APPENDIX A

Generic SSLs

Tables A.1 and A.2 provide generic SSLs for 60 radionuclides in units of pCi/g and mg/kg respectively. These set of generic SSLs are derived using default values in the standardized equations presented in Part 2 of this document. Tables A.3 and A.4 provide a second set of generic SSLs. These were derived using the electronic version of the standardized equations in Part 2 to account for radionuclide decay and ingrowth. The default values (listed in Table A.5) are conservative and are likely to be protective for the majority of site conditions across the nation.

However, the generic SSLs are not necessarily protective of all known human exposure pathways, reasonable land uses, or ecological threats. Thus, before applying generic SSLs at a site, it is extremely important to compare the conceptual site model (see the *User's Guide)* with the assumptions behind the SSLs to ensure that the site conditions and exposure pathways match those used to develop generic SSLs (see Parts 1 and 2 and Table A.5). If this comparison indicates that the site is more complex than the SSL scenario, or that there are significant exposure pathways not accounted for by the SSLs, then generic SSLs are not sufficient for a full evaluation of the site. A more detailed site-specific approach will be necessary to evaluate the additional pathways or site conditions.

Generic SSLs are presented separately for major pathways of concern in both surface and subsurface soils. The pathways include external radiation exposure, inhalation of fugitive dusts, ingestion of homegrown produce, direct ingestion of soil, and migration to ground water.

The last two columns present SSLs for the migration to ground water pathway calculated using two different DAFs (dilution-attenuation factors). The second to last column presents generic SSL values for the migration to ground water pathway developed using a default DAF of 20 to account for natural processes that reduce contaminant concentrations in the subsurface (see Section 2.6.4).

The last column contains the generic SSLs for the migration to ground water pathway developed assuming no dilution or attenuation between the source and the receptor well (i.e, a DAF of 1). These values can be used at sites where little or no dilution or attenuation of soil leachate concentrations is expected at a site (e.g., sites with shallow water tables, fractured media, karst topography, or source size greater than 30 acres).

Generally, if an SSL is not exceeded for a pathway of concern, the user may eliminate the pathway or areas of the site from further investigation. If more than one exposure pathway is of concern, the lowest SSL should be used.

Analysis of Effects of Source Size on Generic SSLs

A large number of commenters on the December 1994 Soil Screening Guidance for chemicals suggested that most contaminated soil sources were 0.5 acre or less. Before changing this default assumption from 30 acres to 0.5 acre, the Office of Emergency and Remedial Response (OERR) conducted an analysis of the effects of changing the area of a chemically-contaminated soil source on generic SSLs calculated for the inhalation and migration to ground water exposure pathways. This analysis includes:

- An analysis of the sensitivity of SSLs to a change in source area from 30 acres to 0.5 acre
- Mass-limit modeling results showing the depth of contamination for a 30-acre source that corresponds to a 0.5-acre SSL

All equations, assumptions, and model input parameters used in this analysis are consistent with those described in Part 2 of the Technical Background Document for chemicals unless otherwise indicated. Chemical properties used in the analysis are described in Part 5 of the Technical Background Document for chemicals.

In summary, the results of this analysis indicate that:

- The SSLs are not particularly sensitive to varying the source area from 30 acres to 0.5 acre. This reduction in source area lowers SSLs for the inhalation pathway by about a factor of 2 and lowers SSLs for the migration to ground water pathway by a factor of 2.9 under typical hydrogeologic conditions.

- Half-acre SSLs calculated for 43 volatile and semivolatile contaminants using the infinite source (i.e., steady-state) models correspond to mass-limit SSLs for a 30-acre source uniformly contaminated to a depth of about 1 to 21 meters (depending on contaminant and pathway); the average depth is 8 meters for the inhalation pathway (21 contaminants) and 11 meters for the migration to ground water pathway (43 contaminants).

Sensitivity Analysis. For the inhalation pathway, source area affects the Q/C value (a measure of dispersion), which directly affects the final SSL and is not chemical-specific. Higher Q/C values result in higher SSLs. As shown in Table 2.4 (Section 2.3.2), the effect of area on the Q/C value is not sensitive to meteorological conditions, with thc ratio of a 0.5-acre Q/C to a 30-acre Q/C ranging from 1.93 to 1.96 over the 29 conditions analyzed. Decreasing the source area from 30 acres to 0.5 acre will therefore increase inhalation SSLs by about a factor of 2.

For the migration to ground water pathway, source area affects the DAF, which also directly affects the final SSLs and is not chemical-specific. The sensitivity analysis for the dilution factor is more complicated than for Q/C because increasing source area (expressed as the length of source parallel to ground water flow) not only increases infiltration to the aquifer, which decreases the dilution factor, but also increases the mixing zone depth, which tends to increase the dilution factor. The first effect generally overrides the second (i.e., longer sources have lower dilution factors) except for very thick aquifers (see Section 2.6.5).

The sensitivity analysis described in Section 2.6.5 shows that the dilution model is most sensitive to the aquifer's Darcy velocity (i.e., hydraulic conductivity x hydraulic gradient). For a less conservative Darcy velocity (90^{th} percentile), decreasing the source area from 30 acres to 0.5 acre increased the dilution factor by a factor of 3.1 (see Table 2.8, Section 2.6.5). For the conditions analyzed, decreasing the source area from 30 acres to 0.5 acre affected dilution factor from no increase to a factor of 4.3 increase. No increase in dilution factor for a 0.5-acre source was observed for the less conservative (higher) aquifer thickness (46 m). In this case the decrease in mixing zone depth balances the decrease in infiltration rate for the smaller source.

Mass-Limit Analysis. The infinite source (i.e., steady-state) assumption is one of the more conservative assumptions inherent in the SSL models, especially for small sources. This assumption should provide adequate protection for sources with larger areas than those used to calculate SSLs. To test this hypothesis the SSL mass-limit models (Section 2.7) were used to calculate, for 43 volatile and semivolatile chemicals, the depth at which a mass-limit SSL for a 30-acre source is equal to a 0.5 acre infinite-source SSL.

The mass limit model is a simple mass-balance model that calculate SSLs based on the conservative assumption that the entire mass of contamination in a source leaches (migration to ground water model) over the exposure period of interest. This model was developed to correct the mass-balance violation in the infinite source (i.e., steady-state) models for highly soluble contaminants.

References

U.S. EPA (Environmental Protection Agency). 1990. *Guidance on Remedial Actions for Sites with PCB Contamination.* Office of Solid Waste and Emergency Response, Washington, DC. NTIS PB91-921206CDH.

U.S. EPA (Environmental Protection Agency). 1994. *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.* Office of Solid Waste and Response, Washington, DC. Directive 9355.4-12.

Table A.1. Generic (no accounting for decay) SSLs for Radionuclides (pCi/g)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure.	Migration to Ground Water	
					20 DAF	1 DAF
Ac-227+D	8.62E-01	6.84E-01	8.69E+01	7.59E-02	— [b]	— [b]
Ag-108m	8.38E-01	4.13E+01	6.80E+05	1.55E-02	3.36E-01[c]	1.68E-02[c]
Ag-110m	6.85E-01	3.35E+01	6.42E+05	8.58E-03	5.22E+00	2.61E-01
Am-241	1.05E+01	3.66E+00	6.46E+02	4.04E+00	2.52E+00	1.26E-01
Am-243+D	9.92E+00	3.42E+00	6.73E+02	1.75E-01	2.52E+00	1.26E-01
Bi-207	1.73E+00	5.33E+01	8.65E+05	1.58E-02	— [b]	— [b]
C-14	1.28E-01	2.84E+02	2.57E+06	1.43E+04	4.00E+01	2.00E+00
Cd-109	7.00E-01	6.96E+01	8.29E+05	1.28E+01	3.48E+01	1.74E+00
Ce-144+D	1.36E+01	7.78E+00	1.65E+05	4.57E-01	2.11E+01	1.06E+00
Cl-36	1.59E-02	1.04E+02	7.26E+05	6.41E+01	— [b]	— [b]
Cm-243	1.14E+01	3.87E+00	6.75E+02	2.66E-01	2.59E+01	1.29E+00
Cm-244	1.30E+01	4.39E+00	7.18E+02	2.30E+03	2.59E+01	1.29E+00
Co-57	1.18E+01	2.86E+02	8.69E+06	3.14E-01	6.00E+00	3.00E-01
Co-60	7.89E-01	1.97E+01	5.07E+05	9.00E-03	6.00E-01	3.00E-02
Cs-134	6.85E-01	1.37E+01	1.10E+06	1.57E-02	1.63E+01	8.16E-01
Cs-135	5.99E+00	1.11E+02	9.76E+06	4.73E+03	1.84E+02	9.18E+00
Cs-137+D	9.41E-01	1.83E+01	1.53E+06	4.38E-02	4.08E+01	2.04E+00
Eu-152	6.47E+01	4.90E+01	2.00E+05	2.11E-02	— [b]	— [b]
Eu-154	3.78E+01	2.78E+01	1.58E+05	1.91E-02	— [b]	— [b]
Eu-155	2.03E+02	1.47E+02	1.23E+06	9.00E-01	— [b]	— [b]
Fe-55	1.21E+03	3.80E+02	2.27E+07	— [a]	1.32E+02	6.60E+00
Gd-153	2.54E+02	1.86E+02	2.77E+06	6.89E-01	— [b]	— [b]
H-3	4.51E+00	8.58E+03	3.23E+08	— [a]	8.00E+01	4.00E+00
I-129	2.19E-01	2.93E+00	2.99E+05	1.83E+01	4.60E-03	2.30E-04
K-40	1.37E-01	1.28E+01	1.76E+06	1.40E-01	— [b]	— [b]
Mn-54	1.51E+00	1.54E+02	3.09E+06	2.87E-02	3.06E+01	1.53E+00
Na-22	2.23E+00	4.03E+01	4.67E+06	1.08E-02	— [b]	— [b]
Nb-94	1.27E+01	3.87E+01	4.82E+05	1.53E-02	— [b]	— [b]
Ni-59	7.24E+01	1.08E+03	3.90E+07	— [a]	2.05E+02	1.03E+01
Ni-63	2.96E+01	4.43E+02	1.11E+07	— [a]	3.42E+01	1.71E+00
Np-237+D	7.74E-01	4.90E+00	1.03E+03	1.40E-01	9.00E-02	4.50E-03
Pa-231	6.23E-01	2.12E+00	3.99E+02	8.03E-01	— [b]	— [b]
Pb-210+D	4.09E-02	2.98E-01	1.31E+03	2.65E+01	6.70E-03	3.35E-04
Pm-147	2.27E+02	1.63E+02	1.13E+06	3.48E+03	— [b]	— [b]
Pu-238	8.33E+00	2.92E+00	5.40E+02	1.55E+03	1.56E+00	7.80E-02
Pu-239	8.09E+00	2.88E+00	5.45E+02	5.58E+02	1.56E+00	7.80E-02
Pu-240	8.09E+00	2.87E+00	5.45E+02	1.60E+03	1.56E+00	7.80E-02
Pu-241	6.18E+02	2.41E+02	5.44E+04	2.72E+04	2.81E+00[c]	1.40E-01[c]
Pu-242	8.53E+00	3.02E+00	5.80E+02	1.79E+03	1.56E+00	7.80E-02
Pu-244+D	7.41E+00	2.53E+00	6.20E+02	7.39E-02	1.56E+00	7.80E-02
Ra-226+D	6.83E-02	1.09E+00	1.57E+03	1.31E-02	3.20E-01	1.60E-02
Ra-228+D	2.46E-02	3.47E-01	3.47E+03	2.46E-02	3.20E-01	1.60E-02
Ru-106+D	7.68E-01	6.67E+00	1.78E+05	1.16E-01	3.12E+00	1.56E-01
Sb-125+D	1.95E+01	6.01E+01	9.41E+05	6.17E-02	— [b]	— [b]
Sm-147	1.18E+01	1.05E+01	2.64E+03	— [a]	— [b]	— [b]
Sm-151	6.98E+02	4.99E+02	3.72E+06	3.10E+05	— [b]	— [b]
Sr-90+D	4.92E-02	5.51E+00	1.61E+05	5.69E+00	1.92E-01	9.60E-03

Table A.1. Generic (no accounting for decay) SSLs for Radionuclides (pCi/g)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure.	Migration to Ground Water	
					20 DAF	1 DAF
Tc-99	7.04E-02	1.04E+02	1.29E+06	1.37E+03	3.73E+00	1.86E-01
Th-228+D	3.34E+00	9.81E-01	1.27E+02	1.44E-02	6.06E+00	3.03E-01
Th-229+D	1.97E+00	6.15E-01	8.07E+01	9.54E-02	6.06E+00	3.03E-01
Th-230	1.18E+01	3.93E+00	6.37E+02	1.36E+02	6.06E+00	3.03E-01
Th-232	1.06E+01	3.44E+00	4.19E+02	3.26E+02	6.06E+00	3.03E-01
Tl-204	8.53E-01	5.15E+01	7.41E+06	4.04E+01	— [b]	— [b]
U-232	1.46E+00	1.38E+00	9.31E+02	1.87E+02	2.40E-01[d]	1.20E-02[d]
U-233	5.81E+00	4.96E+00	1.57E+03	1.14E+02	2.40E-01[d]	1.20E-02[d]
U-234	5.90E+00	5.02E+00	1.59E+03	4.43E+02	2.40E-01[d]	1.20E-02[d]
U-235+D	5.77E+00	4.87E+01	1.80E+03	2.06E-01	2.40E-01[d]	1.20E-02[d]
U-236	6.24E+00	5.33E+00	1.73E+03	8.93E+02	2.40E-01[d]	1.20E-02[d]
U-238+D	4.65E+00	3.78E+00	1.94E+03	9.79E-01	2.40E-01[d]	1.20E-02[d]
Zn-65	2.29E-01	3.24E+01	3.13E+06	3.97E-02	1.80E+00	9.00E-02

— [a] Properties for this radionuclide are such that this pathway is not a concern at any soil concentration.
— [b] SSL cannot be calculated since a default K_d has not been specified for this radionuclide.
— [c] SSL calculated based on risk based limit for this radionuclide.
— [d] SSL calculated based on proposed MCL of 20 pCi/l (activity) for uranium.

Table A.2. Decay Corrected SSLs for Radionuclides (pCi/g)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure	Migration to Ground Water	
					20 DAF	1 DAF
Ac-227+D	1.34E+00	1.06E+00	1.35E+02	1.18E-01	— [b]	— [b]
Ag-108m	9.09E-01	4.48E+01	7.37E+05	1.68E-02	4.0E-01[c]	2.0E-02[c]
Ag-110m	2.08E+01	1.02E+03	1.95E+07	2.61E-01	1.6E+02	7.9E+00
Am-241	1.08E+01	3.75E+00	6.62E+02	4.14E+00	2.6E+00	1.3E-01
Am-243+D	9.93E+00	3.43E+00	6.74E+02	1.76E-01	2.5E+00	1.3E-01
Bi-207	2.25E+00	6.92E+01	1.12E+06	2.05E-02	— [b]	— [b]
C-14	1.28E-01	2.85E+02	2.57E+06	1.43E+04	4.0E+01	2.0E+00
Cd-109	1.15E+01	1.14E+03	1.36E+07	2.09E+02	5.7E+02	2.8E+01
Ce-144+D	3.62E+02	2.08E+02	4.41E+06	1.22E+01	5.6E+02	2.8E+01
Cl-36	1.59E-02	1.04E+02	7.26E+05	6.41E+01	— [b]	— [b]
Cm-243	1.61E+01	5.45E+00	9.51E+02	3.75E-01	3.6E+01	1.8E+00
Cm-244	2.19E+01	7.38E+00	1.21E+03	3.87E+03	4.3E+01	2.2E+00
Co-57	3.31E+02	7.99E+03	2.43E+08	8.80E+00	1.7E+01	8.4E+00
Co-60	3.17E+00	7.92E+01	2.04E+06	3.62E-02	2.4E+00	1.2E-01
Cs-134	6.91E+00	1.38E+02	1.11E+07	1.59E-01	1.6E+02	8.2E+00
Cs-135	5.99E+00	1.11E+02	9.76E+06	4.73E+03	1.8E+02	9.2E+00
Cs-137+D	1.30E+00	2.54E+01	2.12E+06	6.07E-02	5.7E+01	2.8E+00
Eu-152	1.28E+02	9.69E+01	3.95E+05	4.16E-02	— [b]	— [b]
Eu-154	9.86E+01	7.26E+01	4.12E+05	4.99E-02	— [b]	— [b]
Eu-155	8.65E+02	6.26E+02	5.22E+06	3.83E+00	— [b]	— [b]
Fe-55	9.35E+03	2.93E+03	1.75E+08	— [a]	1.0E+03	5.1E+01
Gd-153	7.96E+03	5.84E+03	8.69E+07	2.16E+01	— [b]	— [b]
H-3	9.29E+00	1.77E+04	6.66E+08	— [a]	1.6E+02	8.2E+00
I-129	2.19E-01	2.93E+00	2.99E+05	1.83E+01	4.6E-03	2.3E-04
K-40	1.37E-01	1.28E+01	1.76E+06	1.40E-01	— [b]	— [b]
Mn-54	3.67E+01	3.76E+03	7.51E+07	6.98E-01	7.4E+02	3.7E+01
Na-22	1.79E+01	3.22E+02	3.73E+07	8.67E-02	— [b]	— [b]
Nb-94	1.27E+01	3.87E+01	4.82E+05	1.53E-02	— [b]	— [b]
Ni-59	7.24E+01	1.08E+03	3.90E+07	— [a]	2.1E+02	1.0E+01
Ni-63	3.29E+01	4.93E+02	1.23E+07	— [a]	3.8E+01	1.9E+00
Np-237+D	7.74E-01	4.90E+00	1.03E+03	1.40E-01	9.0E-02	4.5E-03
Pa-231	6.23E-01	2.12E+00	3.99E+02	8.03E-01	— [b]	— [b]
Pb-210+D	6.29E-02	4.59E-01	2.01E+03	4.08E+01	1.1E-02	5.5E-04
Pm-147	1.80E+03	1.29E+03	8.95E+06	2.76E+04	— [b]	— [b]
Pu-238	9.36E+00	3.28E+00	6.07E+02	1.74E+03	1.8E+00	8.8E-02
Pu-239	8.10E+00	2.88E+00	5.46E+02	5.58E+02	1.6E+00	7.8E-02
Pu-240	8.10E+00	2.87E+00	5.46E+02	1.60E+03	1.6E+00	7.8E-02
Pu-241	1.17E+03	4.56E+02	1.03E+05	5.13E+04	1.0E+01[c]	5.0E-01[c]
Pu-242	8.53E+00	3.02E+00	5.80E+02	1.79E+03	1.6E+00	7.8E-02
Pu-244+D	7.41E+00	2.53E+00	6.20E+02	7.39E-02	1.6E+00	7.8E-02
Ra-226+D	6.88E-02	1.09E+00	1.58E+03	1.32E-02	3.2E-01	1.6E-02
Ra-228+D	9.15E-02	1.29E+00	1.29E+04	9.15E-02	1.2E+00	5.9E-02
Ru-106+D	1.60E+01	1.39E+02	3.70E+06	2.40E+00	6.4E+01	3.2E+00
Sb-125+D	1.47E+02	4.52E+02	7.07E+06	4.63E-01	— [b]	— [b]
Sm-147	1.18E+01	1.05E+01	2.64E+03	— [a]	— [b]	— [b]
Sm-151	7.82E+02	5.59E+02	4.17E+06	3.47E+05	— [b]	— [b]
Sr-90+D	6.89E-02	7.71E+00	2.25E+05	7.97E+00	2.7E-01	1.3E-02
Tc-99	7.04E-02	1.04E+02	1.29E+06	1.37E+03	3.7E+00	1.9E-01
Th-228+D	3.63E+01	1.07E+01	1.38E+03	1.57E-01	6.6E+01	3.3E+00

Table A.2. Decay Corrected SSLs for Radionuclides (pCi/g)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure	Migration to Ground Water	
					20 DAF	1 DAF
Th-229+D	1.97E+00	6.16E-01	8.08E+01	9.55E-02	6.1E+00	3.0E-01
Th-230	1.18E+01	3.93E+00	6.37E+02	1.36E+02	6.1E+00	3.0E-01
Th-232	1.06E+01	3.44E+00	4.19E+02	3.26E+02	6.1E+00	3.0E-01
Tl-204	4.71E+00	2.85E+02	4.09E+07	2.23E+02	— [b]	— [b]
U-232	1.68E+00	1.59E+00	1.07E+03	2.15E+02	2.8E-01[d]	1.4E-02[d]
U-233	5.81E+00	4.96E+00	1.57E+03	1.14E+02	2.4E-01[d]	1.2E-02[d]
U-234	5.90E+00	5.02E+00	1.59E+03	4.43E+02	2.4E-01[d]	1.2E-02[d]
U-235+D	5.77E+00	4.87E+01	1.80E+03	2.06E-01	2.4E-01[d]	1.2E-02[d]
U-236	6.24E+00	5.33E+00	1.73E+03	8.93E+02	2.4E-01[d]	1.2E-02[d]
U-238+D	4.65E+00	3.78E+00	1.94E+03	9.79E-01	2.4E-01[d]	1.2E-02[d]
Zn-65	7.11E+00	1.01E+03	9.72E+07	1.24E+00	5.6E+01	2.8E+00

— [a] Properties for this radionuclide are such that this pathway is not a concern at any soil concentration.
— [b] SSL cannot be calculated since a default K_d has not been specified for this radionuclide.
— [c] SSL calculated based on risk based limit for this radionuclide.
— [d] SSL calculated based on proposed MCL of 20 pCi/l (activity) for uranium.

Table A.3. Generic (no accounting for decay) SSLs for Radionuclides (mg/kg)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure.	Migration to Ground Water	
					20 DAF	1 DAF
Ac-227+D *	1.20E-08	9.48E-09	1.20E-06	1.05E-09	— [b]	— [b]
Ag-108m *	3.22E-08	1.59E-06	2.61E-02	5.96E-10	1.28E-08[c]	6.38E-10[c]
Ag-110m *	1.45E-10	7.07E-09	1.35E-04	1.81E-12	1.10E-09	5.51E-11
Am-241	3.06E-06	1.07E-06	1.88E-04	1.18E-06	7.39E-07	3.70E-08
Am-243+D *	4.98E-05	1.72E-05	3.38E-03	8.81E-07	1.26E-05	6.30E-07
Bi-207	3.81E-08	1.17E-06	1.90E-02	3.47E-10	— [b]	— [b]
C-14	2.86E-08	6.36E-05	5.74E-01	3.18E-03	9.00E-06	4.50E-07
Cd-109	2.72E-10	2.70E-08	3.22E-04	4.96E-09	1.33E-08	6.67E-10
Ce-144+D *	4.26E-09	2.44E-09	5.18E-05	1.43E-10	6.41E-09	3.20E-10
Cl-36	4.81E-07	3.14E-03	2.20E+01	1.95E-03	— [b]	— [b]
Cm-243	2.22E-07	7.51E-08	1.31E-05	5.16E-09	5.00E-07	2.50E-08
Cm-244	1.61E-07	5.42E-08	8.88E-06	2.85E-05	3.28E-07	1.64E-08
Co-57	1.40E-09	3.38E-08	1.03E-03	3.73E-11	7.20E-10	3.60E-11
Co-60	6.99E-10	1.74E-08	4.49E-04	7.97E-12	5.34E-10	2.67E-11
Cs-134	5.29E-10	1.06E-08	8.51E-04	1.21E-11	1.26E+14	6.32E+12
Cs-135	5.20E-03	9.61E-02	8.49E+03	4.11E+00	1.59E-01	7.96E-03
Cs-137+D *	1.08E-08	2.11E-07	1.76E-02	5.04E-10	4.69E-07	2.35E-08
Eu-152	3.66E-07	2.77E-07	1.13E-03	1.19E-10	— [b]	— [b]
Eu-154	1.43E-07	1.06E-07	5.99E-04	7.26E-11	— [b]	— [b]
Eu-155	4.38E-07	3.16E-07	2.64E-03	1.94E-09	— [b]	— [b]
Fe-55	5.05E-07	1.58E-07	9.45E-03	— [a]	5.48E+12	2.74E+11
Gd-153	7.21E-08	5.29E-08	7.87E-04	1.96E-10	— [b]	— [b]
H-3	4.69E-10	8.94E-07	3.37E-02	— [a]	8.40E-09	4.20E-10
I-129	1.24E-03	1.66E-02	1.70E+03	1.04E-01	2.28E-05	1.31E-06
K-40	1.96E-02	1.84E+00	2.53E+05	2.01E-02	— [b]	— [b]
Mn-54	1.95E-10	2.00E-08	3.99E-04	3.71E-12	3.98E-09	1.99E-10
Na-22	3.58E-10	6.45E-09	7.48E-04	1.74E-12	— [b]	— [b]
Nb-94	6.78E-05	2.07E-04	2.57E+00	8.18E-08	— [b]	— [b]
Ni-59	8.97E-04	1.34E-02	4.83E+02	— [a]	2.53E-03	1.27E-04
Ni-63	5.01E-07	7.51E-06	1.88E-01	— [a]	5.81E-07	2.91E-08
Np-237+D *	1.10E-03	6.96E-03	1.46E+00	1.99E-04	1.26E-04	6.30E-06
Pa-231	1.32E-05	4.50E-05	8.47E-03	1.70E-05	— [b]	— [b]
Pb-210+D *	5.37E-10	3.91E-09	1.71E-05	3.48E-07	8.80E-11	4.40E-12
Pm-147	2.45E-07	1.75E-07	1.22E-03	3.75E-06	— [b]	— [b]
Pu-238	4.87E-07	1.71E-07	3.16E-05	9.03E-05	9.15E-08	4.58E-09
Pu-239	1.31E-04	4.64E-05	8.80E-03	9.00E-03	2.50E-05	1.25E-06
Pu-240	3.56E-05	1.26E-05	2.40E-03	7.03E-03	6.86E-06	3.43E-07
Pu-241	6.00E-06	2.34E-06	5.28E-04	2.64E-04	2.70E-08[c]	1.35E-09[c]
Pu-242	2.17E-03	7.69E-04	1.48E-01	4.55E-01	3.95E-04	1.98E-05
Pu-244+D*	4.18E-01	1.43E-01	3.50E+01	4.17E-03	8.84E-02	4.42E-03
Ra-226+D*	6.92E-08	1.10E-06	1.59E-03	1.33E-08	3.26E-07	1.63E-08

Table A.3. Generic (no accounting for decay) SSLs for Radionuclides (mg/kg)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure.	Migration to Ground Water	
					20 DAF	1 DAF
Ra-228+D*	9.04E-11	1.27E-09	1.27E-05	9.04E-11	1.15E-09	5.76E-11
Ru-106+D*	2.28E-10	1.98E-09	5.28E-05	3.43E-11	9.36E-10	4.68E-11
Sb-125+D*	1.89E-08	5.83E-08	9.12E-04	5.98E-11	— [b]	— [b]
Sm-147	5.15E+02	4.56E+02	1.15E+05	— [a]	— [b]	— [b]
Sm-151	2.66E-05	1.90E-05	1.42E-01	1.18E-02	— [b]	— [b]
Sr-90+D*	3.61E-10	4.04E-08	1.18E-03	4.18E-08	1.42E-09	7.08E-11
Tc-99	4.16E-06	6.12E-03	7.60E+01	8.09E-02	2.19E-04	1.10E-05
Th-228+D*	4.07E-09	1.20E-09	1.55E-07	1.75E-11	7.27E-09	3.64E-10
Th-229+D*	9.26E-06	2.90E-06	3.80E-04	4.49E-07	2.87E-05	1.43E-06
Th-230	5.87E-04	1.95E-04	3.16E-02	6.76E-03	2.99E-04	1.49E-05
Th-232	9.70E+01	3.15E+01	3.84E+03	2.99E+03	5.66E+01	2.83E+00
Tl-204	1.84E-09	1.11E-07	1.60E-02	8.73E-08	— [b]	— [b]
U-232	6.84E-08	6.47E-08	4.36E-05	8.73E-06	1.13E-08[d]	5.64E-10[d]
U-233	6.03E-04	5.15E-04	1.62E-01	1.18E-02	2.52E-05[d]	1.26E-06[d]
U-234	9.47E-04	8.06E-04	2.56E-01	7.11E-02	3.84E-05[d]	1.92E-06[d]
U-235+D*	2.67E+00	2.26E+01	8.33E+02	9.52E-02	1.12E-01[d]	5.58E-03[d]
U-236	9.64E-02	8.24E-02	2.67E+01	1.38E+01	3.72E-03[d]	1.86E-04[d]
U-238+D*	1.39E+01	1.13E+01	5.79E+03	2.92E+00	7.20E-01[d]	3.60E-02[d]
uranium					2.40E-01[e]	1.20E-02[e]
Zn-65	2.78E-11	3.94E-09	3.80E-04	4.83E-12	2.16E-10	1.08E-11

*Note: The "+D" weight based concentrations only account for the concentration of the first isotope in a series and does not represent the total radioactivity.

— [a] Properties for this radionuclide are such that this pathway is not a concern at any soil concentration.

— [b] SSL cannot be calculated since a default K_d has not been specified for this radionuclide.

— [c] SSL calculated based on risk based limit for this radionuclide.

— [d] SSL calculated based on proposed MCL of 20 pCi/l (activity) for uranium.

— [e] SSL calculated based on proposed MCL of 20 ug/l (mass) for uranium.

Table A.4. Decay Corrected SSLs for Radionuclides (mg/kg)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure	Migration to Groundwater	
					20 DAF	1 DAF
Ac-227+D *	1.85E-08	1.47E-08	1.87E-06	1.63E-09	— [b]	— [b]
Ag-108m *	3.49E-08	1.72E-06	2.83E-02	6.46E-10	1.4E-08[c]	7.1E-10[c]
Ag-110m *	4.39E-09	2.14E-07	4.11E-03	5.50E-11	1.1E-09	5.5E-11
Am-241	3.14E-06	1.09E-06	1.93E-04	1.21E-06	7.4E-07	3.7E-08
Am-243+D *	4.99E-05	1.72E-05	3.38E-03	8.82E-07	1.3E-05	6.3E-07
Bi-207	4.95E-08	1.52E-06	2.47E-02	4.51E-10	— [b]	— [b]
C-14	2.87E-08	6.37E-05	5.75E-01	3.19E-03	9.0E-06	4.5E-07
Cd-109	4.44E-09	4.42E-07	5.26E-03	8.11E-08	1.3E-08	6.7E-10
Ce-144+D *	1.14E-07	6.52E-08	1.38E-03	3.83E-09	6.4E-09	3.2E-10
Cl-36	4.81E-07	3.14E-03	2.20E+01	1.95E-03	— [b]	— [b]
Cm-243	3.13E-07	1.06E-07	1.84E-05	7.28E-09	5.0E-07	2.5E-08
Cm-244	2.71E-07	9.12E-08	1.49E-05	4.79E-05	3.3E-07	1.6E-08
Co-57	3.92E-08	9.47E-07	2.88E-02	1.04E-09	7.2E-10	3.6E-11
Co-60	2.81E-09	7.01E-08	1.81E-03	3.21E-11	5.3E-10	2.7E-11
Cs-134	5.34E-09	1.07E-07	8.59E-03	1.23E-10	1.3E-08	6.3E-10
Cs-135	5.20E-03	9.61E-02	8.49E+03	4.11E+00	1.6E-01	8.0E-03
Cs-137+D *	1.50E-08	2.92E-07	2.43E-02	6.98E-10	4.7E-07	2.3E-08
Eu-152	7.25E-07	5.48E-07	2.23E-03	2.36E-10	— [b]	— [b]
Eu-154	3.74E-07	2.76E-07	1.56E-03	1.89E-10	— [b]	— [b]
Eu-155	1.86E-06	1.35E-06	1.12E-02	8.25E-09	— [b]	— [b]
Fe-55	3.89E-06	1.22E-06	7.28E-02	— [a]	5.5E-08	2.7E-09
Gd-153	2.26E-06	1.66E-06	2.47E-02	6.14E-09	— [b]	— [b]
H-3	9.68E-10	1.84E-06	6.94E-02	— [a]	8.4E-09	4.2E-10
I-129	1.24E-03	1.66E-02	1.70E+03	1.04E-01	2.6E-05	1.3E-06
K-40	1.96E-02	1.84E+00	2.53E+05	2.01E-02	— [b]	— [b]
Mn-54	4.74E-09	4.85E-07	9.71E-03	9.02E-11	4.0E-09	2.0E-10
Na-22	2.86E-09	5.16E-08	5.98E-03	1.39E-11	— [b]	— [b]
Nb-94	6.78E-05	2.07E-04	2.58E+00	8.18E-08	— [b]	— [b]
Ni-59	8.97E-04	1.34E-02	4.83E+02	— [a]	2.5E-03	1.3E-04
Ni-63	5.58E-07	8.35E-06	2.09E-01	— [a]	5.8E-07	2.9E-08
Np-237+D *	1.10E-03	6.96E-03	1.46E+00	1.99E-04	1.3E-04	6.3E-06
Pa-231	1.32E-05	4.50E-05	8.47E-03	1.70E-05	— [b]	— [b]
Pb-210+D *	8.25E-10	6.02E-09	2.63E-05	5.34E-07	9.4E-11	4.7E-12
Pm-147	1.94E-06	1.39E-06	9.66E-03	2.98E-05	— [b]	— [b]
Pu-238	5.47E-07	1.92E-07	3.55E-05	1.01E-04	9.2E-08	4.6E-09
Pu-239	1.31E-04	4.64E-05	8.80E-03	9.00E-03	2.5E-05	1.2E-06
Pu-240	3.56E-05	1.26E-05	2.40E-03	7.04E-03	6.9E-06	3.4E-07
Pu-241	1.13E-05	4.43E-06	9.98E-04	4.99E-04	5.2E-08[c]	2.6E-09[c]
Pu-242	2.17E-03	7.69E-04	1.48E-01	4.55E-01	4.0E-04	2.0E-05
Pu-244+D*	4.18E-01	1.43E-01	3.50E+01	4.17E-03	8.8E-02	4.4E-03
Ra-226+D*	6.97E-08	1.11E-06	1.60E-03	1.34E-08	3.3E-07	1.6E-08

Table A.4. Decay Corrected SSLs for Radionuclides (mg/kg)

Radionuclide	Ingestion of Homegrown Produce	Direct Ingestion of Soil	Inhalation of Fugitive Dusts	External Radiation Exposure	Migration to Groundwater	
					20 DAF	1 DAF
Ra-228+D*	3.36E-10	4.73E-09	4.74E-05	3.36E-10	1.2E-09	5.8E-11
Ru-106+D*	4.74E-09	4.12E-08	1.10E-03	7.13E-10	9.4E-10	4.7E-11
Sb-125+D*	1.42E-07	4.38E-07	6.85E-03	4.49E-10	— [b]	— [b]
Sm-147	5.15E+02	4.56E+02	1.15E+05	— [a]	— [b]	— [b]
Sm-151	2.97E-05	2.13E-05	1.59E-01	1.32E-02	— [b]	— [b]
Sr-90+D*	5.05E-10	5.66E-08	1.65E-03	5.84E-08	1.4E-09	7.1E-11
Tc-99	4.16E-06	6.12E-03	7.60E+01	8.10E-02	2.2E-04	1.1E-05
Th-228+D*	4.43E-08	1.30E-08	1.69E-06	1.91E-10	7.3E-09	3.6E-10
Th-229+D*	9.27E-06	2.90E-06	3.80E-04	4.50E-07	2.9E-05	1.4E-06
Th-230	5.87E-04	1.95E-04	3.16E-02	6.76E-03	3.0E-04	1.5E-05
Th-232	9.70E+01	3.15E+01	3.84E+03	2.99E+03	5.7E+01	2.8E+00
Tl-204	1.02E-08	6.15E-07	8.84E-02	4.82E-07	— [b]	— [b]
U-232	7.88E-08	7.45E-08	5.01E-05	1.00E-05	1.1E-08[d]	5.6E-06[d]
U-233	6.03E-04	5.15E-04	1.62E-01	1.18E-02	2.5E-05[d]	1.2E-06[d]
U-234	9.47E-04	8.06E-04	2.56E-01	7.11E-02	3.9E-05[d]	1.9E-03[d]
U-235+D*	2.67E+00	2.26E+01	8.33E+02	9.52E-02	1.1E-08[d]	5.6E-03[d]
U-236	9.64E-02	8.24E-02	2.67E+01	1.38E+01	3.7E-03[d]	1.9E-04[d]
U-238+D*	1.39E+01	1.13E+01	5.79E+03	2.92E+00	7.1E-01[d]	3.6E-02[d]
Zn-65	8.65E-10	1.23E-07	1.18E-02	1.50E-10	2.2E-10	1.1E-11

*Note: The "+D" weight based concentrations only account for the concentration of the first isotope in a series and does not represent the total radioactivity.

— [a] Properties for this radionuclide are such that this pathway is not a concern at any soil concentration.

— [b] SSL cannot be calculated since a default K_d has not been specified for this radionuclide.

— [c] SSL calculated based on risk based limit for this radionuclide.

— [d] SSL calculated based on proposed MCL of 20 pCi/l (activity) for uranium.

— [e] SSL calculated based on proposed MCL of 20 ug/l (mass) for uranium

Table A.5. Generic SSLs: Default Parameters and Assumptions

Parameter	SSL Pathway: External Radiation Exposure	SSL Pathway: Inhalation of Fugitive Dust	SSL Pathway: Ingestion of Homegrown Produce	SSL Pathway: Migration to Ground Water	Default
Source Characteristics					
Continuous vegetative cover		●			50 percent
Roughness height		❍			0.5 cm for open terrain; used to derive $U_{t,7}$
Source area (A)	❍	●	●	❍	0.5 acres (2,024 m^2); used to derive ACF for EXT, CPF for IHP, and L for MTG,
Source length (L)				●	45 m (assumes square source)
Source depth	❍		❍	❍	Extends to water table (i.e., no attenuation in unsaturated zone) for MTG
Soil Characteristics					
Soil texture		❍		❍	Loam; defines soil characteristics/parameters
Dry soil bulk density (ρ_b)	❍	●		●	1.5 kg/L, used to calculate ACF for EXT
Soil porosity (n)		●		❍	0.43
Vol. soil water content (θ_w)		●		●	0.15 (INH); 0.30 (MTG)
Soil pH				❍	6.8; used to determine pH-specific K_d
Mode soil aggregate size		❍			0.5 mm; used to derive $U_{t,7}$
Threshold windspeed @ 7m ($U_{t,7}$)		●			11.32 m/s
Meteorological Data					
Mean annual windspeed (U_m)		●			4.69 m/s (Minneapolis, MN)
Air dispersion factor (Q/C)		●			90^{th} percentile conterminous U.S.
Fugitive particulate Q/C		●			90.801; Minneapolis, MN; 0.5-acre source
Hydrogeologic Characteristics (DAF)					
Hydrogeologic setting				❍	Generic (national); surficial aquifer
Dilution/attenuation factor (DAF)				●	20

● Indicates parameters used in the SSL equations.
❍ Indicates parameters/assumptions needed to estimate SSL equation parameters.
EXT = External radiation exposure
INH = Inhalation pathway
IHP = Ingestion of homegrown produce
MTG = Migration to ground water pathway