ORAU
OAK RIDGE ASSOCIATED UNIVERSITIES

October 22, 2014

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 TWO SLUDGE, TWO RESIN, FOUR SEDIMENT, AND TWO SLUDGE/RESIN SAMPLES ASSOCIATED WITH THE WESTINGHOUSE HEMATITE DECOMMISSIONING PROJECT IN HEMATITE, MISSOURI [INSPECTION REPORT NO. 07000036/2014005] (RFTA NO. 14-001)
DCN: 5221-LR-05-0

Dear Mr. Bonano:

Oak Ridge Associated Universities (ORAU), under the Oak Ridge Institute for Science and Education (ORISE) contract, received two sludge, two resin, four sediment, and two sludge/resin mixture samples on September 15, 2014 from the Westinghouse Hematite Decommissioning project in Hematite, Missouri. The samples were sent directly from the licensee laboratory and were received in good condition. Sample collection data and identification numbers are presented in Table 1. The gamma spectrometry, isotopic uranium, and technetium-99 data are presented in Tables 2 through 4, respectively. The pertinent procedure references are included with the data tables. Although the request for analysis form listed only four samples to be analyzed by gamma spectrometry, all ten samples were analyzed by gamma spectrometry to provide information needed for the alpha spectrometry and technetium-99 analyses. Two samples were analyzed for isotopic uranium by alpha spectrometry and four samples were analyzed for technetium-99 by liquid scintillation counting. A case narrative is included for discussion of sample analysis.

ORAU's Quality Control (QC) requirements are addressed in the case narrative. The QC files are available for your review upon request.

My contact information is listed below. You may also contact Forrest Smith at 865.574.9802 with any questions or comments.

Sincerely,

Wade P. Ivey

Wade Ivey, Manager
Laboratory
WPI:WFS:km

Enclosures

Electronic: T. Carter, NRC S. Roberts, ORAU T. Vitkus, ORAU File 5221

Distribution approval and concurrence:	Initials
Technical Review	DM
Quality Review	DB
Group Manager Review	WPI

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Telephone: 865.576.9184 **Fax: 865.241.3248** **E-mail: wade.ivey@orau.org**

P.O. Box 117 I Oak Ridge, TN 37831 I www.orau.org

5221-LR-05-0 CASE NARRATIVE

Ten samples were received at the ORAU laboratory in good condition on 9/15/14. The samples were shipped directly from the licensee laboratory. The NRC Form 303 that was sent after the samples had arrived listed four sets of two samples each with the same "Sample Name and Description". Each of the two samples in the set had individual "Sample Numbers" but had different analysis requested. Two additional samples had unique "Sample Name and Descriptions" listed on the NRC Form 303.

The chain of custody form that was shipped with the samples from the licensee laboratory had a discrepancy of the collection date and time that was written on the samples. NRC sample numbers HEM-14-2-3-S and HEM-14-2-4-S, with the sample name and description of 9379-WM-140820-01-01, had a collection date and time of 8/20/14 11:30 written on the sample containers and the licensee chain of custody had 8/25/14 10:00. The date on the NRC Form 303 matched the sample number that was on the samples (there were no times listed on the 303 Form). The dates listed in this report are those found on the NRC Form 303 and sample labels.

The sample descriptions listed in the titles of the data tables within this report match the descriptions on the NRC Form 303. However, two samples (HEM-14-2-1-S and HEM-14-2-2-S) listed as sludge are mostly very dirty resin beads.

Gamma Spectrometry:
Each individual sample was counted by gamma spectrometry (GS) even though the request for analysis form only listed four of the samples to be counted by GS. The reason all of the samples were counted by GS was to give a better idea of what sample quantity would be sufficient for the other two analyses—alpha spectrometry (AS) for isotopic uranium (U) and technetium-99 (Tc-99) by liquid scintillation counting. NRC sample IDs HEM-14-2-3-S and HEM-14-2-4-S (which had the same "Sample Name and Description") were combined for the GS count to provide a better counting geometry. Thus, the data in table 2 shows these two samples as being combined.

The GS data indicates the samples are enriched in uranium. The total U calculation in Table 2 must be used with caution as the degree of enrichment is difficult to determine via GS. The total U calculations are based on the equation: Total U = U-235 + U-238 + (21.7 x U-235). Alpha spectrometry provides more accurate data for total U.

There were no deviations from the referenced procedure (CP1) and all the daily quality control (QC) parameters passed for the GS.

Alpha Spectrometry:
Samples HEM-14-2-5-S and HEM-14-2-7-S were analyzed for isotopic U by AS as listed on the NRC Form 303. The samples were counted for approximately 160 minutes, rather than the standard 16 hours. This is a deviation from the referenced procedure (AP11) and was necessitated by the fact the samples contained elevated amounts of U and the spectral resolution would have been degraded had they been counted for 16 hours. There were no other deviations to procedure AP11 and all the QC parameters passed for the AS analysis.

Technetium-99:
Samples HEM-14-2-2-S, HEM-14-2-4-S, HEM-14-2-6-S, and HEM-14-2-8-S were analyzed for technetium-99 (Tc-99) by liquid scintillation as listed on NRC Form 303. As mentioned above, sample HEM-14-2-2-S was listed as a sludge sample but mostly contained dirty resin beads. Therefore, sample HEM-14-2-2-S and HEM-14-2-4-S (also a resin bead sample) were analyzed using the same QC samples. For these two samples, the sample preparation step prior to separation of the Tc-99 was altered from the standard method. For these samples, the Tc-99 that may have been sorbed onto the resin was stripped from the resin by using 12M and 14M HNO_3. The eluate was evaporated down and neutralized prior to separation using TEVA resin. The laboratory control sample (LCS) in the batch run for samples HEM-14-2-2-S and HEM-14-2-4-S had a recovery greater than internal acceptance criteria. This was due to the fact that the LCS matix was not matched to the sample matrix. Samples HEM-14-2-6-S and HEM-14-2-8-S were sediment samples and were analyzed using the same QC samples. There were no deviations from the referenced procedure (AP5) for samples HEM-14-2-6-S and HEM-14-2-8-S and all the QC parameters passed. All four samples were counted using a quench correction due to the discoloration of the samples.

TABLE 1

SAMPLE IDENTIFICATIONS
AND COLLECTION INFORMATION
WESTINGHOUSE HEMATITE DECOMMISSIONING PROJECT
HEMATITE, MISSOURI

ORAU/ORISE Sample ID	NRC Sample ID	Collection Date
5221M0001	HEM-14-2-1-S	8/16/14
5221M0002	HEM-14-2-2-S	8/16/14
5221M0003	HEM-14-2-3-S	8/20/14
5221M0004	HEM-14-2-4-S	8/20/14
5221M0005	HEM-14-2-5-S	8/22/14
5221M0006	HEM-14-2-6-S	8/22/14
5221M0007	HEM-14-2-7-S	8/22/14
5221M0008	HEM-14-2-8-S	8/22/14
5221M0009	HEM-14-2-9-S	8/31/14
5221M0010	HEM-14-2-10-S	8/23/14

TABLE 2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN SLUDGE, RESIN, SEDIMENT, AND SLUDGE/RESIN SAMPLES BY GAMMA SPECTROMETRY CP1, REVISION 17 WESTINGHOUSE HEMATITE DECOMMISSIONING PROJECT HEMATITE, MISSOURI

ORAU/ORISE Sample ID	NRC Sample ID	Radionuclide Concentrations, TPUs[a], and MDCs[b] (pCi/g)		
		U-235	U-238 by Th-234	Total Uranium[c]
5221M0001	HEM-14-2-1-S	34.64 ± 0.70 , 0.52	199.9 ± 3.7 , 2.4	986 ± 16
5221M0002	HEM-14-2-2-S	31.32 ± 0.62 , 0.54	173.4 ± 3.3 , 2.2	884 ± 14
5221M0003 and 5221M0004	HEM-14-2-3-S and HEM-14-2-4-S[d]	39.45 ± 0.94 , 0.53	210.1 ± 3.4 , 2.6	1,106 ± 21
5221M0005	HEM-14-2-5-S	3.60 ± 0.28 , 0.32	13.88 ± 0.80 , 1.20	95.6 ± 6.1
5221M0006	HEM-14-2-6-S	1.11 ± 0.09 , 0.12	4.72 ± 0.34 , 0.54	29.9 ± 2.0
5221M0007	HEM-14-2-7-S	3.61 ± 0.27 , 0.29	13.96 ± 0.81 , 1.10	95.9 ± 5.9
5221M0008	HEM-14-2-8-S	1.13 ± 0.09 , 0.11	4.64 ± 0.33 , 0.49	30.3 ± 2.0
5221M0009	HEM-14-2-9-S	15.73 ± 0.81 , 0.49	80.1 ± 2.0 , 1.7	437 ± 18
5221M0010	HEM-14-2-10-S	12.17 ± 0.48 , 0.30	67.3 ± 1.6 , 1.4	344 ± 11

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

[b]The MDCs are after the comma.

[c]Total uranium calculated by: U-235 + U-238 + (21.7 x U-235)

[d]Samples combined to provide a better counting efficiency.

TABLE 3

CONCENTRATIONS OF URANIUM ISOTOPES IN SEDIMENT SAMPLES BY ALPHA SPECTROSCOPY AP11, REVISION 7; CP2, REVISION 18 WESTINGHOUSE HEMATITE DECOMMISSIONING PROJECT HEMATITE, MISSOURI

ORAU/ORISE Sample ID	NRC Sample ID	Radionuclide Concentrations, TPUs[a], and MDCs[b](pCi/g)			
		U-234	U-235	U-238	Total U[c]
5221M0005	HEM-14-2-5-S	88.1 ± 9.9 , 0.1	3.09 ± 0.53 , 0.10	13.2 ± 1.6 , 0.0[d]	104 ± 10
5221M0007	HEM-14-2-7-S	84.7 ± 9.9 , 0.1	3.01 ± 0.56 , 0.08	12.3 ± 1.6 , 0.0	100 ± 10

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

[b]The MDCs appear after the commas.

[c]Total U is calculated by U-234 + U-235 + U-238.

[d]Zero values are due to rounding.

TABLE 4

CONCENTRATIONS OF TECHNETIUM-99 IN SLUDGE, RESIN, AND SEDIMENT SAMPLES BY LIQUID SCINTILLATION ANALYSIS AP5, REVISION 20; CP4, REVISION 4 WESTINGHOUSE HEMATITE DECOMMISSIONING PROJECT HEMATITE, MISSOURI

ORAU/ORISE Sample ID	NRC Sample ID	Radionuclide Concentrations, TPUs[a], and MDCs[b] (pCi/g)
5221M0002	HEM-14-2-2-S	69.7 ± 1.4 , 0.3
5221M0004	HEM-14-2-4-S	146.9 ± 2.7 , 0.3
5221M0006	HEM-14-2-6-S	11.03 ± 0.29 , 0.19
5221M0008	HEM-14-2-8-S	9.62 ± 0.27 , 0.18

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

[b]The MDCs are after the comma.

NRC FORM 303 (4-2004) U.S. NUCLEAR REGULATORY COMMISSION

REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY

LABORATORY -- ORISE

LABORATORY USE ONLY

CONTROL NUMBER: HEM-2014-002

SAMPLE LOCATION (LICENSEE): Westinghouse Electric Company (WEC) - Hematite, Festus, MO

LICENSE NO.	DOCKET NO.
SNM-00033	070-00036

SAMPLE SUBMITTED

# TOTAL	TYPE	VOLUME	WEIGHT
4 Samples	Sludge, Resin, Sediment		
2 Samples	Sludge, Resin		

DATE SAMPLES SUBMITTED: 09-10-2014

PRIORITY: ☐ ROUTINE ☒ URGENT

SAMPLE COLLECTION INTERVAL

	MONTH	DAY	YEAR	TIME
START	08	16	2014	
STOP	08	31	2014	

INSPECTOR RESPONSIBLE: Gene Bonano

TELEPHONE NUMBER: 630-829-9826

ANALYSIS TO BE PERFORMED	LIST DESIRED LLD *(Optional)*	OTHER TYPE OF ANALYSIS *(Specify)*	LIST DESIRED LLD *(Optional)*
☐ GROSS ALPHA (GA)		☒ Tc-99	
☐ GROSS BETA (GB)		☒ ISO U (i.e., Alpha Spec)	
☒ GAMMA SPEC (GS)		☐	
☐ TRITIUM (H3)		☐	
☐ CARBON-14 (C14)		☐	
☐ IODINE-125 (I125)		☐	

RELINQUISHED BY	RECEIVED BY	DATE	TIME	REASON FOR CHANGE OF CUSTODY

FEE RECOVERABLE ☐ NO ☒ YES IF YES TAC NUMBER /2014005

REMARKS

4 samples with 2 containers ea.
2 samples are in plastic bags ea.

Hold on to samples until released by NRC...

NOTE: SAMPLES WILL BE DISCARDED AFTER ANALYSIS UNLESS REASONS ARE NOTED IN REMARKS ABOVE.

NRC FORM 303 (4-2004) U.S. NUCLEAR REGULATORY COMMISSION

LABORATORY USE ONLY

CONTROL NUMBER

HEM-2014-002

SAMPLE RECORD -- (Continued)
LABORATORY -- ORISE

SAMPLE NUMBER	SAMPLE NAME AND DESCRIPTION	COLLECTION DATE/TIME	REMARKS, PRESERVATIVE ANALYSIS REQUESTED, ETC.
HEM-14-2-1-S	9352-WM-140816-13-03, (Sludge from Water Treatment System Tank T-5)	08/16/2014	Gamma Spec
HEM-14-2-2-S	9352-WM-140816-13-03, (Sludge from Water TREATMENT SYSTEM TANK T-5)	08/16/2014	Tc-99
HEM-14-2-3-S	9379-WM-140820-01-01, (Resin Beads from INLET of WATER TREATMENT System TANK T-5)	08/20/2014	Gamma Spec
HEM-14-2-4-S	9379-WM-140820-01-01, (Resin Beads from INLET of WATER TREATMENT System TANK T-5)	08/20/2014	Tc-99
HEM-14-2-5-S	9396-SS-140822-01-05, (Outfall #002 Sediment SAMPLE (South of Site POND DAM))	08/22/2014	ISO U, (i.e., Alpha Spec)
HEM-14-2-6-S	9396-SS-140822-01-05, (Outfall #002 Sediment SAMPLE (SOUTH of Site POND DAM))	08/22/2014	Tc-99
HEM-14-2-7-S	9396-SS-140822-01-07, (Outfall #002 Sediment SAMPLE (SOUTH of Site POND DAM))	08/22/2014	ISO U, (i.e., Alpha Spec)
HEM-14-2-8-S	9396-SS-140822-01-07, (Outfall #002 Sediment SAMPLE (SOUTH of Site POND DAM))	08/22/2014	Tc-99
HEM-14-2-9-S	I5-090514-02, (Sludge and Resin from Water TREATMENT System TANK T-3 BACKWASH	08/31/2014	Gamma Spec, (Licensee used ISOCs
HEM-14-2-10-S	I5-090514-03, (Sludge and Resin from Water TREATMENT System	08/23/2014	Gamma Spec, (Licensee used ISOCs