



**YANKEE ATOMIC ELECTRIC COMPANY**

49 Yankee Road, Rowe, Massachusetts 01367

April 20, 2016

BYR 2016-021

10 CFR 50.4 and 10 CFR 50.36a(a)(2)

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555 - 0001

Yankee Atomic Electric Company  
Yankee Nuclear Power Station Independent Spent Fuel Storage Installation  
NRC License No. DPR-3 (NRC Docket No. 50-029)

Subject: Annual Radioactive Effluent Release Report, Annual Radiological Environmental Operating Report, and Changes to the Off-Site Dose Calculation Manual for 2015

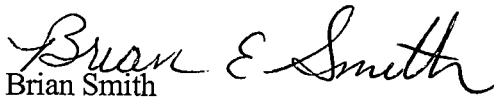
10 CFR 50.36a(a)(2), Section 2.3.2 of Appendix C of the Yankee Atomic Electric Company (YAEC) Quality Assurance Program (QAP) for the Yankee Rowe Independent Spent Fuel Storage Installation (ISFSI), and Section F.2 of the Yankee Nuclear Power Station ISFSI Off-Site Dose Calculation Manual (ODCM), require YAEC to submit an Annual Radioactive Effluent Release Report. Enclosure 1 provides this report for the period of January 1 through December 31, 2015.

Section 2.3.1 of Appendix C of the YAEC QAP for the Yankee Rowe ISFSI and Section F.1 of the Yankee Nuclear Power Station ISFSI ODCM require the submittal of an Annual Radiological Environmental Operating Report. Enclosure 2 provides the report for the period of January 1 through December 31, 2015.

Section 2.2b) of Appendix C of the YAEC Quality Assurance Program for the Yankee Rowe ISFSI requires that any changes to the ODCM to be submitted as part of or concurrent with the Annual Radioactive Effluent Release Report. Enclosure 3 provides Revision 23 to the Yankee Nuclear Power Station ISFSI ODCM. It was issued during the period of January 1 through December 31, 2015.

If you have any questions regarding this submittal, please do not hesitate to contact me at (413) 424-5261 ext. 303.

Respectfully,

  
Brian Smith  
ISFSI Manager

NM5501

Enclosures:

1. Yankee Nuclear Power Station Independent Spent Fuel Storage Installation, Annual Radioactive Effluent Release Report, January – December 2015.
2. Yankee Nuclear Power Station Independent Spent Fuel Storage Installation, Annual Radiological Environmental Operating Report, January – December 2015
3. Yankee Nuclear Power Station Independent Spent Fuel Storage Installation, Off-Site Dose Calculation Manual, Revision 23

cc: D. Dorman, NRC Region I Administrator  
R. Powell, Chief, Decommissioning Branch, NRC, Region 1  
J. Goshen, NRC Project Manager  
J. Giarrusso, Planning, Preparedness & Nuclear Section Chief, MEMA  
J. Cope-Flanagan, Assistant General Counsel, MDPU  
J. Reyes, State of Massachusetts Office of the Attorney General

ENCLOSURE 1

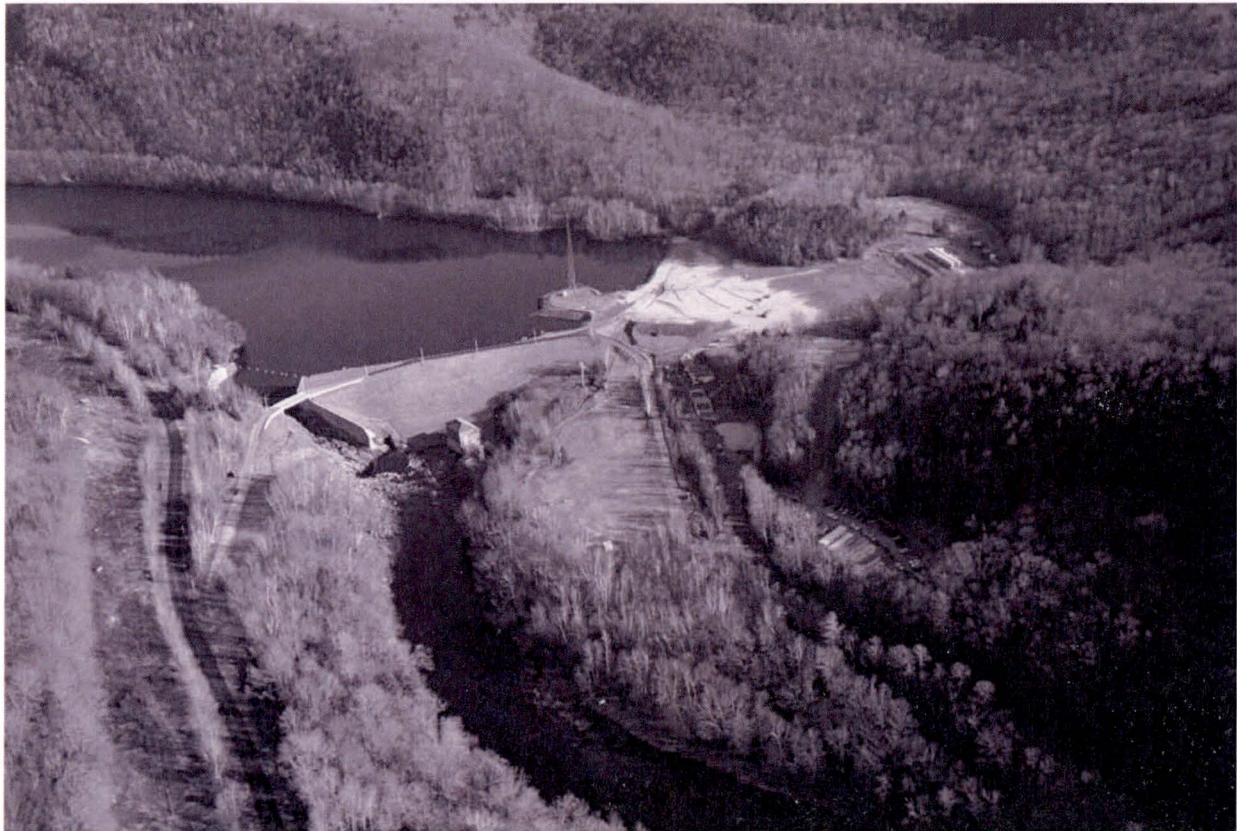
YANKEE NUCLEAR POWER STATION  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION  
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
JANUARY – DECEMBER 2015

**YANKEE NUCLEAR POWER STATION  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION**

License Nos. DPR-3 and SFGL-13

**ANNUAL RADIOACTIVE EFFLUENT  
RELEASE REPORT**

January - December 2015



**April 2016**

Prepared by:

**Radiation Safety & Control Services  
91 Portsmouth Avenue  
Stratham, NH 03885-2468**

## **EXECUTIVE SUMMARY**

Tables 1 and 2 summarize the quantity of radioactive gaseous and liquid effluents, respectively, for each quarter of 2015. There were no gaseous or liquid releases in 2015. Table 3 summarizes waste shipped off-site for disposal for each half year of 2015. There was no waste shipped for disposal in 2015.

Appendices A and B indicate the status of reportable items per the requirements of the Off-site Dose Calculation Manual (ODCM). There were no reportable items in 2015. Appendix C presents any changes in the ODCM. The ODCM was revised in 2015.

**Table 1**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Gaseous Effluents-Summation of All Releases

Nuclides Released	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Error
A. Fission and Activation Gases						
Total Release	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average release rate	μCi/s	N/A*	N/A*	N/A*	N/A*	
Percent of regulatory limit	%	N/A*	N/A*	N/A*	N/A*	
B. Iodines						
Total Iodines released	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average release rate	μCi/s	N/A*	N/A*	N/A*	N/A*	
Percent of regulatory limit	%	N/A*	N/A*	N/A*	N/A*	
C. Particulates						
Particulates Released	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average release rate	μCi/s	N/A*	N/A*	N/A*	N/A*	
Percent of regulatory limit	%	N/A*	N/A*	N/A*	N/A*	
Gross alpha radioactivity	Ci	N/A*	N/A*	N/A*	N/A*	
D. Tritium						
Total release	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average release rate	μCi/s	N/A*	N/A*	N/A*	N/A*	
Percent of regulatory limit	%	N/A*	N/A*	N/A*	N/A*	

N/A\*= Not Applicable

There are no gaseous effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)

**Table 1A**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Gaseous Effluents - Ground Level Releases - Batch Mode

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
<b>1. Fission Gases</b>						
Krypton-85	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-85m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-87	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-88	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-138	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>2. Iodines</b>						
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>3. Particulates</b>						
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Others-						
Plutonium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Curium-243,244	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-234	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Thorium-232	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Radium-226	Ci	N/A*	N/A*	N/A*	N/A*	N/A*

N/A\*= Not Applicable

There are no gaseous effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)

**Table 1B**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Gaseous Effluents - Ground Level Releases - Continuous Mode

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
<b>1. Fission Gases</b>						
Krypton-85	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-85m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-87	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-88	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-138	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>2. Iodines</b>						
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>3. Particulates</b>						
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Others-						
Plutonium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Curium-243,244	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-234	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Thorium-232	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Radium-226	Ci	N/A*	N/A*	N/A*	N/A*	N/A*

N/A\*= Not Applicable

There are no gaseous effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)



**Table 1C**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Gaseous Effluents - Elevated Releases – Batch Mode

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
<b>1. Fission Gases</b>						
Krypton-85	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-85m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-87	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-88	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-138	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>2. Iodines</b>						
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>3. Particulates</b>						
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Others-						
Plutonium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Curium-243,244	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-234	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Thorium-232	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Radium-226	Ci	N/A*	N/A*	N/A*	N/A*	N/A*

N/A\*= Not Applicable

There are no gaseous effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)

**Table 1D**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Gaseous Effluents - Elevated Releases – Continuous Mode

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
<b>1. Fission Gases</b>						
Krypton-85	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-85m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-87	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Krypton-88	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-135m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Xenon-138	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>2. Iodines</b>						
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-133	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-135	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
<b>3. Particulates</b>						
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Others-						
Plutonium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Curium-243,244	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-234	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Uranium-238	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Thorium-232	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Radium-226	Ci	N/A*	N/A*	N/A*	N/A*	N/A*

N/A\* = Not Applicable

There are no gaseous effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)

**Table 2**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Liquid Effluents - Summation of All Releases

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Error
<b>A. Fission and Activation Products</b>						
Total Release (not including tritium, gases, alpha)	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average diluted concentration during period	μCi/ml	N/A*	N/A*	N/A*	N/A*	
Percent of applicable limit	%	N/A*	N/A*	N/A*	N/A*	
<b>B. Tritium</b>						
Total Release	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average diluted concentration during period	μCi/ml	N/A*	N/A*	N/A*	N/A*	
Percent of applicable limit	%	N/A*	N/A*	N/A*	N/A*	
<b>C. Dissolved and Entrained Gases</b>						
Total Release	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average diluted concentration during period	μCi/ml	N/A*	N/A*	N/A*	N/A*	
Percent of applicable limit	%	N/A*	N/A*	N/A*	N/A*	
<b>D. Gross Alpha Radioactivity</b>						
Total release	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Average diluted concentration during period	μCi/ml	N/A*	N/A*	N/A*	N/A*	
<b>E. Volume of Waste Released (prior to dilution)</b>	Liters	N/A*	N/A*	N/A*	N/A*	
<b>F. Volume of Dilution Water Used During Period</b>	Liters	N/A*	N/A*	N/A*	N/A*	

N/A\*= Not Applicable

There are no liquid effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)

**Table 2A**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Liquid Effluents – Batch Mode

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Totals
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-58	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iron-59	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Zinc-65	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Manganese-54	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Chromium-51	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Zirconium-Niobium-95	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Molybdenum-99	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Technetium-99m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cerium-141	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Others- Iron-55	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Antimony-125	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period (above)	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Dissolved and Entrained Gasses	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Tritium	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Gross Alpha	Ci	N/A*	N/A*	N/A*	N/A*	N/A*

N/A\*= Not Applicable

There are no liquid effluents associated with the Yankee Nuclear Power Station  
Independent Spent Fuel Storage Installation (ISFSI)

**Table 2B**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
2015 Liquid Effluents – Continuous Mode

<b>Nuclides Released</b>	<b>Unit</b>	<b>1st Quarter</b>	<b>2nd Quarter</b>	<b>3rd Quarter</b>	<b>4th Quarter</b>	<b>Totals</b>
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-58	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Iron-59	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Zinc-65	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Manganese-54	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Chromium-51	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Zirconium-Niobium-95	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Molybdenum-99	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Technetium-99m	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Cerium-141	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Others- Iron-55	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Antimony-125	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Total for period (above)	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Dissolved and Entrained Gasses	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Tritium	Ci	N/A*	N/A*	N/A*	N/A*	N/A*
Gross Alpha	Ci	N/A*	N/A*	N/A*	N/A*	N/A*

N/A\*= Not Applicable

There are no liquid effluents associated with the Yankee Nuclear Power Station Independent Spent Fuel Storage Installation (ISFSI)

**Table 3**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
First Half 2015 Low Level Waste Shipments

Resins, Filters and Evaporator Bottoms		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				
Dry Active Waste		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				
Irradiated Components		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				
Other Waste		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				

**Table 3A**

YNPS ISFSI  
Effluent and Waste Disposal Annual Report  
Second Half 2015 Low Level Waste Shipments

Resins, Filters and Evaporator Bottoms		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				
Dry Active Waste		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				
Irradiated Components		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				
Other Waste		Volume		Curies Shipped
Waste Class	Solidifying Agent	ft <sup>3</sup>	m <sup>3</sup>	Curies
A		0	0	0
B		0	0	0
C		0	0	0
All		0	0	0
Major radionuclides for above data:				

## **Appendix A**

### **Radiation Dose Assessment**

There were no gaseous or liquid effluent releases in 2015. Therefore, an assessment of radiation doses to the most likely exposed member(s) of the public to show compliance with 40CFR190 or 10CFR72.104 from effluents was not required.



## **Appendix B**

### **Unplanned Releases**

There were no unplanned releases of radioactive materials in effluents in 2015.

## Appendix C

### Off-site Dose Calculation Manual Changes

There were changes to the Off-site Dose Calculation Manual in 2015. The following table presents the changes to the ODCM.

Section	Proposed Change	Rationale
1.0, 2.3.1, 3.2	As applicable, expanded references to 10 CFR 72.104 to 10 CFR 72.104(a).	The expanded references accurately reflect the correct subpart of the code.
1.0, 2.3.1, 3.2	As applicable, expanded references to 40 CFR 190 to 40 CFR 190.10(a) or 40 CFR 190.11.	The expanded references accurately reflect the correct subpart of the code.
1.0, 2.3.1, 3.2	Administrative, editorial, or grammatical changes.	Corrects the language and grammar utilized in the document.
1.0, Figure 1.2	Replaced the term Owner Controlled Area with Controlled Area	Controlled Area is defined in 10 CFR 72.3 and referenced in 10 CFR 72.104 and 10 CFR 72.106. The term is also used in 10 CFR 20 Subpart D.
1.0	Defined that the Site Boundary is the current 10 CFR 50 Licensed Area	The NRC's Safety Evaluation Report regarding the release of land identified that the site boundary had changed. The applicable reference is: Letter from K. I. McConnell (NRC) to W. Norton (YAEC), Yankee Nuclear Power Station – Release of Land from Part 50 License, dated August 10, 2007.
1.1	Defined the property boundary and the controlled area, and modified the definition of the site boundary.	<p>Previously, the Site Boundary was also the property boundary. However, the NRC Safety Evaluation Report dated August 10, 2007, identified that the site boundary needs to be modified to reflect the area governed by the YNPS 10 CFR 50 License.</p> <p>A definition for the property boundary was provided for information.</p> <p>The controlled area boundary is utilized for establishing that the dose to members of the public complies with 10 CFR 20, Subpart D, 10 CFR 72.104(a) and 40 CFR 190.10(a).</p>
2.3.2	The Controlled Area boundary is the location that the site utilizes for establishing that the dose to members of the public complies with 10 CFR 72.104(a) and 40 CFR 190.10(a).	This is consistent with 10 CFR 72.106.
2.3	Identifies that realistic occupancy factors are applied to the net exposure values to determine the annual dose.	Provides a more thorough description of the methodology to determine the annual dose.

Section	Proposed Change	Rationale
3.1	Currently, the section requires missing data to be submitted in a supplementary report. This was revised to identify that if the data is available, it will be submitted in the next annual report.	The change clarifies that missing data will be submitted if it is available. The current wording would be a compliance trap if the data was not available.
4.0	Added references to the Quality Assurance Program, NRC Safety Evaluation dated August 10, 2007, 10 CFR 72.104, 40 CFR 190.10, and 40 CFR 190.11.	References added to be consistent with changes described above and to provide applicable source documents.

ENCLOSURE 2

YANKEE NUCLEAR POWER STATION  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION  
ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT  
JANUARY – DECEMBER 2015

**YANKEE NUCLEAR POWER STATION  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION**

License Nos. DPR-3 and SFGL-13

**ANNUAL RADIOLOGICAL ENVIRONMENTAL  
OPERATING REPORT**

January - December 2015



**April 2016**

Prepared by:  
**Radiation Safety & Control Services**  
91 Portsmouth Avenue  
Stratham, NH 03885-2468

## **EXECUTIVE SUMMARY**

Yankee Nuclear Power Station was permanently shutdown in 1991. All fuel has been transferred into dry storage casks and placed at the Independent Spent Fuel Storage Installation. The Radiological Environmental Monitoring Program (REMP) for the Yankee Nuclear Power Station (YNPS) Independent Spent Fuel Storage Installation (ISFSI) located in Rowe, MA was continued for the period January through December 2015 in compliance with the YNPS Offsite Dose Calculation Manual (ODCM).

By design, there are no liquid or gaseous effluents associated with the operation of the ISFSI. Therefore, the ODCM only requires monitoring of direct exposure from the facility. TLDs were used to measure direct gamma exposure at six locations in the vicinity of the ISFSI and one control location 7.6 kilometers away. The results of these measurements showed no significant change in exposure rates and potential doses to members of the public during the monitoring period. The results of the monitoring performed in 2015 also show that operating the YNPS ISFSI results in only a small fraction of the 40 CFR Part 190 and 10 CFR Part 72.104 direct radiation dose limit of 25 mrem/year to members of the public.

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## 1.0 INTRODUCTION

This report summarizes the findings of the Radiological Environmental Monitoring Program (REMP) conducted by Yankee in the vicinity of the Independent Spent Fuel Storage Installation in Rowe, Massachusetts during the calendar year. It is submitted annually in compliance with the Offsite Dose Calculation Manual (ODCM). The remainder of this report is organized as follows:

- Section 2: Provides a brief description of the Yankee site and its environs.
- Section 3: Provides a description of the overall REMF design. Included is a summary of the ODCM requirements for REMF sampling, tables listing TLD monitoring locations with compass sectors and distances from the ISFSI, and maps showing the location of each of the TLD monitoring locations.
- Section 4: Provides a complete set of TLD data showing measured results (mR) and calculated doses (mrem per year). This section also provides the summarized TLD data in the format specified by the NRC Branch Technical Position on Environmental Monitoring (Reference 1).
- Section 5: Provides the results of the calendar year monitoring program. The performance of the program in meeting ODCM requirements is discussed, and the data acquired during the year is analyzed.
- Section 6: References

## **2.0 GENERAL ISFSI AND SITE INFORMATION**

The Yankee Nuclear Power Station site is located on over 1800 acres in a predominantly rural area of northwestern Massachusetts, three-quarters of a mile south of the Vermont border. The site resides in the town of Rowe, Massachusetts, approximately 9 air miles east-northeast of North Adams, Massachusetts. The surrounding area is heavily forested and lightly populated. Hills bounding the river valley rise 500 to 1000 feet above the site, reaching elevations of 2100 feet.

The Deerfield River is used extensively for hydroelectric power generation both upstream and downstream of YNPS. The Sherman Dam, immediately adjacent to the site, operates as a hydroelectric generating station. Sherman Pond, the impoundment behind this dam, had been used as a source of cooling water for the former power plant.

The former nuclear power plant was voluntarily shut down on October 1, 1991 after 31 years of operation. The site was involved in the process of decommissioning over the years which involved the disassembly and removal of the plant components and structures and was completed in 2006. This process took place in strict conformance with USNRC regulations. Oversight of the site closure process also took place from the U.S. Environmental Protection Agency, the Massachusetts Department of Environmental Protection, and Massachusetts Department of Public Health.

## **3.0 PROGRAM DESIGN**

The Radiological Environmental Monitoring Program (REMP) for the Yankee Nuclear Power Station ISFSI was designed to provide assurance to regulatory agencies and the public that the station's environmental impact is known and within anticipated limits. The direct dose limit for members of the public from operation of the ISFSI is 25 mrem per year (References 3 and 4).

The detailed sampling requirements of the REMP are given in the ODCM. The sampling requirements specified in the ODCM are summarized in Table 3.1 of this report. Details of the monitored locations are shown in Table 3.2, as well as Figures 3.1 through 3.4 of this report.

### **3.1 Monitoring Zones**

The REMP is designed to allow comparison of levels of radioactivity in samples from the area possibly influenced by the ISFSI to levels found in areas not influenced by the ISFSI. The first area is called "indicator stations". The second area is called "control stations". The distinction between the two is based on relative direction from the facility and distance. Analysis of survey data from the two zones aids in determining if there is a significant difference between the two areas. It can also help in differentiating between radioactivity or radiation due to releases and that due to other fluctuations in the environment, such as seasonal variations in the natural background.

### **3.2 Pathways Monitored**

Based on the design of the ISFSI, only the direct radiation exposure pathway is monitored by the REMP. This pathway is monitored by the collection of thermoluminescent dosimeters (TLDs) which are described in more detail below.

### **3.3 Description of Monitoring Program**

#### **3.3.1 Direct Radiation**

Direct gamma radiation exposure was continuously monitored during 2015 with the use of thermoluminescent dosimeters (TLDs). At each monitoring location, these TLDs are sealed in plastic bags and attached to an object such as a tree, fence or utility pole. The TLDs are posted and retrieved on a semi-annual basis. All TLDs are provided and processed by a National Voluntary Laboratory Accreditation Program (NVLAP) certified vendor. The TLDs are placed at various locations around the Independent Spent Fuel Storage Installation (ISFSI). Table 3.2 lists the Station ID Codes, distances and direction of the TLDs from the ISFSI.

#### **3.3.2 Special Monitoring**

Special samples can be taken that are not required in the ODCM. The sample locations do not appear in Table 3.1 or 3.2 of this report. For this monitoring period, no special samples were collected as part of the YNPS ISFSI Radiological Environmental Monitoring Program.

**Table 3.1**  
**Radiological Environmental Monitoring Program**

<b>Exposure Pathway and/or Sample Media</b>	<b>Collection</b>			<b>Analysis</b>	
	<b>Number of Sample Locations</b>	<b>Routine Sampling Mode</b>	<b>Collection Frequency</b>	<b>Analysis Type</b>	<b>Analysis Frequency</b>
Direct Radiation (TLD)	Total Locations: 7 (6 around perimeter of the site and 1 offsite control location)	Continuous	Semi- annual	Gamma dose	Semi- annual

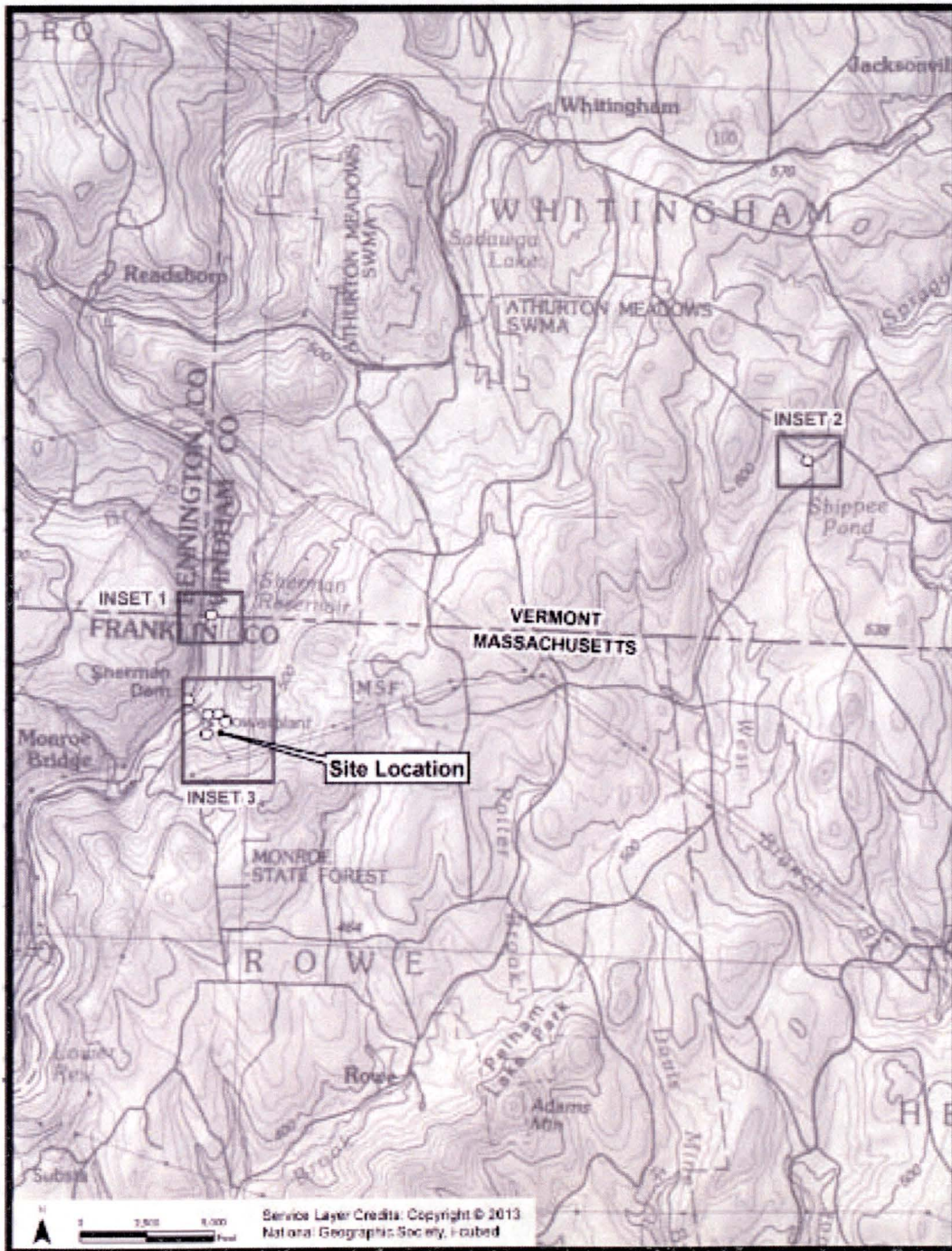
**Table 3.2**  
**Radiological Environmental Monitoring Locations**

<b>Station Code</b>	<b>Station Description</b>	<b>Zone *</b>	<b>Distance From ISFSI (km)</b>	<b>Direction From ISFSI</b>
GM-15	Onsite Perimeter (I)**	1	0.24	NW
GM-16	Onsite Perimeter (I)**	1	0.22	NNW
GM-17	Onsite Perimeter (I)**	1	0.13	NNE
GM-21	Onsite Perimeter (I)**	1	0.17	WSW
GM-02	Observation Stand (O)**	1	0.50	NW
GM-06	Tunnel Road Readsboro Town Line (O)**	1	1.30	N
GM-27	Number Nine Road (O)*	2	7.60	ENE

\*2 = Control TLD; 1 = Indicator TLD

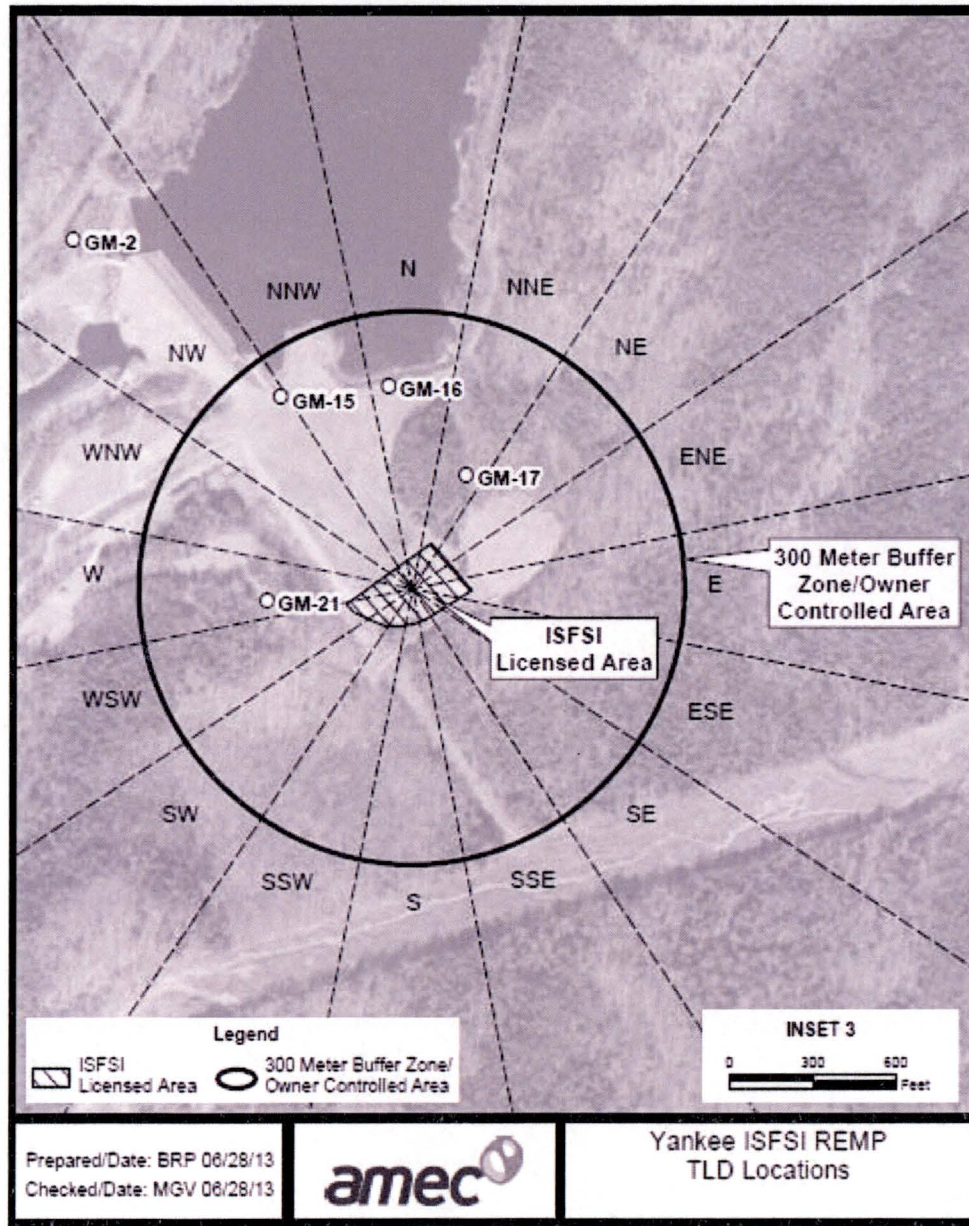
\*\*I = Inner Ring TLD; O = Outer Ring TLD

**Figure 3.1**  
**All Radiation Monitoring Locations**



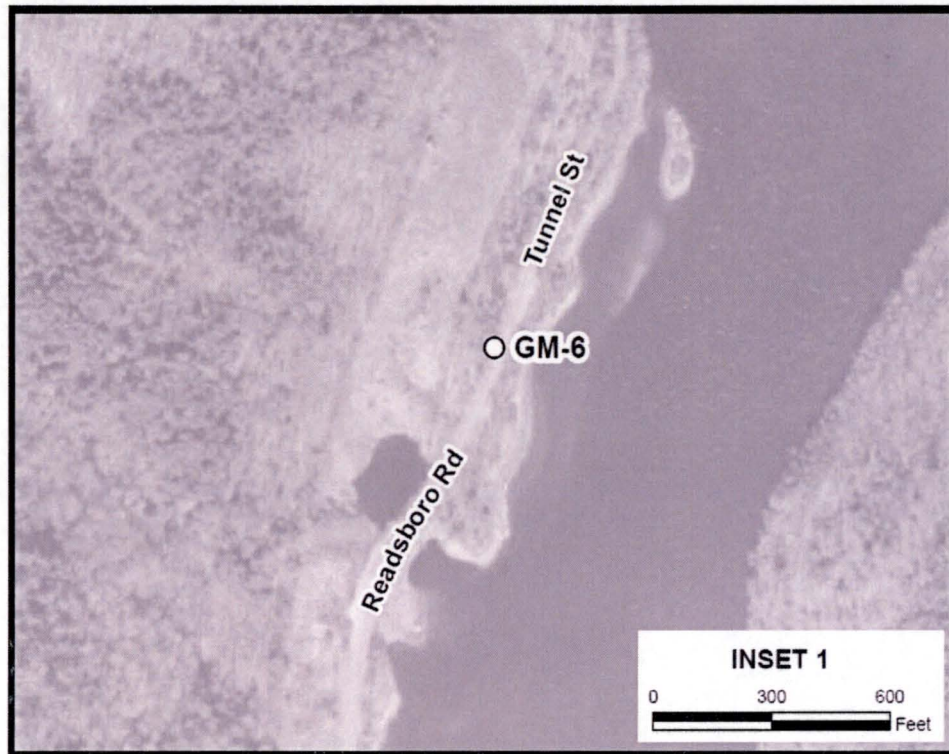


**Figure 3.2**  
**Onsite Direct Radiation Monitoring Locations**

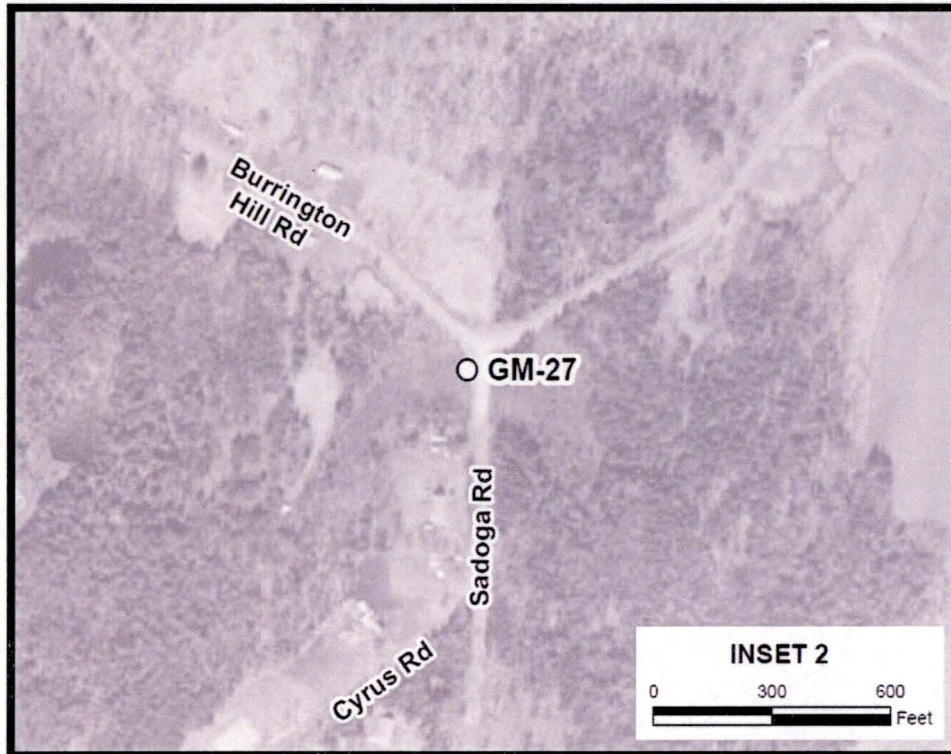




**Figure 3.3**  
**Direct Radiation Monitoring Locations (Within 1 mile)**



**Figure 3.4**  
**Offsite Control Location**



## **4.0 RADIOLOGICAL DATA SUMMARY TABLES**

This section summarizes the analytical results of the environmental samples, which were collected during the monitoring period.

- Data from direct radiation measurements made by TLDs are presented in Table 4.1.
- The summarized TLD measurements, shown in Table 4.2, are presented in a format similar to that prescribed in the NRC's Radiological Assessment Branch Technical Position on Environmental Monitoring (Reference 1).
- Table 4.3 presents the estimated direct dose from ISFSI operations as determined by TLD data shown in Table 4.1.

**Table 4.1 TLD Measurements by Half-Year  
(mR)**

<b>Station ID</b>	<b>Location</b>	<b>1<sup>st</sup> Half-Year</b>	<b>2<sup>nd</sup> Half-Year</b>
GM-02	Observation Stand	37	42
GM-06	Tunnel Road Readsboro Town Line	45.5	53
GM-15	On-site perimeter	52	56
GM-16	On-site perimeter	48	54
GM-17	On-site perimeter	42	51
GM-21	On-site perimeter	44	49
GM-27	Control	41	45
GM-27a	Control Backup	40	41

**Note:** The TLD at location GM-06 was not present for retrieval at the end of the first half of 2015. The value listed is the average of the year 2014 measurements.

**Table 4.2 TLD Data Summary  
(mR)**

Indicator TLDs	Control TLDs	Indicator Station With Highest Mean	
		Station #	Mean (Range) (No. Measurements)*
Mean (Range) (No. Measurements)*	Mean (Range) (No. Measurements)*		
47.8	41.8	GM-15	54
(37 – 56)	(40 – 45)		(52 – 56)
(11)	(4)		(2)

**Note:** The TLD at location GM-06 was not present for retrieval at the end of the first half of 2015. The values listed in the Indicator TLDs column include the 2014 average GM-6 value substituted for the missing measurement.

\* Each "measurement" is based on semi-annual readings.

**Table 4.3 Direct Dose from ISFSI Operations  
(mrem)**

Station ID	1 <sup>st</sup> Half-Year		2 <sup>nd</sup> Half-Year		Annual Dose
	Net TLD Result	Calculated Dose	Net TLD Result	Calculated Dose	
GM-02	0.00	0.00	0.00	0.00	0.00
GM-06	5.00	0.29	10.00	0.57	0.86
GM-15	11.50	0.66	13.00	0.74	1.40
GM-16	7.50	0.43	11.00	0.63	1.06
GM-17	1.50	0.09	8.00	0.46	0.55
GM-21	3.50	0.20	6.00	0.34	0.54
			<b>Max Dose =&gt;</b>		<b>1.40</b>

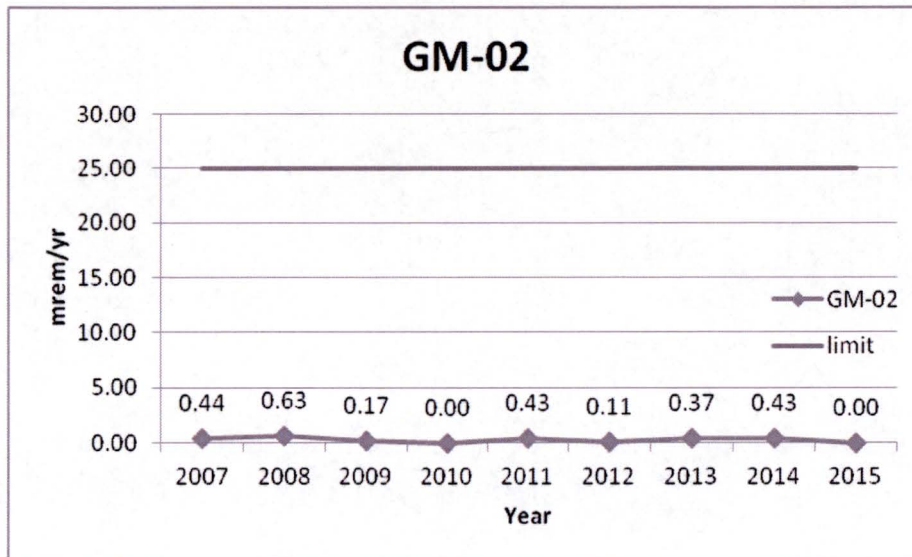
**Note:** The TLD at location GM-06 was not present for retrieval at the end of first half of 2015. The value shown in the Net TLD result column in the 1<sup>st</sup> Half-Year was based upon the average of the year 2014 measurements.

**Note:** Doses based on a 250 hour occupancy in both of the first and second half-years.

### **Radiological Environmental Monitoring Program Trending**

A series of graphs of REMP TLD data have been developed and are provided for trending purposes. The trending is developed for each of the indicator locations based on the annual historical doses. The trending is provided for the “real members of the public” based on the guidance provided in the ODCM. The analysis of the trends and associated data shows very small annual doses with minor fluctuations in the data. In this report, the uncorrected TLD results have been summarized and the annual doses, calculated for “real members of the public” based upon guidance in the ODCM, have been plotted for trending.

**Figure 4.1 Annual Dose Trend at GM-02**

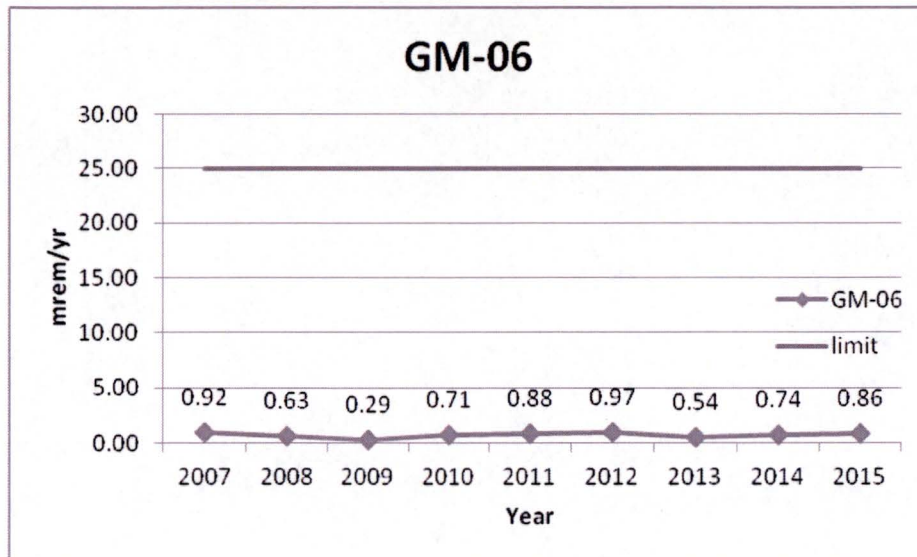


**Annual Doses (mrem/yr)**

Location	2007	2008	2009	2010	2011	2012	2013	2014	2015
GM-02	0.44	0.63	0.17	0.00	0.43	0.11	0.37	0.43	0.00



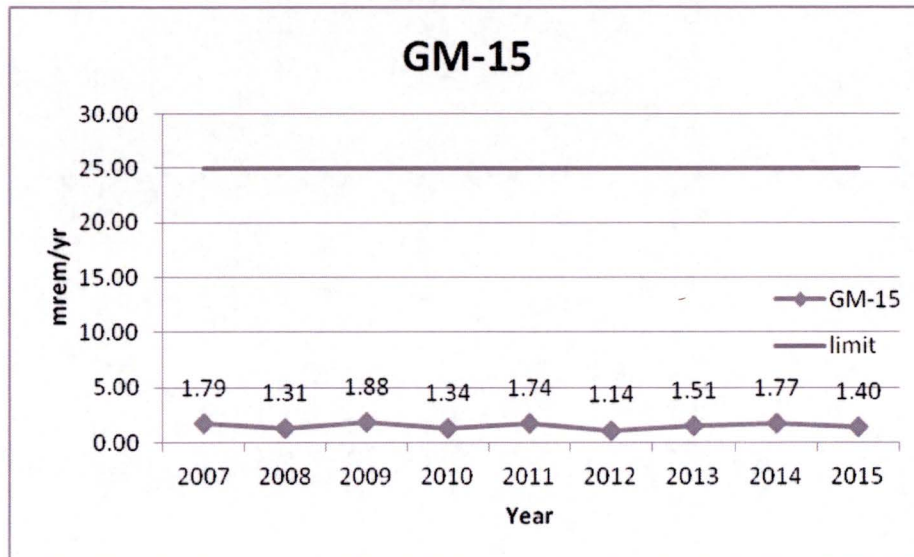
**Figure 4.2 Annual Dose Trend at GM-06**



**Annual Doses (mrem/yr)**

Location	2007	2008	2009	2010	2011	2012	2013	2014	2015
GM-06	0.92	0.63	0.29	0.71	0.88	0.97	0.54	0.74	0.86

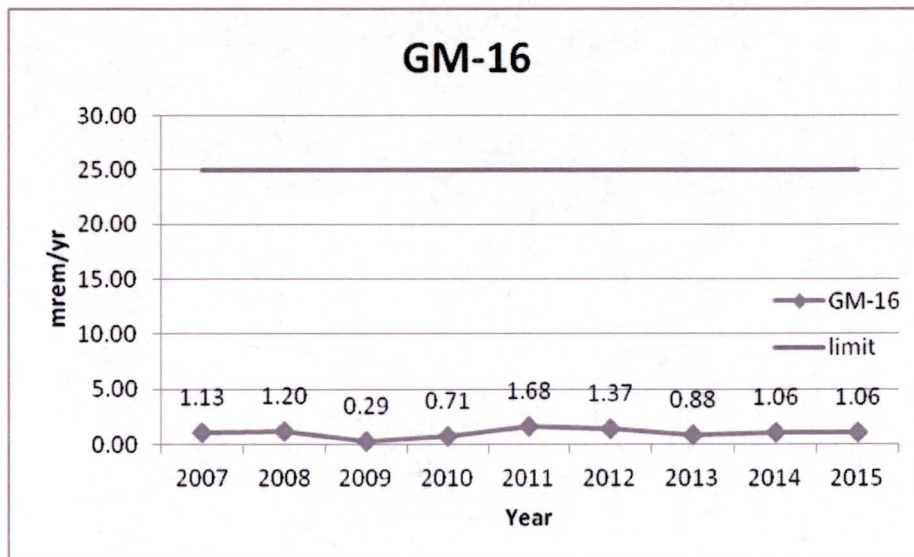
**Figure 4.3 Annual Dose Trend at GM-15**



**Annual Doses (mrem/yr)**

Location	2007	2008	2009	2010	2011	2012	2013	2014	2015
GM-15	1.79	1.31	1.88	1.34	1.74	1.14	1.51	1.77	1.40

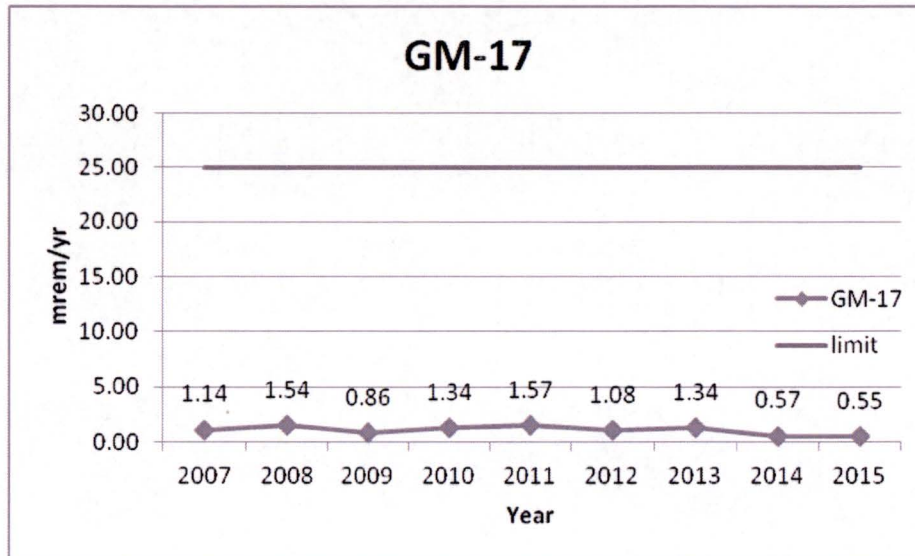
**Figure 4.4 Annual Dose Trend at GM-16**



**Annual Doses (mrem/yr)**

Location	2007	2008	2009	2010	2011	2012	2013	2014	2015
GM-16	1.13	1.20	0.29	0.71	1.68	1.37	0.88	1.06	1.06

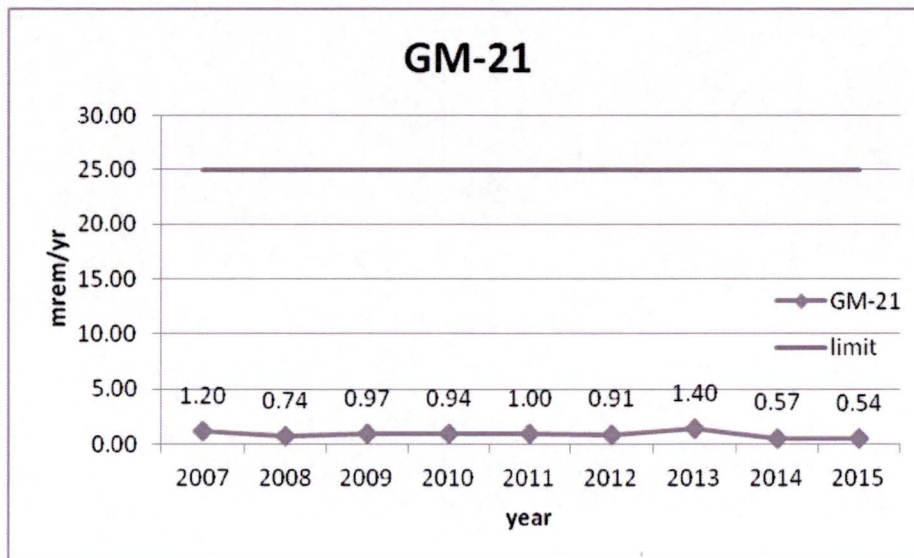
**Figure 4.5 Annual Dose Trend at GM-17**



**Annual Doses (mrem/yr)**

Location	2007	2008	2009	2010	2011	2012	2013	2014	2015
GM-17	1.14	1.54	0.86	1.34	1.57	1.08	1.34	0.57	0.55

**Figure 4.6 Annual Dose Trend at GM-21**



**Annual Doses (mrem/yr)**

Location	2007	2008	2009	2010	2011	2012	2013	2014	2015
GM-21	1.20	0.74	0.97	0.94	1.00	0.91	1.40	0.57	0.54

## **5.0 ANALYSIS OF ENVIRONMENTAL RESULTS**

### **5.1 Sampling Program Deviations**

A sampling program deviation is defined as samples that are unobtainable due to hazardous conditions or to malfunction of sampling equipment. Such deviations do not compromise the program's effectiveness and in fact are considered insignificant with respect to what is normally anticipated for this Radiological Environmental Monitoring Program.

There was one deviation in the sampling program in 2015.

The TLD at location GM-06 was not present for retrieval at the end of the first half of the year. A condition report was written to document the finding. The average of the year 2014 GM-06 readings was used as the value for the first half of 2015.

### **5.2 Direct Radiation Pathway**

#### **5.2.1 Annual Dose Trends**

Direct radiation is continuously measured at 6 indicator locations surrounding the YNPS ISFSI, along with 1 control location at Number Nine Road using thermoluminescent dosimeters (TLDs). These dosimeters are collected semi-annually for readout at the NVLAP certified dosimetry services vendor.

The review of Figures 4.1 through 4.6 shows no significant difference in annual doses over time at the indicator locations and their relation to the 25 mrem/yr limit.

#### **5.2.2 Direct Doses from ISFSI Operations**

The ODCM specifies that a cumulative dose estimate from direct radiation is required to be determined semi-annually. This dose estimate is the potential dose to any real member of the public that could use portions of the site or be present adjacent to the site for recreational activities throughout the year. The ODCM states that direct exposure above background can be estimated by subtracting the average TLD value of the control station from the indicator location measurements. As in previous years, the 2015 dose estimate assumes a total of 500 hours occupancy for the dose calculation; of which 250 hours are

used in both the first and second half-years. The most likely location for exposure to a member of the public from the ISFSI is in Sherman Reservoir for boating and fishing; however, the time estimates are conservatively applied to all monitoring locations.

Table 4.3 presents the results of the dose calculations. The highest calculated dose is at Station ID number GM-15. The maximum calculated annual dose at this location is 1.40 mrem. This value is only 6 percent of the 25 mrem per year limit. This represents a conservative dose estimate because a member of the public would normally be situated further away in the reservoir.

## **6.0 REFERENCES**

1. USNRC Radiological Assessment Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program," Revision 1, November 1979.
2. Yankee Nuclear Power Station Offsite Dose Calculation Manual, Revision 23.
3. 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation".
4. 10 CFR Part 72.104, "Criteria for Radioactive Materials in Effluents and Direct Radiation from an ISFSI or MRS".

ENCLOSURE 3

YANKEE NUCLEAR POWER STATION  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION  
OFF-SITE DOSE CALCULATION MANUAL  
REVISION 23



YANKEE NUCLEAR POWER STATION  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)  
OFF-SITE DOSE CALCULATION MANUAL

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## 1.0 INTRODUCTION

The purpose of this document is to provide a method for demonstrating compliance with the dose limits for MEMBERS OF THE PUBLIC and contains the guidance for submittal of the annual reports required by 10 CFR 50. In addition, the document provides the locations and type of monitoring required for the Radiological Environmental Monitoring Program (REMP).

In accordance with the requirements of 40 CFR 190.10(a) and 10CFR 72.104(a), the dose to a MEMBER OF THE PUBLIC for radioactive material in effluents and direct radiation from an Independent Spent Fuel Storage Installation (ISFSI) is limited to 25 mrem/yr to the whole body, 75 mrem/yr to the thyroid and 25 mrem/yr to any other critical organ as a result of exposure to planned discharges of radioactive materials to the environment, direct radiation from the ISFSI and any other radiation from uranium fuel cycle operations within the region.

Under normal operations, experience has shown that the ISFSI will be operated at a small fraction of the above dose limits. This is primarily due to the design of the Independent Spent Fuel Storage Installation, which prevents the release of radioactive materials in liquid and particulate form and there are no other uranium fuel cycle operations within 5 miles of the YAEC site. Therefore, the dose equations from Regulatory Guide 1.109, Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I are not necessary for inclusion in the ODCM. The remaining dose component to be considered is from direct radiation. 40 CFR 190(a) and 10 CFR 72.104(a) establish this dose limit as 25 mrem/yr for MEMBERS OF THE PUBLIC.

Figure 1.2 shows the Controlled Area (CA), and the Site Boundary (i.e., the current 10 CFR 50 Licensed area).

### 1.1 DEFINITIONS

#### Member(s) of the Public

MEMBER(S) OF THE PUBLIC (for the purposes of 10 CFR 50, Appendix I) shall include all persons who are not occupationally associated with the site. This category does not include employees of the utility, its contractors, or vendors. Also excluded from this category, are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the ISFSI operations.

#### Offsite Dose Calculation Manual (ODCM)

The ODCM contains the methodology and parameters used in the calculation of off-site doses in the conduct of the Radiological Environmental Monitoring Program. The ODCM also contains (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by the Yankee Quality Assurance Program (QAP) and (2)

descriptions of the information that should be included in the Annual Radiological Environmental Operation and Annual Radioactive Effluent Release Reports.

Property Boundary, Site Boundary and Controlled Area

The Property Boundary is that line beyond which land is not owned, leased or otherwise controlled by Yankee Atomic Electric Company (YAEC).

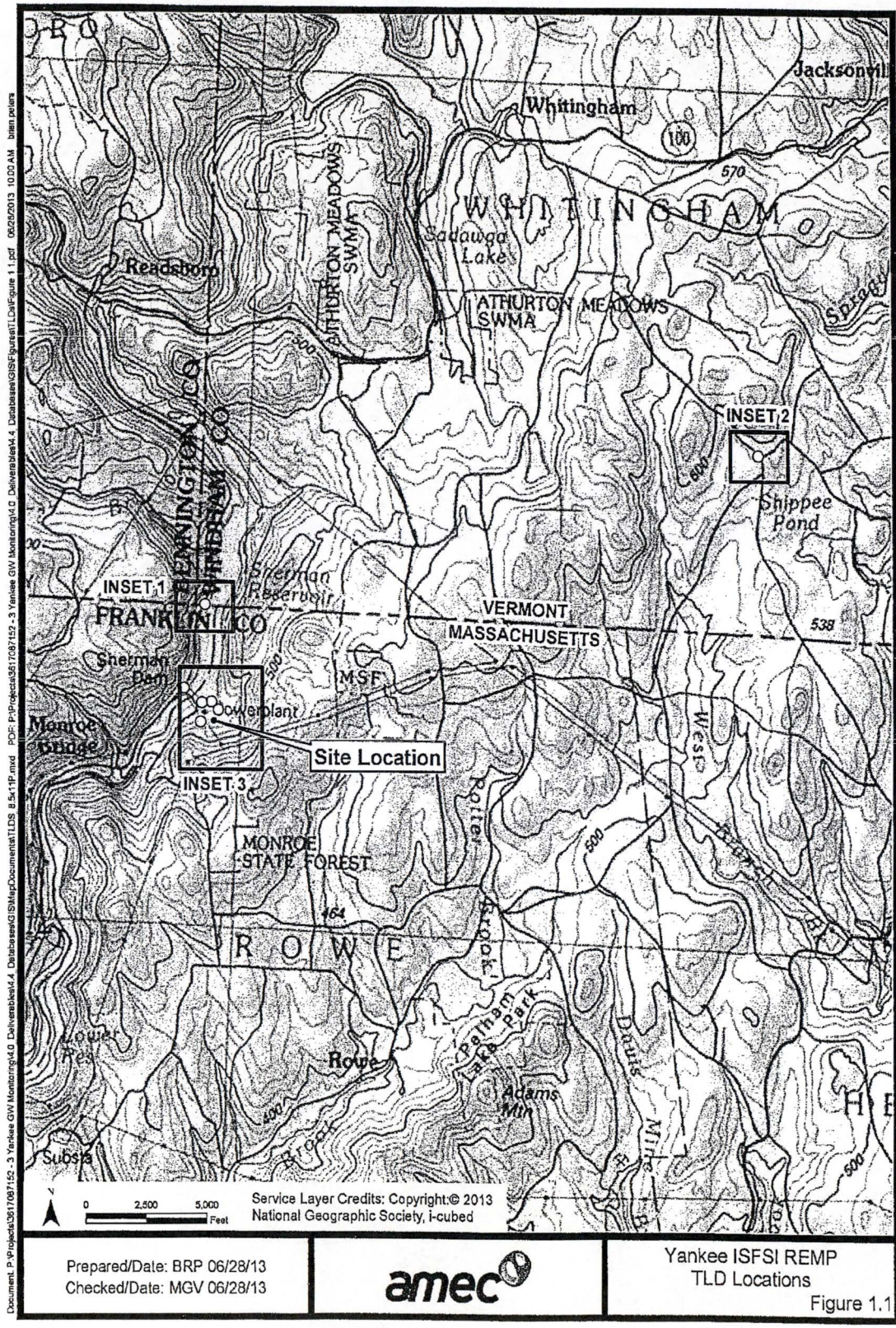
The Site Boundary is defined as the boundary for the area governed by YAEC 10 CFR 50 License in accordance with the NRC Safety Evaluation Report dated August 10, 2007.

The Controlled Area is an area at least 300 meters from the Protected Area Boundary, access to which can be limited by the licensee.

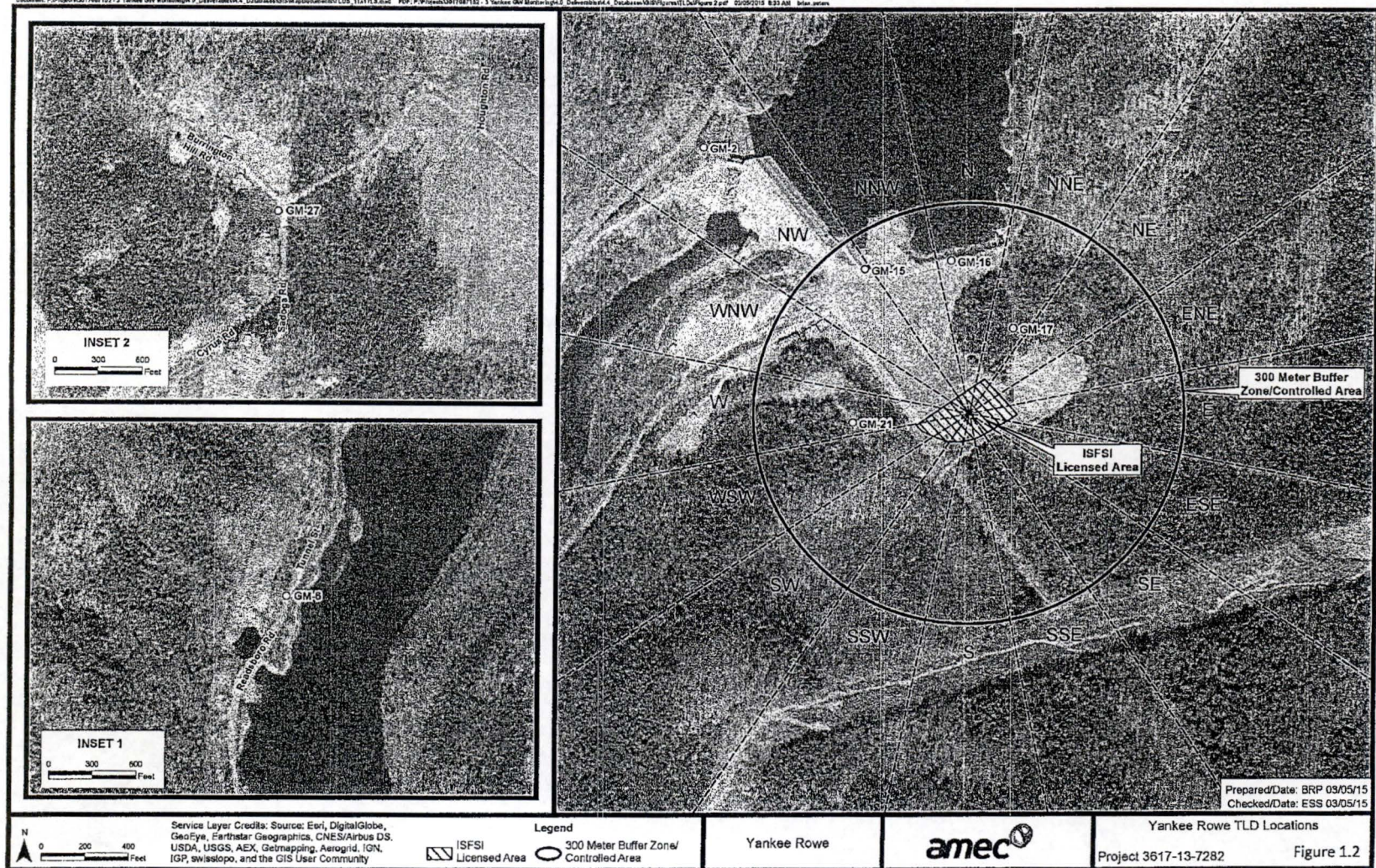
The Controlled Area will be utilized as the boundary for the establishing dose to MEMBERS OF THE PUBLIC. 10 CFR 72.104(a) establishes the annual dose limits that must be met at the Controlled Area boundary during normal operations and anticipated occurrences. Realistic occupancy factors shall be applied at these locations for the purposes of dose calculations. 40 CFR 190.10(a) establishes doses that must be met for normal operations.

The Site Boundary and Controlled Area are depicted on Figure 1.2.











## 2.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

The Radiological Environmental Monitoring Program (REMP) for the ISFSI monitors for direct radiation exposure only. There are no radioactive gaseous or liquid effluent pathways associated with the ISFSI.

### 2.1 Monitoring Program

The type and number of radiological environmental monitoring locations including collection and analysis frequencies are shown below.

Exposure Pathway	Number of Locations	Collection Frequency	Type and Frequency of Analysis
DIRECT RADIATION	7	Semi-annual	Gamma dose, at least once per six months

### 2.2 Environmental Monitoring Locations

The radiological environmental monitoring locations are listed below. These locations are shown on the maps, included as Figures 1.1 and 1.2.

Exposure Pathway	Monitoring Location and Designated Code		Distance From the ISFSI (km)	Direction From ISFSI
DIRECT RADIATION	GM-15	On-Site Perimeter	0.24	NW
	GM-16	On-Site Perimeter	0.22	NNW
	GM-17	On-Site Perimeter	0.13	NNE
	GM-21	On-Site Perimeter	0.17	WSW
	GM-2	Observation Stand	0.50	NW
	GM-6	Tunnel Road Readsboro Town Line (Readsboro Road Barrier)	1.30	N
	GM-27*	Number Nine Road	7.60	ENE

\*Designated control location. Two TLDs at this sample location.

## 2.3 Dose/Dose Rate Controls and Calculations

By design, there are no liquid or gaseous effluents associated with the operation of the ISFSI. With the completion of site remediation activities, along with the removal of all systems or operations that generated, contained or processed waste gas or airborne particulates, there are no longer any gaseous or liquid effluent releases from site operations. Therefore, requirements for control, sampling, analyzing, monitoring or dose impact assessment for radioactive liquids or gases are not needed.

### 2.3.1 Total Dose

The dose or dose commitment to any real MEMBER OF THE PUBLIC from all site sources is limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which is limited to less than or equal to 75 mrem) over a calendar year.

#### Applicability

At all times.

#### ACTION

With the calculated or projected dose from direct radiation contributions from the Independent Spent Fuel Storage Installation (ISFSI) determined to be, or projected to be, above the annual (calendar) limits of 2.3.1, prepare and submit to the commission within 30 days, pursuant to 10 CFR 50.4, a Special Report that defines the corrective action to be taken to reduce subsequent exceedences to prevent recurrence of exceeding the above limits and include the schedule for achieving conformance with the above limits. The Special Report shall include an analysis that estimates the radiation exposure (dose) to a member of the public from site sources for the calendar year covered by the report. It also shall describe levels of radiation and concentrations of radioactive material, if any, involved and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the exposure condition resulting in violation of 40 CFR 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190.11. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.



## SURVEILLANCE REQUIREMENTS

Dose calculations - Cumulative dose contributions from direct radiation shall be determined semi-annually in accordance with Section 2.3.2 of the ODCM.

### Bases

Section 2.3.1 is provided to meet the dose limitations of 40 CFR 190.10(a) that have been incorporated into 10 CFR 20 by 46FR18525. It requires the preparation and submittal of a Special Report whenever the calculated or projected doses from the site exceed the dose limits of 40 CFR 190.10(a). The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR 190.10(a) limits. For the purposes of the Special Report, it may be assumed that the dose commitment to a MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR 190.10(a) have not already been corrected), in accordance with the provisions of 40 CFR 190.11 until NRC staff action is completed. The variance only relates to the limits of 40 CFR 190.10(a) and does not apply in any way to the other requirements for dose limitation of 10 CFR 20 or 10 CFR 72.104(a).

### 2.3.2 Method to Calculate Direct Dose from ISFSI Operations

Section 2.3.1 restricts the dose to the whole body and any organ of any real MEMBERS OF THE PUBLIC at and beyond the Controlled Area Boundary from all site sources (including direct radiation) to the limit of 25 mrem in a year, except for the thyroid which is limited to 75 mrem in a year.

Estimates of direct exposure above background in areas at and beyond the Controlled Area Boundary can be determined from measurements made by environmental TLDs that are part of the Environmental Monitoring Program (Sections 2.1 and 2.2). A net response is determined by subtracting the average TLD value of the control stations from the semi-annual off-site TLD measurements. Realistic occupancy factors are then applied to the net exposure value. A positive net exposure is assumed if the net value is greater than the propagated uncertainty of the TLD indicator and control measurements. Alternatively, direct dose calculations from identified fixed sources on-site can be used to estimate the off-site direct dose contribution where TLD information may not be applicable.

### 3.0 REPORTING REQUIREMENTS

#### 3.1 Annual Radiological Environmental Operating Report

- a. An Annual Radiological Environmental Operating Report covering the operation of the ISFSI during the previous calendar year shall be submitted to the NRC by May 1 of each year.
- b. The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the ISFSI operations on the environment.

The Annual Radiological Environmental Operating Report shall include summarized and tabulated results of all radiological environmental monitoring during the report period pursuant to the table and figures in the ODCM. In the event that some results are not available to include in the report, the report shall be submitted noting and explaining the reasons for the missing results. If available, the missing data shall be submitted in the next annual report.

The report also shall include the following: a summary description of the Radiological Environmental Monitoring Program results with a map of all monitoring locations keyed to a table giving distances and directions from the ISFSI.

#### 3.2 Annual Radioactive Effluent Release Report

- a. By May 1 of each year, a report shall be submitted to the NRC covering the radioactive content of effluents released to unrestricted areas during the previous calendar year.
- b. The Annual Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, Revision 1, June 1974, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," with data summarized on a quarterly basis following the format of Appendix B thereof.

In addition, the Annual Radioactive Effluent Release Report shall include an assessment of the radiation doses due to the radioactive effluents released from the site during the previous year. This report also shall include an assessment of the radiation doses from radioactive effluents to MEMBER(S) OF THE PUBLIC due to the allowed recreational

activities inside the SITE BOUNDARY during the previous year. All assumptions used in making these assessments (e.g., specific activity, exposure time, and location) shall be included in the report. The assessment of radiation doses shall be performed in accordance with the ODCM.

The Annual Radioactive Effluent Release Report also shall include an assessment of radiation doses to the likely most exposed real MEMBER(S) OF THE PUBLIC from site activities to show conformance with 10 CFR 72.104(a) and 40 CFR 190.10(a), if Section 2.3.1 limits has been exceeded during the calendar year.

The Annual Radioactive Effluent Release Report shall include a list and description of unplanned releases from the site to site boundary of radioactive materials in effluents made during the reporting period.

The Annual Radioactive Effluent Release Report shall include any changes made during the reporting period to the ODCM.

#### 4.0 REFERENCES

- a. Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I," U.S. Nuclear Regulatory Commission, Revision 1, October 1977.
- b. Yankee Atomic Electric Company Quality Assurance Program.
- c. Letter from K. I. McConnell (NRC) to W. Norton (YAEC), Yankee Nuclear Power Station – Release of Land from Part 50 License, dated August 10, 2007.
- d. 10 CFR 72.104, Criteria for radioactive materials in effluents and direct radiation from an ISFSI or MRS
- e. 40 CFR 190.10, Standards for normal operations.
- f. 40 CFR 190.11, Variances for unusual operations