Appendix A

Remedial Action Objective Criteria

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A.1 PURPOSE

The purpose of this appendix is to define the allowable waste soil constituent concentrations (i.e., criteria) based on the Remedial Action Objectives (RAOs) defined in the *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE—ID 1999) hereinafter referred to as the ROD. These criteria will be compared with other concentration-based criteria to support the ultimate waste acceptance criteria (WAC) definition.

A.2 REQUIREMENTS OR GIVENS

A.2.1 Design Inventory

The design inventory constituents and associated site-specific concentrations are published in the *INEEL CERCLA Disposal Facility Design Inventory* (EDF-ER-264). All constituents identified in the design inventory will be considered in this evaluation. The design inventory concentrations (C_{DI}) provide the starting point for evaluating the RAOs and determining acceptable concentrations.

A.2.2 Remedial Action Objective

The RAO provides the basis for calculating the required concentrationbased criteria. The RAOs specific to the INEEL CERCLA Disposal Facility is stated in the Operable Unit 3-13 ROD (DOE-ID 1999, page 8-2) as:

> *"Maintain caps placed over contaminated soil or debris areas that are contained in place and the closed ICDF-complex, to prevent the release of leachate to underlying groundwater which would result in exceeding a cumulative carcinogenic risk of 1E-4, a total HI of 1; or applicable State of Idaho groundwater quality standards (i.e., MCLs) in the SRPA."*

This RAO provides the basis for developing three criteria:

- Cumulative excess lifetime carcinogenic risk (ELCR) in groundwater of 1E-4,
- Total non-carcinogenic hazard index (HI) in groundwater of 1, and
- Achieving the maximum contaminant levels (MCLs) in groundwater (e.g., individual constituents, total alpha of 15 pCi/L).

A.2.3 Design Inventory Evaluation

The analysis of the design inventory constituents and concentrations over time is performed in conjunction with the fate and transport modeling. The results of this evaluation indicate that the RAOs are not exceeded in the 1.0E + 06 year simulation period. A detailed discussion of the method and approach of this evaluation is provided in the modeling document (EDF-ER-274).

A.3 METHODOLOGY & IMPLEMENTATION

Since the fate and transport modeling indicates that the C_{DI} is well within acceptable limits, constituent concentrations are adjusted to maximize WAC limits. The purpose of these adjustments is to increase the concentrations such that the RAOs are approached, but not exceeded. The initial concentration adjustments are based on an overall increase in C_{DI} concentrations. These concentration adjustments were to add a margin of safety between the design inventory and WAC limits. Appendix F presents a table summarizing the actual comparison between the design inventory and WAC limits.

The initial adjustments are based on the following rationale, in order of the application:

- Initially, all constituents are reviewed to determine if there are risk factors or MCL elements that warrant setting a RAO limit. If none are identified, the criteria adjusted value is set to "No Limit" and the basis is explained as "No Limits."

- Background is included in the evaluation for constituents with background concentrations. When the background concentration exceeds the C_{DI}, the value is adjusted to 10 × Background and the basis is explained as "10 × Background." The existing background concentrations in the SRPA were also reviewed and combined with predicted peak groundwater concentrations (at the design infiltration rate of 0.0001 m/yr) and compared to the MCL.

- The 10 × value is consistent with the Remedial Investigation/Baseline Risk Assessment for WAG 3 at the INEEL. This approach eliminates contaminants as a concern if the exposure point concentration was less than 10 X the background value.

- Constituents with a C_{DI} less than 1.0E-10, including those with a concentration of zero, are assigned a minimum adjusted concentration of 1.0E-10 irrespective of units and basis is explained as "Minimum Concentration."

- All other C_{DI}s are increased by three orders of magnitude (i.e., a factor of 1,000) and basis is explained as "Cumulative Groundwater RBC."

- All constituents that are less than the maximum concentration detected in historical data are modified to exceed the concentration and basis is explained as "Adjusted to exceed maximum concentrations."

These initial concentration adjustments result in three specific types of exceedence. These specific areas, and the primary contributor(s), include the following:

- An unacceptable HI due to 2-, 3-, and 4-Nitroanilines.

- An unacceptable ELCR due to I-129.

- An unacceptable MCL comparison, specific to the beta particles and photon emitters criterion, due to I129.

The constituent concentrations for the primary contributors are adjusted downward until all RAOs reach acceptable limits. The resultant evaluation provides RAO-based criteria that are protective. Representative adjusted RAO curves are provided in Figures A-1 through A-3.

The existing background concentrations in the SRPA were reviewed and combined with predicted peak groundwater concentrations (at the design infiltration rate of .0001 m/yr). The combined concentration was then compared against the primary MCL to verify that no exceedence of MCL would occur. Results indicate that combined concentrations do not exceed the primary MCL values, as shown in Table A-1.

Table A-1. Comparison of ICDF contribution to SRPA at design recharge rate (0.0001 m/yr).

Constituent	SRPA Background Mean Concentration in Groundwater[a] µg/L	mg/L	MCL Concentration[b] mg/L	Background as Fraction of MCL	WAC Guide Soil Concentration[c] mg/kg	Predicted Peak Groundwater Concentration[d] mg/L	Combined Concentration[e] mg/L	Combine Concentrat as Fraction MCL[f]
Arsenic	1.9	1.9E-03	5.0E-02	0.04	5.8E+01	4.1E-03	6.0E-03	0.12
Barium	66	6.6E-02	2.0E+00	0.03	3.0E+03	2.4E-03	6.8E-02	0.03
Cadmium	<1	1.0E-03	5.0E-03	0.20	3.6E+03	3.4E-03	4.4E-03	0.88
Chromium	12	1.2E-02	1.0E-01	0.12	4.1E+04	3.6E-02	4.8E-02	0.48
Lead	<5	5.0E-03	1.5E-02	0.33	5.8E+04	3.5E-03	8.5E-03	0.57
Mercury	<0.1	1.0E-04	2.0E-03	0.05	9.5E+03	4.6E-04	5.6E-04	0.28
Selenium	1.1	1.1E-03	5.0E-02	0.02	8.5E+02	8.0E-04	1.9E-03	0.04
Silver	1	1.0E-03	NL	NL	9.8E+03	8.0E-04	1.8E-03	NL
Fluoride	0.3	3.0E-04	4.0E+00	0.00	3.9E+03	5.3E-01	5.3E-01	0.13
Nitrate (as NO_3^-)[g]	8.1	8.1E-03	4.4E+01	0.00	3.9E+03	5.3E-01	5.4E-01	0.01

a. Based on existing INEEL background groundwater data (DOE/ID-22094); < (less than) values are converted to mg/L assuming th value stated.

b. MCL Concentration from EPA at www.epa.gov/safewater/mcl.html. NL indicates no primary MCL established. Secondary MCL were not assessed.

c. From Table A-2

d. Peak groundwater concentration using WAC Guide Soil concentration as modeled in this Appendix.

e. Combined value adds the predicted peak groundwater concentration at WAC Guide waste soil concentration and SRPA Backgrou Mean Concentrations.

f. Comparison of the combined value against the MCL value. Presented as a fraction of the applicable MCL value.

g. The nitrate (measured as Nitrogen) background value is 1.86 µg/L. This is converted to Nitrate (as Nitrate), based on previous calculations, as follows:
Nitrate (as N) / % Nitrogen in Nitrate = Nitrate (as Nitrate) – or – 1.86 µg/L / .23 = 8.1 µg/L

A final check is made against the detection limit for the radionuclides. Because the radionuclides in the design inventory were calculated based on a Cesium 137 level, very small concentrations are calculated which are well below typical laboratory detection limits. The detection limit value used for screening all constituents was 1 pCi/g. When the 1pCi/g detection limit exceeds the adjusted value, the value is eliminated from the WAC limits and is explained as "Below Detection Limit." However, if a constituent was detected in the historical data, the constituent was retained. All of these constituents were used in determining the cumulative risk values, but these constituents will be tracked in the WAC by the Cesium-137 concentration. If Cs-137 is below the WAC limit, then all of these radionuclides with very small concentrations will also be within their respective limits. A list of these constituents with very small concentrations are included in Table A-1.

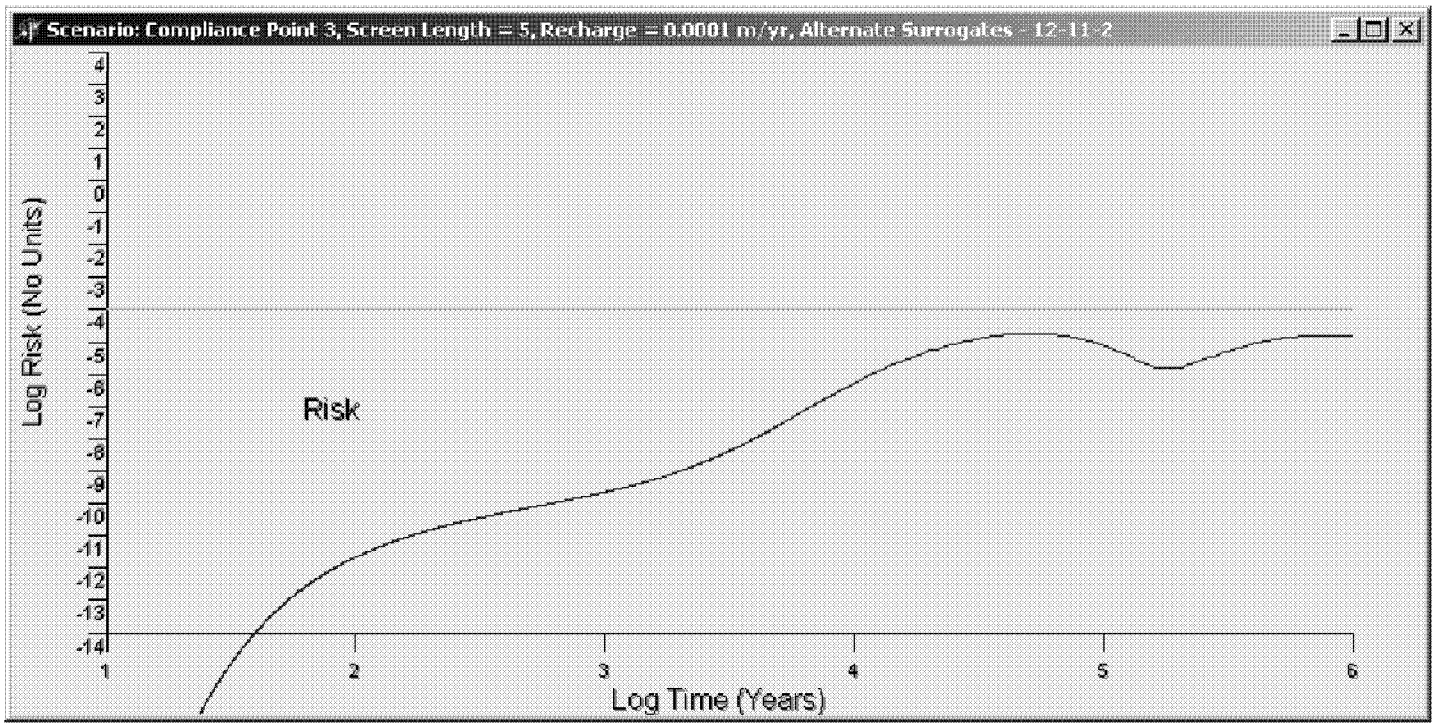

Figure A-1. Adjusted excess lifetime cancer risk curve.

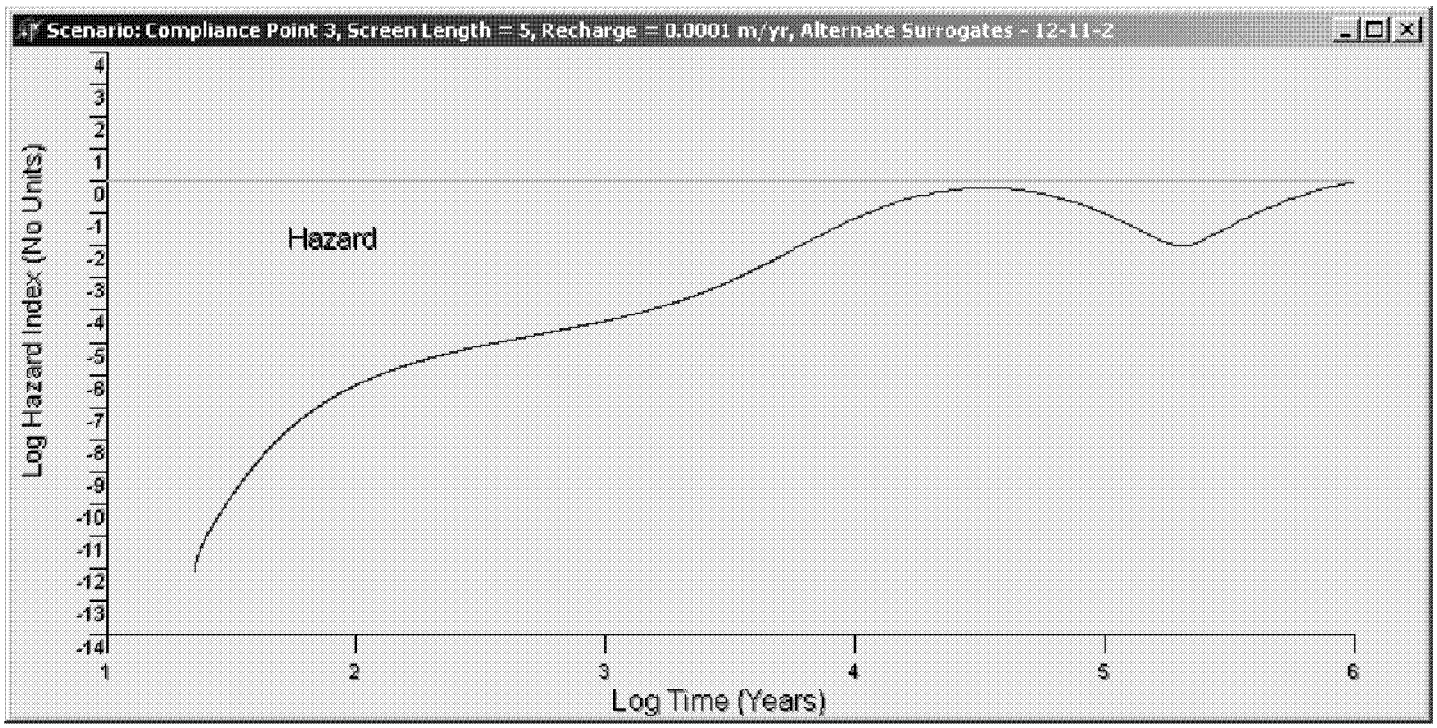

Figure A-2. Adjusted hazard index curve.

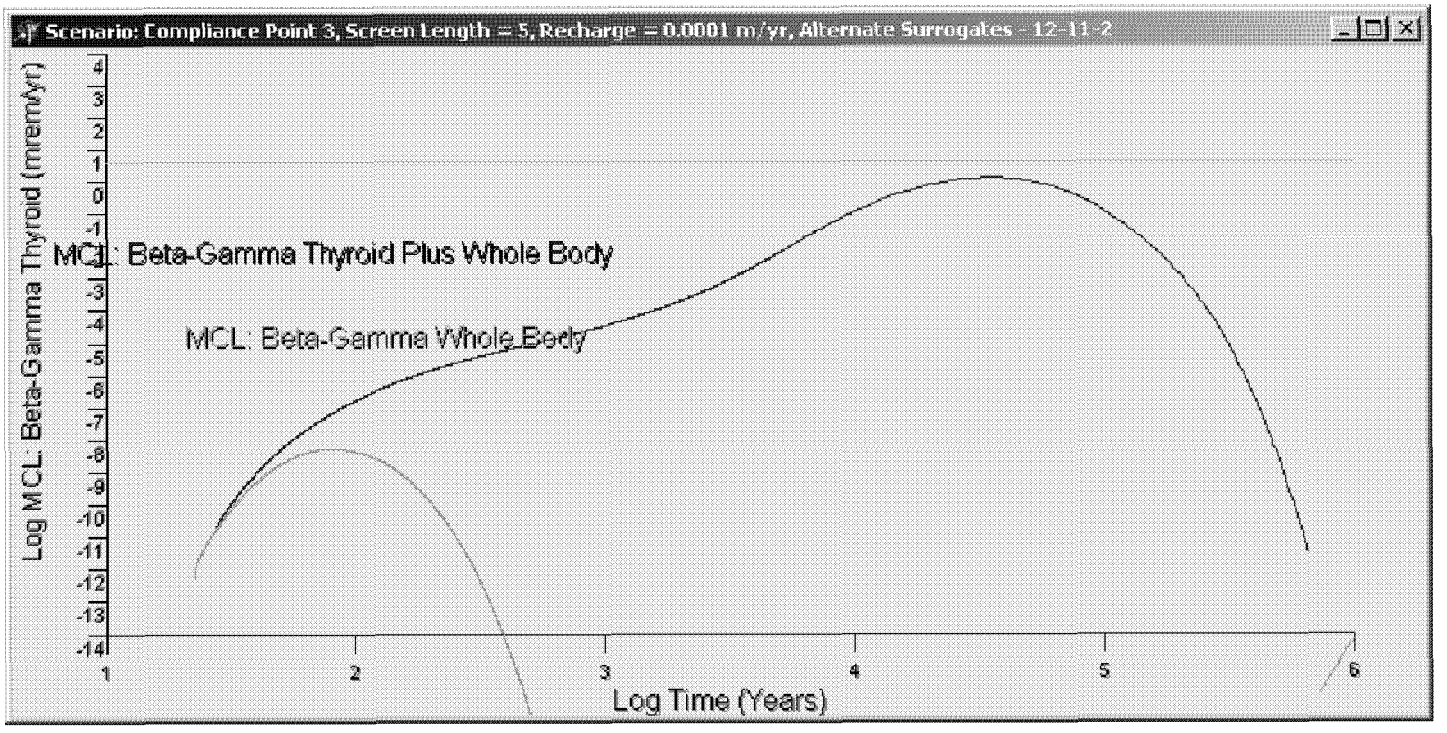

Figure A-3. Adjusted maximum contaminant level—beta and photon emitter curve for thyroid and total body.

A.4 CONCLUSIONS

The allowable concentrations of constituents in the waste soil that will be placed in the INEEL CERCLA Disposal Facility (ICDF) were calculated in order to be protective of groundwater. These selected allowable waste soil concentrations are shown in Table A-1. The C_{DI} and basis for adjustment are included in the table.

Table A-2. Selected allowable waste soil concentrations based on RAOs.

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Ac225	Rad	5.12E-05	5.12E-02	Below Detection Limit
Ac227	Rad	2.04E-02	2.04E+01	Below Detection Limit
Ac228	Rad	1.52E-07	1.52E-04	Below Detection Limit
Ag106	Rad	0.00E+00	1.00E-10	Below Detection Limit
Ag108	Rad	3.69E-06	No Limit	Below Detection Limit
Ag108m	Rad	8.00E+02	8.00E+05	Cumulative Groundwater
Ag109m	Rad	4.92E-09	No Limit	Below Detection Limit
Ag110	Rad	5.18E-08	No Limit	Below Detection Limit
Ag110m	Rad	5.55E-06	5.55E-03	Below Detection Limit
Ag111	Rad	0.00E+00	1.00E-10	Below Detection Limit
Am241	Rad	2.38E+04	2.38E+07	Cumulative Groundwater

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Am242	Rad	4.53E-02	4.53E+01	Below Detection Limit
Am242m	Rad	4.52E-02	4.52E+01	Below Detection Limit
Am243	Rad	3.34E-01	3.34E+02	Cumulative Groundwater
Am245	Rad	0.00E+00	1.00E-10	Below Detection Limit
Am246	Rad	1.38E-22	1.00E-10	Below Detection Limit
At217	Rad	5.12E-05	5.12E-02	Below Detection Limit
Ba136m	Rad	0.00E+00	No Limit	Below Detection Limit
Ba137m	Rad	2.31E+07	No Limit	Cumulative Groundwater
Ba140	Rad	0.00E+00	1.00E-10	Below Detection Limit
Be 10	Rad	1.14E-03	1.14E+00	Below Detection Limit
Bi210	Rad	1.09E-03	1.09E+00	Below Detection Limit
Bi211	Rad	1.83E-02	1.83E+01	Below Detection Limit
Bi212	Rad	5.53E-01	5.53E+02	Below Detection Limit
Bi213	Rad	0.00E+00	1.00E-10	Below Detection Limit
Bi214	Rad	5.62E-03	5.62E+00	Below Detection Limit
Bk249	Rad	2.16E-18	1.00E-10	Below Detection Limit
Bk250	Rad	7.75E-23	1.00E-10	Below Detection Limit
C 14	Rad	4.61E-02	3.00E+03	Cumulative Groundwater
Cd109	Rad	4.92E-09	4.92E-06	Below Detection Limit
Cd113m	Rad	1.62E+03	1.62E+06	Cumulative Groundwater
Cd115m	Rad	4.25E-51	1.00E-10	Below Detection Limit
Ce141	Rad	1.80E-68	1.00E-10	Below Detection Limit
Ce142	Rad	0.00E+00	No Limit	Below Detection Limit
Ce144	Rad	1.81E+00	1.81E+03	Cumulative Groundwater
Cf249	Rad	4.12E-13	1.00E-10	Below Detection Limit
Cf250	Rad	2.11E-13	1.00E-10	Below Detection Limit
Cf251	Rad	9.52E-16	1.00E-10	Below Detection Limit
Cf252	Rad	2.24E-17	1.00E-10	Below Detection Limit
Cm241	Rad	1.30E-77	1.00E-10	Below Detection Limit
Cm242	Rad	5.39E-14	5.00E+01	Below Detection Limit
Cm243	Rad	3.55E-03	3.55E+00	Below Detection Limit
Cm244	Rad	1.80E+00	1.80E+03	Below Detection Limit
Cm245	Rad	8.02E-05	8.02E-02	Below Detection Limit
Cm246	Rad	1.79E-06	1.79E-03	Below Detection Limit

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Cm247	Rad	6.39E-13	1.00E-10	Below Detection Limit
Cm248	Rad	1.95E-13	1.00E-10	Below Detection Limit
Cm250	Rad	5.53E-22	1.00E-10	Below Detection Limit
Co-57	Rad	3.69E+00	3.69E+03	Cumulative Groundwater
Co-58	Rad	5.88E-14	1.00E-10	Below Detection Limit
Co-60	Rad	1.93E+05	1.93E+08	Cumulative Groundwater
Cr-51	Rad	2.30E-51	1.00E-10	Below Detection Limit
Cs132	Rad	0.00E+00	1.00E-10	Below Detection Limit
Cs134	Rad	1.12E+04	1.12E+07	Cumulative Groundwater
Cs135	Rad	3.58E+01	3.58E+04	Below Detection Limit
Cs136	Rad	0.00E+00	1.00E-10	Below Detection Limit
Cs137	Rad	2.44E+07	2.44E+10	Cumulative Groundwater
Er169	Rad	0.00E+00	1.00E-10	Below Detection Limit
Eu150	Rad	1.73E-05	1.73E-02	Below Detection Limit
Eu152	Rad	9.68E+05	9.68E+08	Cumulative Groundwater
Eu154	Rad	8.21E+05	8.21E+08	Cumulative Groundwater
Eu155	Rad	1.76E+05	1.76E+08	Cumulative Groundwater
Eu156	Rad	0.00E+00	1.00E-10	Below Detection Limit
Fe55	Rad	2.00E+09	2.00E+12	Cumulative Groundwater
Fe-59	Rad	4.51E-32	1.00E-10	Below Detection Limit
Fr221	Rad	5.12E-05	5.12E-02	Below Detection Limit
Fr223	Rad	2.82E-04	2.82E-01	Below Detection Limit
Gd152	Rad	2.72E-11	1.00E-10	Below Detection Limit
Gd153	Rad	2.01E-08	2.01E-05	Below Detection Limit
H 3	Rad	4.96E+04	4.96E+07	Cumulative Groundwater
Hf-181	Rad	7.80E-34	1.00E-10	Below Detection Limit
Ho166m	Rad	2.70E-03	2.70E+00	Below Detection Limit
I129	Rad	1.30E+03	3.11E+03	Cumulative Groundwater
I131	Rad	0.00E+00	1.00E-10	Below Detection Limit
In114	Rad	1.89E-51	No Limit	Below Detection Limit
In114m	Rad	1.97E-51	1.00E-10	Below Detection Limit
In115	Rad	5.78E-09	5.78E-06	Below Detection Limit
In115m	Rad	0.00E+00	1.00E-10	Below Detection Limit
K-40	Rad	1.92E+03	2.40E+05	Cumulative Groundwater
Kr81	Rad	5.30E-06	No Limit	Below Detection Limit

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Kr85	Rad	1.16E+06	No Limit	Cumulative Groundwater
La138	Rad	0.00E+00	1.00E-10	Below Detection Limit
La140	Rad	2.65E-102	1.00E-10	Below Detection Limit
Mn-54	Rad	1.93E-05	1.00E+02	Below Detection Limit
Nb92	Rad	6.35E-16	No Limit	Below Detection Limit
Nb93m	Rad	1.35E+01	1.35E+04	Below Detection Limit
Nb94	Rad	8.83E-03	No Limit	Below Detection Limit
Nb95	Rad	4.80E-30	1.00E-10	Below Detection Limit
Nb95m	Rad	1.84E-32	1.00E-10	Below Detection Limit
Nd144	Rad	3.27E-07	3.27E-04	Below Detection Limit
Nd147	Rad	0.00E+00	1.00E-10	Below Detection Limit
Ni59	Rad	9.50E+06	9.50E+09	Cumulative Groundwater
Ni63	Rad	6.00E+07	6.00E+10	Cumulative Groundwater
Nd147	Rad	0.00E+00	1.00E-10	Below Detection Limit
Np235	Rad	6.80E-08	6.80E-05	Below Detection Limit
Np236	Rad	6.93E-05	6.93E-02	Below Detection Limit
Np237	Rad	6.43E+02	6.43E+05	Cumulative Groundwater
Np238	Rad	2.18E-04	2.18E-01	Below Detection Limit
Np239	Rad	3.34E-01	3.34E+02	Below Detection Limit
Np240	Rad	2.79E-11	1.00E-10	Below Detection Limit
Np240m	Rad	2.54E-08	No Limit	Below Detection Limit
Pa231	Rad	6.98E-02	6.98E+01	Below Detection Limit
Pa233	Rad	4.36E+01	4.36E+04	Below Detection Limit
Pa234	Rad	2.74E-03	No Limit	Below Detection Limit
Pa234m	Rad	1.71E+00	1.71E+03	Below Detection Limit
Pb209	Rad	4.85E-05	4.85E-02	Below Detection Limit
Pb210	Rad	1.09E-03	1.09E+00	Below Detection Limit
Pb211	Rad	1.83E-02	1.83E+01	Below Detection Limit
Pb212	Rad	5.53E-01	5.53E+02	Below Detection Limit
Pb214	Rad	5.62E-03	5.62E+00	Below Detection Limit
Pd107	Rad	6.12E+00	6.12E+03	Below Detection Limit
Pm146	Rad	5.81E+00	5.81E+03	Below Detection Limit
Pm147	Rad	3.82E+05	3.82E+08	Cumulative Groundwater
Pm148	Rad	3.97E-56	1.00E-10	Below Detection Limit
Pm148m	Rad	8.23E-55	1.00E-10	Below Detection Limit
Po210	Rad	1.02E-03	1.02E+00	Below Detection Limit
Po211	Rad	6.84E-07	6.84E-04	Below Detection Limit

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Po212	Rad	3.28E-01	3.28E+02	Below Detection Limit
Po213	Rad	4.34E-05	4.34E-02	Below Detection Limit
Po214	Rad	5.62E-03	5.62E+00	Below Detection Limit
Po215	Rad	1.83E-02	1.83E+01	Below Detection Limit
Po216	Rad	5.53E-01	5.53E+02	Below Detection Limit
Po218	Rad	5.62E-03	5.62E+00	Below Detection Limit
Pr143	Rad	0.00E+00	1.00E-10	Below Detection Limit
Pr144	Rad	1.77E+00	No Limit	Below Detection Limit
Pr144m	Rad	2.53E-02	2.53E+01	Below Detection Limit
Pu236	Rad	5.53E-03	5.53E+00	Below Detection Limit
Pu237	Rad	1.21E-55	1.00E-10	Below Detection Limit
Pu238	Rad	2.33E+05	2.33E+08	Cumulative Groundwater
Pu239	Rad	6.66E+03	6.66E+06	Cumulative Groundwater
Pu240	Rad	1.50E+03	1.50E+06	Cumulative Groundwater
Pu241	Rad	6.39E+04	6.39E+07	Cumulative Groundwater
Pu242	Rad	2.41E-01	2.41E+02	Below Detection Limit
Pu243	Rad	6.39E-13	1.00E-10	Below Detection Limit
Pu244	Rad	2.54E-08	2.54E-05	Below Detection Limit
Pu246	Rad	1.38E-22	1.00E-10	Below Detection Limit
Ra222	Rad	1.17E-113	1.00E-10	Below Detection Limit
Ra223	Rad	2.03E-02	2.03E+01	Below Detection Limit
Ra224	Rad	5.53E-01	5.53E+02	Below Detection Limit
Ra225	Rad	5.12E-05	5.12E-02	Below Detection Limit
Ra226	Rad	4.74E+02	4.74E+05	Cumulative Groundwater
Ra228	Rad	1.52E-07	2.70E+03	Below Detection Limit
Rb86	Rad	0.00E+00	1.00E-10	Below Detection Limit
Rb87	Rad	1.11E-02	1.11E+01	Below Detection Limit
Rh102	Rad	2.97E-02	2.97E+01	Below Detection Limit
Rh103m	Rad	2.83E-55	1.00E-10	Below Detection Limit
Rh106	Rad	1.14E+01	No Limit	Below Detection Limit
Rn218	Rad	1.26E-113	1.00E-10	Below Detection Limit
Rn219	Rad	2.03E-02	2.03E+01	Below Detection Limit
Rn220	Rad	5.53E-01	5.53E+02	Below Detection Limit
Rn222	Rad	6.21E-03	6.21E+00	Below Detection Limit

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Ru103	Rad	2.01E-26	1.00E-10	Below Detection Limit
Ru106	Rad	1.21E+01	1.21E+04	Cumulative Groundwater
Sb124	Rad	2.07E-37	1.00E-10	Below Detection Limit
Sb125	Rad	9.27E+03	9.27E+06	Cumulative Groundwater
Sb126	Rad	2.06E+01	2.06E+04	Below Detection Limit
Sb126m	Rad	1.47E+02	1.47E+05	Below Detection Limit
Sc-46	Rad	2.85E-17	1.00E-10	Below Detection Limit
Se 79	Rad	1.66E+02	1.66E+05	Below Detection Limit
Sm146	Rad	4.26E-07	4.26E-04	Below Detection Limit
Sm147	Rad	4.10E-03	4.10E+00	Below Detection Limit
Sm148	Rad	1.01E-09	1.01E-06	Below Detection Limit
Sm149	Rad	5.12E-09	5.12E-06	Below Detection Limit
Sm151	Rad	3.38E+05	3.38E+08	Cumulative Groundwater
Sn117m	Rad	0.00E+00	1.00E-10	Below Detection Limit
Sn119m	Rad	1.48E-04	1.48E-01	Below Detection Limit
Sn121m	Rad	2.69E+01	2.69E+04	Below Detection Limit
Sn123	Rad	8.42E-14	1.00E-10	Below Detection Limit
Sn125	Rad	0.00E+00	1.00E-10	Below Detection Limit
Sn126	Rad	1.47E+02	1.47E+05	Below Detection Limit
Sr89	Rad	5.99E-41	5.00E+02	Below Detection Limit
Sr90	Rad	2.29E+07	2.29E+10	Cumulative Groundwater
Tb160	Rad	3.18E-31	1.00E-10	Below Detection Limit
Tb161	Rad	0.00E+00	1.00E-10	Below Detection Limit
Tc 98	Rad	1.77E-04	1.77E-01	Below Detection Limit
Tc 99	Rad	5.76E+03	5.76E+06	Cumulative Groundwater
Te123	Rad	4.52E-12	1.00E-10	Below Detection Limit
Te123m	Rad	2.95E-20	1.00E-10	Below Detection Limit
Te125m	Rad	2.27E+03	2.27E+06	Cumulative Groundwater
Te127	Rad	9.36E-17	1.00E-10	Below Detection Limit
Te127m	Rad	9.50E-17	1.00E-10	Below Detection Limit
Te129	Rad	6.75E-68	1.00E-10	Below Detection Limit
Te129m	Rad	1.07E-67	1.00E-10	Below Detection Limit
Th226	Rad	2.18E-114	1.00E-10	Below Detection Limit
Th227	Rad	1.82E-02	1.82E+01	Below Detection Limit

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Th228	Rad	3.29E+01	1.60E+04	Cumulative Groundwater
Th229	Rad	5.12E-05	5.12E-02	Below Detection Limit
Th230	Rad	1.73E+02	1.40E+04	Cumulative Groundwater
Th231	Rad	1.61E+02	1.61E+05	Below Detection Limit
Th232	Rad	1.56E+02	1.68E+04	Cumulative Groundwater
Th234	Rad	1.71E+00	1.71E+03	Below Detection Limit
Tl207	Rad	1.83E-02	No Limit	Below Detection Limit
Tl208	Rad	1.98E-01	No Limit	Below Detection Limit
Tl209	Rad	1.05E-06	No Limit	Below Detection Limit
Tm170	Rad	6.38E-23	1.00E-10	Below Detection Limit
Tm171	Rad	1.59E-09	1.59E-06	Below Detection Limit
U230	Rad	0.00E+00	1.00E-10	Below Detection Limit
U232	Rad	5.35E-01	5.35E+02	Below Detection Limit
U233	Rad	1.6E+05	1.6E+08	Cumulative Groundwater
U234	Rad	6.03E+03	6.03E+06	Cumulative Groundwater
U235	Rad	1.10E+02	1.10E+05	Cumulative Groundwater
U236	Rad	2.02E+02	2.02E+05	Cumulative Groundwater
U237	Rad	0.00E+00	1.00E-10	Below Detection Limit
U238	Rad	1.95E+03	1.95E+06	Cumulative Groundwater
U240	Rad	2.54E-08	2.54E-05	Below Detection Limit
Xe127	Rad	1.58E-69	No Limit	Below Detection Limit
Xe129m	Rad	0.00E+00	No Limit	Below Detection Limit
Xe131m	Rad	2.69E-109	No Limit	Below Detection Limit
Xe133	Rad	0.00E+00	No Limit	Below Detection Limit
Y90	Rad	2.29E+07	2.29E+10	Cumulative Groundwater
Y91	Rad	4.14E-34	1.00E-10	Below Detection Limit
Zn65	Rad	2.70E-06	1.00E+02	Below Detection Limit
Zr93	Rad	8.57E+02	8.57E+05	Below Detection Limit
Zr95	Rad	2.93E-22	1.00E-10	Below Detection Limit
1,1,1-Trichloroethane	Organic	1.57E-02	1.57E+01	Design Inventory x 1000
1,1,2,2-Tetrachloroethane	Organic	4.95E-05	4.95E-02	Design Inventory x 1000
1,1,2-Trichloroethane	Organic	2.42E-04	2.42E-01	Design Inventory x 1000
1,1-Dichloroethane	Organic	2.34E-03	2.34E+00	Design Inventory x 1000
1,1-Dichloroethene	Organic	1.48E-03	1.48E+00	Design Inventory x 1000

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
1,2,3,4,6,7,8,9-OCDD	**Organic**	**6.9E-02**	**6.9E+01**	**Cumulative Groundwater**
1,2,3,4,6,7,8,9-OCDF	**Organic**	**1.4E-02**	**1.4E+01**	**Cumulative Groundwater**
1,2,3,4,6,7,8-HpCDD	**Organic**	**4.6E-02**	**4.6E+01**	**Cumulative Groundwater**
1,2,3,4,6,7,8-HpCDF	**Organic**	**1.2E-01**	**1.2E+02**	**Cumulative Groundwater**
1,2,3,4,7,8,9-HpCDF	**Organic**	**5.9E-04**	**5.9E-01**	**Cumulative Groundwater**
1,2,3,4,7,8-HxCDD	**Organic**	**1.1E-04**	**1.1E-01**	**Cumulative Groundwater**
1,2,3,4,7,8-HxCDF	**Organic**	**2.0E-01**	**2.0E+02**	**Cumulative Groundwater**
1,2,3,6,7,8-HxCDD	**Organic**	**8.4E-04**	**8.4E-01**	**Cumulative Groundwater**
1,2,3,6,7,8-HxCDF	**Organic**	**1.0E-02**	**1.0E+01**	**Cumulative Groundwater**
1,2,3,7,8,9-HxCDD	**Organic**	**2.4E-03**	**2.4E+00**	**Cumulative Groundwater**
1,2,3,7,8,9-HxCDF	**Organic**	**2.2E-05**	**2.2E-02**	**Cumulative Groundwater**
1,2,3,7,8-PeCDD	**Organic**	**1.1E-04**	**1.1E-01**	**Cumulative Groundwater**
1,2,3,7,8-PeCDF	**Organic**	**9.3E-04**	**9.3E-01**	**Cumulative Groundwater**
1,2,4-Trichlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
1,2-Dichlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
1,2-Dichloroethane	**Organic**	**2.5E+01**	**2.5E+04**	**Cumulative Groundwater**
1,2-Dichloroethane	Organic	5.38E-06	5.38E-03	Design Inventory x 1000
1,2-Dichloroethene (total)	Organic	3.24E-04	3.24E-01	Design Inventory x 1000
1,3-Dichlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
1,4-Dichlorobenzene	Organic	4.50E-01	4.50E+02	Design Inventory x 1000
1,4-Dioxane	Organic	1.88E-05	1.88E-02	Design Inventory x 1000
2,3,4,6,7,8-HxCDF	**Organic**	**1.6E-02**	**1.6E+01**	**Cumulative Groundwater**
2,3,4,7,8-PeCDF	**Organic**	**6.3E-03**	**6.3E+00**	**Cumulative Groundwater**
2,3,7,8-TCDD	**Organic**	**4.1E-06**	**4.1E-03**	**Cumulative Groundwater**
2,3,7,8-TCDF	**Organic**	**5.5E-02**	**5.5E+01**	**Cumulative Groundwater**
2,4,5-Trichlorophenol	Organic	4.46E-02	4.46E+01	Design Inventory x 1000
2,4,6-Trichlorophenol	Organic	1.83E-02	1.83E+01	Design Inventory x 1000
2,4-Dichlorophenol	Organic	2.16E-02	2.16E+01	Design Inventory x 1000
2,4-Dimethylphenol	Organic	1.83E-02	1.83E+01	Design Inventory x 1000
2,4-Dinitrophenol	Organic	5.09E-02	5.09E+01	Design Inventory x 1000
2,4-Dinitrotoluene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
2,6-Dinitrotoluene	Organic	2.07E-02	2.07E+01	Design Inventory x 1000
2-Butanone	Organic	2.47E-02	2.47E+01	Design Inventory x 1000
2-Chloronaphthalene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
2-Chlorophenol	Organic	1.83E-02	1.83E+01	Design Inventory x 1000
2-Hexanone	Organic	2.70E-03	2.70E+00	Design Inventory x 1000

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
2-Methylnaphthalene	Organic	5.12E-01	5.12E+02	Design Inventory x 1000
2-Methylphenol	Organic	2.06E-02	2.06E+01	Design Inventory x 1000
2-Nitroaniline	**Organic**	**3.4E+00**	**3.4E+03**	**Cumulative Groundwater**
2-Nitrophenol	Organic	1.83E-02	1.83E+01	Design Inventory x 1000
3,3'-Dichlorobenzidine	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
3-Methyl Butanal	Organic	2.23E-04	No Limit	No RAO limits
3-Nitroaniline	**Organic**	**3.4E+00**	**3.4E+03**	**Cumulative Groundwater**
4,6-Dinitro-2-methylphenol	Organic	4.46E-02	4.46E+01	Design Inventory x 1000
4-Bromophenyl-phenylether	Organic	1.14E-02	No Limit	No RAO limits
4-Chloro-3-methylphenol	Organic	1.83E-02	No Limit	No RAO limits
4-Chloroaniline	Organic	4.08E-02	4.12E+01	Design Inventory x 1000
4-Chlorophenyl-phenylether	Organic	1.14E-02	No Limit	No RAO limits
4-Methyl-2-Pentanone	Organic	2.96E-02	2.96E+01	Design Inventory x 1000
4-Methylphenol	Organic	3.86E-02	3.86E+01	Design Inventory x 1000
4-Nitroaniline	**Organic**	**3.4E+00**	**3.4E+03**	**Cumulative Groundwater**
4-Nitrophenol	Organic	5.16E-02	5.16E+01	Design Inventory x 1000
Acenaphthene	Organic	2.02E-01	2.02E+02	Design Inventory x 1000
Acenaphthylene	Organic	2.07E-02	2.07E+01	Design Inventory x 1000
Acetone	Organic	6.20E-01	6.20E+02	Design Inventory x 1000
Acetonitrile	Organic	1.88E-05	1.16E+00	Adjusted to Exceed Maximum Concentration
Acrolein	Organic	9.06E-06	5.47E-01	Adjusted to Exceed Maximum Concentration
Acrylonitrile	Organic	9.06E-06	5.83E-01	Adjusted to Exceed Maximum Concentration
Anthracene	Organic	3.20E-01	3.20E+02	Design Inventory x 1000
Aramite	Organic	1.15E-04	6.71E+00	Adjusted to Exceed Maximum Concentration
Aroclor-1016	Organic	7.69E-03	7.69E+00	Design Inventory x 1000
Aroclor-1254	Organic	1.28E-01	1.28E+02	Design Inventory x 1000
Aroclor-1260	Organic	7.21E-01	7.21E+02	Design Inventory x 1000
Aroclor-1262	**Organic**	**5.0E+00**	**5.0E+03**	**Cumulative Groundwater**

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Aroclor-1268	Organic	6.22E-02	6.22E+01	Design Inventory x 1000
Benzene	Organic	6.03E-01	6.03E+02	Design Inventory x 1000
Benzidine	Organic	2.91E-04	1.72E+01	Adjusted to Exceed Maximum Concentration
Benzo(a)anthracene	Organic	2.53E-01	2.53E+02	Design Inventory x 1000
Benzo(a)pyrene	Organic	1.05E-01	1.05E+02	Design Inventory x 1000
Benzo(b)fluoranthene	Organic	1.79E-01	1.79E+02	Design Inventory x 1000
Benzo(g,h,i)perylene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Benzo(k)fluoranthene	Organic	1.86E-02	1.86E+01	Design Inventory x 1000
Benzoic acid	Organic	8.56E-03	8.56E+00	Design Inventory x 1000
bis(2-Chloroethoxy)methane	Organic	1.14E-02	No Limit	No RAO limits
bis(2-Chloroethyl)ether	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
bis(2-Chloroisopropyl)ether	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
bis(2-Ethylhexyl)phthalate	Organic	1.47E-01	1.47E+02	Design Inventory x 1000
Bromomethane	**Organic**	**4.0E+00**	**4.0E+03**	**Cumulative Groundwater**
bis(2-Ethylhexyl)phthalate	Organic	1.47E-01	1.47E+02	Design Inventory x 1000
Butane,1,1,3,4-Tetrachloro-	Organic	7.89E-03	No Limit	No RAO limits
Butylbenzylphthalate	Organic	6.79E-02	6.79E+01	Design Inventory x 1000
Carbazole	Organic	3.23E-02	3.23E+01	Design Inventory x 1000
Carbon Disulfide	Organic	4.55E-02	4.55E+01	Design Inventory x 1000
Chlorobenzene	Organic	6.57E-03	6.57E+00	Design Inventory x 1000
Chloroethane	Organic	3.02E-06	1.47E-01	Adjusted to Exceed Maximum Concentration
Chloromethane	Organic	3.53E-04	3.53E-01	Design Inventory x 1000
Chrysene	Organic	2.65E-01	2.65E+02	Design Inventory x 1000
Decane, 3,4-Dimethyl	Organic	1.61E-04	No Limit	No RAO limits

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Decane, 3,4-Dimethyl	Organic	1.61E-04	No Limit	No RAO limits
Diacetone alcohol	Organic	4.32E+00	No Limit	No RAO limits
Dibenz(a,h)anthracene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Dibenzofuran	Organic	3.24E-01	3.24E+02	Design Inventory x 1000
Dichlorodifluoro-methane	Organic	1.7E+00	1.7E+03	Cumulative Groundwater
Diethylphthalate	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Dimethyl Disulfide	Organic	2.96E-03	No Limit	No RAO limits
Dimethylphthalate	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Di-n-butylphthalate	Organic	2.39E-02	2.39E+01	Design Inventory x 1000
Di-n-octylphthalate	Organic	2.62E-02	2.62E+01	Design Inventory x 1000
Eicosane	Organic	2.83E-03	No Limit	No RAO limits
Ethyl cyanide	Organic	1.88E-05	No Limit	No RAO limits
Ethylbenzene	Organic	7.81E-02	7.81E+01	Design Inventory x 1000
Famphur	Organic	5.81E-05	No Limit	No RAO limits
Fluoranthene	Organic	7.62E-01	7.62E+02	Design Inventory x 1000
Fluorene	Organic	1.84E-01	1.84E+02	Design Inventory x 1000
Heptadecane, 2,6,10,15-Tetra	Organic	3.44E-03	No Limit	No RAO limits
Hexachlorobenzene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Hexachlorobutadiene	Organic	2.07E-02	2.07E+01	Design Inventory x 1000
Hexachlorocyclopenta diene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Hexachloroethane	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Indeno(1,2,3-cd)pyrene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Isobutyl alcohol	Organic	1.88E-05	1.16E+00	Adjusted to Exceed Maximum Concentration
Isophorone	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Isopropyl Alcohol/2-propanol	Organic	2.12E-03	No Limit	No RAO limits
Kepone	Organic	9.92E-02	9.92E+01	Design Inventory x 1000
Mesityl oxide	Organic	8.48E-02	No Limit	No RAO limits
Methyl Acetate	Organic	4.84E-04	4.84E-01	Design Inventory x 1000
Methylene Chloride	Organic	8.36E-02	8.36E+01	Design Inventory x 1000
Naphthalene	Organic	4.25E-01	4.25E+02	Design Inventory x 1000
Nitrobenzene	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
N-Nitroso-di-n-propylamine	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
N-Nitrosodiphenylamine	Organic	1.14E-02	1.14E+01	Design Inventory x 1000
Octane,2,3,7-Trimethyl	Organic	1.61E-04	No Limit	No RAO limits
o-Toluenesulfonamide	Organic	5.06E-03	No Limit	No RAO limits
Pentachlorophenol	Organic	5.59E-02	5.59E+01	Design Inventory x 1000
Phenanthrene	Organic	1.17E+00	1.17E+03	Design Inventory x 1000
Phenol	Organic	7.98E-02	7.98E+01	Design Inventory x 1000
Phenol,2,6-Bis(1,1-Dimethyl)	Organic	4.05E-03	No Limit	No RAO limits
Polyvinyl Chloride	**Organic**	**2.7E+03**	**NA**	**NA**
p-Toluenesulfonamide	Organic	5.06E-03	No Limit	No RAO limits
Pyrene	Organic	2.53E-01	2.53E+02	Design Inventory x 1000
RDX	Organic	0.00E+00	1.04E+01	Adjusted based on anticipated concentrations
Styrene	**Organic**	**4.3E+04**	**4.3E+07**	**Cumulative Groundwater**
Tetrachloroethene	Organic	9.64E-03	9.64E+00	Design Inventory x 1000
Toluene	Organic	9.82E-01	9.82E+02	Design Inventory x 1000
Tributylphosphate	Organic	3.64E-01	No Limit	No RAO limits
Trichloroethene	Organic	7.20E-02	7.20E+01	Design Inventory x 1000
Trinitrotoluene	Organic	0.00E+00	1.11E+01	Adjusted based on anticipated concentrations
Undecane,4,6-Dimethyl-	Organic	1.61E-04	No Limit	No RAO limits
Vinyl Chloride	**Organic**	**1.2E+01**	**1.2E+04**	**Cumulative Groundwater**

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Xylene (ortho)	Organic	3.88E-03	3.88E+00	Design Inventory x 1000
Xylene (total)	Organic	3.45E+00	3.45E+03	Design Inventory x 1000
Aluminum	Inorganic	7.08E+03	1.61E+05	10 X Background
Antimony	Inorganic	5.83E+00	5.83E+03	Design Inventory x 1000
Arsenic	Inorganic	5.65E+00	5.80E+01	10 X Background
Barium	Inorganic	1.79E+02	3.00E+03	10 X Background
Beryllium	Inorganic	2.87E-01	1.80E+01	10 X Background
Boron	Inorganic	1.85E+02	3.31E+03	Adjusted to Not Exceed Hazard Index
Bromide	**Inorganic**	**3.6E+00**	**NA**	**NA**
Cadmium	Inorganic	3.59E+00	3.59E+03	Design Inventory x 1000
Calcium	Inorganic	2.04E+04	No Limit	No RAO limits
Chloride	Inorganic	1.87E+00	No Limit	No RAO limits
Chromium	Inorganic	4.12E+01	4.12E+04	Design Inventory x 1000
Cobalt	Inorganic	6.04E+00	1.10E+02	10 X Background
Copper	Inorganic	2.99E+01	2.99E+04	Design Inventory x 1000
Cyanide	Inorganic	3.37E-01	3.37E+02	Design Inventory x 1000
Dysprosium	Inorganic	5.93E+01	5.93E+04	Design Inventory x 1000
Fluoride	Inorganic	3.87E+00	3.87E+03	Design Inventory x 1000
Iron	Inorganic	1.02E+04	2.50E+05	10 X Background
Lead	Inorganic	5.76E+01	5.76E+04	Design Inventory x 1000
Magnesium	Inorganic	4.47E+03	No Limit	No RAO limits
Manganese	Inorganic	2.07E+02	4.90E+03	10 X Background
Mercury	Inorganic	9.45E+00	9.45E+03	Design Inventory x 1000
Molybdenum	Inorganic	1.02E+01	1.02E+04	Design Inventory x 1000
Nickel	Inorganic	1.97E+01	3.50E+02	10 X Background
Nitrate	Inorganic	3.93E+00	3.93E+03	Design Inventory x 1000
Nitrate/Nitrite-N	Inorganic	2.22E-01	No Limit	No RAO limits
Nitrite	Inorganic	8.49E-03	8.49E+00	Design Inventory x 1000
Phospahate	**Inorganic**	**5.7E+00**	**NA**	**NA**
Phosphorus	Inorganic	9.74E+01	No Limit	No RAO limits
Potassium	Inorganic	1.13E+03	No Limit	No RAO limits
Selenium	Inorganic	8.46E-01	8.46E+02	Design Inventory x 1000
Silicon	**Inorganic**	**1.6E+04**	**NA**	**NA**

Table A-2. (continued).

Constituent Name	Constituent Type	Design Inventory Concentration [a] (pCi/Kg or mg/Kg)	Adjusted Maximum Inventory to Not Exceed Groundwater RAOs in 1 E+06 yrs (pCi/Kg or mg/Kg)	Basis for Adjusted Concentration
Silver	Inorganic	9.84E+00	9.84E+03	Design Inventory x 1000
Sodium	Inorganic	2.11E+02	No Limit	No RAO limits
Strontium	Inorganic	1.82E+01	1.82E+04	Design Inventory x 1000
Sulfate	Inorganic	2.05E+01	No Limit	No RAO limits
Sulfide	Inorganic	7.59E+02	No Limit	No RAO limits
Terbium	Inorganic	5.73E+02	No Limit	No RAO limits
Thallium	Inorganic	3.70E-01	4.30E+00	10 X Background
Tin	**Inorganic**	**3.0E+00**	**3.0E+03**	**Cumulative Groundwater**
Vanadium	Inorganic	2.12E+01	4.50E+02	10 X Background
Ytterbium	Inorganic	1.95E+02	No Limit	No RAO limits
Zinc	Inorganic	2.08E+02	2.08E+05	Design Inventory x 1000
Zirconium	Inorganic	6.91E+01	No Limit	No RAO limits

a. Design inventory concentrations for radionuclides were calculated using the design inventory activity for January 1, 2002, averaged over the entire landfill volume at a density of 1500kg/cubic meter. Design inventory concentrations for organics and inorganics were calculated using the constitutent mass from the design inventory averaged over the entire landfill volume at a density of 1500kg/cubic meter.

A.5 REFERENCES

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EDF-ER-264, 2001, "INEEL CERCLA Disposal Facility Design Inventory," Rev. A, Environmental Restoration Program, Idaho National Engineering and Environmental Laboratory, March 2001.

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Appendix B

Recommended Maximum Waste Concentrations Based on Liner Compatibility

Appendix B

Allowable Concentrations in Soil For Liner Compatibility Calculation

Purpose: Convert maximum leachate concentrations for liner compatibility to waste soil concentrations.

Methodology: Convert $C_{Leachate}$ to $C_{Waste\ Soil}$, factoring in decay, DAFs

Calculations: $C_{Waste\ Soil} = (C_{Leachate})$ (Leachate to Waste Soil Ratio)

Leachate to Waste Soil Ratio = $(C_{Soil}) / (C_{Liquid}) = 1 / (DAF_T/1000)\ (e^{-LamdaT})$

Based on: $C_{Liquid} = (C_{Soil})\ (DAF_T/1000)\ (e^{-LamdaT})$

The "Leachate to Waste Soil Ratio" can be determined using the EDF-274, operations evaluation, leachate concentrations as compared to the design inventory concentrations. This is identified on the following table under Step 5.

$C_{Leachate}$ maximum leachate concentrations for liner compatibility (Appendix D - EDF 278)

Notes:

1. Constituent reported in the "INEEL CERCLA Disposal Facility Design Inventory (EDF-ER-264).
2. Where a constituent did not have a specific compatibility concentration, the maximum allowable concentrations in leachate are based on chemical category as shown in Table 4-2 of the main text.
3. The suggested maximum activity concentration selected for the ICDF liner system is based on a total absorbed dose of 1,000,000 rads for the individual radionuclides and a maximum 4 cm leachate depth

Table B-1. Maximum Allowable Concentration in Soil For Compatability.

Constituents	Average Leachate Concentration (C_{Liquid})a mg/l	Design Inventory Concentrationin Soil (C_{Soil})b mg/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatability ($C_{Leachate}$)c mg/l	Maximum Allowable Concentration in Soil For Compatability mg/kg
ORGANICS					
1,1,1-Trichloroethane	1.1645E-02	1.6E-02	1.3E+00	2.0E+01	2.7E+01
1,1,2,2-Tetrachloroethane	1.2139E-05	4.9E-05	4.1E+00	5.0E+05	2.0E+06
1,1,2-Trichloroethane	8.9945E-04	2.4E-04	2.7E-01	5.0E+05	1.3E+05
1,1-Dichloroethane	8.3284E-04	2.3E-03	2.8E+00	5.0E+05	1.4E+06
1,1-Dichloroethene	4.4863E-04	1.5E-03	3.3E+00	5.0E+05	1.6E+06
1,2,4-Trichlorobenzene	2.4163E-04	1.1E-02	4.7E+01	5.0E+05	2.4E+07
1,2-Dichlorobenzene	7.0576E-04	1.1E-02	1.6E+01	5.0E+05	8.1E+06
1,2-Dichloroethane	3.5E+01	2.5E+01	7.1E-01	2.0E+03	1.4E+03
1,2-Dichloroethene (total)	2.8947E-04	3.2E-04	1.1E+00	5.0E+05	5.6E+05
1,2,3,4,6,7,8,9-OCDD	2.7E-04	6.9E-02	2.5E+02	5.0E+05	1.3E+08
1,2,3,4,6,7,8,9-OCDF	5.7E-05	1.4E-02	2.5E+02	5.0E+05	1.3E+08
1,2,3,4,6,7,8-HpCDD	1.8E-04	4.6E-02	2.5E+02	5.0E+05	1.3E+08
1,2,3,4,6,7,8-HpCDF	4.8E-04	1.2E-01	2.5E+02	5.0E+05	1.3E+08
1,2,3,4,7,8,9-HpCDF	2.3E-06	5.9E-04	2.5E+02	5.0E+05	1.3E+08
1,2,3,4,7,8-HxCDD	4.4E-07	1.1E-04	2.5E+02	5.0E+05	1.3E+08
1,2,3,4,7,8-HxCDF	7.8E-04	2.0E-01	2.5E+02	5.0E+05	1.3E+08
1,2,3,6,7,8-HxCDD	3.3E-06	8.4E-04	2.5E+02	5.0E+05	1.3E+08
1,2,3,6,7,8-HxCDF	4.0E-05	1.0E-02	2.5E+02	5.0E+05	1.3E+08
1,2,3,7,8,9-HxCDD	9.4E-06	2.4E-03	2.5E+02	5.0E+05	1.3E+08
1,2,3,7,8,9-HxCDF	8.8E-08	2.2E-05	2.5E+02	5.0E+05	1.3E+08
1,2,3,7,8-PeCDD	4.2E-07	1.1E-04	2.5E+02	5.0E+05	1.3E+08
1,2,3,7,8-PeCDF	3.7E-06	9.3E-04	2.5E+02	5.0E+05	1.3E+08

Constituents	Average Leachate Concentration (C_{Liquid})a mg/l	Design Inventory Concentrationin Soil (C_{Soil})b mg/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatability ($C_{Leachate}$)c mg/l	Maximum Allowable Concentration in Soil For Compatability mg/kg
1,3-Dichlorobenzene	1.0090E-03	1.1E-02	1.1E+01	2.0E+03	2.3E+04
1,4-Dichlorobenzene	2.5133E-02	4.5E-01	1.8E+01	5.0E+05	9.0E+06
1,4-Dioxane	1.4684E-05	1.9E-05	1.3E+00	5.0E+05	6.4E+05
2,3,4,6,7,8-HxCDF	6.5E-05	1.6E-02	2.5E+02	5.0E+05	1.3E+08
2,3,4,7,8-PeCDF	2.5E-05	6.3E-03	2.5E+02	5.0E+05	1.3E+08
2,3,7,8-TCDD	1.6E-08	4.1E-06	2.5E+02	5.0E+05	1.3E+08
2,3,7,8-TCDF	2.2E-04	5.5E-02	2.5E+02	5.0E+05	1.3E+08
2,4,5-Trichlorophenol	1.3509E-03	4.5E-02	3.3E+01	5.0E+05	1.7E+07
2,4,6-Trichlorophenol	4.6178E-03	1.8E-02	4.0E+00	5.0E+05	2.0E+06
2,4-Dichlorophenol	1.3442E-03	2.2E-02	1.6E+01	5.0E+05	8.0E+06
2,4-Dimethylphenol	1.9586E-03	1.8E-02	9.3E+00	5.0E+05	4.7E+06
2,4-Dinitrophenol	5.3031E-02	5.1E-02	9.6E-01	5.0E+05	4.8E+05
2,4-Dinitrotoluene	3.1807E-03	1.1E-02	3.6E+00	5.0E+05	1.8E+06
2,6-Dinitrotoluene	7.4130E-03	2.1E-02	2.8E+00	5.0E+05	1.4E+06
2-Butanone	3.1899E-01	2.5E-02	7.7E-02	2.0E+05	1.5E+04
2-Chloronaphthalene	1.8544E-04	1.1E-02	6.1E+01	2.0E+03	1.2E+05
2-Chlorophenol	1.0814E-03	1.8E-02	1.7E+01	2.0E+03	3.4E+04
2-Hexanone	2.5941E-02	2.7E-03	1.0E-01	5.0E+05	5.2E+04
2-Methylnaphthalene	9.0259E-02	5.1E-01	5.7E+00	5.0E+05	2.8E+06
2-Methylphenol	4.4781E-03	2.1E-02	4.6E+00	5.0E+05	2.3E+06
2-Nitroaniline	2.1E+01	3.4E+00	1.6E-01	5.0E+05	8.2E+04
2-Nitrophenol	7.2451E-03	1.8E-02	2.5E+00	5.0E+05	1.3E+06

Constituents	Average Leachate Concentration (C_{Liquid})a mg/l	Design Inventory Concentrationin Soil (C_{Soil})b mg/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatability ($C_{Leachate}$)c mg/l	Maximum Allowable Concentration in Soil For Compatability mg/kg
3,3'-Dichlorobenzidine	5.1019E-04	1.1E-02	2.2E+01	5.0E+05	1.1E+07
3-Methyl Butanal	3.3689E-03	2.2E-04	6.6E-02	5.0E+05	3.3E+04
3-Nitroaniline	2.1E+01	3.4E+00	1.6E+00	5.0E+05	8.2E+05
4,6-Dinitro-2-methylphenol	1.6991E-03	4.5E-02	2.6E+01	5.0E+05	1.3E+07
4-Bromophenyl-phenylether	2.6728E-04	1.1E-02	4.3E+01	2.0E+03	8.5E+04
4-Chloro-3-methylphenol	9.5508E-02	1.8E-02	1.9E-01	5.0E+05	9.6E+04
4-Chloroaniline	1.7631E-01	4.1E-02	2.3E-01	5.0E+05	1.2E+05
4-Chlorophenyl-phenylether	1.4533E-03	1.1E-02	7.8E+00	5.0E+05	3.9E+06
4-Methyl-2-Pentanone	4.6888E-03	3.0E-02	6.3E+00	5.0E+05	3.2E+06
4-Methylphenol	9.2045E-03	3.9E-02	4.2E+00	5.0E+05	2.1E+06
4-Nitroaniline	2.1E+01	3.4E+00	1.6E-01	5.0E+05	8.2E+04
4-Nitrophenol	2.0462E-02	5.2E-02	2.5E+00	5.0E+05	1.3E+06
Acenaphthene	7.9944E-04	2.0E-01	2.5E+02	2.0E+03	5.1E+05
Acenaphthylene	2.7884E-04	2.1E-02	7.4E+01	2.0E+03	1.5E+05
Acetone	6.3120E-01	6.2E-01	9.8E-01	2.0E+05	2.0E+05
Acetonitrile	1.1869E-05	1.9E-05	1.6E+00	5.0E+05	7.9E+05
Acrolein	5.0103E-06	9.1E-06	1.8E+00	2.0E+05	3.6E+05
Acrylonitrile	9.1136E-06	9.1E-06	9.9E-01	2.0E+05	2.0E+05
Anthracene	6.8926E-04	3.2E-01	4.6E+02	2.0E+03	9.3E+05
Aramite	2.9502E-06	1.1E-04	3.9E+01	5.0E+05	1.9E+07
Aroclor-1016	4.9059E-05	7.7E-03	1.6E+02	5.0E+05	7.8E+07

Constituents	Average Leachate Concentration (C_{Liquid})a mg/l	Design Inventory Concentrationin Soil (C_{Soil})b mg/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatability ($C_{Leachate}$)c mg/l	Maximum Allowable Concentration in Soil For Compatability mg/kg
Aroclor-1254	8.1934E-04	1.3E-01	1.6E+02	5.0E+05	7.8E+07
Aroclor-1260	4.5996E-03	7.2E-01	1.6E+02	5.0E+05	7.8E+07
Aroclor-1262	3.7E-03	5.0E+00	1.3E+03	2.0E+03	2.6E+06
Aroclor-1268	3.9679E-04	6.2E-02	1.6E+02	5.0E+05	7.8E+07
Benzene	2.2188E-01	6.0E-01	2.7E+00	2.0E+03	5.4E+03
Benzidine	4.0608E-05	2.9E-04	7.2E+00	2.0E+05	1.4E+06
Benzo(a)anthracene	5.7216E-05	2.5E-01	4.4E+03	2.0E+03	8.8E+06
Benzo(a)pyrene	7.3239E-06	1.0E-01	1.4E+04	2.0E+03	2.9E+07
Benzo(b)fluoranthene	1.5631E-05	1.8E-01	1.1E+04	2.0E+03	2.3E+07
Benzo(g,h,i)perylene	3.8440E-07	1.1E-02	3.0E+04	5.0E+05	1.5E+10
Benzo(k)fluoranthene	3.4878E-06	1.9E-02	5.3E+03	5.0E+05	2.7E+09
Benzoic acid	8.6965E-03	8.6E-03	9.8E-01	5.0E+05	4.9E+05
bis(2-Chloroethoxy)methane	1.4241E-01	1.1E-02	8.0E-02	2.0E+03	1.6E+02
bis(2-Chloroethyl)ether	4.0649E-03	1.1E-02	2.8E+00	2.0E+03	5.6E+03
bis(2-Chloroisopropyl)ether	3.8576E-03	1.1E-02	2.9E+00	2.0E+03	5.9E+03
bis(2-Ethylhexyl)phthalate	3.3897E-07	1.5E-01	4.3E+05	2.0E+03	8.7E+08
Bromomethane	3.9E+01	4.0E+00	1.0E-01	5.0E+05	5.1E+04
Butane,1,1,3,4-Tetrachloro-	1.9359E-03	7.9E-03	4.1E+00	5.0E+05	2.0E+06
Butylbenzylphthalate	3.1464E-05	6.8E-02	2.2E+03	2.0E+05	4.3E+08
Carbazole	3.7871E-03	3.2E-02	8.5E+00	5.0E+05	4.3E+06
Carbon Disulfide	1.6330E-02	4.6E-02	2.8E+00	5.0E+05	1.4E+06
Chlorobenzene	7.6794E-04	6.6E-03	8.6E+00	2.0E+03	1.7E+04
Chloroethane	1.9486E-06	3.0E-06	1.5E+00	5.0E+05	7.7E+05
Chloromethane	2.2959E-03	3.5E-04	1.5E-01	2.0E+03	3.1E+02

Constituents	Average Leachate Concentration (C_{Liquid})a mg/l	Design Inventory Concentrationin Soil (C_{Soil})b mg/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatability ($C_{Leachate}$)c mg/l	Maximum Allowable Concentration in Soil For Compatability mg/kg
Chrysene	9.3760E-05	2.7E-01	2.8E+03	2.0E+03	5.7E+06
Decane, 3,4-Dimethyl	2.4354E-03	1.6E-04	6.6E-02	5.0E+05	3.3E+04
Diacetone alcohol	6.8362E-01	4.3E+00	6.3E+00	5.0E+05	3.2E+06
Dibenz(a,h)anthracene	4.0472E-07	1.1E-02	2.8E+04	2.0E+03	5.6E+07
Dibenzofuran	1.0411E-03	3.2E-01	3.1E+02	5.0E+05	1.6E+08
Dichlorodiflouromethane	**8.4E+00** [c]	**1.7E+00**	**2.0E-01**	**2.0E+03**	**4.0E+02**
Diethylphthalate	9.2474E-04	1.1E-02	1.2E+01	1.0E+05	1.2E+06
Dimethyl Disulfide	4.4649E-02	3.0E-03	6.6E-02	5.0E+05	3.3E+04
Dimethylphthalate	3.0602E-03	1.1E-02	3.7E+00	1.0E+05	3.7E+05
Di-n-butylphthalate	2.3435E-05	2.4E-02	1.0E+03	1.0E+05	1.0E+08
Di-n-octylphthalate	1.0692E-08	2.6E-02	2.5E+06	5.0E+05	1.2E+12
Eicosane	2.9500E-03	2.8E-03	9.6E-01	5.0E+05	4.8E+05
Ethyl cyanide	2.8373E-04	1.9E-05	6.6E-02	5.0E+05	3.3E+04
Ethylbenzene	8.8938E-03	7.8E-02	8.8E+00	2.0E+03	1.8E+04
Famphur	3.6881E-06	5.8E-05	1.6E+01	5.0E+05	7.9E+06
Fluoranthene	5.0608E-04	7.6E-01	1.5E+03	2.0E+03	3.0E+06
Fluorene	3.5464E-04	1.8E-01	5.2E+02	2.0E+03	1.0E+06
Heptadecane, 2,6,10,15-Tetra	5.1892E-02	3.4E-03	6.6E-02	5.0E+05	3.3E+04
Hexachlorobenzene	4.7695E-05	1.1E-02	2.4E+02	2.0E+03	4.8E+05
Hexachlorobutadiene	1.3242E-05	2.1E-02	1.6E+03	2.0E+03	3.1E+06
Hexachlorocyclopentadiene	1.6242E-06	1.1E-02	7.0E+03	2.0E+03	1.4E+07
Hexachloroethane	1.7398E-04	1.1E-02	6.5E+01	2.0E+03	1.3E+05
Indeno(1,2,3-cd)pyrene	8.1993E-08	1.1E-02	1.4E+05	2.0E+03	2.8E+08

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Isobutyl alcohol	1.6376E-05	1.9E-05	1.1E+00	5.0E+05	5.7E+05
Isophorone	5.7423E-03	1.1E-02	2.0E+00	2.0E+03	4.0E+03
Isopropyl Alcohol/2-propanol	2.1584E-03	2.1E-03	9.8E-01	5.0E+05	4.9E+05
Kepone	1.1625E-04	9.9E-02	8.5E+02	5.0E+05	4.3E+08
Mesityl oxide	1.3410E-02	8.5E-02	6.3E+00	5.0E+05	3.2E+06
Methyl Acetate	6.7478E-03	4.8E-04	7.2E-02	5.0E+05	3.6E+04
Methylene Chloride	6.1482E-02	8.4E-02	1.4E+00	2.0E+01	2.7E+01
Naphthalene	5.2556E-03	4.3E-01	8.1E+01	2.0E+03	1.6E+05
Nitrobenzene	4.4494E-03	1.1E-02	2.6E+00	1.0E+05	2.6E+05
N-Nitroso-di-n-propylamine	8.3201E-03	1.1E-02	1.4E+00	1.0E+05	1.4E+05
N-Nitrosodiphenylamine	2.1715E-04	1.1E-02	5.2E+01	1.0E+05	5.2E+06
Octane,2,3,7-Trimethyl	2.4354E-03	1.6E-04	6.6E-02	5.0E+05	3.3E+04
o-Toluenesulfonamide	7.6311E-02	5.1E-03	6.6E-02	5.0E+05	3.3E+04
Pentachlorophenol	4.8512E-03	5.6E-02	1.2E+01	1.0E+05	1.2E+06
Phenanthrene	8.7835E-03	1.2E+00	1.3E+02	2.0E+03	2.7E+05
Phenol	3.7775E-02	8.0E-02	2.1E+00	1.0E+05	2.1E+05
Phenol,2,6-Bis(1,1-Dimethyl)	4.3406E-04	4.0E-03	9.3E+00	5.0E+05	4.7E+06
Polyvinyl Chloride	2.7E+00	2.7E+03	1.0E+03	5.0E+05	5.0E+08
p-Toluenesulfonamide	7.6311E-02	5.1E-03	6.6E-02	5.0E+05	3.3E+04
Pyrene	4.5491E-04	2.5E-01	5.6E+02	2.0E+03	1.1E+06
RDX	0.0000E+00	0.0E+00	Not in inventory	5.0E+03	Not in inventory
Styrene	5.8E+04	4.3E+04	7.3E-01	2.0E+03	1.5E+03

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Tetrachloroethene	1.3971E-03	9.6E-03	6.9E+00	2.0E+01	1.4E+02
Toluene	1.4969E-01	9.8E-01	6.6E+00	5.0E+05	3.3E+06
Tributylphosphate	8.3321E-01	3.6E-01	4.4E-01	1.1E+03	4.8E+02
Trichloroethene	2.4672E-02	7.2E-02	2.9E+00	5.0E+05	1.5E+06
Trinitrotoluene	0.0000E+00	0.0E+00	Not in inventory	5.0E+05	Not in inventory
Undecane,4,6-Dimethyl-	2.4354E-03	1.6E-04	6.6E-02	5.0E+03	3.3E+02
Vinyl Chloride	9.7E.01	1.2E+01	1.3E-01	2.0E+03	2.5E+02
Xylene (ortho)	4.4125E-04	3.9E-03	8.8E+00	5.0E+05	4.4E+06
Xylene (total)	3.9255E-01	3.5E+00	8.8E+00	5.0E+05	4.4E+06
INORGANICS					
Aluminum	2.8302E+01	7.1E+03	2.5E+02	5.0E+05	1.3E+08
Antimony	1.1645E-01	5.8E+00	5.0E+01	5.0E+05	2.5E+07
Arsenic	1.8E+00	5.7E+00	3.1E+00	5.0E+05	1.5E+06
Barium	3.6E+00	1.8E+02	5.0E+01	5.0E+05	2.5E+07
Beryllium	1.1E-03	2.9E-01	2.5E+02	5.0E+05	1.3E+08
Boron	3.6E+01	1.8E+02	5.1E+00	5.0E+05	2.5E+06
Bromide	5.4E+01	3.6E+00	6.6E-02	5.0E+05	3.3E+04
Cadmium	5.9E-01	3.6E+00	6.1E+00	5.0E+05	3.0E+06
Calcium	4.0E+03	2.0E+04	5.1E+00	5.0E+05	2.5E+06
Chloride	2.8E+01	1.9E+00	6.6E-02	5.0E+05	3.3E+04
Chromium	1.4E+00	4.1E+01	3.0E+01	5.0E+05	1.5E+07
Cobalt	6.0E-01	6.0E+00	1.0E+01	5.0E+05	5.0E+06
Copper	1.5E+00	3.0E+01	2.0E+01	5.0E+05	1.0E+07
Cyanide	3.8E+00	3.4E-01	8.8E-02	5.0E+05	4.4E+04

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Dysprosium	2.5E-01	5.9E+01	2.4E+02	5.0E+05	1.2E+08
Fluoride	5.8E+01	3.9E+00	6.6E-02	5.0E+05	3.3E+04
Iron	4.7E+01	1.0E+04	2.2E+02	5.0E+05	1.1E+08
Lead	5.8E-01	5.8E+01	1.0E+02	5.0E+05	5.0E+07
Magnesium	8.8E+02	4.5E+03	5.1E+00	5.0E+05	2.5E+06
Manganese	4.1E+00	2.1E+02	5.0E+01	5.0E+05	2.5E+07
Mercury	9.4E-02	9.4E+00	1.0E+02	5.0E+05	5.0E+07
Molybdenum	1.0E+00	1.0E+01	1.0E+01	5.0E+05	5.0E+06
Nickel	2.0E-01	2.0E+01	1.0E+02	5.0E+05	5.0E+07
Nitrate	5.9E+01	3.9E+00	6.6E-02	5.0E+05	3.3E+04
Nitrate/Nitrite-N	3.3E+00	2.2E-01	6.6E-02	5.0E+05	3.3E+04
Nitrite	1.3E-01	8.5E-03	6.6E-02	5.0E+05	3.3E+04
Phosphate	8.6E+01	5.7E+00	6.6E-02	5.0E+05	3.3E+04
Phosphorus	1.9E+01	9.7E+01	5.1E+00	5.0E+05	2.5E+06
Potassium	7.5E+01	1.1E+03	1.5E+01	5.0E+05	7.5E+06
Selenium	2.1E-01	8.5E-01	4.1E+00	5.0E+05	2.0E+06
Silicon	2.4E+05	1.6E+04	6.6E-02	5.0E+05	3.3E+04
Silver	1.1E-01	9.8E+00	9.0E+01	5.0E+05	4.5E+07
Sodium	2.8E+00	2.1E+02	7.6E+01	5.0E+05	3.8E+07
Strontium	1.5E+00	1.8E+01	1.2E+01	5.0E+05	6.0E+06
Sulfate	3.1E+02	2.1E+01	6.6E-02	5.0E+05	3.3E+04
Sulfide	1.1E+04	7.6E+02	6.6E-02	5.0E+05	3.3E+04
Terbium	2.4E+00	5.7E+02	2.4E+02	5.0E+05	1.2E+08
Thallium	3.7E-03	3.7E-01	1.0E+02	5.0E+05	5.0E+07
Tin	3.0E+01	3.0E+00	1.0E-01	5.0E+05	5.1E+04
Vanadium	3.5E+00	2.1E+01	6.1E+00	5.0E+05	3.0E+06
Ytterbium	8.1E-01	2.0E+02	2.4E+02	5.0E+05	1.2E+08
Zinc	1.3E+01	2.1E+02	1.6E+01	5.0E+05	8.0E+06
Zirconium	1.1508E-01	6.9E+01	6.0E+02	5.0E+05	3.0E+08

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
RADIONUCLIDES					
Ac225	1.2254E-22	5.1E-05	4.2E+17	2.2E+07	9.2E+24
Ac227	5.0026E-16	2.0E-02	4.1E+13	1.6E+09	6.6E+22
Ac228	9.4312E-27	1.5E-07	1.6E+19	9.4E+07	1.5E+27
Ag106	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Ag108	3.4865E-27	3.7E-06	1.1E+21	2.0E+08	2.1E+29
Ag108m	3.2648E-10	8.0E+02	2.4E+12	7.8E+07	1.9E+20
Ag109m	1.3042E-30	4.9E-09	3.8E+21	1.5E+09	5.5E+30
Ag110	8.6089E-30	5.2E-08	6.0E+21	1.1E+08	6.3E+29
Ag110m	1.2722E-21	5.5E-06	4.4E+15	4.6E+07	2.0E+23
Ag111	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Am241	2.0154E-08	2.4E+04	1.2E+12	2.3E+07	2.7E+19
Am242	1.0293E-20	4.5E-02	4.4E+18	6.7E+08	2.9E+27
Am242m	1.3207E-14	4.5E-02	3.4E+12	1.9E+09	6.7E+21
Am243	4.9209E-12	3.3E-01	6.8E+10	2.4E+07	1.6E+18
Am245	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Am246	1.2965E-42	1.4E-22	1.1E+20	1.0E+08	1.1E+28
At217	3.3139E-26	5.1E-05	1.5E+21	1.8E+07	2.8E+28
Ba136m	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Ba137m	5.3572E-14	2.3E+07	4.3E+20	1.9E+08	8.3E+28
Ba140	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Be 10	1.9429E-13	1.1E-03	5.9E+09	6.3E+08	3.7E+18
Bi210	5.4959E-21	1.1E-03	2.0E+17	3.3E+08	6.5E+25
Bi211	2.7459E-23	1.8E-02	6.7E+20	1.9E+07	1.3E+28
Bi212	2.3593E-20	5.5E-01	2.3E+19	4.5E+07	1.1E+27
Bi213	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Bi214	7.9491E-23	5.6E-03	7.1E+19	5.9E+07	4.2E+27
Bk249	3.7647E-35	2.2E-18	5.7E+16	3.9E+09	2.2E+26

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Bk250	3.1111E-43	7.8E-23	2.5E+20	1.1E+08	2.7E+28
C 14	2.0391E-12	4.6E-02	2.3E+10	2.6E+09	5.8E+19
Cd109	4.6671E-23	4.9E-09	1.1E+14	6.5E+09	6.9E+23
Cd113m	8.0411E-10	1.6E+03	2.0E+12	6.9E+08	1.4E+21
Cd115m	1.7276E-66	4.3E-51	2.5E+15	2.0E+08	5.0E+23
Ce141	7.9135E-86	1.8E-68	2.3E+17	5.2E+08	1.2E+26
Ce142	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Ce144	1.1981E-16	1.8E+00	1.5E+16	1.1E+09	1.7E+25
Cf249	1.9467E-25	4.1E-13	2.1E+12	2.1E+07	4.4E+19
Cf250	2.6202E-27	2.1E-13	8.0E+13	2.1E+07	1.7E+21
Cf251	1.1691E-27	9.5E-16	8.1E+11	2.2E+07	1.8E+19
Cf252	2.1811E-32	2.2E-17	1.0E+15	1.2E+10	1.3E+25
Cm241	1.2267E-95	1.3E-77	1.1E+18	7.5E+08	7.9E+26
Cm242	3.2300E-31	5.4E-14	1.7E+17	2.1E+07	3.5E+24
Cm243	1.4421E-17	3.6E-03	2.5E+14	2.1E+07	5.2E+21
Cm244	4.2430E-15	1.8E+00	4.3E+14	2.2E+07	9.4E+21
Cm245	1.1668E-16	8.0E-05	6.9E+11	2.3E+07	1.6E+19
Cm246	1.4542E-18	1.8E-06	1.2E+12	2.4E+07	2.9E+19
Cm247	1.7209E-21	6.4E-13	3.7E+08	2.4E+07	9.0E+15
Cm248	1.1478E-23	2.0E-13	1.7E+10	2.7E+07	4.7E+17
Cm250	9.3665E-34	5.5E-22	5.9E+11	9.8E+07	5.8E+19

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Co-57	4.4657E-15	3.7E+00	8.3E+14	8.9E+08	7.4E+23
Co-58	1.1801E-29	5.9E-14	5.0E+15	1.3E+08	6.5E+23
Co-60	7.5535E-09	1.9E+05	2.6E+13	4.9E+07	1.3E+21
Cr-51	5.1738E-68	2.3E-51	4.5E+16	3.5E+09	1.6E+26
Cs132	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Cs134	3.7642E-12	1.1E+04	3.0E+15	7.4E+07	2.2E+23
Cs135	6.2106E-08	3.6E+01	5.8E+08	2.3E+09	1.3E+18
Cs136	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Cs137	4.7432E-07	2.4E+07	5.2E+13	7.5E+08	3.9E+22
Er169	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Eu150	1.9164E-24	1.7E-05	9.0E+18	4.4E+08	4.0E+27
Eu152	1.1185E-08	9.7E+05	8.7E+13	1.0E+08	8.7E+21
Eu154	5.4018E-09	8.2E+05	1.5E+14	8.4E+07	1.3E+22
Eu155	4.7686E-10	1.8E+05	3.7E+14	1.0E+09	3.9E+23
Eu156	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Fe55	2.5E+06	2.0E+09	8.1E+02	2.3E+10	1.9E+13
Fe-59	2.5813E-49	4.5E-32	1.7E+17	9.8E+07	1.7E+25
Fr221	3.6109E-26	5.1E-05	1.4E+21	2.0E+07	2.8E+28
Fr223	9.1235E-25	2.8E-04	3.1E+20	2.9E+08	9.1E+28
Gd152	5.1942E-12	2.7E-11	5.2E+00	5.9E+07	3.1E+08
Gd153	2.2887E-24	2.0E-08	8.8E+15	8.4E+08	7.4E+24
H 3	5.4072E-08	5.0E+04	9.2E+11	2.2E+10	2.1E+22

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Hf-181	6.3798E-51	7.8E-34	1.2E+17	1.7E+08	2.1E+25
Ho166m	9.5753E-22	2.7E-03	2.8E+18	7.3E+07	2.1E+26
I129	1.1080E-01	1.3E+03	1.2E+04	1.6E+09	1.9E+13
I131	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
In114	2.1932E-73	1.9E-51	8.6E+21	1.6E+08	1.4E+30
In114m	1.3743E-68	2.0E-51	1.4E+17	5.3E+08	7.7E+25
In115	2.4263E-08	5.8E-09	2.4E-01	8.4E+08	2.0E+08
In115m	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
K-40	1.8191E-02	1.9E+03	1.1E+05	2.1E+08	2.2E+13
Kr81e	0.0000E+00	5.3E-06	Not in Leachate	Not in Leachate	Not in Leachate
Kr85e	0.0000E+00	1.2E+06	Not in Leachate	Not in Leachate	Not in Leachate
La138	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
La140	2.4808E-121	2.6E-102	1.1E+19	4.5E+07	4.8E+26
Mn-54	5.6208E-21	1.9E-05	3.4E+15	1.5E+08	5.2E+23
Nb92	6.0265E-23	6.3E-16	1.1E+07	8.5E+07	8.9E+14
Nb93m	3.3422E-13	1.4E+01	4.0E+13	4.2E+09	1.7E+23
Nb94	4.7008E-13	8.8E-03	1.9E+10	7.4E+07	1.4E+18
Nb95	7.6761E-47	4.8E-30	6.3E+16	1.6E+08	9.9E+24
Nb95m	3.0154E-50	1.8E-32	6.1E+17	5.2E+08	3.2E+26
Nd144	1.1499E-06	3.3E-07	2.8E-01	6.7E+07	1.9E+07
Nd147	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Ni59	9.5E+04	9.5E+06	1.0E+02	1.9E+10	1.9E+12
Ni63	5.7E+04	6.0E+07	1.1E+02	7.3E+09	7.7E+11
Np235	7.9572E-22	6.8E-08	8.5E+13	1.3E+10	1.1E+24
Np236	6.5219E-13	6.9E-05	1.1E+08	3.7E+08	4.0E+16
Np237	1.1303E-04	6.4E+02	5.7E+06	2.6E+07	1.5E+14
Np238	6.5324E-21	2.2E-04	3.3E+16	1.6E+08	5.3E+24
Np239	1.1189E-17	3.3E-01	3.0E+16	3.1E+08	9.2E+24
Np240	1.7962E-29	2.8E-11	1.6E+18	8.0E+07	1.2E+26
Np240m	1.8591E-27	2.5E-08	1.4E+19	1.3E+08	1.8E+27
Pa231	2.6870E-12	7.0E-02	2.6E+10	2.3E+07	6.1E+17
Pa233	2.3845E-16	4.4E+01	1.8E+17	3.1E+08	5.7E+25
Pa234	1.5587E-22	2.7E-03	1.8E+19	5.2E+07	9.1E+26
Pa234m	2.8344E-22	1.7E+00	6.0E+21	1.5E+08	9.3E+29
Pb209	6.5639E-24	4.8E-05	7.4E+18	6.5E+08	4.8E+27
Pb210	1.1431E-16	1.1E-03	9.6E+12	3.3E+09	3.1E+22
Pb211	4.6321E-22	1.8E-02	4.0E+19	2.5E+08	1.0E+28
Pb212	2.4761E-19	5.5E-01	2.2E+18	4.0E+08	8.9E+26
Pb214	1.0705E-22	5.6E-03	5.2E+19	2.4E+08	1.2E+28
Pd107	2.1579E-07	6.1E+00	2.8E+07	3.9E+09	1.1E+17
Pm146	2.5092E-14	5.8E+00	2.3E+14	1.5E+08	3.5E+22
Pm147	4.5314E-10	3.8E+05	8.4E+14	2.1E+09	1.7E+24
Pm148	6.2917E-74	4.0E-56	6.3E+17	9.8E+07	6.2E+25
Pm148m	1.0045E-71	8.2E-55	8.2E+16	5.9E+07	4.9E+24

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Po210	1.1168E-19	1.0E-03	9.1E+15	2.4E+07	2.2E+23
Po211	2.7502E-30	6.8E-07	2.5E+23	1.7E+07	4.3E+30
Po212	7.8312E-31	3.3E-01	4.2E+29	1.5E+07	6.1E+36
Po213	1.4337E-33	4.3E-05	3.0E+28	1.5E+07	4.6E+35
Po214	7.2803E-30	5.6E-03	7.7E+26	1.7E+07	1.3E+34
Po215	2.5865E-28	1.8E-02	7.1E+25	1.7E+07	1.2E+33
Po216	6.6128E-25	5.5E-01	8.4E+23	1.9E+07	1.6E+31
Po218	8.2761E-24	5.6E-03	6.8E+20	2.1E+07	1.4E+28
Pr143	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Pr144	6.1071E-21	1.8E+00	2.9E+20	1.0E+08	2.9E+28
Pr144m	3.6345E-23	2.5E-02	7.0E+20	1.1E+10	7.5E+30
Pu236	2.1049E-17	5.5E-03	2.6E+14	2.2E+07	5.8E+21
Pu237	4.4568E-72	1.2E-55	2.7E+16	2.1E+09	5.6E+25
Pu238	9.1694E-08	2.3E+05	2.5E+12	2.3E+07	5.9E+19
Pu239	7.6571E-07	6.7E+03	8.7E+09	2.5E+07	2.2E+17
Pu240	4.6958E-08	1.5E+03	3.2E+10	2.5E+07	7.9E+17
Pu241	3.1615E-09	6.4E+04	2.0E+13	2.4E+10	4.9E+23
Pu242	4.3705E-10	2.4E-01	5.5E+08	2.6E+07	1.4E+16
Pu243	1.0969E-31	6.4E-13	5.8E+18	6.6E+08	3.8E+27
Pu244	1.0228E-14	2.5E-08	2.5E+06	2.8E+07	6.9E+13
Pu246	1.2669E-39	1.4E-22	1.1E+17	8.3E+08	9.0E+25

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Ra222	5.4610E-135	1.2E-113	2.1E+21	2.0E+07	4.2E+28
Ra223	2.4635E-19	2.0E-02	8.2E+16	2.2E+07	1.8E+24
Ra224	2.1683E-18	5.5E-01	2.6E+17	2.2E+07	5.7E+24
Ra225	8.1576E-22	5.1E-05	6.3E+16	1.1E+09	6.7E+25
Ra226	4.7699E-09	4.7E+02	9.9E+10	2.7E+07	2.7E+18
Ra228	2.6232E-21	1.5E-07	5.8E+13	1.1E+10	6.4E+23
Rb86	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Rb87	2.3115E-06	1.1E-02	4.8E+03	1.6E+09	7.8E+12
Rh102	1.3562E-16	3.0E-02	2.2E+14	1.6E+09	3.5E+23
Rh103m	1.0414E-74	2.8E-55	2.7E+19	3.3E+09	8.9E+28
Rh106	3.8311E-21	1.1E+01	3.0E+21	7.9E+07	2.3E+29
Rn218	8.8751E-135	1.3E-113	1.4E+21	1.8E+07	2.5E+28
Rn219	1.6220E-21	2.0E-02	1.2E+19	1.9E+07	2.3E+26
Rn220	6.2441E-19	5.5E-01	8.9E+17	2.0E+07	1.8E+25
Rn222	4.2003E-17	6.2E-03	1.5E+14	2.3E+07	3.4E+21
Ru103	7.0663E-43	2.0E-26	2.8E+16	2.3E+08	6.6E+24
Ru106	8.2725E-15	1.2E+01	1.5E+15	3.2E+09	4.8E+24
Sb124	1.5012E-53	2.1E-37	1.4E+16	5.7E+07	7.9E+23
Sb125	4.9644E-11	9.3E+03	1.9E+14	2.4E+08	4.5E+22
Sb126	3.0774E-16	2.1E+01	6.7E+16	4.2E+07	2.8E+24
Sb126m	2.3390E-18	1.5E+02	6.3E+19	5.9E+07	3.7E+27

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Sc-46	1.7783E-34	2.8E-17	1.6E+17	6.0E+07	9.6E+24
Se 79	5.8469E-07	1.7E+02	2.8E+08	2.4E+09	6.9E+17
Sm146	7.4486E-14	4.3E-07	5.7E+06	5.1E+07	2.9E+14
Sm147	7.4416E-07	4.1E-03	5.5E+03	5.7E+07	3.1E+11
Sm148	1.2161E-08	1.0E-09	8.3E-02	6.4E+07	5.3E+06
Sm149	8.8790E-08	5.1E-09	5.8E-02	Not in Leachate	Not in Leachate
Sm151	5.0410E-08	3.4E+05	6.7E+12	6.5E+09	4.3E+22
Sn117m	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Sn119m	3.2878E-20	1.5E-04	4.5E+15	6.5E+09	2.9E+25
Sn121m	3.4980E-12	2.7E+01	7.7E+12	1.5E+09	1.1E+22
Sn123	5.7152E-30	8.4E-14	1.5E+16	4.2E+10	6.2E+26
Sn125	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Sn126	3.9880E-08	1.5E+02	3.7E+09	2.4E+08	9.0E+17
Sr89	1.0737E-56	6.0E-41	5.6E+15	3.6E+08	2.0E+24
Sr90	1.1664E-05	2.3E+07	2.0E+12	2.2E+08	4.3E+20
Tb160	7.5505E-48	3.2E-31	4.2E+16	2.3E+08	9.9E+24
Tb161	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Tc 98	7.6338E-10	1.8E-04	2.3E+05	9.5E+07	2.2E+13
Tc 99	1.2734E-03	5.8E+03	4.5E+06	8.4E+07	3.8E+14
Te123	1.2422E-13	4.5E-12	3.6E+01	1.5E+09	5.5E+10
Te123m	1.8932E-36	2.9E-20	1.6E+16	7.5E+09	1.2E+26

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
Te125m	6.3652E-14	2.3E+03	3.6E+16	5.2E+08	1.9E+25
Te127	1.7707E-35	9.4E-17	5.3E+18	8.0E+08	4.2E+27
Te127m	5.5758E-33	9.5E-17	1.7E+16	5.6E+08	9.6E+24
Te129	1.6092E-87	6.7E-68	4.2E+19	1.4E+09	5.9E+28
Te129m	1.7769E-84	1.1E-67	6.0E+16	2.1E+08	1.3E+25
Th226	5.0570E-134	2.2E-114	4.3E+19	4.1E+08	1.8E+28
Th227	3.6903E-19	1.8E-02	4.9E+16	2.0E+07	9.9E+23
Th228	8.1923E-14	3.3E+01	4.0E+14	2.1E+07	8.5E+21
Th229	2.4030E-15	5.1E-05	2.1E+10	2.4E+07	5.0E+17
Th230	8.5819E-08	1.7E+02	2.0E+09	2.5E+07	5.1E+16
Th231	1.8890E-16	1.6E+02	8.5E+17	2.7E+07	2.3E+25
Th232	1.4238E-02	1.6E+02	1.1E+04	7.2E+08	7.8E+12
Th234	4.6218E-17	1.7E+00	3.7E+16	3.2E+07	1.2E+24
Tl207	5.9894E-23	1.8E-02	3.0E+20	1.9E+09	5.9E+29
Tl208	4.2003E-22	2.0E-01	4.7E+20	2.6E+08	1.2E+29
Tl209	1.6057E-27	1.1E-06	6.5E+20	3.2E+07	2.1E+28
Tm170	3.2435E-39	6.4E-23	2.0E+16	3.2E+07	6.3E+23
Tm171	1.2527E-24	1.6E-09	1.3E+15	3.8E+08	4.9E+23
U230	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
U232	3.8337E-12	5.3E-01	1.4E+11	4.9E+09	6.8E+20
U233	2.7E+04	1.6E+05	6.1E+00	2.7E+07	1.6E+08

Constituents	Average Leachate Concentration (C_{Liquid})a pCi/l	Design Inventory Concentration Soil (C_{Soil})b pCi/kg	Leachate to Waste Soil Ratio (C_{Soil}/S_{Liquid}) l/kg	Maximum Concentration Allowed in Leachate For Compatibility ($C_{Leachate}$)c pCi/l	Maximum Allowable Concentration in Soil For Compatibility d pCi/kg
U234	1.5924E-04	6.0E+03	3.8E+07	2.7E+07	1.0E+15
U235	8.4040E-03	1.1E+02	1.3E+04	2.7E+07	3.5E+11
U236	5.1441E-04	2.0E+02	3.9E+05	2.8E+07	1.1E+13
U237	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
U238	9.5710E-01	2.0E+03	2.0E+03	2.8E+07	5.8E+10
U240	2.8268E-25	2.5E-08	9.0E+16	3.0E+07	2.7E+24
Xe127	5.8291E-83	1.6E-69	2.7E+13	8.0E+08	2.2E+22
Xe129m	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Xe131m	3.3438E-123	2.7E-109	8.0E+13	4.1E+08	3.3E+22
Xe133	0.0000E+00	0.0E+00	Not in Leachate	Not in Leachate	Not in Leachate
Y90	1.5435E-11	2.3E+07	1.5E+18	7.9E+08	1.2E+27
Y91	6.2855E-51	4.1E-34	6.6E+16	1.3E+08	8.7E+24
Zn65	1.9732E-21	2.7E-06	1.4E+15	2.1E+08	2.9E+23
Zr93	5.6711E-07	8.6E+02	1.5E+09	2.2E+08	3.3E+17
Zr95	1.4447E-39	2.9E-22	2.0E+17	6.6E+09	1.3E+27

Notes:

a. Average leachate concentration based on 15 year operations period (2001_ EDF-274).

b. Predicted concentrations of constituents in waste soil (2000, EDF-264).

c. Maximum concentration allowed in leachate for liner capability (2001__, EDF 278)

d. Maximum allowable concentration in soil is the leachate to waste soil ratio multiplied by the maximum allowable concentration in leachate for compatibility.

e. The average leachate concentration is based on the design inventory concentration applied to 510,000 cubic yards. The peak leachate concentration as discussed in the technical memorandum titled "Analysis of Dichlorodifluoromethane Leachate Reduction for the ICDF Landfill and Evaporation Ponds," November 26, 2003, was derived by assuming that only 2,080 cubic yards of waste at TAN contained dichlorodifluoromethane at the design inventory concentration.

Appendix C

Class C Waste Calculations

Appendix C

Class C Waste Calculation

C.1. DISCUSSION

The Nuclear Regulatory Commission performance-based disposal requirement (10 CFR Part 61) is invoked by DOE Order 435.1 and includes radiological waste classification. Waste greater than Class C wastes can not be disposed to the ICDF landfill. The exact regulatory text for determining waste classification is provided. The radiological activities have been converted into pCi/g for comparison to other values calculated for the ICDF landfill WAC. Waste is classified either according to long-lived radionuclides (Table C-1) short-lived radionuclides (Table C-2) or both. The appropriate numbers for comparison have been put into bold font in each table. If the waste contains more than one radionuclide from one table, the sum of fractions is used to determine waste classification. If both long-and short-lived radionuclides are present, then a combination of the tables and the sum of fractions is used, as explained in the regulatory text below, which is taken directly from the regulations.

Because each waste stream will have a different mixture of isotopes, a separate Class C determination must be made for each waste stream. For simple waste streams that contain only one isotope from one table or the other the Class C limitations is given in the WAC, and matches the bold values in Table C-1 or Table C-2 below. For more complicated waste streams, the procedure outlined below must be followed.

10 CFR 61.7(b)(5) Waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste.

10 CFR 61.55 Waste Classification. (a)(2)(iv)

(3) Classification determined by long-lived radionuclides. If radioactive waste contains only radionuclides listed in Table C-1, classification shall be determined as follows:

(i) If the concentration does not exceed 0.1 times the value in Table C-1, the waste is Class A.

(ii) If the concentration exceeds 0.1 times the value in Table C-1 but does not exceed the value in Table C-1, the waste is Class C.

(iii) If the concentration exceeds the value in Table C-1, the waste is not generally acceptable for near-surface disposal.

(iv) For wastes containing mixtures of radionuclides listed in Table C-1, the total concentration shall be determined by the sum of fractions rule described in paragraph (a)(7) of this section.

Table C-1. Long-lived radionuclides.

Radionuclide	0.1 × Class C Radionuclide Concentration pCi/g[a]	**Class C Radionuclide Concentration pCi/g[a]**	Concentration curies per cubic meter
C-14	4.0×10^5	**4.0×10^6**	8
C-14 in activated metal	4.0×10^6	**4.0×10^7**	80
Ni-59 in activated metal	1.10×10^7	**1.10×10^8**	220
Nb-94 in activated metal	1.00×10^4	**1.00×10^5**	0.2
Tc-99	1.5×10^5	**1.5×10^6**	3
I-129	4.0×10^3	**4.0×10^4**	0.08
Alpha emitting transuranic nuclides with half-life greater than 5 years	1.0×10^4	**1.0×10^5**	100[b]
Pu-241	3.5×10^5	**3.5×10^6**	3,500[b]
Cm-242	2.0×10^6	**2.0×10^7**	20,000[b]

a. Assumes a waste density of 2.0 gm/cc, the regulation lists activities as seen in the third column of this table. Columns 1 and 2 have been converted to pCi/g for ease of use.

b. Units are nanocuries per gram.

(4) Classification determined by short-lived radionuclides. If radioactive waste does not contain any of the radionuclides listed in Table C-1, classification shall be determined based on the concentrations shown in Table C-2. However, as specified in paragraph (a)(6) of this section, if radioactive waste does not contain any nuclides listed in either Table C-1 or C-2, it is Class A.

(i) If the concentration does not exceed the value in Column 1, the waste is Class A.

(ii) If the concentration exceeds the value in Column 1, but does not exceed the value in Column 2, the waste is Class B.

(iii) If the concentration exceeds the value in Column 2, but does not exceed the value in Column 3, the waste is Class C.

(iv) If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.

(v) For wastes containing mixtures of the nuclides listed in Table C-2, the total concentration shall be determined by the sum of fractions rule described in paragraph (a)(7) of this section.

Table C-2. Short-lived Radionuclides.

Radionuclide	Concentration, pCi/g[a]		
	Col. 1	Col. 2	**Col. 3**
Total of all nuclides with less than 5 year half-life	3.5×10^8	([b])	([b])
H-3	2.0×10^7	([b])	([b])
Co-60	3.5×10^8	([b])	([b])
Ni-63	1.75×10^6	3.5×10^7	**3.5×10^8**
Ni-63 in activated metal	1.75×10^7	3.5×10^8	**3.5×10^9**
Sr-90	2.0×10^4	7.5×10^7	**3.5×10^9**
Cs-137	5.00×10^5	2.2×10^7	**2.3×10^9**

a. The regulation gives the activities in curies per cubic meter. These have been converted to pCi/g using an assumed mass of 2 gm/cc.

b. No limits are established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other nuclides in Table C-2 determine the waste to be Class C independent of these nuclides.

(5) Classification determined by both long- and short-lived radionuclides. If radioactive waste contains a mixture of radionuclides, some of which are listed in Table C-1, and some of which are listed in Table C-2, classification shall be determined as follows:

(i) If the concentration of a nuclide listed in Table C-1 does not exceed 0.1 times the value listed in Table C-1, the class shall be that determined by the concentration of nuclides listed in Table C-2.

(ii) If the concentration of a nuclide listed in Table C-1 exceeds 0.1 times the value listed in Table C-1 but does not exceed the value in Table C-1, the waste shall be Class C, provided the concentration of nuclides listed in Table C-2 does not exceed the value shown in Column 3 of Table C-2.

(6) Classification of wastes with radionuclides other than those listed in Tables 1 and 2. If radioactive waste does not contain any nuclides listed in either Table C-1 or 2, it is Class A.

(7) The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 50 Ci/m3 and Cs-137 in a concentration of 22 Ci/m3. Since the concentrations both exceed the values in Column 1, Table C-2, they must be compared to Column 2 values. For Sr-90 fraction 50/150=0.33; for Cs-137 fraction, 22/44=0.5; the sum of the fractions=0.83. Since the sum is less than 1.0, the waste is Class B.

C.2. REFERENCES

10 CFR 61,1999, "Licensing Requirements for Land Disposal of Radioactive Waste", *Code of Federal Regulations*, Office of the Federal Register, July 1, 1999.

C.3. BIBLIOGRAPHY

40 CFR 264, 1999, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Subpart BB, "Air emission standards for equipment leaks," *Code of Federal Regulations,* Office of the Federal Register, July 1, 1999.

40 CFR 761, 1999, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations,* Office of the Federal Register, July 1, 1999.

DOE-ID, 1999, *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13,* DOE/ID-10660, Rev. 0, Department of Energy Idaho Operations Office, Idaho Falls, Idaho, U.S. Environmental Protection Agency Region 10, and State of Idaho Department of Health and Welfare.

Appendix D

Master Landfill Waste Acceptance Criteria Table

Appendix D

Master Landfill Allowable Concentration Criteria Development Calculation

Purpose: Compare the concentrations of waste constituents allowable in the waste mass to determine the maximum concentration in the waste mass. The maximum concentration will be used to compute a maximum mass of each design inventory constituent that can be used for the waste acceptance criteria

Methodology: Copy the design inventory constituent list and concentrations allowed in the landfill based on the following criterian:
1. Groundwater remedial action objectives (RAO) based concentrations
2. Maximum allowable concentrations of waste soil that if placed in the landfill would have a leachate chemical make-up compatable with the liner materials (HDPE geomembrane, geosynthetic clay liner, and soil bentonite liner)
3. Regulatory limitations (ARARs)
4. Background concentrations

Calculations:
1. Input the allowable concentration for each design inventory consitutent based on the 4 criterian listed above.
2. Compare the concentration based on each criteria and determine the the criteria that provides the minimum or most conservative allowable concentration in the soil mass.
3. Compare the concentration determined in step 2 with background concentrations and select the maximum concentration between the 2 values for the landfill waste acceptance criteria maximum allowable concentration.
4. If background is selected for the limiting value, the associated concentration will be set at 10 X background

Notes: See Figure 4-1 in the text for WAC development logic

Table D-1. WAC Concentration Selection

Constituent[a]	Concentration Based on Criterion mg/kg or pCi/kg					
	Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[b] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
Organics						
1,1,1-Trichloroethane	1.6E+01	2.7E+01	5.0E+02	NA	1.6E+01	RAO
1,1,2,2-Tetrachloroethane	5.0E-02	2.0E+06	5.0E+02	NA	5.0E-02	RAO
1,1,2-Trichloroethane	2.4E-01	1.3E+05	5.0E+02	NA	2.4E-01	RAO
1,1-Dichloroethane	2.3E+00	1.4E+06	5.0E+02	NA	2.3E+00	RAO
1,1-Dichloroethene	1.5E+00	1.6E+06	5.0E+02	NA	1.5E+00	RAO
1,2,4-Trichlorobenzene	1.1E+01	2.4E+07	5.0E+02	NA	1.1E+01	RAO
1,2-Dichlorobenzene	1.1E+01	8.1E+06	5.0E+02	NA	1.1E+01	RAO
1,2-Dichloroethane	2.5E+04	1.4E+03	5.0E+02	NA	5.0E+02	Other Reg.
1,2-Dichloroethene (total)	3.2E-01	5.6E+05	5.0E+02	NA	3.2E-01	RAO
1,2,3,4,6,7,8,9-OCDD	6.9E+01	1.3E+08	1.0E+05	NA	6.9E+01	RAO
1,2,3,4,6,7,8,9-OCDF	1.4E+01	1.3E+08	1.0E+05	NA	1.4E+01	RAO
1,2,3,4,6,7,8-HpCDD	4.6E+01	1.3E+08	1.0E+05	NA	4.6E+01	RAO
1,2,3,4,6,7,8-HpCDF	1.2E+02	1.3E+08	1.0E+05	NA	1.2E+02	RAO
1,2,3,4,7,8,9-HpCDF	5.9E-01	1.3E+08	1.0E+05	NA	5.9E-01	RAO
1,2,3,4,7,8-HxCDD	1.1E-01	1.3E+08	1.0E+05	NA	1.1E-01	RAO
1,2,3,4,7,8-HxCDF	2.0E+02	1.3E+08	1.0E+05	NA	2.0E+02	RAO
1,2,3,6,7,8-HxCDD	8.4E-01	1.3E+08	1.0E+05	NA	8.4E-01	RAO
1,2,3,6,7,8-HxCDF	1.0E+01	1.3E+08	1.0E+05	NA	1.0E+01	RAO
1,2,3,7,8,9-HxCDD	2.4E+00	1.3E+08	1.0E+05	NA	2.4E+00	RAO
1,2,3,7,8,9-HxCDF	2.2E-02	1.3E+08	1.0E+05	NA	2.2E-02	RAO
1,2,3,7,8-PeCDD	1.1E-01	1.3E+08	1.0E+05	NA	1.1E-01	RAO
1,2,3,7,8-PeCDF	9.3E-01	1.3E+08	1.0E+05	NA	9.3E-01	RAO
1,3-Dichlorobenzene	1.1E+01	2.3E+04	5.0E+02	NA	1.1E+01	RAO
1,4-Dichlorobenzene	4.5E+02	9.0E+06	4.4E+01	NA	4.5E+02	RAO
1,4-Dioxane	1.9E-02	6.4E+05	5.0E+02	NA	1.9E-02	RAO
2,3,4,6,7,8-HxCDF	1.6E+01	1.3E+08	1.0E+05	NA	1.6E+01	RAO
2,3,4,7,8-PeCDF	6.3E+00	1.3E+08	1.0E+05	NA	6.3E+00	RAO
2,3,7,8-TCDD	4.1E-03	1.3E+08	1.0E+05	NA	4.1E-03	RAO
2,3,7,8-TCDF	5.5E+01	1.3E+08	1.0E+05	NA	5.5E+01	RAO

Constituent[a]	Concentration Based on Criterion mg/kg or pCi/kg: Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[h] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
2,4,5-Trichlorophenol	4.5E+01	1.7E+07	1.0E+05	NA	4.5E+01	RAO
2,4,6-Trichlorophenol	1.8E+01	2.0E+06	1.0E+05	NA	1.8E+01	RAO
2,4-Dichlorophenol	2.2E+01	8.0E+06	1.0E+05	NA	2.2E+01	RAO
2,4-Dimethylphenol	1.8E+01	4.7E+06	1.0E+05	NA	1.8E+01	RAO
2,4-Dinitrophenol	5.1E+01	4.8E+05	1.0E+05	NA	5.1E+01	RAO
2,4-Dinitrotoluene	1.1E+01	1.8E+06	1.0E+05	NA	1.1E+01	RAO
2,6-Dinitrotoluene	2.1E+01	1.4E+06	1.0E+05	NA	2.1E+01	RAO
2-Butanone	2.5E+01	1.5E+04	5.0E+02	NA	2.5E+01	RAO
2-Chloronaphthalene	1.1E+01	1.2E+05	1.0E+05	NA	1.1E+01	RAO
2-Chlorophenol	1.8E+01	3.4E+04	1.0E+05	NA	1.8E+01	RAO
2-Hexanone	2.7E+00	5.2E+04	5.0E+02	NA	2.7E+00	RAO
2-Methylnaphthalene	5.1E+02	2.8E+06	1.0E+05	NA	5.1E+02	RAO
2-Nitroaniline	3.4E+03	8.2E+04	1.0E+05	NA	3.4E+03	RAO
2-Nitroaniline	1.0E-01	5.4E+04	1.0E+05	NA	1.0E-01	RAO
2-Nitrophenol	1.8E+01	1.3E+06	1.0E+05	NA	1.8E+01	RAO
3,3'-Dichlorobenzidine	1.1E+01	1.1E+07	1.0E+05	NA	1.1E+01	RAO
3-Methyl Butanal	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
3-Nitroaniline	3.4E+03	8.2E+04	1.0E+05	NA	3.4E+03	RAO
4,6-Dinitro-2-methylphenol	4.5E+01	1.3E+07	1.0E+05	NA	4.5E+01	RAO
4-Bromophenyl-phenylether	No Limit	8.5E+04	1.0E+05	NA	8.5E+04	Liner Compatibility
4-Chloro-3-methylphenol	No Limit	9.6E+04	1.0E+05	NA	9.6E+04	Liner Compatibility
4-Chloroaniline	4.1E+01	1.2E+05	1.0E+05	NA	4.1E+01	RAO
4-Chlorophenyl-phenylether	No Limit	3.9E+06	1.0E+05	NA	1.0E+05	Regulatory Limit
4-Methyl-2-Pentanone	3.0E+01	3.2E+06	5.0E+02	NA	3.0E+01	RAO
4-Methylphenol	3.9E+01	2.1E+06	1.0E+05	NA	3.9E+01	RAO
4-Nitroaniline	3.4E+03	8.2E+04	1.0E+05	NA	3.4E+03	RAO

Concentration Based on Criterion
mg/kg or pCi/kg

Constituent[a]	Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[b] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
4-Nitrophenol	5.2E+01	1.3E+06	1.0E+05	NA	5.2E+01	RAO
Acenaphthene	2.0E+02	5.1E+05	1.0E+05	NA	2.0E+02	RAO
Acenaphthylene	2.1E+01	1.5E+05	1.0E+05	NA	2.1E+01	RAO
Acetone	6.2E+02	2.0E+05	4.9E+01	NA	5.0E+02	Regulatory Limit
Acetonitrile	1.2E+00	7.9E+05	5.0E+02	NA	1.2E+00	RAO
Acrolein	5.5E-01	3.6E+05	5.0E+02	NA	5.5E-01	RAO
Acrylonitrile	5.8E-01	2.0E+05	5.0E+02	NA	5.8E-01	RAO
Anthracene	3.2E+02	9.3E+05	1.0E+05	NA	3.2E+02	RAO
Aramite	6.7E+00	1.9E+07	1.0E+05	NA	6.7E+00	RAO
Aroclor-1016	7.7E+00	7.8E+07	5.0E+02	NA	7.7E+00	RAO
Aroclor-1254	1.3E+02	7.8E+07	5.0E+02	NA	1.3E+02	RAO
Aroclor-1260	7.2E+02	7.8E+07	5.0E+02	NA	5.0E+02	Regulatory Limit
Aroclor-1262	5.0E+03	2.6E+06	5.0E+02	NA	5.0E+02	Other Reg.
Aroclor-1268	6.2E+01	7.8E+07	5.0E+02	NA	6.2E+01	RAO
Benzene	6.0E+02	5.4E+03	2.2E+02	NA	5.0E+02	Regulatory Limit
Benzidine	1.7E+01	1.4E+06	1.0E+05	NA	1.7E+01	RAO
Benzo(a)anthracene	2.5E+02	8.8E+06	1.0E+05	NA	2.5E+02	RAO
Benzo(a)pyrene	1.1E+02	2.9E+07	1.0E+05	NA	1.1E+02	RAO
Benzo(b)fluoranthene	1.8E+02	2.3E+07	1.0E+05	NA	1.8E+02	RAO
Benzo(g,h,i)perylene	1.1E+01	1.5E+10	1.0E+05	NA	1.1E+01	RAO
Benzo(k)fluoranthene	1.9E+01	2.7E+09	1.0E+05	NA	1.9E+01	RAO
Benzoic acid	8.6E+00	4.9E+05	1.0E+05	NA	8.6E+00	RAO
bis(2-Chloroethoxy)methane	No Limit	1.6E+02	1.0E+05	NA	1.6E+02	Liner Compatibility
bis(2-Chloroethyl)ether	1.1E+01	5.6E+03	1.0E+05	NA	1.1E+01	RAO
bis(2-Chloroisopropyl)ether	1.1E+01	5.9E+03	1.0E+05	NA	1.1E+01	RAO
bis(2-Ethylhexyl)phthalate	1.5E+02	8.7E+08	1.0E+05	NA	1.5E+02	RAO
Bromomethane	4.0E+03	5.1E+04	5.0E+02	NA	5.0E+02	Other Reg.
Butane,1,1,3,4-Tetrachloro-	No Limit	2.0E+06	1.0E+05	NA	1.0E+05	Regulatory Limit
Butylbenzylphthalate	6.8E+01	4.3E+08	1.0E+05	NA	6.8E+01	RAO
Carbazole	3.2E+01	4.3E+06	1.0E+05	NA	3.2E+01	RAO
Carbon Disulfide	4.6E+01	1.4E+06	5.0E+02	NA	4.6E+01	RAO
Chlorobenzene	6.6E+00	1.7E+04	5.0E+02	NA	6.6E+00	RAO
Chloroethane	1.5E-01	7.7E+05	5.0E+02	NA	1.5E-01	RAO
Chloromethane	3.5E-01	3.1E+02	5.0E+02	NA	3.5E-01	RAO
Chrysene	2.7E+02	5.7E+06	1.0E+05	NA	2.7E+02	RAO
Decane, 3,4-Dimethyl	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
Diacetone alcohol	No Limit	3.2E+06	1.0E+05	NA	1.0E+05	Regulatory Limit

Table D-1. (continued).

Constituent[a]	Concentration Based on Criterion mg/kg or pCi/kg					
	Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[b] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
Dibenz(a,h)anthracene	1.1E+01	5.6E+07	1.0E+05	NA	1.1E+01	RAO
Dibenzofuran	3.2E+02	1.6E+08	1.0E+05	NA	3.2E+02	RAO
Dichlorodifluoromethane	1.7E+03	4.0E+02	5.0E+02	NA	4.0E+02	Liner Compatibility
Diethylphthalate	1.1E+01	1.2E+06	1.0E+05	NA	1.1E+01	RAO
Dimethyl Disulfide	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
Dimethylphthalate	1.1E+01	3.7E+05	1.0E+05	NA	1.1E+01	RAO
Di-n-butylphthalate	2.4E+01	1.0E+08	1.0E+05	NA	2.4E+01	RAO
Di-n-octylphthalate	2.6E+01	1.2E+12	1.0E+05	NA	2.6E+01	RAO
Eicosane	No Limit	4.8E+05	1.0E+05	NA	1.0E+05	Regulatory Limit
Ethyl cyanide	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
Ethylbenzene	7.8E+01	1.8E+04	5.0E+02	NA	7.8E+01	RAO
Famphur	No Limit	7.9E+06	1.0E+05	NA	1.0E+05	Regulatory Limit
Fluoranthene	7.6E+02	3.0E+06	1.0E+05	NA	7.6E+02	RAO
Fluorene	1.8E+02	1.0E+06	1.0E+05	NA	1.8E+02	RAO
Heptadecane, 2,6,10,15-Tetra	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
Hexachlorobenzene	1.1E+01	4.8E+05	1.0E+05	NA	1.1E+01	RAO
Hexachlorobutadiene	2.1E+01	3.1E+06	5.0E+02	NA	2.1E+01	RAO
Hexachlorocyclopentadiene	1.1E+01	1.4E+07	1.0E+05	NA	1.1E+01	RAO
Hexachloroethane	1.1E+01	1.3E+05	5.0E+02	NA	1.1E+01	RAO
Indeno(1,2,3-cd)pyrene	1.1E+01	2.8E+08	1.0E+05	NA	1.1E+01	RAO
Isobutyl alcohol	1.2E+00	5.7E+05	5.0E+02	NA	1.2E+00	RAO
Isophorone	1.1E+01	4.0E+03	1.0E+05	NA	1.1E+01	RAO
Isopropyl Alcohol/2-propanol	No Limit	4.9E+05	1.0E+05	NA	1.0E+05	Regulatory Limit
Kepone	9.9E+01	4.3E+08	1.0E+05	NA	9.9E+01	RAO
Mesityl oxide	No Limit	3.2E+06	1.0E+05	NA	1.0E+05	Regulatory Limit
Methyl Acetate	4.8E-01	3.6E+04	1.0E+05	NA	4.8E-01	RAO
Methylene Chloride	8.4E+01	2.7E+01	5.0E+02	NA	2.7E+01	Liner Compatibility
Naphthalene	4.3E+02	1.6E+05	1.0E+05	NA	4.3E+02	RAO
Nitrobenzene	1.1E+01	2.6E+05	5.0E+02	NA	1.1E+01	RAO
N-Nitroso-di-n-propylamine	1.1E+01	1.4E+05	1.0E+05	NA	1.1E+01	RAO
N-Nitrosodiphenylamine	1.1E+01	5.2E+06	1.0E+05	NA	1.1E+01	RAO
Octane,2,3,7-Trimethyl	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
o-Toluenesulfonamide	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility
Pentachlorophenol	5.6E+01	1.2E+06	1.0E+05	NA	5.6E+01	RAO
Phenanthrene	1.2E+03	2.7E+05	1.0E+05	NA	1.2E+03	RAO
Phenol	8.0E+01	2.1E+05	1.0E+05	NA	8.0E+01	RAO
Phenol,2,6-Bis(1,1-Dimethyl)	No Limit	4.7E+06	1.0E+05	NA	1.0E+05	Regulatory Limit
Polyvinyl Chloride	NA	5.0E+08	1.0E+05	NA	1.0E+05	Other Reg.
p-Toluenesulfonamide	No Limit	3.3E+04	1.0E+05	NA	3.3E+04	Liner Compatibility

Table D-1. (continued).

Constituent[a]	Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[b] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
	Concentration Based on Criterion mg/kg or pCi/kg					
Pyrene	2.5E+02	1.1E+06	1.0E+05	NA	2.5E+02	RAO
RDX	1.0E+01	Not in inventory	1.0E+05	NA	1.0E+01	RAO
Styrene	4.3E+07	1.5E+03	5.0E+02	NA	5.0E+02	Other Reg.
Tetrachloroethene	9.6E+00	1.4E+02	5.0E+02	NA	9.6E+00	RAO
Toluene	9.8E+02	3.3E+06	3.0E+01	NA	5.0E+02	Regulatory Limit
Tributylphosphate	No Limit	4.8E+02	1.0E+05	NA	4.8E+02	Liner Compatibility
Trichloroethene	7.2E+01	1.5E+06	3.1E+01	NA	7.2E+01	RAO
Trinitrotoluene	1.1E+01	Not in inventory	1.0E+05	NA	1.1E+01	RAO
Undecane,4,6-Dimethyl-	No Limit	3.3E+02	1.0E+05	NA	3.3E+02	Liner Compatibility
Vinyl Chloride	1.2E+04	2.5E+02	5.0E+02	NA	2.5E+02	Liner Compatibility
Xylene (ortho)	3.9E+00	4.4E+06	5.0E+02	NA	3.9E+00	RAO
Xylene (total)	3.5E+03	4.4E+06	2.8E+02	NA	5.0E+02	Regulatory Limit
Inorganics						
Aluminum	1.6E+05	1.3E+08	NA	1.60E+04	1.6E+05	10 X Background
Antimony	5.8E+03	2.5E+07	NA	4.80E+00	5.8E+03	RAO
Arsenic	5.8E+01	1.5E+06	NA	5.80E+00	5.8E+01	RAO
Barium	3.0E+03	2.5E+07	NA	3.00E+02	3.0E+03	RAO
Beryllium	1.8E+01	1.3E+08	NA	1.80E+00	1.8E+01	RAO
Boron	3.3E+03	2.5E+06	NA	NA	3.3E+03	RAO
Bromide	NA	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Boron	3.3E+03	2.5E+06	NA	NA	3.3E+03	RAO
Cadmium	3.6E+03	3.0E+06	NA	2.20E+00	3.6E+03	RAO
Calcium	No Limit	NA[b]	NA	2.40E+04	No Limit	Liner Compatibility
Chloride	No Limit	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Chromium	4.1E+04	1.5E+07	NA	3.30E+01	4.1E+04	RAO
Cobalt	1.1E+02	5.0E+06	NA	1.10E+01	1.1E+02	RAO
Copper	3.0E+04	1.0E+07	NA	2.20E+01	3.0E+04	RAO
Cyanide	3.4E+02	4.4E+04	NA	NA	3.4E+02	RAO
Dysprosium	5.9E+04	1.2E+08	NA	NA	5.9E+04	RAO
Fluoride	3.9E+03	3.3E+04	NA	NA	3.9E+03	RAO
Iron	2.5E+05	1.1E+08	NA	2.40E+04	2.4E+05	10 X Background
Lead	5.8E+04	5.0E+07	NA	1.70E+01	5.8E+04	RAO
Magnesium	No Limit	2.5E+06	NA	1.20E+04	1.2E+05	10 X Background
Manganese	4.9E+03	2.5E+07	NA	4.90E+02	4.9E+03	RAO
Mercury	9.5E+03	5.0E+07	NA	5.00E-02	9.5E+03	RAO
Molybdenum	1.0E+04	5.0E+06	NA	NA	1.0E+04	RAO
Nickel	3.5E+02	5.0E+07	NA	3.50E+01	3.5E+02	RAO
Nitrate	3.9E+03	3.3E+04	NA	NA	3.9E+03	RAO
Nitrate/Nitrite-N	No Limit	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Nitrite	8.5E+00	3.3E+04	NA	NA	8.5E+00	RAO
Phosphate	NA	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Phosphorus	No Limit	NA[b]	NA	NA	No Limit	Liner Compatibility
Potassium	No Limit	7.5E+06	NA	4.30E+03	4.3E+04	10 X Background
Selenium	8.5E+02	2.0E+06	NA	2.20E-01	8.5E+02	RAO
Silicon	NA	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Silver	9.8E+03	4.5E+07	NA	0.00E+00	9.8E+03	RAO

Table D-1. (continued).

Constituent[a]	Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[b] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
	Concentration Based on Criterion mg/kg or pCi/kg					
Sodium	No Limit	3.8E+07	NA	3.20E+02	3.2E+03	10 X Background
Strontium	1.8E+04	6.0E+06	NA	NA	1.8E+04	RAO
Sulfate	No Limit	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Sulfide	No Limit	3.3E+04	NA	NA	3.3E+04	Liner Compatibility
Terbium	No Limit	NA[h]	NA	NA	No Limit	Liner Compatibility
Thallium	4.3E+00	5.0E+07	NA	4.30E-01	4.3E+00	RAO
Tin	3.0E+03	5.1E+04	NA	NA	3.0E+03	RAO
Vanadium	4.5E+02	3.0E+06	NA	4.50E+01	4.5E+02	RAO
Ytterbium	No Limit	NA[h]	NA	NA	No Limit	Liner Compatibility
Zinc	2.1E+05	8.0E+06	NA	1.50E+02	2.1E+05	RAO
Zirconium	No Limit	NA[h]	NA	NA	No Limit	Liner Compatibility
Radionuclides						
Ag108m	8.0E+05	1.9E+20	NA	NA	8.0E+05	RAO
Am241	2.4E+07	2.7E+19	1.0E+07	NA	1.0E+07	Regulatory Limit
Am243	3.3E+02	1.6E+18	1.0E+07	NA	3.3E+02	RAO
Ba137m	No Limit	NA[h]	NA	NA	No Limit	Liner Compatibility
C14	3.0E+03	5.8E+19	4.0E+09	NA	3.0E+03	RAO
Cd113m	1.6E+06	1.4E+21	NA	NA	1.6E+06	RAO
Ce144	1.8E+03	1.7E+25	NA	NA	1.8E+03	RAO
Co57	3.7E+03	7.4E+23	NA	NA	3.7E+03	RAO
Co60	1.9E+08	1.3E+21	NA	NA	1.9E+08	RAO
Cs134	1.1E+07	2.2E+23	NA	NA	1.1E+07	RAO
Cs137	No Limit	3.9E+22	2.3E+12	NA	2.3E+12	Regulatory Limit
Eu152	9.7E+08	8.7E+21	NA	NA	9.7E+08	RAO
Eu154	8.2E+08	1.3E+22	NA	NA	8.2E+08	RAO
Eu155	1.8E+08	3.9E+23	NA	NA	1.8E+08	RAO
Fe55	2.0E+12	1.9E+13	NA	NA	2.0E+12	RAO
H3	5.0E+07	2.1E+22	NA	NA	5.0E+07	RAO
I129	3.1E+03	1.9E+13	4.0E+07	NA	3.1E+03	RAO
K40	2.4E+05	2.2E+13	NA	NA	2.4E+05	RAO
Kr85	No Limit	No Limit	NA	NA	No Limit	RAO
Ni59	9.5E+09	1.9E+12	1.1E+11	NA	9.5E+09	RAO
Ni63	6.0E+10	7.7E+11	3.5E+11	NA	6.0E+10	RAO
Np237	6.4E+05	1.5E+14	1.0E+07	NA	6.4E+05	RAO
Pm147	3.8E+08	1.7E+24	NA	NA	3.8E+08	RAO
Pu238	2.3E+08	5.9E+19	1.0E+07	NA	1.0E+07	Regulatory Limit
Pu239	6.7E+06	2.2E+17	1.0E+07	NA	6.7E+06	RAO
Pu240	1.5E+06	7.9E+17	1.0E+07	1.00E-01	1.5E+06	RAO
Pu241	6.4E+07	4.9E+23	3.5E+09	1.00E-01	6.4E+07	RAO
Ra226	4.7E+05	2.7E+18	NA	NA	4.7E+05	RAO
Ru106	1.2E+04	4.8E+24	NA	NA	1.2E+04	RAO
Sb125	9.3E+06	4.5E+22	NA	NA	9.3E+06	RAO
Sm151	3.4E+08	4.3E+22	NA	NA	3.4E+08	RAO
Sr90	No Limit	4.3E+20	3.5E+12	NA	3.5E+12	Regulatory Limit
Tc99	5.8E+06	3.8E+14	1.5E+09	NA	5.8E+06	RAO
Te125m	2.3E+06	1.9E+25	NA	NA	2.3E+06	RAO
Th228	1.6E+04	8.5E+21	NA	NA	1.6E+04	RAO
Th230	1.4E+04	5.1E+16	NA	NA	1.4E+04	RAO
Th232	1.7E+04	7.8E+12	NA	NA	1.7E+04	RAO
U233	1.6E+08	1.6E+08	NA	NA	1.6E+08	Liner Compatibility

Table D-1. (continued).

Constituent[a]	Concentration Based on Criterion mg/kg or pCi/kg: Groundwater RAO Guidance Concentration mg/kg or pCi/kg	Liner Compatability[b] mg/kg or pCi/kg	Regulatory Limitation[c,d,e,f,g] mg/kg or pCi/kg	Background mg/kg or pCi/kg	Selected WAC Concentration mg/kg or pCi/kg	Source of WAC Concentration
U234	6.0E+06	1.0E+15	NA	NA	6.0E+06	RAO
U235	1.1E+05	3.5E+11	NA	NA	1.1E+05	RAO
U236	2.0E+05	1.1E+13	NA	NA	2.0E+05	RAO
U238	2.0E+06	5.8E+10	NA	NA	2.0E+06	RAO
Y90	2.3E+10	1.2E+27	NA	NA	2.3E+10	RAO

[a] All constituents' design inventory concentrations where compared against background to determine if they should be included in the excess lifetime cancer risk and hazard index evalations. No limit was used as the default if the constituent was less than background and does not have a risk factor, otherwise the concentration was defaulted to the background concentration. MCL

[b] For all constituents where liner compatability data was available, these numbers are given. For constituents without specific compatibility, the maximum allowable leachate concentration by chemical class was used as per Table 4-2 in the main text.

[c] < 10nCi/g total Transuranic isotopes. If more than one transuranic isotope is present the sum must not exceed 10 nCi/g (liquid 10nCi/ml, or 1E7 pCi/L)*These limits are shown in italics*. This is calculated for alpha-emitting TRU isotopes, with half-lives greater than 20 years: NP-237, Pu-238, Pu-239, Pu-240, Pu-244, Pu-244, Am-241, Am-243, Cm-245, cm-248, Cm-250, Bk-247, Cf-249, and Cf-251.

[d] Class C waste, assuming only a single isotope is present. For wastes containing more than one of these isotopes, use the formula in 10 CFR 61.55 to determine waste classification. This is shown in Appendix D to the ICDF Landfill WAC.

[e] Total organic constituents cannot exceede 10% by weight (100,000 mg/kg) 40 CFR 1082(c)(1). total volatile organic constituents cannot exceed 500 ppm.

[f] Total PCBs cannot exceed 500 mg/kg (40 CFR 761.60).

[g] Based on 40 CFR 264 Section BB, exemption provided if organics are less than 10% by weight

"Calculated concentration exceeds unity therefore "No Limit" applies to the specific evaluation criterion.

Appendix E

Thermal Power Calculation Methods

Appendix E

E.1 Calculation of Thermal Power

The thermal power of the waste in a container is calculated from the concentration of radionuclides in the waste and the heat of decay from Table E-1. The thermal power calculation is performed in the following steps. The information provided is an excerpt from the Appendix A: Radiological Calculation Methods (DOE/RL 1998)

1. The concentration of each radionuclide (expressed in curies per cubic meter) is multiplied by the heat of decay for that nuclide from Table E-1, yielding the heat of decay for each in units of watts per cubic meter.

2. To determine the thermal power add the heat of decay for each radionuclide in the waste to provide a total "heat of decay" for the waste stream.

E.2 References

DOE/RL 1998, "Hanford Site Solid Waste Acceptance Criteria, " HNF-EP-0063, Rev. 5, U. S. Department of Energy Richland Field Office, Richland, Washington, June 29, 1998.

Table E-1. Conversion factors for general radiological calculations.

Isotope	Half-life (days)	Specific Activity (curies per gram)	Heat of Decay (watts per curie)	Dose Equivalent Curie Correction Factor
^{3}H	4.5034 E+03	9.66 E+03	3.38 E-05	1.49 E-07
^{7}Be	5.3920 E+01	3.50 E+05	2.94 E-04	7.47 E-07
^{10}Be	5.8439 E+08	2.23 E-02	1.20 E-03	8.25 E-04
^{14}C	2.0928 E+06	4.46 E+00	2.93 E-04	4.86 E-06
^{22}Na	9.5032 E+02	6.25 E+03	8.71 E-03	1.78 E-05
^{32}P	1.4262 E+01	2.86 E+05	4.12 E-03	3.61 E-05
^{35}S	8.7510 E+01	4.26 E+04	2.88 E-04	5.76 E-06
^{36}Cl	1.0994 E+08	3.30 E-02	1.43 E-03	5.11 E-05
^{40}K	4.6641 E+11	7.00 E-06	3.33 E-03	2.87 E-05
^{45}Ca	1.6380 E+02	1.77 E+04	4.56 E-04	1.54 E-05
^{46}Sc	8.3790 E+01	3.39 E+04	1.26 E-02	6.90 E-05
^{49}V	3.3000 E+02	8.08 E+03	5.16 E-06	8.04 E-07
^{51}Cr	2.7702 E+01	9.24 E+04	1.93 E-04	7.78 E-07
^{54}Mn	3.1210 E+02	7.75 E+03	4.96 E-03	1.56 E-05
^{55}Fe	**9.97 E+02**	**2.38 E+03**	**9.66 E-06**	6.25 E-06
^{56}Co	7.7270 E+01	3.02 E+04	2.02 E-02	9.22 E-05
^{57}Co	2.7179 E+02	8.43 E+03	7.42 E-04	2.11 E-05
^{58}Co	7.0820 E+01	3.12 E+04	4.91 E-03	2.53 E-05
^{59}Fe	4.4503 E+01	4.97 E+04	7.74 E-03	3.44 E-05
^{59}Ni	**2.77 E+07**	**7.97 E-02**	**1.36 E-05**	**3.44 E-5**
^{60}Co	1.9253 E+03	1.13 E+03	1.54 E-02	5.09 E-04
^{63}Ni	**3.65 E+04**	**5.67 E+01**	**1.01 E-04**	7.23 E-06
^{65}Zn	2.4426 E+02	8.22 E+03	3.38 E-03	4.75 E-05
^{68}Ge	2.7082 E+02	7.09 E+03	2.44 E-05	1.20 E-04
^{75}Se	1.1978 E+02	1.45 E+04	2.32 E-03	1.97 E-05
^{79}Se	2.3741 E+07	6.96 E-02	3.14 E-04	2.29 E-05
^{82}Sr	2.5550 E+01	6.23 E+04	4.65 E-05	1.43 E-04
^{85}Kr	3.9285 E+03	3.91 E+02	1.50 E-03	1.64 E-14
^{85}Sr	6.4840 E+01	2.37 E+04	3.07 E-03	1.17 E-05
^{86}Rb	1.8631 E+01	8.15 E+04	4.51 E-03	1.54 E-05
^{88}Y	1.0665 E+02	1.39 E+04	1.59 E-02	6.54 E-05
^{89}Sr	5.0530 E+01	2.90 E+04	3.46 E-03	9.65 E-05
$^{90}Sr - ^{90}Y$*	1.0512 E+04	2.76 E+02	5.54 E-03	3.04 E-03
^{93}Mo	1.4610 E+06	9.61 E-01	7.41 E-05	6.62 E-05
^{93m}Nb	5.8914 E+03	2.38 E+02	1.09 E-05	6.81 E-05

Table E-1. (continued).

Isotope	Half-life (days)	Specific Activity (curies per gram)	Heat of Decay (watts per curie)	Dose Equivalent Curie Correction Factor
^{93}Zr	5.5882 E+08	2.51 E-03	1.24 E-04	7.74 E-04
^{94}Nb	7.4144 E+06	1.87 E-01	1.02 E-02	9.65 E-04
^{95}Nb	3.4975 E+01	3.93 E+05	4.68 E-03	1.35 E-05
^{95}Zr–^{95m}Nb*	6.4020 E+01	4.42 E+04	4.24 E-04	6.09 E-05
^{99}Tc	7.7103 E+07	1.71 E-02	5.04 E-04	1.93 E-05
^{103}Ru–^{103m}Rh*	3.6260 E+01	7.00 E+04	3.36 E-03	2.08 E-05
^{106}Ru–^{106}Rh*	3.7359 E+02	6.59 E+03	3.99 E-04	1.11 E-03
^{107}Pd	2.3741 E+09	5.14 E-04	5.51 E-05	2.97 E-05
^{108m}Ag	4.6386 E+04	2.61 E+01	9.96 E-03	6.60 E-04
^{109}Cd	4.6260 E+02	2.59 E+03	1.54 E-04	2.66 E-04
^{110m}Ag–^{110}Ag*	2.4979 E+02	9.50 E+03	7.19 E-03	1.87 E-04
^{113m}Cd	5.1499 E+03	2.24 E+02	1.08 E-03	3.56 E-03
^{113}Sn	1.1509 E+02	1.00 E+04	1.66 E-03	2.48 E-05
^{119m}Sn	2.9310 E+02	3.74 E+03	6.78 E-05	1.45 E-05
^{121m}Sn	2.0088 E+04	5.37 E+01	6.59 E-05	2.68 E-05
^{121}Te	1.6780 E+01	6.43 E+04	3.42 E-03	4.43 E-06
^{123}Te	3.6524 E+15	2.91 E-10	1.29 E-03	2.45 E-05
^{124}Sb	6.0200 E+01	1.75 E+04	1.33 E-02	5.86 E-05
^{125}I	5.9408 E+01	1.76 E+04	2.51 E-04	5.62 E-05
^{125}Sb	1.0074 E+03	1.04 E+03	3.14 E-03	2.84 E-05
^{125m}Te	5.7400 E+01	1.82 E+04	2.13 E-04	1.69 E-05
^{126}Sb	1.2460 E+01	8.32 E+04	1.83 E-02	2.73 E-05
^{126}Sn–^{126m}Sb*	3.6524 E+07	5.68 E-02	1.23 E-02	2.31 E-04
^{127m}Te–^{127}Te*	1.0900 E+02	1.89 E+04	1.36 E-03	5.07 E-05
^{129}I	5.7343 E+09	1.77 E-04	3.93 E-04	4.04 E-04
^{129m}Te	3.3600 E+01	3.01 E+04	1.44 E-03	5.57 E-05
^{131m}Xe	1.1840 E+01	8.42 E+04	1.19 E-04	6.07 E-12
^{133}Ba	3.8423 E+03	2.56 E+02	2.39 E-03	1.81 E-05
^{134}Cs	7.5313 E+02	1.29 E+03	1.02 E-02	1.08 E-04
^{135}Cs	8.4006 E+08	1.15 E-03	3.32 E-04	1.06 E-05
^{137}Cs–^{137m}Ba*	1.0983 E+04	1.69 E+02	3.36 E-03	7.44 E-05
^{140}Ba	1.2752 E+01	7.31 E+04	2.72 E-03	8.70 E-06
^{141}Ce	3.2501 E+01	2.85 E+04	8.60 E-04	2.80 E-05
^{144}Ce–^{144}Pr*	2.8489 E+02	6.37 E+03	7.34 E-03	8.70 E-04
^{147}Nd	1.0980 E+01	8.09 E+04	2.22 E-03	1.59 E-05

Table E-1. (continued).

Isotope	Half-life (days)	Specific Activity (curies per gram)	Heat of Decay (watts per curie)	Dose Equivalent Curie Correction Factor
^{147}Pm	9.5818 E+02	9.27 E+02	3.68 E-04	9.13 E-05
^{147}Sm	3.8716 E+13	2.29 E-08	1.37 E-02	1.74 E-01
^{150}Eu	1.3076 E+04	6.66 E+01	8.90 E-03	6.25 E-04
^{151}Sm	3.2872 E+04	2.63 E+01	7.41 E-04	6.98 E-05
^{152}Eu	4.9461 E+03	1.74 E+02	7.03 E-03	5.14 E-04
^{152}Gd	3.9446 E+16	2.18 E-11	1.31 E-02	5.67 E-01
^{153}Gd	2.4160 E+02	3.53 E+03	6.02 E-04	5.54 E-05
^{154}Eu	3.1385 E+03	2.70 E+02	8.77 E-03	6.66 E-04
^{155}Eu	1.7390 E+03	4.84 E+02	6.53 E-04	9.65 E-05
^{170}Tm	1.2860 E+02	5.97 E+03	1.90 E-03	6.12 E-05
^{175}Hf	7.0000 E+01	1.07 E+04	2.16 E-03	1.30 E-05
^{181}Hf	4.2390 E+01	1.70 E+04	3.85 E-03	3.59 E-05
^{182}Ta	1.1443 E+02	6.27 E+03	8.46 E-03	1.04 E-04
^{185}W	7.5100 E+01	9.40 E+03	7.53 E-04	1.75 E-06
^{187}Re	1.5888 E+13	4.39 E+08	3.91 E-06	1.26 E-07
^{195}Au	1.8609 E+02	3.60 E+03	5.10 E-04	3.01 E-05
^{203}Hg	4.6612 E+01	1.38 E+04	1.75 E-03	1.70 E-05
^{204}Tl	1.3806 E+03	4.64 E+02	1.38 E-03	5.60 E-06
^{207}Bi	1.1523 E+04	5.47 E+01	9.12 E-03	4.66 E-05
^{210}Pb	8.1449 E+03	7.63 E+01	6.62 E-05	3.16 E-02
^{210}Po	1.3838 E+02	4.49 E+03	3.26 E-02	2.18 E-02
^{226}Ra	5.8439 E+05	9.89 E+01	2.89 E-02	2.00 E-02
^{227}Ac	7.9524 E+03	7.23 E+01	1.46 E-03	4.00 E+00
^{228}Ra	2.1001 E+03	2.73 E+02	2.71 E-04	1.11 E-02
^{228}Th	6.9874 E+02	8.20 E+02	3.27 E-02	7.95 E-01
^{229}Th	2.6809 E+06	2.13 E-01	3.08 E-02	5.00 E+00
^{230}Th	2.7532 E+07	2.06 E-02	2.83 E-02	7.58 E-01
^{231}Pa	1.1965 E+07	4.72 E-02	3.08 E-02	2.99 E+00
^{232}Th	5.1317 E+12	1.10 E-07	2.42 E-02	3.81 E+00
^{232}U	2.5165 E+04	2.24 E+01	3.21 E-02	1.53 E+00
^{233}U	5.8147 E+07	9.64 E-03	2.91 E-02	3.15 E-01
^{234}Th	2.4100 E+01	2.32 E+04	1.49 E-04	8.16 E-05
^{234}U	8.9667 E+07	6.26 E-03	2.88 E-02	3.08 E-01
^{235}U	2.5706 E+11	2.16 E-06	2.86 E-02	2.86 E-01
^{236}Pu	1.0439 E+03	5.30 E+02	3.48 E-02	3.37 E-01

Table E-1. (continued).

Isotope	Half-life (days)	Specific Activity (curies per gram)	Heat of Decay (watts per curie)	Dose Equivalent Curie Correction Factor
^{236}U	8.5540 E+09	6.47 E-05	2.71 E-02	2.92 E-01
^{237}Np	7.8162 E+08	7.05 E-04	2.96 E-02	1.25 E+00
^{238}Pu	3.2032 E+04	1.71 E+01	3.31 E-02	9.13 E-01
^{238}U	1.6319 E+12	3.36 E-07	2.53 E-02	2.75 E-01
^{239}Pu	8.8060 E+06	6.21 E-02	3.11 E-02	1.00 E+00
^{240}Pu	2.3971 E+06	2.28 E-01	3.10 E-02	1.00 E+00
^{241}Am	1.5786 E+05	3.44 E+00	3.33 E-02	1.03 E+00
^{241}Pu	5.2412 E+03	1.03 E+02	3.30 E-05	1.92 E-02
^{242m}Am	5.1499 E+04	1.05 E+01	2.37 E-04	9.91 E-01
^{242}Cm	1.6280 E+02	3.31 E+03	3.68 E-02	4.02 E-02
^{242}Pu	1.3634 E+08	3.96 E-03	2.93 E-02	9.56 E-01
^{243}Am	2.6918 E+06	2.00 E-01	3.22 E-02	1.02 E+00
^{243}Cm	1.0629 E+04	5.16 E+01	3.73 E-02	7.15 E-01
^{244}Cm	6.6109 E+03	8.09 E+01	3.50 E-02	5.77 E-01
^{244}Pu	2.9512 E+10	1.83 E-05	2.77 E-02	9.39 E-01
^{245}Cm	3.1046 E+06	1.72 E-01	3.40 E-02	1.06 E+00
^{246}Cm	1.7276 E+06	3.07 E-01	3.25 E-02	1.05 E+00
^{247}Bk	5.0403 E+05	1.05 E+00	3.56 E-02	1.34 E+00
^{247}Cm	5.6978 E+09	9.29 E-05	3.36 E-02	9.65 E-01
^{248}Cm	1.2418 E+08	4.24 E-03	3.06 E-02	3.85 E+00
^{249}Cf	1.2820 E+05	4.09 E+00	3.93 E-02	1.34 E+00
^{250}Cf	4.7774 E+03	1.09 E+02	3.63 E-02	6.10 E-01
^{250}Cm	3.2872 E+06	2.07 E-01	2.19 E-04	2.18 E+01
^{251}Cf	3.2799 E+05	1.59 E+00	3.74 E-02	1.37 E+00
^{252}Cf	9.6607 E+02	5.38 E+02	3.69 E-02	3.65 E-01
^{254}Es	2.7570 E+02	1.86 E+03	3.92 E-02	9.56 E-02

* When this parent-daughter pair are in secular equilibrium, only the activity of the parent nuclide should be considered in performing the calculations. E.g., if ^{90}Sr–^{90}Y are in secular equilibrium in the waste, the thermal power for both nuclides would be determined by multiplying the ^{90}Sr activity by the heat of the decay for the ^{90}Sr–^{90}Y pair.

Appendix F

Comparison of Design Inventory and Waste Acceptance Criteria Concentrations

Table F-1. Comparison of Design Inventory and Waste Acceptance Criteria Concentrations

Constituents	Design Inventory (DI) Mass or Activity kg or Ci	Waste Acceptance Criteria (WAC) Mass or Activity kg or Ci	Mass or Activity Comparison (DI / WAC) %
Organic			
1,1,1-Trichloroethane	7.4E+00	1.2E+04	<0.1%
1,1,2,2-Tetrachloroethane	2.3E-02	3.8E+01	<0.1%
1,1,2-Trichloroethane	1.1E-01	1.8E+02	<0.1%
1,1-Dichloroethane	1.1E+00	1.8E+03	<0.1%
1,1-Dichloroethene	7.0E-01	1.1E+03	<0.1%
1,2,3,4,6,7,8,9-OCDD	5.2E+01	5.2E+04	0.1%
1,2,3,4,6,7,8,9-OCDF	1.1E+01	1.1E+04	0.1%
1,2,3,4,6,7,8-HpCDD	3.5E+01	3.5E+04	0.1%
1,2,3,4,6,7,8-HpCDF	9.1E+01	9.1E+04	0.1%
1,2,3,4,7,8,9-HpCDF	4.4E-01	4.4E+02	0.1%
1,2,3,4,7,8-HxCDD	8.3E-02	8.3E+01	0.1%
1,2,3,4,7,8-HxCDF	1.5E+02	1.5E+05	0.1%
1,2,3,6,7,8-HxCDD	6.4E-01	6.4E+02	0.1%
1,2,3,6,7,8-HxCDF	7.7E+00	7.7E+03	0.1%
1,2,3,7,8,9-HxCDD	1.8E+00	1.8E+03	0.1%
1,2,3,7,8,9-HxCDF	1.7E-02	1.7E+01	0.1%
1,2,3,7,8-PeCDD	8.0E-02	8.0E+01	0.1%
1,2,3,7,8-PeCDF	7.1E-01	7.1E+02	0.1%
1,2,4-Trichlorobenzene	5.4E+00	8.7E+03	<0.1%
1,2-Dichlorobenzene	5.4E+00	8.7E+03	<0.1%
1,2-dichloroethane	1.9E+04	3.8E+05	5.0%
1,2-Dichloroethene (total)	1.5E-01	2.5E+02	<0.1%
1,3-Dichlorobenzene	5.4E+00	8.7E+03	<0.1%
1,4-Dichlorobenzene	2.1E+02	3.2E+04	0.67%
1,4-Dioxane	8.9E-03	1.4E+01	<0.1%
2,3,4,6,7,8-HxCDF	1.2E+01	1.2E+04	0.1%
2,3,4,7,8-PeCDF	4.8E+00	4.8E+03	0.1%
2,3,7,8-TCDD	3.1E-03	3.1E+00	0.1%
2,3,7,8-TCDF	4.2E+01	4.2E+04	0.1%
2,4,5-Trichlorophenol	2.1E+01	3.4E+04	<0.1%
2,4,6-Trichlorophenol	8.6E+00	1.4E+04	<0.1%
2,4-Dichlorophenol	1.0E+01	1.6E+04	<0.1%
2,4-Dimethylphenol	8.6E+00	1.4E+04	<0.1%
2,4-Dinitrophenol	2.4E+01	3.9E+04	<0.1%
2,4-Dinitrotoluene	5.4E+00	8.7E+03	<0.1%
2,6-Dinitrotoluene	9.8E+00	1.6E+04	<0.1%
2-Butanone	1.2E+01	1.9E+04	<0.1%
2-Chloronaphthalene	5.4E+00	8.7E+03	<0.1%
2-Chlorophenol	8.6E+00	1.4E+04	<0.1%
2-Hexanone	1.3E+00	2.0E+03	<0.1%
2-Methylnaphthalene	2.4E+02	3.9E+05	<0.1%
2-Methylphenol	9.8E+00	1.6E+04	<0.1%
2-Nitroaniline	2.6E+03	2.6E+06	0.1%
2-Nitrophenol	8.6E+00	1.4E+04	<0.1%
3,3'-Dichlorobenzidine	5.4E+00	8.7E+03	<0.1%
3-Methyl Butanal	1.1E-01	2.5E+07	<0.1%
3-Nitroaniline	2.6E+03	2.6E+06	0.1%
4,6-Dinitro-2-methylphenol	2.1E+01	3.4E+04	<0.1%
4-Bromophenyl-phenylether	5.4E+00	6.5E+07	<0.1%
4-Chloro-3-methylphenol	8.6E+00	7.3E+07	<0.1%
4-Chloroaniline	1.9E+01	3.1E+04	<0.1%
4-Chlorophenyl-phenylether	5.4E+00	7.6E+07	<0.1%
4-Methyl-2-Pentanone	1.4E+01	2.2E+04	<0.1%
4-Methylphenol	1.8E+01	2.9E+04	<0.1%
4-Nitroaniline	2.6E+03	2.6E+06	0.1%

Table F-1. (continued).

4-Nitrophenol	2.4E+01	3.9E+04	<0.1%
Acetonitrile	8.9E-03	8.8E+02	<0.1%
Acrolein	4.3E-03	4.2E+02	<0.1%
Acrylonitrile	4.3E-03	4.4E+02	<0.1%
Anthracene	1.5E+02	2.4E+05	<0.1%
Aramite	5.4E-02	5.1E+03	<0.1%
Aroclor-1016	3.6E+00	5.8E+03	<0.1%
Aroclor-1254	**6.1E+01**	**9.7E+04**	**<0.1%**
Aroclor-1260	**3.4E+02**	**3.8E+05**	**<0.1%**
Aroclor-1262	**3.8E+03**	**3.8E+05**	**1.0%**
Aroclor-1268	2.9E+01	4.7E+04	<0.1%
Benzene	2.9E+02	1.7E+05	0.17%
Benzidine	1.4E-01	1.3E+04	<0.1%
Benzo(a)anthracene	1.2E+02	1.9E+05	<0.1%
Benzo(a)pyrene	5.0E+01	8.0E+04	<0.1%
Benzo(b)fluoranthene	8.5E+01	1.4E+05	<0.1%
Benzo(g,h,i)perylene	5.4E+00	8.7E+03	<0.1%
Benzo(k)fluoranthene	8.8E+00	1.4E+04	<0.1%
Benzoic acid	4.1E+00	6.5E+03	<0.1%
bis(2-Chloroethoxy)methane	5.4E+00	1.2E+05	<0.1%
bis(2-Chloroethyl)ether	5.4E+00	8.7E+03	<0.1%
bis(2-Chloroisopropyl)ether	5.4E+00	8.7E+03	<0.1%
bis(2-Ethylhexyl)phthalate	7.0E+01	1.1E+05	<0.1%
Bromomethane	**3.0E+03**	**3.8E+05**	**0.8%**
Butane,1,1,3,4-Tetrachloro-	3.7E+00	7.6E+07	<0.1%
Butylbenzylphthalate	3.2E+01	5.2E+04	<0.1%
Carbazole	1.5E+01	2.5E+04	<0.1%
Carbon Disulfide	2.2E+01	3.5E+04	<0.1%
Chlorobenzene	3.1E+00	5.0E+03	<0.1%
Chloroethane	1.4E-03	1.1E+02	<0.1%
Chloromethane	1.7E-01	2.7E+02	<0.1%
Chrysene	1.3E+02	2.0E+05	<0.1%
Decane, 3,4-Dimethyl	7.6E-02	2.5E+07	<0.1%
Diacetone alcohol	2.0E+03	7.6E+07	<0.1%
Dibenz(a,h)anthracene	5.4E+00	8.7E+03	<0.1%
Dibenzofuran	1.5E+02	2.5E+05	<0.1%
Dichlorodifluoromethane	**1.3E+03**	**3.0E+05**	**0.4%**
Diethylphthalate	5.4E+00	8.7E+03	<0.1%
Dimethyl Disulfide	1.4E+00	2.5E+07	<0.1%
Dimethylphthalate	5.4E+00	8.7E+03	<0.1%
Di-n-butylphthalate	1.1E+01	1.8E+04	<0.1%
Di-n-octylphthalate	1.2E+01	2.0E+04	<0.1%
Eicosane	1.3E+00	7.6E+07	<0.1%
Ethyl cyanide	8.9E-03	2.5E+07	<0.1%
Ethylbenzene	3.7E+01	5.9E+04	<0.1%
Famphur	2.8E-02	7.6E+07	<0.1%
Fluoranthene	3.6E+02	5.8E+05	<0.1%
Fluorene	8.7E+01	1.4E+05	<0.1%
Heptadecane, 2,6,10,15-Tetra	1.6E+00	2.5E+07	<0.1%
Hexachlorobenzene	5.4E+00	8.7E+03	<0.1%
Hexachlorobutadiene	9.8E+00	1.6E+04	<0.1%
Hexachlorocyclopentadiene	5.4E+00	8.7E+03	<0.1%
Hexachloroethane	5.4E+00	8.7E+03	<0.1%
Indeno(1,2,3-cd)pyrene	5.4E+00	8.7E+03	<0.1%
Isobutyl alcohol	8.9E-03	8.8E+02	<0.1%
Isophorone	5.4E+00	8.7E+03	<0.1%
Isopropyl Alcohol/2-propanol	1.0E+00	7.6E+07	<0.1%
Kepone	4.7E+01	7.5E+04	<0.1%

Table F-1. (continued).

Mesityl oxide	4.0E+01	7.6E+07	<0.1%
Methyl Acetate	2.3E-01	3.7E+02	<0.1%
Methylene Chloride	4.0E+01	2.1E+04	0.19%
Aroclor-1254	4.3E+01	2.1E+07	<0.1%
Nitrobenzene	5.4E+00	8.7E+03	<0.1%
N-Nitroso-di-n-propylamine	5.4E+00	8.7E+03	<0.1%
N-Nitrosodiphenylamine	5.4E+00	8.7E+03	<0.1%
Octane,2,3,7-Trimethyl	7.6E-02	2.5E+07	<0.1%
o-Toluenesulfonamide	2.4E+00	2.5E+07	<0.1%
Pentachlorophenol	2.6E+01	4.2E+04	<0.1%
Phenanthrene	5.5E+02	8.9E+05	<0.1%
Phenol	3.8E+01	6.1E+04	<0.1%
Phenol,2,6-Bis(1,1-Dimethyl)	1.9E+00	7.6E+07	<0.1%
Polyvinyl Chloride	2.0E+06	7.6E+07	2.7%
p-Toluenesulfonamide	2.4E+00	2.5E+07	<0.1%
Pyrene	1.2E+02	1.9E+05	<0.1%
RDX	-	7.9E+03	-
Styrene [a,b]	3.2E+07	3.8E+05	8500.0%
Tetrachloroethene	4.6E+00	7.3E+03	<0.1%
Toluene	4.7E+02	2.2E+04	2.11%
Tributylphosphate	1.7E+02	3.6E+05	<0.1%
Trichloroethene	3.4E+01	2.3E+04	0.15%
Trinitrotoluene	-	8.4E+03	-
Undecane,4,6-Dimethyl-	7.6E-02	2.5E+05	<0.1%
Vinyl Chloride	9.2E+03	1.9E+05	4.8%
Xylene (ortho)	1.8E+00	2.9E+03	<0.1%
Xylene (total)	1.6E+03	2.1E+05	0.78%
Inorganics			
Aluminum	3.4E+06	1.2E+08	2.76%
Antimony	2.8E+03	4.4E+06	<0.1%
Arsenic	2.7E+03	4.4E+04	6.08%
Barium	8.5E+04	2.3E+06	3.73%
Beryllium	1.4E+02	1.4E+04	1.00%
Boron	8.7E+04	2.5E+06	3.48%
Bromide	2.7E+03	2.5E+07	<0.1%
Cadmium	1.7E+03	2.7E+06	<0.1%
Calcium	9.7E+06	-	-
Chloride	8.8E+02	2.5E+07	<0.1%
Chromium	1.9E+04	3.1E+07	<0.1%
Cobalt	2.9E+03	8.3E+04	3.42%
Copper	1.4E+04	2.3E+07	<0.1%
Cyanide	1.6E+02	2.6E+05	<0.1%
Dysprosium	2.8E+04	4.5E+07	<0.1%
Fluoride	1.8E+03	2.9E+06	<0.1%
Iron	4.9E+06	1.8E+08	2.66%
Lead	2.7E+04	4.4E+07	<0.1%
Magnesium	2.1E+06	9.1E+07	2.33%
Manganese	9.8E+04	3.7E+06	2.63%
Mercury	4.5E+03	7.2E+06	<0.1%
Molybdenum	4.8E+03	7.7E+06	<0.1%
Nickel	9.3E+03	2.7E+05	3.50%
Nitrate	1.9E+03	3.0E+06	<0.1%
Nitrate/Nitrite-N	1.1E+02	2.5E+07	<0.1%
Nitrite	4.0E+00	6.4E+03	<0.1%
Phosphate	4.3E+03	2.5E+07	<0.1%
Phosphorus	4.6E+04	-	-
Potassium	5.3E+05	3.3E+07	1.64%
Selenium	4.0E+02	6.4E+05	<0.1%
Silicon [b]	1.2E+07	2.5E+07	47.3%
Silver	4.7E+03	7.5E+06	<0.1%
Nitrobenzene	1.3E+02	1.1E+07	<0.1%

Table F-1. (continued).

Strontium	8.6E+03	1.4E+07	<0.1%
Sulfate	9.7E+03	2.5E+07	<0.1%
Sulfide	3.6E+05	2.5E+07	1.43%
Terbium	2.7E+05	-	-
Thallium	1.8E+02	3.3E+03	5.37%
Tin	2.3E+03	2.3E+06	0.1%
Vanadium	1.0E+04	3.4E+05	2.95%
Ytterbium	9.2E+04	-	-
Zinc	9.9E+04	1.6E+08	<0.1%
Zirconium	3.3E+04	-	-
Radionuclide			
Ac225	2.4E-08	-	-
Ac227	9.7E-06	-	-
Ac228	7.2E-11	-	-
Ag106	0.0E+00	-	-
Ag108	1.8E-09	-	-
Ag108m	3.8E-01	6.1E+02	<0.1%
Ag109m	2.3E-12	-	-
Ag110	2.5E-11	-	-
Ag110m	2.6E-09	-	-
Ag111	0.0E+00	-	-
Am241	1.1E+01	7.6E+03	0.15%
Am242	2.1E-05	-	-
Am242m	2.1E-05	-	-
Am243	1.6E-04	2.5E-01	<0.1%
Am245	0.0E+00	-	-
Am246	6.5E-26	-	-
At217	2.4E-08	-	-
Ba136m	0.0E+00	-	-
Ba137m	1.1E+04	-	-
Ba140	0.0E+00	-	-
Be10	5.4E-07	-	-
Bi210	5.2E-07	-	-
Bi211	8.7E-06	-	-
Bi212	2.6E-04	-	-
Bi213	0.0E+00	-	-
Bi214	2.7E-06	-	-
Bk249	1.0E-21	-	-
Bk250	3.7E-26	-	-
C14	2.2E-05	2.3E+00	<0.1%
Cd109	2.3E-12	-	-
Cd113m	7.7E-01	1.2E+03	<0.1%
Cd115m	2.0E-54	-	-
Ce141	8.5E-72	-	-
Ce142	0.0E+00	-	-
Ce144	8.6E-04	1.4E+00	<0.1%
Cf249	2.0E-16	-	-
Cf250	1.0E-16	-	-
Cf251	4.5E-19	-	-
Cf252	1.1E-20	-	-
Cm241	6.1E-81	-	-
Cm242	2.6E-17	-	-
Cm243	1.7E-06	-	-

Table F-1. (continued).

Cm244	8.5E-04	-	-
Cm245	3.8E-08	-	-
Cm246	8.5E-10	-	-
Cm247	3.0E-16	-	-
Cm248	9.3E-17	-	-
Cm250	2.6E-25	-	-
Co57	1.7E-03	2.8E+00	<0.1%
Co58	2.8E-17	-	-
Co60	9.2E+01	1.5E+05	<0.1%
Cr51	1.1E-54	-	-
Cs132	0.0E+00	-	-
Cs134	5.3E+00	8.5E+03	<0.1%
Cs135	1.7E-02	-	-
Cs136	0.0E+00	-	-
Cs137	1.2E+04	1.7E+09	<0.1%
Er169	0.0E+00	-	-
Eu150	8.2E-09	-	-
Eu152	4.6E+02	7.3E+05	<0.1%
Eu154	3.9E+02	6.2E+05	<0.1%
Eu155	8.4E+01	1.3E+05	<0.1%
Eu156	0.0E+00	-	-
Fe59	2.1E-35	-	-
Fe55	1.5E+06	4.6E+07	3.3%
Fr221	2.4E-08	-	-
Fr223	1.3E-07	-	-
Gd152	1.3E-14	-	-
Gd153	9.5E-12	-	-
H3	2.3E+01	3.8E+04	<0.1%
Hf181	3.7E-37	-	-
Ho166m	1.3E-06	-	-
I129	6.1E-01	2.4E+00	26.05%
I131	0.0E+00	-	-
In114	8.9E-55	-	-
In114m	9.4E-55	-	-
In115	2.7E-12	-	-
In115m	0.0E+00	-	-
K40	9.1E-01	1.8E+02	0.50%
Kr81	2.5E-09	-	-
Kr85	5.5E+02	-	-
La138	0.0E+00	-	-
La140	1.3E-105	-	-
Mn54	9.1E-09	-	-
Nb92	3.0E-19	-	-
Nb93m	6.4E-03	-	-
Nb94	4.2E-06	-	-
Nb95	2.3E-33	-	-
Nb95m	8.7E-36	-	-
Nd144	1.5E-10	-	-
Nd147	0.0E+00	-	-
Ni59	7.2E+03	1.5E+09	<0.1%
Ni63	4.6E+04	7.2E+06	0.6%
Np235	3.2E-11	-	-
Np236	3.3E-08	-	-
Np237	3.0E-01	4.9E+02	<0.1%
Np238	1.0E-07	-	-

Table F-1. (continued).

Np239	1.6E-04	-	-
Np240	1.3E-14	-	-
Np240m	1.2E-11	-	-
Pa231	3.3E-05	-	-
Pa233	2.1E-02	-	-
Pa234	1.3E-06	-	-
Pa234m	8.1E-04	-	-
Pb209	2.3E-08	-	-
Pb210	5.2E-07	-	-
Pb211	8.7E-06	-	-
Pb212	2.6E-04	-	-
Pb214	2.7E-06	-	-
Pd107	2.9E-03	-	-
Pm146	2.8E-03	-	-
Pm147	1.8E+02	2.9E+05	<0.1%
Pm148	1.9E-59	-	-
Pm148m	3.9E-58	-	-
Po210	4.8E-07	-	-
Po211	3.2E-10	-	-
Po212	1.6E-04	-	-
Po213	2.1E-08	-	-
Po214	2.7E-06	-	-
Po215	8.7E-06	-	-
Po216	2.6E-04	-	-
Po218	2.7E-06	-	-
Pr143	0.0E+00	-	-
Pr144	8.4E-04	-	-
Pr144m	1.2E-05	-	-
Pu236	2.6E-06	-	-
Pu237	5.7E-59	-	-
Pu238	1.1E+02	7.6E+03	1.46%
Pu239	3.2E+00	5.1E+03	<0.1%
Pu240	7.1E-01	1.1E+03	<0.1%
Pu241	3.0E+01	4.9E+04	<0.1%
Pu242	1.1E-04	-	-
Pu243	3.0E-16	-	-
Pu244	1.2E-11	-	-
Pu246	6.5E-26	-	-
Ra222	5.5E-117	-	-
Ra223	9.6E-06	-	-
Ra224	2.6E-04	-	-
Ra225	2.4E-08	-	-
Ra226	2.2E-01	3.6E+02	<0.1%
Ra228	7.2E-11	-	-
Rb86	0.0E+00	-	-
Rb87	5.3E-06	-	-
Rh102	1.4E-05	-	-
Rh103m	1.3E-58	-	-
Rh106	5.4E-03	-	-
Rn218	6.0E-117	-	-
Rn219	9.6E-06	-	-
Rn220	2.6E-04	-	-

Table F-1. (continued).

Rn222	2.9E-06	-	-
Ru103	9.5E-30	-	-
Ru106	5.8E-03	9.2E+00	<0.1%
Sb124	9.8E-41	-	-
Sb125	4.4E+00	7.0E+03	<0.1%
Sb126	9.8E-03	-	-
Sb126m	7.0E-02	-	-
Sc46	1.3E-20	-	-
Se79	7.9E-02	-	-
Sm146	2.0E-10	-	-
Sm147	1.9E-06	-	-
Sm148	4.8E-13	-	-
Sm149	2.4E-12	-	-
Sm151	1.6E+02	2.6E+05	<0.1%
Sn117m	0.0E+00	-	-
Sn119m	7.0E-08	-	-
Sn121m	1.3E-02	-	-
Sn123	4.0E-17	-	-
Sn125	0.0E+00	-	-
Sn126	7.0E-02	-	-
Sr89	2.8E-44	-	-
Sr90	1.1E+04	2.7E+09	<0.1%
Tb160	1.5E-34	-	-
Tb161	0.0E+00	-	-
Tc98	8.4E-08	-	-
Tc99	2.7E+00	4.4E+03	<0.1%
Te123	2.1E-15	-	-
Te123m	1.4E-23	-	-
Te125m	1.1E+00	1.7E+03	<0.1%
Te127	4.4E-20	-	-
Te127m	4.5E-20	-	-
Te129	3.2E-71	-	-
Te129m	5.1E-71	-	-
Th226	1.0E-117	-	-
Th227	8.6E-06	-	-
Th228	1.6E-02	1.2E+01	0.13%
Th229	2.4E-08	-	-
Th230	8.2E-02	1.1E+01	0.77%
Th231	7.6E-02	-	-
Th232	7.4E-02	1.3E+01	0.58%
Th234	8.1E-04	-	-
Tl207	8.7E-06	-	-
Tl208	9.4E-05	-	-
Tl209	5.0E-10	-	-
Tm170	3.0E-26	-	-
Tm171	7.6E-13	-	-
U230	0.0E+00	-	-
U232	2.5E-04	-	-
U233	1.2E+02	1.2E+05	0.1%
U234	2.9E+00	4.6E+03	<0.1%
U235	5.2E-02	8.3E+01	<0.1%
U236	9.6E-02	1.5E+02	<0.1%

Table F-1. (continued).

U237	0.0E+00	-	-
U238	9.2E-01	1.5E+03	<0.1%
U240	1.2E-11	-	-
Xe127	7.5E-73	-	-
Xe129m	0.0E+00	-	-
Xe131m	1.3E-112	-	-
Xe133	0.0E+00	-	-
Y90	1.1E+04	1.7E+07	<0.1%
Y91	2.0E-37	-	-
Zn65	1.3E-09	-	-
Zr93	4.1E-01	-	-
Zr95	1.4E-25	-	-

a. WAC mass limits are based on applying the given concentrations across the total landfill volume of 510,000 yd^3, which yields a very conservative value. It is anticipated that styrene will be found in only a fraction of the waste volume and the actual mass disposed will not approach the WAC mass.
b. The information in the first paragraph of DOE/ID-10865 Section 5.3 should be updated to reflect this information.