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Kimberly P. Crapse
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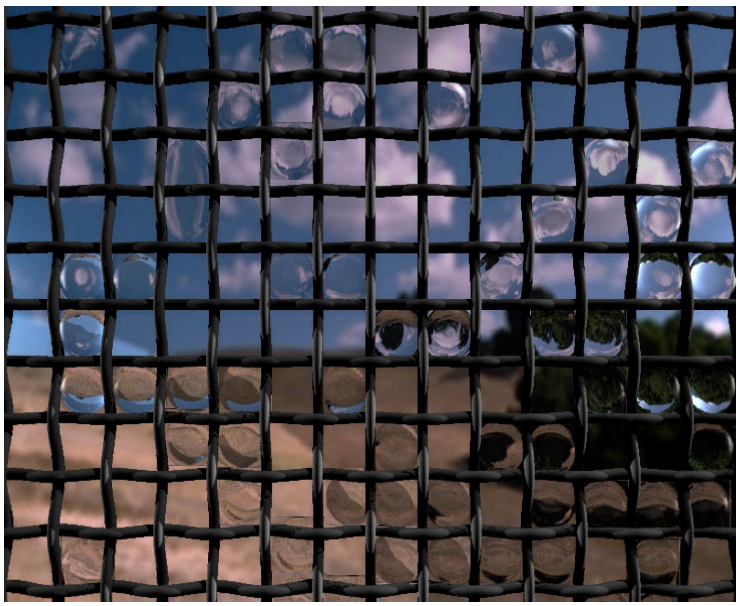

NOVEMBER 9, 2004

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U.S. Department of Energy Under Contract Number DE-AC09-96SR18500

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EXECUTIVE SUMMARY

A sequential screening process using a methodology developed by the National Council on Radiation Protection and Measurements, professional judgement and process knowledge has been used to produce a list of radionuclides requiring detailed analysis to derive disposal limits for the Saltstone Disposal Facility based on the atmospheric pathway.

DISCUSSION

The National Council on Radiation Protection and Measurements (NCRP) has published a report that described a methodology to screen out, or remove from further consideration, radionuclides for detailed analysis in a performance assessment (NCRP, 1996). The NCRP provides a screening methodology, which uses some conservative assumptions, a few facility-specific parameters and an estimated inventory to produce a dose estimate for each radionuclide. If the estimated dose exceeds the dose criteria, then that radionuclide must undergo further analysis.

This process was implemented for the Saltstone Disposal Facility by conservatively assuming an inventory of 10,000,000 curies for each radionuclide and a dose criteria of 0.1 mrem/year. When the process was applied, 13 of the 826 radionuclides considered were removed from further consideration – Ar-37, Ar-39, At-215, At-216, Fr-219, Hf-174, Kr-81m, Ne-19, Po-211, Po-212, Po-213, Po-214 and Rn-218. The screening factors and doses are shown in Table 1.

In order to further reduce the number of radionuclides to be considered in the detailed analysis, some fundamental principles of physics and chemistry were applied. The performance assessment only considers times after final facility closure. Once the disposal vaults are filled and capped, there are only two possible ways for radionuclides to be released to the atmosphere. One is by particulates produced by intrusion, which will be considered separately in the performance assessment, and the other is by release as a gas. The list of elements comprising the remaining 813 radionuclides was examined to identify those which have the potential to form a vapor phase in the disposal vault. This produced the following elements: Ar, As, At, Br, C, Cl, F, Ge, H, Hg, I, Kr, N, O, P, S, Sb, Se, Sn and Xe. These elements have a total of 137 individual radionuclides. Radon was not considered further because it is treated separately in the performance assessment process (USDOE 1999).

Three Saltstone inventory estimate sources were used to develop a list of radionuclides thought to be in the feed to Saltstone (MMES, 1992; Cook et al., 2002; Chandler, 2004). Of the 137 radionuclides that could exist in the gas phase, 9 are thought to be in potential Saltstone feed: C-14, Cl-36, H-3, I-129, Sb-125, Sb-126, Se-79, Sn-121m and Sn-126. A detailed analysis of the atmospheric pathway for these radionuclides will be performed.

Trigger values were calculated from the screening results for the remaining 142 radionuclides using the methodology developed for E-Area (Cook, 2004). If any of the 128 radionuclides does appear in the Saltstone feed, the quantity can be compared to the Trigger Value. If the estimated vault inventory will be less than the Trigger Value, then no further analysis is needed. If the estimated inventory exceeds the Trigger Value, a Special Analysis will be required before that feed can be accepted for disposal. The Trigger Values are given in Table 2.

CONCLUSIONS

Nine radionuclides have been determined to require detailed analysis for the atmospheric pathway. Trigger values have been developed for other radionuclides of potential interest to the atmospheric pathway.

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor (Sv/Bq-m^{-3})	Level I Screening Factor (mrem/Ci-m^{-3})	Screening Dose mrem/yr
Ac-223	1.6E-08	5.9E+07	1.4E+02
Ac-224	5.1E-04	1.9E+12	4.4E+06
Ac-225	2.5E-02	9.3E+13	2.2E+08
Ac-226	2.9E-03	1.1E+13	2.5E+07
Ac-227	1.0E+01	3.7E+16	8.7E+10
Ac-228	4.4E-04	1.6E+12	3.8E+06
Ag-102	3.9E-06	1.4E+10	3.4E+04
Ag-103	2.5E-06	9.3E+09	2.2E+04
Ag-104	7.9E-06	2.9E+10	6.8E+04
Ag-104m	3.2E-06	1.2E+10	2.8E+04
Ag-105	1.5E-03	5.6E+12	1.3E+07
Ag-106	1.2E-06	4.4E+09	1.0E+04
Ag-106m	1.8E-03	6.7E+12	1.6E+07
Ag-108	3.0E-09	1.1E+07	2.6E+01
Ag-108m	3.6E-01	1.3E+15	3.1E+09
Ag-109m	1.5E-10	5.6E+05	1.3E+00
Ag-110	3.1E-10	1.1E+06	2.7E+00
Ag-110m	2.8E-02	1.0E+14	2.4E+08
Ag-111	1.0E-03	3.7E+12	8.7E+06
Ag-112	5.1E-06	1.9E+10	4.4E+04
Ag-115	2.4E-06	8.9E+09	2.1E+04
Al-26	5.7E-01	2.1E+15	4.9E+09
Al-28	2.7E-07	1.0E+09	2.3E+03
Am-237	1.4E-06	5.2E+09	1.2E+04
Am-238	5.2E-06	1.9E+10	4.5E+04
Am-239	7.2E-06	2.7E+10	6.2E+04
Am-240	1.2E-04	4.4E+11	1.0E+06
Am-241	1.0E+00	3.7E+15	8.7E+09
Am-242	1.4E-04	5.2E+11	1.2E+06
Am-242m	1.0E+00	3.7E+15	8.7E+09
Am-243	1.1E+00	4.1E+15	9.5E+09
Am-244	5.1E-05	1.9E+11	4.4E+05
Am-244m	1.5E-06	5.6E+09	1.3E+04
Am-245	3.1E-07	1.1E+09	2.7E+03
Am-246	2.1E-06	7.8E+09	1.8E+04
Am-246m	1.7E-06	6.3E+09	1.5E+04
Ar-37	1.7E-12	6.3E+03	1.5E-02
Ar-39	0.0E+00	0.0E+00	0.0E+00
Ar-41	1.5E-06	5.6E+09	1.3E+04
As-69	1.8E-06	6.7E+09	1.6E+04
As-70	1.0E-05	3.7E+10	8.7E+04
As-71	1.1E-04	4.1E+11	9.5E+05
As-72	1.2E-04	4.4E+11	1.0E+06
As-73	3.1E-04	1.1E+12	2.7E+06
As-74	1.4E-03	5.2E+12	1.2E+07

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
As-76	6.2E-05	2.3E+11	5.4E+05
As-77	2.1E-05	7.8E+10	1.8E+05
As-78	4.8E-06	1.8E+10	4.2E+04
At-207	1.6E-05	5.9E+10	1.4E+05
At-211	2.4E-04	8.9E+11	2.1E+06
At-215	5.8E-15	2.1E+01	5.0E-05
At-216	3.1E-12	1.1E+04	2.7E-02
At-217	3.2E-10	1.2E+06	2.8E+00
At-218	2.2E-08	8.1E+07	1.9E+02
Au-193	7.0E-06	2.6E+10	6.1E+04
Au-194	8.2E-05	3.0E+11	7.1E+05
Au-195	9.1E-04	3.4E+12	7.9E+06
Au-195m	4.5E-09	1.7E+07	3.9E+01
Au-198	1.5E-04	5.6E+11	1.3E+06
Au-198m	2.8E-04	1.0E+12	2.4E+06
Au-199	6.9E-05	2.6E+11	6.0E+05
Au-200	8.1E-07	3.0E+09	7.0E+03
Au-200m	8.3E-05	3.1E+11	7.2E+05
Au-201	1.4E-07	5.2E+08	1.2E+03
Ba-126	5.4E-06	2.0E+10	4.7E+04
Ba-128	3.3E-04	1.2E+12	2.9E+06
Ba-131	4.2E-04	1.6E+12	3.6E+06
Ba-131m	4.6E-07	1.7E+09	4.0E+03
Ba-133	4.6E-02	1.7E+14	4.0E+08
Ba-133m	5.2E-05	1.9E+11	4.5E+05
Ba-135m	1.8E-05	6.7E+10	1.6E+05
Ba-137m	1.2E-07	4.4E+08	1.0E+03
Ba-139	4.6E-07	1.7E+09	4.0E+03
Ba-140	2.4E-03	8.9E+12	2.1E+07
Ba-141	1.6E-06	5.9E+09	1.4E+04
Ba-142	1.8E-06	6.7E+09	1.6E+04
Be-7	1.2E-04	4.4E+11	1.0E+06
Be-10	2.6E-03	9.6E+12	2.2E+07
Bi-200	6.6E-06	2.4E+10	5.7E+04
Bi-201	8.4E-06	3.1E+10	7.3E+04
Bi-202	1.0E-05	3.7E+10	8.7E+04
Bi-203	5.7E-05	2.1E+11	4.9E+05
Bi-205	1.3E-03	4.8E+12	1.1E+07
Bi-206	1.2E-03	4.4E+12	1.0E+07
Bi-207	2.7E-01	1.0E+15	2.3E+09
Bi-210	4.5E-03	1.7E+13	3.9E+07
Bi-210m	1.2E-01	4.4E+14	1.0E+09
Bi-211	7.4E-09	2.7E+07	6.4E+01
Bi-212	3.8E-05	1.4E+11	3.3E+05
Bi-213	2.7E-05	1.0E+11	2.3E+05
Bi-214	1.3E-05	4.8E+10	1.1E+05

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Bk-245	1.5E-04	5.6E+11	1.3E+06
Bk-246	9.0E-05	3.3E+11	7.8E+05
Bk-247	1.3E+00	4.8E+15	1.1E+10
Bk-249	3.3E-03	1.2E+13	2.9E+07
Bk-250	2.0E-05	7.4E+10	1.7E+05
Br-74	7.9E-06	2.9E+10	6.8E+04
Br-74m	9.2E-06	3.4E+10	8.0E+04
Br-75	1.2E-05	4.4E+10	1.0E+05
Br-76	8.1E-05	3.0E+11	7.0E+05
Br-77	6.4E-05	2.4E+11	5.5E+05
Br-80	1.5E-07	5.6E+08	1.3E+03
Br-80m	1.6E-06	5.9E+09	1.4E+04
Br-82	2.3E-04	8.5E+11	2.0E+06
Br-83	2.4E-07	8.9E+08	2.1E+03
Br-84	3.6E-06	1.3E+10	3.1E+04
C-11	1.5E-06	5.6E+09	1.3E+04
C-14	2.6E-04	9.6E+11	2.2E+06
Ca-41	2.4E-03	8.9E+12	2.1E+07
Ca-45	1.0E-03	3.7E+12	8.7E+06
Ca-47	7.3E-04	2.7E+12	6.3E+06
Ca-49	3.0E-06	1.1E+10	2.6E+04
Cd-104	4.9E-06	1.8E+10	4.2E+04
Cd-107	6.1E-07	2.3E+09	5.3E+03
Cd-109	2.8E-03	1.0E+13	2.4E+07
Cd-113	1.5E-01	5.6E+14	1.3E+09
Cd-113m	8.3E-02	3.1E+14	7.2E+08
Cd-115	2.0E-04	7.4E+11	1.7E+06
Cd-115m	2.8E-03	1.0E+13	2.4E+07
Cd-117	4.1E-05	1.5E+11	3.5E+05
Cd-117m	1.7E-05	6.3E+10	1.5E+05
Ce-134	3.6E-04	1.3E+12	3.1E+06
Ce-135	6.5E-05	2.4E+11	5.6E+05
Ce-137	6.6E-07	2.4E+09	5.7E+03
Ce-137m	3.0E-05	1.1E+11	2.6E+05
Ce-139	1.0E-03	3.7E+12	8.7E+06
Ce-141	5.0E-04	1.9E+12	4.3E+06
Ce-143	1.1E-04	4.1E+11	9.5E+05
Ce-144	5.2E-03	1.9E+13	4.5E+07
Cf-244	2.0E-05	7.4E+10	1.7E+05
Cf-246	1.5E-03	5.6E+12	1.3E+07
Cf-248	1.3E-01	4.8E+14	1.1E+09
Cf-249	1.3E+00	4.8E+15	1.1E+10
Cf-250	5.7E-01	2.1E+15	4.9E+09
Cf-251	1.3E+00	4.8E+15	1.1E+10
Cf-252	4.1E-01	1.5E+15	3.5E+09
Cf-253	8.5E-03	3.1E+13	7.4E+07

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Cf-254	8.7E-01	3.2E+15	7.5E+09
Cl-36	6.5E-01	2.4E+15	5.6E+09
Cl-38	3.3E-06	1.2E+10	2.9E+04
Cl-39	3.8E-06	1.4E+10	3.3E+04
Cm-238	1.6E-05	5.9E+10	1.4E+05
Cm-240	1.9E-02	7.0E+13	1.6E+08
Cm-241	1.4E-03	5.2E+12	1.2E+07
Cm-242	4.0E-02	1.5E+14	3.5E+08
Cm-243	7.1E-01	2.6E+15	6.1E+09
Cm-244	5.4E-01	2.0E+15	4.7E+09
Cm-245	1.1E+00	4.1E+15	9.5E+09
Cm-246	1.1E+00	4.1E+15	9.5E+09
Cm-247	1.1E+00	4.1E+15	9.5E+09
Cm-248	3.9E+00	1.4E+16	3.4E+10
Cm-249	5.5E-07	2.0E+09	4.8E+03
Cm-250	2.2E+01	8.1E+16	1.9E+11
Co-55	7.5E-05	2.8E+11	6.5E+05
Co-56	1.6E-02	5.9E+13	1.4E+08
Co-57	2.1E-03	7.8E+12	1.8E+07
Co-58	4.2E-03	1.6E+13	3.6E+07
Co-58m	2.2E-05	8.1E+10	1.9E+05
Co-60	1.7E-01	6.3E+14	1.5E+09
Co-60m	6.4E-07	2.4E+09	5.5E+03
Co-61	5.6E-07	2.1E+09	4.8E+03
Co-62m	3.3E-06	1.2E+10	2.9E+04
Cr-48	1.8E-04	6.7E+11	1.6E+06
Cr-49	2.3E-06	8.5E+09	2.0E+04
Cr-51	9.2E-05	3.4E+11	8.0E+05
Cs-125	2.7E-05	1.0E+11	2.3E+05
Cs-126	8.8E-08	3.3E+08	7.6E+02
Cs-127	7.5E-06	2.8E+10	6.5E+04
Cs-128	3.5E-07	1.3E+09	3.0E+03
Cs-129	2.1E-05	7.8E+10	1.8E+05
Cs-130	9.8E-07	3.6E+09	8.5E+03
Cs-131	1.1E-04	4.1E+11	9.5E+05
Cs-132	7.0E-04	2.6E+12	6.1E+06
Cs-134	1.3E-01	4.8E+14	1.1E+09
Cs-134m	2.1E-05	7.8E+10	1.8E+05
Cs-135	2.0E-02	7.4E+13	1.7E+08
Cs-135m	4.0E-06	1.5E+10	3.5E+04
Cs-136	6.7E-03	2.5E+13	5.8E+07
Cs-137	2.2E-01	8.1E+14	1.9E+09
Cs-138	4.5E-06	1.7E+10	3.9E+04
Cu-60	6.3E-06	2.3E+10	5.5E+04
Cu-61	5.7E-06	2.1E+10	4.9E+04
Cu-62	9.3E-07	3.4E+09	8.0E+03

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Cu-64	5.2E-06	1.9E+10	4.5E+04
Cu-66	4.6E-08	1.7E+08	4.0E+02
Cu-67	6.3E-05	2.3E+11	5.5E+05
Dy-155	1.6E-05	5.9E+10	1.4E+05
Dy-157	5.2E-06	1.9E+10	4.5E+04
Dy-159	3.2E-04	1.2E+12	2.8E+06
Dy-165	3.9E-07	1.4E+09	3.4E+03
Dy-166	3.6E-04	1.3E+12	3.1E+06
Er-161	6.1E-06	2.3E+10	5.3E+04
Er-165	8.4E-07	3.1E+09	7.3E+03
Er-169	1.3E-04	4.8E+11	1.1E+06
Er-171	6.7E-06	2.5E+10	5.8E+04
Er-172	2.6E-04	9.6E+11	2.2E+06
Es-250	1.1E-05	4.1E+10	9.5E+04
Es-251	2.2E-05	8.1E+10	1.9E+05
Es-253	1.0E-02	3.7E+13	8.7E+07
Es-254	9.4E-02	3.5E+14	8.1E+08
Es-254m	1.4E-03	5.2E+12	1.2E+07
Eu-145	4.6E-04	1.7E+12	4.0E+06
Eu-146	6.0E-04	2.2E+12	5.2E+06
Eu-147	6.6E-04	2.4E+12	5.7E+06
Eu-148	3.4E-02	1.3E+14	2.9E+08
Eu-149	3.0E-04	1.1E+12	2.6E+06
Eu-150a	4.4E-06	1.6E+10	3.8E+04
Eu-150b	2.8E-01	1.0E+15	2.4E+09
Eu-152	1.4E-01	5.2E+14	1.2E+09
Eu-152m	7.6E-06	2.8E+10	6.6E+04
Eu-154	1.2E-01	4.4E+14	1.0E+09
Eu-155	4.7E-03	1.7E+13	4.1E+07
Eu-156	1.6E-03	5.9E+12	1.4E+07
Eu-157	1.4E-05	5.2E+10	1.2E+05
Eu-158	2.6E-06	9.6E+09	2.2E+04
F-18	4.1E-06	1.5E+10	3.5E+04
Fe-52	4.8E-05	1.8E+11	4.2E+05
Fe-55	2.8E-04	1.0E+12	2.4E+06
Fe-59	4.3E-03	1.6E+13	3.7E+07
Fe-60	5.0E-01	1.9E+15	4.3E+09
Fm-252	9.1E-04	3.4E+12	7.9E+06
Fm-253	1.5E-03	5.6E+12	1.3E+07
Fm-254	1.2E-04	4.4E+11	1.0E+06
Fm-255	5.9E-04	2.2E+12	5.1E+06
Fm-257	5.1E-02	1.9E+14	4.4E+08
Fr-219	1.2E-12	4.4E+03	1.0E-02
Fr-220	2.9E-07	1.1E+09	2.5E+03
Fr-221	2.1E-06	7.8E+09	1.8E+04
Fr-222	1.9E-05	7.0E+10	1.6E+05

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Fr-223	6.8E-05	2.5E+11	5.9E+05
Ga-65	2.7E-06	1.0E+10	2.3E+04
Ga-66	4.2E-05	1.6E+11	3.6E+05
Ga-67	3.9E-05	1.4E+11	3.4E+05
Ga-68	3.0E-06	1.1E+10	2.6E+04
Ga-70	6.9E-08	2.6E+08	6.0E+02
Ga-72	6.9E-05	2.6E+11	6.0E+05
Ga-73	3.7E-06	1.4E+10	3.2E+04
Gd-145	4.9E-06	1.8E+10	4.2E+04
Gd-146	5.9E-03	2.2E+13	5.1E+07
Gd-147	1.5E-04	5.6E+11	1.3E+06
Gd-148	4.4E-01	1.6E+15	3.8E+09
Gd-149	3.2E-04	1.2E+12	2.8E+06
Gd-151	4.5E-04	1.7E+12	3.9E+06
Gd-152	3.2E-01	1.2E+15	2.8E+09
Gd-153	1.3E-03	4.8E+12	1.1E+07
Gd-159	1.0E-05	3.7E+10	8.7E+04
Ge-66	1.2E-05	4.4E+10	1.0E+05
Ge-67	2.2E-06	8.1E+09	1.9E+04
Ge-68	1.3E-02	4.8E+13	1.1E+08
Ge-69	7.2E-05	2.7E+11	6.2E+05
Ge-71	1.1E-05	4.1E+10	9.5E+04
Ge-75	2.7E-07	1.0E+09	2.3E+03
Ge-77	2.8E-05	1.0E+11	2.4E+05
Ge-78	4.3E-06	1.6E+10	3.7E+04
H-3	1.9E-06	7.0E+09	1.6E+04
Hf-170	9.4E-05	3.5E+11	8.1E+05
Hf-172	4.9E-02	1.8E+14	4.2E+08
Hf-173	2.8E-05	1.0E+11	2.4E+05
Hf-174	0.0E+00	0.0E+00	0.0E+00
Hf-175	1.2E-03	4.4E+12	1.0E+07
Hf-177m	5.8E-06	2.1E+10	5.0E+04
Hf-178m	4.5E-01	1.7E+15	3.9E+09
Hf-179m	1.5E-03	5.6E+12	1.3E+07
Hf-180m	1.1E-05	4.1E+10	9.5E+04
Hf-181	1.5E-03	5.6E+12	1.3E+07
Hf-182	3.5E-01	1.3E+15	3.0E+09
Hf-182m	3.9E-06	1.4E+10	3.4E+04
Hf-183	4.8E-06	1.8E+10	4.2E+04
Hf-184	1.5E-05	5.6E+10	1.3E+05
Hg-193	3.1E-06	1.1E+10	2.7E+04
Hg-193m	2.7E-05	1.0E+11	2.3E+05
Hg-194	4.7E-01	1.7E+15	4.1E+09
Hg-195	6.1E-06	2.3E+10	5.3E+04
Hg-195m	6.9E-05	2.6E+11	6.0E+05
Hg-197	3.7E-05	1.4E+11	3.2E+05

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Hg-197m	3.0E-05	1.1E+11	2.6E+05
Hg-199m	5.5E-07	2.0E+09	4.8E+03
Hg-203	1.8E-03	6.7E+12	1.6E+07
Ho-155	2.2E-06	8.1E+09	1.9E+04
Ho-157	6.8E-07	2.5E+09	5.9E+03
Ho-159	7.7E-07	2.9E+09	6.7E+03
Ho-161	3.4E-07	1.3E+09	2.9E+03
Ho-162	2.0E-07	7.4E+08	1.7E+03
Ho-162m	1.9E-06	7.0E+09	1.6E+04
Ho-164	6.4E-08	2.4E+08	5.5E+02
Ho-164m	1.6E-07	5.9E+08	1.4E+03
Ho-166	4.7E-05	1.7E+11	4.1E+05
Ho-166m	3.8E-01	1.4E+15	3.3E+09
Ho-167	2.5E-06	9.3E+09	2.2E+04
I-120	9.9E-06	3.7E+10	8.6E+04
I-120m	1.4E-05	5.2E+10	1.2E+05
I-121	5.1E-06	1.9E+10	4.4E+04
I-122	3.3E-07	1.2E+09	2.9E+03
I-123	7.6E-06	2.8E+10	6.6E+04
I-124	8.4E-03	3.1E+13	7.3E+07
I-125	5.2E-02	1.9E+14	4.5E+08
I-126	5.5E-02	2.0E+14	4.8E+08
I-128	2.2E-07	8.1E+08	1.9E+03
I-129	5.6E-01	2.1E+15	4.8E+09
I-130	7.1E-05	2.6E+11	6.1E+05
I-131	2.8E-02	1.0E+14	2.4E+08
I-132	1.2E-05	4.4E+10	1.0E+05
I-132m	6.2E-06	2.3E+10	5.4E+04
I-133	2.2E-04	8.1E+11	1.9E+06
I-134	6.6E-06	2.4E+10	5.7E+04
I-135	2.5E-05	9.3E+10	2.2E+05
In-109	6.3E-06	2.3E+10	5.5E+04
In-110a	4.8E-06	1.8E+10	4.2E+04
In-110b	2.7E-05	1.0E+11	2.3E+05
In-111	7.6E-05	2.8E+11	6.6E+05
In-112	3.3E-07	1.2E+09	2.9E+03
In-113m	1.0E-06	3.7E+09	8.7E+03
In-114	1.3E-09	4.8E+06	1.1E+01
In-114m	3.6E-03	1.3E+13	3.1E+07
In-115	4.0E-02	1.5E+14	3.5E+08
In-115m	1.6E-06	5.9E+09	1.4E+04
In-116m	6.1E-06	2.3E+10	5.3E+04
In-117	1.6E-06	5.9E+09	1.4E+04
In-117m	3.0E-05	1.1E+11	2.6E+05
In-119	1.4E-07	5.2E+08	1.2E+03
In-119m	1.2E-07	4.4E+08	1.0E+03

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Ir-182	2.5E-06	9.3E+09	2.2E+04
Ir-184	1.1E-05	4.1E+10	9.5E+04
Ir-185	3.3E-05	1.2E+11	2.9E+05
Ir-186a	4.8E-05	1.8E+11	4.2E+05
Ir-186b	3.8E-06	1.4E+10	3.3E+04
Ir-187	7.3E-06	2.7E+10	6.3E+04
Ir-188	1.3E-04	4.8E+11	1.1E+06
Ir-189	1.5E-04	5.6E+11	1.3E+06
Ir-190	1.1E-03	4.1E+12	9.5E+06
Ir-190m	4.4E-06	1.6E+10	3.8E+04
Ir-190n	8.7E-07	3.2E+09	7.5E+03
Ir-191m	1.8E-10	6.7E+05	1.6E+00
Ir-192	3.3E-03	1.2E+13	2.9E+07
Ir-192m	2.4E-01	8.9E+14	2.1E+09
Ir-194	2.8E-05	1.0E+11	2.4E+05
Ir-194m	1.6E-02	5.9E+13	1.4E+08
Ir-195	5.9E-07	2.2E+09	5.1E+03
Ir-195m	3.6E-06	1.3E+10	3.1E+04
K-38	2.7E-06	1.0E+10	2.3E+04
K-40	9.4E-02	3.5E+14	8.1E+08
K-42	1.1E-05	4.1E+10	9.5E+04
K-43	4.5E-05	1.7E+11	3.9E+05
K-44	3.7E-06	1.4E+10	3.2E+04
K-45	3.0E-06	1.1E+10	2.6E+04
Kr-74	3.2E-06	1.2E+10	2.8E+04
Kr-76	6.8E-05	2.5E+11	5.9E+05
Kr-77	2.7E-06	1.0E+10	2.3E+04
Kr-79	3.1E-07	1.1E+09	2.7E+03
Kr-81	1.3E-08	4.8E+07	1.1E+02
Kr-81m	4.4E-19	1.6E-03	3.8E-09
Kr-83m	1.1E-10	4.1E+05	9.5E-01
Kr-85	2.8E-09	1.0E+07	2.4E+01
Kr-85m	2.0E-07	7.4E+08	1.7E+03
Kr-87	1.0E-06	3.7E+09	8.7E+03
Kr-88	5.4E-06	2.0E+10	4.7E+04
La-131	3.3E-06	1.2E+10	2.9E+04
La-132	1.8E-05	6.7E+10	1.6E+05
La-134	4.8E-07	1.8E+09	4.2E+03
La-135	1.7E-06	6.3E+09	1.5E+04
La-137	6.2E-03	2.3E+13	5.4E+07
La-138	2.7E-01	1.0E+15	2.3E+09
La-140	2.4E-04	8.9E+11	2.1E+06
La-141	3.8E-06	1.4E+10	3.3E+04
La-142	9.8E-06	3.6E+10	8.5E+04
La-143	9.6E-07	3.6E+09	8.3E+03
Lu-169	1.1E-04	4.1E+11	9.5E+05

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Lu-170	2.3E-04	8.5E+11	2.0E+06
Lu-171	3.9E-04	1.4E+12	3.4E+06
Lu-172	7.3E-04	2.7E+12	6.3E+06
Lu-173	2.8E-03	1.0E+13	2.4E+07
Lu-174	5.6E-03	2.1E+13	4.8E+07
Lu-174m	1.4E-03	5.2E+12	1.2E+07
Lu-176	1.3E-01	4.8E+14	1.1E+09
Lu-176m	6.4E-07	2.4E+09	5.5E+03
Lu-177	1.5E-04	5.6E+11	1.3E+06
Lu-177m	7.8E-03	2.9E+13	6.7E+07
Lu-178	3.2E-07	1.2E+09	2.8E+03
Lu-178m	1.8E-06	6.7E+09	1.6E+04
Lu-179	9.8E-07	3.6E+09	8.5E+03
Md-257	9.5E-05	3.5E+11	8.2E+05
Md-258	3.5E-02	1.3E+14	3.0E+08
Mg-28	1.8E-04	6.7E+11	1.6E+06
Mn-51	2.6E-06	9.6E+09	2.2E+04
Mn-52	9.6E-04	3.6E+12	8.3E+06
Mn-52m	3.7E-06	1.4E+10	3.2E+04
Mn-53	1.8E-04	6.7E+11	1.6E+06
Mn-54	9.7E-03	3.6E+13	8.4E+07
Mn-56	9.1E-06	3.4E+10	7.9E+04
Mo-101	2.2E-06	8.1E+09	1.9E+04
Mo-90	4.7E-05	1.7E+11	4.1E+05
Mo-93	2.1E-03	7.8E+12	1.8E+07
Mo-93m	2.5E-05	9.3E+10	2.2E+05
Mo-99	2.3E-04	8.5E+11	2.0E+06
N-13	9.7E-07	3.6E+09	8.4E+03
Na-22	1.0E-01	3.7E+14	8.7E+08
Na-24	1.1E-04	4.1E+11	9.5E+05
Nb-88	6.1E-06	2.3E+10	5.3E+04
Nb-89a	7.2E-06	2.7E+10	6.2E+04
Nb-89b	1.5E-05	5.6E+10	1.3E+05
Nb-90	1.0E-04	3.7E+11	8.7E+05
Nb-93m	3.2E-04	1.2E+12	2.8E+06
Nb-94	3.8E-01	1.4E+15	3.3E+09
Nb-95	1.2E-03	4.4E+12	1.0E+07
Nb-95m	2.1E-04	7.8E+11	1.8E+06
Nb-96	1.1E-04	4.1E+11	9.5E+05
Nb-97	2.1E-06	7.8E+09	1.8E+04
Nb-97m	5.1E-08	1.9E+08	4.4E+02
Nb-98	6.1E-06	2.3E+10	5.3E+04
Nd-136	4.5E-06	1.7E+10	3.9E+04
Nd-138	9.9E-06	3.7E+10	8.6E+04
Nd-139	1.0E-06	3.7E+09	8.7E+03
Nd-139m	1.9E-05	7.0E+10	1.6E+05

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Nd-141	3.8E-07	1.4E+09	3.3E+03
Nd-141m	2.7E-08	1.0E+08	2.3E+02
Nd-147	4.7E-04	1.7E+12	4.1E+06
Nd-149	4.4E-06	1.6E+10	3.8E+04
Nd-151	1.4E-06	5.2E+09	1.2E+04
Ne-19	2.3E-15	8.5E+00	2.0E-05
Ni-56	2.5E-03	9.3E+12	2.2E+07
Ni-57	3.1E-04	1.1E+12	2.7E+06
Ni-59	6.8E-04	2.5E+12	5.9E+06
Ni-63	1.6E-03	5.9E+12	1.4E+07
Ni-65	3.3E-06	1.2E+10	2.9E+04
Ni-66	1.6E-03	5.9E+12	1.4E+07
Np-232	2.8E-06	1.0E+10	2.4E+04
Np-233	1.9E-07	7.0E+08	1.6E+03
Np-234	3.0E-04	1.1E+12	2.6E+06
Np-235	1.2E-04	4.4E+11	1.0E+06
Np-236a	3.8E+03	1.4E+19	3.3E+13
Np-236b	2.3E-04	8.5E+11	2.0E+06
Np-237	1.3E+00	4.8E+15	1.1E+10
Np-238	1.7E-04	6.3E+11	1.5E+06
Np-239	8.5E-05	3.1E+11	7.4E+05
Np-240	3.4E-06	1.3E+10	2.9E+04
Np-240m	2.6E-07	9.6E+08	2.2E+03
O-15	1.3E-07	4.8E+08	1.1E+03
Os-180	1.9E-06	7.0E+09	1.6E+04
Os-181	7.9E-06	2.9E+10	6.8E+04
Os-182	6.9E-05	2.6E+11	6.0E+05
Os-185	2.8E-03	1.0E+13	2.4E+07
Os-189m	7.3E-08	2.7E+08	6.3E+02
Os-190m	1.5E-06	5.6E+09	1.3E+04
Os-191	3.1E-04	1.1E+12	2.7E+06
Os-191m	1.2E-05	4.4E+10	1.0E+05
Os-193	3.5E-05	1.3E+11	3.0E+05
Os-194	1.2E-02	4.4E+13	1.0E+08
P-30	1.9E-07	7.0E+08	1.6E+03
P-32	7.3E-03	2.7E+13	6.3E+07
P-33	9.8E-04	3.6E+12	8.5E+06
Pa-227	9.8E-05	3.6E+11	8.5E+05
Pa-228	1.1E-03	4.1E+12	9.5E+06
Pa-230	5.4E-03	2.0E+13	4.7E+07
Pa-231	3.0E+00	1.1E+16	2.6E+10
Pa-232	2.0E-04	7.4E+11	1.7E+06
Pa-233	6.7E-04	2.5E+12	5.8E+06
Pa-234	2.5E-05	9.3E+10	2.2E+05
Pa-234m	5.3E-10	2.0E+06	4.6E+00
Pb-195m	2.9E-06	1.1E+10	2.5E+04

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Pb-198	9.3E-06	3.4E+10	8.0E+04
Pb-199	5.8E-06	2.1E+10	5.0E+04
Pb-200	6.2E-05	2.3E+11	5.4E+05
Pb-201	1.6E-05	5.9E+10	1.4E+05
Pb-202	1.3E-01	4.8E+14	1.1E+09
Pb-202m	1.5E-05	5.6E+10	1.3E+05
Pb-203	4.4E-05	1.6E+11	3.8E+05
Pb-205	5.0E-04	1.9E+12	4.3E+06
Pb-209	1.8E-07	6.7E+08	1.6E+03
Pb-210	7.1E-01	2.6E+15	6.1E+09
Pb-211	1.6E-05	5.9E+10	1.4E+05
Pb-212	3.4E-04	1.3E+12	2.9E+06
Pb-214	2.0E-05	7.4E+10	1.7E+05
Pd-100	5.2E-04	1.9E+12	4.5E+06
Pd-101	1.2E-05	4.4E+10	1.0E+05
Pd-103	9.3E-05	3.4E+11	8.0E+05
Pd-107	1.3E-04	4.8E+11	1.1E+06
Pd-109	6.1E-06	2.3E+10	5.3E+04
Pm-141	1.2E-06	4.4E+09	1.0E+04
Pm-142	1.5E-08	5.6E+07	1.3E+02
Pm-143	3.1E-03	1.1E+13	2.7E+07
Pm-144	2.1E-02	7.8E+13	1.8E+08
Pm-145	4.4E-03	1.6E+13	3.8E+07
Pm-146	5.1E-02	1.9E+14	4.4E+08
Pm-147	3.2E-04	1.2E+12	2.8E+06
Pm-148	6.8E-04	2.5E+12	5.9E+06
Pm-148m	4.1E-03	1.5E+13	3.5E+07
Pm-149	8.3E-05	3.1E+11	7.2E+05
Pm-150	8.1E-06	3.0E+10	7.0E+04
Pm-151	4.1E-05	1.5E+11	3.5E+05
Po-203	6.2E-06	2.3E+10	5.4E+04
Po-205	1.3E-05	4.8E+10	1.1E+05
Po-207	1.9E-05	7.0E+10	1.6E+05
Po-210	1.6E-01	5.9E+14	1.4E+09
Po-211	1.7E-12	6.3E+03	1.5E-02
Po-212	0.0E+00	0.0E+00	0.0E+00
Po-213	6.4E-17	2.4E-01	5.5E-07
Po-214	5.7E-18	2.1E-02	4.9E-08
Po-215	1.3E-11	4.8E+04	1.1E-01
Po-216	1.3E-09	4.8E+06	1.1E+01
Po-218	2.0E-06	7.4E+09	1.7E+04
Pr-136	2.5E-06	9.3E+09	2.2E+04
Pr-137	1.7E-06	6.3E+09	1.5E+04
Pr-138	4.9E-08	1.8E+08	4.2E+02
Pr-138m	1.1E-05	4.1E+10	9.5E+04
Pr-139	2.5E-06	9.3E+09	2.2E+04

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Pr-142	2.7E-05	1.0E+11	2.3E+05
Pr-142m	3.5E-07	1.3E+09	3.0E+03
Pr-143	5.2E-04	1.9E+12	4.5E+06
Pr-144	1.1E-07	4.1E+08	9.5E+02
Pr-144m	3.7E-08	1.4E+08	3.2E+02
Pr-145	1.7E-06	6.3E+09	1.5E+04
Pr-147	1.4E-06	5.2E+09	1.2E+04
Pt-186	6.4E-06	2.4E+10	5.5E+04
Pt-188	9.6E-04	3.6E+12	8.3E+06
Pt-189	1.2E-05	4.4E+10	1.0E+05
Pt-191	6.4E-05	2.4E+11	5.5E+05
Pt-193	1.7E-04	6.3E+11	1.5E+06
Pt-193m	7.6E-05	2.8E+11	6.6E+05
Pt-195m	1.1E-04	4.1E+11	9.5E+05
Pt-197	7.3E-06	2.7E+10	6.3E+04
Pt-197m	1.0E-06	3.7E+09	8.7E+03
Pt-199	9.1E-07	3.4E+09	7.9E+03
Pt-200	1.6E-05	5.9E+10	1.4E+05
Pu-234	1.2E-04	4.4E+11	1.0E+06
Pu-235	1.6E-07	5.9E+08	1.4E+03
Pu-236	3.5E-01	1.3E+15	3.0E+09
Pu-237	1.6E-04	5.9E+11	1.4E+06
Pu-238	8.9E-01	3.3E+15	7.7E+09
Pu-239	1.0E+00	3.7E+15	8.7E+09
Pu-240	1.0E+00	3.7E+15	8.7E+09
Pu-241	2.0E-02	7.4E+13	1.7E+08
Pu-242	9.5E-01	3.5E+15	8.2E+09
Pu-243	6.2E-07	2.3E+09	5.4E+03
Pu-244	1.0E+00	3.7E+15	8.7E+09
Pu-245	1.3E-05	4.8E+10	1.1E+05
Pu-246	1.5E-03	5.6E+12	1.3E+07
Ra-222	4.7E-08	1.7E+08	4.1E+02
Ra-223	5.6E-02	2.1E+14	4.8E+08
Ra-224	1.6E-02	5.9E+13	1.4E+08
Ra-225	4.7E-02	1.7E+14	4.1E+08
Ra-226	8.3E-01	3.1E+15	7.2E+09
Ra-227	1.1E-05	4.1E+10	9.5E+04
Ra-228	4.2E-01	1.6E+15	3.6E+09
Rb-79	2.4E-06	8.9E+09	2.1E+04
Rb-80	1.8E-08	6.7E+07	1.6E+02
Rb-81	5.4E-06	2.0E+10	4.7E+04
Rb-81m	5.7E-07	2.1E+09	4.9E+03
Rb-82	5.3E-08	2.0E+08	4.6E+02
Rb-82m	3.1E-05	1.1E+11	2.7E+05
Rb-83	7.5E-03	2.8E+13	6.5E+07
Rb-84	7.3E-03	2.7E+13	6.3E+07

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Rb-86	4.8E-03	1.8E+13	4.2E+07
Rb-87	1.6E-02	5.9E+13	1.4E+08
Rb-88	1.0E-06	3.7E+09	8.7E+03
Rb-89	3.4E-06	1.3E+10	2.9E+04
Re-177	1.2E-06	4.4E+09	1.0E+04
Re-178	1.7E-06	6.3E+09	1.5E+04
Re-180	2.2E-07	8.1E+08	1.9E+03
Re-181	3.6E-05	1.3E+11	3.1E+05
Re-182a	2.5E-05	9.3E+10	2.2E+05
Re-182b	2.8E-04	1.0E+12	2.4E+06
Re-184	1.9E-03	7.0E+12	1.6E+07
Re-184m	7.9E-03	2.9E+13	6.8E+07
Re-186	2.4E-04	8.9E+11	2.1E+06
Re-186m	2.1E-02	7.8E+13	1.8E+08
Re-187	1.8E-05	6.7E+10	1.6E+05
Re-188	2.3E-05	8.5E+10	2.0E+05
Re-188m	5.4E-07	2.0E+09	4.7E+03
Re-189	2.4E-05	8.9E+10	2.1E+05
Rh-99	5.9E-04	2.2E+12	5.1E+06
Rh-99m	5.9E-06	2.2E+10	5.1E+04
Rh-100	9.8E-05	3.6E+11	8.5E+05
Rh-101	1.3E-02	4.8E+13	1.1E+08
Rh-101m	9.1E-05	3.4E+11	7.9E+05
Rh-102	8.0E-02	3.0E+14	6.9E+08
Rh-102m	5.5E-03	2.0E+13	4.8E+07
Rh-103m	1.2E-08	4.4E+07	1.0E+02
Rh-105	2.4E-05	8.9E+10	2.1E+05
Rh-106	2.7E-09	1.0E+07	2.3E+01
Rh-106m	1.3E-05	4.8E+10	1.1E+05
Rh-107	5.2E-07	1.9E+09	4.5E+03
Rn-218	1.2E-15	4.4E+00	1.0E-05
Rn-219	2.9E-08	1.1E+08	2.5E+02
Rn-220	5.0E-07	1.9E+09	4.3E+03
Rn-222	5.5E-04	2.0E+12	4.8E+06
Ru-103	1.1E-03	4.1E+12	9.5E+06
Ru-94	4.2E-06	1.6E+10	3.6E+04
Ru-97	4.1E-05	1.5E+11	3.5E+05
Ru-105	1.0E-05	3.7E+10	8.7E+04
Ru-106	9.6E-03	3.6E+13	8.3E+07
S-35	3.0E-03	1.1E+13	2.6E+07
Sb-115	1.7E-06	6.3E+09	1.5E+04
Sb-116	2.8E-06	1.0E+10	2.4E+04
Sb-116m	8.5E-06	3.1E+10	7.4E+04
Sb-117	1.1E-06	4.1E+09	9.5E+03
Sb-118m	2.2E-05	8.1E+10	1.9E+05
Sb-119	5.6E-06	2.1E+10	4.8E+04

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Sb-120a	5.9E-07	2.2E+09	5.1E+03
Sb-120b	7.2E-04	2.7E+12	6.2E+06
Sb-122	2.3E-04	8.5E+11	2.0E+06
Sb-124	5.3E-03	2.0E+13	4.6E+07
Sb-124m	1.0E-07	3.7E+08	8.7E+02
Sb-124n	1.6E-06	5.9E+09	1.4E+04
Sb-125	1.6E-02	5.9E+13	1.4E+08
Sb-126	2.1E-03	7.8E+12	1.8E+07
Sb-126m	2.6E-06	9.6E+09	2.2E+04
Sb-127	3.7E-04	1.4E+12	3.2E+06
Sb-128a	2.0E-06	7.4E+09	1.7E+04
Sb-128b	5.3E-05	2.0E+11	4.6E+05
Sb-129	1.5E-05	5.6E+10	1.3E+05
Sb-130	7.1E-06	2.6E+10	6.1E+04
Sb-131	5.9E-05	2.2E+11	5.1E+05
Sc-43	8.5E-06	3.1E+10	7.4E+04
Sc-44	1.5E-05	5.6E+10	1.3E+05
Sc-44m	4.2E-04	1.6E+12	3.6E+06
Sc-46	6.6E-03	2.4E+13	5.7E+07
Sc-47	8.8E-05	3.3E+11	7.6E+05
Sc-48	3.0E-04	1.1E+12	2.6E+06
Sc-49	2.0E-07	7.4E+08	1.7E+03
Se-70	7.1E-06	2.6E+10	6.1E+04
Se-73	1.6E-05	5.9E+10	1.4E+05
Se-73m	1.6E-06	5.9E+09	1.4E+04
Se-75	1.4E-02	5.2E+13	1.2E+08
Se-77m	7.1E-10	2.6E+06	6.1E+00
Se-79	1.7E-02	6.3E+13	1.5E+08
Se-81	5.9E-08	2.2E+08	5.1E+02
Se-81m	2.6E-07	9.6E+08	2.2E+03
Se-83	3.9E-06	1.4E+10	3.4E+04
Si-31	4.4E-07	1.6E+09	3.8E+03
Si-32	6.8E-02	2.5E+14	5.9E+08
Sm-141	1.8E-06	6.7E+09	1.6E+04
Sm-141m	3.9E-06	1.4E+10	3.4E+04
Sm-142	3.3E-06	1.2E+10	2.9E+04
Sm-145	1.2E-03	4.4E+12	1.0E+07
Sm-146	1.4E-01	5.2E+14	1.2E+09
Sm-147	1.3E-01	4.8E+14	1.1E+09
Sm-151	1.6E-04	5.9E+11	1.4E+06
Sm-153	5.6E-05	2.1E+11	4.8E+05
Sm-155	2.5E-07	9.3E+08	2.2E+03
Sm-156	4.5E-05	1.7E+11	3.9E+05
Sn-110	1.3E-05	4.8E+10	1.1E+05
Sn-111	1.7E-06	6.3E+09	1.5E+04
Sn-113	2.3E-03	8.5E+12	2.0E+07

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Sn-117m	6.1E-04	2.3E+12	5.3E+06
Sn-119m	6.7E-04	2.5E+12	5.8E+06
Sn-121	8.9E-06	3.3E+10	7.7E+04
Sn-121m	3.7E-03	1.4E+13	3.2E+07
Sn-123	3.4E-03	1.3E+13	2.9E+07
Sn-123m	4.0E-07	1.5E+09	3.5E+03
Sn-125	2.1E-03	7.8E+12	1.8E+07
Sn-126	5.2E-01	1.9E+15	4.5E+09
Sn-127	1.7E-05	6.3E+10	1.5E+05
Sn-128	6.2E-06	2.3E+10	5.4E+04
Sr-80	5.7E-06	2.1E+10	4.9E+04
Sr-81	2.9E-06	1.1E+10	2.5E+04
Sr-82	8.4E-03	3.1E+13	7.3E+07
Sr-83	1.8E-04	6.7E+11	1.6E+06
Sr-85	1.8E-03	6.7E+12	1.6E+07
Sr-85m	1.8E-06	6.7E+09	1.6E+04
Sr-87m	1.9E-06	7.0E+09	1.6E+04
Sr-89	3.6E-03	1.3E+13	3.1E+07
Sr-90	1.9E-01	7.0E+14	1.6E+09
Sr-91	3.2E-05	1.2E+11	2.8E+05
Sr-92	9.0E-06	3.3E+10	7.8E+04
Ta-172	5.0E-06	1.9E+10	4.3E+04
Ta-173	8.7E-06	3.2E+10	7.5E+04
Ta-174	2.0E-06	7.4E+09	1.7E+04
Ta-175	2.5E-05	9.3E+10	2.2E+05
Ta-176	2.8E-05	1.0E+11	2.4E+05
Ta-177	1.5E-05	5.6E+10	1.3E+05
Ta-178a	9.3E-08	3.4E+08	8.0E+02
Ta-178b	5.0E-06	1.9E+10	4.3E+04
Ta-179	9.2E-04	3.4E+12	8.0E+06
Ta-180	1.5E-01	5.6E+14	1.3E+09
Ta-180m	1.0E-06	3.7E+09	8.7E+03
Ta-182	6.0E-03	2.2E+13	5.2E+07
Ta-182m	9.2E-07	3.4E+09	8.0E+03
Ta-183	3.0E-04	1.1E+12	2.6E+06
Ta-184	2.8E-05	1.0E+11	2.4E+05
Ta-185	1.3E-06	4.8E+09	1.1E+04
Ta-186	1.6E-06	5.9E+09	1.4E+04
Tb-147	1.2E-05	4.4E+10	1.0E+05
Tb-149	3.4E-05	1.3E+11	2.9E+05
Tb-150	1.1E-05	4.1E+10	9.5E+04
Tb-151	3.3E-05	1.2E+11	2.9E+05
Tb-153	5.3E-05	2.0E+11	4.6E+05
Tb-154	8.5E-05	3.1E+11	7.4E+05
Tb-155	7.0E-05	2.6E+11	6.1E+05
Tb-156	5.5E-04	2.0E+12	4.8E+06

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Tb-156m	1.1E-04	4.1E+11	9.5E+05
Tb-156n	2.2E-05	8.1E+10	1.9E+05
Tb-157	1.1E-03	4.1E+12	9.5E+06
Tb-158	1.8E-01	6.7E+14	1.6E+09
Tb-160	3.9E-03	1.4E+13	3.4E+07
Tb-161	2.0E-04	7.4E+11	1.7E+06
Tc-93	7.3E-06	2.7E+10	6.3E+04
Tc-93m	2.9E-06	1.1E+10	2.5E+04
Tc-94	2.4E-05	8.9E+10	2.1E+05
Tc-94m	4.9E-06	1.8E+10	4.2E+04
Tc-95	2.8E-05	1.0E+11	2.4E+05
Tc-95m	2.1E-03	7.8E+12	1.8E+07
Tc-96	5.4E-04	2.0E+12	4.7E+06
Tc-96m	4.5E-06	1.7E+10	3.9E+04
Tc-97	5.2E-03	1.9E+13	4.5E+07
Tc-97m	7.1E-04	2.6E+12	6.1E+06
Tc-98	4.4E-01	1.6E+15	3.8E+09
Tc-99	3.4E-02	1.3E+14	2.9E+08
Tc-99m	1.6E-06	5.9E+09	1.4E+04
Tc-101	4.5E-07	1.7E+09	3.9E+03
Tc-104	3.0E-06	1.1E+10	2.6E+04
Te-116	9.4E-06	3.5E+10	8.1E+04
Te-121	5.6E-04	2.1E+12	4.8E+06
Te-121m	5.5E-03	2.0E+13	4.8E+07
Te-123	3.2E-03	1.2E+13	2.8E+07
Te-123m	1.6E-03	5.9E+12	1.4E+07
Te-125m	6.9E-04	2.6E+12	6.0E+06
Te-127	1.2E-06	4.4E+09	1.0E+04
Te-127m	1.9E-03	7.0E+12	1.6E+07
Te-129	3.4E-07	1.3E+09	2.9E+03
Te-129m	2.3E-03	8.5E+12	2.0E+07
Te-131	6.3E-05	2.3E+11	5.5E+05
Te-131m	4.2E-03	1.6E+13	3.6E+07
Te-132	7.2E-04	2.7E+12	6.2E+06
Te-133	3.2E-06	1.2E+10	2.8E+04
Te-133m	1.6E-05	5.9E+10	1.4E+05
Te-134	5.2E-06	1.9E+10	4.5E+04
Th-226	6.5E-05	2.4E+11	5.6E+05
Th-227	6.4E-02	2.4E+14	5.5E+08
Th-228	8.0E-01	3.0E+15	6.9E+09
Th-229	3.4E+00	1.3E+16	2.9E+10
Th-230	4.9E-01	1.8E+15	4.2E+09
Th-231	1.1E-05	4.1E+10	9.5E+04
Th-232	2.6E+00	9.6E+15	2.2E+10
Th-234	1.8E-03	6.7E+12	1.6E+07
Ti-44	4.5E-01	1.7E+15	3.9E+09

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Ti-45	5.5E-06	2.0E+10	4.8E+04
Tl-194	1.6E-06	5.9E+09	1.4E+04
Tl-194m	4.6E-06	1.7E+10	4.0E+04
Tl-195	4.4E-06	1.6E+10	3.8E+04
Tl-197	4.0E-06	1.5E+10	3.5E+04
Tl-198	1.8E-05	6.7E+10	1.6E+05
Tl-198m	7.7E-06	2.9E+10	6.7E+04
Tl-199	3.5E-06	1.3E+10	3.0E+04
Tl-200	5.8E-05	2.1E+11	5.0E+05
Tl-201	2.6E-05	9.6E+10	2.2E+05
Tl-202	5.1E-04	1.9E+12	4.4E+06
Tl-204	1.9E-03	7.0E+12	1.6E+07
Tl-206	4.6E-11	1.7E+05	4.0E-01
Tl-207	1.1E-09	4.1E+06	9.5E+00
Tl-208	9.9E-07	3.7E+09	8.6E+03
Tl-209	3.1E-07	1.1E+09	2.7E+03
Tm-162	2.8E-06	1.0E+10	2.4E+04
Tm-166	2.4E-05	8.9E+10	2.1E+05
Tm-167	2.4E-04	8.9E+11	2.1E+06
Tm-170	1.2E-03	4.4E+12	1.0E+07
Tm-171	1.3E-04	4.8E+11	1.1E+06
Tm-172	2.1E-04	7.8E+11	1.8E+06
Tm-173	7.1E-06	2.6E+10	6.1E+04
Tm-175	1.6E-06	5.9E+09	1.4E+04
U-230	8.3E-02	3.1E+14	7.2E+08
U-231	6.4E-05	2.4E+11	5.5E+05
U-232	1.9E+00	7.0E+15	1.6E+10
U-233	3.2E-01	1.2E+15	2.8E+09
U-234	3.1E-01	1.1E+15	2.7E+09
U-235	3.4E-01	1.3E+15	2.9E+09
U-236	3.0E-01	1.1E+15	2.6E+09
U-237	2.5E-04	9.3E+11	2.2E+06
U-238	2.9E-01	1.1E+15	2.5E+09
U-239	7.0E-07	2.6E+09	6.1E+03
U-240	2.1E-05	7.8E+10	1.8E+05
V-47	2.0E-06	7.4E+09	1.7E+04
V-48	2.8E-03	1.0E+13	2.4E+07
V-49	2.3E-05	8.5E+10	2.0E+05
W-176	8.1E-06	3.0E+10	7.0E+04
W-177	4.9E-06	1.8E+10	4.2E+04
W-178	5.3E-04	2.0E+12	4.6E+06
W-179	1.5E-07	5.6E+08	1.3E+03
W-181	4.4E-04	1.6E+12	3.8E+06
W-185	1.5E-03	5.6E+12	1.3E+07
W-187	3.6E-05	1.3E+11	3.1E+05
W-188	8.0E-03	3.0E+13	6.9E+07

Table 1. Results of the Screening Analysis

Radionuclide	Level I Screening Factor ($Sv/Bq-m^{-3}$)	Level I Screening Factor ($mrem/Ci-m^{-3}$)	Screening Dose mrem/yr
Xe-120	3.4E-06	1.3E+10	2.9E+04
Xe-121	3.5E-06	1.3E+10	3.0E+04
Xe-122	3.1E-05	1.1E+11	2.7E+05
Xe-123	1.8E-06	6.7E+09	1.6E+04
Xe-125	5.8E-04	2.1E+12	5.0E+06
Xe-127	3.3E-07	1.2E+09	2.9E+03
Xe-129m	2.9E-08	1.1E+08	2.5E+02
Xe-131m	1.1E-08	4.1E+07	9.5E+01
Xe-133	4.3E-08	1.6E+08	3.7E+02
Xe-133m	3.7E-08	1.4E+08	3.2E+02
Xe-135	3.0E-07	1.1E+09	2.6E+03
Xe-135m	3.7E-07	1.4E+09	3.2E+03
Xe-138	2.2E-06	8.1E+09	1.9E+04
Y-86	8.7E-05	3.2E+11	7.5E+05
Y-86m	5.1E-06	1.9E+10	4.4E+04
Y-87	1.6E-04	5.9E+11	1.4E+06
Y-88	1.0E-02	3.7E+13	8.7E+07
Y-90	2.8E-04	1.0E+12	2.4E+06
Y-90m	1.8E-05	6.7E+10	1.6E+05
Y-91	1.8E-03	6.7E+12	1.6E+07
Y-91m	2.4E-06	8.9E+09	2.1E+04
Y-92	3.1E-06	1.1E+10	2.7E+04
Y-93	9.5E-06	3.5E+10	8.2E+04
Y-94	1.7E-06	6.3E+09	1.5E+04
Y-95	1.5E-06	5.6E+09	1.3E+04
Yb-162	1.5E-06	5.6E+09	1.3E+04
Yb-166	2.4E-04	8.9E+11	2.1E+06
Yb-167	6.8E-07	2.5E+09	5.9E+03
Yb-169	8.3E-04	3.1E+12	7.2E+06
Yb-175	8.1E-05	3.0E+11	7.0E+05
Yb-177	2.7E-06	1.0E+10	2.3E+04
Yb-178	7.1E-07	2.6E+09	6.1E+03
Zn-62	3.0E-05	1.1E+11	2.6E+05
Zn-63	2.4E-06	8.9E+09	2.1E+04
Zn-65	2.7E-02	1.0E+14	2.3E+08
Zn-69	7.7E-08	2.9E+08	6.7E+02
Zn-69m	1.6E-05	5.9E+10	1.4E+05
Zn-71m	1.2E-05	4.4E+10	1.0E+05
Zn-72	6.1E-04	2.3E+12	5.3E+06
Zr-86	1.1E-04	4.1E+11	9.5E+05
Zr-88	8.7E-03	3.2E+13	7.5E+07
Zr-89	2.2E-04	8.1E+11	1.9E+06
Zr-93	7.4E-04	2.7E+12	6.4E+06
Zr-95	4.1E-03	1.5E+13	3.5E+07
Zr-97	7.2E-05	2.7E+11	6.2E+05

Table 2. Trigger Values

Radionuclide	Trigger Value Ci
Ar-37	6.8E+07
Ar-41	7.7E+01
As-69	6.4E+01
As-70	1.2E+01
As-71	1.1E+00
As-72	9.6E-01
As-73	3.7E-01
As-74	8.3E-02
As-76	1.9E+00
As-77	5.5E+00
As-78	2.4E+01
At-207	7.2E+00
At-211	4.8E-01
At-215	2.0E+10
At-216	3.7E+07
At-217	3.6E+05
At-218	5.3E+03
Br-74	1.5E+01
Br-74m	1.3E+01
Br-75	9.6E+00
Br-76	1.4E+00
Br-77	1.8E+00
Br-80	7.7E+02
Br-80m	7.2E+01
Br-82	5.0E-01
Br-83	4.8E+02
Br-84	3.2E+01
C-11	7.7E+01
Cl-38	3.5E+01
Cl-39	3.0E+01
F-18	2.8E+01
Ge-66	9.6E+00
Ge-67	5.3E+01
Ge-68	8.9E-03
Ge-69	1.6E+00
Ge-71	1.1E+01
Ge-75	4.3E+02
Ge-77	4.1E+00
Ge-78	2.7E+01
Hg-193	3.7E+01
Hg-193m	4.3E+00
Hg-194	2.5E-04
Hg-195	1.9E+01
Hg-195m	1.7E+00
Hg-197	3.1E+00
Hg-197m	3.9E+00

Table 2. Trigger Values

Radionuclide	Trigger Value Ci
Hg-199m	2.1E+02
Hg-203	6.4E-02
I-120	1.2E+01
I-120m	8.3E+00
I-121	2.3E+01
I-122	3.5E+02
I-123	1.5E+01
I-124	1.4E-02
I-125	2.2E-03
I-126	2.1E-03
I-128	5.3E+02
I-130	1.6E+00
I-131	4.1E-03
I-132	9.6E+00
I-132m	1.9E+01
I-133	5.3E-01
I-134	1.8E+01
I-135	4.6E+00
Kr-74	3.6E+01
Kr-76	1.7E+00
Kr-77	4.3E+01
Kr-79	3.7E+02
Kr-81	8.9E+03
Kr-81m	2.6E+14
Kr-83m	1.1E+06
Kr-85	4.1E+04
Kr-85m	5.8E+02
Kr-87	1.2E+02
Kr-88	2.1E+01
N-13	1.2E+02
O-15	8.9E+02
P-30	6.1E+02
P-32	1.6E-02
P-33	1.2E-01
S-35	3.9E-02
Sb-115	6.8E+01
Sb-116	4.1E+01
Sb-116m	1.4E+01
Sb-117	1.1E+02
Sb-118m	5.3E+00
Sb-119	2.1E+01
Sb-120a	2.0E+02
Sb-120b	1.6E-01
Sb-122	5.0E-01
Sb-124	2.2E-02
Sb-124m	1.2E+03

Table 2. Trigger Values

Radionuclide	Trigger Value Ci
Sb-124n	7.2E+01
Sb-127	3.1E-01
Sb-128a	5.8E+01
Sb-128b	2.2E+00
Sb-129	7.7E+00
Sb-130	1.6E+01
Sb-131	2.0E+00
Se-70	1.6E+01
Se-73	7.2E+00
Se-73m	7.2E+01
Se-75	8.3E-03
Se-77m	1.6E+05
Se-81	2.0E+03
Se-81m	4.4E+02
Se-83	3.0E+01
Sn-110	8.9E+00
Sn-111	6.8E+01
Sn-113	5.0E-02
Sn-117m	1.9E-01
Sn-119m	1.7E-01

Table 2. Trigger Values

Radionuclide	Trigger Value Ci
Sn-121	1.3E+01
Sn-123	3.4E-02
Sn-123m	2.9E+02
Sn-125	5.5E-02
Sn-127	6.8E+00
Sn-128	1.9E+01
Xe-120	3.4E+01
Xe-121	3.3E+01
Xe-122	3.7E+00
Xe-123	6.4E+01
Xe-125	2.0E-01
Xe-127	3.5E+02
Xe-129m	4.0E+03
Xe-131m	1.1E+04
Xe-133	2.7E+03
Xe-133m	3.1E+03
Xe-135	3.9E+02
Xe-135m	3.1E+02
Xe-138	5.3E+01

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DESIGN CHECK PACKAGE

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DESIGN CHECK INSTRUCTIONS FOR ATMOSPHERIC PATHWAY SCREENING REPORT

Perform a design check for *Atmospheric Pathway Screening Analysis for Saltstone Disposal Facility Vault 4* following the general guidance provided in WSRC-IM-2002-00011.

Specific instructions are as follows:

Check that the Screening Factors have been accurately transcribed from the NCRP Report 123.

Check that the Screening Dose calculations have been computed properly following the Screening Level I procedure on page 30 of NCRP Report 123, Volume II.

Check that the Trigger Values have been computed properly.

Verify that the contents of the spreadsheet used to make the calculations have been accurately transcribed into the tables in the report.

DESIGN CHECK REPORT

Greater than 10 percent of the Screening factors were checked and several transcription errors in the exponential factors were noted. These changes were addressed and all transcribed data was rechecked prior to proceeding with the design check.

The Screening Dose calculations were computed independently and greater than 10 percent of these calculated values were compared with the Screening Dose values in the report. Within round off error the values were in agreement.

10 percent of the reported Trigger Values were compared with independently calculated values. Within round off error the values were in agreement.

The aforementioned spot checks with independently calculated values provide a verification that the data have been accurately transcribed into the tables in the report.

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