ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

November 1, 2004

Mr. Mike McCann
U.S. Nuclear Regulatory Commission
Region III
801 Warrenville Road
Lisle, IL 60532-4351

SUBJECT: ANALYTICAL RESULTS FOR SOIL SAMPLES COLLECTED SEPTEMBER 29 AND 30, 2004 FROM THE MINNESOTA MINING AND MANUFACTURING COMPANY, TWIN CITIES ARMY AMMUNITION PLANT (TCAAP), RAMSEY COUNTY, MINNESOTA [INSPECTION REPORT 040-07982/004-002](RFTA NO. 05-001)

Dear Mr. McCann:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) received five soil samples on October 4, 2004 that were collected at TCAAP. The samples were analyzed by gamma spectroscopy (GS) (Procedure CP1, Revision14). After discussing the preliminary GS results on October 7, 2004, you requested that the laboratory staff determine if the cesium-137 (Cs-137) activity in samples #1 and #13 (S0001 and S0004) was uniformly distributed throughout each sample or the activity of the Cs-137 was a result of Cs-137 microspheres present in those two samples. The results of the initial GS are presented in Table 1. At your request on October 21, 2004, uranium-235 (U-235) and uranium-238 (U-238) concentrations were added to the data tables. A case narrative discussing the effort to isolate Cs-137 microspheres and to include the appropriate U-235 and U-238 concentrations is enclosed with this letter report. The GS results from the individual aliquots of samples S0001 and S004 are presented in Tables 2 and 3, respectively.

ESSAP's Quality Control (QC) requirements were met for these analyses. The QC files are available for your review upon request.

If you have any questions, please call me at (865) 241-3242 or Wade Ivey at (865) 576-9184.

Sincerely,

Dale Condra

Dale Condra
Laboratory Manager
Environmental Survey and
Site Assessment Program

RDC:WPI:ar

Enclosures

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Distribution approval and concurrence:	**Initials**	**Date**
Technical Management Team Member	GQB	11/1/04
Quality Manager	CTP	11/1/04

CASE NARRATIVE

This case narrative addresses the process used to determine the nature of the cesium-137 (Cs-137) contamination in samples #1 (S0001) and #13 (S0004) and the process used to include the appropriate concentrations of uranium-235 (U-235) and uranium-238 (U-238) in Tables 1, 2, and 3.

The initial (Cs-137) gamma spectroscopy (GS) results for samples #1 (S0001) and #13 (S0004) were approximately 770 pCi/g and 170 pCi/g, respectively. To determine if the contamination was uniform throughout the sample or due to Cs-137 microspheres, sample #1 (S0001) was surveyed with a beta/gamma detector while still in the 0.5 L Marinelli beaker. This survey indicated that the contamination was not uniform. A similar survey of sample #13 (S0004) did not indicate the presence of isolated contamination.

To further isolate the contamination in sample #1 (S0001), the sample was removed from the Marinelli beaker and spread evenly on a tray. Using the same beta/gamma detector, a microsphere of Cs-137 was isolated and removed from the sample. The remaining sample material, which accounted for over 99.9% of the total weight, was put back into the 0.5 L Marinelli beaker and returned to the counting room for reanalysis. The Cs-137 concentration from the reanalysis was 11.7 pCi/g.

After discussing this result with Mike McCann on October 12, 2004, the decision was made to split sample #1 (S0001) into portions that could be contained in the smallest calibrated counting geometry. Four aliquots of approximately 200 grams each were created and counted. The Cs-137 concentrations from the four counts were 11.92, 11.21, 11.73, and 10.43 pCi/g, respectively. The results of these measurements indicate a uniform distribution of the Cs-137 contamination in S0001 after removal of the cesium microsphere.

Because the beta/gamma survey of sample #13 (S0004) did not indicate the presence of isolated Cs-137 contamination, the entire sample was split into eight equal aliquots of approximately 200 grams each. The Cs-137 concentrations from the eight aliquots ranged from a low of 166.8 pCi/g to a high of 204.6 pCi/g. A comparison of the concentrations shows that six of the eight results are statistical at the 95% confidence level. The results from the beta/gamma survey and the gamma counts seem to indicate an absence of microspheres in this sample. The conclusion from these measurements is that sample S0004 has a reasonably uniform distribution of the Cs-137 contamination.

On October 21, 2004, Mike McCann requested that the concentrations of U-235 and U-238 be added to the report. After reviewing the data from the initial GS counts, the decision was made to report the U-235 and U-238 concentrations for samples #27 (S0002), #30 (S0003), and #45 (S0005) in Table 1. These concentrations from the initial GS counts were unaffected (i.e. Compton Effect) due to the absence of any appreciable Cs-137 contamination in any of the samples. The U-235 and U-238 concentrations from the initial GS counts for samples #1 (S0001) and #13 (S0004) could not be reported due to the interference from the Compton Effect in the spectra caused by the high Cs-137 contamination. The decision was made to report the U-235 and U-238 concentrations from the GS counts of each of the aliquots created when the samples were divided. The U-235 and U-238 concentrations from sample #1 (S0001) aliquots are in Table 2 and concentrations from #13 (S0004) aliquots are in Table 3. The minimum detectable concentrations (MDC) for #13 (S0004) reported in Table 3 are all higher values than one would normally expect. These higher MDC values are directly related to the Cs-137 contamination in this sample.

ORISE TABLE 1

CESIUM-137 (Cs-137) AND URANIUM-235,-238 (U-235,U-238) CONCENTRATIONS IN SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 14 MINNESOTA MINING AND MANUFACTURING TWIN CITIES ARMY AMMUNITION PLANT RAMSEY COUNTY, MINNESOTA

ESSAP Sample ID	NRC Region III Sample ID	Radionuclide Concentrations [a,b] (pCi/g dry weight)		
		Cs-137	U-235	U-238 by Th-234
1630S0001	#1	767 ± 34[c]	[d]	[d]
1630S0002	#27	0.46 ± 0.04	0.04 ± 0.05	0.59 ± 0.39
1630S0003	#30	0.97 ± 0.07	0.09 ± 0.08	1.02 ± 0.59
1630S0004	#13	171.4 ± 7.7	[e]	[e]
1630S0005	#45	0.14 ± 0.04	0.04 ± 0.03	0.33 ± 0.39

[a]The MDC for a one-hour count of soil in a 0.5L Marinelli for Cs-137 ranged from a low of 0.02 pCi/g to a high of 0.63 pCi/g.

[b]The average MDC for a one-hour count of soil in a 0.5L Marinelli for U-235 is 0.12 pCi/g and U-238 is 0.44 pCi/g.

[c]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[d]See Table 2 for U-235 and U-238 concentrations, uncertainties, and MDCs for the four aliquots of sample 1630S0001.

[e]See Table 3 for U-235 and U-238 concentrations, uncertainties, and MDCs for the eight aliquots of sample 1630S0004.

ORISE TABLE 2

CESIUM-137 (Cs-137) AND URANIUM-235,-238 (U235,U238) CONCENTRATIONS IN ALIQUOTS OF SAMPLE S0001 BY GAMMA SPECTROSCOPY CP1, REVISION 14 MINNESOTA MINING AND MANUFACTURING TWIN CITIES ARMY AMMUNITION PLANT RAMSEY COUNTY, MINNESOTA

ESSAP Sample ID	NRC Region III Sample ID	Radionuclide Concentrations[a] (pCi/g dry weight)		
		Cs-137	U-235	U-238 by Th-234
1630S0001A	#1	11.92 ± 0.66[b]	0.03 ± 0.22	0.44 ± 0.97
1630S0001B	#1	11.21 ± 0.59	0.10 ± 0.19	0.19 ± 0.58
1630S0001C	#1	11.73 ± 0.65	-0.02 ± 0.24	1.2 ± 1.2
1630S0001D	#1	10.43 ± 0.55	0.04 ± 0.19	0.52 ± 0.79

[a]The average MDC for a one-hour count of the four soil splits in a Hockey Puck Full geometry for Cs-137 is 0.08 pCi/g, U-235 is 0.36 pCi/g, and U-238 by Th-234 is 1.0 pCi/g.

[b]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

ORISE TABLE 3

CESIUM-137 (Cs-137) AND URANIUM-235,-238 (U235,U238) CONCENTRATIONS IN ALIQUOTS OF SAMPLE S0004 BY GAMMA SPECTROSCOPY CP1, REVISION 14 MINNESOTA MINING AND MANUFACTURING TWIN CITIES ARMY AMMUNITION PLANT RAMSEY COUNTY, MINNESOTA

ESSAP Sample ID	NRC Region III Sample ID	Radionuclide Concentrations[a] (pCi/g dry weight)		
		Cs-137	U-235	U-238 by Th-234
1630S0004A	#13	200.3 ± 9.5[b]	-0.35 ± 0.72	1.3 ± 2.3
1630S0004B	#13	187.1 ± 8.6	-0.24 ± 0.59	0.5 ± 1.6
1630S0004C	#13	166.8 ± 7.9	-0.26 ± 0.64	1.0 ± 1.9
1630S0004D	#13	203.6 ± 9.3	0.46 ± 0.63	0.8 ± 1.7
1630S0004E	#13	204.6 ± 9.7	0.07 ± 0.71	1.5 ± 2.0
1630S0004F	#13	186.4 ± 8.8	-0.14 ± 0.70	2.3 ± 2.3
1630S0004G	#13	186.6 ± 8.5	0.08 ± 0.59	1.9 ± 1.8
1630S0004H	#13	170.0 ± 8.0	0.07 ± 0.65	1.1 ± 2.3

[a]The average MDC for a one-hour count of the eight soil splits in a Hockey Puck Full geometry for Cs-137 is 0.19 pCi/g, U-235 is 1.1 pCi/g, and U-238 by Th-234 is 2.8 pCi/g.

[b]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

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