Technical Memorandum
Radionuclide Data Assessment Report for Santa Susana Field Laboratory Area IV Soils for use in Risk Assessment for the Environmental Impact Statement

Thomas L. Rucker, Ph.D.
Leidos, Inc.
April 2018

Background

The U.S. Environmental Protection Agency (EPA) in its final report[1] of soil radionuclide sampling in Area IV and the Northern Buffer Zone (NBZ) of the Santa Susana Field Laboratory (SSFL) listed a number of radionuclides that were detected above the EPA Field Action Levels (FALs), above the Radiological Trigger Levels (RTL), and/or above the Radionuclide Reference Concentrations (RRC) values for the specific laboratory that generated the data. The RRCs have been used as provisional look-up table (LUT) values for the project and laboratory-specific RRCs are recommended for evaluation of the EPA soil survey data for identifying remediation areas. However, additional samples had results for a number of radionuclides above the laboratory critical levels (CLs); CLs are used as the criteria for detection decisions due to random uncertainties in radioactive decay (known as counting uncertainty) and the analysis processes (known as laboratory random uncertainty). The detection frequency for each exposure unit (subareas of Area IV and the NBZ) will be used to determine the Contaminants of Concern (COC) for the exposure unit for purposes of offsite risk assessment rather than the frequency of results above the FAL, RTL, or provisional LUT values because the contributions of these detected radionuclides need to be included in the calculation of total risk even if they do not drive clean-up decisions.

However, it is also possible that interferences and misidentifications could cause exceedances of the above values. An evaluation of these factors is desired in order to see if some detected radionuclides can be eliminated from the COC list based on them.

All of the radionuclides that were detected could be related to the historical processes that occurred in Area IV of the SSFL. However, some are more likely than others to be still present on site in measurable quantities due to their longer half-lives. The potential process-related radionuclides and their likely presence after 30 years of decay has been previously discussed in a white paper.[2] In addition, the EPA in its final report of soil radionuclide sampling in Area IV of the SSFL indicated that the uranium and thorium decay series radionuclides that were above the RTL were

---

[1] *Final Radiological Characterization of Soils, Area IV and the Northern Buffer Zone, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California*, HydroGeoLogic, Inc., December 21, 2012.
[2] Rucker, T.L., *Radionuclides Related to Historical Operations at the Santa Susana Field Laboratory Area IV*, Science Applications International Corporation, for the United States Department of Energy, March 2009.

mostly from naturally occurring radioactive material (NORM) and not related to site contamination. EPA did not provide a list of samples that exceeded the RTL for the uranium and thorium decay series radionuclides that were not considered site related and did not include any results for uranium and thorium decay series radionuclides in their list of Radiological Areas of Interest. Therefore, an evaluation was previously performed to identify which samples that exceed the LUT values for the uranium and thorium decay series radionuclides appear to be NORM and which appear to be site related.[3] These determinations will be used for determining which exposure units will contain uranium and thorium as COCs (above natural background).

Methodology

The EPA soil radionuclide database was used to extract the data for all detected radionuclides. The data included the sample location, laboratory name, analysis results, total propagated uncertainties (TPUs), CLs, and validation qualifiers for each analyte and sample. The results flagged as unusable (R) and exclude (X) were eliminated from the dataset used for statistical calculations.

Detection Frequency

The rate of detection can be used to evaluate the potential for false-positives in the data. Since the probability of a false positive goes down as the analyte concentration in soil increases, fewer false positives would be expected to be above the FALs and fewer still above the RRCs. For most analytes, a CL was calculated such that about 5% of the samples would generate results above the CL when no analyte is present if there is no analytical bias (false positive rate) assuming the analyte is normally distributed. However, for the analyses performed by alpha spectroscopy (for isotopes of Th, U, Np, Pu, Am and Cm) CLs were calculated that would only generate about 2.5% false positive rate.

The EPA database included a field for their calculated CL values. These values were used by EPA data validators for flagging non-detects (U qualifier) in most cases. However, there are a few results that are below the CL value where the U qualifier is missing in the database. In the current evaluation, these results have been qualified as U in an added "Data Assessment Qualifier" field. In addition, there are a number of results where the CL value was missing in the database where the U qualifier was obviously also missing (zero and negative results). These were judged to be defects in the database. Therefore, an additional critical value (CV) was calculated based on the standard normal distribution of 1.645 times the reported TPU to provide 95% confidence of the true result being above 0 (5% false positive) as a substitute for qualifying data as non-detections when the CL value was not reported. The results less than the CV have been qualified as U in an added "Data Assessment Qualifier" field when the CL value was not reported.

The detection frequency was calculated as the number of valid analyte results not flagged as U divided by the total number of valid analyte results for each exposure unit times 100 for percent detected. If the result was less than the expected false positive rate in any exposure unit, the analyte

---

[3] Rucker, T.L., *Technical Memorandum, Evaluation of Naturally Occurring Uranium and Thorium Decay Chain Radionuclides in Santa Susana Field Laboratory Area IV Soils,* Leidos, Inc. for the United States Department of Energy, August 2015.

was eliminated as a COC for the exposure unit. The results of this analysis are shown in the next section.

<u>Interference</u>

The raw data packages were not available for data assessment. Therefore, the possibility of interferences and misidentifications in the unreduced data set will be evaluated based on the flags added during the data validation process and upon known spectral interferences of primary gamma-ray energies of the analyte from gamma-ray energies of NORM.

Of the 3,282 results for Cs-134, 2,721 (82.9%) were qualified as undetected (U) during validation. Twenty-two more results for Cs-134 were qualified as undetected (U) during data assessment as discussed above, for a total of 83.6% qualified as U. In addition, 526 more were qualified as Z (spectral interference, unsupported), S (spectral interference, consistent with background), K (biased high) or some combination of these qualifiers. Eight more results were qualified as J (estimated). Only 5 results were unqualified. While there were 14 Cs-134 results that exceeded the RTL, all were flagged as Z (spectral interference, unsupported), S (spectral interference, consistent with background), or both and not considered an RTL exceedance. Detection and quantitation of Cs-134 is subject to interference at one of its primary energy peaks, 795.8 keV, from the 797.7 keV energy peak of naturally occurring Tl-208 and the 794.93 keV energy peak of naturally occurring Ac-228. Cs-134 has a 2.06 year half-life and only 0.00154% of it would remain following the 33 years of radioactive decay since its last possible production in a reactor. Therefore, all detections of Cs-134 are considered to be from interference and all Cs-134 results have been flagged as SKR (spectral interference, high bias, rejected) in the Data Assessment Qualifier field.

Of the 3,259 results for Eu-152, 3,077 (94.4%) were qualified as undetected (U) during validation. Sixteen more results for Eu-152 were qualified as undetected (U) during data assessment as discussed above, for a total of 94.9% qualified as U which is very close to the expected false positive rate range. In addition, 70 more were qualified as either Z (spectral interference, unsupported), S (spectral interference, consistent with background), or some combination of these qualifiers. Ninety-one more results were qualified as J (estimated) and 5 results qualified as Y (spectral interference but considered exceedance of the RTL. Only 63 (1.9%) of the results were unqualified. While there were 8 Eu-152 results that exceeded the RTL, all but three were flagged as Z (spectral interference, unsupported) and not considered an RTL exceedance. Detection and quantitation of Eu-152 is subject to interference at one of its primary energy peaks, 1,407.92 keV, from the 1,407.99 keV energy peak of naturally the occurring Bi-214. Therefore, all detections of Eu-152 are considered to be from interference and all Eu-152 results have been flagged as SKR (spectral interference, high bias, rejected) in the Data Assessment Qualifier field.

Of the 3,286 results for Eu-154, 3,147 (95.8%) were qualified as undetected (U) during validation. Fifteen more results for Eu-154 were qualified as undetected (U) during data assessment as discussed above, for a total of 96.2% qualified as U, which is in the expected false positive rate range. Only 1 was qualified as S (spectral interference, consistent with background). Ninety-eight

more results were qualified as J (estimated). Only 42 (1.3%) of the results were unqualified. The maximum result was less than the RTL. Detection and quantitation of Eu-154 is subject to interference at one of its primary energy peaks, 723.3 keV, from the 722.0 keV energy peak of naturally occurring Tl-208. Therefore, all detections of Eu-154 are considered to be from either the counting uncertainty or from interference and all Eu-154 results have been flagged as unusable SKR (spectral interference, high bias, rejected) in the Data Assessment Qualifier field.

Of the 3,255 results for Eu-155, 250 (7.7%) were qualified as undetected (U) during validation. Three more results for Eu-155 were qualified as undetected (U) during data assessment as discussed above for a total of 7.8% qualified as U. However, an additional 2,825 results were qualified as either Z (spectral interference, unsupported), S (spectral interference, consistent with background), or some combination of these qualifiers. Seventy-eight more results were qualified as J (estimated). Only 102 (3.1%) of the results were unqualified. The maximum result was less than the RTL. Detection and quantitation of Eu-155 is subject to interference at its primary energy peak, 86.55 keV, from the 87.33 keV energy peak of naturally occurring Pb-212 and from the 87.2 keV energy peak of naturally occurring uranium ore). Therefore, all detections of Eu-155 are considered to be from interference and all Eu-155 results have been flagged as SKR (spectral interference, high bias, rejected) in the Data Assessment Qualifier field.

Of the 3,269 results for Sb-125, 2,104 (64.4%) were qualified as undetected (U) during validation. Thirteen more results for Sb-125 were qualified as undetected (U) during data assessment as discussed above, for a total of 64.8% qualified as U. However, an additional 1,012 results were qualified as either Z (spectral interference, unsupported), S (spectral interference, consistent with background), or some combination of these qualifiers. Fifty-four more results were qualified as J (estimated). Only 89 (2.7%) of the results were unqualified. The maximum result was less than the RTL. Detection and quantitation of Sb-125 is subject to interference at its primary energy peak, 427.89 keV, from the 427.08 keV energy peak of the naturally occurring Pb-211 and from the 426.8 keV energy peak of naturally occurring Bi-214. Therefore, all detections of Sb-125 are considered to be from interference and all Sb-125 results have been flagged as SKR (spectral interference, high bias, rejected) in the Data Assessment Qualifier field.

Site Related NORM

The previously referenced evaluation to identify which samples that exceeded the LUT values for the uranium and thorium decay series radionuclides appear to be NORM and which appear to be site related was used to identify subareas that should have uranium and thorium isotopes considered as potential COCs. Only U-238, U-234, U-235, and Th-232 of the radionuclides in the NORM decay series needed to be reviewed since their short ingrowth time (short-half-life) daughters can be assumed to be in equilibrium with them and the long ingrowth time (longer half-life) daughter decay series radionuclides will not be site-process related. No Th-232 results exceeded its LUT value and, therefore, Th-232 is not considered a potential COC. Of the 13 locations that exceeded the LUT values for U-234, U-238, or both, 4 were determined to be from NORM and 9 were determined to be from site processes based on their ratios with long-ingrowth

daughters and/or ratios of the uranium isotopes. Seven of the nine locations whose concentrations were determined to be from site processes are in Subarea 7; one is in Subarea 6 and one is in the Northern Boundary Zone. The results for all but one of the locations were from surface soil. The one exception was from a sample taken from the 1 to 2.3 foot depth. Uranium isotopes would only need to be considered as potential COCs in these three subareas for onsite exposures, except they are also eliminated from these three subareas based on the statistical evaluation comparison to background below. However, the increased airborne concentrations of uranium and thorium NORM materials during remedial activities in all subareas will be evaluated for offsite exposures. This is referred to as technologically enhanced NORM exposure.

Statistical Evaluation

The statistical summary of the reduced data set (based on the data assessment described above) of the radionuclide soil characterization data as evaluated above for all subareas of SSFL Area IV and the NBZ is shown in Table 1 and for each subarea individually in Tables 2 through 10 for all radionuclides except NORM. The NORM radionuclides statistical summary is shown in Tables 11 through 20. The numbers of samples and the detection frequency for each radionuclide analyte is shown in each table. The COCs for each subarea, highlighted in yellow, were identified based on the methodology discussed above for eliminating radionuclides for interference (Cs-134, Eu-152, Eu-154, Eu-155, and Sb-124) and radionuclides with detection rates less than or equal to the expected false detection rate. The final COCs for each subarea are presented in Table 21. These subarea COC determinations will be used for offsite exposure evaluations. However, for onsite exposures, COCs will be determined on an exposure unit basis based on a 10,000 m^2 exposure unit size.

The 95% upper confidence limit on the mean (UCL95) of the entire reduced data set for each subarea will be used as the exposure point concentration for the No Action Alternative for offsite exposures from wind scour. A UCL95 will similarly be calculated for a subset of the data that are located within the remediated volume for each subarea and will be used for the exposure point concentration for each action alternative for offsite exposures from airborne emissions during excavation and transportation of soil.

The NORM radionuclides were only identified as site related for Subareas 6, 7, and NBZ. However, the UCL95 calculated for these three areas is less than both the UCL95 and the mean calculated for the background study data. Therefore, the NORM radionuclides can be eliminated as COCs for all subareas for onsite exposures in order to prevent a negative bias from being introduced for the radionuclides when background subtraction is performed for a net exposure. However, the contribution of these radionuclides will be included in offsite air concentration exposures from airborne emissions during excavation and transportation of soil.

Table 1. SSFL Area IV and NBZ summary statistics for all sediment and soil

				Non-detect Detection Limits[a]							Detected					UCL[b]	UTL[b]
	Freq. of	**Percent**		**Min**	**Max**						**Min**	**Mean**	**Max**	**S.D.**		**95**	**95/95**
Constituent	**Detection**	**Detected**	**Units**	**Min**	**Max**	**Min[b]**	**Mean[b]**	**Median[b]**	**Max[b]**	**S.D.[b]**	**Min**	**Mean**	**Max**	**S.D.**	**Dist.**	**95**	**95/95**
								All sediment and soil									
								Radionuclides									
Am-241	968 / 2821	34.3	pCi/g	0	0.035	-0.017	0.004	0.003	0.059	0.006	0.001	0.009	0.059	0.006	X	0.004	0.015
Cm-243/244	497 / 2804	17.7	pCi/g	0	0.055	-0.024	0.002	9.1E-04	0.065	0.006	0.001	0.009	0.065	0.006	X	0.002	0.012
Co-60	144 / 3300	4.36	pCi/g	0.004	0.022	-0.024	4.2E-04	4.0E-04	0.048	0.005	0.006	0.012	0.048	0.005	X	8.1E-04	0.006
Cs-134	539 / 3282	16.4	pCi/g	8.0E-04	0.038	-0.036	0.006	0.004	0.232	0.013	0.005	0.018	0.232	0.025	X	0.007	0.016
Cs-137	1949 / 3298	59.1	pCi/g	0.003	0.023	-0.024	0.232	0.016	196	3.83	0.004	0.394	196	4.98	X	0.523	0.535
Eu-152	166 / 3259	5.09	pCi/g	0.008	0.143	-0.092	-0.007	-0.007	0.165	0.018	0.01	0.03	0.165	0.02	X	-0.006	0.017
Eu-154	124 / 3286	3.77	pCi/g	0.02	0.13	-0.152	-0.018	-0.019	0.136	0.036	0.024	0.061	0.136	0.022	X	-0.016	0.024
Eu-155	3002 / 3255	92.2	pCi/g	0.015	0.15	-0.081	0.071	0.072	0.221	0.028	0.015	0.075	0.221	0.023	X	0.073	0.114
H-3	126 / 635	19.8	pCi/g	0.018	4.82	-4.52	1.01	0.108	7.55	1.75	0.032	2.53	7.55	2.29	X	1.31	5.07
I-129	13 / 320	4.06	pCi/g	0	0.49	-0.207	0.011	0.008	0.474	0.081	0.068	0.161	0.275	0.056	X	0.031	0.124
Ni-59	16 / 820	1.95	pCi/g	0.009	5.1	-7.09	-0.308	0	23.9	1.54	0.872	3.8	23.9	5.41	X	-0.075	0.872
Np-237	6 / 46	13.0	pCi/g	0	0.038	-0.018	-1.1E-04	-5.9E-04	0.021	0.008	0.007	0.012	0.021	0.006	N	0.002	0.017
Pu-238	575 / 2858	20.1	pCi/g	0	0.051	-0.049	0.001	9.1E-04	0.049	0.005	0.001	0.006	0.049	0.005	X	0.002	0.009
Pu-239/240	977 / 2858	34.2	pCi/g	0	0.034	-0.023	0.003	0.002	0.187	0.007	0.001	0.008	0.187	0.01	X	0.004	0.014
Sb-125	1152 / 3269	35.2	pCi/g	0.012	0.168	-0.043	0.041	0.012	0.209	0.059	0.014	0.11	0.209	0.047	X	0.045	0.155
Sr-90	816 / 3185	25.6	pCi/g	0.015	0.417	-0.21	0.103	0.023	21.3	0.569	0.016	0.358	21.3	1.08	X	0.147	0.417
Tc-99	18 / 848	2.12	pCi/g	0.035	0.954	-0.943	-0.097	-0.055	1.46	0.272	0.04	0.421	1.46	0.44	X	-0.056	0.04

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

N = normal. UCL95 is calculated using t statistic.

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 2. SSFL Area IV summary statistics for Subarea 3

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 3																	
Radionuclides																	
Am-241	4 / 13	30.8	pCi/g	0	0.017	-0.006	0.005	0.004	0.017	0.007	0.008	0.013	0.017	0.004	N	0.009	0.025
Cm-243/244	3 / 13	23.1	pCi/g	0	0.023	-0.013	0.001	-8.3E-04	0.017	0.01	0.012	0.015	0.017	0.002	N	0.006	0.028
Co-60	0 / 13	0	pCi/g	0.006	0.011	-0.006	-8.2E-04	-8.2E-04	0.007	0.004	--	--	--	--	N	0.001	0.009
Cs-134	2 / 13	15.4	pCi/g	0.005	0.01	-0.004	0.015	0.004	0.172	0.047	0.008	0.09	0.172	0.116	X	0.072	--
Cs-137	8 / 13	61.5	pCi/g	0.007	0.011	-0.013	0.034	0.025	0.126	0.046	0.008	0.058	0.126	0.043	X	0.089	--
Eu-152	0 / 13	0	pCi/g	0.016	0.029	-0.05	-0.012	-0.012	0.012	0.018	--	--	--	--	N	-0.003	0.037
Eu-154	0 / 13	0	pCi/g	0.034	0.063	-0.085	-0.023	-0.03	0.026	0.033	--	--	--	--	N	-0.007	0.065
Eu-155	10 / 13	76.9	pCi/g	0.03	0.036	-0.011	0.062	0.064	0.102	0.031	0.054	0.076	0.102	0.017	N	0.078	0.145
Pu-238	0 / 13	0	pCi/g	0	0.012	-0.008	-7.6E-04	-8.2E-04	0.005	0.004	--	--	--	--	N	0.001	0.01
Pu-239/240	3 / 13	23.1	pCi/g	0.004	0.013	-0.01	0.002	6.2E-04	0.023	0.008	0.007	0.014	0.023	0.008	N	0.006	0.024
Sb-125	1 / 13	7.69	pCi/g	0.015	0.029	-0.007	0.006	0.002	0.022	0.01	0.022	0.022	0.022	--	N	0.011	0.031
Sr-90	1 / 13	7.69	pCi/g	0.074	0.274	-0.098	0.071	0.043	0.444	0.141	0.444	0.444	0.444	--	N	0.14	0.448

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 3. SSFL Area IV summary statistics for Subarea 5A

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
								Subarea 5A									
								Radionuclides									
Am-241	120 / 342	35.1	pCi/g	0	0.021	-0.008	0.003	0.002	0.039	0.005	0.002	0.006	0.039	0.005	X	0.004	0.013
Cm-243/244	53 / 341	15.5	pCi/g	0	0.022	-0.014	0.001	9.0E-04	0.023	0.004	0.002	0.006	0.023	0.005	X	0.002	0.009
Co-60	6 / 372	1.61	pCi/g	0.004	0.015	-0.015	4.9E-04	6.5E-04	0.011	0.004	0.006	0.008	0.011	0.002	X	0.001	0.006
Cs-134	44 / 375	11.7	pCi/g	0.004	0.038	-0.036	0.007	0.006	0.027	0.008	0.005	0.015	0.027	0.005	X	0.009	0.019
Cs-137	177 / 372	47.6	pCi/g	0.004	0.01	-0.017	0.032	0.006	0.993	0.098	0.005	0.069	0.993	0.132	X	0.055	0.154
Eu-152	12 / 352	3.41	pCi/g	0.009	0.036	-0.048	-0.004	-0.005	0.165	0.02	0.016	0.063	0.165	0.05	X	0.001	0.017
Eu-154	11 / 372	2.96	pCi/g	0.023	0.076	-0.103	-0.011	-0.004	0.077	0.029	0.024	0.045	0.077	0.017	X	-0.005	0.024
Eu-155	353 / 365	96.7	pCi/g	0.016	0.043	-0.004	0.075	0.075	0.162	0.02	0.021	0.077	0.162	0.018	X	0.08	0.11
H-3	4 / 37	10.8	pCi/g	0.093	4.7	-2.62	0.246	0.037	3.61	1.19	0.116	0.123	0.137	0.01	X	1.1	--
Ni-59	4 / 130	3.08	pCi/g	0.054	2.48	-3.78	0.128	0	23.9	2.23	0.872	7.81	23.9	10.8	X	0.98	2.72
Pu-238	126 / 342	36.8	pCi/g	0	0.028	-0.018	0.001	0.002	0.015	0.004	0.001	0.003	0.014	0.002	X	0.002	0.006
Pu-239/240	171 / 342	50	pCi/g	0	0.018	-0.009	0.002	0.002	0.016	0.003	0.001	0.004	0.016	0.003	X	0.003	0.01
Sb-125	248 / 371	66.8	pCi/g	0.013	0.038	-0.04	0.086	0.117	0.201	0.066	0.016	0.127	0.201	0.037	X	0.101	0.174
Sr-90	80 / 353	22.7	pCi/g	0.015	0.226	-0.162	0.025	0.015	2.56	0.146	0.021	0.093	2.56	0.29	X	0.059	0.13
Tc-99	1 / 124	0.806	pCi/g	0.13	0.826	-0.846	-0.05	-0.049	0.645	0.211	0.645	0.645	0.645	--	X	0.033	0.645

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 4. SSFL Area IV summary statistics for Subarea 5B

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 5B																	
Radionuclides																	
Am-241	165 / 481	34.3	pCi/g	0.001	0.007	-0.007	0.002	0.002	0.016	0.002	0.001	0.004	0.016	0.002	X	0.002	0.007
Cm-243/244	69 / 481	14.3	pCi/g	0.001	0.014	-0.009	5.0E-04	0	0.019	0.003	0.001	0.005	0.019	0.004	X	0.001	0.009
Co-60	13 / 521	2.5	pCi/g	0.004	0.012	-0.011	0.001	0.001	0.023	0.004	0.006	0.012	0.023	0.005	X	0.002	0.006
Cs-134	56 / 515	10.9	pCi/g	8.0E-04	0.034	-0.023	0.008	0.01	0.03	0.008	0.007	0.014	0.03	0.005	X	0.01	0.016
Cs-137	221 / 520	42.5	pCi/g	0.003	0.01	-0.018	0.027	0.004	0.911	0.084	0.004	0.065	0.911	0.118	X	0.043	0.147
Eu-152	51 / 511	9.98	pCi/g	0.008	0.029	-0.037	0.002	0.002	0.078	0.012	0.01	0.023	0.078	0.012	X	0.004	0.022
Eu-154	17 / 520	3.27	pCi/g	0.02	0.068	-0.102	-0.006	0	0.082	0.025	0.031	0.05	0.082	0.013	X	-7.9E-04	0.031
Eu-155	494 / 501	98.6	pCi/g	0.016	0.034	0.003	0.071	0.072	0.123	0.017	0.015	0.072	0.123	0.016	X	0.074	0.1
H-3	23 / 147	15.6	pCi/g	0.018	0.11	-0.058	0.096	0.04	7.38	0.608	0.035	0.453	7.38	1.51	X	0.315	0.316
Ni-59	0 / 164	0	pCi/g	0.055	0.56	-0.123	-7.1E-04	0	0.065	0.015	--	--	--	--	X	0.004	--
Pu-238	157 / 481	32.6	pCi/g	9.3E-04	0.005	-0.004	9.9E-04	8.2E-04	0.007	0.002	0.001	0.003	0.007	0.001	X	0.001	0.004
Pu-239/240	184 / 481	38.3	pCi/g	8.5E-04	0.005	-0.002	0.001	9.3E-04	0.013	0.002	0.001	0.003	0.013	0.002	X	0.002	0.005
Sb-125	459 / 501	91.6	pCi/g	0.013	0.034	-0.031	0.112	0.121	0.203	0.044	0.016	0.122	0.203	0.03	X	0.12	0.166
Sr-90	103 / 486	21.2	pCi/g	0.015	0.179	-0.142	0.012	0.009	0.563	0.034	0.018	0.044	0.563	0.056	X	0.018	0.051
Tc-99	1 / 158	0.633	pCi/g	0.12	0.424	-0.15	-0.041	-0.042	0.144	0.041	0.144	0.144	0.144	--	X	-0.027	0.144

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 5. SSFL Area IV summary statistics for Subarea 5C

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Non-detect Detection Limits[a] Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Detected Mean	Detected Max	Detected S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 5C																	
Radionuclides																	
Am-241	59 / 203	29.1	pCi/g	0.001	0.014	-0.008	0.001	0.001	0.037	0.004	0.002	0.005	0.037	0.005	X	0.002	0.007
Cm-243/244	22 / 203	10.8	pCi/g	0.001	0.027	-0.014	4.5E-05	0	0.015	0.003	0.002	0.004	0.015	0.003	X	8.9E-04	0.005
Co-60	4 / 213	1.88	pCi/g	0.005	0.011	-0.011	0.001	0.001	0.025	0.004	0.009	0.017	0.025	0.007	X	0.003	0.009
Cs-134	15 / 209	7.18	pCi/g	0.006	0.037	-0.016	0.009	0.011	0.04	0.008	0.006	0.015	0.04	0.008	X	0.012	0.016
Cs-137	101 / 213	47.4	pCi/g	0.004	0.01	-0.014	0.021	0.007	0.942	0.073	0.005	0.045	0.942	0.101	X	0.043	0.085
Eu-152	21 / 213	9.86	pCi/g	0.01	0.029	-0.035	0.002	5.0E-04	0.033	0.012	0.012	0.021	0.033	0.005	X	0.005	0.024
Eu-154	7 / 210	3.33	pCi/g	0.027	0.059	-0.062	-0.004	0.002	0.117	0.028	0.031	0.074	0.117	0.035	X	0.005	0.041
Eu-155	201 / 205	98.0	pCi/g	0.015	0.028	0.008	0.078	0.08	0.12	0.019	0.019	0.079	0.12	0.017	X	0.084	0.111
H-3	7 / 42	16.7	pCi/g	0.088	2.96	-2.22	0.066	0.061	2.03	0.481	0.102	0.146	0.243	0.053	X	0.389	--
Ni-59	0 / 24	0	pCi/g	0.05	1.57	-0.349	-0.015	0	0	0.071	--	--	--	--	X	0.049	--
Np-237	0 / 9	0	pCi/g	0.006	0.027	-0.014	-0.003	-0.003	0.005	0.006	--	--	--	--	N	1.3E-04	0.014
Pu-238	49 / 212	23.1	pCi/g	0	0.018	-0.004	6.1E-04	0	0.011	0.002	0.001	0.004	0.011	0.002	X	0.001	0.006
Pu-239/240	63 / 212	29.7	pCi/g	9.2E-04	0.007	-0.002	0.001	6.0E-04	0.049	0.004	0.001	0.004	0.049	0.007	X	0.003	0.007
Sb-125	199 / 213	93.4	pCi/g	0.017	0.026	-0.018	0.125	0.136	0.191	0.044	0.027	0.134	0.191	0.029	X	0.138	0.179
Sr-90	35 / 203	17.2	pCi/g	0.016	0.178	-0.032	0.01	0.009	0.217	0.026	0.017	0.048	0.217	0.037	X	0.018	0.063
Tc-99	0 / 42	0	pCi/g	0.13	0.567	-0.178	-0.037	-0.037	0.162	0.045	--	--	--	--	X	-0.007	--

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

N = normal. UCL95 is calculated using t statistic.

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 6. SSFL Area IV summary statistics for Subarea 5D

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 5D																	
Radionuclides																	
Am-241	172 / 473	36.4	pCi/g	0	0.025	-0.013	0.006	0.005	0.059	0.007	0.004	0.012	0.059	0.007	X	0.007	0.019
Cm-243/244	85 / 465	18.3	pCi/g	0	0.028	-0.017	0.002	0.002	0.035	0.007	0.005	0.012	0.035	0.006	X	0.004	0.016
Co-60	23 / 494	4.66	pCi/g	0.005	0.017	-0.024	-2.7E-04	-4.7E-04	0.018	0.006	0.007	0.013	0.018	0.003	X	8.9E-04	0.011
Cs-134	88 / 494	17.8	pCi/g	0.005	0.016	-0.019	0.006	0.002	0.232	0.023	0.008	0.029	0.232	0.048	X	0.01	0.022
Cs-137	253 / 494	51.2	pCi/g	0.005	0.017	-0.024	0.027	0.011	1.42	0.076	0.008	0.056	1.42	0.098	X	0.042	0.137
Eu-152	17 / 494	3.44	pCi/g	0.014	0.044	-0.092	-0.012	-0.013	0.105	0.02	0.023	0.037	0.105	0.02	X	-0.008	0.023
Eu-154	29 / 494	5.87	pCi/g	0.029	0.088	-0.124	-0.022	-0.026	0.136	0.043	0.052	0.071	0.136	0.02	X	-0.013	0.066
Eu-155	460 / 494	93.1	pCi/g	0.029	0.054	-0.081	0.083	0.08	0.221	0.036	0.031	0.088	0.221	0.032	X	0.09	0.153
H-3	15 / 48	31.3	pCi/g	2.67	4.5	-1.18	2.46	2.46	5.81	1.76	3.02	4.33	5.81	0.899	N	2.88	6.12
I-129	5 / 122	4.1	pCi/g	0.02	0.233	-0.174	0.008	0.004	0.21	0.079	0.101	0.156	0.21	0.044	N	0.02	0.158
Ni-59	0 / 155	0	pCi/g	1.32	3.86	-5.99	-0.493	-0.233	2.72	1.54	--	--	--	--	X	0.046	--
Np-237	3 / 19	15.8	pCi/g	0	0.019	-0.012	0.002	0.002	0.016	0.008	0.007	0.012	0.016	0.005	N	0.005	0.021
Pu-238	66 / 484	13.6	pCi/g	0	0.051	-0.049	0.001	7.5E-04	0.049	0.007	0.005	0.011	0.049	0.007	X	0.003	0.012
Pu-239/240	115 / 484	23.8	pCi/g	0	0.034	-0.023	0.004	0.003	0.053	0.007	0.005	0.011	0.053	0.007	X	0.005	0.014
Sb-125	36 / 494	7.29	pCi/g	0.014	0.045	-0.043	0.005	0.005	0.05	0.014	0.025	0.031	0.05	0.007	N	0.006	0.03
Sr-90	149 / 564	26.4	pCi/g	0.061	0.319	-0.137	0.099	0.054	1.55	0.187	0.082	0.308	1.55	0.239	X	0.133	0.45
Tc-99	1 / 162	0.617	pCi/g	0.313	0.802	-0.841	-0.139	-0.153	0.622	0.262	0.622	0.622	0.622	--	N	-0.105	0.348

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

N = normal. UCL95 is calculated using t statistic.

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 7. SSFL Area IV summary statistics for Subarea 6

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
								Subarea 6									
								Radionuclides									
Am-241	149 / 452	33.0	pCi/g	0	0.027	-0.012	0.004	0.004	0.029	0.006	0.004	0.01	0.029	0.004	X	0.005	0.016
Cm-243/244	78 / 452	17.3	pCi/g	0	0.025	-0.014	0.002	0.002	0.021	0.005	0.004	0.009	0.021	0.004	X	0.003	0.012
Co-60	41 / 649	6.32	pCi/g	0.005	0.022	-0.017	4.9E-04	1.6E-04	0.048	0.006	0.006	0.011	0.048	0.007	X	0.001	0.009
Cs-134	138 / 649	21.3	pCi/g	0.004	0.034	-0.015	0.004	0.002	0.109	0.011	0.005	0.016	0.109	0.018	X	0.006	0.018
Cs-137	419 / 649	64.6	pCi/g	0.005	0.023	-0.02	0.715	0.023	196	8.51	0.006	1.11	196	10.6	X	2.17	1.27
Eu-152	30 / 649	4.62	pCi/g	0.012	0.143	-0.077	-0.011	-0.012	0.059	0.018	0.018	0.03	0.059	0.01	X	-0.008	0.023
Eu-154	29 / 649	4.47	pCi/g	0.027	0.13	-0.124	-0.024	-0.027	0.12	0.038	0.035	0.06	0.12	0.023	X	-0.018	0.04
Eu-155	579 / 649	89.2	pCi/g	0.023	0.15	-0.063	0.064	0.064	0.161	0.027	0.024	0.07	0.161	0.022	X	0.069	0.111
H-3	33 / 177	18.6	pCi/g	0.035	4.82	-4.52	1.54	1.49	5.88	1.9	0.038	3.8	5.88	1.5	N	1.78	5.06
I-129	6 / 154	3.9	pCi/g	0	0.218	-0.14	0.012	0.007	0.275	0.074	0.147	0.193	0.275	0.044	N	0.022	0.15
Ni-59	9 / 163	5.52	pCi/g	0.012	4.57	-6.25	-0.431	-0.458	3.48	1.62	1.6	2.55	3.48	0.671	X	0.121	2.85
Np-237	0 / 1	0	pCi/g	0.016	0.016	-0.003	-0.003	-0.003	-0.003	--	--	--	--	--	O	--	--
Pu-238	43 / 453	9.49	pCi/g	0	0.042	-0.03	8.9E-04	6.4E-04	0.025	0.006	0.001	0.01	0.025	0.005	X	0.002	0.012
Pu-239/240	127 / 453	28.0	pCi/g	0	0.018	-0.015	0.004	0.003	0.052	0.007	0.002	0.011	0.052	0.007	X	0.005	0.018
Sb-125	73 / 649	11.2	pCi/g	0.012	0.168	-0.042	0.006	0.005	0.147	0.016	0.014	0.032	0.147	0.025	X	0.009	0.029
Sr-90	81 / 496	16.3	pCi/g	0.03	0.417	-0.21	0.099	0.023	21.3	0.97	0.044	0.544	21.3	2.36	X	0.289	0.392
Tc-99	4 / 166	2.41	pCi/g	0.072	0.939	-0.874	-0.146	-0.165	1.46	0.36	0.09	0.817	1.46	0.61	X	-0.024	0.09

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

N = normal. UCL95 is calculated using t statistic.

O = no detected results to calculate some summary statistics.

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 8. SSFL Area IV summary statistics for Subarea 7

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 7																	
Radionuclides																	
Am-241	93 / 264	35.2	pCi/g	0	0.03	-0.016	0.005	0.005	0.032	0.006	0.004	0.011	0.032	0.005	X	0.007	0.019
Cm-243/244	72 / 264	27.3	pCi/g	0	0.025	-0.015	0.004	0.004	0.021	0.006	0.004	0.01	0.021	0.004	X	0.005	0.016
Co-60	30 / 402	7.46	pCi/g	0.006	0.015	-0.012	5.9E-04	1.3E-04	0.026	0.006	0.008	0.013	0.026	0.004	X	0.002	0.012
Cs-134	84 / 402	20.9	pCi/g	0.005	0.027	-0.015	0.004	0.003	0.076	0.008	0.006	0.014	0.076	0.012	X	0.006	0.018
Cs-137	313 / 402	77.9	pCi/g	0.006	0.012	-0.021	0.564	0.11	20.2	1.74	0.009	0.726	20.2	1.94	X	0.943	2.77
Eu-152	13 / 402	3.23	pCi/g	0.016	0.056	-0.066	-0.012	-0.013	0.055	0.019	0.022	0.032	0.055	0.01	X	-0.007	0.022
Eu-154	12 / 402	2.99	pCi/g	0.033	0.079	-0.115	-0.026	-0.03	0.1	0.036	0.042	0.065	0.1	0.017	X	-0.018	0.042
Eu-155	342 / 402	85.1	pCi/g	0.025	0.053	-0.011	0.061	0.062	0.152	0.026	0.022	0.068	0.152	0.021	N	0.063	0.108
H-3	18 / 85	21.2	pCi/g	3.17	4.8	-2.1	1.97	2.11	7.55	2.25	0.032	4.55	7.55	1.91	N	2.37	6.36
I-129	1 / 26	3.85	pCi/g	0.07	0.49	-0.207	0.013	-0.003	0.474	0.136	0.09	0.09	0.09	--	X	0.13	--
Ni-59	0 / 30	0	pCi/g	1.32	3.38	-3.67	-0.519	-0.721	2.72	1.37	--	--	--	--	N	-0.093	2.53
Np-237	2 / 6	33.3	pCi/g	0.006	0.018	-0.016	0.002	0.001	0.021	0.012	0.007	0.014	0.021	0.01	N	0.012	0.047
Pu-238	42 / 269	15.6	pCi/g	0	0.029	-0.014	0.002	0.002	0.035	0.006	0.004	0.011	0.035	0.007	X	0.004	0.016
Pu-239/240	102 / 269	37.9	pCi/g	0	0.017	-0.009	0.007	0.005	0.187	0.014	0.002	0.015	0.187	0.019	X	0.011	0.025
Sb-125	38 / 402	9.45	pCi/g	0.015	0.062	-0.031	0.006	0.005	0.133	0.016	0.019	0.034	0.133	0.022	X	0.009	0.03
Sr-90	162 / 367	44.1	pCi/g	0.063	0.242	-0.153	0.355	0.1	14.3	1.12	0.051	0.771	14.3	1.59	X	0.609	2.31
Tc-99	1 / 32	3.13	pCi/g	0.4	0.954	-0.903	-0.09	-0.065	0.404	0.314	0.041	0.041	0.041	--	N	0.004	0.6

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

N = normal. UCL95 is calculated using t statistic.

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 9. SSFL Area IV summary statistics for Subarea 8

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a]		Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected				Dist.	UCL[b] 95	UTL[b] 95/95
				Min	Max						Min	Mean	Max	S.D.			
Subarea 8																	
Radionuclides																	
Am-241	126 / 297	42.4	pCi/g	0	0.035	-0.017	0.006	0.005	0.051	0.007	0.002	0.011	0.051	0.007	X	0.007	0.021
Cm-243/244	77 / 289	26.6	pCi/g	0	0.027	-0.015	0.004	0.003	0.026	0.006	0.005	0.01	0.024	0.005	X	0.005	0.017
Co-60	11 / 314	3.5	pCi/g	0.005	0.021	-0.019	-4.4E-04	-2.3E-04	0.017	0.006	0.008	0.012	0.017	0.003	X	9.8E-04	0.009
Cs-134	57 / 314	18.2	pCi/g	0.006	0.034	-0.016	0.004	0.003	0.144	0.014	0.007	0.021	0.144	0.025	X	0.008	0.023
Cs-137	188 / 313	60.1	pCi/g	0.006	0.021	-0.024	0.036	0.017	0.878	0.078	0.008	0.064	0.878	0.091	X	0.056	0.173
Eu-152	10 / 314	3.18	pCi/g	0.015	0.053	-0.068	-0.011	-0.011	0.046	0.018	0.017	0.027	0.046	0.008	N	-0.01	0.021
Eu-154	11 / 314	3.5	pCi/g	0.032	0.113	-0.152	-0.026	-0.028	0.079	0.036	0.028	0.055	0.079	0.014	N	-0.023	0.039
Eu-155	277 / 314	88.2	pCi/g	0.024	0.052	-0.043	0.068	0.069	0.158	0.03	0.027	0.075	0.158	0.024	N	0.071	0.123
H-3	4 / 29	13.8	pCi/g	0.037	3.59	-2.93	0.009	0.046	5.75	1.56	0.037	1.48	5.75	2.84	X	1.27	--
Ni-59	3 / 113	2.65	pCi/g	0.013	5.1	-7.09	-0.928	-0.805	2.57	1.76	1.93	2.18	2.57	0.34	X	-0.207	2.05
Np-237	1 / 11	9.09	pCi/g	0.007	0.038	-0.018	-0.002	7.0E-04	0.008	0.007	0.008	0.008	0.008	--	N	0.002	0.018
Pu-238	54 / 298	18.1	pCi/g	0	0.027	-0.014	0.002	0.002	0.027	0.005	0.002	0.009	0.025	0.005	X	0.004	0.014
Pu-239/240	110 / 298	36.9	pCi/g	0	0.026	-0.012	0.005	0.004	0.087	0.008	0.001	0.011	0.087	0.01	X	0.007	0.02
Sb-125	29 / 314	9.24	pCi/g	0.016	0.059	-0.036	0.008	0.008	0.154	0.022	0.017	0.048	0.154	0.042	X	0.013	0.034
Sr-90	116 / 381	30.4	pCi/g	0.036	0.324	-0.164	0.14	0.068	2.71	0.315	0.044	0.39	2.71	0.479	X	0.211	0.995
Tc-99	3 / 118	2.54	pCi/g	0.04	0.949	-0.943	-0.171	-0.215	0.781	0.368	0.04	0.449	0.781	0.376	N	-0.115	0.528

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

N = normal. UCL95 is calculated using t statistic.

X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 10. SSFL summary statistics for the NBZ

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
								NBZ									
								Radionuclides									
Am-241	56 / 233	24.0	pCi/g	0	0.03	-0.015	0.003	0.003	0.027	0.007	0.005	0.011	0.024	0.004	N	0.004	0.016
Cm-243/244	20 / 233	8.58	pCi/g	0.004	0.055	-0.024	-9.4E-04	-0.002	0.065	0.01	0.005	0.018	0.065	0.015	X	0.002	0.018
Co-60	10 / 233	4.29	pCi/g	0.006	0.015	-0.016	-7.9E-05	-3.1E-04	0.021	0.006	0.008	0.013	0.021	0.004	N	5.2E-04	0.01
Cs-134	43 / 233	18.5	pCi/g	0.005	0.014	-0.01	0.004	0.003	0.047	0.007	0.007	0.013	0.047	0.008	X	0.006	0.017
Cs-137	188 / 233	80.7	pCi/g	0.006	0.013	-0.017	0.051	0.042	0.277	0.05	0.008	0.065	0.277	0.047	X	0.066	0.177
Eu-152	7 / 232	3.02	pCi/g	0.018	0.041	-0.072	-0.01	-0.01	0.051	0.018	0.02	0.031	0.051	0.011	N	-0.008	0.024
Eu-154	5 / 233	2.15	pCi/g	0.034	0.087	-0.127	-0.025	-0.023	0.118	0.039	0.051	0.081	0.118	0.028	N	-0.021	0.046
Eu-155	211 / 233	90.6	pCi/g	0.03	0.044	0.004	0.068	0.067	0.157	0.026	0.032	0.072	0.157	0.023	N	0.07	0.114
Pu-238	21 / 233	9.01	pCi/g	0	0.029	-0.016	-2.1E-04	-4.8E-04	0.027	0.006	0.004	0.011	0.027	0.007	X	0.002	0.011
Pu-239/240	62 / 233	26.6	pCi/g	0	0.018	-0.015	0.004	0.003	0.038	0.007	0.005	0.012	0.038	0.006	X	0.006	0.019
Sb-125	18 / 233	7.73	pCi/g	0.017	0.035	-0.038	0.006	0.007	0.049	0.014	0.021	0.032	0.049	0.008	N	0.007	0.031
Sr-90	53 / 233	22.7	pCi/g	0.037	0.191	-0.117	0.071	0.032	1.35	0.169	0.042	0.253	1.35	0.275	X	0.12	0.586

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
All sediment and soil																	
NORM Radionuclides																	
Ac-227	301 / 3386	8.89	pCi/g	0.039	0.534	-0.26	0.001	0.007	2.53	0.08	0.039	0.118	2.53	0.157	X	0.007	0.086
Ac-228	3439 / 3439	100	pCi/g	--	--	0.404	1.25	1.23	3.64	0.241	0.404	1.25	3.64	0.241	X	1.27	1.62
Bi-212	3439 / 3439	100	pCi/g	--	--	0.281	0.954	0.938	2.74	0.207	0.281	0.954	2.74	0.207	X	0.969	1.31
Bi-214	3427 / 3427	100	pCi/g	--	--	0.372	0.932	0.902	3.49	0.22	0.372	0.932	3.49	0.22	X	0.949	1.29
Pa-231	78 / 3440	2.27	pCi/g	0.12	2.24	-1.5	-0.047	-0.019	1.77	0.233	0.166	0.464	1.77	0.251	X	-0.03	0.166
Pb-212	3439 / 3439	100	pCi/g	--	--	0.483	1.5	1.48	4.56	0.316	0.483	1.5	4.56	0.316	X	1.53	2.01
Pb-214	3439 / 3439	100	pCi/g	--	--	0.408	1.03	0.998	3.87	0.244	0.408	1.03	3.87	0.244	X	1.05	1.41
Th-228	2946 / 2946	100	pCi/g	--	--	0.362	1.38	1.33	3.97	0.359	0.362	1.38	3.97	0.359	X	1.41	2.05
Th-229	1377 / 2946	46.7	pCi/g	0	0.125	-0.131	0.02	0.013	0.296	0.026	0.003	0.031	0.296	0.029	X	0.022	0.068
Th-230	2946 / 2946	100	pCi/g	--	--	0.28	0.925	0.902	3.88	0.228	0.28	0.925	3.88	0.228	X	0.943	1.33
Th-232	2946 / 2946	100	pCi/g	--	--	0.262	1.2	1.19	3.34	0.267	0.262	1.2	3.34	0.267	X	1.23	1.62
Th-234	2847 / 2849	99.9	pCi/g	0.616	0.616	0.199	1.43	1.43	4.35	0.428	0.199	1.43	4.35	0.427	X	1.46	2.08
Tl-208	3439 / 3439	100	pCi/g	--	--	0.145	0.467	0.458	1.43	0.101	0.145	0.467	1.43	0.101	X	0.474	0.631
U-232(Tracer)	3 / 33	9.09	pCi/g	0.017	0.112	-0.093	0.005	0.007	0.068	0.026	0.023	0.042	0.068	0.024	X	0.025	--
U-233/234	2968 / 2968	100	pCi/g	--	--	0.142	0.857	0.813	4.09	0.272	0.142	0.857	4.09	0.272	X	0.878	1.33
U-235/236	2700 / 2968	91.0	pCi/g	0	0.051	-0.018	0.049	0.045	0.304	0.023	0.01	0.052	0.304	0.022	X	0.051	0.092
U-238	2968 / 2968	100	pCi/g	--	--	0.213	0.873	0.833	2.67	0.24	0.213	0.873	2.67	0.24	X	0.892	1.33

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 12. SSFL Area IV NORM summary statistics for Subarea 3

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 3																	
NORM Radionuclides																	
Ac-227	0 / 13	0	pCi/g	0.065	0.113	-0.105	-0.007	-0.007	0.09	0.066	--	--	--	--	N	0.025	0.169
Ac-228	13 / 13	100	pCi/g	--	--	0.969	1.16	1.17	1.33	0.099	0.969	1.16	1.33	0.099	N	1.21	1.42
Bi-212	13 / 13	100	pCi/g	--	--	0.709	0.836	0.81	1.08	0.1	0.709	0.836	1.08	0.1	N	0.885	1.1
Bi-214	13 / 13	100	pCi/g	--	--	0.747	0.902	0.907	1.04	0.093	0.747	0.902	1.04	0.093	N	0.949	1.15
Pa-231	0 / 13	0	pCi/g	0.269	0.47	-0.543	-0.158	-0.263	0.26	0.264	--	--	--	--	N	-0.028	0.547
Pb-212	13 / 13	100	pCi/g	--	--	1.14	1.37	1.39	1.54	0.119	1.14	1.37	1.54	0.119	N	1.43	1.69
Pb-214	13 / 13	100	pCi/g	--	--	0.836	0.997	1.01	1.21	0.106	0.836	0.997	1.21	0.106	N	1.05	1.28
Th-228	13 / 13	100	pCi/g	--	--	0.991	1.33	1.36	1.74	0.223	0.991	1.33	1.74	0.223	N	1.44	1.93
Th-229	4 / 13	30.8	pCi/g	0.02	0.038	-0.018	0.023	0.022	0.072	0.025	0.022	0.048	0.072	0.023	N	0.036	0.091
Th-230	13 / 13	100	pCi/g	--	--	0.698	0.874	0.893	1.07	0.115	0.698	0.874	1.07	0.115	N	0.931	1.18
Th-232	13 / 13	100	pCi/g	--	--	0.739	1.17	1.13	1.52	0.226	0.739	1.17	1.52	0.226	N	1.28	1.77
Th-234	13 / 13	100	pCi/g	--	--	1.15	1.33	1.33	1.5	0.096	1.15	1.33	1.5	0.096	N	1.38	1.59
Tl-208	13 / 13	100	pCi/g	--	--	0.348	0.419	0.433	0.476	0.044	0.348	0.419	0.476	0.044	N	0.441	0.537
U-233/234	13 / 13	100	pCi/g	--	--	0.494	0.767	0.771	0.948	0.126	0.494	0.767	0.948	0.126	N	0.83	1.1
U-235/236	13 / 13	100	pCi/g	--	--	0.019	0.052	0.048	0.105	0.024	0.019	0.052	0.105	0.024	N	0.064	0.115
U-238	13 / 13	100	pCi/g	--	--	0.648	0.834	0.843	1.11	0.127	0.648	0.834	1.11	0.127	N	0.896	1.17

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

 N = normal. UCL95 is calculated using t statistic.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 13. SSFL Area IV NORM summary statistics for Subarea 5A

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 5A																	
NORM Radionuclides																	
Ac-227	62 / 348	17.8	pCi/g	0.044	0.148	-0.146	0.019	0.026	0.187	0.052	0.051	0.086	0.187	0.027	X	0.031	0.102
Ac-228	374 / 374	100	pCi/g	--	--	0.576	1.27	1.26	1.8	0.149	0.576	1.27	1.8	0.149	X	1.3	1.57
Bi-212	374 / 374	100	pCi/g	--	--	0.533	1.01	1.01	1.46	0.145	0.533	1.01	1.46	0.145	N	1.02	1.27
Bi-214	374 / 374	100	pCi/g	--	--	0.42	0.88	0.851	2.29	0.172	0.42	0.88	2.29	0.172	X	0.918	1.23
Pa-231	6 / 375	1.6	pCi/g	0.13	0.607	-0.83	-0.015	0.007	0.5	0.161	0.166	0.313	0.5	0.117	X	0.021	0.166
Pb-212	374 / 374	100	pCi/g	--	--	0.74	1.6	1.6	2.28	0.205	0.74	1.6	2.28	0.205	X	1.64	2
Pb-214	374 / 374	100	pCi/g	--	--	0.465	0.98	0.95	2.54	0.192	0.465	0.98	2.54	0.192	X	1.02	1.37
Th-228	340 / 340	100	pCi/g	--	--	0.57	1.42	1.39	2.17	0.227	0.57	1.42	2.17	0.227	X	1.47	1.91
Th-229	179 / 340	52.6	pCi/g	0	0.049	-0.03	0.011	0.007	0.09	0.016	0.003	0.016	0.09	0.018	X	0.015	0.056
Th-230	340 / 340	100	pCi/g	--	--	0.394	0.962	0.967	1.78	0.176	0.394	0.962	1.78	0.176	X	1.0	1.3
Th-232	340 / 340	100	pCi/g	--	--	0.554	1.25	1.26	1.75	0.181	0.554	1.25	1.75	0.181	X	1.29	1.57
Th-234	144 / 144	100	pCi/g	--	--	0.796	1.51	1.48	2.54	0.281	0.796	1.51	2.54	0.281	L	1.55	2.1
Tl-208	374 / 374	100	pCi/g	--	--	0.222	0.491	0.487	0.714	0.065	0.222	0.491	0.714	0.065	X	0.505	0.62
U-233/234	340 / 340	100	pCi/g	--	--	0.334	0.804	0.797	1.49	0.186	0.334	0.804	1.49	0.186	X	0.848	1.14
U-235/236	325 / 340	95.6	pCi/g	0	0.023	0.007	0.042	0.04	0.104	0.016	0.014	0.043	0.104	0.015	X	0.046	0.079
U-238	340 / 340	100	pCi/g	--	--	0.334	0.811	0.801	1.44	0.184	0.334	0.811	1.44	0.184	X	0.854	1.17

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  L = lognormal. UCL95 is calculated using Land's statistic, Chebyshev minimum variance unbiased estimator, or nonparametric Chebyshev inequality method.

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 14. SSFL Area IV NORM summary statistics for Subarea 5B

| | Freq. of | Percent | | Non-detect Detection Limits[a] | | Min[b] | Mean[b] | Median[b] | Max[b] | S.D.[b] | Detected | | | | Dist. | UCL[b] 95 | UTL[b] 95/95 |
Constituent	Detection	Detected	Units	Min	Max						Min	Mean	Max	S.D.			
								Subarea 5B									
								NORM Radionuclides									
Ac-227	99 / 493	20.1	pCi/g	0.039	0.109	-0.195	0.039	0.036	0.373	0.049	0.039	0.092	0.373	0.067	X	0.048	0.102
Ac-228	520 / 520	100	pCi/g	--	--	0.53	1.16	1.17	1.64	0.146	0.53	1.16	1.64	0.146	X	1.19	1.42
Bi-212	520 / 520	100	pCi/g	--	--	0.411	0.944	0.957	1.38	0.138	0.411	0.944	1.38	0.138	X	0.971	1.18
Bi-214	520 / 520	100	pCi/g	--	--	0.409	0.829	0.826	1.47	0.134	0.409	0.829	1.47	0.134	X	0.854	1.09
Pa-231	16 / 520	3.08	pCi/g	0.12	0.454	-0.667	0.014	0.009	0.508	0.129	0.19	0.31	0.508	0.097	X	0.039	0.19
Pb-212	520 / 520	100	pCi/g	--	--	0.543	1.45	1.48	2.3	0.219	0.543	1.45	2.3	0.219	X	1.5	1.82
Pb-214	520 / 520	100	pCi/g	--	--	0.459	0.922	0.918	1.66	0.15	0.459	0.922	1.66	0.15	X	0.951	1.22
Th-228	480 / 480	100	pCi/g	--	--	0.489	1.23	1.23	1.84	0.173	0.489	1.23	1.84	0.173	X	1.26	1.58
Th-229	331 / 480	69.0	pCi/g	0.002	0.009	-0.003	0.008	0.007	0.022	0.004	0.003	0.01	0.022	0.004	X	0.008	0.017
Th-230	480 / 480	100	pCi/g	--	--	0.416	0.917	0.902	2.01	0.164	0.416	0.917	2.01	0.164	X	0.95	1.25
Th-232	480 / 480	100	pCi/g	--	--	0.503	1.17	1.18	1.71	0.164	0.503	1.17	1.71	0.164	X	1.21	1.5
Th-234	198 / 198	100	pCi/g	--	--	0.211	1.07	1.24	2.13	0.49	0.211	1.07	2.13	0.49	G	1.14	2.44
Tl-208	520 / 520	100	pCi/g	--	--	0.187	0.451	0.458	0.697	0.065	0.187	0.451	0.697	0.065	X	0.463	0.564
U-233/234	463 / 463	100	pCi/g	--	--	0.205	0.776	0.763	1.59	0.158	0.205	0.776	1.59	0.158	X	0.808	1.07
U-235/236	463 / 463	100	pCi/g	--	--	0.01	0.04	0.039	0.088	0.011	0.01	0.04	0.088	0.011	X	0.042	0.06
U-238	463 / 463	100	pCi/g	--	--	0.213	0.782	0.777	1.44	0.146	0.213	0.782	1.44	0.146	X	0.812	1.07

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

   G = 95% UCL was calculated using either the adjusted or unadjusted gamma.

   X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 15. SSFL Area IV NORM summary statistics for Subarea 5C

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Non-detect Detection Limits[a] Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Detected Mean	Detected Max	Detected S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Area 5C																	
NORM Radionuclides																	
Ac-227	36 / 213	16.9	pCi/g	0.039	0.106	-0.141	0.063	0.042	2.53	0.186	0.054	0.227	2.53	0.413	X	0.118	0.346
Ac-228	213 / 213	100	pCi/g	--	--	0.917	1.24	1.24	1.53	0.118	0.917	1.24	1.53	0.118	X	1.28	1.49
Bi-212	213 / 213	100	pCi/g	--	--	0.689	1.02	1.02	1.48	0.131	0.689	1.02	1.48	0.131	N	1.03	1.26
Bi-214	201 / 201	100	pCi/g	--	--	0.593	0.901	0.895	1.95	0.159	0.593	0.901	1.95	0.159	X	0.95	1.26
Pa-231	5 / 213	2.35	pCi/g	0.16	0.485	-0.598	0.026	0.02	0.441	0.131	0.29	0.31	0.34	0.023	X	0.065	0.29
Pb-212	213 / 213	100	pCi/g	--	--	0.893	1.55	1.56	2.37	0.18	0.893	1.55	2.37	0.18	X	1.6	1.82
Pb-214	213 / 213	100	pCi/g	--	--	0.662	1.0	0.987	2.23	0.178	0.662	1.0	2.23	0.178	X	1.05	1.31
Th-228	203 / 203	100	pCi/g	--	--	0.824	1.29	1.28	2.2	0.16	0.824	1.29	2.2	0.16	X	1.34	1.71
Th-229	153 / 203	75.4	pCi/g	0.002	0.036	-0.011	0.008	0.007	0.092	0.008	0.003	0.01	0.092	0.009	X	0.01	0.019
Th-230	203 / 203	100	pCi/g	--	--	0.588	0.941	0.923	2.24	0.172	0.588	0.941	2.24	0.172	X	0.994	1.28
Th-232	203 / 203	100	pCi/g	--	--	0.792	1.25	1.25	2.02	0.144	0.792	1.25	2.02	0.144	X	1.29	1.56
Th-234	175 / 175	100	pCi/g	--	--	0.199	1.08	1.29	2.63	0.546	0.199	1.08	2.63	0.546	X	1.26	1.86
Tl-208	213 / 213	100	pCi/g	--	--	0.292	0.485	0.49	0.697	0.054	0.292	0.485	0.697	0.054	X	0.501	0.588
U-233/234	203 / 203	100	pCi/g	--	--	0.243	0.788	0.776	1.74	0.179	0.243	0.788	1.74	0.179	X	0.843	1.13
U-235/236	203 / 203	100	pCi/g	--	--	0.013	0.041	0.04	0.084	0.011	0.013	0.041	0.084	0.011	X	0.044	0.066
U-238	203 / 203	100	pCi/g	--	--	0.243	0.79	0.774	1.61	0.17	0.243	0.79	1.61	0.17	X	0.842	1.23

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 16. SSFL Area IV NORM summary statistics for Subarea 5D

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 5D																	
NORM Radionuclides																	
Ac-227	12 / 494	2.43	pCi/g	0.055	0.183	-0.207	-0.024	-0.02	0.237	0.067	0.098	0.143	0.237	0.042	N	-0.019	0.094
Ac-228	494 / 494	100	pCi/g	--	--	0.924	1.45	1.36	3.64	0.374	0.924	1.45	3.64	0.374	X	1.53	2.56
Bi-212	494 / 494	100	pCi/g	--	--	0.715	1.12	1.06	2.74	0.268	0.715	1.12	2.74	0.268	X	1.17	1.81
Bi-214	494 / 494	100	pCi/g	--	--	0.442	1.03	0.964	2.94	0.334	0.442	1.03	2.94	0.334	X	1.1	1.93
Pa-231	10 / 494	2.02	pCi/g	0.23	0.729	-1.48	-0.075	-0.05	1.02	0.275	0.402	0.602	1.02	0.174	X	-0.021	0.402
Pb-212	494 / 494	100	pCi/g	--	--	1.16	1.81	1.72	4.56	0.429	1.16	1.81	4.56	0.429	X	1.9	3.11
Pb-214	494 / 494	100	pCi/g	--	--	0.462	1.14	1.06	3.07	0.375	0.462	1.14	3.07	0.375	X	1.22	2.13
Th-228	464 / 464	100	pCi/g	--	--	0.879	1.6	1.51	3.97	0.396	0.879	1.6	3.97	0.396	X	1.68	2.63
Th-229	174 / 464	37.5	pCi/g	0	0.098	-0.046	0.029	0.027	0.216	0.028	0.016	0.055	0.216	0.024	X	0.035	0.083
Th-230	464 / 464	100	pCi/g	--	--	0.425	0.904	0.867	2.24	0.221	0.425	0.904	2.24	0.221	X	0.949	1.44
Th-232	464 / 464	100	pCi/g	--	--	0.69	1.27	1.19	3.34	0.366	0.69	1.27	3.34	0.366	X	1.34	2.31
Th-234	494 / 494	100	pCi/g	--	--	0.694	1.62	1.5	4.35	0.531	0.694	1.62	4.35	0.531	X	1.72	3.03
Tl-208	494 / 494	100	pCi/g	--	--	0.357	0.56	0.534	1.43	0.135	0.357	0.56	1.43	0.135	X	0.587	0.922
U-232(Tracer)	3 / 33	9.09	pCi/g	0.017	0.112	-0.093	0.005	0.007	0.068	0.026	0.023	0.042	0.068	0.024	X	0.025	--
U-233/234	484 / 484	100	pCi/g	--	--	0.339	0.838	0.756	2.02	0.28	0.339	0.838	2.02	0.28	X	0.894	1.55
U-235/236	418 / 484	86.4	pCi/g	0	0.048	-0.008	0.053	0.052	0.234	0.025	0.021	0.058	0.234	0.023	X	0.058	0.101
U-238	484 / 484	100	pCi/g	--	--	0.368	0.88	0.809	2.22	0.267	0.368	0.88	2.22	0.267	X	0.933	1.52

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 17. SSFL Area IV NORM summary statistics for Subarea 6

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
Subarea 6																	
NORM Radionuclides																	
Ac-227	19 / 649	2.93	pCi/g	0.043	0.534	-0.26	-0.015	-0.017	0.354	0.062	0.084	0.143	0.354	0.063	X	-0.004	0.084
Ac-228	649 / 649	100	pCi/g	--	--	0.61	1.19	1.19	1.93	0.158	0.61	1.19	1.93	0.158	X	1.22	1.47
Bi-212	649 / 649	100	pCi/g	--	--	0.405	0.846	0.846	1.32	0.127	0.405	0.846	1.32	0.127	X	0.868	1.1
Bi-214	649 / 649	100	pCi/g	--	--	0.372	0.943	0.933	1.95	0.164	0.372	0.943	1.95	0.164	X	0.971	1.25
Pa-231	11 / 649	1.69	pCi/g	0.218	2.24	-1.1	-0.084	-0.068	0.879	0.255	0.313	0.529	0.879	0.18	N	-0.068	0.362
Pb-212	649 / 649	100	pCi/g	--	--	0.665	1.35	1.36	2.12	0.191	0.665	1.35	2.12	0.191	X	1.39	1.71
Pb-214	649 / 649	100	pCi/g	--	--	0.408	1.04	1.03	2.14	0.187	0.408	1.04	2.14	0.187	X	1.08	1.39
Th-228	452 / 452	100	pCi/g	--	--	0.594	1.27	1.27	1.93	0.196	0.594	1.27	1.93	0.196	X	1.31	1.61
Th-229	142 / 452	31.4	pCi/g	0	0.118	-0.051	0.024	0.021	0.244	0.03	0.005	0.054	0.244	0.028	X	0.03	0.086
Th-230	452 / 452	100	pCi/g	--	--	0.301	0.916	0.9	2.05	0.184	0.301	0.916	2.05	0.184	X	0.953	1.25
Th-232	452 / 452	100	pCi/g	--	--	0.491	1.15	1.15	1.58	0.174	0.491	1.15	1.58	0.174	X	1.18	1.46
Th-234	648 / 649	99.8	pCi/g	0.616	0.616	0.35	1.47	1.46	2.73	0.279	0.35	1.47	2.73	0.276	X	1.51	1.99
Tl-208	649 / 649	100	pCi/g	--	--	0.204	0.417	0.419	0.699	0.057	0.204	0.417	0.699	0.057	X	0.427	0.516
U-233/234	452 / 452	100	pCi/g	--	--	0.323	0.905	0.887	2.48	0.203	0.323	0.905	2.48	0.203	X	0.947	1.27
U-235/236	398 / 452	88.1	pCi/g	0	0.036	-9.4E-04	0.053	0.052	0.153	0.024	0.018	0.058	0.153	0.021	X	0.058	0.101
U-238	452 / 452	100	pCi/g	--	--	0.421	0.927	0.921	2.34	0.192	0.421	0.927	2.34	0.192	X	0.966	1.27

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 18. SSFL Area IV NORM summary statistics for Subarea 7

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95

Subarea 7

NORM Radionuclides

Constituent	Freq. of Detection	Percent Detected	Units	Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Min	Mean	Max	S.D.	Dist.	UCL 95	UTL 95/95
Ac-227	10 / 402	2.49	pCi/g	0.067	0.212	-0.243	-0.02	-0.02	0.187	0.064	0.091	0.134	0.187	0.038	N	-0.014	0.094
Ac-228	402 / 402	100	pCi/g	--	--	0.657	1.14	1.13	1.63	0.135	0.657	1.14	1.63	0.135	X	1.17	1.46
Bi-212	402 / 402	100	pCi/g	--	--	0.441	0.802	0.8	1.23	0.113	0.441	0.802	1.23	0.113	X	0.827	1.02
Bi-214	402 / 402	100	pCi/g	--	--	0.446	0.895	0.886	1.63	0.138	0.446	0.895	1.63	0.138	X	0.925	1.13
Pa-231	10 / 402	2.49	pCi/g	0.25	0.906	-1.5	-0.069	-0.073	0.672	0.263	0.385	0.508	0.67	0.099	X	-0.012	0.385
Pb-212	402 / 402	100	pCi/g	--	--	0.72	1.28	1.27	1.85	0.155	0.72	1.28	1.85	0.155	X	1.31	1.59
Pb-214	402 / 402	100	pCi/g	--	--	0.475	0.989	0.981	1.74	0.155	0.475	0.989	1.74	0.155	X	1.02	1.27
Th-228	261 / 261	100	pCi/g	--	--	0.714	1.22	1.21	2.04	0.181	0.714	1.22	2.04	0.181	X	1.27	1.58
Th-229	116 / 261	44.4	pCi/g	0	0.055	-0.05	0.03	0.027	0.296	0.033	0.007	0.053	0.296	0.035	X	0.039	0.092
Th-230	261 / 261	100	pCi/g	--	--	0.316	0.867	0.84	2.31	0.218	0.316	0.867	2.31	0.218	X	0.925	1.19
Th-232	261 / 261	100	pCi/g	--	--	0.61	1.13	1.13	1.81	0.165	0.61	1.13	1.81	0.165	X	1.18	1.46
Th-234	402 / 402	100	pCi/g	--	--	0.742	1.4	1.38	2.85	0.263	0.742	1.4	2.85	0.263	X	1.45	2.02
Tl-208	402 / 402	100	pCi/g	--	--	0.212	0.395	0.393	0.596	0.049	0.212	0.395	0.596	0.049	X	0.405	0.5
U-233/234	264 / 264	100	pCi/g	--	--	0.315	0.993	0.906	4.09	0.434	0.315	0.993	4.09	0.434	X	1.11	2.29
U-235/236	241 / 264	91.3	pCi/g	0	0.04	-0.009	0.059	0.054	0.304	0.034	0.015	0.063	0.304	0.033	X	0.068	0.121
U-238	264 / 264	100	pCi/g	--	--	0.432	0.945	0.906	2.65	0.261	0.432	0.945	2.65	0.261	X	1.02	1.52

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

  N = normal. UCL95 is calculated using t statistic.

  X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 19. SSFL Area IV NORM summary statistics for Subarea 8

| | Freq. of | Percent | | Non-detect Detection Limits[a] | | | | | | | | Detected | | | | | UCL[b] | UTL[b] |
Constituent	Detection	Detected	Units	Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Min	Mean	Max	S.D.	Dist.	95	95/95
								Subarea 8									
								NORM Radionuclides									
Ac-227	9 / 313	2.88	pCi/g	0.058	0.199	-0.181	-0.022	-0.023	0.273	0.062	0.068	0.138	0.273	0.064	X	-0.007	0.068
Ac-228	313 / 313	100	pCi/g	--	--	0.404	1.23	1.25	1.74	0.179	0.404	1.23	1.74	0.179	X	1.27	1.51
Bi-212	313 / 313	100	pCi/g	--	--	0.281	0.966	0.989	1.43	0.177	0.281	0.966	1.43	0.177	X	1.01	1.27
Bi-214	313 / 313	100	pCi/g	--	--	0.395	0.863	0.861	1.33	0.149	0.395	0.863	1.33	0.149	X	0.9	1.11
Pa-231	4 / 313	1.28	pCi/g	0.23	0.842	-1.38	-0.07	-0.07	0.525	0.259	0.382	0.444	0.525	0.065	X	-0.006	0.382
Pb-212	313 / 313	100	pCi/g	--	--	0.483	1.55	1.59	2.29	0.263	0.483	1.55	2.29	0.263	X	1.61	1.99
Pb-214	313 / 313	100	pCi/g	--	--	0.443	0.954	0.953	1.44	0.161	0.443	0.954	1.44	0.161	X	0.994	1.23
Th-228	288 / 288	100	pCi/g	--	--	0.537	1.43	1.46	2.26	0.273	0.537	1.43	2.26	0.273	X	1.5	1.85
Th-229	105 / 288	36.5	pCi/g	0	0.111	-0.033	0.03	0.03	0.131	0.026	0.004	0.055	0.131	0.02	X	0.037	0.086
Th-230	288 / 288	100	pCi/g	--	--	0.358	0.834	0.836	1.23	0.15	0.358	0.834	1.23	0.15	X	0.873	1.11
Th-232	288 / 288	100	pCi/g	--	--	0.262	1.13	1.14	1.69	0.188	0.262	1.13	1.69	0.188	X	1.18	1.43
Th-234	313 / 313	100	pCi/g	--	--	0.335	1.36	1.38	2.31	0.261	0.335	1.36	2.31	0.261	X	1.43	1.86
Tl-208	313 / 313	100	pCi/g	--	--	0.145	0.477	0.489	0.709	0.082	0.145	0.477	0.709	0.082	X	0.497	0.611
U-233/234	288 / 288	100	pCi/g	--	--	0.33	0.746	0.733	1.57	0.163	0.33	0.746	1.57	0.163	X	0.788	1.12
U-235/236	237 / 288	82.3	pCi/g	0	0.029	-0.005	0.046	0.045	0.121	0.022	0.019	0.052	0.121	0.019	X	0.051	0.088
U-238	288 / 288	100	pCi/g	--	--	0.346	0.798	0.779	1.47	0.144	0.346	0.798	1.47	0.144	X	0.835	1.12

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

   X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 20. SSFL NORM summary statistics for the NBZ

Constituent	Freq. of Detection	Percent Detected	Units	Non-detect Detection Limits[a] Min	Max	Min[b]	Mean[b]	Median[b]	Max[b]	S.D.[b]	Detected Min	Mean	Max	S.D.	Dist.	UCL[b] 95	UTL[b] 95/95
								NBZ									
								NORM Radionuclides									
Ac-227	3 / 233	1.29	pCi/g	0.073	0.141	-0.221	-0.023	-0.027	0.156	0.066	0.12	0.134	0.153	0.017	N	-0.016	0.097
Ac-228	233 / 233	100	pCi/g	--	--	0.713	1.21	1.2	1.78	0.161	0.713	1.21	1.78	0.161	X	1.26	1.57
Bi-212	233 / 233	100	pCi/g	--	--	0.391	0.849	0.851	1.43	0.135	0.391	0.849	1.43	0.135	X	0.887	1.09
Bi-214	233 / 233	100	pCi/g	--	--	0.561	1.06	1.02	3.49	0.27	0.561	1.06	3.49	0.27	X	1.14	1.68
Pa-231	4 / 233	1.72	pCi/g	0.302	0.604	-0.926	-0.107	-0.097	0.54	0.267	0.445	0.502	0.54	0.044	N	-0.078	0.38
Pb-212	233 / 233	100	pCi/g	--	--	0.777	1.34	1.33	2.05	0.18	0.777	1.34	2.05	0.18	L	1.36	1.7
Pb-214	233 / 233	100	pCi/g	--	--	0.648	1.17	1.13	3.87	0.296	0.648	1.17	3.87	0.296	X	1.26	1.79
Th-228	233 / 233	100	pCi/g	--	--	0.362	1.14	1.2	1.79	0.317	0.362	1.14	1.79	0.317	X	1.23	1.65
Th-229	53 / 233	22.7	pCi/g	0.015	0.125	-0.131	0.02	0.02	0.206	0.035	0.028	0.063	0.206	0.026	X	0.03	0.085
Th-230	233 / 233	100	pCi/g	--	--	0.28	0.893	0.857	3.88	0.39	0.28	0.893	3.88	0.39	X	1.0	1.64
Th-232	233 / 233	100	pCi/g	--	--	0.334	1.06	1.11	1.63	0.295	0.334	1.06	1.63	0.295	X	1.14	1.57
Th-234	233 / 233	100	pCi/g	--	--	0.842	1.54	1.47	2.94	0.326	0.842	1.54	2.94	0.326	X	1.63	2.33
Tl-208	233 / 233	100	pCi/g	--	--	0.235	0.415	0.41	0.64	0.058	0.235	0.415	0.64	0.058	X	0.431	0.545
U-233/234	233 / 233	100	pCi/g	--	--	0.142	0.85	0.822	2.4	0.339	0.142	0.85	2.4	0.339	X	0.947	1.61
U-235/236	183 / 233	78.5	pCi/g	0	0.041	-0.018	0.049	0.046	0.127	0.026	0.026	0.057	0.127	0.021	N	0.051	0.095
U-238	233 / 233	100	pCi/g	--	--	0.24	0.883	0.861	2.67	0.336	0.24	0.883	2.67	0.336	X	0.979	1.81

[a] Detection Limit statistics are represented by critical levels associated with non-detects.

[b] This summary statistic is calculated using both detects and non-detects.

Dist. = distribution. Distribution flags are defined as:

   L = lognormal. UCL95 is calculated using Land's statistic, Chebyshev minimum variance unbiased estimator, or nonparametric Chebyshev inequality method.

   N = normal. UCL95 is calculated using t statistic.

   X = neither normal, lognormal nor gamma. UCL95 calculated using a nonparametric bootstrap or the nonparametric Chebyshev inequality method.

S.D. = standard deviation.

UCL95 = upper confidence limit on the mean concentration with 95% confidence.

UTL95/95 = upper tolerance limit on individual concentrations with 95% confidence and 95% coverage. A nonparametric UTL95/95 requires at least 59 samples.

-- = Not applicable, not available or insufficient data to calculate the statistic.

Table 21. SSFL Area IV and NBZ Radionuclide Contaminants of Concern by Subarea

Radionuclide	Subarea 3	Subarea 5A	Subarea 5B	Subarea 5C	Subarea 5D	Subarea 6	Subarea 7	Subarea 8	NBZ
Am-241	X	X	X	X	X	X	X	X	X
Cm-243/244	X	X	X	X	X	X	X	X	X
Co-60						X	X		
Cs-134									
Cs-137	X	X	X	X	X	X	X	X	X
Eu-152									
Eu-154									
Eu-155									
H-3		X	X	X	X	X	X	X	
I-129									
Ni-59						X			
Np-237					X		X	X	
Pu-238		X	X	X	X	X	X	X	X
Pu-239/240	X	X	X	X	X	X	X	X	X
Sb-125									
Sr-90	X	X	X	X	X	X	X	X	X
Tc-99									
U-234						X	X		X
U-235						X	X		X
U-238						X	X		X

X = Should be considered COC based on passing Data Assessment and frequency of detection above 5%