May 28, 2013

Mr. Kevin Ramsey
Senior Project Manager
Fuel Manufacturing Branch
U.S. Nuclear Regulatory Commission
Mailstop: E2C40M
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: COMPARISON OF RESULTS FOR QUARTER 3 SURFACE WATER SPLIT SAMPLES COLLECTED AT THE NUCLEAR FUEL SERVICES SITE, ERWIN, TENNESSEE
DCN: 5198-SR-03-0

Dear Mr. Ramsey:

Oak Ridge Associated Universities (ORAU), under the Oak Ridge Institute for Science and Education (ORISE) contract, has completed the collection, sample analysis, and review of split surface water sample results collected at the Nuclear Fuel Services site in Erwin, Tennessee. Details of these activities are presented in the enclosed report.

Please contact me at 865.574.0685, or Erika Bailey at 865.576.6659, if you have any questions.

Sincerely,

David A. King, CHP, PMP
Sr. Health Physicist/Project Manager
Independent Environmental Assessment
and Verification Program

DAK:fr

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COMPARISON OF RESULTS FOR QUARTER 3 SURFACE WATER SPLIT SAMPLES COLLECTED AT THE NUCLEAR FUEL SERVICES SITE ERWIN, TENNESSEE

Oak Ridge Associated Universities (ORAU), under the Oak Ridge Institute for Science and Education (ORISE) contract, collected split surface water samples with Nuclear Fuel Services (NFS) representatives on March 20, 2013. Representatives from the U.S. Nuclear Regulatory Commission and the Tennessee Department of Environment and Conservation were also in attendance. Samples were collected at four surface water stations, as required in the approved Request for Technical Assistance number 11-018. These stations included Nolichucky River upstream (NRU), Nolichucky River downstream (NRD), Martin Creek upstream (MCU), and Martin Creek downstream (MCD).

Both ORAU and NFS performed gross alpha and gross beta analyses, and Table 1 presents the comparison of results using the duplicate error ratio (DER), also known as the normalized absolute difference. A DER ≤ 3 indicates that at a 99% confidence interval, split sample results do not differ significantly when compared to their respective one standard deviation (sigma) uncertainty (ANSI N42.22). The following equation presents the DER calculation.

$$DER = \frac{|P - S|}{\sqrt{{U_P}^2 + {U_S}^2}}$$

Where:

P = NFS primary sample result
S = ORAU split sample result
U_P = NFS primary sample one sigma uncertainty
U_S = ORAU split sample one sigma uncertainty

The NFS split sample report does not specify the confidence level of reported uncertainties (NFS 2013). Therefore, standard two sigma reporting is assumed and uncertainty values were divided by 1.96.

In conclusion and as shown in Table 1, most DER values were less than 3 and results are consistent with low (e.g., background) concentrations. The gross beta result for sample 5198W0012 was the exception. The ORAU result of 9.23 ± 0.73 pCi/L from location MCD is well above NFS's result

of -0.567 ± 0.63 pCi/L (non-detected). NFS's data package included a detected result for U-233/234, but no other uranium or plutonium detection, and nothing that would suggest the presence of beta-emitting radionuclides. The ORAU laboratory reanalyzed sample 5198W0012 using the remaining portion of the sample volume and a result of 11.3 ± 1.1 pCi/L was determined. As directed, the laboratory also counted the filtrate using gamma spectrometry analysis and identified only naturally occurring or ubiquitous man-made constituents, including beta emitters that are presumably responsible for the elevated gross beta values. The instrument generated Gamma Spectrum Analysis report is attached for your records.

REFERENCES

ANSI N42.22. Traceability of Radioactive Sources to NIST and Associated Instrument Quality Control. American National Standards Institute.

NFS 2013. File name "03-20-13 Sampling Event Results.pdf," e-mailed by Carol Hale/NFS to Jason Lee/ORAU on April 22, 2013. Nuclear Fuel Services.

Table 1. Quarter 3 Results for Split Surface Water Samples Collected on March 20, 2013												
Quarter	Station	ORAU Sample	NFS Sample	Analyte	ORAU (pCi/L)			NFS (pCi/L)			DER	
					Result	Uncert.	MDC	Result	Uncert.	MDC	Value	≤ 3?
3	NRU	5198W0009	NRU	Gross alpha	0.19	0.19	0.29	-0.784	0.352	1.98	2.5	YES
				Gross beta	1.66	0.48	0.71	0.352	0.71	2.50	1.5	YES
3	NRD	5198W0010	NRD	Gross alpha	0.19	0.19	0.31	0.487	0.440	1.50	0.60	YES
				Gross beta	1.58	0.48	0.72	0.962	0.86	2.92	0.63	YES
3	MCU	5198W0011	MCU	Gross alpha	0.11	0.17	0.29	-0.101	0.370	1.67	0.50	YES
				Gross beta	1.21	0.46	0.71	0.488	0.59	2.08	1.0	YES
3	MCD	5198W0012	MCD @ RR Trestle	Gross alpha	1.61	0.47	0.41	0.806	0.58	1.94	1.1	YES
				Gross beta	9.23	0.73	0.74	-0.567	0.63	2.44	10	NO

Uncert. = one sigma uncertainty; standard two sigma reporting is assumed for NFS data, thus the reported uncertainty values were divided by 1.96.
MDC = minimum detectable concentration

ATTACHMENT 1. GAMMA SPEC RESULTS

Apex™

Analysis Report for 5198W0012

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 5198W0012
Sample Description	:
Sample Type	: GAMMA
Sample Size	: 3.000E-01 L
Facility	: ORAU
Sample Taken On	: 5/3/2013 8:32:58AM
Acquisition Started	: 5/7/2013 4:12:25PM
Procedure	: AIR FILTER
Operator	: Administrator
Detector Name	: DET09
Geometry	: AF1
Live Time	: 57600.0 seconds
Real Time	: 57614.0 seconds
Dead Time	: 0.02 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 1 - 4096
Peak Area Range (in channels)	: 1 - 4096
Identification Energy Tolerance	: 1.500 keV
Energy Calibration Used Done On	: 3/5/2008
Efficiency Calibration Used Done On	: 3/11/2008
Efficiency Calibration Description	:
Sample Number	: 18231

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 5/13/2013 3:32:39PM

Peak Analysis From Channel : 1
Peak Analysis To Channel : 4096

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	13.13	23 -	28	26.32	4.49E+02	279.37	9.58E+03	0.81
2	15.85	29 -	34	31.75	1.55E+03	223.56	5.43E+03	1.59
3	24.44	46 -	51	48.95	1.41E+02	137.42	2.30E+03	0.89

Analysis Report for 5198W0012

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	4	46.52	88 -	95	93.13	4.87E+02	141.79	1.86E+03	0.69
	5	53.29	103 -	109	106.68	-7.42E+01	124.35	1.77E+03	0.50
	6	63.29	123 -	129	126.68	3.85E+02	127.35	1.66E+03	0.84
	7	66.56	130 -	136	133.22	1.45E+02	117.69	1.47E+03	1.16
M	8	72.88	139 -	157	145.88	2.16E+02	54.46	1.44E+03	0.87
m	9	74.97	139 -	157	150.04	5.01E+02	67.59	1.36E+03	0.87
m	10	77.12	139 -	157	154.35	2.17E+02	54.68	1.28E+03	0.87
M	11	84.66	166 -	177	169.45	2.69E+02	64.69	1.54E+03	1.09
m	12	87.35	166 -	177	174.82	1.37E+02	56.69	1.49E+03	1.10
M	13	92.66	182 -	192	185.44	7.01E+02	71.97	1.53E+03	0.97
m	14	94.53	182 -	192	189.18	7.58E+01	42.70	1.35E+03	0.97
	15	143.44	283 -	290	287.04	1.58E+02	94.97	1.42E+03	1.54
	16	147.21	291 -	297	294.59	-2.64E+01	89.28	1.48E+03	0.50
	17	178.59	354 -	360	357.38	-1.76E+01	87.62	1.43E+03	0.79
	18	185.75	368 -	375	371.71	3.45E+02	103.67	1.60E+03	1.06
	19	191.06	378 -	385	382.32	7.35E+01	94.48	1.46E+03	0.61
	20	198.33	394 -	400	396.88	8.71E+00	86.15	1.35E+03	0.98
	21	209.54	415 -	422	419.31	3.78E+01	95.05	1.50E+03	1.23
	22	225.64	448 -	455	451.52	-1.94E+01	89.38	1.36E+03	0.55
M	23	238.57	473 -	488	477.39	2.11E+02	49.97	1.19E+03	0.87
m	24	242.00	473 -	488	484.25	9.55E+01	40.61	9.62E+02	0.87
	25	254.61	506 -	513	509.49	1.99E+01	85.51	1.22E+03	0.58
	26	294.88	586 -	593	590.06	1.41E+02	83.42	1.08E+03	0.84
	27	351.97	700 -	708	704.29	3.05E+02	82.96	8.94E+02	0.84
	28	475.02	946 -	954	950.52	5.82E+00	66.19	6.80E+02	0.53
	29	495.68	988 -	996	991.85	1.75E+01	64.00	6.28E+02	0.80
M	30	509.14	1014 -	1026	1018.79	4.80E+01	165.84	8.85E+02	1.66
m	31	510.87	1014 -	1026	1022.24	1.09E+03	194.77	1.13E+03	2.19
	32	558.41	1113 -	1121	1117.37	3.11E+01	63.61	6.11E+02	1.12
	33	569.66	1137 -	1144	1139.88	3.21E+01	55.68	4.96E+02	0.99
	34	583.02	1163 -	1171	1166.62	5.55E+01	60.41	5.32E+02	1.51
	35	602.17	1201 -	1209	1204.94	-1.19E+01	64.90	6.62E+02	1.25
	36	609.09	1214 -	1223	1218.78	1.42E+02	75.53	7.51E+02	1.13
	37	661.69	1319 -	1328	1324.04	7.21E+01	63.76	5.51E+02	0.78
	38	762.04	1522 -	1528	1524.84	-1.29E+01	42.84	3.43E+02	0.84
	39	780.95	1553 -	1565	1562.68	1.85E+01	62.91	4.61E+02	0.51
M	40	802.87	1601 -	1615	1606.55	7.89E+01	32.08	3.88E+02	2.04
m	41	805.96	1601 -	1615	1612.73	3.04E+01	24.90	3.03E+02	2.04
	42	849.71	1698 -	1704	1700.26	-2.00E+01	39.15	2.88E+02	0.79
	43	860.34	1719 -	1726	1721.53	2.20E+01	40.97	2.65E+02	0.96
	44	875.24	1749 -	1755	1751.35	5.57E+00	35.78	2.28E+02	0.99
M	45	880.51	1757 -	1774	1761.89	5.41E+01	25.71	2.90E+02	2.18
m	46	884.31	1757 -	1774	1769.51	7.27E+01	28.50	3.23E+02	2.18
	47	911.19	1819 -	1828	1823.29	5.62E+01	47.21	2.90E+02	1.42
	48	947.27	1893 -	1899	1895.49	-4.51E+00	31.48	2.36E+02	0.76
	49	961.93	1921 -	1929	1924.84	2.89E+01	37.55	2.63E+02	1.86
	50	968.39	1935 -	1942	1937.76	3.81E+01	34.95	2.33E+02	0.94
	51	1111.36	2220 -	2226	2223.86	-1.72E+01	29.70	2.14E+02	0.50
	52	1120.62	2237 -	2247	2242.38	5.09E+01	42.64	2.86E+02	0.78
	53	1138.58	2274 -	2283	2278.33	1.84E+01	36.13	2.34E+02	0.79
	54	1194.43	2387 -	2394	2390.08	1.61E+01	29.07	1.68E+02	0.78
	55	1238.30	2473 -	2483	2477.88	3.11E+01	40.68	2.74E+02	1.56
	56	1264.96	2527 -	2534	2531.23	1.34E+01	25.39	1.29E+02	2.05

Analysis Report for 5198W0012

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	57	1327.65	2652 -	2661	2656.67	2.15E+01	28.13	1.34E+02	1.13
	58	1377.40	2754 -	2760	2756.23	1.17E+01	22.57	1.06E+02	1.03
	59	1398.64	2796 -	2801	2798.75	-8.38E+00	20.99	1.18E+02	0.80
	60	1460.62	2918 -	2928	2922.77	4.34E+02	49.16	1.36E+02	1.70
	61	1485.27	2970 -	2975	2972.10	5.42E+00	18.05	7.17E+01	0.50
	62	1523.00	3045 -	3053	3047.60	0.00E+00	22.41	1.00E+02	0.92
	63	1554.65	3106 -	3115	3110.95	-9.72E+00	23.91	1.15E+02	0.75
	64	1593.91	3187 -	3192	3189.52	4.03E+00	17.66	6.85E+01	0.50
	65	1638.97	3277 -	3283	3279.70	-8.12E+00	18.22	8.06E+01	0.63
	66	1672.75	3345 -	3350	3347.30	6.75E+00	14.10	4.17E+01	0.50
M	67	1679.95	3355 -	3374	3361.71	-3.78E-01	10.54	2.78E+01	0.38
m	68	1684.73	3355 -	3374	3371.27	-1.03E+00	28.79	2.59E+01	0.38
	69	1711.97	3421 -	3430	3425.79	1.16E+01	21.84	7.91E+01	1.09
	70	1764.35	3525 -	3536	3530.62	6.19E+01	27.76	9.03E+01	0.85
	71	1785.11	3569 -	3575	3572.15	5.98E+00	14.40	4.32E+01	0.50
	72	1814.04	3628 -	3633	3630.05	3.71E+00	13.65	4.17E+01	0.50
M	73	1912.49	3826 -	3840	3827.08	-4.28E+00	14.96	2.15E+01	0.39
m	74	1916.69	3826 -	3840	3835.49	-4.19E+00	14.63	2.66E+01	0.39
	75	1991.75	3983 -	3989	3985.71	1.41E+01	14.04	3.31E+01	0.59
	76	2032.62	4064 -	4070	4067.50	7.83E+00	13.18	3.17E+01	1.30

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.960 sigma

PEAK EFFICIENCY REPORT

Peak Analysis Performed on : 5/13/2013 3:32:39PM

	Peak No.	Energy (keV)	Net Peak Area	Net Area Uncertainty	Peak Efficiency	Efficiency Uncertainty
	1	13.13	4.49E+02	279.37	7.10E-02	5.22E-03
	2	15.85	1.55E+03	223.56	6.37E-02	5.22E-03
	3	24.44	1.41E+02	137.42	6.42E-02	5.22E-03
	4	46.52	4.87E+02	141.79	7.95E-02	5.22E-03
	5	53.29	-7.42E+01	124.35	8.20E-02	5.22E-03
	6	63.29	3.85E+02	127.35	8.37E-02	5.40E-03
	7	66.56	1.45E+02	117.69	8.38E-02	5.56E-03
M	8	72.88	2.16E+02	54.46	8.37E-02	5.87E-03
m	9	74.97	5.01E+02	67.59	8.35E-02	5.97E-03
m	10	77.12	2.17E+02	54.68	8.33E-02	6.07E-03
M	11	84.66	2.69E+02	64.69	8.22E-02	6.44E-03
m	12	87.35	1.37E+02	56.69	8.17E-02	6.57E-03
M	13	92.66	7.01E+02	71.97	8.06E-02	6.50E-03
m	14	94.53	7.58E+01	42.70	8.01E-02	6.46E-03
	15	143.44	1.58E+02	94.97	6.65E-02	4.90E-03

Analysis Report for 5198W0012

	Peak No.	Energy (keV)	Net Peak Area	Net Area Uncertainty	Peak Efficiency	Efficiency Uncertainty
	16	147.21	-2.64E+01	89.28	6.55E-02	4.74E-03
	17	178.59	-1.76E+01	87.62	5.74E-02	3.81E-03
	18	185.75	3.45E+02	103.67	5.57E-02	3.74E-03
	19	191.06	7.35E+01	94.48	5.45E-02	3.69E-03
	20	198.33	8.71E+00	86.15	5.29E-02	3.62E-03
	21	209.54	3.78E+01	95.05	5.06E-02	3.51E-03
	22	225.64	-1.94E+01	89.38	4.75E-02	3.36E-03
M	23	238.57	2.11E+02	49.97	4.53E-02	3.24E-03
m	24	242.00	9.55E+01	40.61	4.47E-02	3.21E-03
	25	254.61	1.99E+01	85.51	4.27E-02	3.09E-03
	26	294.88	1.41E+02	83.42	3.73E-02	2.71E-03
	27	351.97	3.05E+02	82.96	3.15E-02	2.17E-03
	28	475.02	5.82E+00	66.19	2.34E-02	1.73E-03
	29	495.68	1.75E+01	64.00	2.25E-02	1.72E-03
M	30	509.14	4.80E+01	165.84	2.19E-02	1.71E-03
m	31	510.87	1.09E+03	194.77	2.18E-02	1.71E-03
	32	558.41	3.11E+01	63.61	2.00E-02	1.67E-03
	33	569.66	3.21E+01	55.68	1.96E-02	1.67E-03
	34	583.02	5.55E+01	60.41	1.92E-02	1.66E-03
	35	602.17	-1.19E+01	64.90	1.86E-02	1.64E-03
	36	609.09	1.42E+02	75.53	1.84E-02	1.64E-03
	37	661.69	7.21E+01	63.76	1.70E-02	1.60E-03
	38	762.04	-1.29E+01	42.84	1.48E-02	1.37E-03
	39	780.95	1.85E+01	62.91	1.45E-02	1.32E-03
M	40	802.87	7.89E+01	32.08	1.41E-02	1.27E-03
m	41	805.96	3.04E+01	24.90	1.41E-02	1.27E-03
	42	849.71	-2.00E+01	39.15	1.34E-02	1.17E-03
	43	860.34	2.20E+01	40.97	1.32E-02	1.14E-03
	44	875.24	5.57E+00	35.78	1.30E-02	1.11E-03
M	45	880.51	5.41E+01	25.71	1.29E-02	1.09E-03
m	46	884.31	7.27E+01	28.50	1.29E-02	1.09E-03
	47	911.19	5.62E+01	47.21	1.25E-02	1.04E-03
	48	947.27	-4.51E+00	31.48	1.21E-02	9.85E-04
	49	961.93	2.89E+01	37.55	1.19E-02	9.64E-04
	50	968.39	3.81E+01	34.95	1.18E-02	9.55E-04
	51	1111.36	-1.72E+01	29.70	1.04E-02	7.52E-04
	52	1120.62	5.09E+01	42.64	1.03E-02	7.39E-04
	53	1138.58	1.84E+01	36.13	1.02E-02	7.14E-04
	54	1194.43	1.61E+01	29.07	9.71E-03	6.93E-04
	55	1238.30	3.11E+01	40.68	9.38E-03	7.53E-04
	56	1264.96	1.34E+01	25.39	9.19E-03	7.89E-04
	57	1327.65	2.15E+01	28.13	8.76E-03	8.74E-04
	58	1377.40	1.17E+01	22.57	8.45E-03	8.39E-04
	59	1398.64	-8.38E+00	20.99	8.32E-03	8.19E-04
	60	1460.62	4.34E+02	49.16	7.96E-03	7.62E-04
	61	1485.27	5.42E+00	18.05	7.82E-03	7.39E-04
	62	1523.00	0.00E+00	22.41	7.62E-03	7.04E-04
	63	1554.65	-9.72E+00	23.91	7.46E-03	6.74E-04
	64	1593.91	4.03E+00	17.66	7.26E-03	6.38E-04
	65	1638.97	-8.12E+00	18.22	7.04E-03	5.96E-04
	66	1672.75	6.75E+00	14.10	6.89E-03	5.65E-04
M	67	1679.95	-3.78E-01	10.54	6.86E-03	5.58E-04
m	68	1684.73	-1.03E+00	28.79	6.83E-03	5.54E-04

Analysis Report for 5198W0012

	Peak No.	Energy (keV)	Net Peak Area	Net Area Uncertainty	Peak Efficiency	Efficiency Uncertainty
	69	1711.97	1.16E+01	21.84	6.71E-03	5.29E-04
	70	1764.35	6.19E+01	27.76	6.49E-03	4.80E-04
	71	1785.11	5.98E+00	14.40	6.40E-03	4.61E-04
	72	1814.04	3.71E+00	13.65	6.28E-03	4.34E-04
M	73	1912.49	-4.28E+00	14.96	5.90E-03	4.14E-04
m	74	1916.69	-4.19E+00	14.63	5.88E-03	4.14E-04
	75	1991.75	1.41E+01	14.04	5.61E-03	4.14E-04
	76	2032.62	7.83E+00	13.18	5.46E-03	4.14E-04

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.960 sigma

BACKGROUND SUBTRACT REPORT

Peak Analysis Performed on : 5/13/2013 3:32:39PM

Env. Background File : \\N12967\ApexRoot\ORAU\Data\0000018118.CNF

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	1	13.13	4.49E+02	279.37	4.94E+02	1.60E+02	-4.47E+01	3.22E+02
	2	15.85	1.55E+03	223.56	4.56E+02	1.59E+02	1.09E+03	2.74E+02
	3	24.44	1.41E+02	137.42			1.41E+02	1.37E+02
	4	46.52	4.87E+02	141.79	4.19E+02	8.24E+01	6.74E+01	1.64E+02
	5	53.29	-7.42E+01	124.35			-7.42E+01	1.24E+02
	6	63.29	3.85E+02	127.35	5.43E+02	8.42E+01	-1.58E+02	1.53E+02
	7	66.56	1.45E+02	117.69			1.45E+02	1.18E+02
M	8	72.88	2.16E+02	54.46	1.30E+02	8.48E+01	8.68E+01	1.01E+02
m	9	74.97	5.01E+02	67.59	3.55E+02	8.81E+01	1.46E+02	1.11E+02
m	10	77.12	2.17E+02	54.68			2.17E+02	5.47E+01
M	11	84.66	2.69E+02	64.69	2.28E+02	8.09E+01	4.18E+01	1.04E+02
m	12	87.35	1.37E+02	56.69			1.37E+02	5.67E+01
M	13	92.66	7.01E+02	71.97	6.28E+02	7.86E+01	7.28E+01	1.07E+02
m	14	94.53	7.58E+01	42.70			7.58E+01	4.27E+01
	15	143.44	1.58E+02	94.97			1.58E+02	9.50E+01
	16	147.21	-2.64E+01	89.28			-2.64E+01	8.93E+01
	17	178.59	-1.76E+01	87.62			-1.76E+01	8.76E+01
	18	185.75	3.45E+02	103.67	3.09E+02	6.64E+01	3.66E+01	1.23E+02
	19	191.06	7.35E+01	94.48			7.35E+01	9.45E+01
	20	198.33	8.71E+00	86.15			8.71E+00	8.62E+01
	21	209.54	3.78E+01	95.05			3.78E+01	9.51E+01
	22	225.64	-1.94E+01	89.38			-1.94E+01	8.94E+01
M	23	238.57	2.11E+02	49.97	2.40E+02	6.67E+01	-2.85E+01	8.33E+01
m	24	242.00	9.55E+01	40.61			9.55E+01	4.06E+01
	25	254.61	1.99E+01	85.51			1.99E+01	8.55E+01
	26	294.88	1.41E+02	83.42	1.41E+02	5.64E+01	7.38E-01	1.01E+02
	27	351.97	3.05E+02	82.96	1.67E+02	5.33E+01	1.38E+02	9.86E+01

Analysis Report for 5198W0012

	Peak No.	Energy (keV)	Original Area	Orig. Area Uncertainty	Ambient Background	Backgr. Uncert.	Subtracted Area	Subtracted Uncert.
	28	475.02	5.82E+00	66.19			5.82E+00	6.62E+01
	29	495.68	1.75E+01	64.00			1.75E+01	6.40E+01
M	30	509.14	4.80E+01	165.84			4.80E+01	1.66E+02
m	31	510.87	1.09E+03	194.77	6.61E+02	8.20E+01	4.31E+02	2.11E+02
	32	558.41	3.11E+01	63.61	7.78E+01	4.41E+01	-4.67E+01	7.74E+01
	33	569.66	3.21E+01	55.68			3.21E+01	5.57E+01
	34	583.02	5.55E+01	60.41	6.56E+01	3.96E+01	-1.01E+01	7.22E+01
	35	602.17	-1.19E+01	64.90			-1.19E+01	6.49E+01
	36	609.09	1.42E+02	75.53	1.08E+02	5.05E+01	3.42E+01	9.08E+01
	37	661.69	7.21E+01	63.76			7.21E+01	6.38E+01
	38	762.04	-1.29E+01	42.84			-1.29E+01	4.28E+01
	39	780.95	1.85E+01	62.91			1.85E+01	6.29E+01
M	40	802.87	7.89E+01	32.08	3.70E+01	3.46E+01	4.19E+01	4.72E+01
m	41	805.96	3.04E+01	24.90			3.04E+01	2.49E+01
	42	849.71	-2.00E+01	39.15			-2.00E+01	3.92E+01
	43	860.34	2.20E+01	40.97			2.20E+01	4.10E+01
	44	875.24	5.57E+00	35.78			5.57E+00	3.58E+01
M	45	880.51	5.41E+01	25.71			5.41E+01	2.57E+01
m	46	884.31	7.27E+01	28.50			7.27E+01	2.85E+01
	47	911.19	5.62E+01	47.21	4.08E+01	3.40E+01	1.54E+01	5.82E+01
	48	947.27	-4.51E+00	31.48			-4.51E+00	3.15E+01
	49	961.93	2.89E+01	37.55			2.89E+01	3.76E+01
	50	968.39	3.81E+01	34.95	2.95E+01	3.24E+01	8.65E+00	4.77E+01
	51	1111.36	-1.72E+01	29.70			-1.72E+01	2.97E+01
	52	1120.62	5.09E+01	42.64			5.09E+01	4.26E+01
	53	1138.58	1.84E+01	36.13			1.84E+01	3.61E+01
	54	1194.43	1.61E+01	29.07			1.61E+01	2.91E+01
	55	1238.30	3.11E+01	40.68			3.11E+01	4.07E+01
	56	1264.96	1.34E+01	25.39			1.34E+01	2.54E+01
	57	1327.65	2.15E+01	28.13			2.15E+01	2.81E+01
	58	1377.40	1.17E+01	22.57			1.17E+01	2.26E+01
	59	1398.64	-8.38E+00	20.99			-8.38E+00	2.10E+01
	60	1460.62	4.34E+02	49.16	3.24E+02	4.27E+01	1.10E+02	6.51E+01
	61	1485.27	5.42E+00	18.05			5.42E+00	1.80E+01
	62	1523.00	0.00E+00	22.41			0.00E+00	2.24E+01
	63	1554.65	-9.72E+00	23.91			-9.72E+00	2.39E+01
	64	1593.91	4.03E+00	17.66			4.03E+00	1.77E+01
	65	1638.97	-8.12E+00	18.22			-8.12E+00	1.82E+01
	66	1672.75	6.75E+00	14.10			6.75E+00	1.41E+01
M	67	1679.95	-3.78E-01	10.54			-3.78E-01	1.05E+01
m	68	1684.73	-1.03E+00	28.79			-1.03E+00	2.88E+01
	69	1711.97	1.16E+01	21.84			1.16E+01	2.18E+01
	70	1764.35	6.19E+01	27.76	6.80E+01	2.01E+01	-6.10E+00	3.43E+01
	71	1785.11	5.98E+00	14.40			5.98E+00	1.44E+01
	72	1814.04	3.71E+00	13.65			3.71E+00	1.36E+01
M	73	1912.49	-4.28E+00	14.96			-4.28E+00	1.50E+01
m	74	1916.69	-4.19E+00	14.63			-4.19E+00	1.46E+01
	75	1991.75	1.41E+01	14.04			1.41E+01	1.40E+01
	76	2032.62	7.83E+00	13.18			7.83E+00	1.32E+01

Analysis Report for 5198W0012

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.960 sigma

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : \\N12967\ApexRoot\ORAU\Library\MAIN.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/L)	Activity Uncertainty
K40	0.997	1460.81	*	10.67	2.03E+02	1.22E+02
SB124	0.980	602.71	*	97.87	-1.08E+00	5.89E+00
CS137	1.000	661.65	*	85.12	7.81E+00	6.94E+00
TL208	0.877	277.35		2.44		
		510.84	*	7.76	3.98E+02	1.98E+02
		583.14	*	30.25	-2.72E+00	1.95E+01
		860.37	*	4.48	5.80E+01	1.08E+02
PB210	1.000	46.50	*	4.05	3.27E+01	7.97E+01
PB212	1.000	238.63	*	44.60	-2.21E+00	6.46E+00
BI214	0.996	609.31	*	46.30	6.29E+00	1.67E+01
		1120.29	*	15.10	5.11E+01	4.31E+01
		1764.50	*	15.80	-9.30E+00	5.23E+01
PB214	0.998	241.98	*	7.49	4.46E+01	1.92E+01
		295.21	*	19.20	1.61E-01	2.20E+01
		351.92	*	37.20	1.85E+01	1.32E+01
RA224	0.929	240.98	*	3.95	8.46E+01	3.65E+01
AC228	0.573	93.35	*	3.50	4.04E+01	5.92E+01
		338.32		11.40		
		911.07	*	27.70	6.91E+00	2.62E+01
		969.11	*	16.60	6.88E+00	3.80E+01
TH230	0.916	67.67	*	0.37	7.23E+02	5.91E+02
TH234	1.000	63.29	*	3.80	-7.79E+01	7.52E+01
		92.59	*	5.41	2.61E+01	3.83E+01
U235	0.895	143.76	*	10.90	3.40E+01	2.06E+01
		185.71	*	57.50	1.79E+00	6.02E+00
		205.31		5.00		

* = Energy line found in the spectrum.
- = Manually added nuclide.
? = Manually edited nuclide.
Energy Tolerance : 1.500 keV
Nuclide confidence index threshold = 0.50
Errors quoted at 1.960 sigma

Analysis Report for 5198W0012

UNIDENTIFIED PEAKS

Peak Locate Performed on : 5/13/2013 3:32:39PM
Peak Locate From Channel : 1
Peak Locate To Channel : 4096

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	1	13.13	-7.75354E-04	- 368.0		
	2	15.85	1.89637E-02	12.80		
	3	24.44	2.44887E-03	49.71		
	5	53.29	-1.28799E-03	- 85.5		
M	8	72.88	1.50651E-03	59.23		
m	9	74.97	2.52746E-03	38.92		
m	10	77.12	3.77145E-03	12.84		
M	11	84.66	7.25155E-04	126.57		
m	12	87.35	2.37190E-03	21.17		
m	14	94.53	1.31533E-03	28.76		
	16	147.21	-4.59132E-04	- 172.2		
	17	178.59	-3.04822E-04	- 254.6		
	19	191.06	1.27554E-03	65.61		
	20	198.33	1.51171E-04	504.80		
	21	209.54	6.56268E-04	128.30		
	22	225.64	-3.36297E-04	- 235.4		
	25	254.61	3.45521E-04	219.21		
	28	475.02	1.00995E-04	580.53		
	29	495.68	3.04462E-04	186.19		
M	30	509.14	8.34081E-04	176.12		
	32	558.41	-8.11269E-04	- 84.5		
	33	569.66	5.58023E-04	88.38		
	38	762.04	-2.23444E-04	- 169.8		
	39	780.95	3.22001E-04	173.05		
M	40	802.87	7.27633E-04	57.47		
m	41	805.96	5.27826E-04	41.79		
	42	849.71	-3.47769E-04	- 99.7		
	44	875.24	9.66246E-05	328.01		
M	45	880.51	9.40035E-04	24.23		
m	46	884.31	1.26149E-03	20.01		
	48	947.27	-7.83246E-05	- 355.9		
	49	961.93	5.01129E-04	66.38		
	51	1111.36	-2.97907E-04	- 88.3		
	53	1138.58	3.19629E-04	100.12		
	54	1194.43	2.79310E-04	92.18		
	55	1238.30	5.39548E-04	66.78		
	56	1264.96	2.32507E-04	96.71		
	57	1327.65	3.72685E-04	66.86		
	58	1377.40	2.02546E-04	98.68		
	59	1398.64	-1.45566E-04	- 127.7		
	61	1485.27	9.41082E-05	169.85		
	62	1523.00	0.00000E+00	0.00		
	63	1554.65	-1.68769E-04	- 125.4		
	64	1593.91	6.98896E-05	223.81		
	65	1638.97	-1.40993E-04	- 114.4		

Analysis Report for 5198W0012

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
	66	1672.75	1.17187E-04	106.54		
M	67	1679.95	-6.56099E-06	-1423.3		
m	68	1684.73	-1.79226E-05	-1422.8		
	69	1711.97	2.02101E-04	95.74		
	71	1785.11	1.03753E-04	122.95		
	72	1814.04	6.43519E-05	187.84		
M	73	1912.49	-7.43781E-05	- 178.1		
m	74	1916.69	-7.27345E-05	- 178.1		
	75	1991.75	2.44736E-04	50.80		
	76	2032.62	1.35995E-04	85.82		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.960 sigma

NUCLIDE MDA REPORT

Nuclide Library Used : \\N12967\ApexRoot\ORAU\Library\MAIN.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/L)	Nuclide MDA (pCi/L)	Line MDA (pCi/L)
	BE7	477.59		10.42	-1.52E+01	8.46E+01	8.46E+01
	NA22	1274.54		99.94	-1.62E+00	1.26E+01	1.26E+01
+	K40	1460.81	*	10.67	2.03E+02	2.75E+02	2.75E+02
	MN54	834.83		99.98	0.00E+00	1.18E+01	1.18E+01
	CO57	122.06		85.51	-1.76E+00	4.49E+00	4.49E+00
		136.48		10.60	-6.93E+00		3.98E+01
	CO58	810.76		99.40	-2.24E-01	1.17E+01	1.17E+01
	FE59	1099.22		56.50	-7.94E-01	2.26E+01	2.26E+01
		1291.56		43.20	-1.29E+00		3.13E+01
	CO60	1173.22		100.00	2.11E-01	1.20E+01	1.25E+01
		1332.49		100.00	3.26E+00		1.20E+01
	ZN65	1115.51		50.70	-7.68E-01	2.67E+01	2.67E+01
	KR85	514.00		0.43	-1.76E+03	2.61E+03	2.61E+03
	NB94	702.62		100.00	8.57E+00	1.14E+01	1.22E+01
		871.10		100.00	-1.79E+00		1.14E+01
	ZR95	724.18		43.70	-1.26E+01	2.05E+01	2.58E+01
		756.72		55.30	-1.36E+00		2.05E+01
	AG108M	433.93		90.50	-5.13E-01	8.98E+00	8.98E+00
		614.37		90.40	-4.45E+00		1.11E+01
		722.95		90.80	-2.14E+00		1.18E+01
	AG110M	657.75		94.40	-2.98E+00	1.16E+01	1.16E+01
		884.67		72.60	2.43E+00		1.69E+01
		937.23		34.20	-6.95E+00		3.45E+01
+	SB124	602.71	*	97.87	-1.08E+00	1.43E+01	1.43E+01
	I125	35.49		6.49	-5.37E-02	7.33E+01	7.33E+01
	SB125	427.89		29.33	1.40E+01	2.76E+01	2.76E+01

Analysis Report for 5198W0012

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/L)	Nuclide MDA (pCi/L)	Line MDA (pCi/L)
	SB125	463.38		10.35	-4.71E+00	2.76E+01	7.98E+01
		600.56		17.80	1.09E+01		6.05E+01
		635.90		11.32	9.32E+00		9.39E+01
	I129	29.61		57.00	-2.62E+00	9.09E+00	9.09E+00
		33.60		13.20	8.61E+00		3.60E+01
		39.58		7.52	-1.10E+01		5.47E+01
	BA133	81.00		33.00	1.11E+00	1.09E+01	1.09E+01
		302.84		17.80	-9.64E+00		3.94E+01
		356.01		60.00	1.14E+00		1.23E+01
	CS134	569.31		15.43	1.24E-01	1.04E+01	6.32E+01
		604.70		97.60	1.74E+00		1.04E+01
		795.84		85.40	4.62E+00		1.36E+01
+	CS137	661.65	*	85.12	7.81E+00	1.61E+01	1.61E+01
	CE144	133.54		10.80	-1.06E+00	3.84E+01	3.84E+01
	EU152	121.78		28.40	-5.25E+00	1.33E+01	1.33E+01
		344.27		26.50	-6.31E+00		2.80E+01
		778.89		12.74	3.87E+01		8.57E+01
		1407.95		20.70	4.22E+00		6.70E+01
	EU154	123.07		40.50	3.13E+00	9.58E+00	9.58E+00
		723.30		19.70	-9.90E+00		5.44E+01
		873.19		11.50	2.76E+01		1.03E+02
		1004.76		17.90	-1.33E+01		6.32E+01
		1274.45		35.50	-4.55E+00		3.53E+01
	EU155	86.54		30.90	-2.15E+00	1.32E+01	1.32E+01
		105.31		20.70	6.56E-01		1.78E+01
+	TL208	277.35		2.44	7.95E+01	4.72E+01	2.78E+02
		510.84	*	7.76	3.98E+02		2.59E+02
		583.14	*	30.25	-2.72E+00		4.72E+01
		860.37	*	4.48	5.80E+01		2.58E+02
+	PB210	46.50	*	4.05	3.27E+01	1.90E+02	1.90E+02
	PB211	404.84		2.90	3.42E+01	2.65E+02	2.65E+02
		831.96		2.90	5.91E+00		3.94E+02
	BI212	727.17		7.56	2.98E+01	1.47E+02	1.47E+02
		785.46		1.26	2.95E+02		9.07E+02
		1620.62		1.76	2.20E+02		8.02E+02
+	PB212	238.63	*	44.60	-2.21E+00	1.86E+01	1.86E+01
+	BI214	609.31	*	46.30	6.29E+00	3.98E+01	3.98E+01
		1120.29	*	15.10	5.11E+01		9.89E+01
		1764.50	*	15.80	-9.30E+00		1.30E+02
+	PB214	241.98	*	7.49	4.46E+01	3.08E+01	6.94E+01
		295.21	*	19.20	1.61E-01		5.28E+01
		351.92	*	37.20	1.85E+01		3.08E+01
	RA223	94.90		11.20	-1.05E+02	3.34E+01	3.34E+01
		144.24		3.24	-3.30E+00		1.33E+02
		269.46		13.60	-1.19E+01		4.85E+01
		323.87		3.88	1.51E+01		1.86E+02
		338.28		2.73	5.66E+01		2.78E+02
+	RA224	240.98	*	3.95	8.46E+01	1.32E+02	1.32E+02
	RA226	186.21	*	3.59	2.86E+01	2.30E+02	2.30E+02
	TH227	50.10		8.40	3.22E+00	4.27E+01	4.27E+01
		236.05		11.50	1.80E+01		5.69E+01
		256.20		6.30	-6.27E-01		1.05E+02

Analysis Report for 5198W0012

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/L)	Nuclide MDA (pCi/L)	Line MDA (pCi/L)
+	AC228	93.35	*	3.50	4.04E+01	6.30E+01	1.61E+02
		338.32		11.40	1.36E+01		6.66E+01
		911.07	*	27.70	6.91E+00		6.30E+01
		969.11	*	16.60	6.88E+00		9.17E+01
	TH229	85.43		15.00	3.21E+00	1.55E+01	2.78E+01
		88.47		24.70	-2.98E+00		1.55E+01
		100.00		11.30	2.72E+00		3.14E+01
		217.99		10.90	3.66E+00		5.57E+01
+	TH230	67.67	*	0.37	7.23E+02	1.38E+03	1.38E+03
	PA231	283.67		1.60	4.61E+00	3.05E+02	4.11E+02
		300.08		2.30	9.07E+01		3.11E+02
		302.67		2.30	-7.45E+01		3.05E+02
	PA233	300.12		6.60	-1.09E+01	1.83E+01	1.07E+02
		311.98		38.60	1.61E+00		1.83E+01
		340.50		4.50	4.82E+01		1.67E+02
	PA234	1001.03		0.92	3.58E+02	1.34E+03	1.34E+03
+	TH234	63.29	*	3.80	-7.79E+01	1.04E+02	1.82E+02
		92.59	*	5.41	2.61E+01		1.04E+02
+	U235	143.76	*	10.90	3.40E+01	1.44E+01	4.76E+01
		185.71	*	57.50	1.79E+00		1.44E+01
		205.31		5.00	2.68E+01		1.09E+02
	NP239	106.12		22.90	1.46E+00	1.61E+01	1.61E+01
		228.18		10.80	3.00E+00		5.62E+01
		277.60		14.20	1.37E+01		4.79E+01
	AM241	59.54		35.90	-5.44E-01	9.80E+00	9.80E+00
	CM243	228.18		10.60	3.05E+00	4.86E+01	5.72E+01
		277.60		14.00	1.39E+01		4.86E+01
	CM245	133.00		6.30	5.01E-01	6.51E+01	6.51E+01
		174.00		6.40	1.45E+00		7.71E+01
	CM247	402.60		72.00	-2.47E+00	1.05E+01	1.05E+01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction