

License No. DPR-29  
YANKEE NUCLEAR POWER STATION  
Independent Spent Fuel Storage Installation

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

January-December 2007



**April 2008**

Prepared by:

Edward L. Mercer

**Radiological Safety & Control Services**

**91 Portsmouth Avenue  
Stratham, NH 03885-2468**

## Tables, Appendices and Reports

Tables 1 and 2 summarize the quantity of radioactive gaseous and liquid effluents, respectively, for each quarter of 2007. Table 3 states that waste was shipped off-site for burial or disposal during the year 2007. Table 4 contains supplementary information.

Appendices A through D, indicate the status of reportable items per the requirements of the Off-site Dose Calculation Manual (ODCM).

Changes to the ODCM made during the year 2007 are summarized in Appendix E. A complete copy of the revised manual is attached as well as the specific pages that changed.

Estimated Dose Report for 2007

TABLE 1A

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
First and Second Quarters, 2007  
Gaseous Effluents-Summation of All Releases

	Unit	1 <sup>st</sup> Quarter	2 <sup>nd</sup> Quarter	Est. Total Error, %
<b>A. Fission and Activation Gases</b>				
1. Total Release	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	
<b>B. Iodines</b>				
1. Total Iodine-131	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	
<b>C. Particulates</b>				
1. Particulates with T-1/2 > 8 days	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	
4. Gross alpha radioactivity	Ci	N/A*	N/A*	
<b>D. Tritium</b>				
1. Total release	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	

N/D\*= Not Detected

N/A\*= Not Applicable

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

TABLE 1A

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
Third and Fourth Quarters, 2007  
Gaseous Effluents-Summation of All Releases

	Unit	3 <sup>rd</sup> Quarter	4 <sup>th</sup> Quarter	Est. Total Error, %
<b>A. Fission and Activation Gases</b>				
1. Total Release	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	
<b>B. Iodines</b>				
1. Total Iodine-131	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	
<b>C. Particulates</b>				
1. Particulates with T-1/2 > 8 days	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	
4. Gross alpha radioactivity	Ci	N/A*	N/A*	
<b>D. Tritium</b>				
1. Total release	Ci	N/A*	N/A*	N/A
2. Average release rate for period	uCi/sec	N/A*	N/A*	
3. Percent of regulatory limit	%	N/A*	N/A*	

N/D\*= Not Detected

N/A\*= Not Applicable

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

TABLE 1B

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
First and Second Quarters, 2007  
Gaseous Effluents-Elevated Release

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

N/D\*= Not Detected

N/A\*= Not Applicable

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

TABLE 1B

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
Third and Fourth Quarters, 2007  
Gaseous Effluents-Elevated Release

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

N/D\*= Not Detected

N/A\*= Not Applicable

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

TABLE 1C

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
January-December 2007  
Gaseous Effluents-Ground Level Release

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

TABLE 2A

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
First and Second Quarters, 2007  
Liquid Effluents-Summation of All Releases

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

N/D\*= Not Detected

N/A\*= Not Applicable

There are no liquid releases associated with the Yankee Rowe ISFSI



TABLE 2A

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
Third and Fourth Quarters, 2007  
Liquid Effluents-Summation of All Releases

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

N/D\*= Not Detected

N/A\*= Not Applicable

There are no liquid releases associated with the Yankee Rowe ISFSI

TABLE 2B

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
First and Second Quarters, 2007  
Liquid Effluents

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		1 <sup>st</sup> Quarter	2 <sup>nd</sup> Quarter	1 <sup>st</sup> Quarter	2 <sup>nd</sup> Quarter
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*
Cobalt-58	Ci	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*
Iron-59	Ci	N/A*	N/A*	N/A*	N/A*
Zinc-65	Ci	N/A*	N/A*	N/A*	N/A*
Manganese-54	Ci	N/A*	N/A*	N/A*	N/A*
Chromium-51	Ci	N/A*	N/A*	N/A*	N/A*
Zirconium-Niobium-95	Ci	N/A*	N/A*	N/A*	N/A*
Molybdenum-99	Ci	N/A*	N/A*	N/A*	N/A*
Technetium-99m	Ci	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*
Cerium-141	Ci	N/A*	N/A*	N/A*	N/A*
Others- Iron-55	Ci	N/A*	N/A*	N/A*	N/A*
Antimony-125	Ci	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*
Total for period (above)	Ci	N/A*	N/A*	N/A*	N/A*
Xenon-133	Ci	N/A*	N/A*	N/A*	N/A*
Xenon-135	Ci	N/A*	N/A*	N/A*	N/A*

N/D\*= Not Detected

N/A\*= Not Applicable

There are no liquid releases associated with the Yankee Rowe ISFSI

TABLE 2B

YANKEE NUCLEAR POWER STATION  
Effluent and Waste Disposal Annual Report  
Third and Fourth Quarters, 2007  
Liquid Effluents

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		3rd Quarter	4th Quarter	3rd Quarter	4th Quarter
Strontium-89	Ci	N/A*	N/A*	N/A*	N/A*
Strontium-90	Ci	N/A*	N/A*	N/A*	N/A*
Cesium-134	Ci	N/A*	N/A*	N/A*	N/A*
Cesium-137	Ci	N/A*	N/A*	N/A*	N/A*
Iodine-131	Ci	N/A*	N/A*	N/A*	N/A*
Cobalt-58	Ci	N/A*	N/A*	N/A*	N/A*
Cobalt-60	Ci	N/A*	N/A*	N/A*	N/A*
Iron-59	Ci	N/A*	N/A*	N/A*	N/A*
Zinc-65	Ci	N/A*	N/A*	N/A*	N/A*
Manganese-54	Ci	N/A*	N/A*	N/A*	N/A*
Chromium-51	Ci	N/A*	N/A*	N/A*	N/A*
Zirconium-Niobium-95	Ci	N/A*	N/A*	N/A*	N/A*
Molybdenum-99	Ci	N/A*	N/A*	N/A*	N/A*
Technetium-99m	Ci	N/A*	N/A*	N/A*	N/A*
Barium-Lanthanum-140	Ci	N/A*	N/A*	N/A*	N/A*
Cerium-141	Ci	N/A*	N/A*	N/A*	N/A*
Others- Iron-55	Ci	N/A*	N/A*	N/A*	N/A*
Antimony-125	Ci	N/A*	N/A*	N/A*	N/A*
Unidentified	Ci	N/A*	N/A*	N/A*	N/A*
Total for period (above)	Ci	N/A*	N/A*	N/A*	N/A*
Xenon-133	Ci	N/A*	N/A*	N/A*	N/A*
Xenon-135	Ci	N/A*	N/A*	N/A*	N/A*

N/D\*= Not Detected

N/A\*= Not Applicable

There are no liquid releases associated with the Yankee Rowe ISFSI

**TABLE 3**  
**YANKEE NUCLEAR POWER STATION**  
**Effluent and Waste Disposal Semiannual Report**  
**First Half, 2007**  
**Solid Waste and Irradiated Fuel Shipments**

A. Solid Waste Shipped Off-Site for Burial or Disposal (Not Irradiated Fuel).

1. Type of Waste.	Unit	6-Month Period	Est. Total Error, %
a. Spent resins, filter sludges, etc.	Cu. M.	0.0	
	Ci.	0.0	+/- 25
b. Dry compressible waste, contaminated equipment, DAW, cement.	Cu. M.	350.0	
	Ci.	0.00245	+/- 25
c. Irradiated Hardware.	Cu. M.	0.0	
	Ci.	0.0	+/- 25

2. Estimate of major nuclide composition (by type of waste).

a.	Co-60	0	0
	Ni-63	0	0
	Cs-137	0	0
	Fe-55	0	0
b.	Co-60	12.94%	3.17E-4
	Fe-55	21.22%	5.20E-4
	Ni-63	11.92%	2.92E-4
	Cs-137	27.51%	6.74E-4
	H-3	26.37%	6.46E-4
	Pu-241	0	0
c.	Co-60	0	0
	Fe-55	0	0
	Ni-63	0	0

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
1	Trucking over highway	Studsvik RACE Memphis, TN 38113
0	Trucking over highway	N/A
0	Rail	N/A

**Table 3 (Cont.)**

B. Irradiated Fuel Shipments (Disposition): None Shipped.

Additional ODCM Requirements.

<u>Solid Waste Class</u>	<u>Volume (Cu. M.)</u>	<u>Est. Activity (Ci)</u>	<u>Est. Total Error</u>
A	3.50E+02	2.45E-03	+/- 25%
B	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	+/- 25%

<u>Container</u>	<u>Type</u>	<u>Package Volume (Cu. M.)</u>
Gondola Car	Strong Tight Container	N/A
Tom Dente Box	Strong Tight Container	29.340

**TABLE 3**  
**YANKEE NUCLEAR POWER STATION**  
**Effluent and Waste Disposal Semiannual Report**  
**Second Half, 2007**  
**Solid Waste and Irradiated Fuel Shipments**

A. Solid Waste Shipped Off-Site for Burial or Disposal (Not Irradiated Fuel).

1. Type of Waste.	Unit	6-Month Period	Est. Total Error, %
b Dry compressible waste, contaminated equipment, DAW, cement.	Cu. M. Ci	0 0	+/- 25

2. Estimate of major nuclide composition (by type of waste).

b.	Co-60	0.00	0.00
	Ni-63	0.00	0.00
	Cs-137	0.00	0.00

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
0	Rail	N/A

**TABLE 3**

(Continued)

B. Irradiated Fuel Shipments (Disposition):

None Shipped.

Additional ODCM Requirements.

<u>Solid Waste Class</u>	<u>Volume (Cu. M.)</u>	<u>Est. Activity (Ci)</u>	<u>Est. Total Error</u>
A	0.00E+00	0.00E+00	+/- 25%
B	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	+/- 25%

<u>Container</u>	<u>Type</u>	<u>Package Volume (Cu. M.)</u>
Gondola Car	Strong Tight Container	N/A

# TABLE 4

## Supplemental Information

### 1. Regulatory Limits

#### Effluent Concentrations

- |                                                        |                                          |
|--------------------------------------------------------|------------------------------------------|
| a. Fission and activation gases                        | 10 CFR 20; Appendix B, Table 2, Column 1 |
| b. Iodines                                             | 10 CFR 20; Appendix B, Table 2, Column 1 |
| c. Particulates, (with half lives greater than 8 days) | 10 CFR 20; Appendix B, Table 2, Column 1 |
| d. Liquid effluents:                                   | 10 CFR 20; Appendix B, Table 2, Column 2 |
| e. Total noble gas concentration:                      | 2.0 E-4 uCi/ml                           |

### 2. Average Energy- Not Applicable

### 3. Measurements and Approximations of Radioactivity

- a. Fission and Activation Gases  
There are no gaseous effluent release paths associated with ISFSI Operations.
- b. Iodines  
There are no gaseous effluent release paths associated with ISFSI Operations
- c. Particulates  
There are no particulate release paths associated with ISFSI Operations
- d. Liquid Effluents  
  
Continuous Discharges  
There are no liquid effluent release paths associated with ISFSI Operations.

### 4. Batch Releases

- a. Liquids
  1. Number of Batch release: N/A  
Number of Continuous Release: N/A
  2. Total time period for batch releases: N/A  
Total time period for continuous release: N/A
  3. Maximum time period for a batch release: N/A
  4. Average time period for batch releases: N/A
  5. Minimum time period for a batch release: N/A
  6. Average stream flow during periods of release of effluents into a flowing stream:  
N/A
  7. Maximum gross release concentration (uCi/ml): N/A
- b. Gaseous
  1. Number of batch release: N/A
  2. Total time period for batch releases: Not Applicable
  3. Maximum time period for a batch release: Not Applicable
  4. Average time period for batch releases: Not Applicable
  5. Minimum time period for a batch release: Not Applicable
  6. Maximum gross release rate (uCi/sec): Not Applicable

### 5. Unplanned Releases -N/A



## APPENDIX A

### Radioactive Effluent Monitoring Instrumentation

There are no gaseous or liquid effluent release pathways associated with ISFSI Operations. Therefore, effluent monitoring instrumentation is not required.

## APPENDIX B

### Liquid Radwaste Treatment System

There are no liquid release pathways associated with ISFSI Operations. Therefore, a radwaste treatment system is not required.

## APPENDIX C

### Gaseous Radwaste Treatment System

There are no gaseous effluent release pathways associated with ISFSI Operations. Therefore, a gaseous waste treatment system is not required.

## APPENDIX D

### Lower Limit of Detection for Radiological Analysis

There are no liquid or gaseous sampling requirements associated with ISFSI Operations since effluent release pathways do not exist.

## APPENDIX E

### Summary of Off-site Dose Calculation Manual Revisions

Change number 21 was made to the Offsite Dose Calculation Manual during the period of this report.

Change Description;

- Updated the ODCM to reflect the site boundary pertaining to the ISFSI
- Removed references from the ODCM that are not applicable to the ISFSI.
- The reporting section for the annual effluent was specific to report the data for the year 2006. The specific year was removed, and replaced with the words "previous year."

**ODCM Change Request Approval**

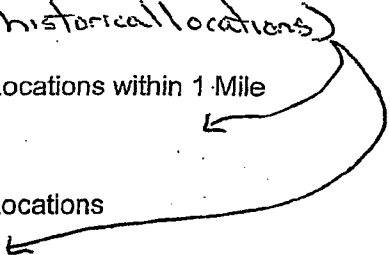
(Page 1 of 1)

ODCM Rev. <u>21</u>	Originator Name (Print): J. Bourassa <i>Joseph Bourassa</i>
<p>Description of and Reason for Change: (Marked-up pages may be attached to show the changes) (List the Procedures that need to be changed)</p> <p>The primary portion of the change is being made to implement the reduction in the Licensed area under License Basis Document Change Request - LBDCR # 07-03. This change was identified as being required to implement that LBDCR. The change which is required to implement the LBDCR is to update Figure 1-1b. This change will also include several minor editorial changes and a deletion of 2 References that are no longer needed based on the current status of the site. There are no impacts to the Radiological Environmental Monitoring Program or the Radiological Effluent Monitoring Program based on this change.</p> <p>No procedures require updating based on this change.</p>	
<p><b><u>CONCLUSION:</u></b></p> <p>The proposed change [X] will / [ ] will not maintain the level of the radiation exposure control required by 10 CFR 20.1302, 40 CFR 190, 10 CFR 50.36a, and Appendix I to 10 CFR 50 and [ ] will / [X] will not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.</p>	
<p>Radiation Protection Review:</p> <p><i>Don Carr</i> Approve <input checked="" type="checkbox"/> Disapprove <input type="checkbox"/> <u>7/24/07</u> ISESI Radiation Protection Manager (or designee) Date</p>	
<p>Independent Review:</p> <p><i>Paul W. G. S.</i> Approve <input checked="" type="checkbox"/> Disapprove <input type="checkbox"/> <u>08-08-07</u> Independent Reviewer Date</p>	
<p>ISFSI Manager Approval:</p> <p><i>R. M. M. H. Bell</i> Approve <input checked="" type="checkbox"/> Disapprove <input type="checkbox"/> <u>8/14/07</u> ISFSI Manager (or designee) Date</p>	

Retain this completed document. If the change is ultimately denied, then it is not required to retain this document as a record.

## LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1.1a	YNPS Site Boundary Lines	5
1.1b	Current 10CFR50 Licensed Site Boundaries	6
2.1	Radiological Environmental Monitoring Locations On-Site (Direct Radiation Pathway) <i>(Includes historical locations)</i>	10
2.2	Radiological Environmental Monitoring Locations within 1 Mile (Direct Radiation Pathway)	11
2.3	Radiological Environmental Monitoring Locations (Direct Radiation Pathway)	12









Revision 21

6

## 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 stations 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 stations are listed below. The locations of these stations with respect to the Yankee ISFSI are shown on the maps, Figures 2.1, 2.2 & 2.3.

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	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 that required period dewatering of construction excavations, 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

#### ~~Control~~ 2.3.1

In accordance with Yankee Quality Assurance Program (QAP), 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 ~~Control 2.3.1~~, prepare and submit to the commission with 30 days, pursuant to 10CFR50.4, 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 40CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40CFR190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

## SURVEILLANCE REQUIREMENTS

### ~~SR~~ 2.3.1

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

#### Bases

<sup>Section</sup>  
~~Control~~

2.3.1 is provided to meet the dose limitations of 40CFR Part 190 that have been incorporated into 10CFR Part 20 by 46FR18525. <sup>It</sup> ~~The control~~ requires the preparation and submittal of a Special Report whenever the calculated or projected doses from the site exceed the dose limits of 40CFR Part 190. 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 40CFR Part 190 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 40CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190 and does not apply in any way to the other requirements for dose limitation of 10CFR Part 20.

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

<sup>Set Section</sup>  
~~Control~~

2.3.1 restricts the dose to the whole body and any organ of any real MEMBERS OF THE PUBLIC at and beyond the Site 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 site 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. 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 site 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 site operation 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. The missing data shall be submitted as soon as possible in a supplementary report.

The report also shall include the following: a summary description of the Radiological Environmental Monitoring Program 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 ~~2000~~.

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

the previous year

*the previous year*

inside the SITE BOUNDARY during 2006. All assumptions used in making these assessments (e.g., specific activity, exposure time, and location) shall be included in the report. ~~Historical average meteorological conditions shall be used for determining the gaseous pathway doses.~~ 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 releases (including doses from primary effluent pathways and direct radiation) for 2006 to show conformance with 40CFR190, "Environmental Radiation Protection Standards for Nuclear Power Operation," if ~~Control 2.3.1~~ *Section limits* has been exceeded during the calendar year. *activities*

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 Supplemental Information for the Purposes of Evaluation of 10CFR Part 50, Appendix I, Amendment 2, October 1976 (Transmitted by J. L. French - YAEC to USNRC in letters, dated June 2, 1976; August 31, 1976; and October 8, 1976).
- b/c. Yankee Quality Assurance Program (QAP), Yankee Atomic Electric Company.
- d. Issuance of NPDES Permit No. MA0004367; Letter to J. A. Kay from R. Janson, US EPA, dated July 29, 2003

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

TABLE OF CONTENTS

1.0	INTRODUCTION .....	3
1.1	Definitions	
2.0	RADIOLOGICAL ENVIRONMENTAL MONITORING .....	7
2.1	Monitoring Program	
2.2	Environmental Monitoring Locations	
2.3	Dose/Dose Rate Controls and Calculations	
3.0	REPORTING REQUIREMENTS .....	13
3.1	Annual Radiological Environmental Operating Report	
3.2	Annual Radioactive Effluent Release Report	
4.0	REFERENCES .....	14

## LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1.1a	YNPS Site Boundary Lines	5
1.1b	Current 10CFR50 Licensed Site Boundaries	6
2.1	Radiological Environmental Monitoring Locations On-Site (Direct Radiation Pathway) Includes Historical Locations	10
2.2	Radiological Environmental Monitoring Locations within 1 Mile (Direct Radiation Pathway) Includes Historical Locations	11
2.3	Radiological Environmental Monitoring Locations (Direct Radiation Pathway) Includes Historical Locations	12



## 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 Part 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 40CFR Part 190, 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 YAEF 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 establishes this dose limit as 25 mrem/yr for MEMBERS OF THE PUBLIC.

Figure 1 – 1a shows the site boundary lines for the site, and Figure 1-1b shows the current 10CFR Part 50 licensed site boundary.

### 1.1 DEFINITIONS

#### Member(s) of the Public

MEMBER(S) OF THE PUBLIC (for the purposes of 10CFR50, 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 site operations or decommissioning of the plant.

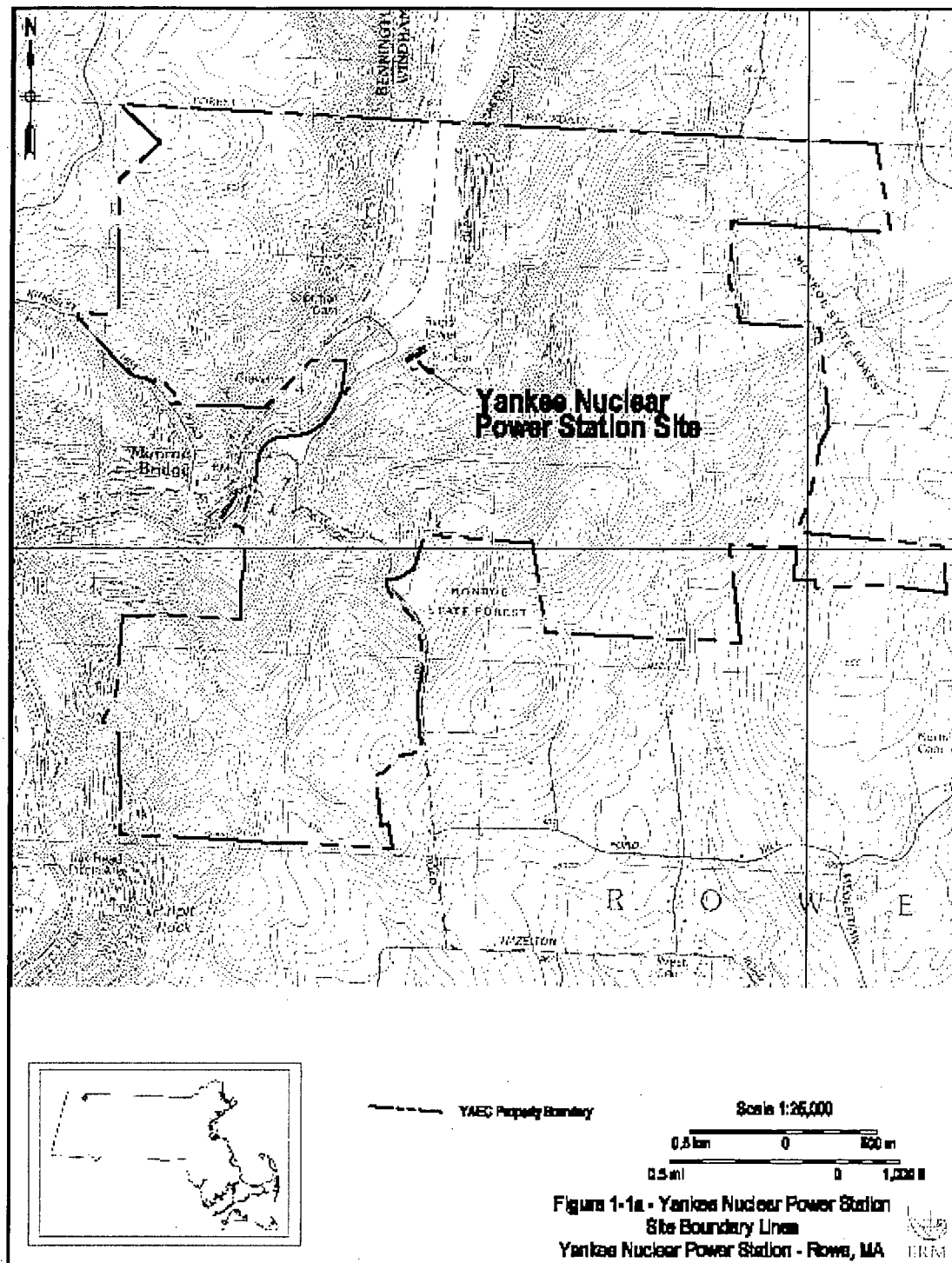
#### Offsite Dose Calculation Manual (ODCM)

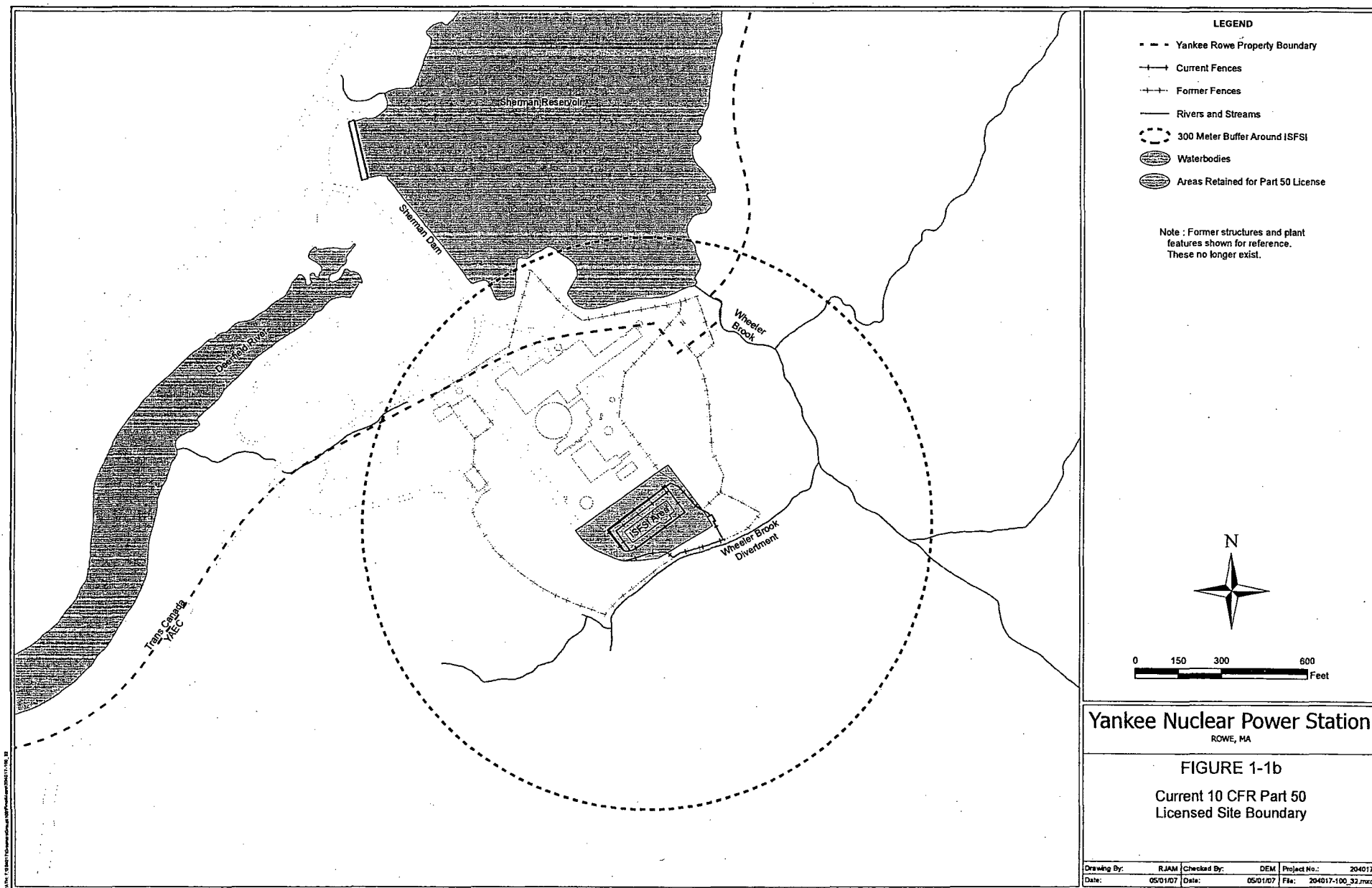
The ODCM contains the methodology and parameters used in the calculation of off-site doses in the conduct of the Radiological Environmental Monitoring Program. The ODCM also contains (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by the Yankee Quality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

Site Boundary

The SITE BOUNDARY shall be that line beyond which the land is not owned, leased, or otherwise controlled by the licensee. Realistic occupancy factors shall be applied at these locations for the purposes of dose calculations.





## 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 stations 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 stations are listed below. The locations of these stations with respect to the Yankee ISFSI are shown on the maps, Figures 2.1, 2.2 & 2.3.

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	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 that required period dewatering of construction excavations, 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

#### 2.3.1

In accordance with Yankee Quality Assurance Program (QAP), 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 with 30 days, pursuant to 10CFR50.4, 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 40CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40CFR190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

## SURVEILLANCE REQUIREMENTS

### 2.3.1

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

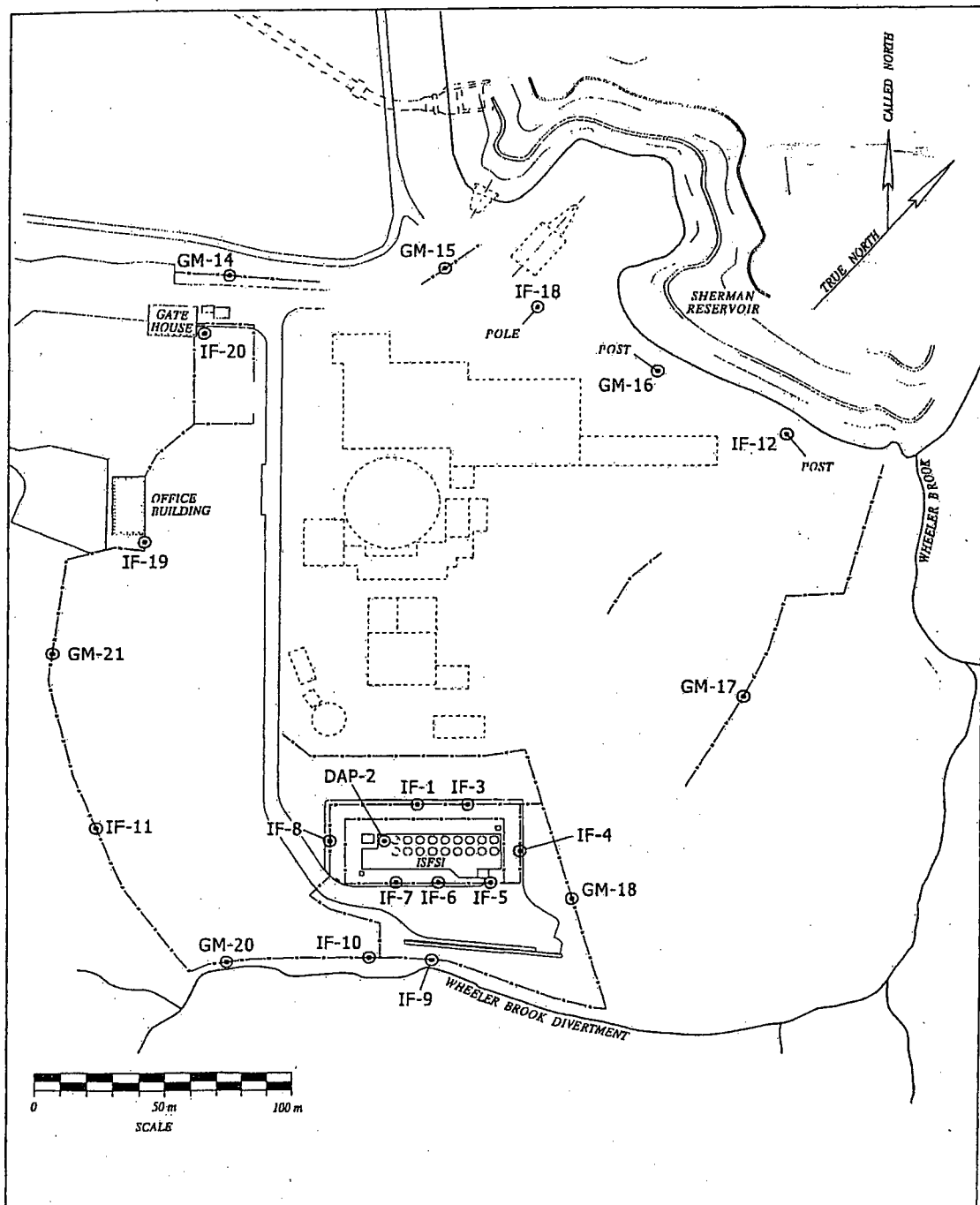
### Bases

Section 2.3.1 is provided to meet the dose limitations of 40CFR Part 190 that have been incorporated into 10CFR Part 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 40CFR Part 190. 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 40CFR Part 190 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 40CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190 and does not apply in any way to the other requirements for dose limitation of 10CFR Part 20.

### 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 Site 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 site 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. 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.



G:\Yankee Rowe\Yr site\YR Rad Mon Loc-2005-December.dgn

Figure 2.1 Radiological Environmental Monitoring Locations On-Site (Direct Radiation Pathway)



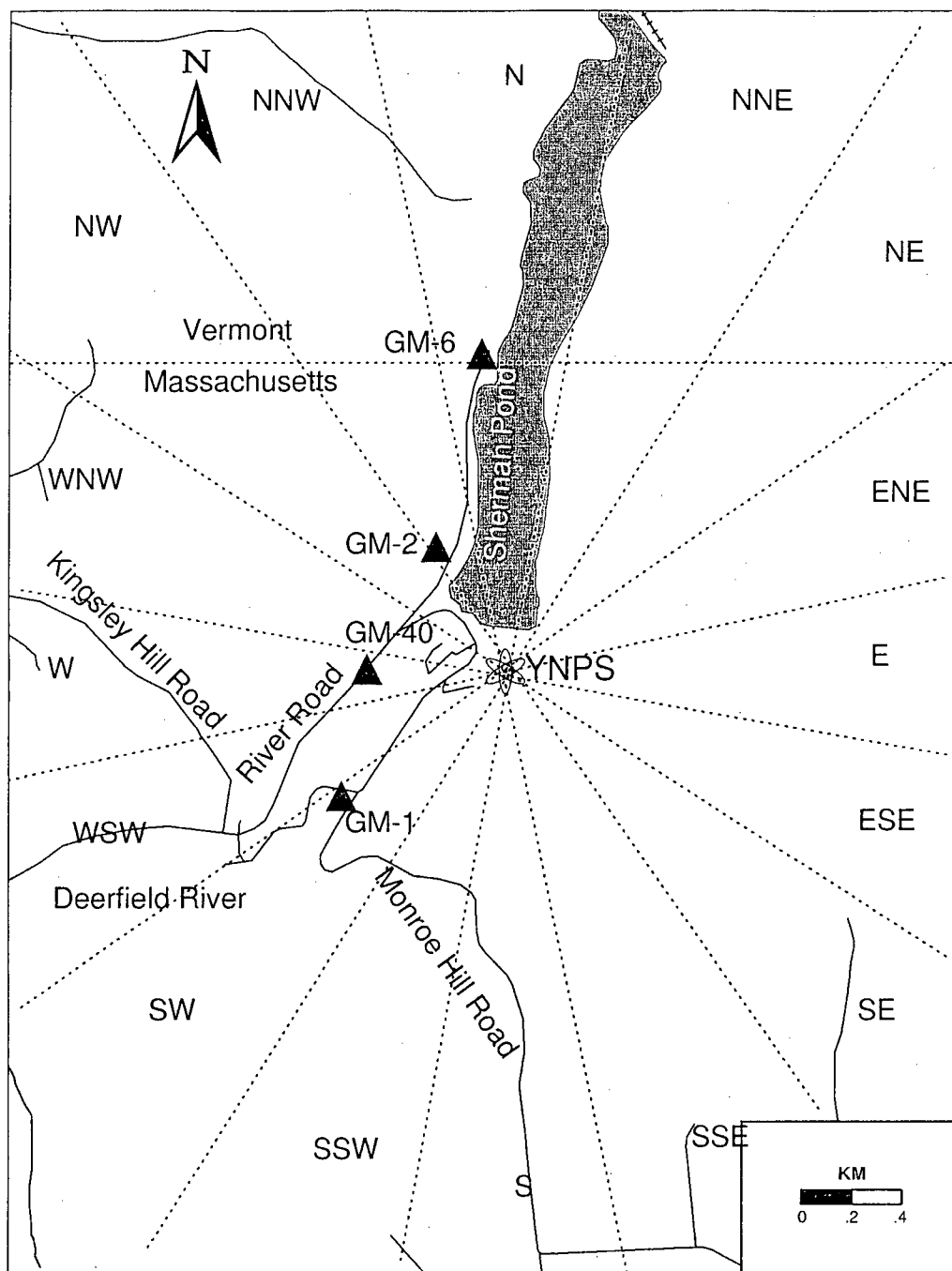


Figure 2.2 Radiological Environmental Monitoring Locations within 1 mile (Direct Radiation Pathway)

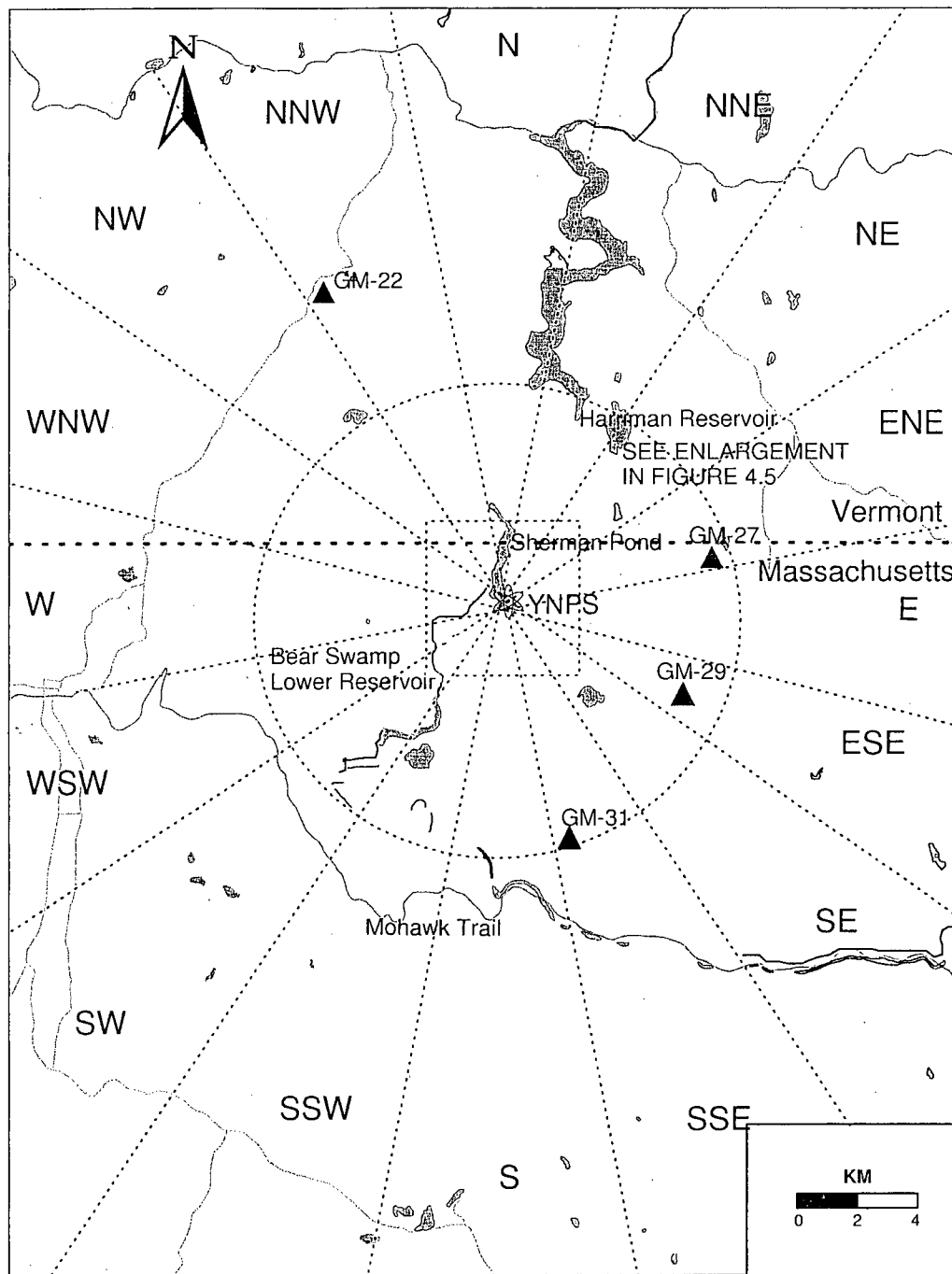


Figure 2.3 Radiological Environmental Monitoring Locations (Direct Radiation Pathway)

### 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. The missing data shall be submitted as soon as possible in a supplementary 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 40CFR190, "Environmental Radiation Protection Standards for Nuclear Power Operation," 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.

***ESTIMATED DOSE REPORT FOR 2007***  
***YANKEE NUCLEAR POWER STATION***  
***INDEPENDENT SPENT FUEL STORAGE***  
***INSTALLATION***

License No. DPR-29  
Yankee Nuclear Power Station



April 2008

Prepared by:

**Radiological Safety & Control Services**

**91 Portsmouth Avenue**  
**Stratham, NH 03885-2468**

## TABLE OF CONTENTS

	<u>Page</u>
<b>TABLE OF CONTENTS .....</b>	<b>1</b>
<b>LIST OF TABLES .....</b>	<b>2</b>
<b>1.0 INTRODUCTION.....</b>	<b>3</b>
<b>2.0 DOSE ASSESSMENT .....</b>	<b>3</b>
<b>3.0 REFERENCES.....</b>	<b>4</b>

## LIST OF TABLES

<u>TABLE</u>	<u>TITLE</u>	<u>Page</u>
<b>TABLE 1</b>	<b>Yankee Nuclear Power Station Maximum Annual Dose from Direct External Radiation for 2007<sup>(a)</sup>(40CFR190).....</b>	<b>5</b>

# **YANKEE NUCLEAR POWER STATION**

## **ESTIMATED DOSE REPORT FOR 2007**

### **1.0 INTRODUCTION**

The Yankee Nuclear Power Station's ISFSI is designed with the NAC-MPC Transportable Storage Containers that are stored in Vertical Concrete Cask. Per the NAC-MPC Safety Analysis Report, and the 10 CFR 72.212 Evaluation, this type of design meets the definition of a leak tight canister as defined by ANSI N 14.5. As such, there are no liquid, particulate, or gaseous effluents resulting from ISFSI operations. The only dose to be considered from facility operations is from direct radiation.

For the purposes of demonstrating compliance with 40CFR190, "Environmental Radiation Protection Standards for Nuclear Power Operations," radiation dose estimates must include direct radiation contributions from significant plant sources. Data from thermoluminescent dosimeters (TLDs) indicated a plant-related direct radiation component during 2007. Therefore, an assessment was performed to determine compliance with the 40CFR190 dose limits. Table 1 lists the exposure results from ISFSI related sources to any member of the public as a result of ISFSI operation.

The total dose to the most limiting member of the public due to ISFSI related direct radiation was well below the dose standards of 40CFR190.

### **2.0 DOSE ASSESSMENT**

The annual (calendar year) total dose to any member of the public due to direct radiation from fixed sources are limited to EPA's radiation protection standards for the uranium fuel cycle (40CFR190). The dose limits are set to less than or equal to 25 mrem per year to the total body or any organ, except the thyroid, which is limited to less than or equal to 75 mrem per year.

Direct external dose from fixed sources of radioactive materials within the ISFSI controlled area was estimated from Yankee Rowe's 2007 TLD data. The data from TLDs posted in the ISFSI controlled area boundary indicate above-background radiation in 2007. However, it is not reasonable to consider that someone would spend long periods of time living within the controlled area of the Yankee ISFSI. Therefore, a dose estimate is performed to a member of the public along the northwest boundary of the site where an individual could spend time on recreational activities within the Sherman Reservoir. The maximum annual dose from fixed radiation sources to members of the public spending time at this location, as derived from TLD measurements, was estimated to be 1.78 mrem. This estimate of dose incorporates an occupancy time of 500 hours per year, which is a conservative estimate of the amount of time that any real individual could spend time at this location for the purpose of demonstrating compliance with 40CFR190 limits. The receptor location used (containing GM-15) in the dose assessment was the location with the highest annual average exposure rate. This represents a conservative estimate as a member of the public would be situated further away from this selected reference point. As a result, actual exposures from direct radiation would be less than the value applied in the estimate of direct dose (1.78 mrem) to any one individual who may spend up to 500 hours per year in the Sherman Reservoir. Additionally, the dose estimate is conservative since the dose calculation makes no attempt to apply a correction factor to the onsite TLD measurement for the purpose of obtaining the exposure rate to the Sherman Reservoir. The dose rate at this location would be much less as a function of distance.

Table 1 provides the quarterly and annual dose to the maximally exposed member of the public from direct radiation associated with ISFSI operations.



### **3.0 REFERENCES**

1. "Off-Site Dose Calculation Manual," Yankee Nuclear Power Station.
2. 40CFR190, Environmental Radiation Protection For Nuclear Power Operations
5. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, October 1978.

**TABLE 1**  
**Yankee Nuclear Power Station**  
**Maximum Annual Dose from Direct External Radiation**  
**for 2007<sup>(a)</sup>**  
**(40CFR190)**

Pathway	1 <sup>st</sup> Qtr.	2 <sup>nd</sup> Qtr.	3 <sup>rd</sup> Qtr.	4 <sup>th</sup> Qtr.	Year
Direct External Exposure Rate (Micro-R/hr)	3.74 <sup>(c)</sup>	3.74 <sup>(c)</sup>	3.40 <sup>(c)</sup>	3.40 <sup>(c)</sup>	3.57 avg.
Occupancy Hours/interval	50 <sup>(a)</sup>	200 <sup>(a)</sup>	200 <sup>(a)</sup>	50 <sup>(a)</sup>	500 <sup>(a)</sup>
mrem/interval	1.87E-1	7.48E-1	6.80E-1	1.70E-1	1.79E-0 <sup>(b)</sup>

- (a) The location of maximum individual doses from direct radiation corresponds to the Sherman Reservoir where an individual could spend time on recreational activities for each interval due to changes in the season. The annual occupancy of 500 hours per year was applied to the dose estimate for demonstrating compliance with 40CFR190 limits.
- (b) For any member of the public, EPA radiation protection standards (40CFR190) established annual dose limits of 25 mrem to the total body and any organ (except the thyroid, which has a dose limit of 75 mrem).
- (c) Exposure rate above the average background of the Yankee ISFSI offsite TLD location (Number 9 Road). For this dose estimate, the TLD location with the highest annual average was used (GM-15).