

April 12, 2007

Mr. Jim Kottan  
U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

**SUBJECT: REVISED FINAL REPORT FOR REQUESTED ANALYSES OF EIGHT WATER SAMPLES, SET FOURTEEN, FROM THE INDIAN POINT POWER STATION, BUCHANAN, NEW YORK [INSPECTION REPORT NO. 050-247/2006-007] [RFTA NO. 06-001]**

Dear Mr. Kottan:

The Oak Ridge Institute for Science and Education (ORISE) received set 14, which consisted of eight water samples received on September 26, 2006 from the Indian Point Power Station in Buchanan, New York. Sample analysis was initiated based on your previous direction for handling samples from this facility. The final report was delayed until technical concerns about plutonium in water samples were resolved through analytical testing conducted by Radiological and Environmental Sciences Laboratory. Sample identification and collection data for the samples addressed in this report are presented in Table 1. Gamma spectroscopy, the hard-to-detect betas (iron-55, nickel-59/63, and tritium), technetium-99, total radiostrontium, alpha spectroscopy, plutonium-241, and carbon-14 data are provided in Tables 2 through Table 8, respectively. The pertinent procedure references are provided in each specific table.

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

The water samples were processed using a deviation to the sample preparation procedure, SP3, Revision 4. The water samples were filtered through 0.45 micron filter papers. An aliquot was removed for tritium and carbon-14 before acidification. An aliquot was removed for alpha analysis and the pH was adjusted to approximately zero using concentrated nitric acid (HNO<sub>3</sub>) and a few drops of hydrofluoric acid (HF). A pH of zero and a few drops of HF should ensure that any plutonium that may be in the sample remains in solution. ORISE analyzed the filtered solid portion of each sample for all the requested alpha isotopes. The remaining aliquot of each sample was adjusted to a pH of approximately 2 with concentrated HNO<sub>3</sub>.

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Mr. Jim Kottan

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April 12, 2007

In the original report the date of the letter was incorrectly reported as January 26, 2006. The date has been corrected and I apologize for any inconvenience this incorrect date may have caused.

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:WPI:km

Enclosures

c: T. Carter, NRC/FSME/DWMEP 7J18  
E. Knox-Davin, NRC/FSME/TWFN 8A23  
M. Roberts, NRC Region I  
File 1697

E. Abelquist, ORISE  
S. Kirk, ORISE  
J. White, NRC Region I

Distribution approval and concurrence :	Initials
Technical Management Team Member	JK
Quality Manager	ATP

Voice: 865.241.3242

Fax: 865.241.3248

E-mail: Dale.Condra@orau.org

**TABLE 1****SAMPLE IDENTIFICATIONS  
AND COLLECTION DATA  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

<b>ORISE Sample ID</b>	<b>NRC Region I Sample ID</b>	<b>Collection Date</b>	<b>Collection Time</b>
1697W0070 <sup>a</sup>	MW-42@41	9/18/2006	14:45
1697M0033 <sup>b</sup>	MW-42@41	9/18/2006	14:45
1697W0071	MW-42@43	9/18/2006	13:00
1697M0034	MW-42@43	9/18/2006	13:00
1697W0072	MW-42@46	9/15/2006	12:45
1697M0035	MW-42@46	9/15/2006	12:45
1697W0073	MW-42@48	9/15/2006	11:20
1697M0036	MW-42@48	9/15/2006	11:20
1697W0074	MW-59@70	9/15/2006	10:20
1697M0037	MW-59@70	9/15/2006	10:20
1697W0075	LAF-001-(003)	9/19/2006	15:49
1697M0038	LAF-001-(003)	9/19/2006	15:49
1697W0076	LAF-002-(003)	9/19/2006	13:41
1697M0039	LAF-002-(003)	9/19/2006	13:41
1697W0077	LAF-003-(003)	9/19/2006	11:08
1697M0040	LAF-003-(003)	9/19/2006	11:08

<sup>a</sup>The W in the ORISE sample identification represents a water matrix.

<sup>b</sup>The M in the ORISE sample identification represents the filtered fraction of the preceding water sample.

**TABLE 2**

**CONCENTRATIONS OF SELECTED  
GAMMA EMITTING RADIONUCLIDES  
IN WATER SAMPLES  
BY GAMMA SPECTROSCOPY CP1, REVISION 15  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations <sup>a,b</sup> (pCi/L)			
		Co-58	Co-60	Cs-134	Cs-137
1697W0070	MW-42@41	3 ± 11 <sup>c</sup>	4 ± 13	6.5 ± 9.3	13,730 ± 470
1697W0071	MW-42@43	-12 ± 12	3 ± 12	6.0 ± 9.2	15,140 ± 510
1697W0072	MW-42@46	-1.7 ± 7.7	11.7 ± 9.9	2.4 ± 7.8	20,260 ± 650
1697W0073	MW-42@48	6 ± 13	15 ± 11	1 ± 11	21,650 ± 750
1697W0074	MW-59@70	0.1 ± 3.0	0.3 ± 4.1	1.3 ± 2.7	-3.8 ± 4.1
1697W0075	LAF-001-(003)	1.2 ± 2.8	3.8 ± 2.9	-0.5 ± 2.4	1.2 ± 2.1
1697W0076	LAF-002-(003)	-2.4 ± 3.0	2.2 ± 4.6	0.7 ± 2.6	0.5 ± 2.2
1697W0077	LAF-003-(003)	-1.7 ± 2.0	0.7 ± 1.6	-0.8 ± 1.7	-0.7 ± 1.6

<sup>a</sup>The range of MDCs for the selected radionuclides for samples W0070-W0073 is 13 pCi/L to 37 pCi/L.

<sup>b</sup>The range of MDCs for the selected radionuclides for samples W0074-W0077 is 2.9 pCi/L to 5.0 pCi/L.

<sup>c</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

TABLE 3

**CONCENTRATIONS OF HARD TO DETECT  
BETA EMITTING RADIONUCLIDES  
IN WATER SAMPLES  
BY LIQUID SCINTILLATION ANALYSIS CP4, REVISION 3  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations <sup>a</sup> (pCi/L)			
		Fe-55 <sup>b</sup>	Ni-59 <sup>c</sup>	Ni-63 <sup>c</sup>	H-3 <sup>d</sup>
1697W0070	MW-42@41	-19 ± 19 <sup>c</sup> (32)	-72 ± 12 (22)	452 ± 40 (35)	2,830 ± 380 (420)
1697W0071	MW-42@43	-17 ± 19 (32)	3 ± 13 (22)	435 ± 39 (35)	2,350 ± 360 (420)
1697W0072	MW-42@46	-3 ± 19 (32)	15 ± 13 (22)	1,207 ± 85 (35)	1,500 ± 320 (420)
1697W0073	MW-42@48	-2 ± 19 (32)	-73 ± 12 (22)	1,272 ± 89 (35)	1,370 ± 310 (420)
1697W0074	MW-59@70	-4 ± 19 (32)	2.0 ± 5.1 (8.7)	-0.4 ± 8.2 (14.1)	130 ± 250 (420)
1697W0075	LAF-001-(003)	-6 ± 19 (32)	1.0 ± 5.1 (8.7)	0.3 ± 8.2 (14.1)	-94 ± 230 (420)
1697W0076	LAF-002-(003)	-1 ± 19 (32)	-0.7 ± 5.1 (8.7)	2.0 ± 8.3 (14.1)	-220 ± 230 (420)
1697W0077	LAF-003-(003)	2 ± 19 (32)	-17.4 ± 4.9 (8.7)	2.6 ± 8.3 (14.1)	-40 ± 240 (420)

<sup>a</sup>The MDCs for each radionuclide are in parentheses.

<sup>b</sup>Fe-55 analyzed using procedure AP13, Revision 4.

<sup>c</sup>Ni-59/63 analyzed using procedure AP17, Revision 0.

<sup>d</sup>H-3 analyzed using procedure AP2, Revision 15.

<sup>e</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

**TABLE 4**

**CONCENTRATIONS OF TECHNETIUM-99 (Tc-99)  
IN WATER SAMPLES  
BY LIQUID SCINTILLATION ANALYSIS  
AP5, REVISION 16; CP4, REVISION 3  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

<b>ORISE Sample ID</b>	<b>NRC Region I Sample ID</b>	<b>Tc-99 Concentrations<sup>a</sup> (pCi/L)</b>
1697W0070	MW-42@41	4 ± 18 <sup>b</sup> (31)
1697W0071	MW-42@43	8 ± 18 (31)
1697W0072	MW-42@46	-1 ± 18 (31)
1697W0073	MW-42@48	5 ± 18 (31)
1697W0074	MW-59@70	-4.7 ± 8.9 (15.6)
1697W0075	LAF-001-(003)	-2.7 ± 9.0 (15.6)
1697W0076	LAF-002-(003)	-0.5 ± 9.1 (15.6)
1697W0077	LAF-003-(003)	2.8 ± 9.1 (15.6)

<sup>a</sup>The MDCs are in parentheses.

<sup>b</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

**TABLE 5**

**CONCENTRATIONS OF TOTAL RADIOSTRONTIUM  
IN WATER SAMPLES  
BY LOW BACKGROUND BETA COUNTING  
AP4, REVISION 13; CP3, REVISION 2  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations, TPUs, and MDCs <sup>a</sup> (pCi/L)			
1697W0070	MW-42@41	20.2	±	2.0 <sup>b</sup>	(2.3)
1697W0071	MW-42@43	15.7	±	1.7	(1.9)
1697W0072	MW-42@46	32.8	±	2.4	(2.2)
1697W0073	MW-42@48	35.0	±	2.3	(2.0)
1697W0074	MW-59@70	0.14	±	0.50	(0.89)
1697W0075	LAF-001-(003)	0.10	±	0.52	(0.93)
1697W0076	LAF-002-(003)	0.97	±	0.55	(0.87)
1697W0077	LAF-003-(003)	-0.17	±	0.45	(0.83)

<sup>a</sup>MDCs are in parentheses.

<sup>b</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

TABLE 6

**CONCENTRATIONS OF SELECTED  
ALPHA EMITTING RADIONUCLIDES  
IN SUSPENDED AND DISSOLVED FRACTIONS OF WATER SAMPLES  
AP11, REVISION 3; CP2, REVISION 12  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations <sup>a</sup> (pCi/g of sediment in 100 mL or pCi/L for water)			
		Am-241	Cm-242	Cm-243/244	Np-237
1697W0070	MW-42@41	0.03 ± 0.09 <sup>b</sup> (0.15)	0.01 ± 0.04 (0.07)	0.01 ± 0.08 (0.14)	0.01 ± 0.02 (0.03)
1697M0033	MW-42@41	0.01 ± 0.02 (0.04)	0.01 ± 0.01 (0.02)	0.00 <sup>c</sup> ± 0.02 (0.03)	0.00 ± 0.02 (0.03)
1697W0071	MW-42@43	0.07 ± 0.09 (0.15)	0.07 ± 0.06 (0.08)	0.01 ± 0.09 (0.17)	0.01 ± 0.02 (0.03)
1697M0034	MW-42@43	-0.01 ± 0.02 (0.05)	0.00 ± 0.01 (0.03)	-0.01 ± 0.02 (0.04)	-0.01 ± 0.02 (0.04)
1697W0072	MW-42@46	0.04 ± 0.08 (0.14)	0.03 ± 0.06 (0.10)	-0.03 ± 0.07 (0.14)	0.03 ± 0.06 (0.11)
1697M0035	MW-42@46	0.01 ± 0.02 (0.03)	0.01 ± 0.01 (0.02)	0.00 ± 0.02 (0.04)	0.00 ± 0.01 (0.03)
1697W0073	MW-42@48	0.06 ± 0.07 (0.11)	0.03 ± 0.03 (0.02)	0.01 ± 0.07 (0.14)	-0.04 ± 0.05 (0.12)
1697M0036	MW-42@48	0.00 ± 0.02 (0.04)	0.00 ± 0.01 (0.02)	-0.01 ± 0.02 (0.04)	0.002 ± 0.004 <sup>d</sup> (0.007)
1697W0074	MW-59@70	0.00 ± 0.05 (0.09)	0.02 ± 0.02 (0.03)	-0.01 ± 0.04 (0.08)	0.02 ± 0.02 (0.02)
1697M0037	MW-59@70	-0.01 ± 0.02 (0.04)	0.01 ± 0.01 (0.01)	0.00 ± 0.02 (0.03)	0.00 ± 0.01 (0.03)
1697W0075	LAF-001-(003)	0.03 ± 0.04 (0.07)	0.00 ± 0.03 (0.06)	-0.02 ± 0.04 (0.08)	0.00 ± 0.01 (0.04)
1697M0038	LAF-001-(003)	0.02 ± 0.02 (0.03)	0.01 ± 0.01 (0.03)	-0.01 ± 0.02 (0.04)	0.002 ± 0.005 (0.007)
1697W0076	LAF-002-(003)	-0.02 ± 0.05 (0.09)	0.00 ± 0.03 (0.06)	0.00 ± 0.03 (0.05)	0.00 ± 0.04 (0.08)
1697M0039	LAF-002-(003)	0.01 ± 0.02 (0.03)	0.00 ± 0.01 (0.02)	0.00 ± 0.02 (0.03)	0.00 ± 0.01 (0.03)
1697W0077	LAF-003-(003)	0.02 ± 0.03 (0.04)	0.01 ± 0.02 (0.03)	0.00 ± 0.01 (0.01)	-0.06 ± 0.04 (0.10)
1697M0040	LAF-003-(003)	0.00 ± 0.01 (0.03)	0.00 ± 0.01 (0.02)	0.00 ± 0.01 (0.02)	0.002 ± 0.004 (0.006)



TABLE 6 (Continued)

**CONCENTRATIONS OF SELECTED  
ALPHA EMITTING RADIONUCLIDES  
IN SUSPENDED AND DISSOLVED FRACTIONS OF WATER SAMPLES  
AP11, REVISION 3; CP2, REVISION 12  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations <sup>a</sup> (pCi/g of sediment in 100 mL or pCi/L for water)											
		Pu-238		Pu-239/240		U-234		U-238					
1697W0070	MW-42@41	0.08	± 0.09	(0.15)	0.03	± 0.04	(0.07)	1.47	± 0.26	(0.10)	1.27	± 0.24	(0.07)
1697M0033	MW-42@41	0.00	± 0.02	(0.04)	0.01	± 0.01	(0.01)	0.01	± 0.01	(0.02)	0.01	± 0.01	(0.02)
1697W0071	MW-42@43	0.06	± 0.13	(0.23)	0.01	± 0.04	(0.09)	1.93	± 0.29	(0.03)	1.72	± 0.27	(0.03)
1697M0034	MW-42@43	0.02	± 0.02	(0.03)	0.01	± 0.01	(0.02)	0.01	± 0.01	(0.01)	0.01	± 0.01	(0.01)
1697W0072	MW-42@46	0.11	± 0.08	(0.12)	0.01	± 0.03	(0.07)	1.87	± 0.30	(0.10)	1.70	± 0.28	(0.07)
1697M0035	MW-42@46	0.01	± 0.02	(0.04)	0.01	± 0.01	(0.02)	0.02	± 0.01	(0.01)	0.02	± 0.01	(0.01)
1697W0073	MW-42@48	-0.01	± 0.07	(0.15)	0.03	± 0.06	(0.11)	2.10	± 0.30	(0.06)	1.74	± 0.26	(0.06)
1697M0036	MW-42@48	0.00	± 0.02	(0.03)	0.01	± 0.01	(0.01)	0.03	± 0.02	(0.02)	0.04	± 0.02	(0.01)
1697W0074	MW-59@70	0.04	± 0.03	(0.04)	0.04	± 0.03	(0.02)	0.54	± 0.10	(0.07)	0.48	± 0.09	(0.05)
1697M0037	MW-59@70	0.00	± 0.02	(0.03)	0.01	± 0.01	(0.02)	0.01	± 0.01	(0.02)	0.03	± 0.02	(0.01)
1697W0075	LAF-001-(003)	0.01	± 0.03	(0.05)	0.03	± 0.02	(0.02)	0.67	± 0.10	(0.02)	0.73	± 0.11	(0.02)
1697M0038	LAF-001-(003)	0.01	± 0.02	(0.03)	0.01	± 0.02	(0.02)	0.00	± 0.01	(0.02)	0.00	± 0.01	(0.01)
1697W0076	LAF-002-(003)	0.04	± 0.05	(0.09)	0.03	± 0.03	(0.04)	26.3	± 2.1	(0.1)	17.1	± 1.4	(0.1)
1697M0039	LAF-002-(003)	0.01	± 0.02	(0.03)	0.02	± 0.01	(0.01)	0.05	± 0.02	(0.01)	0.03	± 0.01	(0.01)
1697W0077	LAF-003-(003)	0.03	± 0.03	(0.04)	0.00	± 0.02	(0.04)	0.56	± 0.12	(0.09)	0.48	± 0.10	(0.03)
1697M0040	LAF-003-(003)	0.02	± 0.02	(0.03)	0.02	± 0.01	(0.02)	0.01	± 0.01	(0.02)	0.01	± 0.01	(0.01)

<sup>a</sup>The MDCs are in parentheses.

<sup>b</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

<sup>c</sup>Zero values are due to rounding.

<sup>d</sup>Significant figures expanded to avoid reporting a TPU of zero at the request of the inspector.

**TABLE 7**

**CONCENTRATIONS OF PLUTONIUM-241  
IN SUSPENDED AND DISSOLVED FRACTIONS OF WATER SAMPLES  
BY LIQUID SCINTILLATION ANALYSIS  
AP10, REVISION 2; CP4, REVISION 3  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

<b>ORISE Sample ID</b>	<b>NRC Region I Sample ID</b>	<b>Radionuclide Concentrations<sup>a</sup> (pCi/g of sediment in 100 mL or pCi/L for water)</b>			
1697W0070	MW-42@41	-3	±	17 <sup>b</sup>	(29)
1697M0033	MW-42@41	-0.2	±	3.4	(5.9)
1697W0071	MW-42@43	-8	±	16	(28)
1697M0034	MW-42@43	-0.6	±	3.7	(6.4)
1697W0072	MW-42@46	-10	±	16	(27)
1697M0035	MW-42@46	-2.5	±	3.5	(6.1)
1697W0073	MW-42@48	-10	±	15	(27)
1697M0036	MW-42@48	-0.6	±	3.5	(6.0)
1697W0074	MW-59@70	-2.5	±	9.3	(16.1)
1697M0037	MW-59@70	-0.9	±	3.4	(5.9)
1697W0075	LAF-001-(003)	-2.7	±	7.9	(13.7)
1697M0038	LAF-001-(003)	1.1	±	3.5	(6.0)
1697W0076	LAF-002-(003)	-6.4	±	7.8	(13.6)
1697M0039	LAF-002-(003)	1.4	±	3.6	(6.1)
1697W0077	LAF-003-(003)	-2.5	±	8.2	(14.2)
1697M0040	LAF-003-(003)	2.6	±	3.5	(5.9)

<sup>a</sup>MDCs are in parentheses.

<sup>b</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

**TABLE 8**

**CONCENTRATIONS OF CARBON-14  
IN WATER SAMPLES  
BY LIQUID SCINTILLATION ANALYSIS  
AP9, REVISION 3; CP4, REVISION 3  
INDIAN POINT POWER STATION  
BUCHANAN, NEW YORK**

<b>ORISE Sample ID</b>	<b>NRC Region I Sample ID</b>	<b>Radionuclide Concentrations, TPUs, and MDCs<sup>a</sup> (pCi/L)</b>			
1697W0070	MW-42@41	0.8	±	9.7 <sup>b</sup>	(16.4)
1697W0071	MW-42@43	8.8	±	9.8	(16.4)
1697W0072	MW-42@46	0.2	±	9.6	(16.4)
1697W0073	MW-42@48	-0.6	±	9.6	(16.4)
1697W0074	MW-59@70	6.9	±	9.8	(16.4)
1697W0075	LAF-001-(003)	0.5	±	9.7	(16.4)
1697W0076	LAF-002-(003)	1.4	±	9.7	(16.4)
1697W0077	LAF-003-(003)	8.3	±	9.8	(16.4)

<sup>a</sup>MDCs are in parentheses.

<sup>b</sup>Uncertainties represent the 95% confidence level, based on total propagated uncertainties.