c]		2.56E-06	4.68E+03
	Th-230	5.43E-08	
	Ra-226	6.44E-07	
	Pb-210	3.24E-08	
Pu-239/240		1.06E-02	1.70E+04
	U-235	8.32E-07	
	Pa-231	1.01E-07	
	Ac-227	1.16E-08	
Ra-226		8.49E-09	2.20E+04
	Pb-210	8.61E-09	
Tl-208 (Pb-208)[e]		n/a[e]	n/a[e]
U-234		3.54E+00	1.35E+03
	Th-230	2.50E-02	
	Ra-226	6.20E-03	
	Pb-210	5.94E-03	
U-235		2.56E-01	1.35E+03
	Pa-231	5.08E-03	
	Ac-227	5.70E-04	
U-238		3.91E+00	1.35E+03
	U-234	1.49E-02	
	Th-230	5.38E-05	

Table D-20. (continued).

Contaminant	Modeled Decay Product[a]	Peak Concentration[b] (mg/L or pCi/L)	Time (yr) at Peak Concentration
	Ra-226	9.20E-06	
	Pb-210	8.61E-06	
Zr-95 (Mo-95)[f]		n/a[f]	n/a[f]
1,1,1-Trichloroethane		6.22E-08	1.20E+02
Arsenic		4.40E-02	6.96E+02
Benzo(a)anthracene		1.23E-08	2.88E+05
Benzo(b)fluoranthene		1.85E-09	8.92E+05
Benzo(g,h,i)perylene		1.83E-09	1.15E+06
Chlorodifluoromethane		1.74E-04	7.79E+01
Di-n-butylphthalate		2.98E-06	2.22E+04
Lead		1.33E-03	5.02E+04
Mercury		1.03E-02	2.18E+04
Phenanthrene		3.83E-08	2.42E+04
Phenol		7.10E-05	5.91E+01
Tetrachloroethene		1.05E-07	2.29E+02
TPH-diesel[g]		3.74E+00	4.27E+02
TPH-gasoline		6.89E+00	3.30E+02
TPH-heating		7.95E+00	4.64E+02

a. Some radionuclide COCs decay to significant daughter products; the daughter product ingrowth is included here. For this analysis, daughter products are assumed to travel at the same rate as the parent.

b. The groundwater concentrations reported in this table represent the maximum predicted in a network of ten receptor aquifer wells located in a line perpendicular to the flow direction immediately downgradient of the reference site (CFA-04).

c. Radionuclide contaminants that have short half-life relative to the vadose zone transit time were modeled as their first radioactive decay product. These include Ac-228, Am-241, Bi-214, and Pu-238 which were modeled as Th-228, Np-237, Pb-210, and U-234, respectively.

d. Some radioactive contaminants decay to stable products before reaching any receptor well locations.

e. Some radionuclides with very short half-life (<1.0 yr) that have no significant radioactive decay products were modeled as stable decay products. Bi-212, Pb-212, Tl-208 soil inventories were converted to stable lead which was added to the total lead inventory (see results for lead).

f. Zr-95 is also very short-lived with no significant radioactive decay products; the inventory of Zr-95 was converted to stable Mo-95, which was found to be an insignificant soil inventory relative to the molybdenum MCL.

g. TPH = total petroleum hydrocarbon

Table D-21: Concentrations of Volatiles from Indoor Water Use

COPC	Volatiles from indoor water use - 100 year (mg/m^3 or pCi/m^3)
1,1,1-Trichloroethane	--
Aroclor-1254	NA
Aroclor-1260	NA
Arsenic	NA
Benzo(a)anthracene	NA
Benzo(b)fluoranthene	NA
Benzo(g,h,i)perylene	NA
Chlorodifluoromethane	1.13E-05
Di-n-butylphthalate	NA
Lead	NA
Mercury	NA
Phenanthrene	--
Phenol	NA
Tetrachloroethene	--
Ac-228	NA
Ag-108m	NA
Am-241	NA
Ba-133	NA
Bi-212	NA
Bi-214	NA
Cs-137	NA
Eu-152	NA
Pb-212	NA
Pu-238	NA
Pu-239/240	NA
Ra-226	NA
Tl-208	NA
U-234	NA
U-235	NA
U-238	NA
Zr-95	NA

Notes:

--: Chemical is not a COPC for this site or was not shown to impact groundwater.

NA: Not applicable; chemical is not a volatile

Table D-22. Toxicity Data for WAG 4 COPCs.

COPC	Chemical type	Weight of Evidence	Oral RfD (mg/kg-day)		Oral SF (mg/kg-day)$^{-1}$ or Ingestion SF (risk/pCi)		Inhal RfD (mg/kg-day)		Inhal SF (mg/kg-day)$^{-1}$ or Inhal SF (risk/pCi)		Dermal RfD (mg/kg-day) [a]		Dermal SF (mg/kg-day)$^{-1}$ [a]		External SF (risk/yr-pCi/g)		Absorption Factor	
Ac-228	Radionuclide	A	--	--	1.62E-12	[1]	--	--	3.27E-11	[1]	--	--	1.62E-12	[1]	3.28E-06	[1]	*	
Ag-108m	Radionuclide	A	--	--	6.05E-12	[1]	--	--	7.02E-11	[1]	--	--	6.05E-12	[1]	5.61E-06	[1]	*	
Am-241	Radionuclide	A	--	--	3.28E-10	[1]	--	--	3.85E-08	[1]	--	--	3.28E-10	[1]	4.59E-09	[1]	*	
Aroclor-1254	PCB	A	2.00E-05	[2]	4.00E-01	[2]	--	--	--	--	--	--	9.10E+00	[2]	--	--	6.00E-02	[6]
Aroclor-1260	PCB	A	2.00E-05	[2]	4.00E-01	[2]	--	--	--	--	--	--	9.10E+00	[2]	--	--	6.00E-02	[6]
Arsenic	Inorganic	A	3.00E-04	[2]	1.50E+00	[2]	--	--	1.50E+01	[1]	3.00E-04	[2]	1.50E+00	[2]	--	--	3.00E-02	[6]
Ba-133	Radionuclide	A	--	--	2.70E-12	[1]	--	--	4.03E-12	[1]	--	--	2.70E-12	[1]	9.15E-07	[1]	*	
Benzo(a)anthracene	Organic	B2	--	--	7.30E-01	[3,4]	--	--	3.10E-01	[3,4]	--	--	7.30E-01	[3,4]	--	--	1.00E-01	[6]
Benzo(b)fluoranthene	Organic	B2	--	--	7.30E-01	[3,4]	--	--	3.10E-01	[3,4]	--	--	7.30E-01	[3,4]	--	--	1.00E-01	[6]
Benzo(g,h,i)perylene	Organic	D	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.00E-01	[6]
Bi-212	Radionuclide	A	--	--	6.20E-13	[1]	--	--	3.65E-11	[1]	--	--	6.20E-13	[1]	6.67E-07	[1]	*	
Bi-214	Radionuclide	A	--	--	1.95E-13	[1]	--	--	1.46E-11	[1]	--	--	1.95E-13	[1]	6.02E-06	[1]	*	
Chlorodifluoromethane (GW)	Organic	--	--	--	--	--	1.43E+01	[2]	--	--	--	--	--	--	--	--	5.00E-04	[6]
Cs-137	Radionuclide	A	--	--	3.16E-11	[1][b]	--	--	1.91E-11	[1][b]	--	--	3.16E-11	[1][b]	2.09E-06	[1][b]	*	
Di-n-butylphthalate (GW)	Organic	D	1.00E-01	[2]	--	--	--	--	--	--	1.00E-01	[2]	--	--	--	--	1.00E-01	[6]
Eu-152	Radionuclide	A	--	--	5.73E-12	[1]	--	--	7.91E-11	[1]	--	--	5.73E-12	[1]	4.08E-06	[1]	*	
Lead	Inorganic	B2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	*	
Mercury	Inorganic	D	3.00E-04	[1][c]	--	--	8.57E-05	[2][d]	--	--	3.00E-04	--	--	--	--	--	*	
Pb-212	Radionuclide	A	--	--	1.80E-11	[1]	--	--	3.85E-11	[1]	--	--	1.80E-11	[1]	3.00E-07	[1]	*	
Phenanthrene	Organic	D	4.00E-02	[7]	--	--	--	--	--	--	4.00E-02	[7]	--	--	--	--	1.00E-01	[6]
Phenol (GW)	Organic	D	6.00E-01	[2]	--	--	--	--	--	--	6.00E-01	[2]	--	--	--	--	1.00E-01	[6]
Pu-238	Radionuclide	A	--	--	2.95E-10	[1]	--	--	2.74E-08	[1]	--	--	2.95E-10	[1]	1.94E-11	[1]	*	
Pu-239/240 [e]	Radionuclide	A	--	--	3.15E-10	[1]	--	--	2.78E-08	[1]	--	--	3.15E-10	[1]	1.87E-11	[1]	*	
Ra-226	Radionuclide	A	--	--	2.96E-10	[1][b]	--	--	2.75E-09	[1][b]	--	--	2.96E-10	[1][b]	6.74E-06	[1][b]	*	
Tetrachloroethene (GW)	Organic	C-B2	1.00E-02	[2]	5.20E-02	[3]	--	--	2.03E-03	[3]	1.00E-02	[2]	5.20E-02	[3]	--	--	3.00E-02	[6]
1,1,1-Trichloroethane (GW)	Organic	--	2.00E-02	[3,4]	--	--	2.86E-01	[4][c]	--	--	2.00E-02	[3,4]	--	--	--	--	5.00E-04	[6]
U-234	Radionuclide	A	--	--	4.44E-11	[1]	--	--	1.40E-08	[1]	--	--	4.44E-11	[1]	2.14E-11	[1]	*	
U-235	Radionuclide	A	--	--	4.70E-11	[1]	--	--	1.30E-08	[1]	--	--	4.70E-11	[1]	2.65E-07	[1]	*	
U-238	Radionuclide	A	--	--	6.20E-11	[1][b]	--	--	1.24E-08	[1][b]	--	--	6.20E-11	[1][b]	6.57E-08	[1][b]	*	
Zr-95		A	--	--	3.92E-12	[1]	--	--	6.48E-12	[1]	--	--	3.92E-12	[1]	2.81E-06	[1]	*	

Notes:

-- Not available.

* COPC is not evaluated for dermal exposure.

(GW) COPC for groundwater exposure pathways only.

[a] Dermal toxicity values are assumed to equal oral toxicity values.

[b] Slope factor based on COPC plus daughter products.

[c] Withdrawn

[d] Under review

[e] Toxicity values are not available for Pu-239/240. Therefore, Pu-240 toxicity values were assumed based on more conservative values than those for Pu-239.

References:

[1] U.S. Environmental Protection Agency (USEPA). 1995. Health Effects Assessment Summary Table. Office of Research and Development, Cincinnati, OH.

[2] U.S. Environmental Protection Agency (USEPA). 1997. Integrated Risk Information System. On-line data base. Office of Research and Development, Cincinnati, OH.

[3] U.S. Environmental Protection Agency (USEPA). National Center for Environmental Assessment (NCEA). Office of Research and Development, Cincinnati, OH.

[4] U.S. Environmental Protection Agency (USEPA). 1997. Region III Risk-Based Concentration Table. Region III, Philadelphia, PA. October 22.

[5] U.S. Environmental Protection Agency (USEPA). 1993. Risk Assessment Review, EPA/600/N-93/014, August.

[6] U.S. Environmental Protection Agency (USEPA). 1995. Region III Technical Guidance Manual, Risk Assessment, Assessing Dermal Exposure from Soil. Office of Superfund Programs, Hazardous Waste Management Division. EPA/903-K-95-003. December.

[7] TPHCWG, 1996, Development of Fraction-Specific Reference Doses (RfDs) for Total Petroleum Hydrocarbon (TPH), TPHCWG Methodology, Draft, Total Petroleum Hydrocarbon Criteria Working Group, Volume 6, May 17, 1996.

Table D-23. Exposure Assumptions

EXPOSURE PARAMETER	Current and Future Occupational Worker[a]	Future Adult Resident[a]	Future Child Resident[a]
Contact Rate Assumptions			
Soil ingestion rate (mg/day)	50	100	200
Skin surface area available for soil contact (cm^2/event)	2,000[b]	3,000[b]	--
Soil-to-skin adherence factor (mg/cm^2)	0.5	0.5	--
Inhalation rate (m^3/hr)	0.83	0.83	--
Homegrown produce ingestion rate, nonradionuclide-contaminated (g/kg-day)	--	0.276[c]	--
Homegrown produce ingestion rate, radionuclide-contaminated (g/day)	--	16.7[c]	--
Groundwater ingestion rate (L/day)	--	2	1
Skin surface area available for groundwater contact	--	17,000	--
General Assumptions			
Inhalation exposure time (hr/day)	8	24	--
Dermal contact exposure time (hr/day)	--	0.25	--
Exposure frequency (days/year)	250	350	350
Exposure duration (years)	25	24	6
Body weight (kg)	70	70	15

Notes:
[a] Value from DOE-ID (1994), unless otherwise noted.
[b] Value from EPA (1992)
[c] Derivation based on LMITCO (1996).
-- Not applicable; exposure assumption parameter is not relevant for this receptor.

Table D-23. Soil ingestion intake factor equation for the occupational exposure scenario.[a,b]

$$\text{Intake factor} = \frac{C_{air} * IR * FI * EF * ED * CF}{BW * AT}$$

		Parameter	Value
C_{soil}	=	contaminant concentration in soil (mg/kg or pCi/g)	Contaminant dependent
IR	=	ingestion rate (mg/day)	50
FI	=	fraction ingested from contaminated source	1
EF	=	exposure frequency (day/year)	250
ED	=	exposure duration (year)	25
CF	=	conversion factor (kg/mg)	
		nonradionuclide	10^{-6}
		radionuclide	10^{-3}
BW	=	body weight (kg)	70
AT	=	averaging time (day)	
		noncarcinogenic	9.13E+03
		carcinogenic	2.55E+04

a. The equation for radionuclides does not include the denominator (BW*AT).

b. The source of the values is DOE-ID (1994).

Table D-24. External exposure intake factor equation for the occupational exposure scenario.[a]

Exposure Factor $= C_{soil} * ET * EF * ED * CF$

		Parameter	Value
C_{soil}	=	Contaminant concentration in soil (pCi/g)	Contaminant dependent
ET	=	Exposure time (hour/day)	8
EF	=	Exposure frequency (day/year)	250
ED	=	Exposure duration (year)	25
CF	=	Conversion factor (year/hour)	1.14×10^{-4}

a. The source of the values is DOE-ID (1994).