

November 22, 2010

Mr. Gene Bonano
U.S. Nuclear Regulatory Commission
Region III
2443 Warrenville Road
Lisle, IL 60532-4351

**SUBJECT: ORISE CONTRACT NO. DE-AC05-06OR23100
LETTER REPORT FOR ANALYTICAL RESULTS FOR ELEVEN SOIL SAMPLES
FROM BRECKENRIDGE, MICHIGAN
[INSPECTION REPORT NOS. 04006264/2010001]
(RFTA NO. 11-001), DCN: 2030-LR-01-0**

Dear Mr. Bonano:


The Oak Ridge Institute for Science and Education (ORISE) received eleven soil samples on November 4, 2010 from Breckenridge, Michigan. The samples were analyzed according to the 303 form supplied with the samples including an "urgent" priority. The suspected contaminants of interest (COI) were natural thorium (Th) and uranium (U). During a phone call on November 5, 2010, you requested that radium-226 be added to the COI. Preliminary data was sent to NRC Region III staff on November 8, 2010. After submission of the preliminary data, ORISE staff continued to review the gamma data and noticed that Th-230 was identified in several of the samples. After discussing the gamma spectroscopy (gamma spec) data with NRC Region III staff, it was determined that 5 of the samples should be analyzed, priority "urgent", for thorium and uranium isotopes using alpha spectroscopy (alpha spec) to verify the results of the gamma spec analyses. The preliminary alpha spec results were discussed with the NRC Region III staff during a teleconference on November 12, 2010. The sample identification numbers are presented in Table 1. The gamma spec data are in Table 2. The thorium alpha spec data are in Table 3. The uranium alpha spec data are in Table 4. The pertinent procedure references are included with the data tables.

A case narrative discussing the discrepancy between the Th-232 gamma spec and Th-232 alpha spec data for sample B-10-1-10 is included in this report. ORISE will investigate this discrepancy and report the findings of the investigation to you in a separate letter report.

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

My contact information is listed below. You may also contact Wade Ivey at 865.576.9184 with any questions or comments.

Sincerely,


Dale Condra, Manager
Laboratory

RDC:WPL:jc
Enclosures

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CASE NARRATIVE FOR ELEVEN SOIL SAMPLES FROM BRECKENRIDGE, MI
DCN 2030-LR-01-0
SAMPLE B-10-1-10

Sample B-10-1-10 was analyzed by gamma spectroscopy and alpha spectroscopy. The results of the different analyses were compared for the different isotopes of interest. While the results of these two analyses are not always in statistical agreement, the ratios of different isotopes of the same element analyzed by both gamma spec and alpha spec tend to be in agreement. In the case of this sample, the gamma spec concentrations of Th-232 and Th-228 were 31.6 ± 3.5 pCi/g and 26.3 ± 2.0 pCi/g, respectively. The concentrations are statistically the same. The alpha spec concentrations of Th-232 and Th-228 were 60 ± 12 pCi/g and 35.0 ± 8.9 pCi/g, respectively. The Th-228 concentrations from both analyses are in agreement, but the Th-232 concentrations from both analyses do not agree. Also, the ratios of Th-232 to Th-228 for the different analyses are not in agreement. These isotopes of thorium are in the same decay change and therefore should be a one-to-one ratio of the two isotopes in an unprocessed sample.

At present, ORISE does not have an answer to this discrepancy, but will begin an investigation into this problem. The results of the investigation will be reported to the NRC Region III staff.

TABLE 1

SAMPLE IDENTIFICATIONS
AND COLLECTION INFORMATION
BRECKENRIDGE SITE
BRECKENRIDGE, MICHIGAN

ORISE Sample ID	NRC Region III Sample ID	Collection Date	Collection Time
2030S0001	B-10-1-01	11/3/10	14:10
2030S0002	B-10-1-02	11/3/10	14:15
2030S0003	B-10-1-03	11/2/10	16:20
2030S0004	B-10-1-04	11/2/10	16:30
2030S0005	B-10-1-05	11/2/10	16:35
2030S0006	B-10-1-06	11/2/10	16:37
2030S0007	B-10-1-07	11/2/10	16:45
2030S0008	B-10-1-08	11/3/10	10:30
2030S0009	B-10-1-09	11/3/10	10:50
2030S0010	B-10-1-10	11/3/10	11:07
2030S0011	B-10-1-11	11/3/10	11:25

TABLE 2

CONCENTRATIONS OF SELECTED GAMMA EMITTING RADIONUCLIDES
IN SOIL SAMPLES
BY GAMMA SPECTROSCOPY CP1, REVISION 17
BRECKENRIDGE SITE
BRECKENRIDGE, MICHIGAN

ORISE Sample ID	NRC Region III Sample ID	Radionuclide Concentrations, TPU's, and MDCs ^a (pCi/g)			
		Th-228 by Pb-212	Th-232 by Ac-228	Total Th ^b	Th-230
2030S0001	B-10-1-01	0.38 ± 0.04 ^c , 0.05	0.51 ± 0.09 , 0.09	0.89 ± 0.10	0.8 ± 3.6 , 6.9
2030S0002	B-10-1-02	0.38 ± 0.04 , 0.06	0.47 ± 0.09 , 0.10	0.85 ± 0.10	-9.4 ^d ± 6.3 , 10.0
2030S0003	B-10-1-03	0.74 ± 0.06 , 0.05	0.78 ± 0.12 , 0.09	1.52 ± 0.13	3.5 ± 2.0 , 5.2
2030S0004	B-10-1-04	0.82 ± 0.08 , 0.08	1.00 ± 0.14 , 0.13	1.82 ± 0.16	5.7 ± 6.5 , 11.0
2030S0005	B-10-1-05	0.94 ± 0.09 , 0.07	1.11 ± 0.17 , 0.13	2.05 ± 0.19	-2.6 ± 7.8 , 14.0
2030S0006	B-10-1-06	4.59 ± 0.34 , 0.11	5.75 ± 0.70 , 0.14	10.34 ± 0.78	54.9 ± 5.7 , 12.0
2030S0007	B-10-1-07	2.14 ± 0.18 , 0.11	2.56 ± 0.29 , 0.16	4.70 ± 0.34	20 ± 10 , 17
2030S0008	B-10-1-08	0.61 ± 0.06 , 0.07	0.78 ± 0.13 , 0.16	1.39 ± 0.14	-10.6 ± 7.4 , 12.0
2030S0009	B-10-1-09	4.81 ± 0.35 , 0.15	6.05 ± 0.67 , 0.20	10.86 ± 0.76	60.7 ± 6.8 , 15.0
2030S0010	B-10-1-10	26.3 ± 2.0 , 0.3	31.6 ± 3.5 , 0.4	57.9 ± 4.0	439 ± 32 , 27
2030S0011	B-10-1-11	0.57 ± 0.06 , 0.05	0.65 ± 0.11 , 0.13	1.22 ± 0.13	-1.4 ± 4.7 , 7.4

TABLE 2 (CONTINUED)

CONCENTRATIONS OF SELECTED GAMMA EMITTING RADIONUCLIDES
IN SOIL SAMPLES
BY GAMMA SPECTROSCOPY CP1, REVISION 17

BRECKENRIDGE, MICHIGAN

ORISE Sample ID	NRC Region III Sample ID	Radionuclide Concentrations, TPU's, and MDCs ^a (pCi/g)			
		U-238 by Th-234	U-235	Total U ^c	Ra-226 by Pb-214
2030S0001	B-10-1-01	0.66 ± 0.24 , 0.48	0.00 ^f ± 0.09 , 0.18	1.32 ± 0.49	0.32 ± 0.04 , 0.06
2030S0002	B-10-1-02	0.77 ± 0.27 , 0.82	0.12 ± 0.16 , 0.27	1.66 ± 0.56	0.38 ± 0.05 , 0.07
2030S0003	B-10-1-03	0.96 ± 0.21 , 0.51	0.04 ± 0.14 , 0.23	1.96 ± 0.44	0.49 ± 0.05 , 0.05
2030S0004	B-10-1-04	2.1 ± 1.2 , 0.9	0.54 ± 0.09 , 0.22	4.70 ± 2.40	1.05 ± 0.09 , 0.06
2030S0005	B-10-1-05	1.15 ± 0.33 , 1.00	-0.06 ± 0.22 , 0.33	2.24 ± 0.70	0.53 ± 0.06 , 0.07
2030S0006	B-10-1-06	6.62 ± 0.62 , 1.10	0.66 ± 0.11 , 0.29	13.9 ± 1.2	0.73 ± 0.06 , 0.08
2030S0007	B-10-1-07	7.3 ± 1.1 , 1.9	1.42 ± 0.16 , 0.26	16.0 ± 2.2	1.37 ± 0.12 , 0.12
2030S0008	B-10-1-08	0.69 ± 0.32 , 0.98	0.03 ± 0.21 , 0.33	1.41 ± 0.67	0.48 ± 0.06 , 0.07
2030S0009	B-10-1-09	5.70 ± 0.65 , 1.40	0.78 ± 0.12 , 0.33	12.2 ± 1.3	1.11 ± 0.09 , 0.10
2030S0010	B-10-1-10	17.3 ± 1.6 , 2.8	2.47 ± 0.29 , 0.72	37.1 ± 3.2	2.01 ± 0.16 , 0.24
2030S0011	B-10-1-11	0.74 ± 0.20 , 0.66	0.00 ± 0.11 , 0.20	1.48 ± 0.41	0.45 ± 0.05 , 0.06

^aThe MDCs appear after the commas.
^bTotal Th is the sum of Th-228 + Th-232.
^cUncertainties represent the 95% confidence level, based on total propagated uncertainties.
^dStatistically negative concentrations are due to the force fit routine in Canberra's Apex Gamma Software.
^eTotal U is calculated by (U-238*2) + U-235.
^fZero values are due to rounding or sample and background counts being equal.

TABLE 3

CONCENTRATIONS OF THORIUM RADIONUCLIDES
IN SOIL SAMPLES
BY ALPHA SPECTROSCOPY AP11, REVISION 5; CP2, REVISION 15
BRECKENRIDGE SITE
BRECKENRIDGE, MICHIGAN

ORISE Sample ID	NRC Region III Sample ID	Radionuclide Concentrations, TPU's, and MDCs ^a (pCi/g)			
		Th-228	Th-230	Th-232	Total Th ^b
2030S0004	B-10-1-04	0.94 ± 0.12 ^c , 0.05	3.75 ± 0.34 , 0.03	0.86 ± 0.11 , 0.01	1.80 ± 0.16
2030S0006	B-10-1-06	5.39 ± 0.86 , 0.23	49.8 ± 5.1 , 0.1	5.54 ± 0.87 , 0.07	10.9 ± 1.2
2030S0007	B-10-1-07	2.80 ± 0.44 , 0.14	22.6 ± 2.3 , 0.1	2.85 ± 0.44 , 0.07	5.65 ± 0.62
2030S0009	B-10-1-09	7.2 ± 1.1 , 0.3	71.8 ± 7.3 , 0.2	7.5 ± 1.1 , 0.1	14.7 ± 1.5
2030S0010	B-10-1-10	35.0 ± 8.9 , 5.3	592 ± 72 , 4	59.9 ± 12.2 , 1.4	94.9 ± 15.1

^aThe MDCs appear after the commas.

^bTotal Th is the sum of Th-228 + Th-232.

^cUncertainties represent the 95% confidence level, based on total propagated uncertainties.

TABLE 4

CONCENTRATIONS OF URANIUM RADIONUCLIDES
IN SOIL SAMPLES
BY ALPHA SPECTROSCOPY AP11, REVISION 5; CP2, REVISION 15
BRECKENRIDGE SITE
BRECKENRIDGE, MICHIGAN

ORISE Sample ID	NRC Region III Sample ID	Radionuclide Concentrations, TPU _s , and MDC _s ^a (pCi/g)			
		U-234	U-235	U-238	Total U ^b
2030S0004	B-10-1-04	2.22 ± 0.22 , 0.03	0.13 ± 0.04 , 0.02	2.24 ± 0.22 , 0.03	4.59 ± 0.31
2030S0006	B-10-1-06	6.61 ± 0.69 , 0.09	0.36 ± 0.13 , 0.14	7.13 ± 0.73 , 0.02	14.1 ± 1.0
2030S0007	B-10-1-07	7.56 ± 0.67 , 0.03	0.45 ± 0.09 , 0.05	7.77 ± 0.69 , 0.04	15.77 ± 0.96
2030S0009	B-10-1-09	5.31 ± 0.58 , 0.02	0.33 ± 0.11 , 0.03	5.63 ± 0.61 , 0.02	11.27 ± 0.85
2030S0010	B-10-1-10	19.1 ± 2.0 , 0.2	0.90 ± 0.33 , 0.09	21.3 ± 2.2 , 0.2	41.2 ± 3.0

^aThe MDCs appear after the commas.

^bTotal U is calculated by (U-234 + U-235 + U-238).

^cUncertainties represent the 95% confidence level, based on total propagated uncertainties.