

**Post Closure Groundwater and Surface Water  
Monitoring Report, Spring 2016  
Yankee Nuclear Power Station**

**Prepared for:**



**Yankee Atomic Electric Company  
Yankee Nuclear Power Station  
49 Yankee Road  
Rowe, Massachusetts**

**Prepared by:**



**Amec Foster Wheeler Environment & Infrastructure, Inc.  
511 Congress Street  
Portland, Maine 04101**

**April 27, 2016**

**Project Number 3617147318**

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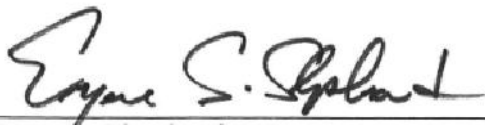
Prepared by:



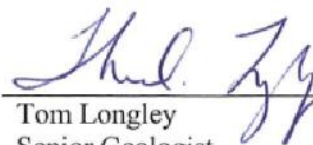
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A handwritten signature in blue ink, reading "Eugene S. Shephard".

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## **1.0 INTRODUCTION**

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) has been contracted by Yankee Nuclear Power Station (YNPS) to conduct the Post Closure Groundwater and Surface Water Monitoring Program at their site, located at 49 Yankee Road in Rowe, Massachusetts.

YNPS completed its decommissioning in 2007, under the oversight of the Nuclear Regulatory Commission (NRC). However, as part of the closure process, ongoing groundwater and surface water monitoring is still required under the Massachusetts Department of Environmental Protection (MassDEP). This work is to demonstrate that the groundwater is in compliance with the Massachusetts Contingency Plan (MCP) and for post closure monitoring of the Beneficial Use Determination (BUD) Area and the Southeast Construction Fill Area (SCFA). This report presents the findings from samples collected in March 2016 in support of the site closure requirements under the MCP.

## **2.0 BACKGROUND**

Through the site closure process, a comprehensive investigation was conducted to characterize environmental conditions and to develop the conceptual site model, not only to identify source areas and impacted media, but to also describe the fate and transport of both chemicals and radionuclides in soils, groundwater, and surface water. These findings have been published in numerous reports and have achieved the appropriate regulatory approvals. The conceptual site model for groundwater at YNPS was published in the Final Groundwater Conditions Report, submitted to the NRC on February 15, 2007 (YNPS, 2007).

As part of the decommissioning project, 81 groundwater monitoring wells were installed to characterize the hydrogeology, and groundwater quality. Currently there are 15 wells that remain on site. Of these wells, five groundwater monitoring wells were sampled in March 2016 to demonstrate compliance with the MCP and to support post closure monitoring. Results are presented and discussed in the following report.



### **3.0 SCOPE OF WORK**

Groundwater monitoring for closure under the License Termination Plan (LTP) has been completed. However, groundwater and surface water monitoring is still required to reach closure under the MassDEP and to support post closure monitoring. In keeping with this goal this program was completed in accordance with the MassDEP-approved Groundwater Monitoring Plan to Support Closure under the MCP (ERM, 2007) as modified by the MassDEP by letter dated February 23, 2016 (Appendix A), as well as the Phase II - Comprehensive Site Assessment Report (MassDEP, April 08, 2009).

On February, 23, 2016 YNPS received a letter from the MassDEP approving the Minor Modification Permit application, entitled “Proposed 2015 Revisions to the Groundwater and Surface Water Monitoring Program”, for the former YNPS in Rowe, MA. The application was prepared by Ransom Consulting, Inc. (Ransom) on behalf of Yankee Atomic Electric Company (YAEC), the owner of the YNPS. The application proposed to amend the June 19, 2007 MassDEP approval of the Final Post-Closure Groundwater Monitoring Plan (the Groundwater Monitoring Plan) for the YNPS, which addressed environmental monitoring at the Beneficial Use Determination (BUD) Fill Area (the former industrial area) and the Southeast Construction Fill Area (SCFA), in accordance with MassDEP’s Solid Waste Regulations at 310 CMR 19.000.

The MassDEP approved the Minor Modification permit subject to a number of conditions and requirements. These conditions and requirements were identified in the MassDEP approval letter (Appendix A) and included a list of locations to be sampled, the frequency of sampling, and for which constituents they were to be analyzed. Additionally, this modification was to be initiated during the 2016 sampling event, for which this report describes. Accordingly, the March 2016 sampling event included the sampling of five monitoring wells, three surface water locations, and one surface water seep location. A subset of sample locations were split and submitted to the Massachusetts Department of Public Health Environmental Radiation Laboratory. The sampling program is summarized in Table 1. The sampling locations are shown on Figure 1. Groundwater samples were collected in accordance with Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (USEPA, 2010) and in accordance with Amec Foster Wheeler’s Site Specific Health and Safety Plan (Amec Foster Wheeler, 2016). Field data records are presented in Appendix B, and a summary of the field data parameters is presented in Table 2.

During the field effort, locks were replaced on the monitoring wells CFW-5, CFW-6, MW-105B, and MW-107C. The lock hasp on monitoring well CFW-1 was broken and YAEC was notified to initiate repairs. Subsequent to the field sampling effort, YAEC has repaired the lock hasp on CFW-1 and a new lock has been installed.

The radiochemistry data were validated in accordance with Site procedure ES-4, Rev. 0 (YNPS, 2016). Chemical analytical data were validated in accordance with EPA Region 1, New England Validation Guidelines (USEPA, 1989 and 1996b). A summary of the data validation findings and tabulated validated data are provided in Appendix C-1 (radiological), C-2 (chemical), and C-3 (validation checklists).

## **4.0 FINDINGS**

Groundwater samples were submitted for both radiological and chemical parameters. The results and findings from the sampling events are presented in the following subsections.

### **4.1 RADIOLOGICAL PARAMETERS**

Radionuclides in groundwater are compared to the United States Environmental Protection Agency's (USEPA's) Maximum Contaminant Level (MCL). In addition to these criteria, data are also evaluated over time to assess if trends are decreasing, stable, or increasing. Consistent with evaluations presented in previous Annual Post Closure Groundwater and Surface Water Monitoring Reports, a change of 15 percent over previous sampling events has been used to identify trends.

Groundwater samples were collected from two monitoring wells and one surface water seep location for analysis of radionuclides in March 2016. The tritium results are presented on Table 3 with previous data to demonstrate that there continues to be a generally downward and/or stable trend in tritium concentrations. Tritium was not detected in any of the surface water locations sampled during this event.

Consistent with historical results, the highest concentration of tritium was detected at MW-107C at 6,330 picocuries per liter (pCi/L), with the next highest detection reported at monitoring well MW-105B (1,460 pCi/L). The MCL for tritium is 20,000 pCi/L. As shown on Table 3, these detections are consistent with the conceptual site model.

No other radionuclides were detected in any of the groundwater or surface water sample locations sampled during the March 2016 event.

Validated radiological data from the sampling event is provided in Appendix C-1.

## **4.2 CHEMICAL PARAMETERS**

Groundwater chemical data are evaluated using the GW-1 groundwater standards (310 CMR 40.0974(2)) (MassDEP, 2008). For the analyses where GW-1 standards are not published, data are compared to Massachusetts MCLs or Massachusetts Secondary MCLs (SMCLs) (MassDEP, 2007). Surface water chemical data are evaluated using USEPA Ambient Water Quality Criteria (AWQC) (USEPA, 2002). For the analyses where AWQC are not published, data are compared to Massachusetts MCLs or SMCLs (MassDEP, 2007).

Former Southeast Construction Fill Area. Samples were collected from three groundwater monitoring wells (CFW-1, CFW-5, and CFW-6) and three surface water locations (SW-1, SW-4 and SW-5) to assess the potential environmental impacts from the Former SCFA. A summary of the sampling program is presented in Table 1.

Several metals and other naturally occurring compounds were detected in both groundwater and surface water samples; however the concentrations are consistent with background and historic data. Only iron and manganese were detected at concentrations that exceed the SMCLs. SMCLs are used to assess the aesthetic qualities of drinking water and are not health-based standards; concentrations that exceed SMCLs are not necessarily indicative of potential health risks.

The surface water samples were also analyzed for 1,4-dioxane. 1,4-dioxane was not detected in any of the surface water samples from the SCFA.

A summary of the groundwater data for wells downgradient of the SCFA is presented on Table 4. A summary of the surface water data for locations associated with the SCFA is presented in Table 5.

Sherman Spring. Sampling was completed at the Sherman Spring surface water location (SP-1) and samples were analyzed for VOCs, 1,4-dioxane, and total Resource Conservation and Recovery Act

(RCRA) 8 metals. Barium and 1,4-dioxane were detected below applicable criteria. Other results were reported as not detected. Validated data is included in Appendix C-2.

## **5.0 CONCLUSIONS**

The results from the March 2016 groundwater sampling event were consistent with the approved conceptual site model. Based on the data collected during the March 2016 sampling event, tritium concentrations continue to be stable or decreasing across the site, with the highest concentration reported at MW-107C at an activity of 6,330 pCi/L compared to the MCL of 20,000 pCi/L.

No additional sampling is warranted at this time. In accordance with the Post Closure Groundwater and Surface Water Monitoring Plan, the next groundwater sampling event is scheduled for March 2021.

## **6.0 RECOMMENDATIONS**

As the groundwater monitoring program is progressing, wells that are no longer part of the active network were recommended for closure in accordance with MassDEP Guidelines as described in previous reports. Table 6 summarizes the status of each monitoring well at the Site as of April 2016. The monitoring wells remaining at the site include five wells that are sampled as part of the long-term monitoring program (CFW-1, CFW-5, CFW-6, MW-105B, and MW-107C) as well as ten wells (MW-102A/B/C, MW-104A, MW-105A/C, MW-106A, and MW-107B/D/E), that are no longer sampled but, at the request of MassDEP, are kept active for potential future sampling events. In consultation with the MassDEP, YAEC maintenance responsibilities for the wells that will be left for possible future monitoring will be to protect from damage, and complete a visual inspection and lock replacement once every three years, which began in 2012 (MassDEP, 2011).

## 7.0 ACRONYMS

Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
AWQC	Ambient Water Quality Criteria
BUD	Beneficial Use Determination
LTP	License Termination Plan
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mg/L	milligrams per liter
NRC	Nuclear Regulatory Commission
pCi/L	picocuries per liter
Ransom	Ransom Consulting Inc.
RCRA	Resource Conservation and Recovery Act
SCFA	Southeast Construction Fill Area
SMCL	Secondary Maximum Concentration Limit
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
YAEC	Yankee Atomic Electric Company
YNPS	Yankee Nuclear Power Station

## **8.0 REFERENCES**

- Amec Foster Wheeler, 2016. Short Form Health and Safety Plan, Yankee Nuclear Power Station, Rowe, Massachusetts, March 2016.
- ERM 2007. Groundwater Monitoring Plan to Support Closure under the Massachusetts Contingency Plan, Yankee Nuclear Power Station, Site Closure Project, Rowe, Massachusetts, June 2007.
- MassDEP, 2007. Standards and Guidelines for Contaminants in Massachusetts Drinking Waters. Spring 2007. Department of Environmental Protection, Office of Research and Standards.
- MassDEP, 2008. Massachusetts Contingency Plan, 310 CMR 40.000. February 14, 2008.
- MassDEP, 2009. Phase II – Comprehensive Site Assessment Report, April 8, 2009.
- MassDEP, 2011. Letter from Massachusetts Department of Environmental Protection to Yankee Atomic Electric Company dated December 6, 2011.
- MassDEP, 2016. Letter from Massachusetts Department of Environmental Protection to Yankee Atomic Electric Company dated February 23, 2016.
- USEPA, 1989. “Region I, Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses;” Hazardous Site Evaluation Division; February, 1989.
- USEPA, 1996a. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Ground Water Monitoring Wells, July 1996.
- USEPA, 1996b. “Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses, Parts I and II,” Quality Assurance Unit Staff; Office of Environmental Measurement and Evaluation; December, 1996.
- USEPA. 2002. Nationally Recommended Water Quality Criteria: 2002. Office of Water, Science and Technology. Doc. No. EPA-822-R-02-047
- YNPS, 2007. Final Groundwater Conditions Report, Yankee Nuclear Power Station, Rowe, Massachusetts, February 15, 2007.
- YNPS, 2016. Groundwater Monitoring Program, ES-4, Rev. 0, ISFSI Procedure, March 17, 2016.

## Figures







## Tables

**Table 1**  
**Groundwater and Surface Water Monitoring Program Summary**  
**March 2016**

**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

				<b>Analysis Method</b>	VOC - (8260 with TICs) <sup>1</sup>	1,4-Dioxane (8270 SIM)	Calcium, Iron, Manganese	RCRA 8 Metals - (6020A/7470)	Alkalinity - (SM2320B)	COD - (EPA 410.4)	Radionuclides - (Gamma Spec) <sup>2, 3</sup>	Strontium-90 - (GPC, LSC) Hard to Detect	Tritium - (LSC)- Hard to Detect	D.O., ORP, S.C., Temp., NTU (field parameters)
<b>Fraction</b>					T	T	T	D (Field)	T	T	T	T	T	
<b>Bottle Size (Qty per Sample)</b>					40 (3)	250 (2)	250 (1)	250 (1)	125 (1)	125 (1) <sup>4</sup>	2 (1) <sup>4</sup>	1 (1) <sup>4</sup>	250 (1) <sup>4</sup>	
<b>Bottle Size Units</b>					mL	mL	mL	mL	mL	mL	Liter	Liter	mL	
<b>Bottle Material</b>					Glass Vial	Amber glass	Poly	Poly	Poly	Poly	Poly	Poly	Amber Glass	
<b>Preservative</b>					HCl	4 Deg C	HNO3	HNO3	4 Deg C	H2SO4	HNO3	HNO3	None	
<b>Lab ID</b>					GEL	Eurofins	GEL	GEL	GEL	GEL	GEL	GEL	GEL	FIELD
<b>Media</b>	<b>Loc Name</b>	<b>Field Sample ID</b>	<b>QC Code</b>											
GW	CFW-1	CFW-1	FS				X		X	X				X
GW	CFW-5	CFW-5	FS				X		X	X				X
GW	CFW-5	CFW-5DUP	FD				X		X	X				
GW	CFW-5	CFW-5MS	MS				X		X	X				
GW	CFW-5	CFW-5MSD	MSD				X		X	X				
GW	CFW-6	CFW-6	FS				X		X	X				X
GW	MW-105B	MW-105B	FS										X	X
GW	MW-107C	MW-107C	FS										X	X
SW	Sherman Spring	SP-1	FS	X	X			X			X	X	X	X
SW	SW-1	SW-1	FS	X	X	X	X	X	X	X				X
SW	SW-4	SW-4	FS	X	X	X	X	X	X	X				X
SW	SW-5	SW-5	FS	X	X	X	X	X	X	X				X
QC	EB-006	EB-006	EB										X	
QC	TB-009	TB-009	TB	X										
QC	TB-010	TB-010	TB	X										
<b>TOTAL</b>					<b>6</b>	<b>4</b>	<b>9</b>	<b>4</b>	<b>9</b>	<b>9</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>9</b>

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Checked/Date: TDL 03/08/16

**Notes:**

<sup>1</sup> = VOCs shall be performed as outlined in 310 CMR 19.132(h)(1-3), specifically methyl ethyl ketone, methyl isobutyl ketone, acetone, and 1,4-dioxane shall be included, and unknown peaks having intensities greater than 5 times the background intensity shall be identified (TICs)

<sup>2</sup> = Radiological analysis by Gamma Spectroscopy shall at a minimum quantify the radionuclides Ag-108m, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, Nb-94, and Sb-125; also any other plant-related radionuclides detected by gamma spectroscopy above MDAs shall be reported as part of these analyses

As outlined in 310 CMR 19.132(i), detection limits for all parameters tested in groundwater samples shall be at or below the Massachusetts Drinking Water Standards & Guidelines (Maximum Contaminant Levels, or MCLs), including the 1,4-dioxane MCL of 0.3 micrograms/liter (ug/l)

<sup>3</sup> = Sample volume needed per sample is 2 L for Gamma Spectroscopy

<sup>4</sup> = Sample volume includes volume needed for QC samples, if applicable, for rad parameters and COD

4 Deg C	4 Degrees Celsius	mL	milliliter
COD	chemical oxygen demand	MS	Matrix Spike
D	Dissolved	MSD	Matrix Spike Duplicate
EB	Equipment Blank	NaOH	Sodium Hydroxide
FD	Field Duplicate	QC	Quality Control
FS	Field Sample	RCRA	Resource Conservation and Recovery Act
GEL	General Engineering Laboratories	SW	Surface Water Sample
GPC	Gross Proportional Counter	T	Total
GW	Groundwater Sample	TB	Trip Blank
H2SO4	Sulfuric Acid	TICs	Tentatively Identified Compounds
HCl	Hydrochloric Acid	VOC	volatile organic compound
HNO3	Nitric Acid	X	indicates parameter scheduled for analysis.
LSC	Liquid Scintillation Counter		
	Location of split sample collected for MassDEP		

**Table 2**  
**Field Parameter Measurements**

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**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

	Parameter	Conductivity	DO	Eh	pH	Temperature	Turbidity
	Units	µSiemens/cm	mg/L	mv	S.U.	Deg C	NTUs
Field Sample ID	Sample Date						
CFW-1	3/24/2016	0.026	5.6	87	7.8	4	--
CFW-5	3/24/2016	0.232	4.1	1	7.6	5	6.8
CFW-6	3/24/2016	0.088	3.1	117	6.9	6	1.6
MW-105B	3/23/2016	0.605	0.8	-67	8.0	11	0.6
MW-107C	3/23/2016	0.431	0.6	53	7.0	10	0.7
SW-1	3/24/2016	0.028	14.3	207	7.1	3	0.9
SW-4	3/24/2016	0.026	13.8	144	6.1	3	1.6
SW-5	3/24/2016	0.02	12.0	165	6.0	4	0.8

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Notes:

Deg C - Degrees Celsius

DO - dissolved oxygen

Eh - oxidation/reduction potential

µSiemens/cm - microseimens per centimeter

mg/L - milligrams per liter

mv - millivolts

NTUs - Nephelometric Turbidity Units

S.U. - Standard Units

-- = well was purged dry prior to sampling; turbidity was not recorded on the sampled water; value was 596 NTU's at end of purging

**Table 3**  
**Summary of Tritium Analytical Data and Trend Analysis**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

Location	Aug-03 pCi/L	Sep-03 pCi/L	Nov-03 pCi/L	Mar-04 pCi/L	May-04 pCi/L	Dec-06 pCi/L	Mar-07 pCi/L	Mar-08 pCi/L	Mar-09 pCi/L	Mar-10 pCi/L	Mar-12 pCi/L	Mar-14 pCi/L	Mar-16 pCi/L	Trend Analysis*
CFW-5	-		-		-	-	392	-	-					Not sampled this event
CFW-6	-		-		-	581	4000/4210	-	2440					Not sampled this event
MW-102D						6530	8580	1590	-	-				Not sampled this event
MW-104A						2850	3100/2930	1850	831/900	967/774	456 / -	- / -		Not sampled this event
MW-105B	4850		5220	4890	4530	2900	3440	4710	3490	3890	2500	1640	1460	Decrease
MW-106A						3010	- /2850	846	484	530	-	-		Not sampled this event
MW-107C		48000	45780	8880**	39020	29100	30900	25700	21300	20100	11400	8910	6330	Decrease
MW-107D		9150	9710	5940	10910	9310	9440	9380	8210	7280				Not sampled this event
MW-107E						5700	6420	5060 / 5160	4650	5470				Not sampled this event
MW-107F						9210	9220	9890	8150	8940				Not sampled this event
Monroe Dam									-	-	-	-		Not sampled this event
SP-1	-		-	210	890	1100	452	-	-	244	-	-	-	Not sampled this event
SW-011									-	-	-			Not sampled this event
SW-408									-	-	-			Not sampled this event

\* Trend analysis is based on a concentration change of greater than 15% from previous four events.

\*\* Result outside expected range and considered questionable. Subsequent results match conceptual site model.

967/774 - shows sample and duplicate sample

"-" signifies concentration less than minimum detectable activity

pCi/L - picocuries per liter

Prepared/Date: KMS 04/21/16

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**Table 4**  
**Summary of Chemical Data From SCFA Monitoring Wells**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

			Location Sample Date Sample ID Qc Code	CFW-1 8/7/2003 CFW-1-080703 FS	CFW-1 8/18/2004 CFW-1-081804 FS	CFW-1 8/19/2005 CFW-1-081905 FS	CFW-1 8/25/2005 CFW-1-082505 FS	CFW-1 9/18/2006 CFW-1-091806 FS	CFW-1 9/19/2006 CFW-1-091906 FS	CFW-1 3/15/2007 CFW-1-031507 FS	CFW-1 3/16/2007 CFW-1-031607 FS	CFW-1 3/25/2008 CFW-1 FS	CFW-1 3/11/2009 CFW-1 FS	CFW-1 3/3/2010 CFW-1 FS	CFW-1 3/8/2012 CFW-1 FS	CFW-1 3/5/2014 CFW-1 FS
Analysis	Parameter	MCP Criteria														
VOCs	4-Methyl-2-pentanone	0.35	-	-	0.0014 J	-	-	-	-	-	-	-	-	-	-	-
	Acetone	6.3	R	-	-	-	-	R	-	-	-	0.0027	-	-	-	-
	Chloromethane	NA	-	0.00069 J	0.0007 J	-	-	-	-	-	-	-	-	-	-	-
	Methylene chloride	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Naphthalene	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toluene	1	-	0.00043 J	-	-	-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barium	2	0.017	0.014	0.012	-	-	0.0451	-	0.0138	-	-	-	-	0.0248	0.0417
	Cadmium	0.005	-	-	-	-	-	-	-	0.0005 J	-	-	-	-	-	-
	Calcium	NA	-	-	-	-	-	-	-	1.83	1.5	1.7	1.3	1.9	2.51	-
	Chromium	0.1	-	-	-	-	-	0.0036 J	-	-	-	-	-	0.00263 J	0.00673 J	-
	Copper	1.3	-	-	-	-	-	0.0091	-	0.0026 J	-	-	-	0.00406	0.00752	-
	Iron	0.3*	<b>1.8</b>	<b>1.2 J</b>	<b>0.706 J</b>	-	-	<b>10.7</b>	-	<b>1.98</b>	<b>5.8 J</b>	<b>3.6 J</b>	<b>5.7</b>	<b>9.15</b>	<b>13.4</b>	-
	Lead	0.015	-	-	-	-	-	0.0056 J	-	0.0041 J	-	-	-	0.0012 J	0.002	-
	Manganese	0.05*	0.047	<b>0.11</b>	<b>0.0533</b>	-	-	<b>0.305</b>	-	<b>0.12</b>	<b>0.15</b>	<b>0.14</b>	<b>0.2</b>	<b>0.22</b>	<b>0.233</b>	-
	Mercury	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Selenium	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Silver	0.1	-	-	-	-	-	-	-	0.0013 J	-	-	-	-	0.00134	-
	Sodium	NA	-	-	-	-	-	-	-	1.28	0.94	-	0.81	0.958	0.935	-
	Zinc	5	-	-	-	-	-	-	-	0.0126	-	-	-	0.0142	0.0189	-
	Cyanide, Total	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total Alkalinity, as CaCO3	NA	6	5.1	7	-	-	5	-	7.14	3.4	3.4 J	4.6	5.64	4.07 J	-
Wet Chemistry	Chemical Oxygen Demand	NA	-	-	-	-	-	14.4	-	17.8	-	-	-	13.2 J	6.9 J	-
	Chloride	250*	-	-	-	-	-	-	0.67 J	-	-	-	-	0.6	0.594	-
	Nitrate as N	10	-	-	-	-	-	-	0.08 J	-	-	-	-	-	-	-
	Sulfate	250*	4.4 J	4.9	3.81 J	-	-	3.7	-	3.32	-	3.2	3.3	2.6	2.78	3.43
	Total Dissolved Solids	500*	-	4	22	-	13	-	29	-	12	46	1	-	15 J	8.57 J

Notes:  
All results in milligrams per liter (mg/L)  
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Applicable criteria is the MCP GW-1 standard (310 CMR 40.0974(2); effective 2/14/2008) and, if not available, the Maximum Contaminant Level or Secondary Maximum Contaminant Level (SMCL) (MADEP, 2007)  
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QC - Quality Control  
R - data rejected during validation; unusable  
VOCs - volatile organic compounds  
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**Table 4**  
**Summary of Chemical Data From SCFA Monitoring Wells**  
**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

			Location Sample Date Sample ID Qc Code	CFW-1 3/24/2016 CFW-1 FS	CFW-5 8/5/2003 CFW-5-080503 FS	CFW-5 3/22/2004 CFW-5-032204 FS	CFW-5 6/8/2004 CFW-5-060804 FS	CFW-5 8/18/2004 CFW-5-081804 FS	CFW-5 8/17/2005 CFW-5-081705 FS	CFW-5 9/13/2006 CFW-5-091306 FS	CFW-5 3/8/2007 CFW-5-030807 FS	CFW-5 3/26/2008 CFW-5 FS	CFW-5 3/26/2008 CFW-5 DUP FD	CFW-5 3/10/2009 CFW-5 FS	CFW-5 3/10/2009 CFW-5DUP FD	CFW-5 3/2/2010 CFW-5 FS
Analysis	Parameter	MCP Criteria														
VOCs	4-Methyl-2-pentanone	0.35		-			-	0.0006 J	-	-	-	-	-	-	-	-
	Acetone	6.3		-			-	-	R	-	-	-	-	-	-	-
	Chloromethane	NA		-			0.00069 J	0.0009 J	-	-	-	-	-	-	-	-
	Methylene chloride	0.005		-			-	-	-	-	-	-	-	-	-	-
	Naphthalene	0.14		-			-	-	-	-	-	-	-	-	-	-
	Toluene	1		-			-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	0.01		-			-	-	-	0.0063	-	-	-	-	-	-
	Barium	2		0.043			0.061	0.0612	0.0638	0.0537	-	-	-	0.051	0.052	0.053
	Cadmium	0.005		-			-	-	-	-	-	-	-	-	-	-
	Calcium	NA	2.79	-	19.3	21.4	-	-	-	29.1	16	15	28	28	28	28
	Chromium	0.1		-			-	-	-	-	-	-	-	-	-	-
	Copper	1.3		-			-	-	-	-	-	-	-	-	-	-
	Iron	0.3*	15.3	38	26.2	27.2	67	89.2	75.1	70.6	32 J	31 J	65 J	63 J	70	70
	Lead	0.015		-	R		-	-	0.0036 J	-	-	-	-	-	-	-
	Manganese	0.05*	0.346	3.5	2.42	2.58	4.4	4.16 J	4.62	4.28	1.9	1.8	3.7	3.7	3.8	3.8
	Mercury	0.002		-			-	-	-	-	-	-	-	-	-	-
	Selenium	0.05		-			-	-	0.007 J	-	-	-	-	-	0.021 J	0.021 J
	Silver	0.1		-			-	-	-	-	-	-	-	0.017	0.018	-
	Sodium	NA								3.71	1.8	1.6	-	-	-	2.9
	Zinc	5		-			-	-	-	-	-	-	-	-	-	-
	Cyanide, Total	0.2								-	-	-	-	0.012	0.012	-
Cyanide Wet Chemistry	Total Alkalinity, as CaCO3	NA	5.22	87	92.8	87.6	93	101	130	127	69	63	130 J	170 J	110	110
	Chemical Oxygen Demand	NA	38	26	20.8	23.7	32	27.3	36.9	51.9	18	17	35	30	29	29
	Chloride	250*		-			2.7	1.91	15.5 J	9.12	2.3	2.2	4.8	4.2	5.1 J	5.1 J
	Nitrate as N	10		-			-	-	-	0.04 J	-	-	-	-	-	-
	Sulfate	250*		1.2			1.2	0.58 J	-	0.44 J	2.3	2.3	-	-	-	-
	Total Dissolved Solids	500*		120			200	111	170	170	110	100	110	150	130 J	130 J

Notes:  
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**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

			Location Sample Date Sample ID Qc Code	CFW-5 3/2/2010 CFW-5 Dup FD	CFW-5 3/6/2012 CFW-5 FS	CFW-5 3/6/2012 CFW-5DUP FD	CFW-5 3/4/2014 CFW-5 FS	CFW-5 3/4/2014 CFW-5 DUP FD	CFW-5 3/24/2016 CFW-5 FS	CFW-5 3/24/2016 CFW-5 DUP FD	CFW-6 8/11/2003 CFW-6-081103 FS	CFW-6 8/18/2004 CFW-6-081804 FS	CFW-6 8/24/2005 FD001-082405 FD	CFW-6 8/24/2005 CFW-6-082405 FS	CFW-6 4/19/2006 CFW-6-042006 FS	CFW-6 9/13/2006 CFW-6-091306 FS
Analysis	Parameter	MCP Criteria														
VOCs	4-Methyl-2-pentanone	0.35	-	-	-	-	-	-	-	-	-	-	0.0009 J	0.0008 J	-	-
	Acetone	6.3	-	-	-	-	-	-	-	-	-	-	-	0.008 J	0.0026 J	R
	Chloromethane	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Methylene chloride	0.005	-	-	-	0.00159 J	0.00165 J	-	-	-	-	-	-	-	-	-
	Naphthalene	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Toluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barium	2	0.053	0.0681	0.0685 J	0.0487	0.0489	-	0.069	0.077	0.0641	0.0629	-	-	-	0.0544
	Cadmium	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Calcium	NA	27	31.9	33 J	28.3	28.7	19.3	21.4	-	-	-	-	-	-	0.0024 J
	Chromium	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Copper	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Iron	0.3*	71	85.5	86.4 J	45.7	47.4	26.2	27.2	67	51 J	71.5	71	-	-	64.6
	Lead	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0031 J
	Manganese	0.05*	3.7	5.32	5.36 J	3.61	3.76	2.42	2.58	8.8	6.9	7.65	7.54	-	-	6.69
	Mercury	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00018 J
	Selenium	0.05	0.022 J	-	-	-	-	-	-	-	-	-	-	-	-	0.0091 J
	Silver	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sodium	NA	2.9	3.11	2.95 J	2.36	2.29	-	-	-	-	-	-	-	-	-
	Zinc	5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0134
	Cyanide, Total	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total Alkalinity, as CaCO3	NA	140	R	152	136 J	139 J	92.8	87.6	100	110	136	116	-	-	108
Wet Chemistry	Chemical Oxygen Demand	NA	26	59.7	52.7	34.4	34.4	20.8	23.7	38	33	30.1	31.8	-	-	35.1
	Chloride	250*	5 J	R	3.92	1.37	1.37	-	-	-	2.3	9.12	7.79	-	-	14.7 J
	Nitrate as N	10	-	R	-	-	-	-	-	-	-	-	-	-	-	0.04 J
	Sulfate	250*	-	R	0.557	0.226 J	0.249 J	-	-	-	-	-	-	-	-	-
	Total Dissolved Solids	500*	140 J	R	180	163	190	-	-	180	200	204	214	-	-	147

Notes:  
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**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

Analysis	Parameter	MCP Criteria	Location Sample Date Sample ID Qc Code	CFW-6 9/13/2006 FD001-091306 FD	CFW-6 3/8/2007 CFW-6-030807 FS	CFW-6 3/8/2007 FD007-030807 FD	CFW-6 3/25/2008 CFW-6 FS	CFW-6 3/10/2009 CFW-6 FS	CFW-6 3/2/2010 CFW-6 FS	CFW-6 3/6/2012 CFW-6 FS	CFW-6 3/6/2012 CFW-6 FS	CFW-6 3/5/2014 CFW-6 FS	CFW-6 3/24/2016 CFW-6 FS
VOCs	4-Methyl-2-pentanone	0.35		-	-	-	-	-	-	-	-	-	
	Acetone	6.3		R	-	-	-	-	-	-	-	-	
	Chloromethane	NA		-	-	-	-	-	-	-	-	-	
	Methylene chloride	0.005		-	-	-	-	0.00071 J	-	-	-	-	
	Naphthalene	0.14		-	-	-	-	-	-	-	-	-	
	Toluene	1		-	-	-	-	-	-	-	-	-	
Metals	Arsenic	0.01		-	0.0054 J	0.0049 J	-	-	-	-	-	-	
	Barium	2		0.0592	0.0612	0.0592	-	-	-	0.0602	0.0647	0.0647	
	Cadmium	0.005		-	0.0005 J	0.0002 J	-	-	-	-	0.000135 J	0.000135 J	
	Calcium	NA		-	25.5	25.4	7.4	14	14	16.7	15.9	15.9	9.34
	Chromium	0.1		0.0027 J	0.0022 J	0.0028 J	-	-	-	-	-	-	
	Copper	1.3		-	-	-	-	-	-	-	-	-	
	Iron	0.3*		<b>68.1</b>	<b>56.8</b>	<b>58.8</b>	<b>0.57 J</b>	<b>39 J</b>	<b>20</b>	<b>67.1</b>	<b>35.5</b>	<b>35.5</b>	<b>4.64</b>
	Lead	0.015		0.003 J	0.0029 J	-	-	-	-	-	-	-	
	Manganese	0.05*		<b>7.2</b>	<b>6.74</b>	<b>6.8</b>	<b>0.2</b>	<b>3.6</b>	<b>2.9</b>	<b>4.93</b>	<b>3.74</b>	<b>3.74</b>	<b>1.33</b>
	Mercury	0.002		-	0.00006 J	-	-	-	-	-	-	-	
	Selenium	0.05		0.0101 J	-	-	-	-	-	-	-	-	
	Silver	0.1		-	-	-	-	0.013	-	-	-	-	
	Sodium	NA		-	1.56	1.52	1.3	-	2.7	5.05	4	4	
	Zinc	5		-	-	0.0056	-	-	-	-	0.00581 J	0.00581 J	
	Cyanide, Total	0.2		-	-	-	-	-	-	0.00412 J	-	-	
Wet Chemistry	Total Alkalinity, as CaCO3	NA		131	100	128	17	100 J	71	126	108 J	108 J	26.1
	Chemical Oxygen Demand	NA		36.4	26.3	51.9	27	23	12	59.7	39.4	39.4	40.8
	Chloride	250*		16.1 J	12.5	11.8	-	3.2	2.7 J	1.53	0.911	0.911	
	Nitrate as N	10		-	0.04 J	0.04 J	-	-	-	-	-	-	
	Sulfate	250*		-	0.7 J	0.68 J	4.7	5.8	4.3 J	0.755	1.49	1.49	
	Total Dissolved Solids	500*		172	189	181	33	77	89 J	187	130	130	

Notes:

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**Table 5**  
**Summary of Chemical Data for SCFA Surface Water Locations**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

			Location Sample Date Sample ID Qc Code	SW-1 3/25/2008 SW-1 FS	SW-1 3/10/2009 SW-1 FS	SW-1 3/3/2010 SW-1 FS	SW-1 3/8/2012 SW-1 FS	SW-1 3/5/2014 SW-1 FS	SW-1 3/24/2016 SW-1 FS	SW-2 3/25/2008 SW-2 FS
Analysis	Param Name	Screening Values								
VOCs	Methylene chloride	0.005	-	-	-	-	-	-	-	-
	1,4-Dioxane	0.0003	-	-	-	-	-	-	-	-
Metals	Barium	1	-	-	-	0.0123	0.00967	0.00796	-	-
	Calcium	NA	2.5	2.2	2.6	2.39	2.84	1.96	2.3	-
	Chromium	0.1	-	-	-	-	0.00215 J	-	-	-
	Iron	0.3*	0.016 J	0.064 J	0.032	0.133	-	-	0.021 J	-
	Manganese	0.05*	-	-	-	0.0144	0.0202	0.00312 J	-	-
	Sodium	NA	1.1	-	0.78	0.878	1.1	-	1.1	-
	Zinc	5	-	-	-	0.00451 J	-	-	-	-
Cyanide	Cyanide, Total	0.004	-	-	-	-	-	-	-	-
Wet Chemistry	Total Alkalinity, as CaCO3	NA	1.9	2.3	5.4	2.57	4.07 J	3.13	1.1	-
	Chemical Oxygen Demand	NA	-	-	-	-	-	18 J	-	-
	Chloride	250*	-	-	-	0.591	0.47	-	-	-
	Nitrate as N	10	-	-	-	0.25	0.14	-	-	-
	Sulfate	250*	5	4.2	5.5	4.97	5.91	-	5	-
	Total Dissolved Solids	500	21	5	19 J	20	4.29 J	-	54	-

Notes:

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Screening value is the USEPA Ambient Water Quality Criteria

(AWQC) and, if not available, the Maximum Contaminant

Level or Secondary Maximum Contaminant Level (MADEP, 2007)

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**Table 5**  
**Summary of Chemical Data for SCFA Surface Water Locations**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
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**Rowe, Massachusetts**

			Location	SW-2	SW-2	SW-2	SW-2	SW-3	SW-3	SW-3
			Sample Date	3/10/2009	3/3/2010	3/8/2012	3/4/2014	3/25/2008	3/10/2009	3/3/2010
			Sample ID	SW-2	SW-2	SW-2	SW-2	SW-3	SW-3	SW-3
			Qc Code	FS	FS	FS	FS	FS	FS	FS
Analysis	Param Name	Screening Values								
VOCs	Methylene chloride	0.005	-	-	-	0.00151 J	-	-	-	
	1,4-Dioxane	0.0003								
Metals	Barium	1	-	-	0.0107	0.0108	-	-	-	
	Calcium	NA	2.1	2.5	1.89	2.25	2.2	2	2.4	
	Chromium	0.1	-	-	-	-	-	-	-	
	Iron	0.3*	0.063 J	0.037	0.0483 J	-	0.029 J	0.061 J	<b>0.5</b>	
	Manganese	0.05*	-	-	0.00437 J	0.00835	-	-	<b>0.074</b>	
	Sodium	NA	-	0.8	0.675	0.857	1.1	-	0.6	
	Zinc	5	-	-	0.00491 J	0.00356 J	-	-	-	
Cyanide	Cyanide, Total	0.004	-	-	-	-	-	-	-	
Wet Chemistry	Total Alkalinity, as CaCO3	NA	2.1	5.4	2.05	-	-	1.7	5.6	
	Chemical Oxygen Demand	NA	-	-	-	11.9 J	-	-	-	
	Chloride	250*	-	-	0.556	0.571	-	-	-	
	Nitrate as N	10	-	-	0.227	0.0937 J	-	-	-	
	Sulfate	250*	5.4	5.5	4.26	5.22	5.9	5.3	4.8	
	Total Dissolved Solids	500	16	19 J	15.7	5.71 J	8	26	13 J	

Notes:

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Screening value is the USEPA Ambient Water Quality Criteria

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**Summary of Chemical Data for SCFA Surface Water Locations**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
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**Rowe, Massachusetts**

			Location	SW-3	SW-3	SW-4	SW-4	SW-4	SW-4	SW-4
			Sample Date	3/8/2012	3/4/2014	3/25/2008	3/10/2009	3/2/2010	3/6/2012	3/4/2014
			Sample ID	SW-3	SW-3	SW-4	SW-4	SW-4	SW-4	SW-4
			Qc Code	FS	FS	FS	FS	FS	FS	FS
Analysis	Param Name	Screening Values								
VOCs	Methylene chloride	0.005	-	0.00173 J	-	-	-	-	-	-
	1,4-Dioxane	0.0003								
Metals	Barium	1	0.0106	0.0103	-	-	-	0.0142	0.0118	
	Calcium	NA	1.95	2.54	2.6	2.2	2.4	3.12	3.04	
	Chromium	0.1	-	-	-	-	-	-	-	
	Iron	0.3*	<b>0.362</b>	<b>0.514</b>	<b>1.1 J</b>	<b>0.55 J</b>	<b>0.9</b>	<b>2.08</b>	<b>1.81</b>	
	Manganese	0.05*	0.0242	<b>0.0661</b>	<b>0.14</b>	<b>0.076</b>	<b>0.13</b>	<b>0.24</b>	<b>0.212</b>	
	Sodium	NA	0.654	0.893	1.1	-	0.65	0.96	0.967	
	Zinc	5	0.00362 J	-	-	-	-	0.00456 J	-	
Cyanide	Cyanide, Total	0.004	-	-	-	-	-	-	-	
Wet Chemistry	Total Alkalinity, as CaCO3	NA	3.08	5.6 J	3.5	2.9	6.5	6.67	8.14 J	
	Chemical Oxygen Demand	NA	-	19.4 J	-	-	-	13.2 J	-	
	Chloride	250*	0.553	0.673	-	-	-	0.711	0.61	
	Nitrate as N	10	0.228	0.0986 J	-	-	-	0.205	0.0932 J	
	Sulfate	250*	4.28	5.13	5.1	5.2	4.8 J	4.79	5.05	
	Total Dissolved Solids	500	8.57 J	4.29 J	19	35	11 J	28.6	15.7	

Notes:

All results in milligrams per liter (mg/L)

Screening value is the USEPA Ambient Water Quality Criteria

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**Rowe, Massachusetts**

			Location	SW-4	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5
			Sample Date	3/24/2016	3/25/2008	3/10/2009	3/2/2010	3/6/2012	3/4/2014	3/24/2016
			Sample ID	SW-4	SW-5	SW-5	SW-5	SW-5	SW-5	SW-5
			Qc Code	FS	FS	FS	FS	FS	FS	FS
Analysis	Param Name	Screening Values								
VOCs	Methylene chloride	0.005	-	-	-	-	-	-	-	-
	1,4-Dioxane	0.0003	-	-	-	-	-	-	-	-
Metals	Barium	1	0.0107	-	-	-	-	0.0126	0.0105	0.00999
	Calcium	NA	2.05	2.3	2.2	2	2.77	2.33	1.8	
	Chromium	0.1	-	-	-	-	-	-	-	-
	Iron	0.3*	<b>0.774</b>	0.26 J	<b>0.48 J</b>	0.27	<b>1.52</b>	<b>0.496</b>	0.265	
	Manganese	0.05*	<b>0.107</b>	0.04	<b>0.071</b>	0.044	<b>0.141</b>	<b>0.0657</b>	0.04	
	Sodium	NA		1	-	0.6	0.883	0.859		
	Zinc	5		-	-	-	-	-		
	Cyanide, Total	0.004		-	-	-	-	-		
Wet Chemistry	Total Alkalinity, as CaCO3	NA	3.65	1.5	2.7	4.3	13.9	3.56 J	2.09	
	Chemical Oxygen Demand	NA	-	-	-	-	13.2 J	31.9	29.4	
	Chloride	250*		-	-	-	0.662	0.526		
	Nitrate as N	10		-	-	-	0.195	0.087 J		
	Sulfate	250*		5	5.3	4.2 J	4.67	4.72		
	Total Dissolved Solids	500		31	3	4 J	20	37.1		

Notes:

All results in milligrams per liter (mg/L)

Screening value is the USEPA Ambient Water Quality Criteria

(AWQC) and, if not available, the Maximum Contaminant

Level or Secondary Maximum Contaminant Level (MADEP, 2007)

\* indicates criteria is from the Secondary Maximum

Contaminant Level; not a health-based standard

FS - Field Sample

J - estimated value

NA - Not Available

QC - Quality Control

VOCs - volatile organic compounds

"-" indicates analyte not detected

**Table 6**  
**Monitoring Well Status Update April 2016**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

Well ID	Well Diameter	Well Depth (feet)	Protection	Is Well Located in BUD?	Is Well Located in BUDFA?	Surrounding Area	Well Status as of April 2016
CB-3R	2 inch	21	Standpipe	Yes	No	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
CB-4	2.25 inch	20	Road box	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
CB-6	2 inch	27	Standpipe	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
CB-8	2.5 inch	24.5	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
CW-5R	2 inch	23	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
CW-10	2 inch	31.5	Standpipe	Yes	No	Topsoil, grass seed	Decommissioning activities completed in 2010
CFW-1	2 inch	8	Standpipe	No	No	Topsoil, grass seed	Part of long-term monitoring program
CFW-5	2 inch	5	Standpipe	No	No	Topsoil, grass seed	Part of long-term monitoring program
CFW-6	2 inch	6	Standpipe	No	No	Topsoil, grass seed	Part of long-term monitoring program
HA-1	Unknown	18	Standpipe	Yes	No	Topsoil, grass seed	Proposed for grouting 2012 but well could not be located. It is believed that it was a temporary well and was previously removed.
MW-6R	2 inch	22	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-100A	2 inch	20	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-100B	2 inch	43	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-101A	2 inch	25	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-101B	2.25 inch	156	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-101C	2 inch	99	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-102A	2 inch	39	Standpipe	Yes	Yes	Topsoil, grass seed	Leave for possible future sampling
MW-102B	2 inch	131.5	Standpipe	Yes	Yes	Topsoil, grass seed	Leave for possible future sampling
MW-102C	2 inch	99	Standpipe	Yes	Yes	Topsoil, grass seed	Leave for possible future sampling
MW-102D	2 inch	21	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-103A	2 inch	26	Standpipe	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-103B	2.25 inch	295	Standpipe	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-103C	2 inch	125	Standpipe	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-104A	2 inch	20	Standpipe	Yes	No	Topsoil, grass seed	Leave for possible future sampling
MW-104B	2.25 inch	194.5	Standpipe	Yes	No	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-104C	2.25 inch	99	Standpipe	Yes	No	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-104D	2 inch	45	Standpipe	Yes	No	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-105A	2 inch	20	Standpipe	Yes	No	Topsoil, grass seed	Leave for possible future sampling
MW-105B	2 inch	75	Standpipe	Yes	No	Topsoil, grass seed	Part of long-term monitoring program
MW-105C	2 inch	45	Standpipe	Yes	No	Topsoil, grass seed	Leave for possible future sampling
MW-106A	2 inch	22	Road box	No	No	Topsoil, grass seed	Leave for possible future sampling
MW-106B	2.25 inch	265	Road box	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-106C	2 inch	95	Road box	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-106D	2.25 inch	155	Road box	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-107A	2 inch	25	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-107B	2.25 inch	110	Standpipe	Yes	Yes	Topsoil, grass seed	Leave for possible future sampling
MW-107C	2 inch	32	Standpipe	Yes	Yes	Topsoil, grass seed	Part of long-term monitoring program

**Table 6**  
**Monitoring Well Status Update April 2016**

**Post Closure Groundwater and Surface Water Monitoring Report Spring 2016**  
**Yankee Nuclear Power Station**  
**Rowe, Massachusetts**

Well ID	Well Diameter	Well Depth (feet)	Protection	Is Well Located in BUD?	Is Well Located in BUDFA?	Surrounding Area	Well Status as of April 2016
MW-107D	2 inch	81.2	Standpipe	Yes	Yes	Topsoil, grass seed	Leave for possible future sampling
MW-107E	2 inch	60	Standpipe	Yes	Yes	Topsoil, grass seed	Leave for possible future sampling
MW-107F	2 inch	57	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-108A	2 inch	25	Standpipe	Yes	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-108B	2.25 inch	215	Standpipe	Yes	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-108C	2 inch	170	Standpipe	Yes	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-109A	2 inch	20	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-109B	2.25 inch	190	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-109C	2 inch	55	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-109D	2 inch	113	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2010
MW-110A	2 inch	30	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-110B	2 inch	110	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-110C	2 inch	51	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-110D	2 inch	88	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-111A	2 inch	23	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-111B	2 inch	80	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-111C	2 inch	37	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-112A	2 inch	26	Standpipe	Yes	Yes	Topsoil, grass seed	Monitoring well grouted to the surface in 2012
MW-113A	2 inch	25	Road box	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010
MW-113C	2 inch	90	Road box	No	No	Topsoil, grass seed	Decommissioning activities completed in 2010

Notes:

BUD = Beneficial Use Determination

BUDFA = Beneficial Use Determination Fill Area

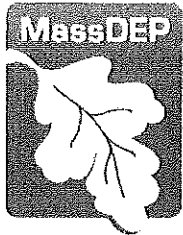
Created by MV 7/10/12

Updated and Checked by ESS 04/26/16

## **APPENDIX A**

**MassDEP LETTER TO YNPS DATED FEBRUARY 23, 2016, “ROWE – DSWM-16-253-009**

**MassDEP – APPROVAL MINOR MODIFICATION PERMIT POST-CLOSURE  
ENVIRONMENTAL MONITORING 310 CMR 19.000”**



Commonwealth of Massachusetts  
Executive Office of Energy & Environmental Affairs

## Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker  
Governor

Karyn E. Polito  
Lieutenant Governor

Matthew A. Beaton  
Secretary

Martin Suuberg  
Commissioner

Yankee Atomic Electric Company  
49 Yankee Rd  
Rowe, MA 01367  
Attention: Brian Smith, ISFSI Manager

**FEB 23 2016**

RE: Rowe-DSWM-16-253-009  
MassDEP - **Approval**  
Minor Modification Permit  
Post-Closure Environmental Monitoring  
310 CMR 19.000  
Yankee Nuclear Power Station  
49 Yankee Road

Dear Mr. Smith:

On January 13, 2016, the Massachusetts Department of Environmental Protection (MassDEP) received the Minor Modification Permit application (the application), entitled "Proposed 2015 Revisions to the Groundwater and Surface Water Monitoring Program", for the former Yankee Nuclear Power Station (YNPS) in Rowe, MA. The application was prepared by Ransom Consulting, Inc. (Ransom) on behalf of Yankee Atomic Electric Company (Yankee), the owner of the YNPS. The application proposes to amend the June 19, 2007 MassDEP approval of the Final Post-Closure Groundwater Monitoring Plan (the Groundwater Monitoring Plan) for the YNPS, which addressed environmental monitoring at the Beneficial Use Determination (BUD) Fill Area (the former industrial area) and the Southeast Construction Fill Area (SCFA), in accordance with MassDEP's Solid Waste Regulations at 310 CMR 19.000.

In accordance with 310 CMR 19.142, the June 19, 2007 Groundwater Monitoring Plan approval required ongoing groundwater monitoring during the 30-year post-closure maintenance and monitoring period (which ends on June 19, 2037) at groundwater monitoring wells MW-104A, MW-105B, MW-106A, MW-107C, and Sherman Spring (SP-1) in the BUD Fill Area, and also at monitoring wells CFW-1, CFW-5, and CFW-6 in the SCFA. On December 6, 2011, MassDEP issued correspondence to Yankee, which approved the decommissioning of numerous additional groundwater monitoring wells at the YNPS, but which required Yankee to retain, maintain and preserve monitoring wells MW-102A, MW-102B, MW-102C, MW-105A, MW-105C, MW-107B, MW-107D, and MW-107E throughout the 30-year post-closure maintenance and monitoring period.

### Proposed Modifications

The application proposes the following modifications to the June 19, 2007 Groundwater Monitoring Plan



approval:

1. Discontinue all groundwater monitoring in the BUD Fill Area, except continue monitoring for tritium only, in monitoring well MW-107C and Sherman Spring, every five years.
2. Abandon and properly decommission all remaining groundwater monitoring wells in the BUD Fill Area, i.e. MW-102A, MW-102B, MW-102C, MW-105A, MW-105C, MW-107B, MW-107D, and MW-107E. Decommissioning will include grouting the full depth of each well, in accordance with MassDEP's "Standard References for Monitoring Wells, Policy #WSC-310-91, dated April, 1991" (Standard References).
3. Discontinue surface water sampling at the Deerfield River (upstream/SW-408, and downstream/Monroe Dam), Sherman Reservoir (SW-011), and locations SW-2 and SW-3 on Wheeler Brook.
4. Continue monitoring at the SCFA of groundwater monitoring wells CFW-1, CFW-5, & CFW-6 and surface water locations SW-1, SW-4, & SW-5 in Wheeler Brook every five years, but reduce monitoring parameters to: dissolved oxygen, oxidation/reduction potential, specific conductance, temperature and turbidity (as field parameters); and alkalinity, calcium, iron, manganese, and chemical oxygen demand (as laboratory parameters).

Ransom states that the proposed reductions in environmental monitoring are justified based on monitoring results to date. Ransom states that the next monitoring event is scheduled for 2019, however MassDEP notes that the actual scheduled monitoring events, according to the Groundwater Monitoring Plan, are 2016, 2021, 2026, 2031, and 2036.

#### MassDEP Determinations

MassDEP has reviewed the Minor Modification permit application in accordance with MGL c. 111 s. 150A, MGL c. 30A, the Massachusetts Solid Waste Regulations 310 CMR 19.000, the MassDEP's publication Landfill Technical Guidance Manual (the LAC), revised in May, 1997, and the MassDEP's publication Standard References for Monitoring Wells (WSC-310-91). MassDEP approves the Minor Modification permit application in accordance with the regulations at 310 CMR 19.000, subject to the following conditions and requirements.

1. Yankee shall perform environmental monitoring at the YNPS site in accordance with this Modification Permit approval during 2016, 2021, 2026, 2031, and 2036. MassDEP may, in writing, extend or shorten the 30-year post-closure monitoring period, or modify the post-closure monitoring requirements, if deemed appropriate based on protection of public health, safety, and the environment.
2. Except as modified by the conditions of this approval, Yankee shall also comply with the requirements of: MassDEP's Corrective Action Design (CAD) and Closure Certification permit approvals for the SCFA; MassDEP's June 19, 2007 Revised Beneficial Use Determination (BUD) for Structures permit approval; and the MassDEP's review of the Final BWSC Phase II Assessment for the YNPS site, including the Final Risk Assessment.
3. All environmental monitoring shall be performed by a qualified, independent consultant experienced in the solid waste field, in accordance with 310 CMR 19.132 and MassDEP's publication Standard References for Monitoring Wells (WSC-310-91).
4. Groundwater monitoring wells shall be sampled in accordance with the procedures outlined in the MassDEP's publication Standard References for Monitoring Wells (WSC-310-91). Sampling can alternatively be performed in accordance with the USEPA publication Low

Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, dated July 30, 1996.

5. Quality Assurance/Quality Control Plan (QA/QC) protocols for all environmental monitoring should generally follow those outlined in the MassDEP's LAC Manual and Standard References manuals.
6. Groundwater monitoring wells MW-105B, MW-107C, CFW-1, CFW-5, & CFW-6, and surface water locations SW-1, SW-4, SW-5 and Sherman Spring shall be sampled during 2016, 2021, 2026, 2031, and 2036. Monitoring wells MW-105B, MW-107C, CFW-1, CFW-5, & CFW-6 shall be protected from damage, and shall be visually inspected and equipped with a new lock during each monitoring event.
7. Groundwater samples from monitoring wells MW-105B and MW-107C shall be analyzed for tritium, as a Hard-to-Detect (HTD) radionuclide.
8. Groundwater samples from monitoring wells CFW-1, CFW-5, and CFW-6 shall be analyzed for dissolved oxygen, oxidation/reduction potential, specific conductance, temperature and turbidity (as field parameters); and alkalinity, calcium, iron, manganese, and chemical oxygen demand (as laboratory parameters).
9. Surface water samples from Sherman Spring shall be analyzed for Dissolved RCRA 8 metals, volatile organic compounds (VOCs) by EPA Method 8260, radionuclides by gamma spectroscopy, and also for the HTD radionuclides tritium and Sr-90. Radiological analyses by gamma spectroscopy shall at a minimum quantify the radionuclides Ag-108m, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, Nb-94, and Sb-125. In addition, any other plant-related radionuclides detected by gamma spectroscopy above MDAs shall be reported as part of these analyses.
10. Surface water samples from surface water locations SW-1, SW-4, and SW-5 shall be analyzed for: dissolved oxygen, oxidation/reduction potential, specific conductance, temperature and turbidity (as field parameters); and Dissolved RCRA 8 metals, VOCs by EPA Method 8260, alkalinity, calcium, iron, manganese, and chemical oxygen demand (as laboratory parameters).
11. All VOC analyses by EPA Method 8260 shall be performed as outlined in 310 CMR 19.132(h)(1-3), specifically methyl ethyl ketone, methyl isobutyl ketone, acetone, and 1,4-dioxane shall be included, and unknown peaks having intensities greater than 5 times the background intensity shall be identified (Tentatively Identified Compounds, or TICs). As outlined at 310 CMR 19.132(i), detection limits for all parameters tested in groundwater samples shall be at or below the Massachusetts Drinking Water Standards & Guidelines (Maximum Contaminant Levels, or MCLs), including the 1,4-dioxane MCL of 0.3 micrograms/liter (ug/l).
12. Yankee shall submit the results of all groundwater monitoring data to MassDEP within 45 days of the date of sampling.
13. Yankee shall ensure that certified, third-party operations & maintenance (O&M) inspections of the BUD Fill Area and SCFA are completed once every two years, in accordance with 310 CMR 19.018, and that third-party inspection reports are submitted to MassDEP within 30 days of the date of the inspection.

14. MassDEP reserves the right to modify this approval at any time, based on its review of the results of monitoring data, or should MassDEP otherwise determine that additional environmental monitoring is required to protect public health, safety or the environment.
15. MassDEP and its agents and employees shall have the right to enter upon the YNPS site at reasonable times and with reasonable notice, to inspect the groundwater monitoring network, and to otherwise monitor compliance with this Approval and other MassDEP environmental laws and regulations.

Pursuant to 310 CMR 19.033(5), any person aggrieved by the issuance of this approval, except as provided for under 310 CMR 19.033(4)(b), may file an appeal for judicial review of said decision in accordance with the provisions of M.G.L. c. 111, s. 150A and C. 30A not later than thirty [30] days following the date of issuance of this decision. The standing of a person to file an appeal and the procedures for filing such appeal shall be governed by the provisions of M.G.L. c. 30 A. Unless the person requesting an appeal requests and is granted a stay of the terms and conditions of the permit by a court of competent jurisdiction, the final permit decision shall be effective in accordance with 310 CMR 19.033(3).

Any aggrieved person intending to appeal the decision to the superior court shall first provide notice to the MassDEP of said intention to commence such action. Said Notice of Intention shall include the MassDEP File Number (16-253-009) and shall identify with particularity the issues and reason(s) why it is believed the approval decision was not proper. Such notice shall be provided to the Office of General Counsel of the MassDEP and the Regional Director for the regional office which made the decision, at least five days prior to the filing of an appeal. The appropriate addresses to which to send such notices are:

General Counsel  
MassDEP of Environmental Protection  
One Winter Street-Third floor  
Boston, MA 02108

&

Regional Director  
MassDEP of Environmental Protection  
436 Dwight Street - 5th Floor  
Springfield, MA 01103

No allegation shall be made in any judicial appeal of this decision unless the matter complained of was raised at the appropriate point in the administrative review procedures established in 310 CMR 19.000, provided that a matter may be raised upon a showing that it is material and that it was not reasonably possible with due diligence to have been raised during such procedures or that matter sought to be raised is of critical importance to the public health or environmental impact of the permitted activity.

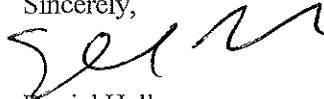
The MassDEP reserves the right to require additional investigatory or remedial work at the YNPS site, including alternative remedial measures, if continued monitoring results indicate such a need. This approval pertains only to the solid waste management aspects of the proposal and does not negate the responsibilities of the owners or operators to comply with any other local, state or federal laws and regulations now or in the future.

Yankee Nuclear Power Station - Rowe  
Monitoring Modification Permit Approval

5

If you have any questions concerning this matter, please contact the undersigned of this office, at #413-755-2280, or Larry Hanson of this office, at #413-755-2287.

Sincerely,



Daniel Hall  
Section Chief  
Solid Waste Management

DH/LGH/lgh

Word:yankeemonmod216

Certified Mail, #7011 0470 0001 8408 0225

cc: Rowe Board of Selectmen  
Rowe Board of Health  
MA DPH – Radiation Control Program – Michael Whalen  
USEPA, Region 1  
NRC  
DEP/WERO – Michael Gorski, David Howland, Eva Tor  
Franklin Regional Council of Governments  
Citizens Awareness Network – Deborah Katz

## **APPENDIX B**

### **FIELD DATA RECORDS – MARCH 2016**

GROUND WATER SAMPLING FIELD LOG (SAMPLE)

Form 1

PAGE 1 OF 2

Sample Location MW-105B Well Designation MW-105B  
Sampling Team TOM LONGLEY Sample Period MARCH 2016  
Date 3-23-16 Time 12:50 - 15:30

Measuring Point <u>TOR</u>	Depth to Mid Screen <u>—</u> (ft)
Well Depth (from measuring point) (D) <u>75.52</u>	Diameter of Well <u>2.0</u> (in)
Depth to water (DTW) <u>21.87</u>	<u>21.87</u> <u>75.52</u> (ft)
Length of Water Column (LWC) <u>53.65</u>	(ft) (LWC=D-DTW)
Volume of Water in Well (VW) <u>8.58</u>	gal Conversion Factor <u>0.16</u>
Volume of Purge (VTP) (VTP = VW x 3) <u>25.75</u>	(gal)

At Time of Measurements:

Color <u>CLEAR</u>	Odor <u>NONE</u>
Total volume purged <u>3.7 GALLONS</u>	Duration of purging <u>140 min.</u>
Purging method <u>BLADDER PUMP</u>	Did well go dry? <u>NO</u>
Weather conditions <u>PTLY. SUNNY, WINDY, 50's</u>	

Pump Serial Number 9982 SET AT ~65.5' BTOR  
Water Quality Monitor Serial Number M015-13/10E100323/YSI 556 MPS  
Analyses Requested TRITIUM (250ml, AG, None) LSC/HARD TO DETECT  
NTN METER: HACH 2100Q/M024-37

Previous Final Readings: pH 7.43 Cond 0.65 Turb 1.60 DO 0.39 Temp 6.16 ORP -119.4 DTW 29.46 Flow 100 ml/min.

13:05 STOP PURGE  
13:15 AT 100ml/min. rate

## WATER QUALITY PARAMETERS (SAMPLE)

13:05 START PURGE: Got it To 100ml/min. Form 2

PAGE 2 OF 2

Sample Round <u>MARCH 2016</u>								
<u>3-23-16</u>			Current Readings					
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments
0	+/- 0.1 std. unit	+/- 3%	+/- 10% NA <10NTU	+/-10%	+/- 1 E	+/-10 mv		PURGE RATE ml/min.
13:20 <del>13:20</del> 5	8.35	0.602	12.7	7.94	10.68	-85.1	24.29	100 ml/min.
13:25 <del>13:25</del> 10	8.36	0.614	11.7	5.32	10.42	-87.1	24.60	100
13:30 <del>13:30</del> 15	8.37	0.619	14.8	3.59	10.46	-91.9	24.97	100
13:40 <del>13:40</del> 20	8.32	0.621	9.97	2.98	10.36	-87.5	25.31	100
13:45 <del>13:45</del> 25	8.26	0.623	7.69	2.61	10.29	-83.8	25.61	100
13:50 <del>13:50</del> 30	8.20	0.621	5.35	2.28	10.44	-82.0	25.90	100
13:55 <del>13:55</del> 35	8.17	0.618	3.68	2.06	10.60	-82.7	26.15	100
14:00 <del>14:00</del> 40	8.09	0.616	3.09	1.91	10.63	-81.8	26.35	100
14:05 <del>14:05</del> 45	8.08	0.613	2.37	1.81	10.78	-83.6	26.51	100
14:10 <del>14:10</del> 50	8.04	0.612	1.92	1.70	10.88	-85.3	26.63	100
14:15 <del>14:15</del> 55	8.03	0.610	1.78	1.48	10.78	-86.1	26.78	100 ml/min. purge rate
14:20 <del>14:20</del> 60	8.01	0.609	1.51	1.36	10.70	-83.1	26.90	100
14:25 <del>14:25</del> 65	8.00	0.609	1.42	1.28	10.63	-81.3	26.90	100
14:30 <del>14:30</del> 70	8.00	0.609	1.22	1.22	10.49	-78.4	27.10	100
14:35 <del>14:35</del> 75	8.00	0.607	0.98	1.19	10.56	-79.2	27.15	100
14:40 <del>14:40</del> 80	7.99	0.607	0.77	1.14	10.55	-75.7	27.25	100
14:45 <del>14:45</del> 85	8.01	0.606	0.82	1.12	10.48	-74.2	27.32	100
14:50 <del>14:50</del> 90	7.98	0.605	0.61	1.09	10.40	-70.9	27.42	100
14:55 <del>14:55</del> 95	7.98	0.605	0.83	1.05	10.40	-70.4	27.44	100
15:00 <del>15:00</del> 100	7.98	0.604	0.82	1.02	10.40	-71.6	27.50	100
15:05 <del>15:05</del> 105	7.96	0.605	0.72	1.00	10.41	-68.6	27.56	100
15:10 <del>15:10</del> 110	7.97	0.605	0.52	0.96	10.44	-68.9	27.60	100
15:15 <del>15:15</del> 115	7.96	0.605	0.58	0.92	10.44	-68.9	27.64	100
15:20 <del>15:20</del> 120	7.97	0.605	0.46	0.88	10.52	-67.8	27.68	100
15:25 <del>15:25</del> 125	7.95	0.605	0.66	0.85	10.52	-66.1	27.70	100
15:30 <del>15:30</del> 130	7.96	0.605	0.56	0.84	10.51	-67.4	27.70	100
15:35 <del>15:35</del> 135	Collect Sample							
140								
145			BOTTLE TIME OF 15:30					
150								
155								



GROUND WATER SAMPLING FIELD LOG (SAMPLE)

Form 1

Sample Location MW-107C Well Designation MW-107C  
Sampling Team RENE AUBE Sample Period MARCH 2016  
Date 3/23/16 Time 13-40 1340-1615

Measuring Point <u>TOP</u>	Depth to Mid Screen <u>—</u> (ft)
Well Depth (from measuring point) (D) <u>42.81</u>	Diameter of Well <u>2.0</u> (in)
Depth to water (DTW) <u>22.83</u>	(ft)
Length of Water Column (LWC) <u>19.98</u>	(ft) (LWC=D-DTW)
Volume of Water in Well (VW) <u>3.20</u>	gal Conversion Factor <u>0.16</u>
Volume of Purge (VTP) (VTP = VW x 3) <u>9.60</u>	(gal)

## At Time of Measurements:

Color CLEAR Odor NONE  
Total volume purged 3.53 Duration of purging 136 MIN  
Purging method BLADDER PUMP Did well go dry? NO  
Weather conditions MIXED SUN + CLOUDS, COOL, WINDY.

Pump Serial Number #9978  
Water Quality Monitor Serial Number M015-10  
Analyses Requested TRITIUM

Previous Final Readings: pH 6.92 Cond. 429 Turb. 2.01 DO 76 Temp. 6.66 ORP 53.4 DTW 22.83 Flow 100



WATER QUALITY PARAMETERS (SAMPLE)

Form 2

Sample Round		MARCH 2016							MW-107C
3/23/16		Current Readings							1340-1615
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments	
0	+/- 0.1	+/- 3%	+/- 10%	+/-10%	+/- 1 E	+/-10 mv		1350 BEGIN PURGE	
3/23/16	std. unit		NA <10NTU					100 ML/MN	
5									
1400	10	5.36	0.450	3.46	1.76	11.73	187.0	24.91	
1405	15	5.41	0.450	3.22	1.24	11.81	167.5	25.45	
1410	20	5.55	0.450	3.07	1.05	11.50	161.4	25.88	
1415	25	6.75	0.448	2.65	0.95	11.24	99.3	26.30	
1420	30	6.79	0.448	2.28	0.90	11.05	97.9	26.68	
1425	35	6.81	0.446	3.06	0.87	10.95	96.5	27.01	
1430	40	6.82	0.446	4.18	0.87	10.84	92.4	27.31	
1435	45	6.85	0.445	3.62	0.82	10.84	88.6	27.57	
1440	50	6.86	0.445	3.14	0.80	10.75	84.2	27.81	
1445	55	6.87	0.444	3.03	0.79	10.63	80.6	28.03	
1450	60	6.87	0.442	2.88	0.76	10.61	75.9	28.23	
1455	65	6.89	0.441	2.50	0.75	10.56	72.8	28.41	
1500	70	6.91	0.440	2.17	0.73	10.57	66.5	28.57	
1505	75	6.91	0.439	1.95	0.70	10.69	64.6	28.71	
1510	80	6.90	0.438	1.74	0.69	10.67	61.5	28.80	
1515	85	6.30	0.438	1.70	0.68	10.63	96.4	28.91	
1520	90	6.77	0.437	1.66	0.69	10.60	70.2	29.00	
1525	95	6.90	0.437	1.63	0.69	10.58	57.9	29.11	
1530	100	6.93	0.436	1.15	0.66	10.62	56.1	29.19	
1535	105	6.93	0.434	0.97	0.63	10.50	54.8	29.29	
1540	110	6.94	0.433	0.85	0.61	10.34	53.7	29.36	
1545	115	6.96	0.433	0.81	0.61	10.29	54.6	29.40	
1550	120	6.95	0.432	0.77	0.60	10.30	54.0	29.42	
1555	125	6.96	0.432	0.75	0.60	10.28	53.8	29.43	
1600	130	6.96	0.431	0.74	0.59	10.26	53.7	29.43	
1605	135	6.97	0.431	0.72	0.59	10.25	53.4	29.43	V
1606	140	COLLECT SAMPLES							
145									
150									
155									

GROUND WATER SAMPLING FIELD LOG (SAMPLE)

Form 1

Sample Location CFW-1 Well Designation CFW-1  
 Sampling Team RENE AUBE Sample Period MARCH 2016  
 Date 3/24/16 Time 0945 - 1545

Measuring Point <u>TOR</u>	Depth to Mid Screen <u>—</u> (ft)
Well Depth (from measuring point) (D) <u>8.90</u> (ft)	Diameter of Well <u>2.0</u> (in)
Depth to water (DTW) <u>3.17</u> (ft)	
Length of Water Column (LWC) <u>5.73</u> (ft) (LWC=D-DTW)	
Volume of Water in Well (VW) <u>0.92</u> gal	Conversion Factor <u>0.16</u>
Volume of Purge (VTP) (VTP = VW x 3) <u>2.76</u> (gal)	

## At Time of Measurements:

Color TURBID Odor NONE  
 Total volume purged DRY Duration of purging NA  
 Purging method GEO PUMP Did well go dry? YES  
 Weather conditions MIX SUN + CLOUDS, COLD, CALM

Pump Serial Number 5008-43 PPA  
 Water Quality Monitor Serial Number M015-1013  
 Analyses Requested CA, FE, MN - ALKALINITY - COD

Previous Final Readings: pH 6.75 Cond 204 Turb 37.3 DO 10.2 Temp 3.18 ORP 31.2 DTW 4.07 Flow NA



WATER QUALITY PARAMETERS

Form 2

Sample Round		Current Readings							
MARCH 2016								CFW-1	
3/24/16								0945-1545	
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments	
0	+/- 0.1	+/- 3%	+/- 10%	+/- 10%	+/- 1 E	+/- 10 mv		1000 BEGIN PURGIE	
3/24/16	std.unit		NA <10NTU					150 ML/MN *	
1005	5	7.86	0.028	10.2	42.38	4.14	132.1	4.60	
1010	10	7.78	0.026	12.3	25.42	3.79	128.8	5.16	
1015	15	7.75	0.025	14.8	14.22	3.55	120.6	5.72	
1020	20	7.83	0.030	59.0	9.35	3.30	100.5	6.28	
1025	25	7.90	0.031	90.1	6.93	3.31	79.9	6.84	
1030	30	7.87	0.029	177	6.04	3.43	71.6	7.40	
1035	35	7.82	0.028	323	5.80	3.55	76.8	8.08	
1040	40	7.76	0.026	596	5.62	3.78	86.7	8.85	✓
1042	45	WELL PURGED DRY. STOP PUMP, LET							
	50	WELL RECHARGE.							
1535	55	COLLECT SAMPLES.							
	60								
	65								
	70								
	75								
	80								
	85								
	90								
	95								
	100								
	105								
	110								
	115								
	120								

\* LOWEST POSSIBLE PURGE RATE

GROUND WATER SAMPLING FIELD LOG (SAMPLE)Form 1

Sample Location CFW-5 Well Designation CFW-5  
 Sampling Team RENE AUBE Sample Period MARCH 2016  
 Date 3/24/16 Time 1115-1300

Measuring Point <u>TOR</u>	Depth to Mid Screen <u>—</u> (ft)
Well Depth (from measuring point) (D) <u>8.10</u> (ft)	Diameter of Well <u>2.0</u> (in)
Depth to water (DTW) <u>4.69</u> (ft)	
Length of Water Column (LWC) <u>3.41</u> (ft) (LWC=D-DTW)	
Volume of Water in Well (VW) <u>0.55</u> gal	Conversion Factor <u>0.16</u>
Volume of Purge (VTP) (VTP = VW x 3) <u>1.65</u> (gal)	

At Time of Measurements:

Color <u>CLEAR</u>	Odor <u>NONE</u>
Total volume purged <u>2.22</u>	Duration of purging <u>61 MINS</u>
Purging method <u>GEO PUMP</u>	Did well go dry? <u>NO</u>
Weather conditions <u>MIXED SUN + CLOUDS, COLD, CALM</u>	

Pump Serial Number 5008-43  
 Water Quality Monitor Serial Number M015-13  
 Analyses Requested CA, FE, MN - ALKALINITY - COD

Previous Final Readings: pH 6.35 Cond 0.330 Turb 8.4 DO 0.48 Temp 2.59 ORP 10.6 DTW 5.27 Flow 1.65

WATER QUALITY PARAMETERS (SAMPLE)

Form 2

Sample Round <u>MARCH 2016</u> <u>CFW-5</u>								
<u>3/24/16</u> Current Readings <u>1115 - 1300</u>								
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments
0 <u>3/24/16</u>	+/- 0.1 std. unit	+/- 3%	+/- 10% NA <10NTU	+/-10%	+/- 1 E	+/-10 mv		<u>1135 BEGIN PURGE</u> <u>140 ML/MN *</u>
5								
<u>1145</u>	10	<u>7.69</u>	<u>0.217</u>	<u>48.9</u>	<u>7.29</u>	<u>5.61</u>	<u>-10.3</u>	<u>4.94</u>
<u>1150</u>	15	<u>7.72</u>	<u>0.219</u>	<u>39.0</u>	<u>3.43</u>	<u>5.62</u>	<u>-9.6</u>	<u>4.97</u>
<u>1155</u>	20	<u>7.72</u>	<u>0.221</u>	<u>28.7</u>	<u>2.83</u>	<u>5.58</u>	<u>-8.2</u>	<u>4.97</u>
<u>1200</u>	25	<u>7.70</u>	<u>0.223</u>	<u>25.0</u>	<u>2.94</u>	<u>5.51</u>	<u>-7.3</u>	<u>4.98</u>
<u>1205</u>	30	<u>7.68</u>	<u>0.225</u>	<u>22.2</u>	<u>3.56</u>	<u>5.53</u>	<u>-5.8</u>	<u>4.98</u>
<u>1210</u>	35	<u>7.66</u>	<u>0.227</u>	<u>19.6</u>	<u>4.11</u>	<u>5.54</u>	<u>-3.7</u>	<u>4.98</u>
<u>1215</u>	40	<u>7.65</u>	<u>0.230</u>	<u>15.5</u>	<u>4.25</u>	<u>5.40</u>	<u>-2.9</u>	<u>4.98</u>
<u>1220</u>	45	<u>7.64</u>	<u>0.230</u>	<u>11.3</u>	<u>4.27</u>	<u>5.28</u>	<u>-1.1</u>	<u>4.98</u>
<u>1225</u>	50	<u>7.62</u>	<u>0.231</u>	<u>8.25</u>	<u>4.19</u>	<u>5.22</u>	<u>-0.6</u>	<u>4.98</u>
<u>1230</u>	55	<u>7.62</u>	<u>0.232</u>	<u>7.00</u>	<u>4.14</u>	<u>5.23</u>	<u>0.1</u>	<u>4.98</u>
<u>1235</u>	60	<u>7.61</u>	<u>0.232</u>	<u>6.81</u>	<u>4.11</u>	<u>5.22</u>	<u>0.7</u>	<u>4.98</u>
<u>1236</u>	65	<u>COLLECT SAMPLES, DUP, MS, MSD</u>						<u>↓</u>
	70							
	75							
	80							
	85							
	90							
	95							
	100							
	105							
	110							
	115							
	120							
	125							
	130							
	135							
	140							
	145							
	150							
	155							

\* LOWEST POSSIBLE PURGE RATE,



GROUND WATER SAMPLING FIELD LOG (SAMPLE)Form 1

Sample Location CFW-6 Well Designation CFW-6  
Sampling Team RENE AUBE Sample Period MARCH 2016  
Date 3/24/16 Time 1330-1510

Measuring Point <u>TOR</u>	Depth to Mid Screen <u>—</u> (ft)
Well Depth (from measuring point) (D) <u>8.42</u> (ft)	Diameter of Well <u>2.0</u> (in)
Depth to water (DTW) <u>5.25</u> (ft)	
Length of Water Column (LWC) <u>3.17</u> (ft) (LWC=D-DTW)	
Volume of Water in Well (VW) <u>0.51</u> gal	Conversion Factor <u>0.16</u>
Volume of Purge (VTP) (VTP = VW x 3) <u>1.53</u> (gal)	

## At Time of Measurements:

Color CLEAR Odor NONE  
Total volume purged 1.99 Duration of purging 51 MNS  
Purging method GEO PUMP Did well go dry? NO  
Weather conditions MIX SUN + CLOUDS, COLD, CALM

Pump Serial Number 5008-43  
Water Quality Monitor Serial Number M015-13  
Analyses Requested CA, FE, MN - ALKALINITY - COD

Previous Final Readings: pH 5.95 Cond 0.226 turb 1.37 DO 0.71 Temp 3.54 ORP 48.0 DTW 7.55 Flow 180

WATER QUALITY PARAMETERS (SAMPLE)

Form 2

Sample Round		CFW-6						
3/24/16		Current Readings 1330-1510						
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments
0	+/- 0.1 std. unit	+/- 3%	+/- 10% NA <10NTU	+/-10%	+/- 1 E	+/-10 mv		1350 BEGIN PURGIE 150 ML/MN *
5								
1400 10	6.84	0.079	6.24	9.93	5.76	132.5	5.60	
1405 15	6.85	0.084	5.00	7.06	5.70	119.3	5.67	
1410 20	6.89	0.085	2.96	5.72	5.72	115.2	5.71	
1415 25	6.89	0.087	2.25	4.79	5.84	113.8	5.74	
1420 30	6.89	0.088	1.84	4.18	5.88	113.4	5.75	
1425 35	6.90	0.088	1.70	3.70	5.98	112.9	5.76	
1430 40	6.89	0.088	1.63	3.34	6.06	113.3	5.76	
1435 45	6.89	0.088	1.59	3.10	6.03	115.7	5.76	
1440 50	6.88	0.088	1.55	3.12	6.00	116.6	5.76	↓
1441 55	COLLECT SAMPLES							
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								

\* LOWEST POSSIBLE PURGE RATE

GROUND WATER SAMPLING FIELD LOG (SAMPLE)

Form 1

1072

Sample Location SW-1 Well Designation SW-1  
 Sampling Team Tom Longley Sample Period MARCH 2016  
 Date 3-24-16 Time 09:30 → 10:30 / Sample @ 10:00

Measuring Point _____	Depth to Mid Screen _____ (ft)
Well Depth (from measuring point) (D) _____	Diameter of Well _____ (in)
Depth to water (DTW) _____	_____ (ft)
Length of Water Column (LWC) _____	_____ (ft) (LWC=D-DTW)
Volume of Water in Well (VW) _____	_____ gal Conversion Factor _____
Volume of Purge (VTP) (VTP = VW x 3) _____	_____ (gal)

*1158 N/A*  
*3-24-16*

At Time of Measurements:	
Color <u>CLEAR</u>	Odor <u>None</u>
Total volume purged <u>NA</u>	Duration of purging <u>NA</u>
Purging method <u>NA</u>	Did well go dry? <u>NA</u>
Weather conditions <u>Cloudy, 30's, breezy</u>	

Pump Serial Number <u>N/A</u>
Water Quality Monitor Serial Number <u>YSI 556 (10E 100326), HACH 2100R (M024-32)</u>
Analyses Requested <u>VOCs, 1,4-DIOXANE, Metals, RCRA 8 Metals (D), ALKALINITY, COD</u>

Previous Final Readings: pH 6.3 Cond 0.03 Turb 6.66 DO 0.45 Temp 10.50 ORP 99.7 DTW NA Flow —  
 (ON 3-5-14)



SW-1

WATER QUALITY PARAMETERS (SAMPLE)

2072

Form 2

Sample Round <u>3-24-16</u>								
Current Readings								
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments
0	+/- 0.1 std. unit	+/- 3%	+/- 10% NA <10NTU	+/-10%	+/- 1 E	+/-10 mv		
5:10:00	7.1	0.028	0.87	14.3	2.83	207	-	Sample @ 10:00
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								

GROUND WATER SAMPLING FIELD LOG (SAMPLE)

Page 1 of 2

Form 1

Sample Location SW-4 Well Designation SW-4  
Sampling Team Tom Langley Sample Period March 2016  
Date 3-24-16 Time 10:30 → 11:20 Sample @ 11:00

Measuring Point _____	Depth to Mid Screen _____ (ft)
Well Depth (from measuring point) (D) _____	Diameter of Well _____ (in)
Depth to water (DTW) _____	_____ (ft)
Length of Water Column (LWC) <u>N/A</u> _____	_____ (ft) (LWC=D-DTW)
Volume of Water in Well (VW) <u>157</u> _____	_____ gal Conversion Factor _____
Volume of Purge (VTP) (VTP = VW x 3) _____	_____ (gal)

## At Time of Measurements:

Color CLEAR Odor None  
Total volume purged NA Duration of purging NA  
Purging method NA Did well go dry? NA  
Weather conditions PTLY Sunny, low 40's

Pump Serial Number NA  
Water Quality Monitor Serial Number 455 556 (10E100326) Archt 2100Q (M024-32)  
Analyses Requested VOCs, 1,4-DIOXANE, Metals, RCRA8 Metals (D), ALKALINITY, COD

Previous Final Readings: pH 6.25 Condo 0.027 Turb 1.39 DO 1.85 Temp 0.21 ORP 108.7 DTW N/A Flow —

WATER QUALITY PARAMETERS (SAMPLE)

Form 2

SW-4

PKE 2 of 2

Sample Round <u>March 2016</u>								
<u>3-24-16</u> Current Readings								
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments
0	+/- 0.1 std. unit	+/- 3%	+/- 10% NA <10NTU	+/-10%	+/- 1 E	+/-10 mv		
<u>11:05</u>	<u>6.13</u>	<u>0.026</u>	<u>1.61</u>	<u>13.80</u>	<u>3.44</u>	<u>144.1</u>	<u>NA</u>	<u>COLLECT Sample</u>
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								

GROUND WATER SAMPLING FIELD LOG (SAMPLE)

Page 1 of 2

Form 1

Sample Location SW-5 Well Designation SW-5  
 Sampling Team Tom Longley Sample Period March 2016  
 Date 3-24-16 Time 11:20 → 12:15 Sample 11:50

Measuring Point _____	Depth to Mid Screen _____ (ft)
Well Depth (from measuring point) (D) _____	Diameter of Well _____ (in)
Depth to water (DTW) _____	_____ (ft)
Length of Water Column (LWC) <u>N/A</u>	_____ (ft) (LWC=D-DTW)
Volume of Water in Well (VW) <u>915.7</u>	_____ gal Conversion
	Factor _____
Volume of Purge (VTP) (VTP = VW x 3) _____	_____ (gal)

3/24/16

At Time of Measurements:	
Color <u>CLEAR</u>	Odor <u>None</u>
Total volume purged <u>NA</u>	Duration of purging <u>N/A</u>
Purging method <u>NA</u>	Did well go dry? <u>N/A</u>
Weather conditions <u>Sunny, 40's/50's</u>	

Pump Serial Number <u>N/A</u>
Water Quality Monitor Serial Number <u>YSI 556 (106100326), HACH 2100Q (M024-32)</u>
Analyses Requested <u>VOCs, 1,4-Dioxane, Metals, RCRA Metals, Alkalinity, COD</u>

Previous Final Readings: pH 6.75 Cond 0.025 Turb 0.2 DO 2.77 Temp 0.09 ORP 74.8 DTW — Flow —



SW-5

WATER QUALITY PARAMETERS (SAMPLE)

Page 2 of 2

Form 2

Sample Round <u>March 2016</u>								
<u>3-24-16</u> Current Readings								
Time (min)	pH	Cond mS/cm	Turb (NTU)	D.O (mg/L)	Temp (°C)	ORP (mv)	DTW (feet)	Comments
0	+/- 0.1 std. unit	+/- 3%	+/- 10% NA <10NTU	+/-10%	+/- 1 E	+/-10 mv		
<del>11:50</del> 11:50	5.99	0.020	0.82	11.98	3.57	164.5	NA	11:50 Sample
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								

# FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: e Nuclear Power Station, Rowe, Massac  
 PROJECT NUMBER: 3617147318  
 PROJECT LOCATION: Rowe, MA  
 WEATHER CONDITIONS (AM): Cloudy 50's  
 WEATHER CONDITIONS (PM): PTly Sunny 50's

TASK NO: 0.03 DATE: 3-23-16  
 MACTEC CREW: Thomas D. Langley  
 SAMPLER NAME: Thomas D. Langley  
 SAMPLER SIGNATURE: Thomas D. Langley  
 CHECKED BY: Thomas D. Langley DATE: 3-23-16

## MULTI-PARAMETER WATER QUALITY METER

METER TYPE YSI 556 mps  
 MODEL NO. 556 mps  
 UNIT ID NO. M015-10

AM CALIBRATION  
 Start Time 0845 /End Time 0920

POST CALIBRATION CHECK  
 Start Time            /End Time           

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
pH (4)	SU	4.0	<u>4.00</u>	+/- 0.1 pH Units
pH (7)	SU	7.0	<u>7.00</u>	+/- 0.1 pH Units
pH (10)	SU	10.0	<u>          </u>	+/- 0.1 pH Units
Redox	+/- mV	240	<u>240.3</u>	+/- 10 mV
Conductivity	mS/cm	1.413	<u>1.413</u>	+/- 0.5 % of standard
DO (saturated)	%	100	<u>93</u>	+/- 2% of standard
Temp. — DO (saturated) mg/L <sup>1</sup> (see Chart 1)		<u>9.6</u>	<u>9.65</u>	+/- 0.2 mg/L
DO (<0.1)	mg/L	<0.1	<u>          </u>	< 0.5 mg/L
Temperature	°C		<u>13.5</u>	
Baro. Press.	mmHg		<u>727.3</u>	

Standard Value	Meter Value	*Acceptance Criteria (PM)
7.0	<u>5.81</u>	+/- 0.3 pH Units
240	<u>302</u>	+/- 10 mV
1.413	<u>1.426</u>	+/- 5% of standard
<u>8.7</u>	<u>7.8</u>	+/- 0.5 mg/L of standard
	<u>19.9</u>	
	<u>730.5</u>	

## TURBIDITY METER

METER TYPE HACH  
 MODEL NO. 2100Q  
 UNIT ID NO. M034-32

Units	Standard Value	Meter Value
10 Standard	NTU	<0.1
20 Standard	NTU	<u>20.6</u>
100 Standard	NTU	<u>99.9</u>
800 Standard	NTU	<u>780</u>

Standard Value	Meter Value	*Acceptance Criteria (PM)
10	<u>10.1</u>	+/- 0.3 NTU of stan.
20	<u>21.6</u>	+/- 5% of standard
100	<u>99.3</u>	+/- 5% of standard
800	<u>774</u>	+/- 5% of standard

## PHOTOIONIZATION DETECTOR

METER TYPE Background ppmv <0.1  
 MODEL NO.             
 UNIT ID NO.            Span Gas ppmv 100

<0.1 within 5 ppmv of BG  
 100 +/- 10% of standard

## O<sub>2</sub>-LEL 4 GAS METER

METER TYPE            Methane % 50  
 MODEL NO.            O<sub>2</sub> % 20.9  
 UNIT ID NO.            H<sub>2</sub>S ppmv 25  
           CO ppmv 50

50 +/- 10% of standard  
 20.9 +/- 10% of standard  
 25 +/- 10% of standard  
 50 +/- 10% of standard

## OTHER METER

METER TYPE             
 MODEL NO.             
 UNIT ID NO.           

See Notes Below for Additional Information

- ☒ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above. (in A.M.)  
☒ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above\*\*. (p.m./post-cal. check)

## MATERIALS RECORD

Deionized Water Source: Portland FOS  
 Lot#/Date Produced:             
 Trip Blank Source:             
 Sample Preservatives Source:             
 Disposable Filter Type: 0.45µm cellulose  
 Calibration Fluids / Standard Source:  
 - DO Calibration Fluid (<0.1 mg/L) Portland FOS  
 - Other             
 - Other             
 - Other           

	Cal. Standard Lot Number	Exp. Date
pH (4)	<u>5GL 573</u>	<u>12/17</u>
pH (7)	<u>5GL 345</u>	<u>12/17</u>
pH (10)	<u>          </u>	<u>          </u>
ORP	<u>8540</u>	<u>1/20</u>
Conductivity	<u>5GH 100</u>	<u>8/16</u>
<0.1 Turb. Stan.	<u>A5042</u>	<u>May -16</u>
20 Turb. Stan.	<u>A5057</u>	<u>May -16</u>
100 Turb. Stan.	<u>A5061</u>	<u>May -16</u>
800 Turb. Stan.	<u>A5057</u>	<u>May -16</u>
PID Span Gas	<u>          </u>	<u>          </u>
O <sub>2</sub> -LEL Span Gas	<u>          </u>	<u>          </u>
Other	<u>          </u>	<u>          </u>

NOTES: Post calibration check criteria not met for pH 7.0, Redox, & DO

\* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations.

\*\* = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

**MACTEC**  
 511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD



# FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: YANKEE Nuclear Power Station, Rowe, Massac  
 PROJECT NUMBER: 3617147318  
 PROJECT LOCATION: \_\_\_\_\_  
 WEATHER CONDITIONS (AM): MIX SUN + CLOUDS, COOL, DRY  
 WEATHER CONDITIONS (PM): " "

TASK NO: 0.03 DATE: 3/23/16  
 MACTEC CREW: \_\_\_\_\_  
 SAMPLER NAME: RENE AURE  
 SAMPLER SIGNATURE: Rene Aure  
 CHECKED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

## MULTI-PARAMETER WATER QUALITY METER

METER TYPE YSI  
 MODEL NO. 556 MPS  
 UNIT ID NO. M015-13  
 AM CALIBRATION  
 Start Time 0830 / End Time 0905

Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
pH (4)	SU 4.0	<u>4.00</u>	+/- 0.1 pH Units
pH (7)	SU 7.0	<u>7.00</u>	+/- 0.1 pH Units
pH (10)	SU 10.0	<u>NA</u>	+/- 0.1 pH Units
Redox	+/- mV <u>240</u>	<u>247.0</u>	+/- 10 mV
Conductivity	mS/cm 1.413	<u>1.413</u>	+/- 0.5 % of standard
DO (saturated)	% 100	<u>98.4</u>	+/- 2% of standard
DO (saturated)	mg/L <sup>1</sup> (see Chart 1) <u>9.43</u>	<u>9.37</u>	+/- 0.2 mg/L
DO (<0.1)	mg/L <0.1	<u>NA</u>	< 0.5 mg/L
Temperature	°C	<u>16.00</u>	
Baro. Press.	mmHg	<u>730.6</u>	

## POST CALIBRATION CHECK

Start Time 1645 / End Time 1705

Standard Value	Meter Value	*Acceptance Criteria (PM)
7.0	<u>6.76</u>	+/- 0.3 pH Units
240	<u>238</u>	+/- 10 mV
1.413	<u>1.402</u>	+/- 5% of standard
<u>8.73</u>	<u>4.74</u>	+/- 0.5 mg/L of standard
	<u>20.38</u>	
	<u>733.9</u>	

## TURBIDITY METER

METER TYPE HACH  
 MODEL NO. 2100R  
 UNIT ID NO. M024-37

Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<u>9.81</u>	+/- 0.3 NTU of stan.
20 Standard	NTU	<u>20.3</u>	+/- 5% of standard
100 Standard	NTU	<u>101</u>	+/- 5% of standard
800 Standard	NTU	<u>801</u>	+/- 5% of standard

## PHOTOIONIZATION DETECTOR

METER TYPE \_\_\_\_\_ Background ppmv <0.1 \_\_\_\_\_ within 5 ppmv of BG  
 MODEL NO. \_\_\_\_\_  
 UNIT ID NO. \_\_\_\_\_ Span Gas ppmv 100 +/- 10% of standard

## O<sub>2</sub>-LEL 4 GAS METER

METER TYPE \_\_\_\_\_ Methane % 50 +/- 10% of standard  
 MODEL NO. \_\_\_\_\_ O<sub>2</sub> % 20.9 +/- 10% of standard  
 UNIT ID NO. \_\_\_\_\_ H<sub>2</sub>S ppmv 25 +/- 10% of standard  
 \_\_\_\_\_ CO ppmv 50 +/- 10% of standard

## OTHER METER

METER TYPE \_\_\_\_\_  
 MODEL NO. \_\_\_\_\_  
 UNIT ID NO. \_\_\_\_\_  
 See Notes Below for Additional Information



Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.



Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above\*\* **FAILED PM CAL CHECK DO.**

## MATERIALS RECORD

Deionized Water Source: Portland FOS  
 Lot#/Date Produced: \_\_\_\_\_  
 Trip Blank Source: \_\_\_\_\_  
 Sample Preservatives Source: \_\_\_\_\_  
 Disposable Filter Type: 0.45µm cellulose  
 Calibration Fluids / Standard Source:  
 - DO Calibration Fluid (<0.1 mg/L) Portland FOS  
 - Other \_\_\_\_\_  
 - Other \_\_\_\_\_  
 - Other \_\_\_\_\_

	Cal. Standard Lot Number	Exp. Date
pH (4)	<u>561545</u>	<u>12-17</u>
pH (7)	<u>561573</u>	<u>12-17</u>
pH (10)	<u>NA</u>	<u>NA</u>
ORP	<u>7760</u>	<u>6-19</u>
Conductivity	<u>561100</u>	<u>8-16</u>
20 Turb. Stan.	<u>A5761</u>	<u>9-16</u>
100 Turb. Stan.	<u>A576</u>	<u>10-16</u>
800 Turb. Stan.	<u>A573</u>	<u>9-16</u>
PID Span Gas	<u>A5769</u>	<u>9-16</u>
O <sub>2</sub> -LEL Span Gas	_____	_____
Other	_____	_____

## NOTES:

\* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations.

\*\* = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.



511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

# FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: e Nuclear Power Station, Rowe, Massac  
 PROJECT NUMBER: 3617147318  
 PROJECT LOCATION:  
 WEATHER CONDITIONS (AM): CLOUDY, COLD, CALM  
 WEATHER CONDITIONS (PM): " " "

TASK NO: 0.03 DATE: 3/24/16  
 MACTEC CREW:  
 SAMPLER NAME: RENE AUBE  
 SAMPLER SIGNATURE: *René Aube*  
 CHECKED BY: DATE:

## MULTI-PARAMETER WATER QUALITY METER

METER TYPE: YSI  
 MODEL NO.: 556 MRS  
 UNIT ID NO.: MC15-13

AM CALIBRATION  
 Start Time 0745 / End Time 0820

Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
pH (4)	SU	4.0	4.00 +/- 0.1 pH Units
pH (7)	SU	7.0	7.00 +/- 0.1 pH Units
pH (10)	SU	10.0	NA +/- 0.1 pH Units
Redox	+/- mV	240.236	236.0 +/- 10 mV
Conductivity	mS/cm	1.413	1.413 +/- 0.5 % of standard
DO (saturated)	%	100	97.2 +/- 2% of standard
DO (saturated)	mg/L <sup>1</sup> (see Chart 1)	8.60	8.61 +/- 0.2 mg/L
DO (<0.1)	mg/L	<0.1	NA < 0.5 mg/L
Temperature	°C	21.36	
Baro. Press.	mmHg	739.1	

## POST CALIBRATION CHECK

Start Time 1700 / End Time 1720

Standard Value	Meter Value	*Acceptance Criteria (PM)
7.0	7.70	+/- 0.3 pH Units
240.236	236.4	+/- 10 mV
1.413	1.415	+/- 5% of standard
8.70	8.37	+/- 0.5 mg/L of standard
	20.24	
	733.7	

## TURBIDITY METER

METER TYPE: HACH  
 MODEL NO.: 2100Q  
 UNIT ID NO.: M024-37

Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	10	9.79 +/- 0.3 NTU of stan.
20 Standard	NTU	20	20.1 +/- 5% of standard
100 Standard	NTU	100	102 +/- 5% of standard
800 Standard	NTU	800	796 +/- 5% of standard

Standard Value	Meter Value	*Acceptance Criteria (PM)
10	10.3	+/- 0.3 NTU of stan.
20	20.4	+/- 5% of standard
100	101	+/- 5% of standard
800	809	+/- 5% of standard

## PHOTOIONIZATION DETECTOR

METER TYPE: Background  
 MODEL NO.:  
 UNIT ID NO.: Span Gas

Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
ppmv	<0.1		within 5 ppmv of BG
ppmv	100		+/- 10% of standard

Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1		within 5 ppmv of BG
100		+/- 10% of standard

## O<sub>2</sub>-LEL 4 GAS METER

METER TYPE: Methane  
 MODEL NO.:  
 UNIT ID NO.: O<sub>2</sub>, H<sub>2</sub>S, CO

Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
%	50		+/- 10% of standard
%	20.9		+/- 10% of standard
ppmv	25		+/- 10% of standard
ppmv	50		+/- 10% of standard

Standard Value	Meter Value	*Acceptance Criteria (PM)
50		+/- 10% of standard
20.9		+/- 10% of standard
25		+/- 10% of standard
50		+/- 10% of standard

## OTHER METER

METER TYPE:  
 MODEL NO.:  
 UNIT ID NO.:

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☒ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above\*\*. **FAILED DO CAL.**

## MATERIALS RECORD

	Cal. Standard Lot Number	Exp. Date
Deionized Water Source: Portland FOS	pH (4) 5GL345	12-17
Lot#/Date Produced:	pH (7) 5GL573	12-17
Trip Blank Source:	pH (10) NA	NA
Sample Preservatives Source:	ORP 7160	6-19
Disposable Filter Type: 0.45µm cellulose	Conductivity 5GH100	8-16
Calibration Fluids / Standard Source:	20 Turb. Stan. A5161	9-16
- DO Calibration Fluid (<0.1 mg/L) Portland FOS	100 Turb. Stan. A5176	10-16
- Other	800 Turb. Stan. A5173	9-16
- Other	PID Span Gas A5169	9-16
- Other	O <sub>2</sub> -LEL Span Gas	
	Other	

## NOTES:

\* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations.

\*\* = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.



511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD



# FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT NAME: e Nuclear Power Station, Rowe, Massac TASK NO: 0.03 DATE: 3-24-16  
 PROJECT NUMBER: 3617147318 MACTEC CREW: Tom Longley  
 PROJECT LOCATION: Rowe, MA SAMPLER NAME: Thomas D. Longley  
 WEATHER CONDITIONS (AM): Cloudy, Calm, 40's SAMPLER SIGNATURE: Th.D. Longley  
 WEATHER CONDITIONS (PM): Sunny, 50's, Breezy CHECKED BY: Th.D. Longley DATE: 3-24-16

## MULTI-PARAMETER WATER QUALITY METER

METER TYPE: YSI  
 MODEL NO.: 556 MP3  
 UNIT ID NO.: MDS-10  
 Start Time: 07:35 / End Time: 07:52  
 AM CALIBRATION

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
pH (4)	SU	4.0	<u>4.0</u>	+/- 0.1 pH Units
pH (7)	SU	7.0	<u>7.0</u>	+/- 0.1 pH Units
pH (10)	SU	10.0	<u>10.0</u>	+/- 0.1 pH Units
Redox	+/- mV	240	<u>239</u>	+/- 10 mV
Conductivity	mS/cm	1.413	<u>1.413</u>	+/- 0.5 % of standard
DO (saturated)	%	100	<u>N/A</u>	+/- 2% of standard
DO (saturated)	mg/L <sup>1</sup> (see Chart 1)	<u>8.6</u>	<u>8.0</u>	+/- 0.2 mg/L
DO (<0.1)	mg/L	<0.1	<u>—</u>	< 0.5 mg/L
Temperature	°C		<u>21.04</u>	
Baro. Press.	mmHg		<u>736.2</u>	

POST CALIBRATION CHECK  
 Start Time: 16:15 / End Time: 16:30

	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	4.0	<u>7.01</u>	+/- 0.3 pH Units
pH (7)	7.0	<u>7.01</u>	+/- 0.3 pH Units
pH (10)	10.0	<u>243.5</u>	+/- 10 mV
Redox	240	<u>1.417</u>	+/- 5% of standard
Conductivity	1.413	<u>8.53</u>	+/- 0.5 mg/L of standard
DO (saturated)	100	<u>7.94</u>	+/- 0.5 mg/L of standard
DO (<0.1)	<0.1	<u>20.89</u>	
Temperature		<u>730.7</u>	
Baro. Press.		<u>730.7</u>	

## TURBIDITY METER

	Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
METER TYPE				
MODEL NO.				
UNIT ID NO.				
10	NTU	<0.1	<u>10.1</u>	+/- 0.3 NTU of stan.
20	NTU	20	<u>20.7</u>	+/- 5% of standard
100	NTU	100	<u>99.9</u>	+/- 5% of standard
800	NTU	800	<u>802</u>	+/- 5% of standard

## PHOTOIONIZATION DETECTOR

	Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
METER TYPE				
MODEL NO.				
UNIT ID NO.				
Background	ppmv	<0.1	<u>&lt;0.1</u>	within 5 ppmv of BG
Span Gas	ppmv	100	<u>100</u>	+/- 10% of standard

## O<sub>2</sub>-LEL 4 GAS METER

	Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
METER TYPE				
MODEL NO.				
UNIT ID NO.				
Methane	%	50	<u>50</u>	+/- 10% of standard
O <sub>2</sub>	%	20.9	<u>20.9</u>	+/- 10% of standard
H <sub>2</sub> S	ppmv	25	<u>25</u>	+/- 10% of standard
CO	ppmv	50	<u>50</u>	+/- 10% of standard

## OTHER METER

	Units	Standard Value	Meter Value	*Acceptance Criteria (PM)
METER TYPE				
MODEL NO.				
UNIT ID NO.				
				See Notes Below for Additional Information

- ☒ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above. (IN A.M.)  
☒ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above\*\*. (IN POST CAL. CHECK IN P.M.)

## MATERIALS RECORD

	Cal. Standard Lot Number	Exp. Date
Deionized Water Source: <u>Portland FOS</u>	pH (4) <u>5GL 345</u>	<u>12/17</u>
Lot#/Date Produced: _____	pH (7) <u>5GL 573</u>	<u>12/17</u>
Trip Blank Source: _____	pH (10) _____	
Sample Preservatives Source: _____	ORP <u>8540</u>	<u>1/20</u>
Disposable Filter Type: <u>0.45µm cellulose</u>	Conductivity <u>5GH 100</u>	<u>8/16</u>
Calibration Fluids / Standard Source:	<0.1 Turb. Stan. <u>A5042</u>	<u>may 16</u>
- DO Calibration Fluid (<0.1 mg/L) <u>Portland FOS</u>	20 Turb. Stan. <u>A5056</u>	<u>may 16</u>
- Other _____	100 Turb. Stan. <u>A5061</u>	<u>may 16</u>
- Other _____	800 Turb. Stan. <u>A5057</u>	<u>may 16</u>
- Other _____	PID Span Gas _____	
	O <sub>2</sub> -LEL Span Gas _____	
	Other _____	

NOTES: DO in p.m. calibration is v. slightly out of standard

\* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations.

\*\* = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.



511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

## **APPENDIX C**

### **ANALYTICAL DATA – MARCH 2016**

**APPENDIX C-1**

**RADIOLOGICAL DATA - MARCH 2016**

**APPENDIX C-1  
Radiological Data - March 2016**

**Yankee Nuclear Power Station**

				MW-105B MW-105B 3/23/2016 FS			MW-107C MW-107C 3/23/2016 FS			SP-1 SP-1 3/23/2016 FS		
Lab ID	Analysis	Parameter	Units	Result	Qualifier	Uncertainty	Result	Qualifier	Uncertainty	Result	Qualifier	Uncertainty
GEL	EPA 901.1	Antimony-125	pCi/L							4.05 U		9.26
GEL	EPA 901.1	Cesium-134	pCi/L							0.822 U		2.99
GEL	EPA 901.1	Cesium-137	pCi/L							3.75 U		3.14
GEL	EPA 901.1	Cobalt-60	pCi/L							1.62 U		3.06
GEL	EPA 901.1	Europium-152	pCi/L							3.96 U		9.64
GEL	EPA 901.1	Europium-154	pCi/L							-4.75 U		9.92
GEL	EPA 901.1	Europium-155	pCi/L							-11.2 U		12.5
GEL	EPA 901.1	Niobium-94	pCi/L							-0.388 U		2.7
GEL	EPA 901.1	Silver-108	pCi/L							-1.11 U		2.53
GEL	EPA 905.0 Modified	Strontium-90	pCi/L							-0.261 U		0.759
GEL	EPA 906.0 Modified	Tritium	pCi/L	1460		481	6330		1380	186 U		293

Notes:

FS = Field Sample

pCi/L = Picocuries per liter

U = Not detected

R = Rejected during data validation

J = Result is estimated

**APPENDIX C-2**

**CHEMICAL DATA – MARCH 2016**

**APPENDIX C-2**  
**Chemical Data - March 2016**

**Yankee Nuclear Power Station**

Lab ID	Analysis	Parameter	Location Sample ID Sample Date Qc Code Units	CFW-1 CFW-1 3/24/2016 FS		CFW-5 CFW-5 3/24/2016 FS		CFW-5 CFW-5 DUP 3/24/2016 FD		CFW-6 CFW-6 3/24/2016 FS		QC TB-009 3/24/2016 TB		SP-1 SP-1 3/23/2016 FS		SW-1 SW-1 3/24/2016 FS		SW-4 SW-4 3/24/2016 FS		SW-5 SW-5 3/24/2016 FS	
				Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
GEL	SW8260B	1,1,1,2-Tetrachloroethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,1,1-Trichloroethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,1,2,2-Tetrachloroethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,1,2-Trichloroethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,1-Dichloroethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,1-Dichloroethene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,2,4-Trichlorobenzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,2-Dibromoethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,2-Dichlorobenzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,2-Dichloroethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,2-Dichloropropane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,3-Dichlorobenzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	1,3-Dichloropropene (total)	ug/l									2 U		2 U		2 U		2 U		2 U	
GEL	SW8260B	1,4-Dichlorobenzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	2-Butanone	ug/l									5 U		5 U		5 U		5 U		5 U	
GEL	SW8260B	4-Methyl-2-pentanone	ug/l									5 U		5 U		5 U		5 U		5 U	
GEL	SW8260B	Acetone	ug/l									5 U		5 U		5 U		5 U		5 U	
GEL	SW8260B	Benzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Bromodichloromethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Bromoform	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Bromomethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Carbon tetrachloride	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Chlorobenzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Chloroform	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Cis-1,2-Dichloroethene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Dibromochloromethane	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Ethylbenzene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Methyl Tertbutyl Ether	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Methylene chloride	ug/l									5 U		5 U		5 U		5 U		5 U	
GEL	SW8260B	Naphthalene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Styrene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Tetrachloroethene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Toluene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	trans-1,2-Dichloroethene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Trichloroethene	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Vinyl chloride	ug/l									1 U		1 U		1 U		1 U		1 U	
GEL	SW8260B	Xylenes, Total	ug/l									3 U		3 U		3 U		3 U		3 U	
LANCAST	SW8270C	1,4-Dioxane	ug/l											0.09 J		0.2 U		0.21 U		0.21 U	
GEL	SW6020A	Arsenic	ug/l											5 U		5 U		5 U		5 U	
GEL	SW6020A	Barium	ug/l											22.1		7.96		10.7		9.99	
GEL	SW6020A	Cadmium	ug/l											1 U		1 U		1 U		1 U	
GEL	SW6020A	Calcium	ug/l			2790		19300		21400		9340				1960		2050		1800	
GEL	SW6020A	Chromium	ug/l											10 U		10 U		10 U		10 U	
GEL	SW6020A	Iron	ug/l			15300		26200		27200		4640				100 U		774		265	
GEL	SW6020A	Lead	ug/l											2 U		2 U		2 U		2 U	
GEL	SW6020A	Manganese	ug/l			346		2420		2580		1330				3.12 J		107		40	
GEL	SW6020A	Selenium	ug/l											5 U		5 U		5 U		5 U	
GEL	SW6020A	Silver	ug/l											1 U		1 U		1 U		1 U	
GEL	SW7470A	Mercury	ug/l											0.2 U		0.2 U		0.2 U		0.2 U	
GEL	E410.4	Chemical Oxygen Demand	mg/l			38		20.8		23.7		40.8				18 J		20 U		29.4	
GEL	SM2320B	Total Alkalinity, as CaCO3	mg/l			5.22		92.8		87.6		26.1				3.13		3.65		2.09	

Notes:  
 FS = Field Sample  
 FD = Field Duplicate  
 TB = Trip Blank  
 ug/l = micrograms per liter  
 mg/l = milligrams per liter  
 U = Not detected  
 J = Result is estimated

## **APPENDIX C-3**

### **VALIDATION CHECKLISTS – MARCH 2016**

**DATA VALIDATION SUMMARY  
MARCH 2016 SAMPLING  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS**

## **1.0 INTRODUCTION**

Groundwater and surface water samples were collected on March 24, 2016, at the Yankee Nuclear Power Station, located in Rowe, Massachusetts. Sample analyses for all parameters except 1,4-dioxane were performed by GEL Laboratories, located in Charleston, South Carolina. Analyses for 1,4-dioxane were performed by Eurofins Lancaster Laboratories, located in Lancaster, Pennsylvania. Samples were analyzed by one or more of the following methods:

- Volatile Organic Compounds (VOCs) by Method 8260B
- 1,4-Dioxane by Method 8270C Selected Ion Monitoring (SIM)
- RCRA Metals (dissolved) by Methods 6020A/7470A
- Calcium, iron, and manganese by Method 6020A
- Alkalinity by Method 2320B
- Chemical Oxygen Demand (COD) by Method 410.4
- Isotopes by Gamma Spectroscopy Method 901.1
- Strontium-90 by Method 905.0 Modified
- Tritium by Method 906.0 Modified

A chemist review was performed on the samples in the data set using information supplied by the laboratories. The data packages were validated using USEPA Region I EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses (USEPA, 1996), the Yankee Nuclear Power Station Groundwater Monitoring Program, Document RP-05, Revision 5 (YNPS, 2012), and "Laboratory Data Validation Guidelines for Evaluating Radionuclide Analyses," Revision 7 (SAIC, 2002).

Results were reported in GEL sample delivery groups (SDGs) 393869 and 393869-1, and Eurofins SDG 1644529. A listing of samples included in this chemistry review is presented in Table 1. A summary of the analytical results is presented in Table 2. No data qualifiers were added to the laboratory results based on the chemist review.

The following data qualifiers are used in the final data presentation:

U = target analyte is not detected at or above the reported detection limit or is qualified as not detected  
J = concentration is estimated

Results are interpreted to be usable as reported by the laboratory unless discussed in the following sections.

## **2.0 DATA REVIEW SUMMARY**

### **2.1 VOCs**

Data were evaluated for the following parameters:

- \* Collection and Preservation
- \* Holding Times



- \* Data Completeness
- \* Surrogate Recoveries
- \* Blank Contamination
- \* Laboratory Control Samples (LCS)
- \* Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
- \* Miscellaneous

\* - all criteria were met for this parameter

The results of all associated quality control measurements were within control limits, and sample results were determined to be usable as reported by the laboratory.

## 2.2 1,4-Dioxane

Data were evaluated for the following parameters:

- \* Collection and Preservation
- \* Holding Times
- \* Data Completeness
- \* Surrogate Recoveries
- \* Blank Contamination
- \* LCS/Laboratory Control Sample Duplicates (LCSD)
- \* Miscellaneous

\* - all criteria were met for this parameter

The results of all associated quality control measurements were within control limits, and sample results were determined to be usable as reported by the laboratory.

## 2.3 Metals

Data were evaluated for the following parameters:

- \* Collection and Preservation
- \* Holding Times
- \* Data Completeness
- \* Blank Contamination
- \* Duplicates
- \* LCS
- \* MS/MSD
- \* Miscellaneous

\* - all criteria were met for this parameter

The results of all associated quality control measurements were within control limits, and sample results were determined to be usable as reported by the laboratory.

## 2.4 Wet Chemistry

Data were evaluated for the following parameters:

- \* Collection and Preservation

- \* Holding Times
- \* Data Completeness
- \* Blank Contamination
- \* Duplicates
- \* LCS
- \* MS
- \* Miscellaneous

\* - all criteria were met for this parameter

The results of all associated quality control measurements were within control limits, and sample results were determined to be usable as reported by the laboratory.

## 2.5 Radiological Parameters

Data were evaluated for the following parameters:

- \* Collection and Preservation
- \* Holding Times
- \* Data Completeness
- \* Blank Contamination
- \* Duplicates
- \* LCS
- \* MS
- \* Miscellaneous

\* - all criteria were met for this parameter

The results of all associated quality control measurements were within control limits, and sample results were determined to be usable as reported by the laboratory.

## References:

U.S. Environmental Protection Agency (USEPA), 1996. "Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses, Parts I and II," Quality Assurance Unit Staff; Office of Environmental Measurement and Evaluation; December, 1996.

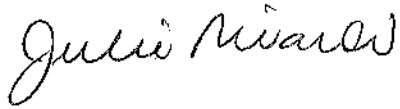
Yankee Nuclear Power Station (YNPS), 2012. "YNPS Groundwater Monitoring Program." ISFSI Radiation Protection, RP-05: Revision 5, October 18, 2012.

Science Applications International Corporation (SAIC), 2002. "Laboratory Data Validation Guidelines for Evaluating Radionuclide Analyses." Thomas L. Rucker, Ph.D. and C. Matrin Johnson, Jr.; Revision 7, April, 2002.

April 21, 2016

Data Validator: Julie Ricardi

April 21, 2016



Senior Reviewed: Bradley B. LaForest, NRCC-EAC

April 21, 2016




TABLE 1 - SUMMARY OF SAMPLES AND ANALYTICAL METHODS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 SAMPLING EVENT

Lab SDG	Media	Location	Field Sample Date	Field Sample ID	Method Class		COD	RAD			Alkalinity	Metals			VOCs	1,4-Dioxane
					Analysis Method	Fraction		E901.1	E905.0	E906.0		SW6020A	SW6020A	SW7470A		
1644529	SW	SP-1	3/23/2016	SP-1	FS											
1644529	SW	SW-1	3/24/2016	SW-1	FS											1
1644529	SW	SW-4	3/24/2016	SW-4	FS											1
1644529	SW	SW-5	3/24/2016	SW-5	FS											1
393869	BW	QC	3/24/2016	TB-009	TB											
393869	GW	CFW-1	3/24/2016	CFW-1	FS						1				37	
393869	GW	CFW-5	3/24/2016	CFW-5	FS						1					
393869	GW	CFW-5	3/24/2016	CFW-5 DUP	FD						1					
393869	GW	CFW-6	3/24/2016	CFW-6	FS						1					
393869	GW	MW-105B	3/23/2016	MW-105B	FS					1						
393869	GW	MW-107C	3/23/2016	MW-107C	FS					1						
393869	SW	SP-1	3/23/2016	SP-1	FS			9	1	1						
393869	SW	SW-1	3/24/2016	SW-1	FS						1					
393869	SW	SW-4	3/24/2016	SW-4	FS						1					
393869	SW	SW-5	3/24/2016	SW-5	FS						1					
393869-1	SW	SP-1	3/23/2016	SP-1	FS							7		1		
393869-1	SW	SW-1	3/24/2016	SW-1	FS							7		1		
393869-1	SW	SW-4	3/24/2016	SW-4	FS							7		1		
393869-1	SW	SW-5	3/24/2016	SW-5	FS							7		1		

NOTES:

T, N = total, D = dissolved  
FS = field sample, FD = field duplicate, TB = trip blank  
GW = groundwater  
SW = surface water  
BW = blank water

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - VOCs

Analysis	Fraction	Parameter	Sample Delivery Group		393869		393869		393869		393869	
			Location	Sample Date	QC	TB	SP-1	SW-1	SW-4	QC	SP-1	SW-1
			Sample ID	Sample Date	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260B	N	1,1,1,2-Tetrachloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,1,1-Trichloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,1,2,2-Tetrachloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,1,2-Trichloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,1-Dichloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,1-Dichloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,2,4-Trichlorobenzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,2-Dibromoethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,2-Dichlorobenzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,2-Dichloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,2-Dichloropropane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,3-Dichlorobenzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	1,3-Dichloropropene (total)		3/24/2016	0.002 U		0.002 U		0.002 U		0.002 U	
SW8260B	N	1,4-Dichlorobenzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	2-Butanone		3/24/2016	0.005 U		0.005 U		0.005 U		0.005 U	
SW8260B	N	4-Methyl-2-pentanone		3/24/2016	0.005 U		0.005 U		0.005 U		0.005 U	
SW8260B	N	Acetone		3/24/2016	0.005 U		0.005 U		0.005 U		0.005 U	
SW8260B	N	Benzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Bromodichloromethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Bromoform		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Bromomethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Carbon tetrachloride		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Chlorobenzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Chloroform		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Cis-1,2-Dichloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Dibromochloromethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Ethylbenzene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Methyl Tertbutyl Ether		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Methylene chloride		3/24/2016	0.005 U		0.005 U		0.005 U		0.005 U	
SW8260B	N	Naphthalene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Styrene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Tetrachloroethane		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	
SW8260B	N	Toluene		3/24/2016	0.001 U		0.001 U		0.001 U		0.001 U	

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - VOCs

Analysis	Fraction	Parameter	Sample Delivery Group		393869		393869		393869		393869	
			Location	Units	QC	QC	SP-1	SP-1	SW-1	SW-1	SW-4	SW-4
SW8260B	N	trans-1,2-Dichloroethene	3/24/2016	mg/L	TB-009	TB	3/23/2016	3/23/2016	3/24/2016	3/24/2016	3/24/2016	3/24/2016
SW8260B	N	Trichloroethene		mg/L			FS	FS	FS	FS	FS	FS
SW8260B	N	Vinyl chloride		mg/L								
SW8260B	N	Xylenes, Total		mg/L								
					Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
					0.001 U		0.001 U		0.001 U		0.001 U	
					0.001 U		0.001 U		0.001 U		0.001 U	
					0.001 U		0.001 U		0.001 U		0.001 U	
					0.003 U		0.003 U		0.003 U		0.003 U	

NOTES:

VOCs = volatile organic compounds

N = total

mg/L = milligram per liter

U = not detected at the reported quantitation limit

FS = field sample, TB = trip blank

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - VOCs

Analysis	Fraction	Parameter	Sample Delivery Group		Sample Date	Sample ID	Qc Code	Units	Result	Qualifier
			Location	393869						
SW8260B	N	1,1,1,2-Tetrachloroethane	SW-5	3/24/2016	SW-5 FS			mg/L	0.001 U	
SW8260B	N	1,1,1-Trichloroethane						mg/L	0.001 U	
SW8260B	N	1,1,2,2-Tetrachloroethane						mg/L	0.001 U	
SW8260B	N	1,1,2-Trichloroethane						mg/L	0.001 U	
SW8260B	N	1,1-Dichloroethane						mg/L	0.001 U	
SW8260B	N	1,1-Dichloroethane						mg/L	0.001 U	
SW8260B	N	1,2,4-Trichlorobenzene						mg/L	0.001 U	
SW8260B	N	1,2-Dibromoethane						mg/L	0.001 U	
SW8260B	N	1,2-Dichlorobenzene						mg/L	0.001 U	
SW8260B	N	1,2-Dichloroethane						mg/L	0.001 U	
SW8260B	N	1,2-Dichloropropane						mg/L	0.001 U	
SW8260B	N	1,3-Dichlorobenzene						mg/L	0.001 U	
SW8260B	N	1,3-Dichloropropene (total)						mg/L	0.002 U	
SW8260B	N	1,4-Dichlorobenzene						mg/L	0.001 U	
SW8260B	N	2-Butanone						mg/L	0.005 U	
SW8260B	N	4-Methyl-2-pentanone						mg/L	0.005 U	
SW8260B	N	Acetone						mg/L	0.005 U	
SW8260B	N	Benzene						mg/L	0.001 U	
SW8260B	N	Bromodichloromethane						mg/L	0.001 U	
SW8260B	N	Bromoform						mg/L	0.001 U	
SW8260B	N	Bromomethane						mg/L	0.001 U	
SW8260B	N	Carbon tetrachloride						mg/L	0.001 U	
SW8260B	N	Chlorobenzene						mg/L	0.001 U	
SW8260B	N	Chloroform						mg/L	0.001 U	
SW8260B	N	Cis-1,2-Dichloroethene						mg/L	0.001 U	
SW8260B	N	Dibromochloromethane						mg/L	0.001 U	
SW8260B	N	Ethylbenzene						mg/L	0.001 U	
SW8260B	N	Methyl Tertiaryl Ether						mg/L	0.001 U	
SW8260B	N	Methylene chloride						mg/L	0.005 U	
SW8260B	N	Naphthalene						mg/L	0.001 U	
SW8260B	N	Styrene						mg/L	0.001 U	
SW8260B	N	Tetrachloroethene						mg/L	0.001 U	
SW8260B	N	Toluene						mg/L	0.001 U	

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
 DATA VALIDATION SUMMARY  
 YANKEE NUCLEAR POWER STATION  
 ROWE, MASSACHUSETTS

MARCH 2016 - VOCs

Sample Delivery Group				393869
Location				SW-5
Sample Date				3/24/2016
Sample ID				SW-5
Qc Code				FS
Analysis	Fraction	Parameter	Units	Result
SW8260B	N	trans-1,2-Dichloroethene	mg/L	0.001 U
SW8260B	N	Trichloroethene	mg/L	0.001 U
SW8260B	N	Vinyl chloride	mg/L	0.001 U
SW8260B	N	Xylenes, Total	mg/L	0.003 U

NOTES:

VOCs = volatile organic compounds

N = total

mg/L = milligram per liter

U = not detected at the reported quantitation limit

FS = field sample, TB = trip blank





TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - INORGANICS DATA

Analysis	Fraction	Parameter	Sample Delivery Group		Sample Date	Sample ID	Qc Code	Units	393869 CFW-1		393869 CFW-5		393869 CFW-5 DUP		393869 CFW-6	
			Location	Result					FS	Qualifier	FS	Qualifier	FD	Qualifier	FS	Qualifier
SW6020A	D	Arsenic						mg/L								
SW6020A	D	Barium						mg/L								
SW6020A	D	Cadmium						mg/L								
SW6020A	D	Chromium						mg/L								
SW6020A	D	Lead						mg/L								
SW6020A	D	Selenium						mg/L								
SW6020A	D	Silver						mg/L								
SW6020A	T	Calcium						mg/L	2.79		19.3		21.4		9.34	
SW6020A	T	Iron						mg/L	15.3		26.2		27.2		4.64	
SW6020A	T	Manganese						mg/L	0.346		2.42		2.58		1.33	
SW7470A	D	Mercury						mg/L								
E410.4	N	Chemical Oxygen Demand						mg/L	38		20.8		23.7		40.8	
SM2320B	N	Total Alkalinity, as CaCO3						mg/L	5.22		92.8		87.6		26.1	

NOTES:

mg/L = milligram per liter  
U = not detected at the reported quantitation limit  
J = estimated value  
FS = field sample, FD = field duplicate  
T, N = total, D = dissolved

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - INORGANICS DATA

Analysis	Fraction	Parameter	Sample Delivery Group		Units	393869		393869		393869		393869-1	
			Location	Sample Date		SW-1	Result	SW-4	Result	SW-5	Result	SP-1	Result
SW6020A	D	Arsenic			mg/L							3/23/2016	
SW6020A	D	Barium			mg/L							SP-1	
SW6020A	D	Cadmium			mg/L							3/23/2016	
SW6020A	D	Chromium			mg/L							SP-1	
SW6020A	D	Lead			mg/L							FS	
SW6020A	D	Selenium			mg/L								
SW6020A	D	Silver			mg/L								
SW6020A	T	Calcium			mg/L	1.96		2.05		1.8			
SW6020A	T	Iron			mg/L	0.1 U		0.774		0.265			
SW6020A	T	Manganese			mg/L	0.00312 J		0.107		0.04			
SW7470A	D	Mercury			mg/L								
E410.4	N	Chemical Oxygen Demand			mg/L	18 J		20 U		29.4			
SM2320B	N	Total Alkalinity, as CaCO3			mg/L	3.13		3.65		2.09			

NOTES:

mg/L = milligram per liter  
U = not detected at the reported quantitation limit  
J = estimated value  
FS = field sample, FD = field duplicate  
T, N = total, D = dissolved

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - INORGANICS DATA

Analysis	Fraction	Parameter	Sample Delivery Group			393869-1			393869-1			393869-1		
			Location	Sample Date	Sample ID	Qc Code	Units	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result
SW6020A	D	Arsenic					mg/L	0.005 U		0.005 U		0.005 U		
SW6020A	D	Barium					mg/L	0.00796		0.0107		0.00999		
SW6020A	D	Cadmium					mg/L	0.001 U		0.001 U		0.001 U		
SW6020A	D	Chromium					mg/L	0.01 U		0.01 U		0.01 U		
SW6020A	D	Lead					mg/L	0.002 U		0.002 U		0.002 U		
SW6020A	D	Selenium					mg/L	0.005 U		0.005 U		0.005 U		
SW6020A	D	Silver					mg/L	0.001 U		0.001 U		0.001 U		
SW6020A	T	Calcium					mg/L							
SW6020A	T	Iron					mg/L							
SW6020A	T	Manganese					mg/L							
SW7470A	D	Mercury					mg/L	0.0002 U		0.0002 U		0.0002 U		
E410.4	N	Chemical Oxygen Demand					mg/L							
SM2320B	N	Total Alkalinity, as CaCO3					mg/L							

NOTES:

mg/L = milligram per liter  
U = not detected at the reported quantitation limit  
J = estimated value  
FS = field sample, FD = field duplicate  
T, N = total, D = dissolved

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS  
DATA VALIDATION SUMMARY  
YANKEE NUCLEAR POWER STATION  
ROWE, MASSACHUSETTS

MARCH 2016 - RADIOLOGICAL DATA

Sample Delivery Group			393869			393869			393869		
Location			MW-105B			MW-107C			SP-1		
Sample Date			3/23/2016			3/23/2016			3/23/2016		
Sample ID			MW-105B			MW-107C			SP-1		
Qc Code			FS			FS			FS		
Analysis	Parameter	Units	Result	Qualifier	Uncertainty	Result	Qualifier	Uncertainty	Result	Qualifier	Uncertainty
E901.1	Antimony-125	pCi/L							4.05	U	9.26
E901.1	Cesium-134	pCi/L							0.822	U	2.99
E901.1	Cesium-137	pCi/L							3.75	U	3.14
E901.1	Cobalt-60	pCi/L							1.62	U	3.06
E901.1	Europium-152	pCi/L							3.96	U	9.64
E901.1	Europium-154	pCi/L							-4.75	U	9.92
E901.1	Europium-155	pCi/L							-11.2	U	12.5
E901.1	Niobium-94	pCi/L							-0.388	U	2.7
E901.1	Silver-108	pCi/L							-1.11	U	2.53
E905.0	Strontium-90	pCi/L							-0.261	U	0.759
E906.0	Tritium	pCi/L	1460		481	6330		1380	186	U	293

NOTES:

pCi/L = picocurie per liter

U = not detected at the reported quantitation limit

FS = field sample

**ATTACHMENT C**  
**ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Alkalinity**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
CFW-1	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-5	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-5 DUP	3/29/16	DU (Field)	Yes	O.K.	Yes	See attached checklist
SW-1	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
SW-4	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
SW-5	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-6	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203517263	3/29/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203517264	3/29/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203517266	3/29/16	DU	Yes	O.K.	Yes	See attached checklist
QC1203517709	3/29/16	SK	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples? ☒ X Yes ☐ No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

**ATTACHMENT C**

**ASSESSMENT OF DATA QUALITY**

Reviewer *Julie Mares* Date April 12, 2016

**ATTACHMENT C****ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks, and Spikes.  
(Several pages will be required for each batch)

**Chemical Oxygen Demand (COD)**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
CFW-1	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-5	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-5 DUP	3/29/16	DU (Field)	Yes	O.K.	Yes	See attached checklist
SW-1	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
SW-4	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
SW-5	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-6	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203517024	3/29/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203517025	3/29/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203517026	3/29/16	DU	Yes	O.K.	Yes	See attached checklist
QC1203517027	3/29/16	SK	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples? ☒ X Yes ☐ No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA



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**ATTACHMENT C**

**ASSESSMENT OF DATA QUALITY**

Reviewer Julie Miranda Date April 12, 2016

**ATTACHMENT C**  
**ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Gamma Spec**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
SP-1	4/1/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203518030	4/1/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203518032	4/1/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203518031	4/1/16	DU	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples?   X   Yes        No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

Reviewer

*Julie Nizarov*

Date April 12, 2016

**ATTACHMENT C****ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Strontium-90**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
SP-1	4/4/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203518575	4/4/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203518578	4/4/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203518576	4/4/16	DU	Yes	O.K.	Yes	See attached checklist
QC1203518577	4/4/16	SK	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples?   X   Yes        No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

Reviewer Julie Warner Date April 12, 2016

**ATTACHMENT C****ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Semivolatile Organic Compounds (SVOCs) – 1,4-Dioxane**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
SP-1	4/1/16	FS	Yes	O.K.	Yes	See attached checklist
SW-1	4/1/16	FS	Yes	O.K.	Yes	See attached checklist
SW-4	4/1/16	FS	Yes	O.K.	Yes	See attached checklist
SW-5	4/1/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
Blank16090WAA026	4/1/16	BL	Yes	O.K.	Yes	See attached checklist
LCS16090WAA026	4/1/16	QC	Yes	O.K.	Yes	See attached checklist
LCSD16090WAA026	4/1/16	QC	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples?   X   Yes        No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

**ATTACHMENT C**

**ASSESSMENT OF DATA QUALITY**

Reviewer Julie Mares Date April 12, 2016

**ATTACHMENT C**  
**ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Total Mercury**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
SW-1	3/30/16	FS	Yes	O.K.	Yes	See attached checklist
SW-4	3/30/16	FS	Yes	O.K.	Yes	See attached checklist
SW-5	3/30/16	FS	Yes	O.K.	Yes	See attached checklist
SP-1	3/30/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203516962	3/30/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203516963	3/30/16	QC	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

- I. All Requested analyses performed on all samples?   X   Yes        No
- II. Resolution of Sample Processing/Missing Analytes comments:  
No processing issues or missing analytes.
- III. Resolution of Sample Processing/Missing Analytes comments:
- IV. No processing issues or missing analytes.
- V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):  
See attached checklist for details; no sample qualifications required.
- VI. Data verification calculation sheets are attached(at least one calculation per batch) NA  
Reviewer Julie Niwano Date April 12, 2016

**ATTACHMENT C****ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Total Metals (excluding Mercury)**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
CFW-1	3/29-30/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-5	3/29-30/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-5 DUP	3/29-30/16	DU (Field)	Yes	O.K.	Yes	See attached checklist
SW-1	3/29-30/16	FS	Yes	O.K.	Yes	See attached checklist
SW-4	3/29-30/16	FS	Yes	O.K.	Yes	See attached checklist
SW-5	3/29-30/16	FS	Yes	O.K.	Yes	See attached checklist
CFW-6	3/29-30/16	FS	Yes	O.K.	Yes	See attached checklist
SP-1	3/29/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203516737	3/29-30/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203516738	3/29-30/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203516739	3/29-30/16	SK	Yes	O.K.	Yes	See attached checklist
QC1203516740	3/29-30/16	SK	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples? ☒ X Yes ☐ No

II. Resolution of Sample Processing/Missing Analytes comments:  
No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):  
See attached checklist for details; no sample qualifications required.

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ATTACHMENT C

ASSESSMENT OF DATA QUALITY

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

Reviewer Julie Richards Date April 12, 2016



**ATTACHMENT C****ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Tritium**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
MW-105B	4/4/16	FS	Yes	O.K.	Yes	See attached checklist
MW-107C	4/4/16	FS	Yes	O.K.	Yes	See attached checklist
SP-1	4/4/16	FS	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203518287	4/4/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203518290	4/4/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203518288	4/4/16	DU	Yes	O.K.	Yes	See attached checklist
QC1203518289	4/4/16	SK	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples?   X   Yes        No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

Reviewer Julie Miranda Date April 12, 2016

Yankee Rowe GW Monitoring  
 March 2016 Sampling  
 GEL Work Order 393869  
 Duplicate Error Ratio (DER) Calculation Check

		Result	TPU	Duplicate Result	TPU	RPD	DER	QC Type
MW-105B	Tritium	1460	481	1500	492	3	0.06	OK
								Lab Dup

RPD relative percent difference  
 DER duplicate error ratio  
 TPU total propagated error

**ATTACHMENT C****ASSESSMENT OF DATA QUALITY**

List each analysis individually. Use a separate table for QC. Duplicates, Blanks and Spikes.  
(Several pages will be required for each batch)

**Volatile Organic Compounds (VOCs)**

Sample ID	Analysis Date	Sample Designator (Note 1)	All Scheduled Analyses Performed?	Sample Processing Comments?	Units Correct?	Assessment Criteria (Note 2) (Note 3)
SP-1	4/6/16	FS	Yes	O.K.	Yes	See attached checklist
SW-1	4/6/16	FS	Yes	O.K.	Yes	See attached checklist
SW-4	4/6/16	FS	Yes	O.K.	Yes	See attached checklist
SW-5	4/6/16	FS	Yes	O.K.	Yes	See attached checklist
TB-009	4/6/16	BL (Trip)	Yes	O.K.	Yes	See attached checklist
<b>Laboratory QC</b>						
QC1203522087	4/5/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203522088	4/5/16	QC	Yes	O.K.	Yes	See attached checklist
QC1203522089	4/6/16	SK	Yes	O.K.	Yes	See attached checklist
QC1203522090	4/6/16	SK	Yes	O.K.	Yes	See attached checklist
QC1203523631	4/6/16	BL	Yes	O.K.	Yes	See attached checklist
QC1203523632	4/6/16	QC	Yes	O.K.	Yes	See attached checklist

**NOTE**

- 1.0 FS = Field Sample, BL = Blank, QC = Lab Quality Control. DU = Duplicate, SK = Spike
- 2.0 Reported MDC  $\leq$  Required MDC for FS, DU, BL. Yield for all samples evaluated when reported.
- 3.0 Requirements for SK, DU, and QC per section D.

I. All Requested analyses performed on all samples? ☒ Yes ☐ No

II. Resolution of Sample Processing/Missing Analytes comments:

No processing issues or missing analytes.

III. Resolution of Sample Processing/Missing Analytes comments:

IV. No processing issues or missing analytes.

V. Resolution of Anomalies in QC, Duplicates, Spikes, or Blanks (Identified above):

See attached checklist for details; no sample qualifications required.

VI. Data verification calculation sheets are attached(at least one calculation per batch) NA

ATTACHMENT C

ASSESSMENT OF DATA QUALITY

Reviewer Julie Miano Date April 12, 2016

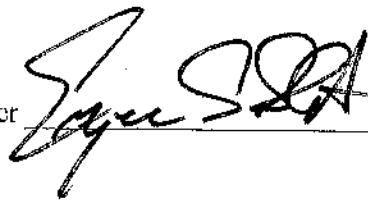
ATTACHMENT D

## REVIEW OF CHAIN OF CUSTODY AND SAMPLE DOCUMENTATION (SAMPLE)

Sampling Event Date(s) MARCH 23/24, 2016 Shipment Date MARCH 24, 2016Wells Sampled in this Batch:

- I. All samples identified on COC forms? ☒ Yes ☐ No
- II. Samples obtained match those required by sampling plan? ☒ Yes ☐ No
- III. Verification of unbroken chain of custody for samples? ☒ Yes ☐ No
- IV. Samples received intact by laboratory? ☒ Yes ☐ No
- V. Sample flush volumes and flow parameters consistent with historical data and acceptable? ☒ Yes ☐ No
- VI. Sample non-radiological parameters consistent with historical data and acceptable? ☒ Yes ☐ No
- VII. All preservative and container requirements met? ☒ Yes ☐ No
- VIII. Samples obtained match those required by sampling plan? ☒ Yes ☐ No
- IX. Evaluation for accepting sample for any questions I – VIII answered "NO" (indicate if resample will be done prior to shipment):
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Reviewer



Date

April 21, 2016

ATTACHMENT E  
YANKEE NUCLEAR POWER STATION  
SITE CHARACTERIZATION QUALITY ASSURANCE PROGRAM PLAN FOR  
SAMPLE DATA QUALITY (SAMPLE)

Identify analytes individually.

Sample	Analyte	Date	Reject, Resample or Reanalyze	Brief Description
No sample results were rejected for the March 2016 sampling event.				

- I. Identify the specific reason for rejection of sample result, resample or reanalysis requirements (this should include a description of why the data point for that analyte may/may not be omitted):

N/A

- II. Are other analytes from this sample affected? Explain.

N/A

- III. Are changes to the procedures for sampling, preservation, transport, analysis or assessment required? Explain specific changes.

N/A

Reviewer

*Julie Mianes*

Date

4/26/16

No Ovals  
on  
4/12/16

VOLATILE ORGANICS  
8260B  
REGION I VALIDATION CHECKLIST  
Criteria and Qualifications: REGION I Organics Guideline (1996)

Chemist Review  
TIER I / II / III (circle one)

SITE: Yankee Rowe Project #: 3617147318 SDG #: 393869

LAB #: GER Laboratories

Sample IDs: Attach tracking sheet and/or sample listing. See attached list

This checklist is designed to be used with USEPA Region I Validation Guidelines Part II (12/1996). During Level III validation, calculation and transcription checks are completed for instrument tuning, surrogates, target compounds, spike recoveries, calibration data, and internal standards as specified in the guideline. These checks are documented on attached validation notes.

YES	NO	NA	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Data completeness</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> All data summaries, QC forms and raw data available from hard copy or electronic data package <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Data summaries match EDD
			Contact lab if missing data. Lab to respond with 24 hours. Data reported matches CQC; CQC was not signed in the field however sampler
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Holding Times and Preservation</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Hold times met (14 days with preservation) <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Preserved (waters HCL, soils methanol)
			physically dropped coolers with Fed X for shipment and lab comments on Sample Receipt & Review Form note that containers were received intact & sealed. No action needed.
			<b>N/A Chemist Review</b> <b>Instrument Performance Check (Tune)</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Tune available for each 12-hour period samples were analyzed <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Appropriate number of significant figures reported (at least 2) <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Mass/Charge list (m/z) criteria met
			<b>N/A Chemist Review</b> <b>Initial Calibration</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> %RSD less than or equal to 30% <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> RRF greater than or equal to 0.05
			<b>N/A Chemist Review</b> <b>Continuing Calibration</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> %D less than or equal to 25% <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> RRF greater than or equal to 0.05.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Blank Contamination</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Method blank contamination <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> Trip blank contamination TB-009; ND <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Equipment/Rinseate blank contamination
			Evaluate all blanks for contamination. Highest contaminant level used for action level. * MB - MeCl <sub>2</sub> 1.1 ug; all samples ND. No quals needed.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Surrogate Recoveries</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Surrogates percent recovery criteria met

VOC\_Region I\_checklist.doc

\* No target compds reported in TB-009; TIC unknown @ RT = 3.473 min;  
remove all sample TICs at corresponding RT (all samples)

VOLATILE ORGANICS  
8260B  
REGION I VALIDATION CHECKLIST  
Criteria and Qualifications: REGION I Organics Guideline (1996)  
Chemist Review  
TIER I - II - III (circle one)

(water and soil: 70%-130%)	
<p>SP-1 MS/MSD</p> <p><b>Matrix Spikes and Laboratory Control Samples</b></p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> MS/MSD percent recovery criteria met (water and soil: 70%-130%)</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> MS/MSD RPD criteria met (water and soil &lt;30%)</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> LCS percent recovery criteria (water and soil: 70%-130%)</p>	MS/MSD: Acetone 65/63; w/in lab limits; no qual
<p><b>Field Duplicates</b></p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> RPD criteria (water &lt;30%, soils &lt;50%) met</p>	
<p>NIA Chemist Review</p> <p><b>Internal Standard</b></p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Area counts within -50 to +100 percent of calib. std.</p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Retention Time within 30 seconds of calib. std.</p>	
<p><b>Target Compounds</b> OK</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Reviewed narrative for anomalies</p>	
<p><b>Tentatively Identified Compounds (TICs)</b></p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> TCL compounds reported as TICs</p>	

Validator's Signature: Julie Nisander

Date: 4/12/16

Reference:

USEPA, 1996b. "Region 1 EPA-NE Data Validation Guidelines For Evaluating Environmental Analyses"; Quality Assurance Unit Staff; Office of Environmental Measurement and Evaluation; December 1996.

USEPA, 2006. "Method 8260C Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)", Revision 3, August, 2006.



**GC/MS Volatile  
Technical Case Narrative  
AMEC Foster Wheeler Environment & Infrastructure (AMEC)  
SDG #: 393869**

**Product:** Volatile Organic Compounds (VOC) by Gas Chromatograph/Mass Spectrometer

**Analytical Method:** SW846 8260B

**Analytical Procedure:** GL-OA-E-038 REV# 22

**Analytical Batch:** 1557512

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
393869006	SP-1
393869007	SW-1
393869008	SW-4
393869009	SW-5
393869010	TB-009
1203522087	Method Blank (MB)
1203522088	Laboratory Control Sample (LCS)
1203522089	393869006(SP-1) Post Spike (PS)
1203522090	393869006(SP-1) Post Spike Duplicate (PSD)
1203523631	Method Blank (MB)
1203523632	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Quality Control (QC) Information**

**Blank (MB) Statement**

Target analytes were detected in the blank 1203523631 (MB) below the reporting limit. ✓ no qual needed

**Miscellaneous Information**

**TIC Comment**

Tentatively identified compounds (TIC) may be requested for samples in this delivery group/work order. Please note that non-requested calibrated analytes detected in a client sample may be reported on the Form 1/Certificate of Analysis as TICs. TIC data, if requested, were included on the Sample Data Summary (Form 1) and included with the sample raw data.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

# GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

## QC Summary

Workorder: 393869

Page 7 of 13

Paramname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Volatile-GC/MS											
Batch 1557512											
1,2-Dibromoethane			U	ND	mg/L				JEB	04/06/16	18:28
1,2-Dichlorobenzene			U	ND	mg/L						
1,2-Dichloroethane			U	ND	mg/L						
1,2-Dichloropropane			U	ND	mg/L						
1,3-Dichlorobenzene			U	ND	mg/L						
1,3-Dichloropropylene			U	ND	mg/L						
1,4-Dichlorobenzene			U	ND	mg/L						
2-Butanone			U	ND	mg/L						
4-Methyl-2-pentanone			U	ND	mg/L						
Acetone			U	ND	mg/L						
Benzene			U	ND	mg/L						
Bromodichloromethane			U	ND	mg/L						
Bromoform			U	ND	mg/L						
Bromomethane			U	ND	mg/L						
Carbon tetrachloride			U	ND	mg/L						
Chlorobenzene			U	ND	mg/L						
Chloroform			U	ND	mg/L						
Dibromochloromethane			U	ND	mg/L						
Ethylbenzene			U	ND	mg/L						
Methylene chloride			J	0.00107	mg/L						
Naphthalene			U	ND	mg/L						

All samples ND;  
no quals needed

4/12/16

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Company : AMEC Foster Wheeler Environment  
& Infrastructure

Address : 511 Congress Street  
Portland, Maine 04112

Report Date: April 7, 2016

Contact: Ms. Julie Ricardi

Project: Yankee Rowe Groundwater Monitoring  
2016

Client Sample ID: TB-009  
Sample ID: 393869010

Project: AMEC005ROWE  
Client ID: AMEC005

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
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### Volatile Organics

#### GEL 8260B Method List Liquid "As Received"

cis-1,2-Dichloroethylene	U	ND	0.0003	0.001	mg/L	1
tert-Butyl methyl ether	U	ND	0.0003	0.001	mg/L	1
trans-1,2-Dichloroethylene	U	ND	0.0003	0.001	mg/L	1

#### Surrogate/Tracer recovery

Result	Nominal	Recovery%	Acceptable Limits
1,2-Dichloroethane-d4	0.0497 mg/L	99	(71%-134%)
Toluene-d8	0.0502 mg/L	100	(74%-124%)
Bromofluorobenzene	0.0509 mg/L	102	(70%-131%)

Date Time: 04/06/16 03 01

Tentatively Identified Compound (TIC) CAS No.  
unknown

RT	Est. Concentration	Fit	Qual
3.473	0.0241 mg/L	0	J

Date Time: 04/06/16 03 01

### The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 8260B	

removed from  
all samples since  
detected in TB

gr  
4/12/16

No Quals  
or  
4/12/16

SEMIVOLATILE ORGANICS  
8270C SIM - 1,4-Dioxane  
REGION I VALIDATION CHECKLIST for  
Criteria and Qualifications: REGION I Organics Guideline (1996)  
Chemist Review  
TIER I - II - III (circle one)

SITE: Yankee Rowe Project #: 367147318 SDG #: 1644529

LAB #: Eurohis Lancaster

Sample IDs: Attach tracking sheet and/or sample listing. See attached list

This checklist is designed to be used with USEPA Region I Validation Guidelines Part II (12/1996). During Level III validation, calculation and transcription checks are completed for instrument tuning, surrogates, target compounds, spike recoveries, calibration data, and internal standards as specified in the guideline. These checks are documented on attached validation notes.

YES	NO	NA	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Data completeness</b> <input checked="" type="checkbox"/> All data summaries, QC forms and raw data available from hard copy or electronic data package <input checked="" type="checkbox"/> Data summaries match EDD
			Contact lab if missing data. Lab to respond with 24 hours. <u>Data reported matches COC; COC was not signed in the field however sampler physically dropped cooler with Fed X for shipment &amp; lab comment on Sample Administration Receipt Documentation log note that samples were intact &amp; shipping container was sealed. No action needed.</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Holding Times and Preservation</b> <input checked="" type="checkbox"/> Hold times met (Waters - Extract within 7 days, analyze within 40 days. Soils - extract within 14 days, analyze within 40 days)
			<b>NIA Chemist Review</b> <b>Instrument Performance Check (Tune)</b> <input type="checkbox"/> Tune available for each 12-hour period samples were analyzed <input type="checkbox"/> Appropriate number of significant figures reported (at least 2) <input checked="" type="checkbox"/> Mass/Charge list (m/z) criteria met
			<b>NIA Chemist Review</b> <b>Initial Calibration</b> <input type="checkbox"/> %RSD less than or equal to 30% <input checked="" type="checkbox"/> RRF greater than or equal to 0.05
			<b>NIA Chemist Review</b> <b>Continuing Calibration</b> <input type="checkbox"/> %D less than or equal to 25% <input checked="" type="checkbox"/> RRF greater than or equal to 0.05.
			<b>Blank Contamination</b> <input type="checkbox"/> Method blank contamination <input checked="" type="checkbox"/> Equipment/Rinseate blank contamination
			Evaluate all blanks for contamination. Highest contaminant level used for action level.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Surrogate Recoveries</b> <input checked="" type="checkbox"/> Surrogates percent recovery criteria met:

# SEMIVOLATILE ORGANICS

8270C SIM - 1,4-Dioxane

## REGION I VALIDATION CHECKLIST for

Criteria and Qualifications: REGION I Organics Guideline (1996)

Chemist Review

TIER I / II / III (circle one)

Soil = (base/neutral 30%-130%, acid 15%-110%) Water = (base/neutral 30%-130%, acid 15%-110%)	
<b>Matrix Spikes and Laboratory Control Samples</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> MS/MSD percent recovery criteria met Soil and Water = (base/neutral 40%-140%, acid 30%-130%) <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> MS/MSD RPD criteria met (soils <50%, water <30%) <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> LCS percent recovery criteria met soil/water (base 40%-140%, acid 30%-130%)	LCS/LCSD: 73/72 <u>OK</u>
<b>Field Duplicates</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> RPD criteria met (soils <50%, water <30%)	
<b>NIA Chemist Review</b> <b>Internal Standard</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Area counts within -50 to +100 percent of calib. std. <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Retention Time within 30 seconds of calib. std.	
<b>Target Compounds</b> <u>OK</u> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Reviewed narrative for anomalies	
<b>Tentatively Identified Compounds (TICs)</b> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> TCL compounds reported as TICs	

Validator's Signature: Julie M. Warren

Date: 4/12/16

### Reference:

USEPA, 1996b. "Region 1 EPA-NE Data Validation Guidelines For Evaluating Environmental Analyses"; Quality Assurance Unit Staff; Office of Environmental Measurement and Evaluation; December 1996.

USEPA, 2007. "Method 8270D Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)", Revision 4, February, 2007.

## ANALYTICAL RESULTS

Prepared by:

Eurofins Lancaster Laboratories Environmental  
2425 New Holland Pike  
Lancaster, PA 17601

Prepared for:

AMEC  
Suite 300  
1105 Lakewood Parkway  
Alpharetta GA 30004

Report Date: April 04, 2016

Project: Yankee Rowe 2016 Monitoring Program

Submittal Date: 03/26/2016  
Group Number: 1644529  
PO Number: C012207977  
Release Number: 3617147318  
State of Sample Origin: MAClient Sample DescriptionSP-1 Grab Groundwater  
SW-4 Grab Groundwater  
SW-1 Grab Groundwater  
SW-5 Grab GroundwaterLancaster Labs (LL) #8305262  
8305263  
8305264  
8305265


The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Regulatory agencies do not accredit laboratories for all methods, analytes, and matrices. Our scopes of accreditation can be viewed at <http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/>.

Electronic Copy To Amec Foster Wheeler

Attn: Julie Ricardi

Respectfully Submitted,

Barbara A. Weyandt  
Specialist

(717) 556-7264

No Qual  
on 4/12/16

RCRA INORGANICS  
~~FAL~~ METALS (including mercury) plus Co, Fe, Mn  
 REGION I VALIDATION CHECKLIST for  
 Criteria and Qualifiers: Region I Guidelines (11/08)  
 Chemist Review  
 TIER I-II-III (circle one)

SITE: Yankee Rowe Project #: 3617147318 SDG #: 393869

LAB #: GEL Laboratories

Sample IDs: Attached tracking sheet or sample listing. See attached list

This checklist is designed to be used with the USEPA Data Validation Guidelines Part IV (November 2008). During Level III validation, calculation and transcription checks are completed for target analytes, spike recoveries, calibration data (blanks, ICV, and CCV), interference check standards, serial dilutions, and QC forms as specified in the guideline. These checks are documented on attached validation notes.

YES	NO	NA	
<b>Data completeness</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> All data summaries, QC forms and raw data available from hard copy or electronic data package <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Data summaries match EDD			Contact lab if missing data. Lab to respond with 24 hours.
<b>Holding Times and Preservation</b> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Hold times met (6 months, 28 days Hg) <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Preserved (waters HNO <sub>3</sub> )			
Calibration <u>Chemist Review</u> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> ICP/MS Instrument Tune. <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Appropriate number of standards used to establish calibration curve. <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Correlation coefficient > 0.995 for Hg <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Calibrated daily. <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> ICV/CCV %R within acceptance range. <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> CCVs analyzed at the proper frequency. <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> QL Standard within limits			Verify that tuning meets mass, resolution, and RSD method criteria. ICP: at least one blank and one standard Hg: at least one blank and four standards Correlation coefficient criteria applicable to all analyses except ICP-AES. 90-110% for ICP-AES/MS, 80-120% for Hg. See additional qualification actions in the Region 1 guidelines. Every 10 samples or every 2 hrs. 70-130% for QL Standard. If out low, (J) detects less than 2X QL standard and (UJ) non-detects. See additional validation actions in the Region I guidelines.

**RCRA INORGANICS**  
**-TAL METALS (including mercury) plus Ca, Fe, Mn**  
**REGION I VALIDATION CHECKLIST for**  
**Criteria and Qualifiers: Region I Guidelines (11/08)**  
*Chemist Review*  
**TIER I - II - III (circle one)**

<p>Blanks</p> <p>Method:</p> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Method blank was prepared with each batch of samples or with a maximum of 20 samples         </div> <div style="flex: 1;"> <input type="checkbox"/> <input checked="" type="checkbox"/> Results &gt;MDL         </div> </div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input checked="" type="checkbox"/> Absolute value negative MB results &gt; 5x MDL         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> For ICP/MS verify IS responses meet method criteria         </div> </div>	<p>Evaluate all blanks for contamination. Highest contaminant level used for action level. 5X the highest blank contamination is the action level.</p>
<p>Calibration Blanks: <i>Chemist Review</i></p> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> ICB/CCB results &gt; IDL         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Absolute value of negative ICB/CCB results &gt; 5x MDL         </div> </div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> CCB analyzed every 10 samples or 2 hrs.         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Results &gt;MDL         </div> </div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Absolute value of negative ICB/CCB results &gt; 5x MDL         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Results &gt;MDL         </div> </div>	
<p>Interference Check Sample <i>Chemist Review</i></p> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> ICS analyzed at proper frequency         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Interference present in sample at &gt; 50% concentration in ICS         </div> </div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> ICS AB %R 80%-120%         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Internal standard relative intensities reported by the laboratory         </div> </div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Internal standard relative intensities are within 60 - 125 %         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Internal standard relative intensities are within 60 - 125 %         </div> </div>	<p>An ICS must be run at the beginning and end of run or every 8 hours.</p> <p>If interferences (Al, Ca, Fe, Mg) are not &gt; 50% ICS concentration in sample, do not apply.</p> <p>Qualify data based on Region 1 guideline</p>
<p>Matrix Spikes <i>OFW-S MS/MSD: Not evaluated; sample results &gt; 4x spike concentrations</i></p> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> All compounds are within %R of 75-125% excluding results exceeding the spike concentration by ≥4x         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Were post-digestion spikes reported for unacceptable pre-digestion spike recoveries         </div> </div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Was a field blank used for spike analysis         </div> <div style="flex: 1;"> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Was a field blank used for spike analysis         </div> </div>	<p><i>RCRA Metals: ICP All OK; Hg not analyzed.</i></p> <p>Post-digestion spikes %R limits = 75% - 125%</p>



PCRA INORGANICS

-FAL METALS (including mercury) plus Ca, Fe, Mn

REGION I VALIDATION CHECKLIST for

Criteria and Qualifiers: Region I Guidelines (11/08)

Chemist Review

TIER I / II / III (circle one)

<p>Laboratory Control Samples (LCS)</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Percent recoveries are within limits (waters and soil 80-120%)</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> An LCS was analyzed for each matrix, batch of samples, or every 20 samples.</p>	
<p>Laboratory Duplicate</p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Was a field blank used as the lab duplicate</p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Is the RPD within water control limits of <math>\pm 20\%</math> for sample values <math>&gt; 5x</math> RL (35% for soil)</p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Is the control limit of <math>\pm</math> RL met for sample values <math>&lt; 5x</math> RL (2x RL for soil)</p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Was a duplicate analyzed for every matrix and every 20 samples or batch</p>	
<p>Field Duplicate CFW-S / CFW-S DUP: All OK</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> For sample values <math>&gt; 5x</math> RL, the RPD control limit of <math>\pm 30\%</math> (50% for soil) was met.</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> For sample values <math>&lt; 5x</math> RL, the control limit of <math>\pm 2x</math> RL (4x RL for soil) was met</p>	
<p>Serial Dilution CFW-S: All OK Ca, Fe, Mn, PCRA by IRP</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> Are any percent difference criteria <math>&gt; 15\%</math> (for samples with a concentration <math>&gt; 50</math> times the IDL)</p> <p><input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> Are results of the diluted samples <math>&gt;</math> the original sample results</p>	

Validator's Signature: Julie Niane

Date: 4/12/16

Reference:

USEPA, 2008. "Region 1 EPA-NE Data Validation Guidelines For Evaluating Environmental Analyses, Part IV, Inorganic data Validation Functional Guidelines"; Quality Assurance Unit Staff, Office of Environmental Measurement and Evaluation; November 2008.

Metals  
 Technical Case Narrative  
 AMEC Foster Wheeler Environment & Infrastructure (AMEC)  
 SDG #: 393869

**Product:** Determination of Metals by ICP-MS

**Analytical Method:** SW846 3005A/6020A

**Analytical Procedure:** GL-MA-E-014 REV# 27

**Analytical Batch:** 1555481

**Preparation Method:** SW846 3005A

**Preparation Procedure:** GL-MA-E-006 REV# 13

**Preparation Batch:** 1555480

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
393869001	CFW-1
393869002	CFW-5
393869003	CFW-5 DUP
393869007	SW-1
393869008	SW-4
393869009	SW-5
393869011	CFW-6
1203516737	Method Blank (MB)ICP-MS
1203516738	Laboratory Control Sample (LCS)
1203516741	393869002(CFW-5L) Serial Dilution (SD)
1203516739	393869002(CFW-5S) Matrix Spike (MS)
1203516740	393869002(CFW-5SD) Matrix Spike Duplicate (MSD)

Ca, Fe, Mn  
 REZA Metals

gn  
 4/12/16

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information**

**Sample Dilutions**

Dilutions are performed to minimize matrix interferences resulting from elevated mineral element concentrations present in solid samples and/or to bring over range target analyte concentrations into the linear calibration range of the instrument. Samples 393869002 (CFW-5), 393869003 (CFW-5 DUP) and 393869011 (CFW-6) were diluted to ensure that the analyte concentrations were within the linear calibration range of the instrument.

Analyte	393869		
	002	003	011
Manganese	10X	10X	10X

**Metals**  
**Technical Case Narrative**  
**AMEC Foster Wheeler Environment & Infrastructure (AMEC)**  
**SDG #: 393869-1**  
**Work Order #: 393878**

**Product:** Determination of Metals by ICP-MS  
**Analytical Method:** SW846 3005A/6020A  
**Analytical Procedure:** GL-MA-E-014 REV# 27  
**Analytical Batch:** 1555481

**Product:** Mercury Analysis Using the Perkin Elmer Automated Mercury Analyzer  
**Analytical Method:** SW846 7470A  
**Analytical Procedure:** GL-MA-E-010 REV# 31  
**Analytical Batch:** 1555569

**Preparation Method:** SW846 3005A  
**Preparation Procedure:** GL-MA-E-006 REV# 13  
**Preparation Batch:** 1555480

**Preparation Method:** SW846 7470A Prep  
**Preparation Procedure:** GL-MA-E-010 REV# 31  
**Preparation Batch:** 1555568

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
393878001	SP-1
393878002	SW-1
393878003	SW-4
393878004	SW-5
1203516737	Method Blank (MB)ICP-MS
1203516738	Laboratory Control Sample (LCS)
1203516741	393869002(CFW-5L) Serial Dilution (SD)
1203516739	393869002(CFW-5S) Matrix Spike (MS)
1203516740	393869002(CFW-5SD) Matrix Spike Duplicate (MSD)
1203516962	Method Blank (MB)CVAA
1203516963	Laboratory Control Sample (LCS)
1203516969	392956001(NonSDGL) Serial Dilution (SD)
1203516967	392956001(NonSDGD) Sample Duplicate (DUP)
1203516968	392956001(NonSDGS) Matrix Spike (MS)

] RCRA metals  
gr 4/12/16

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Certification Statement**

CHEMIST REVIEW-VALIDATION CHECKLIST

No Ovals  
4/12/16

Project: Yankee Rowe Method: 2320B 410.4 Alkalinity; COD  
Project #: 3617147318 Laboratory and SDG: J6EL # 393869  
Date: 4/12/16 Reviewer: Julie Richard

Chemist Review Full Validation (add page 2)

1. Case Narrative and Data Package Completeness (COC Review)

No problems noted; all results reported as per COC  
See attached sample list.

2. Holding Time and Sample Preservation/Collection

OK

3. QC Blanks

ND

4. Laboratory Control Sample Review

OK

5. Field Duplicate Precision

CFW-S / CFW-S DUP: All OK

6. Lab Duplicate Precision

OK (CFW-S)

7. Matrix Spike Results (if applicable)

CFW-S MS: OK

8. Surrogate Recovery (if applicable)

N/A

9. Internal Standard Recovery (if applicable)

N/A

General Chemistry  
Technical Case Narrative  
AMEC Foster Wheeler Environment & Infrastructure (AMEC)  
SDG #: 393869

**Product:** COD

**Analytical Method:** EPA 410.4

**Analytical Procedure:** GL-GC-E-061 REV# 19

**Analytical Batch:** 1555578

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
393869001	CFW-1
393869002	CFW-5
393869003	CFW-5 DUP
393869007	SW-1
393869008	SW-4
393869009	SW-5
393869011	CFW-6
1203517024	Method Blank (MB)
1203517025	Laboratory Control Sample (LCS)
1203517026	393869002(CFW-5) Sample Duplicate (DUP)
1203517027	393869002(CFW-5) Matrix Spike (MS)

COD; Alkalinity      8~4/12/16

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

No Quals  
 2~ 4/14/16

**RADIONUCLIDE ANALYSES**  
**VALIDATION CHECKLIST for YANKEE ROWE**  
 Gamma Spec; Sr 90; Tritium  
 TIER I / II / III Chemist Review (circle one)

SITE: Yankee Rowe Project #: 3617147318 SDG #: 393869

LAB #: GEL laboratories

Sample IDs: See attached

YES	NO	NA	
<b>Data completeness</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>		All data summaries, QC forms and raw data available from hard copy or electronic data package
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Data summaries match EDD
<b>Holding Times and Preservation</b>			Contact lab if missing data. Lab to respond with 24 hours.
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Hold times met (6 months)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Preserved <u>Gamma spec; Sr90</u>
<b>Blanks (Background Checks)</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Method blank was prepared with each batch of samples or with a maximum of 20 samples
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Are result <MDA qualify not detected (U)
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A Are results > 5 times blank concentration
<b>Tracer Recovery</b>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Recovery > 50% and <100% <u>Sr90</u>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Recovery >100%
<b>Matrix Spikes</b> <u>SP-1 for Sr90; MW-105B for Tritium</u>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Percent recovery of 75-125% excluding results exceeding the spike concentration by ≥4x
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Was a field blank used for spike analysis
<b>Laboratory Control Samples (LCS)</b> <u>all methods</u>			<u>OK</u>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Percent recoveries are within limits of 75-125%
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	LCS was analyzed for each matrix, batch of samples, or every 20 samples.

**RADIONUCLIDE ANALYSES**  
**VALIDATION CHECKLIST for YANKEE ROWE**

TIER I / II / III / Chemist Review (circle one)

<b>Laboratory Duplicate</b> <i>Sp-1 for Sr90 &amp; Gemma Spec; MW-105B for tritium</i> <input type="checkbox"/> <input checked="" type="checkbox"/> Was a field blank used as the lab duplicate <input checked="" type="checkbox"/> <input type="checkbox"/> RPD within 20% for results greater than 5X CRDL <input type="checkbox"/> <input checked="" type="checkbox"/> Is the AZS >3 <i>All OK</i> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Duplicate analyzed for every matrix and every 20 samples or batch	If the AZS for a particular radionuclide is > 3, qualify the results for that radionuclide in all associated samples of the same matrix as estimated (J).
<b>Field Duplicate</b> <input type="checkbox"/> <input type="checkbox"/> <i>NIA</i> RPD within 20% for results greater than 5X CRDL <input type="checkbox"/> <input type="checkbox"/> <i>↓</i> Is the AZS >3	
<b>Quantitation</b> <input checked="" type="checkbox"/> <input type="checkbox"/> Results <DL qualified as non-detect (U)	

Validator's Signature: *Jurii M. Wane*

Date: *4/14/16*

Reviewed By: *Brooklyn B. G. O.*

Date: *4/21/16*

**Additional Comments**

The matrix spike, 1203518577 (SP-1MS), aliquot was reduced to conserve sample volume.

**Product:** LSC, Tritium Dist, Liquid

**Analytical Method:** EPA 906.0 Modified

**Analytical Procedure:** GL-RAD-A-002 REV# 21

**Analytical Batch:** 1556067

The following samples were analyzed using the above methods and analytical procedure(s).

**GEL Sample ID#****Client Sample Identification**

393869004	MW-105B
393869005	MW-107C
393869006	SP-1
1203518287	Method Blank (MB)
1203518288	393869004(MW-105B) Sample Duplicate (DUP)
1203518289	393869004(MW-105B) Matrix Spike (MS)
1203518290	Laboratory Control Sample (LCS)

] Tritium

gr 4/12/16

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information****Recounts**

Sample 393869005 (MW-107C) was recounted to verify sample result. The recount result is similar to the original result. Original result is reported.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.



**Radiochemistry**  
**Technical Case Narrative**  
**AMEC Foster Wheeler Environment & Infrastructure (AMEC)**  
**SDG #: 393869**

**Product:** Gammaspec, Gamma, Liquid  
**Analytical Method:** EPA 901.1  
**Analytical Procedure:** GL-RAD-A-013 REV# 25  
**Analytical Batch:** 1555988

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
393869006	SP-1 <i>J</i> <i>8 spec</i>
1203518030	Method Blank (MB)
1203518031	393869006(SP-1) Sample Duplicate (DUP)
1203518032	Laboratory Control Sample (LCS)

*for y112116*

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** GFPC, Sr90, liquid  
**Analytical Method:** EPA 905.0 Modified/DOE RP501 Rev. 1 Modified  
**Analytical Procedure:** GL-RAD-A-004 REV# 17  
**Analytical Batch:** 1556160

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
393869006	SP-1 <i>J</i> <i>Sr 90</i>
1203518575	Method Blank (MB)
1203518576	393869006(SP-1) Sample Duplicate (DUP)
1203518577	393869006(SP-1) Matrix Spike (MS)
1203518578	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Miscellaneous Information**