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U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

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Docket Nos.	50-245
	50-336
	50-423
License Nos.	DPR-21
	DPR-65
	NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 1, 2, AND 3
2014 RADIOACTIVE EFFLUENT RELEASE REPORT

In accordance with 10 CFR 50.36a, this letter transmits the annual Radioactive Effluent Release Report (RERR) for the period January 2014 through December 2014. This report meets the provisions of Section 5.7.3 of the Millstone Power Station Unit 1 Permanently Defueled Technical Specifications (PDTS), and Sections 6.9.1.6b and 6.9.1.4 of the Millstone Power Station Units 2 and 3 Technical Specifications, respectively.

Attachment 1 transmits Volume 1 of the 2014 RERR, in accordance with Regulatory Guide 1.21. The RERR contains information regarding airborne, liquid, and solid radioactivity released from Millstone Power Station, including the off-site dose from airborne and liquid effluents.

Attachment 2 transmits Volume 2 of the report, which consists of a complete copy of the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual (REMODCM) as of December 31, 2014. This satisfies the requirements of Sections 5.6.1c of the Millstone Power Station Unit 1 PDTS, and Sections 6.15c and 6.9.13c of the Millstone Power Station Units 2 and 3 Technical Specifications, respectively.

If you have any questions or require additional information, please contact Mr. Thomas G. Cleary at (860) 447 1791 extension 3232.

Sincerely,

D. B. Blakeney
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IE48
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Attachments: 2

Commitments made in this letter:

1. None.

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Docket Nos. 50-245
50-336
50-423
License Nos. DPR-21
DPR-65
NPF-49

ATTACHMENT 1

2014 RADIOACTIVE EFFLUENTS RELEASE REPORT
VOLUME 1

MILLSTONE POWER STATION UNITS 1, 2, AND 3
DOMINION NUCLEAR CONNECTICUT, INC. (DNC)

Millstone Power Station
2014
Radioactive Effluents Release Report
Volume 1

Dominion Nuclear Connecticut, Inc.

Dominion

Unit	License	Docket
1	DPR-21	50-245
2	DPR-65	50-336
3	NPF-49	50-423

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References

1. NUREG-0597 User Guide to GASPAR Code, KF Eckerman, FJ Congel, AK Roecklien, WJ Pasciak, Division of Site Safety and Environmental Analysis, Office of Nuclear Reactor Regulation, US Nuclear Regulatory Commission, Washington, DC 20555, manuscript completed January 1980, published June 1980.

2. EPRI Report 1021106, Estimation of Carbon-14 in Nuclear Power Plants Gaseous Effluents, December, 2010.

3. NRC 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 Part 50, Appendix I, Revision 1, October 1977.

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7. 10 CFR Part 50 Domestic Licensing of Production and Utilization Facilities, Appendix I Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents.

8. 40 CFR Part 190 Environmental Radiation Protection Standard for Nuclear Power Operation.

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10. NEI 07-07, Nuclear Energy Institute, Industry Ground Water Protection Initiative – Final Guidance Document, August 2007.

11. Memo - MP-HPO-15011, 2014 Report on Solid Waste and Irradiated Component Shipments, April 1, 2015.

12. NRC Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste, Revision 2, October 2008.

13. SQA-DOSAIR-20110131, DOSAIR v2 Code File, January 6, 2014.

14. Radiation Protection Analysis 14-07, "MP3 Event – 5/25/14," June 2, 2014.

15. SQA-MPPPC-EDAN-20130718, EDAN IV Code File, August 13, 2013.

16. EPRI Report 1024827, Carbon-14 Dose Calculation Methods at Nuclear Power Plants, April, 2012.

Introduction

This report, for the period of January through December of 2014, is being submitted by Dominion Nuclear Connecticut, Inc. for Millstone Power Station Units 1, 2, and 3, in accordance with 10 CFR 50.36a, the Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM), and the Station's Technical Specifications.

This report contains radiological and volumetric information on gaseous and liquid effluents, shipments of solid waste & irradiated components, calculated offsite radiological doses, onsite well water results, information on effluent monitors inoperable for more than 30 consecutive days, operating history and corrections to previous reports.

1.0 Off-Site Doses

This report provides a summary of the 2014 off-site radiation doses from releases of radioactive materials in gaseous and liquid effluents and from direct radiation from Units 1, 2 and 3. This includes the annual maximum dose in millirem (mrem) to any real member of the public as well the maximum gamma and beta air doses.

To provide perspective, these doses are compared to the regulatory limits and to the annual average dose that a member of the public could receive from natural background and other sources.

1.1 Dose Calculations

The off-site dose to humans from radioactive material in liquid effluents have been calculated using measured radioactive effluent data and the dose computation algorithm in OpenEMS, an effluent tracking program (Reference 9). The off-site dose to humans from radioactive materials in gaseous effluents have been calculated using measured and estimated radioactive effluent data, measured meteorological data, and the dose computation algorithm in DOSAIR (Reference 13). OpenEMS and DOSEIR give doses equal to doses calculated using the methodology of NRC Regulatory Guide 1.109 (Reference 3). The calculated doses generally tend to be conservative due to the conservative model assumptions.

Doses are based upon exposure to radioactivity in gaseous and liquid effluents over a one-year period and an associated dose commitment over a 50-year period from initial exposure. The portion of the doses due to inhalation and ingestion take into account radioactive decay and biological elimination of the radioactive materials.

Maximum individual dose is defined as the dose to the individual who would receive the maximum dose from releases of gaseous and liquid effluents. Although the location of the maximum individual may vary each quarterly period, the annual dose is the sum of these quarterly doses. This conservatively assumes that the individual is at the location of maximum dose each quarter.

The dose calculations are based upon three types of input: radioactive source term, site-specific data, and generic factors. The radioactive source terms (Curies) are characterized in Section 2, Effluent Radioactivity, of this report. The site-specific data includes: meteorological data (e.g. wind speed, wind direction, atmospheric stability) to calculate the transport and dispersion of gaseous effluents, average annual milk consumption rates and dilution factors for liquid effluents. The generic factors include the average annual consumption rates (for ingestion of vegetables, produce, meat, fish, and shellfish), shielding factor for air submersion and ground irradiation and occupancy factors for shoreline activity, swimming and boating.

1.1.1 Gaseous Effluents

Maximum individual doses due to the release of noble gases, radioiodines, radioactive particulates, tritium (H-3) and Carbon-14 were calculated using DOSAIR. This is equivalent to the NRC code, GASPAR II (Reference 1), which uses a semi-infinite cloud model to implement the NRC Regulatory Guide 1.109 (Reference 3) dose models.

The values of average relative effluent concentration (X/Q) and average relative deposition (D/Q) used in DOSAIR were generated using EDAN (Reference 15), a meteorological computer code which implements the assumptions cited in NRC Regulatory Guide 1.111 (Reference 5), Section C. The annual summary of hourly meteorological data (in 15-minute increments), which includes wind speed, direction, atmospheric stability, and joint frequency distribution, is not provided in the report but are available.

Millstone Power Station stack releases are elevated (375 foot) with Pasquill stability classes determined based upon the temperature gradient between the 33 foot and 374 foot meteorological tower levels. Only Unit 2 and Unit 3 discharge to the Millstone Power Station Stack. In March 2001, Unit 1 was separated from the stack and two new release points were added to Unit 1, the Spent Fuel Pool Island (SFPI) Vent and the Balance of Plant (BOP) Vent.

Unit 1 SFPI Vent (73 foot) and the BOP Vent (80 foot) releases are considered ground level; therefore these doses were calculated using the 33 foot meteorology. Continuous ventilation of the SFPI includes tritium (H-3) releases due to evaporation from the spent fuel pool water release through the SFPI Vent. Continuous ventilation from other Unit 1 buildings is discharged to the BOP Vent. Doses from these release points were summed to determine the total Unit 1 gaseous effluent dose.

Unit 2 Auxiliary Building Ventilation, Spent Fuel Pool Evaporation and Containment Purge releases via the Unit 2 Vent at 159 foot are considered mixed mode (partially elevated and partially ground) releases. The first two are continuous releases and the last is a batch release. The doses for mixed mode releases are calculated using 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels. Containment Purges can also be released via the Millstone Power Station Stack, an elevated release point. Batch releases from the Waste Gas Decay Tanks and Containment Vents are discharged via the Millstone Power Station Stack. The doses for elevated releases are calculated using the 374 foot meteorological parameters except that noble gases released from the Millstone Power Station Stack are included with the mixed mode releases. This is done so that dose from noble gases released from the Stack is calculated as a submersion dose at the mixed mode level rather than as a plume shine dose from elevated level. This yields a conservatively higher dose. The Containment Equipment Hatch and the Reactor Water Storage Tank (RWST) Tank Vent releases are considered ground level where the 33 foot meteorology was used for the dose calculations. Each of the doses for the various release points were summed to determine the total Unit 2 gaseous effluent dose.

Unit 3 Auxiliary Building Ventilation, Spent Fuel Pool Evaporation and Containment Purge releases via the Unit 3 Vent at 133 foot are considered mixed mode (partially elevated and partially ground) releases. The first two of these are continuous releases and the last is a batch release. The doses for mixed mode releases are calculated using 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels. Gaseous Waste System and Containment Vents are released through the Unit 3 Supplementary Leak Collection and Recovery System (SLCRS) system to the Millstone Power Station Stack, an elevated release at 375 foot. The doses for elevated releases are calculated using the 374 foot meteorological parameters except that noble gases released from the Millstone Power Station Stack are included with the mixed mode releases. This is done to calculate dose from noble gases released from the Stack as a submersion dose at the mixed mode level rather than as a plume shine dose from elevated level. This yields a conservatively higher dose. The Engineered Safety Features Building (ESF) Ventilation, the Containment Equipment Hatch, Containment Drawdowns and RWST Vent releases are considered ground level where the doses were calculated using 33 foot meteorology. Each of the doses for the various release points were summed to determine the total Unit 3 gaseous effluent dose.

Based on Reference 16, it was conservatively assumed that 30% of the C-14 exists as carbon dioxide (CO_2) which may be deposited on surfaces. Thus only 30% of C-14 released yielded dose via ingestion pathways of milk, meat, produce and vegetation.

1.1.2 Liquid Effluents

Maximum individual doses from the release of radioactive liquid effluents were calculated using OpenEMS which gives dose results equal to dose results calculated using NRC Regulatory Guide 1.109.

1.2 Dose Results

The calculated maximum off-site doses are presented in Table 1-1 for gaseous effluents and Table 1-2 for liquid effluents. The units 'mrad' and 'mrem' used in this report are units of radiation dose. The letter 'm' is for 'milli', or one-thousandth of a 'rad' or a 'rem.' The word 'rad' is an acronym for radiation absorbed dose. One rad is equal to the absorption of 100 ergs of energy per gram of tissue. The word 'rem' is an acronym for roentgen equivalent man. One rem is equal to a rad multiplied by factors to account for type of radiation and distribution within the body.

1.2.1 Gaseous Effluents

For the dose to the maximum individual, DOSAIR calculates the dose to the whole body, gastrointestinal (GI), bone, liver, kidney, thyroid, lung, and skin from each of the following pathways: direct exposure from submersion in noble gases in the plume, direct exposure from ground deposition of radioactivity, inhalation, and ingestion of vegetation, produce, cow or goat milk, and meat. The values presented are a total from all pathways. However, only the whole body, skin, thyroid and maximum organ (other than thyroid) doses are presented.

For the plume and inhalation pathways, the maximum individual dose is calculated at the off-site location of the highest χ/Q where a potential for dose exists.

For ground deposition, the maximum individual dose is calculated at both the off-site maximum land location of the highest χ/Q and highest D/Q where a potential for dose exists.

For the ingestion pathways (vegetation, meat and milk), the maximum individual dose is calculated at the location of the highest D/Q. For the milk pathways (cow and goat), the calculated dose is included in the maximum individual's dose only at locations and times where these pathways actually exist.

Beginning with the 2012 report, doses from gaseous effluents are reported with and without dose from C-14.

To determine compliance with 10 CFR 50, Appendix I (Reference 7), the maximum individual whole body and organ doses include all applicable external pathways (i.e., plume and ground exposure) as well as the internal pathways (inhalation and ingestion).

1.2.2 Liquid Effluents

OpenEMS performs calculations for the following pathways: fish, shellfish, shoreline activity, swimming, and boating. Doses are calculated for the whole body, skin, thyroid, and maximum organ (GI, bone, liver, kidney, and lung).

1.2.3 Analysis of Results

Table 1-3 provides a quantitative dose comparison with the limits specified in the REMODCM. The data indicates that the total whole body and organ doses to the maximum offsite individual from Millstone Power Station including all sources of the fuel cycle are well within the limits of 40 CFR 190 (Reference 8). On-site radioactive waste and spent fuel storage during this year was within storage criteria and the maximum dose to a member of the public from these sources was approximately 0.18 mrem. The doses from gaseous and liquid effluents were added to the estimated dose from on-site radioactive waste storage to show compliance compared to 40 CFR 190.

The Offsite Dose Comparison, Table 1-4, provides a perspective on the maximum offsite individual dose received from Millstone Power Station with the natural background radiation dose received by the average Connecticut resident (Reference 4). The total dose to the maximum individual received from Millstone Power Station is small (< 0.3%) in comparison to the dose received from natural background radiation.

Table 1-1
2014 Off-Site Dose Commitments from Gaseous Effluents
Millstone Units 1, 2, 3

Unit 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	1.10E-04	2.47E-05	1.88E-03	3.00E-06	2.02E-03
Skin	1.10E-04	2.47E-05	1.88E-03	3.00E-06	2.02E-03
Thyroid	1.10E-04	2.47E-05	1.88E-03	3.00E-06	2.02E-03
Max organ [3]	1.10E-04	2.47E-05	1.88E-03	3.00E-06	2.02E-03

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	9.60E-05	1.67E-04	3.95E-05	3.95E-05	3.42E-04
Gamma	2.46E-04	2.39E-04	7.30E-05	7.30E-05	6.31E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	2.90E-04	1.13E-03	7.89E-04	3.53E-04	2.56E-03
Whole Body [2]	1.41E-03	1.68E-02	1.94E-02	2.23E-03	3.99E-02
Skin [1]	3.95E-04	1.23E-03	8.08E-04	3.76E-04	2.81E-03
Skin [2]	1.51E-03	1.69E-02	1.94E-02	2.24E-03	4.01E-02
Thyroid [1]	3.48E-04	1.72E-03	9.93E-04	3.73E-04	3.43E-03
Thyroid [2]	1.48E-03	1.74E-02	1.96E-02	2.26E-03	4.08E-02
Max organ [1,3]	2.90E-04	1.14E-03	7.92E-04	3.54E-04	2.57E-03
Max organ [2,3]	6.23E-03	7.98E-02	9.37E-02	1.05E-02	1.90E-01

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	3.10E-07	1.95E-06	4.49E-06	1.67E-06	8.41E-06
Gamma	3.22E-08	2.89E-06	7.63E-07	1.27E-07	3.82E-06
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	1.01E-03	1.89E-03	1.84E-03	4.51E-03	9.25E-03
Whole Body [2]	1.92E-03	1.48E-02	1.80E-02	4.89E-03	3.96E-02
Skin [1]	1.01E-03	1.89E-03	1.85E-03	4.60E-03	9.34E-03
Skin [2]	1.92E-03	1.48E-02	1.80E-02	4.89E-03	3.96E-02
Thyroid [1]	1.01E-03	1.89E-03	1.84E-03	4.51E-03	9.25E-03
Thyroid [2]	1.92E-03	1.48E-02	1.80E-02	4.89E-03	3.96E-02
Max organ [1,3]	1.01E-03	1.89E-03	1.84E-03	4.57E-03	9.31E-03
Max organ [2,3]	5.50E-03	6.46E-02	8.12E-02	9.48E-03	1.61E-01

NOTES:

1 - Dose without C-14

2 - Dose with C-14

3 - Maximum of the following organs (not including thyroid): Bone, GI-LLI, Kidney, Liver, Lung

Table 1-2
2014 Off-Site Dose Commitments from Liquid Effluents
Millstone Units 1, 2, 3

Unit 1	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	0.00E+00	0.00E+00	3.04E-05	3.40E-06	3.38E-05
Thyroid	0.00E+00	0.00E+00	8.83E-06	9.86E-07	9.82E-06
Max Organ	0.00E+00	0.00E+00	4.32E-05	4.83E-06	4.80E-05

Unit 2	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	1.73E-04	4.68E-05	2.06E-05	1.63E-05	2.57E-04
Thyroid	1.59E-04	3.31E-05	1.01E-05	1.58E-05	2.18E-04
Max Organ	6.50E-03	3.36E-03	9.22E-04	6.43E-04	1.14E-02

Unit 3	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	2.55E-04	2.05E-04	4.05E-04	4.09E-04	1.27E-03
Thyroid	1.33E-04	1.56E-04	2.05E-04	1.75E-04	6.69E-04
Max Organ	8.28E-04	8.09E-04	1.56E-03	1.51E-03	4.71E-03

Table 1-3
2014 Off-Site Dose Comparison to Limits
Millstone Units 1, 2, 3

Gaseous Effluents Dose (without C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	2.02E-03	2.02E-03	2.02E-03	2.02E-03	0.00E+00	0.00E+00
Unit 2	2.56E-03	3.43E-03	2.57E-03	2.81E-03	3.42E-04	6.31E-04
Unit 3	9.80E-03	1.09E-02	9.82E-03	1.04E-02	2.77E-04	5.84E-05
Millstone Station	**1.44E-02**	**1.63E-02**	**1.44E-02**	**1.52E-02**	**6.19E-04**	**6.90E-04**
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Gaseous Effluents Dose (with C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	2.02E-03	2.02E-03	2.02E-03	2.02E-03	0.00E+00	0.00E+00
Unit 2	3.99E-02	4.08E-02	1.90E-01	4.01E-02	3.42E-04	6.31E-04
Unit 3	4.01E-02	4.01E-02	1.61E-01	4.03E-02	2.77E-04	5.84E-05
Millstone Station	**8.20E-02**	**8.29E-02**	**3.53E-01**	**8.24E-02**	**6.19E-04**	**6.90E-04**
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Liquid Effluents Dose

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)
Unit 1	3.38E-05	9.82E-06	4.80E-05
Unit 2	2.57E-04	2.18E-04	1.14E-02
Unit 3	1.27E-03	6.69E-04	4.71E-03
Millstone Station	**1.56E-03**	**8.97E-04**	**1.62E-02**
Limits	*3*	*10*	*10*

Total Off-Site Dose from Millstone Station

	Whole Body (mrem)	Thyroid (mrem)	Max Organ * (mrem)
Gaseous with C-14	8.20E-02	8.29E-02	3.53E-01
Liquid	1.56E-03	8.97E-04	1.62E-02
Direct Shine**	1.80E-01	1.80E-01	1.80E-01
Millstone Station	**2.64E-01**	**2.64E-01**	**5.49E-01**
Limits	*25*	*75*	*25*

* Maximum of the following organs (not including Thyroid): Bone, GI-LLI, Kidney, Liver, Lung
** Direct shine is radiation exposure from onsite storage of radwaste and spent fuel.

Table 1-4
2014 Offsite Dose Comparison
Natural Background vs Millstone Station

Average Resident	**Natural Background Radiation Dose**
Cosmic	30 -100 mrem
Terrestial (Atlantic and Gulf Coastal Plain)	30 - 60 mrem
Inhaled	20 - 1,000 mrem
In the Body	20 - 80 mrem
	100 - 1,240 mrem

Courtesy UNSCEAR Report 2000

Maximum Off-Site Individual	**Millstone Station Whole Body Dose**
Gaseous Effluents	0.0820 mrem
Liquid Effluents	0.0016 mrem
Direct Shine	0.1800 mrem
	0.2635 mrem

2.0 Effluent Radioactivity

2.1 Gaseous Effluents

2.1.1 Measurement of Gaseous Radioactivity

2.1.1.1 Continuous Releases

The following pathways have continuous radiation monitors that include particulate filters and, except for Unit 1, charcoal cartridges for monitoring the activity being released:

Unit 1 SFPI Island (no charcoal cartridge)
Unit 1 BOP Vent (no charcoal cartridge)
Unit 2 Ventilation Vent
Unit 2 Wide Range Gas Monitor (WRGM) to Site Stack
Unit 3 Ventilation Vent
Unit 3 SLCRS to Site Stack
Unit 3 ESF Building Vent
Unit 2 and Unit 3 Containment Equipment Hatch Openings

Charcoal cartridges and particulate filters are used to collect iodines and particulates, respectively. These cartridges and filters are replaced weekly (except every two weeks for Unit 1) and then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Strontium-89 (Sr-89) (except for Unit 1), Strontium-90 (Sr-90) and gross alpha. At least monthly, gaseous grab samples are taken and analyzed for noble gasses and H-3. The gas washing bottle (bubbler) method is utilized for H-3 collection. This sample is counted on a liquid scintillation detector. Isotopic concentrations at the release point are multiplied by the total flow to obtain the total activity released for each isotope.

Since a major source of H-3 is evaporation of water from the spent fuel pools, H-3 releases were also estimated based upon amount of make-up water to the pools and measured concentrations of H-3 in the pool water. Grab samples from the Unit 1 SFPI Vent and the Unit 2 and Unit 3 Vents are compared to the measured evaporation technique and the higher amount from either the vent or the measured evaporation technique is used to determine the amount of H-3 released.

When water is transferred to the RWST there is a potential for a release of radioactivity through the tank vent. Releases of particulates and H-3 from the Units 2 and 3 RWSTs were estimated. A DF was applied to the total particulates contained in the water transferred to the RWST to estimate the releases. During 2014, noble gases and iodines were not added to the RWSTs.

Samples of air near the containment equipment hatch openings are analyzed for particulates and iodines, during refueling outages for the period that the equipment hatch is open. An estimated flow out of the hatch and sample results are used to determine the radioactivity released. Small releases from the hatchs' openings were measured during the Unit 2 outage in the second quarter and during the Unit 3 outage in the fourth quarter.

C-14 has always been released from the plant but, previous to 2010, was not reported because it was not a significant release relative to other radioactive releases. This nuclide is not monitored because it is too difficult to measure and analyze. Because the overall quantity of other radioactive releases has steadily decreased due to improvements in power plant operations, C-14 now qualifies as a principle radionuclide. The amount of C-14 released is calculated using the guidance given in Regulatory Guide 1.21 (Reference 12) and the methodology of Reference 2. According to the regulatory guidance, releases of C-14 are reported in gaseous effluents but not in liquid effluents and the amount released is calculated based on a normalized source term. The calculation is for an annual source term which is then divided evenly between quarters in the year. For each Unit, it is assumed that half of the C-14 is released from the Millstone Stack and half from each unit's main ventilation vent.

2.1.1.2 Batch Releases

The following pathways have releases that are considered batches:

- Unit 2 Waste Gas Decay Tanks (WGDT) (via Unit 2 WRGM to Millstone Power Station Stack)
- Unit 2 Gaseous surge tank vent.
- Unit 2 and Unit 3 Containment Purges (via Unit Ventilation Vents, except for Unit 2 if using Enclosure Building Filtration System (EBFS) via WRGM to Millstone Power Station)
- Unit 2 and Unit 3 Containment Vents (via EBFS to Millstone Power Station Stack for Unit 2 and via SLCRS to Millstone Power Station Stack for Unit 3)
- Unit 3 Containment Drawdown

Waste Gases from the Unit 2 Gaseous Waste Processing System are held for decay in waste gas decay tanks prior to discharge through the Millstone Power Station Site Stack. Each gas decay tank is analyzed prior to discharge for noble gas and H-3. Calculated volume discharged is multiplied by the isotopic concentrations (noble gas and H-3) from the analysis of grab samples to determine the total activity released.

During 2014 there were two batch releases from Unit 2 gaseous surge tank vent. These were released via the Unit 2 vent.

Containment air is sampled periodically for gamma and H-3 to determine the activity released from containment venting. The measured concentrations are multiplied by the containment vent volume to obtain the total activity released. Unit 2 typically performs this process of discharging air from containment to maintain pressure approximately once per week and Unit 3 vents containment about 15 times per month. Any iodines and particulates discharged would be detected by the continuous monitoring discussed in Section 2.1.1.1.

Containment air is sampled prior to each purge for gamma and H-3 to determine the activity released from containment purging. Similar to containment venting, the measured concentrations are multiplied by the containment purge volume to obtain the total activity released. Any iodines and particulates discharged would be detected by the continuous monitoring discussed in section 2.1.1.1.

Unit 3 containment is initially drawn down prior to startup. This is accomplished by using the containment vacuum steam jet ejector which releases through an unmonitored vent on the roof of the Auxiliary Building. Grab samples are performed prior to drawdown to document the amount of radioactivity released during these evolutions. During 2014 there was no measurable radioactivity released during the drawdown.

2.1.2 Estimate of Errors

Estimates of errors associated with radioactivity measurements were made using the following guidelines:

Radioactivity Measurement Calibration	10%	Calibration to NIST* standards
Sampling/Data Collection	10% - 20%	Variation in sample collection
Sample Line Loss	20% - 40%	Deposition of some nuclides
Sample Counting	10% - 30%	Error for counting statistics
Flow & Level Measurements	10% - 20%	Error for release volumes

*National Institute of Standards and Technology

2.1.3 Gaseous Batch Release Statistics

Unit 1 – None

Unit 2	Ctmt Purges	Ctmt Vents	WGDT	Gas Surge Tank
Number of Batches	1	45	8	2
Total Time (min)	120	6716	2230	2064
Maximum Time (min)	120	202	475	1096
Average Time (min)	120	149	279	1032
Minimum Time (min)	120	76	87	968

Unit 3	Ctmt Purges	Ctmt Vents*
Number of Batches	1	~180
Total Time (min)	71	*
Maximum Time (min)	71	*
Average Time (min)	71	*
Minimum Time (min)	71	*

* ~ 2-3 hrs per Vent

2.1.4 Abnormal Gaseous Releases

An abnormal gaseous release of radioactivity is defined as radioactive material released in gaseous effluents to the environment that was unplanned or uncontrolled due to an unanticipated event. These do not include normal routine effluent releases from anticipated operational and maintenance occurrences such as power level changes, reactor trip, opening primary system loops, degassing, letdown of reactor coolant or transferring spent resin and do not include non-routine events such as minor leakages from piping, valves, pump seals, tank vents, etc.

2.1.4.1 Unit 1 – None

2.1.4.2 Unit 2 – None

2.1.4.3 Unit 3

On May 25, 2014, a loss of offsite power event occurred and resulted in a discharge of some of the contents of the Volume Control Tank (VCT) to the Primary Drains Transfer Tank (PDTT). The PDTT overflowed into the Unit 3 Auxiliary Building. Releases from the auxiliary building to the environment were monitored by effluent radiation monitors. Noble gas responses and iodine and particulate samples from those monitors showed no detectable levels of radioactivity. Despite any monitor response it was conservatively assumed that some noble gases had been released with this event. The amount of noble gases released was based on an estimation of liquid discharged from the PDTT to the auxiliary building. A tritium release was also estimated (tritium is not detected by the monitors). Releases reported from the auxiliary building to the environment are summarized in the following table:

Isotope	Curies
H-3	3.97
Ar-41	1.92E-4
Kr-85m	1.31E-3
Kr-87	3.46E-4
Kr-88	2.94E-4
Xe-135	6.23E-4
Xe-135m	5.07E-4
Xe-138	1.85E-3

Half of the releases were discharged via the Millstone Stack and the other half via the Unit 3 vent. These releases are included in Tables 2.3-A4 and 2.3-A6. Because of this event there was also a release of tritium from the secondary side of 1.49E-3 curies. This released was estimated based on a nominal value of secondary side mass of 1.29E+5 pounds and a tritium analysis performed May 23 which yielded a tritium concentration of 2.55E-5 uci/gm. This release is included in Table 2.3-A2. The maximum offsite dose from this release was less than 0.001 mrem. Radiological assessment of this release is contained in Reference 14.

To prevent a reoccurrence of this event the following was performed:

- Work was performed on the pressure control valves to ensure proper control of VCT pressure.
- Training given to operators to enable them to adequately respond to abnormal VCT pressure following loss of power.

2.1.5 Gaseous Release Tables

The following tables provide the details of the gaseous radioactivity released from each of the Millstone Power Station units. They are categorized by type of release, source(s), and by release point of discharge to the environment.

Table 2.1-A1

Millstone Unit 1

Gaseous Effluents - Release Summary

	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
B. Iodines / Halogens						
1. Total Activity Released	Ci	na	na	na	na	na
2. Average Period Release Rate	uCi/sec	na	na	na	na	na
C. Particulates						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	4.03E-01	1.60E-02	1.43E+00	1.11E-02	1.86E+00
2. Average Period Release Rate	uCi/sec	5.18E-02	2.03E-03	1.80E-01	1.39E-03	5.91E-02

"-" denotes less than Minimum Detectable Activity (MDA)
"na" denotes not required to be analyzed

Table 2.1-A2

Millstone Unit 1

Gaseous Effluents - Ground Continuous - BOP Vent & SFPI Vent

Nuclides Released	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
I-131	Ci	na	na	na	na	na
I-133	Ci	na	na	na	na	na
Other γ Emitters	Ci	na	na	na	na	na
Total Activity	Ci	na	na	na	na	na
C. Particulates						
Cs-137	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	4.03E-01	1.60E-02	1.43E+00	1.11E-02	1.86E+00

"-" denotes less than Minimum Detectable Activity (MDA)
"na" denotes not required to be analyzed

Table 2.2-A1
Millstone Unit 2
Gaseous Effluents - Release Summary

	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	2.01E-01	2.53E-01	5.66E-02	5.70E-02	5.68E-01
2. Average Period Release Rate	uCi/sec	2.59E-02	3.22E-02	7.12E-03	7.17E-03	1.80E-02
B. Iodines / Halogens						
1. Total Activity Released	Ci	6.53E-05	2.13E-04	2.44E-06	1.98E-05	3.01E-04
2. Average Period Release Rate	uCi/sec	8.40E-06	2.71E-05	3.07E-07	2.50E-06	9.53E-06
C. Particulates						
1. Total Activity Released	Ci	1.27E-06	2.45E-05	5.99E-07	9.57E-07	2.73E-05
2. Average Period Release Rate	uCi/sec	1.63E-07	3.12E-06	7.53E-08	1.20E-07	8.67E-07
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.22E+00	2.32E+00	1.70E+00	2.49E+00	7.73E+00
2. Average Period Release Rate	uCi/sec	1.57E-01	2.95E-01	2.14E-01	3.13E-01	2.45E-01
F. C-14						
1. Total Activity Released**	Ci	2.15E+00	2.15E+00	2.15E+00	2.15E+00	8.60E+00
2. Average Period Release Rate	uCi/sec	2.76E-01	2.73E-01	2.70E-01	2.70E-01	2.73E-01

"-" denotes less than Minimum Detectable Activity (MDA)

**Calculated value per "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents" EPRI Final Report, 12/2010.

Table 2.2-A2

Millstone Unit 2

Gaseous Effluents - Ground Level Release - Batch Mode

Release Point - No releases

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Total Activity	Ci	*	*	*	*	*
B. Iodines / Halogens						
Total Activity	Ci	*	*	*	*	*
C. Particulates						
Total Activity	Ci	*	*	*	*	*
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	*	*
E. Tritium						
H-3	Ci	*	*	*	*	*

* No activity released

Table 2.2-A3

Millstone Unit 2

Gaseous Effluents - Ground Level Release - Continuous Mode

Release Point - Reactor Water Storage Tank Vent, Equipment Hatch

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Gases

γ Emitters	Ci	na	na	na	na	na
Total Activity	Ci	na	na	na	na	na

B. Iodines / Halogens

I-131	Ci	-	6.00E-08	-	-	6.00E-08
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	6.00E-08	-	-	6.00E-08

C. Particulates

Cr-51	Ci	-	1.38E-06	9.72E-09	-	1.39E-06
Mn-54	Ci	3.08E-09	1.75E-07	5.86E-09	1.25E-08	1.96E-07
Co-57	Ci	7.75E-10	1.83E-06	-	-	1.83E-06
Co-58	Ci	1.17E-08	8.67E-06	2.96E-07	3.94E-07	9.37E-06
Fe-59	Ci	-	6.27E-08	3.58E-10	-	6.30E-08
Co-60	Ci	3.24E-08	1.10E-06	7.51E-08	1.53E-07	1.36E-06
Nb-95	Ci	-	4.40E-07	1.36E-08	3.54E-09	4.57E-07
Zr-95	Ci	-	2.97E-07	1.12E-08	2.03E-09	3.10E-07
Ag-110m	Ci	1.26E-08	1.04E-06	8.86E-08	1.62E-07	1.31E-06
Sn-113	Ci	-	7.80E-08	9.88E-10	-	7.90E-08
Sn-117m	Ci	-	4.67E-08	1.35E-09	2.08E-10	4.83E-08
Sb-124	Ci	2.51E-10	2.78E-07	1.52E-08	1.57E-08	3.09E-07
Sb-125	Ci	9.30E-08	6.95E-07	7.53E-08	1.98E-07	1.06E-06
Sb-126	Ci	-	3.76E-08	-	-	3.76E-08
Te-132	Ci	-	2.07E-09	-	-	2.07E-09
Cs-137	Ci	1.28E-08	5.32E-07	5.53E-09	1.61E-08	5.67E-07
La-140	Ci	-	2.13E-10	-	-	2.13E-10
La-141	Ci	-	1.49E-13	-	-	1.49E-13
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.67E-07	1.67E-05	5.99E-07	9.57E-07	1.84E-05

D. Gross Alpha

Gross Alpha	Ci	na	na	na	na	na

E. Tritium

H-3	Ci	2.82E-04	1.79E-02	2.39E-02	8.19E-02	1.24E-01

"-" denotes less than Minimum Detectable Activity (MDA)
"na" denotes Not Required to be Analyzed

Table 2.2-A4
Millstone Unit 2
Gaseous Effluents - Elevated Release - Batch Mode
Release Point - Millstone Site Stack

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	4.18E-02	2.77E-02	2.55E-02	2.41E-02	1.19E-01
Kr-85	Ci	2.69E-02	1.43E-01	1.64E-02	7.67E-03	1.94E-01
Xe-133	Ci	5.15E-03	6.54E-03	1.44E-02	2.45E-02	5.06E-02
Xe-133m	Ci	-	-	-	6.21E-05	6.21E-05
Xe-135	Ci	5.30E-04	1.43E-04	2.91E-04	6.39E-04	1.60E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	7.43E-02	1.78E-01	5.66E-02	5.70E-02	3.65E-01
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	1.30E-01	3.29E-02	9.55E-02	9.72E-02	3.56E-01

"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes not required to be analyzed

Table 2.2-A5
Millstone Unit 2
Gaseous Effluents - Elevated Release - Continuous Mode
Release Point - Millstone Site Stack

Nuclides Released	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
Br-82	Ci	-	1.46E-07	-	-	1.46E-07
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	1.46E-07	-	-	1.46E-07
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	3.20E-02	5.75E-02	-	-	8.95E-02
F. C-14						
C-14	Ci	1.08E+00	1.08E+00	1.08E+00	1.08E+00	4.30E+00

"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes not required to be analyzed

Table 2.2-A6
Millstone Unit 2
Gaseous Effluents - Mixed Mode Release - Batch Mode
Release Point - Unit 2 Ventilation Vent

Nuclides Released	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
		2014				
A. Fission & Activation Gases						
Ar-41	Ci	*	3.98E-02	*	*	3.98E-02
Kr-85	Ci	*	6.54E-04	*	*	6.54E-04
Kr-85m	Ci	*	3.56E-07	*	*	3.56E-07
Xe-131m	Ci	*	2.05E-05	*	*	2.05E-05
Xe-133	Ci	*	1.05E-02	*	*	1.05E-02
Xe-133m	Ci	*	7.38E-06	*	*	7.38E-06
Xe-135	Ci	*	9.63E-04	*	*	9.63E-04
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	5.20E-02	*	*	5.20E-02
B. Iodines / Halogens						
Br-82	Ci	*	1.35E-05	*	*	1.35E-05
I-131	Ci	*	1.65E-06	*	*	1.65E-06
I-133	Ci	*	1.20E-06	*	*	1.20E-06
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	1.64E-05	*	*	1.64E-05
C. Particulates						
γ Emitters	Ci	*	-	*	*	-
Sr-89	Ci	*	-	*	*	-
Sr-90	Ci	*	-	*	*	-
Total Activity	Ci	*	-	*	*	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	*	1.74E-01	*	*	1.74E-01

* No activity released
"-" denotes less than Minimum Detectable Activity (MDA)
"na" denotes not required to be analyzed

Table 2.2-A7

Millstone Unit 2
Gaseous Effluents - Mixed Mode Release - Continuous Mode
Release Point - Unit 2 Ventilation Vent

Nuclides Released	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	1.27E-01	2.37E-02	-	-	1.51E-01
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.27E-01	2.37E-02	-	-	1.51E-01
B. Iodines / Halogens						
I-131	Ci	1.56E-05	8.68E-06	2.44E-06	4.72E-06	3.14E-05
I-132	Ci	-	1.62E-04	-	-	1.62E-04
I-133	Ci	4.97E-05	1.77E-05	-	1.51E-05	8.25E-05
Br-82	Ci	-	8.00E-06	-	-	8.00E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	6.53E-05	1.96E-04	2.44E-06	1.98E-05	2.84E-04
C. Particulates						
Sc-46	Ci	-	3.42E-07	-	-	3.42E-07
As-76	Ci	-	6.52E-06	-	-	6.52E-06
Ta-182	Ci	1.10E-06	9.75E-07	-	-	2.07E-06
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.10E-06	7.84E-06	-	-	8.94E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.06E+00	2.04E+00	1.58E+00	2.31E+00	6.99E+00
F. C-14						
C-14	Ci	1.08E+00	1.08E+00	1.08E+00	1.08E+00	4.30E+00

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A1
Millstone Unit 3
Gaseous Effluents - Release Summary

	Units	2014 1st Qtr	2014 2nd Qtr	2014 3rd Qtr	2014 4th Qtr	2014 Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	2.59E-01	1.96E-01	2.56E-01	1.66E-01	8.75E-01
2. Average Period Release Rate	uCi/sec	3.34E-02	2.50E-02	3.22E-02	2.08E-02	2.77E-02
B. Iodines / Halogens						
1. Total Activity Released	Ci	2.42E-06	2.01E-06	4.41E-06	1.31E-06	1.02E-05
2. Average Period Release Rate	uCi/sec	3.11E-07	2.56E-07	5.55E-07	1.65E-07	3.22E-07
C. Particulates						
1. Total Activity Released	Ci	3.10E-07	3.87E-08	2.72E-07	2.77E-04	2.78E-04
2. Average Period Release Rate	uCi/sec	3.98E-08	4.93E-09	3.43E-08	3.49E-05	8.82E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.29E+01	9.84E+00	6.86E+00	4.51E+01	7.48E+01
2. Average Period Release Rate	uCi/sec	1.66E+00	1.25E+00	8.63E-01	5.68E+00	2.37E+00
F. C-14						
1. Total Activity Released**	Ci	2.73E+00	2.73E+00	2.73E+00	2.73E+00	1.09E+01
2. Average Period Release Rate	uCi/sec	3.51E-01	3.47E-01	3.43E-01	3.43E-01	3.46E-01

"-" denotes less than Minimum Detectable Activity (MDA)

**Calculated value per "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents" EPRI Final Report, 12/2010.

Table 2.3-A2
Millstone Unit 3
Gaseous Effluents - Ground Level Release - Batch Mode
Release Point -ESF Building Rooftop, Main Steam Valve Building Roof

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Total Activity	Ci	*	*	*	-	-
B. Iodines / Halogens						
Total Activity	Ci	*	*	*	-	-
C. Particulates						
Total Activity	Ci	*	*	*	-	-
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	-	-
E. Tritium						
H-3	Ci	*	1.49E-03	*	-	1.49E-03

* No activity released
"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A3

Millstone Unit 3

Gaseous Effluents - Ground Level Release - Continuous Mode

Release Point - ESF Building Vent, Containment Equipment Hatch, RWST Vent

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Cr-51	Ci	-	-	-	8.21E-05	8.21E-05
Mn-54	Ci	6.27E-08	9.80E-09	1.22E-09	3.91E-06	3.99E-06
Co-57	Ci	3.30E-09	4.80E-10	3.16E-11	4.58E-08	4.97E-08
Co-58	Ci	1.48E-07	1.15E-08	8.15E-10	6.71E-05	6.73E-05
Fe-59	Ci	-	-	-	2.72E-06	2.72E-06
Co-60	Ci	6.24E-08	1.11E-08	1.85E-09	4.17E-06	4.25E-06
Zr-95	Ci	-	-	0.00E+00	2.54E-06	2.54E-06
Nb-95	Ci	-	-	-	3.80E-06	3.80E-06
Ag-110m	Ci	-	-	-	3.10E-07	3.10E-07
Sn-113	Ci	-	-	-	5.28E-08	5.28E-08
Sb-125	Ci	2.62E-08	4.53E-09	2.28E-09	3.74E-07	4.07E-07
Cs-137	Ci	7.08E-09	1.30E-09	9.94E-11	2.96E-08	3.80E-08
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	3.10E-07	3.87E-08	6.30E-09	1.67E-04	1.68E-04
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	6.78E-03	1.80E-03	7.93E-04	3.48E-02	4.41E-02

"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes not required to be analyzed

Table 2.3-A4

Millstone Unit 3

Gaseous Effluents - Elevated Release - Batch Mode

Release Point - Millstone Site Stack

Nuclides Released	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	5.38E-03	1.01E-02	8.89E-03	1.94E-03	2.63E-02
Kr-85m	Ci	-	6.55E-04	-	-	6.55E-04
Kr-87	Ci	-	1.73E-04	-	-	1.73E-04
Kr-88	Ci	-	1.47E-04	-	-	1.47E-04
Xe-133	Ci	-	3.75E-03	1.69E-05	-	3.77E-03
Xe-135	Ci	-	2.84E-03	-	-	2.84E-03
Xe-135m	Ci	-	2.54E-04	-	-	2.54E-04
Xe-138	Ci	-	9.25E-04	-	-	9.25E-04
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	5.38E-03	1.88E-02	8.91E-03	1.94E-03	3.50E-02
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	3.41E-03	1.99E+00	1.44E-02	5.47E-03	2.02E+00

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A5

Millstone Unit 3

Gaseous Effluents - Elevated Release - Continuous Mode

Release Point - Millstone Site Stack

Nuclides Released	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	4.34E-04	-	-	4.34E-04
Kr-83m	Ci	-	5.30E-04	-	-	5.30E-04
Kr-85	Ci	2.54E-01	1.68E-01	2.47E-01	1.54E-01	8.23E-01
Kr-85m	Ci	-	2.52E-04	-	2.20E-07	2.52E-04
Kr-87	Ci	-	5.52E-04	-	-	5.52E-04
Kr-88	Ci	-	7.03E-04	-	-	7.03E-04
Xe-133	Ci	-	1.90E-03	-	9.50E-03	1.14E-02
Xe-135m	Ci	-	6.92E-04	-	-	6.92E-04
Xe-135	Ci	-	1.06E-03	-	9.40E-05	1.15E-03
Xe-138	Ci	-	1.88E-03	-	-	1.88E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.54E-01	1.76E-01	2.47E-01	1.64E-01	8.41E-01
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Br-82	Ci	2.42E-06	2.01E-06	4.41E-06	7.00E-07	9.54E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.42E-06	2.01E-06	4.41E-06	7.00E-07	9.54E-06
C. Particulates						
Co-58	Ci	-	-	-	4.55E-07	4.55E-07
Co-60	Ci	-	-	2.66E-07	-	2.66E-07
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	2.66E-07	4.55E-07	7.21E-07
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	5.59E-01	5.85E-01	9.47E-01	4.91E-01	2.58E+00
F. C-14						
C-14	Ci	1.37E+00	1.37E+00	1.37E+00	1.37E+00	5.46E+00

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A6

Millstone Unit 3

Gaseous Effluents - Mixed Mode Release - Batch Mode

Release Point - Unit 3 Ventilation Vent

Nuclides Released	Units	2014 1st Qtr	2014 2nd Qtr	2014 3rd Qtr	2014 4th Qtr	2014 Total
A. Fission & Activation Gases						
Ar-41	Ci	*	9.60E-05	*	-	9.60E-05
Kr-85m	Ci	*	6.55E-04	*	-	6.55E-04
Kr-87	Ci	*	1.73E-04	*	-	1.73E-04
Kr-88	Ci	*	1.47E-04	*	-	1.47E-04
Xe-135	Ci	*	3.12E-04	*	-	3.12E-04
Xe-135m	Ci	*	2.54E-04	*	-	2.54E-04
Xe-138	Ci	*	9.25E-04	*	-	9.25E-04
Other γ Emitters	Ci	*	-	*	-	-
Total Activity	Ci	*	2.56E-03	*	-	2.56E-03
B. Iodines / Halogens						
Br-82	Ci	*	-	*	3.06E-07	3.06E-07
I-131	Ci	*	-	*	-	-
I-133	Ci	*	-	*	-	-
Other γ Emitters	Ci	*	-	*	-	-
Total Activity	Ci	*	-	*	3.06E-07	3.06E-07
C. Particulates						
γ Emitters	Ci	*	-	*	-	-
Total Activity	Ci	*	-	*	-	-
D. Gross Alpha						
Gross Alpha	Ci	*	na	*	na	na
E. Tritium						
H-3	Ci	*	1.99E+00	*	1.62E-02	2.00E+00

* No activity released

"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes not required to be analyzed

Table 2.3-A7

Millstone Unit 3

Gaseous Effluents - Mixed Mode Release - Continuous Mode

Release Point - Unit 3 Ventilation Vent

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	-	-	-	-
Kr-85m	Ci	-	-	-	-	-
Kr-87	Ci	-	-	-	-	-
Kr-88	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Xe-135m	Ci	-	-	-	-	-
Xe-138	Ci	-	-	-	-	-
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Cr-51	Ci	-	-	-	7.87E-05	7.87E-05
Co-58	Ci	-	-	-	2.59E-05	2.59E-05
Co-60	Ci	-	-	-	5.11E-06	5.11E-06
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	1.10E-04	1.10E-04
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.24E+01	5.28E+00	5.90E+00	4.46E+01	6.81E+01
F. C-14						
C-14	Ci	1.37E+00	1.37E+00	1.37E+00	1.37E+00	5.46E+00

"-" denotes less than Minimum Detectable Activity (MDA)

2.2 Liquid Effluents

2.2.1 Measurement of Liquid Radioactivity

2.2.1.1 Continuous Liquid Releases

Water containing radioactivity is continuously released through one of two pathways – the Millstone Quarry or DSN006. DSN006 is next to the Unit 3 intake structure (DSN is an acronym for 'discharge serial number.')

Grab samples are taken for continuous liquid release pathways and analyzed on the gamma spectrometer and liquid scintillation detector (for H-3) if required by the conditional action requirements of the REMODCM. Total estimated volume is multiplied by the isotopic concentrations (if any) to determine the total activity released. A proportional aliquot of each discharge is retained for composite analysis for Sr-89, Sr-90, Fe-55 and gross alpha if required by the conditional action requirements of the REMODCM. Pathways for continuous liquid effluent releases via the Millstone Quarry include Steam Generator Blowdown for Unit 3, Service Water Effluent for Unit 2 and Unit 3 and Reactor Building Closed Cooling Water (RBCCW) Sump for Unit 2. Pathways for continuous liquid effluent releases via DSN006 include Turbine Building Sump discharge from Unit 2 and Unit 3.

2.2.1.2 Batch Liquid Releases from Tanks and Sumps

Batch liquid releases are made via both the Millstone Quarry and DSN006. There are numerous sources from which batches of liquids containing radioactivity are discharged to the environs. Except for three sources from Unit 3 to DSN006 they are discharged via the Millstone Quarry. The sources are:

Unit 1 Radwaste Processing System – Includes sources from:

1. Reactor Building Sumps
2. Underground Ventilation Duct
3. Site Stack Sump

Unit 2 Radwaste Processing System:

1. Clean Waste Monitor Tanks (2)
2. Aerated Waste Monitor Tanks

Other Radwaste Sources:

1. CPF Waste Neutralization Sump
2. Steam Generator
3. Other Systems' Bulk Discharges

Unit 3 Radwaste Processing

1. Waste Test Tanks (2)

Other Radwaste Sources:

1. CPF Waste Neutralization Sump
2. Steam Generator Bulk
3. Boron and Waste Test Tanks Berm (via DSN006)
4. Foundation Drains Sumps (via DSN006)
5. Systems' Bulk Discharges (via DSN006)

Prior to release, a tank is re-circulated for two equivalent tank volumes, a sample is drawn and then analyzed on the HPGe gamma spectrometer and liquid scintillation detector (H-3) for individual radionuclide composition. Isotopic concentrations are multiplied by the volume released to obtain the total activity released. For bulk releases, several samples are taken during the discharge to verify the amount of radioactivity released. A proportional aliquot of each discharge is retained for composite analysis for Sr-89, Sr-90, Fe-55, and gross alpha.

2.2.2 Estimate of Errors

Estimates of errors associated with radioactivity measurements were made using the following guidelines:

Radioactivity Measurement Calibration	10%	Calibration to NIST* standards
Sampling/Data Collection	10% - 20%	Variation in sample collection
Sample Counting	10% - 30%	Error for counting statistics
Flow & Level Measurements	10% - 20%	Error for release volumes

* National Institute of Standards and Technology

2.2.3 Liquid Batch Release Statistics

Radwaste Processing System:	Unit 1	Unit 2	Unit 3
Number of Batches	6	58	98
Total Time (min)	217	7,430	10,300
Maximum Time (min)	40	263	152
Average Time (min)	36	128	105
Minimum Time (min)	20	1	27

Other Radwaste Sources:	Unit 1	Unit 2	Unit 3
Number of Batches	NA	74	370
Total Time (min)	NA	179,000	1,270,000
Maximum Time (min)	NA	12,200	41,800
Average Time (min)	NA	2,419	3,432
Minimum Time (min)	NA	9	40

2.2.4 Abnormal Liquid Releases

An abnormal release of radioactivity is the discharge of a volume of liquid radioactive material to the environment that was unplanned or uncontrolled.

In 2014, the following abnormal liquid releases occurred:

2.2.4.1 Unit 1 – None

2.2.4.2 Unit 2 – None

2.2.4.3 Unit 3

In 2014 leakage occurred from a degraded gasket associated with the condensate surge tank leaked. Leakage was collected and discharged via the DSN006 pathway. Tritium was the only radioactivity in this discharge. It totaled 6.51E-6 Curies and is included in Table 2.3-L3 of this report. The whole body dose offsite from this release was 6.43E-10 mrem. To prevent reoccurrence the area of the leak was encapsulated to seal off the leak. During the next Unit 3 outage the leak will be permanently repaired.

2.2.5 Liquid Release Tables

The following tables provide the details of the liquid radioactivity released from each of the Millstone Power Station units. They are categorized by type of release, source(s), and by release point of discharge to the environment.

Table 2.1-L1
Millstone Unit 1

Liquid Effluents - Release Summary

	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	*	*	1.73E-03	1.01E-04	1.83E-03
2. Average Period Diluted Activity+	uCi/ml	*	*	6.13E-12	3.54E-13	3.23E-12
B. Tritium						
1. Total Activity Released	Ci	*	*	4.22E-03	1.22E-04	4.34E-03
2. Average Period Diluted Activity+	uCi/ml	*	*	1.50E-11	4.28E-13	7.66E-12
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	*	*	-	-	-
2. Average Period Diluted Activity+	uCi/ml	*	*	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	*	*	-	-	-
E. Volume						
1. Released Waste Volume	Liters	*	*	1.57E+05	1.55E+04	1.73E+05
2. Dilution Volume During Releases	Liters	*	*	8.94E+08	3.88E+07	9.33E+08
3. Dilution Volume During Period++	Liters	*	*	2.82E+11	2.85E+11	5.67E+11

* No activity released
"-" denotes less than Minimum Detectable Activity (MDA)
+ "Total Activity Released" ÷ ("Released Waste Volume" + "Dilution Volume During Period")
++ Unit 2 Dilution Volume During Period used because there is no Unit 1 dilution

Table 2.1-L2
Millstone Unit 1

Liquid Effluents - Batch
Release to Quarry: Liquid Radwaste Processing System

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Cs-137	Ci	*	*	1.73E-03	1.01E-04	1.83E-03
Other γ Emitters	Ci	*	*	-	-	-
Sr-90	Ci	*	*	-	-	-
Fe-55	Ci	*	*	-	-	-
Total Activity	Ci	*	*	1.73E-03	1.01E-04	1.83E-03
B. Tritium						
H-3	Ci	*	*	4.22E-03	1.22E-04	4.34E-03
C. Dissolved & Entrained Gases						
Kr-85	Ci	*	*	-	-	-
Other γ Emitters	Ci	*	*	-	-	-
Total Activity	Ci	*	*	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	*	*	-	-	-

* No activity released
"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.2-L1

Millstone Unit No. 2
Liquid Effluents - Release Summary

	Units	2014 1st Qtr	2014 2nd Qtr	2014 3rd Qtr	2014 4th Qtr	2014 Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	3.12E-03	3.67E-03	2.23E-03	4.33E-04	9.46E-03
2. Average Period Diluted Activity *	uCi/ml	1.28E-11	2.85E-11	7.90E-12	1.52E-12	1.01E-11
B. Tritium						
1. Total Activity Released	Ci	4.00E+02	3.03E+01	2.05E+01	2.13E+01	4.72E+02
2. Average Period Diluted Activity *	uCi/ml	1.64E-06	2.35E-07	7.27E-08	7.47E-08	5.02E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	5.95E-02	8.66E-03	1.31E-03	1.37E-04	6.96E-02
2. Average Period Diluted Activity *	uCi/ml	2.44E-10	6.71E-11	4.65E-12	4.81E-13	7.40E-11
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.09E+06	6.42E+05	3.60E+05	1.32E+05	2.22E+06
Secondary	Liters	2.57E+06	9.74E+05	8.25E+04	5.72E+05	4.20E+06
2. Dilution Volume During Releases						
Primary	Liters	1.43E+10	6.80E+09	6.60E+09	2.33E+09	3.00E+10
Secondary	Liters	8.19E+10	2.69E+10	1.68E+09	8.85E+07	1.11E+11
3. Dilution Volume During Period	Liters	2.44E+11	1.29E+11	2.82E+11	2.85E+11	9.40E+11

* "Total Activity Released" ÷ (Primary "Released Waste Volume" + "Dilution Volume During Period")

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.2-L2

Millstone Unit 2
Liquid Effluents - Continuous

1. Release to Quarry: Steam Generator Blowdown, Service Water and Reactor Building Closed Cooling Water

2. Release to DSN006: Turbine Building Sumps and Tendon Gallery

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Products

Co-58	Ci	-	1.31E-07	-	-	1.31E-07
Co-60	Ci	-	4.21E-07	-	-	4.21E-07
Cs-137	Ci	-	1.96E-05	-	-	1.96E-05
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Ni-63	Ci	-	-	-	1.47E-06	1.47E-06
Total Activity	Ci	-	2.02E-05	-	1.47E-06	2.16E-05

B. Tritium

H-3	Ci	1.06E-02	6.00E-03	3.17E-04	1.96E-03	1.89E-02

C. Dissolved & Entrained Gases

γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.2-L3

Millstone Unit 2
Liquid Effluents - Batch

Release to Quarry: Liquid Radwaste Processing System

Nuclides Released	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Mn-54	Ci	-	-	2.42E-05	-	2.42E-05
Co-58	Ci	2.32E-06	5.32E-04	3.46E-04	2.89E-05	9.09E-04
Co-60	Ci	9.76E-04	3.05E-04	2.72E-04	6.75E-05	1.62E-03
Nb-97	Ci	-	1.99E-06	2.99E-06	4.46E-06	9.44E-06
Ag-110m	Ci	1.79E-03	5.51E-04	2.80E-04	8.74E-05	2.71E-03
Sn-113	Ci	2.95E-06	-	-	-	2.95E-06
Sn-117m	Ci	-	2.19E-05	-	-	2.19E-05
Sb-124	Ci	-	2.83E-04	1.14E-06	-	2.84E-04
Sb-125	Ci	2.36E-04	1.49E-03	2.31E-04	1.24E-05	1.97E-03
Sb-126	Ci	-	2.30E-06	-	-	2.30E-06
I-131	Ci	9.63E-06	2.05E-05	-	1.13E-05	4.14E-05
I-134	Ci	-	3.76E-05	-	-	3.76E-05
Cs-134	Ci	-	5.21E-06	2.66E-06	-	7.87E-06
Cs-136	Ci	-	1.70E-06	-	-	1.70E-06
Cs-137	Ci	1.16E-05	7.62E-06	8.01E-05	1.70E-05	1.16E-04
Other γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	5.58E-05	3.91E-04	6.31E-04	3.45E-05	1.11E-03
Ni-63	Ci	4.06E-05	-	3.58E-04	1.68E-04	5.67E-04
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	3.12E-03	3.65E-03	2.23E-03	4.31E-04	9.44E-03
B. Tritium						
H-3	Ci	4.00E+02	3.03E+01	2.05E+01	2.13E+01	4.72E+02
C. Dissolved & Entrained Gases						
Ar-41	Ci	9.27E-05	-	-	-	9.27E-05
Kr-85	Ci	2.75E-02	-	-	-	2.75E-02
Xe-133	Ci	3.17E-02	8.66E-03	1.31E-03	1.37E-04	4.18E-02
Xe-135	Ci	1.98E-04	-	-	-	1.98E-04
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	5.95E-02	8.66E-03	1.31E-03	1.37E-04	6.96E-02
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-L1
Millstone Unit 3

Liquid Effluents - Release Summary

	Units	2014 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	1.71E-02	1.23E-02	3.07E-02	3.24E-02	9.25E-02
2. Average Period Diluted Activity *	uCi/ml	3.91E-11	3.22E-11	6.50E-11	9.50E-11	5.67E-11
B. Tritium						
1. Total Activity Released	Ci	2.68E+02	2.82E+02	4.54E+02	2.61E+02	1.27E+03
2. Average Period Diluted Activity *	uCi/ml	6.14E-07	7.37E-07	9.62E-07	7.66E-07	7.75E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.25E+06	1.00E+06	9.41E+05	2.13E+06	5.32E+06
Secondary	Liters	2.96E+07	2.81E+07	1.76E+07	9.65E+06	8.50E+07
2. Dilution Volume During Releases						
Primary	Liters	1.07E+10	7.49E+09	8.44E+09	2.09E+10	4.75E+10
Secondary	Liters	5.73E+11	4.58E+11	6.18E+11	6.09E+10	1.71E+12
3. Dilution Volume During Period	Liters	4.37E+11	3.83E+11	4.72E+11	3.41E+11	1.63E+12

"-" denotes less than Minimum Detectable Activity (MDA)

* "Total Activity Released" ÷ (Primary "Released Waste Volume" + "Dilution Volume During Period")

Table 2.3-L2

Millstone Unit 3
Liquid Effluents - Continuous

1. Release to Quarry: Steam Generator Blowdown & Service Water
2. Release to DSN006: Turbine Building Sump, Waste Test Tank Berm and Foundation Drain Sumps

Nuclides Released	Units	2014				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	3.64E-01	2.42E-01	3.72E-02	4.65E-02	6.90E-01
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-L3

Millstone Unit 3
Liquid Effluents - Batch

1. Release to Quarry: Liquid Radwaste Processing System, CPF Waste Neutralization Sumps, Hotwell and Steam Generator Bulk
2. Release to DSN006: Condesate surge tank

Nuclides Released	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
		2014				
A. Fission & Activation Products						
Cr-51	Ci	-	5.12E-04	-	8.39E-04	1.35E-03
Mn-54	Ci	2.73E-04	2.96E-04	8.02E-04	6.39E-04	2.01E-03
Co-58	Ci	2.25E-04	6.50E-04	6.21E-04	1.21E-03	2.71E-03
Fe-59	Ci	-	-	-	1.07E-04	1.07E-04
Co-60	Ci	1.82E-03	2.63E-03	5.73E-03	6.19E-03	1.64E-02
Sr-92	Ci	-	-	-	3.08E-05	3.08E-05
Nb-95	Ci	-	1.48E-04	1.01E-04	3.82E-05	2.87E-04
Zr-95	Ci	-	1.86E-05	-	-	1.86E-05
Nb-97	Ci	4.34E-05	1.97E-05	1.45E-04	6.67E-06	2.15E-04
Ru-105	Ci	-	1.82E-05	-	-	1.82E-05
Ag-110m	Ci	6.88E-05	1.52E-05	1.42E-04	4.57E-05	2.72E-04
Sb-124	Ci	-	-	-	3.97E-05	3.97E-05
Sb-125	Ci	4.23E-03	5.51E-03	4.97E-03	4.84E-03	1.96E-02
I-134	Ci	2.60E-05	-	-	-	2.60E-05
Cs-134	Ci	4.58E-04	-	-	8.13E-04	1.27E-03
Cs-137	Ci	1.40E-03	-	1.06E-05	3.30E-03	4.71E-03
Other γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	8.55E-03	2.53E-03	1.76E-02	1.23E-02	4.10E-02
Ni-63	Ci	-	-	5.65E-04	2.01E-03	2.58E-03
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.71E-02	1.23E-02	3.07E-02	3.24E-02	9.25E-02
B. Tritium						
H-3	Ci	2.68E+02	2.82E+02	4.54E+02	2.61E+02	1.27E+03
C. Dissolved & Entrained Gases						
Xe-133m	Ci	-	-	-	5.54E-05	5.54E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	5.54E-05	5.54E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

"-" denotes less than Minimum Detectable Activity (MDA)

2.3 Solid Waste

Solid waste shipment summaries for each unit are given in the following tables (Reference 11):

Table 2.1-S Unit 1 Solid Waste and Irradiated Component Shipments
Table 2.2-S Unit 2 Solid Waste and Irradiated Component Shipments
Table 2.3-S Unit 3 Solid Waste and Irradiated Component Shipments

The principal radionuclides in these tables were from shipping manifests.

Solidification Agent(s): No solidification on site

Containers routinely used for radioactive waste shipment include:

55-gal Steel Drum DOT* 17-H container	7.5 ft^3
Steel Boxes	45 ft^3 87 ft^3 95 ft^3
Steel Container	202.1 ft^3
Steel "Sea Van"	1280 ft^3
Polyethylene High Integrity Containers	120.3 ft^3 132.4 ft^3 173.4 ft^3 202.1 ft^3

* United States Department of Transportation

Table 2.1-S

Solid Waste and Irradiated Component Shipments
Millstone Unit 1

January 1, 2014 through December 31, 2014

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**N/A**	**N/A**	**N/A**

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	N/A	N/A	N/A

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Table 2.1-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 1

January 1, 2014 through December 31, 2014

Irradiated Components	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**N/A**	**N/A**	**N/A**

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		**0**

Other Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**N/A**	**N/A**	**N/A**

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		**0**

Table 2.1-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 1
January 1, 2014 through December 31, 2014

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**N/A**	**N/A**	**N/A**

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		**0**

Table 2.2-S
Solid Waste and Irradiated Component Shipments
Millstone Unit 2
January 1, 2014 through December 31, 2014

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.11E+02	3.14E+00	5.01E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.11E+02**	**3.14E+00**	**5.01E-01**

Nuclides for table above:

Radionuclide	% of Total	Curies
H-3	14.42%	7.22E-02
C-14	0.02%	1.16E-04
Cr-51	< 0.01%	1.47E-05
Mn-54	0.68%	3.39E-03
Fe-55	50.36%	2.52E-01
Co-57	0.03%	1.31E-04
Co-58	0.18%	8.99E-04
Co-60	20.22%	1.01E-01
Ni-59	< 0.01%	4.47E-05
Ni-63	4.92%	2.46E-02
Zn-65	0.02%	1.08E-04
Sr-90	< 0.01%	3.90E-05
Zr-95	0.11%	5.59E-04
Nb-95	0.02%	7.81E-05
Tc-99	0.29%	1.45E-03
Ag-110m	5.48%	2.75E-02
Sn-113	0.13%	6.34E-04
Sb-124	< 0.01%	3.26E-05
Sb-125	2.87%	1.44E-02
Cs-137	0.04%	2.06E-04
Pu-238	< 0.01%	9.75E-06
Pu-239	< 0.01%	4.30E-06
Pu-241	0.17%	8.76E-04
Am-241	< 0.01%	8.91E-06
Cm-242	< 0.01%	9.90E-07
Cm-244	<0.01%	1.08E-05
CURIES (TOTAL)		**5.01E-01**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 2
January 1, 2014 through December 31, 2014

Dry Active Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.63E+04	4.62E+02	5.31E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.63E+04**	**4.62E+02**	**5.31E-01**

Nuclides for table above:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	0.04%	1.96E-04	Cd-109	0.05%	2.62E-04
C-14	0.01%	5.85E-05	Ag-110m	0.32%	1.72E-03
Cl-36	< 0.01%	6.80E-06	Sn-113	0.14%	7.31E-04
Cr-51	0.25%	1.33E-03	Sb-125	3.06%	1.63E-02
Mn-54	3.13%	1.66E-02	Ba-133	< 0.01%	7.04E-06
Fe-55	18.52%	9.83E-02	Cs-134	< 0.01%	9.15E-06
Co-57	0.07%	3.81E-04	Cs-137	1.62%	8.60E-03
Co-58	2.04%	1.09E-02	Ce-139	< 0.01%	9.87E-06
Co-60	25.94%	1.38E-01	Eu-152	< 0.01%	3.01E-07
Ni-59	0.33%	1.75E-03	Hg-203	< 0.01%	2.16E-05
Ni-63	41.19%	2.19E-01	Th-232	< 0.01%	1.54E-06
Zn-65	< 0.01%	1.34E-09	U (nat)	< 0.01%	1.10E-06
Sr-85	< 0.01%	5.06E-06	Pu-238	< 0.01%	1.60E-05
Y-88	0.01%	5.62E-05	Pu-239	< 0.01%	4.65E-06
Sr-90	0.05%	2.58E-04	Pu-241	0.15%	8.12E-04
Nb-94	< 0.01%	2.47E-06	Am-241	< 0.01%	3.29E-05
Zr-95	0.98%	5.18E-03	Cm-242	< 0.01%	4.50E-07
Nb-95	1.79%	9.53E-03	Cm-244	< 0.01%	9.88E-06
Tc-99	0.27%	1.43E-03	**CURIES (TOTAL)**		**5.31E-01**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 2
January 1, 2014 through December 31, 2014

Irradiated Components	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**N/A**	**N/A**	**N/A**

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		**0**

Other Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	8.87E+02	2.51E+01	7.93E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**8.87E+02**	**2.51E+01**	**7.93E-02**

Nuclides for table above:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	67.58%	5.36E-02	Ru-106	0.02%	1.68E-05
C-14	0.02%	1.68E-05	Ag-110m	0.07%	5.45E-05
Cr-51	0.29%	2.33E-04	Sb-124	< 0.01%	4.47E-06
Mn-54	0.78%	6.21E-04	Sb-125	2.09%	1.66E-03
Fe-55	1.76%	1.39E-03	Ba-131	< 0.01%	2.32E-13
Fe-59	0.07%	5.58E-05	Cs-134	0.81%	6.43E-04
Co-57	< 0.01%	1.39E-06	Cs-137	17.03%	1.35E-02
Co-58	0.48%	3.77E-04	U-234	< 0.01%	1.83E-06
Co-60	4.64%	3.68E-03	U-235	< 0.01%	9.87E-08
Ni-63	3.78%	2.99E-03	U-238	< 0.01%	4.37E-06
Zn-65	0.20%	1.55E-04	Pu-238	< 0.01%	1.78E-07
Tc-99	0.37%	2.96E-04	Pu-239	< 0.01%	7.63E-08
Ru-103	< 0.01%	2.30E-06	Am-241	< 0.01%	1.29E-06
			CURIES (TOTAL)		**7.93E-02**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 2
January 1, 2014 through December 31, 2014

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.73E+04	4.91E+02	1.11E+00
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.73E+04**	**4.91E+02**	**1.11E+00**

Nuclides for table above:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	11.34%	1.26E-01	Ag-110m	2.63%	2.92E-02
C-14	0.02%	1.91E-04	Sn-113	0.12%	1.36E-03
Cl-36	< 0.01%	6.80E-06	Sb-124	< 0.01%	3.70E-05
Cr-51	0.14%	1.58E-03	Sb-125	2.91%	3.23E-02
Mn-54	1.86%	2.06E-02	Ba-131	< 0.01%	2.32E-13
Fe-55	31.68%	3.52E-01	Ba-133	< 0.01%	7.04E-06
Fe-59	< 0.01%	5.58E-05	Cs-134	0.06%	6.52E-04
Co-57	0.05%	5.13E-04	Cs-137	2.01%	2.23E-02
Co-58	1.09%	1.21E-02	Ce-139	< 0.01%	9.87E-06
Co-60	21.84%	2.43E-01	Eu-152	< 0.01%	3.01E-07
Ni-59	0.16%	1.80E-03	Hg-203	< 0.01%	2.16E-05
Ni-63	22.17%	2.46E-01	Th-232	< 0.01%	1.54E-06
Zn-65	0.02%	2.64E-04	U (nat)	< 0.01%	1.10E-06
Sr-85	< 0.01%	5.06E-06	U-234	< 0.01%	1.83E-06
Y-88	< 0.01%	5.62E-05	U-235	< 0.01%	9.87E-08
Sr-90	0.03%	2.97E-04	U-238	< 0.01%	4.37E-06
Nb-94	< 0.01%	2.47E-06	Pu-238	< 0.01%	2.59E-05
Zr-95	0.52%	5.74E-03	Pu-239	< 0.01%	9.03E-06
Nb-95	0.86%	9.61E-03	Pu-241	0.15%	1.69E-03
Tc-99	0.29%	3.18E-03	Am-241	< 0.01%	4.31E-05
Ru-103	< 0.01%	2.30E-06	Cm-242	< 0.01%	1.44E-06
Ru-106	< 0.01%	1.68E-05	Cm-244	< 0.01%	2.06E-05
Cd-109	0.02%	2.62E-04	**CURIES (TOTAL)**		**1.11E+00**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2014 through December 31, 2014

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.63E+02	4.62E+00	9.59E+00
B	2.02E+02	5.72E+00	3.52E+01
C	N/A	N/A	N/A
ALL	**3.65E+02**	**1.03E+01**	**4.48E+01**

Nuclides for table above:

Radionuclide	% of Total	Curies
H-3	0.06%	2.73E-02
C-14	0.01%	5.17E-03
Cr-51	0.11%	4.82E-02
Mn-54	12.81%	5.73E+00
Fe-55	9.49%	4.25E+00
Fe-59	< 0.01%	7.09E-16
Co-57	0.40%	1.80E-01
Co-58	7.06%	3.16E+00
Co-60	12.19%	5.46E+00
Ni-59	0.64%	2.85E-01
Ni-63	52.24%	2.34E+01
Zn-65	0.04%	1.69E-02
Sr-89	< 0.01%	5.17E-05
Sr-90	0.01%	5.67E-03
Nb-94	< 0.01%	2.22E-04
Zr-95	< 0.01%	7.51E-13
Nb-95	< 0.01%	1.21E-04
Tc-99	< 0.01%	8.12E-04
Ag-110m	< 0.01%	8.77E-04
Sn-113	< 0.01%	1.82E-03
Sb-125	2.78%	1.24E+00
Cs-134	0.50%	2.25E-01
Cs-137	1.64%	7.32E-01
Np-237	< 0.01%	1.13E-06
Pu-238	< 0.01%	1.23E-05
Pu-239	< 0.01%	1.40E-06
Pu-241	0.01%	6.58E-03
Am-241	< 0.01%	8.62E-06
Cm-242	< 0.01%	1.26E-07
Cm-244	< 0.01%	7.00E-06
CURIES (TOTAL)		**4.48E+01**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2014 through December 31, 2014

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.63E+04	4.61E+02	6.08E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.63E+04**	**4.61E+02**	**6.08E-01**

Nuclides for table above:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	1.78%	1.08E-02	Nb-95	0.15%	9.34E-04
C-14	< 0.01%	3.54E-07	Tc-99	1.88%	1.14E-02
Cr-51	< 0.01%	7.25E-06	Ag-110m	< 0.01%	1.04E-05
Mn-54	5.16%	3.14E-02	Sn-113	< 0.01%	4.26E-06
Fe-55	53.37%	3.24E-01	Sb-125	0.85%	5.19E-03
Co-57	0.07%	4.46E-04	Cs-134	1.19%	7.24E-03
Co-58	3.26%	1.98E-02	Cs-137	6.74%	4.10E-02
Co-60	14.57%	8.85E-02	Pu-238	< 0.01%	9.70E-08
Ni-59	0.16%	9.54E-04	Pu-239	< 0.01%	2.82E-08
Ni-63	10.48%	6.37E-02	Pu-241	< 0.01%	4.92E-06
Sr-90	< 0.01%	4.79E-07	Am-241	< 0.01%	7.10E-08
Nb-94	0.32%	1.94E-03	Cm-242	< 0.01%	2.71E-09
Zr-95	< 0.01%	3.04E-05	Cm-244	< 0.01%	6.00E-08
			CURIES (TOTAL)		**6.08E-01**

Irradiated Components	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	N/A	N/A	N/A
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**N/A**	**N/A**	**N/A**

Nuclides for table above:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		**0**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2014 through December 31, 2014

Other Waste	**Volume**		**Curies Shipped**
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.01E+03	2.86E+01	1.28E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.01E+03**	**2.86E+01**	**1.28E-01**

Nuclides for table above:

Radionuclide	% of Total	Curies
H-3	74.92%	9.59E-02
C-14	< 0.01%	6.01E-06
Cr-51	1.36%	1.74E-03
Mn-54	1.86%	2.39E-03
Fe-55	0.96%	1.23E-03
Fe-59	0.33%	4.16E-04
Co-57	< 0.01%	1.04E-05
Co-58	1.75%	2.25E-03
Co-60	4.66%	5.97E-03
Ni-63	2.06%	2.64E-03
Zn-65	0.90%	1.15E-03
Tc-99	0.21%	2.67E-04
Ru-103	0.01%	1.72E-05
Ru-106	< 0.01%	5.17E-06
Ag-110m	0.01%	1.68E-05
Sb-124	0.01%	1.78E-05
Sb-125	1.14%	1.46E-03
Ba-131	< 0.01%	1.73E-12
Cs-134	0.44%	5.69E-04
Cs-137	9.33%	1.19E-02
U-234	0.01%	1.37E-05
U-235	< 0.01%	7.36E-07
U-238	0.01%	1.50E-05
Pu-238	< 0.01%	1.58E-07
Pu-239	< 0.01%	6.77E-08
Am-241	< 0.01%	5.23E-07
CURIES (TOTAL)		**1.28E-01**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2014 through December 31, 2014

Sum of All Low-Level Waste Shipped from Site	**Volume**		**Curies Shipped**
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.75E+04	4.94E+02	1.03E+01
B	2.02E+02	5.72E+00	3.52E+01
C	N/A	N/A	N/A
ALL	**1.77E+04**	**5.00E+02**	**4.55E+01**

Nuclides for table above:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	0.29%	1.34E-01	Ru-106	< 0.01%	5.17E-06
C-14	0.01%	5.17E-03	Ag-110m	< 0.01%	9.04E-04
Cr-51	0.11%	4.99E-02	Sn-113	< 0.01%	1.82E-03
Mn-54	12.68%	5.77E+00	Sb-124	< 0.01%	1.78E-05
Fe-55	10.05%	4.57E+00	Sb-125	2.75%	1.25E+00
Fe-59	< 0.01%	4.16E-04	Ba-131	< 0.01%	1.73E-12
Co-57	0.40%	1.80E-01	Cs-134	0.51%	2.33E-01
Co-58	6.99%	3.18E+00	Cs-137	1.73%	7.85E-01
Co-60	12.20%	5.55E+00	U-234	< 0.01%	1.37E-05
Ni-59	0.63%	2.86E-01	U-235	< 0.01%	7.36E-07
Ni-63	51.54%	2.34E+01	U-238	< 0.01%	1.50E-05
Zn-65	0.04%	1.80E-02	Np-237	< 0.01%	1.13E-06
Sr-89	< 0.01%	5.17E-05	Pu-238	< 0.01%	1.26E-05
Sr-90	0.01%	5.67E-03	Pu-239	< 0.01%	1.50E-06
Nb-94	< 0.01%	2.16E-03	Pu-241	0.01%	6.58E-03
Zr-95	< 0.01%	3.04E-05	Am-241	< 0.01%	9.21E-06
Nb-95	< 0.01%	1.05E-03	Cm-242	< 0.01%	1.29E-07
Tc-99	0.03%	1.25E-02	Cm-244	< 0.01%	7.06E-06
Ru-103	< 0.01%	1.72E-05	**CURIES (TOTAL)**		**4.55E+01**

2.4 Groundwater Monitoring

With the Groundwater Protection Program (GWPP) Millstone Power Station implements the actions cited in the Nuclear Energy's Institute's (NEI) Groundwater Protection Initiative (Reference 10). The purpose of the GWPP is to establish a program to assure timely and effective management of situations involving potential releases of radioactive material to groundwater. A key element in the GWPP is on-site groundwater monitoring. The results of the GWPP are documented in the Annual Radiological Environmental Operating Report (AREOR). Additional wells were sampled and the results are documented in tables below.

Another key element in the GWPP is site hydrological characterization. The general trend of groundwater flow at the station is toward the Long Island Sound. The underdrain system effectively captures groundwater in the area around Unit 3 and channels this water via the storm drain system to Long Island Sound.

Table 2.4-GW
Additional Well Samples

Name	Date	H-3[1,3] (pCi/L)	Name	Date	H-3[1,3] (pCi/L)
MW-7C[2]	1/6/2014	1,860	MW-7D[2]	1/6/2014	<mda
	1/13/2014	2,060		1/13/2014	<mda
	1/27/2014	1,170		1/27/2014	<mda
	2/4/2014	1,170		2/4/2014	<mda
	2/20/2014	<mda		2/20/2014	<mda
	3/3/2014	<mda		3/4/2014	<mda
	3/10/2014	<mda		3/10/2014	<mda
	3/18/2014	<mda		3/18/2014	<mda
	4/1/2014	<mda		4/1/2014	<mda
	4/23/2014	<mda		4/23/2014	<mda
	5/13/2014	<mda		5/13/2014	<mda
	5/30/2014	<mda		5/30/2014	<mda
	6/10/2014	<mda		6/10/2014	<mda
	6/16/2014	<mda		6/16/2014	<mda
	7/2/2014	<mda		7/2/2014	<mda
	7/14/2014	1,900		7/14/2014	2,430
	7/16/2014	<mda		7/16/2014	<mda
	7/29/2014	<mda		7/29/2014	2,720
	8/11/2014	1,770		8/11/2014	2,370
	8/26/2014	<mda		8/26/2014	2,270
	9/15/2014	<mda		9/15/2014	2,150
	10/30/2014	<mda		9/15/2014	2,780
	11/13/2014	<mda		10/24/2014	2,230
	12/1/2014	<mda		10/30/2014	2,030
	12/15/2014	2,160		11/13/2014	2,140
	12/29/2014	<mda		12/1/2014	1,890
				12/15/2014	<mda
				12/29/2014	<mda

Notes: 1 - There was no gamma radioactivity detected in these samples.

2 - These wells are located near the Unit 3 RWST. All or some of the H-3 detected in these wells is from releases out of the RWST vent. Gaseous releases from the RWST vent are reported in Table 2.3-A3. Any releases from RWST vent which reach the groundwater are captured in sumps and underground vaults, and periodically monitored before release to the environment and reported in Table 2.3-L2. There has been no hydraulic communication with offsite groundwater. During 2012, an investigation was initiated to determine if there are additional sources of H-3 to onsite groundwater at these wells.

3 - MDA is typically 1,760 pCi/L.

Table 2.4-GW
Additional Well Samples

Name	Date	H-3[1,3] (pCi/L)	Name	Date	H-3[1,3] (pCi/L)	Name	Date	H-3[1,3] (pCi/L)
DP-102[2]	3/11/2014	4,530	MW-GPI-4	3/5/2014	<MDA	S1-MW-1	2/24/2014	<MDA
	5/13/2014	4,720		6/3/2014	<MDA		6/3/2014	<MDA
	9/2/2014	dry		8/18/2014	<MDA		8/20/2014	<MDA
	12/1/2014	3,110		11/5/2014	<MDA		10/30/2014	<MDA
ME-2	3/19/2014	<MDA	MW-GPI-6	3/11/2014	<MDA	S1-MW-2	3/5/2014	<MDA
	6/9/2014	<MDA		5/13/2014	<MDA		6/3/2014	dry
	8/27/2014	<MDA		9/2/2014	<MDA		8/20/2014	dry
	11/10/2014	<MDA		12/1/2014	<MDA		11/5/2014	dry
ME-5	3/19/2014	<MDA	MW-GPI-8	2/24/2014	<MDA	S3-MW-2	3/24/2014	<MDA
	6/10/2014	<MDA		6/3/2014	<MDA		5/21/2014	<MDA
	9/4/2014	<MDA		8/18/2014	<MDA		7/29/2014	<MDA
	11/10/2014	<MDA		11/5/2014	<MDA		12/8/2014	<MDA
MW-5A	3/21/2014	<MDA	MW-GPI-9	2/24/2014	<MDA	T1-MW-1	3/5/2014	<MDA
	6/10/2014	<MDA		6/3/2014	<MDA		6/3/2014	dry
	7/23/2014	<MDA		8/6/2014	<MDA		9/8/2014	<MDA
	12/5/2014	<MDA		11/13/2014	<MDA		10/30/2014	<MDA
MW-5B	3/21/2014	<MDA	S11-MW-1	3/18/2014	<MDA	T1-MW-3	3/5/2014	<MDA
	5/19/2014	<MDA		5/11/2014	<MDA		6/3/2014	<MDA
	7/23/2014	<MDA		7/23/2014	<MDA		8/20/2014	<MDA
	12/5/2014	<MDA		12/05/2014	<MDA		10/30/2014	<MDA
MW-6A	3/21/2014	<MDA	S12-MW-1	2/20/2014	<MDA	T1-MW-4	3/5/2014	Dry
	4/22/2014	<MDA		5/30/2014	<MDA		6/3/2014	Dry
	7/23/2014	<MDA		8/6/2014	<MDA		8/20/2014	Dry
	12/5/2014	<MDA		11/2/2014	<MDA			
MW-6B	3/25/2014	<MDA	S12-MW-3	2/4/2014	<MDA	T10-MW-6A	3/6/2014	<MDA
	4/22/2014	<MDA		5/30/2014	<MDA		5/20/2014	<MDA
	7/23/2014	<MDA		8/6/2014	<MDA		7/16/2014	<MDA
	12/5/2014	<MDA		11/2/2014	<MDA		12/8/2014	<MDA
MW-GPI-2	2/20/2014	<MDA	S13-MW-1	3/25/2014	<MDA	T10-MW-6B	3/6/2014	<MDA
	5/30/2014	<MDA		5/21/2014	<MDA		5/19/2014	<MDA
	8/6/2014	<MDA		7/29/2014	<MDA		7/16/2014	<MDA
	11/13/2014	<MDA		12/5/2014	<MDA		12/8/2014	<MDA

Notes:
1 - There was no gamma radioactivity from licensed radioactive material detected in these samples.
2 - These wells are located near the Unit 3 RWST. All or some of the H-3 detected in these wells is from releases out of the RWST vent. Gaseous releases from the RWST vent are reported in Table 2.3-A3. Any releases from RWST vent which reach the groundwater are captured in sumps and underground vaults, periodically monitored before release to the environment and reported in Table 2.3-L2. There has been no hydraulic communication with offsite groundwater. During 2012, an investigation was initiated to determine if there are additional sources of H-3 to onsite groundwater at these wells.
3 - MDA is typically 1,760 pCi/L.

3.0 Inoperable Effluent Monitors

During the period January 1 through December 31, 2014, the following effluent instrumentation were inoperable for more than 30 consecutive days:

3.1 Unit 1

Spent Fuel Pool Island Vent

Unit 1 Spent Fuel Pool Island (SFPI) Noble Gas Radioactivity Monitor RM-SFPI-02 had a failed sample pump and was declared nonfunctional on June 28. On July 28 the monitor had not been restored to functionality, exceeding the 30 day limit. The monitor was restored to service on July 31. Because the work to restore the monitor was given a wrong priority when it became nonfunctional the work was not started until July 23. When the wrong priority was identified the work was given a higher priority on July 30 and completed within a day.

3.2 Unit 2

Waste Neutralization Effluent Radiation Monitor

There were two times during 2014 when this monitor was not functional for 30 days or more.

First time Waste Neutralization Effluent Radiation Monitor not functional:

Millstone Unit 2 waste neutralization effluent radiation monitor (RM-245) was removed from service April 3, 2014 at 15:43 and returned to service May 5, 2014 at 04:43. The radiation monitor was removed from service to perform surveillance testing. A discharge is performed as part of the surveillance prior to restoring to service. During that discharge the monitor tripped multiple times because of low sample flow. Troubleshooting resulted in replacement of the sample pump. The work for replacing the sample pump was given a lower priority than required by procedure. It was given a priority 2 when it should have been the higher priority 4. The priority 2 flag was missed by work planning reviewers. Because of the Unit 2 outage, different personnel were performing the work planning review. Both responsible supervisors were briefed of the expectation to provide properly prioritization. To emphasize the importance of correct priorization a poster was developed and displayed in the work planning meeting room. Each morning the work planning lead will review areas of focus to ensure proper focus and prioritization. In addition to enhancements to work planning prioritization, it was recommended that the calibration and functional tests be revised to delete the requirement for a discharge prior to return to service and annual replacement of the sample pump to address degraded performance leading to low sample flow condition.

Second time Waste Neutralization Effluent Radiation Monitor not functional:

Millstone Unit 2 waste neutralization effluent radiation monitor (RM-245) was declared nonfunctional on August 14. On September 13 it had been nonfunctional for 30 days. After repairs it is required that the monitor be tested by Chemistry as part of the next discharge prior to returning it to service. In this case, Chemistry did not perform any discharges within 30 days and the radiation monitor was not tested. To avoid this in the future work orders were changed to have the Instrument and Controls Department perform a functional test to return the monitor to service. In addition, the Operations Department will be tracking radiation monitors on a weekly basis to ensure the proper attention is placed on them. The monitor was returned to service on September 25.

3.3 Unit 3

Turbine Building Floor Drain Radiation Monitor

Turbine plant floor drain radiation monitor (DAS-50) was declared non-functional on December 5, 2014 at 0330 due to low sample flows with start of the turbine building sump pumps (CR 566811). On January 4, 2015 it had not yet been restored to service. A work order was generated to troubleshoot and repair. The condition report and subsequent review did not identify the radiation monitor as being associated with REMODCM V.C. 1 Category B which would have required the work order to be assigned a higher priority. The work was closed out to a work order which was previously prioritized at a lower priority during an earlier auxiliary equipment failure on November 14. The normal work priority review was not performed since it had been previously screened, assigned, and scheduled. Therefore, the appropriate priority was not given in the work review process for auxiliary equipment affecting functionality of the turbine building floor drain radiation monitor. To prevent a reoccurrence of inappropriate prioritization a separate loop table was developed listing all the instruments associated in an instrument loop that affect effluent instrumentation required by the REMODCM. This table was added to the work review process effective January 8, 2015. The monitor was restored to service on January 9, 2015.

Steam Generator Blowdown Radiation Monitor

As of the end of 2014, the Unit 3 Steam Generator Blowdown Radiation Monitor (3SSR-RE08) had not been functional since November 23 because flow could not be established from three of four steam generators. During the Unit 3 outage, which ended on November 14, Deposit Minimization Treatment (DMT) removed 12,000 lbs of deposits from the four steam generators. DMT resulted in magnetite residue which fouled sample lines from the steam generators to the radiation monitor. On December 10, the system was lined up to establish sample line flow but could not establish flow from three of four steam generators. The system was walked down and it was verified that all the required valves to take a sample were open. At that time it was postulated that a blockage existed between alternate sample points and containment. A Maintenance Rule Functional Failure evaluation was performed and a work order was generated to troubleshoot and repair with a status date of January 5, 2015.

Liquid Waste Effluent Line Flow Monitor

Liquid Waste Effluent Line flow rate monitor was declared nonfunctional on November 19 due to flow indication. A difference existed between the discharge flow rate recorded on the initial discharge permit and the flow rate recorded on the final permit. The initial flow rate was based on a reading from the differential pressure transmitter 3LWS-FT71, while the final flow rate was calculated by the OpenEMS software. Flow rate calculated by the OpenEMS software was higher than that reported by 3LWS-FT71. OpenEMS calculates flow rate based on the difference in tank levels and the start stop times of the discharge. The difference in initial and final flow rates was due to the difference in measurement based on flow rate versus measurement of tank level (volume) divided by duration of release. Work was planned to check transmitter 3LWS-FT71 to determine if the difference was due to inaccuracy of the transmitter. As of December 29 this work had not been scheduled. The lack of work was discussed with the Shift Manager and the work scheduler. To prevent a reoccurrence of inappropriate prioritization a separate loop table was developed listing all the instruments associated in an instrument loop that affect effluent instrumentation required by the REMODCM. This table was added to the work review process effective January 8, 2015. Calibration of the flow on January 20, 2015 determined that the loop was within tolerance. An evaluation concluded that the discrepancy between initial and final flow was not consequential.

Prior to returning the sample flow instrumentation to service it was decided that several discharges be performed to assess the functionality of the flow instrument. However, before that could be done the liquid waste radiation monitor (LWS-RE70) was declared non-functional on January 24 because of a failed sample pump.

4.0 Operating History

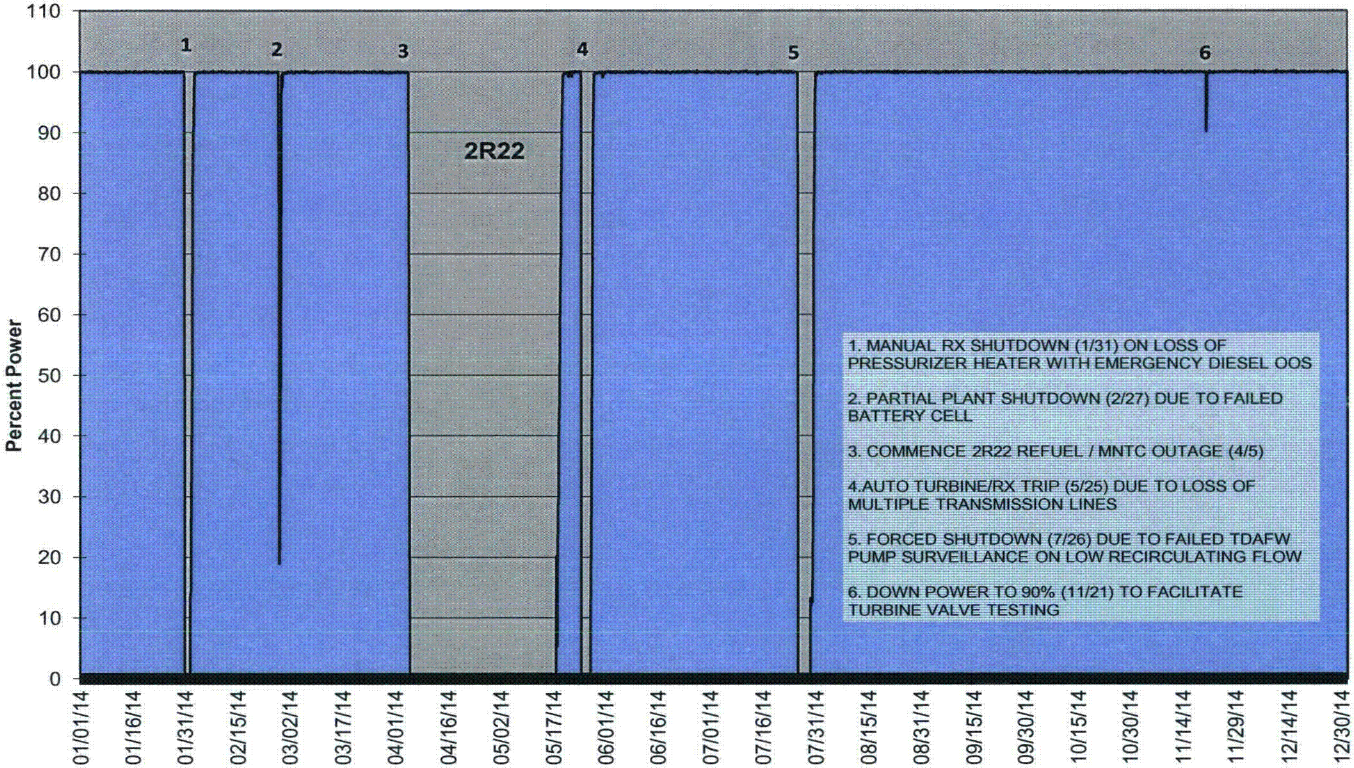
The operating history of the Millstone Power Station Units during this reporting period was as follows:

Unit 1 was shut down November 11, 1995 with a cessation of operation declared in July 1998.

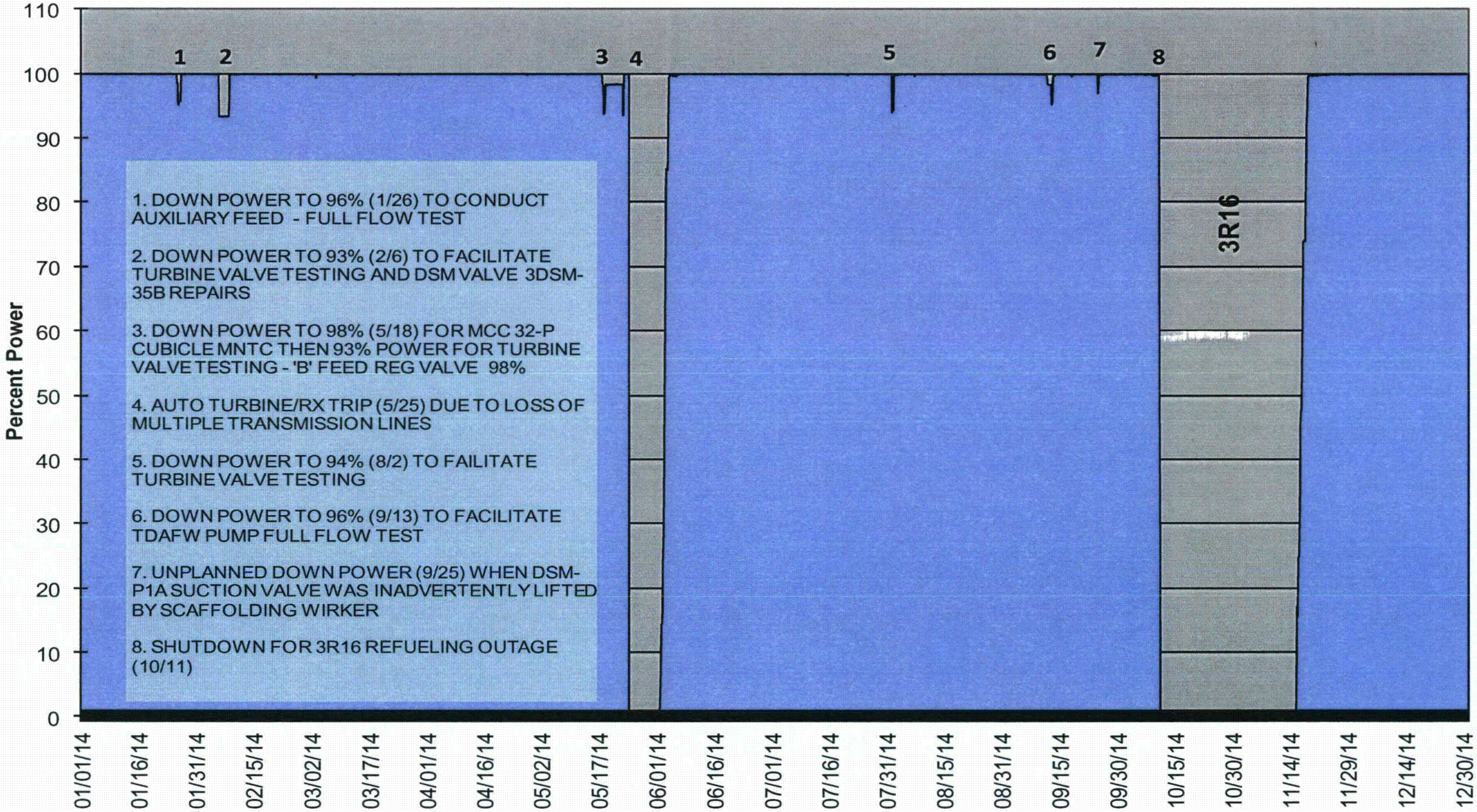
Unit 2 operated with a capacity factor of 85.4% and Unit 3 operated with a capacity factor of 88.1%

The power histograms for 2014 are on the following pages.

MP2 - CYCLE 22 / 23 POWER HISTORY
YEAR 2014



MP3 - CYCLE 16 POWER HISTORY
YEAR 2014



5.0 **Errata**

The following changes are made to the 2013 Millstone effluent report:

5.1 Doses for airborne releases from Millstone Units 2 and 3 in 2013 were revised. The original dose calculation did not include direct shine dose from noble gas radioactivity released from the Millstone Stack, an elevated release. Millstone does not have a methodology for calculating shine dose from elevated releases of noble gas radioactivity. Therefore the doses from noble gases released from the Millstone Stack were recalculated assuming release from rooftop vents. This approach conservatively calculates a higher dose from noble gas radioactivity releases because this methodology uses immersion of the maximum exposed individual in the plume. This change results in revisions to the fifth and sixth paragraphs of Section 1.1.1 and the first paragraph of Section 1.2.1. It also resulted in revisions to the dose results in Tables 1-1 and 1-3.

5.2 In Table 2.3-A1 the values for "Average Period Release Rate" for C-14 were entered. In the original report they were not displayed.

5.3 In Table 2.2-L1 the value for "Released Waste Volume" for primary releases in the first quarter was corrected from 1.19E+04 to 1.33E+05 liters. This changed the annual total from 7.09E+05 to 8.30E+05 liters.

5.4 In Table 2.3-L1 the values for "Released Waste Volume" for secondary releases were corrected in all four quarters and the value for "Dilution Volume During Releases" for secondary release was corrected releases in the third quarter. Annual totals were also corrected. The table below shows the changes (units of liters):

Parameter	Time period	Original value	Corrected value
Secondary Released Waste Volume	1st Q	2.52E+07	2.54E+07
	2nd Q	1.61E+07	2.07E+07
	3rd Q	3.25E+07	3.90E+07
	4th Q	2.87E+07	3.64E+07
	Annual	1.03E+08	1.22E+08
Secondary Dilution Volume	3rd Q	1.88E+11	1.85E+11
	Annual	8.48E+11	8.41E+11

Revised pages for the 2013 report are included as the next six pages.

Unit 1 SFPI Vent (73 foot) and the BOP Vent (80 foot) releases are considered ground level; therefore these doses were calculated using the 33 foot meteorology. Continuous ventilation of the SFPI includes tritium (H-3) releases due to evaporation from the spent fuel pool water release through the SFPI Vent. Continuous ventilation from other Unit 1 buildings is discharged to the BOP Vent. Doses from these release points were summed to determine the total Unit 1 gaseous effluent dose.

Unit 2 Auxiliary Building Ventilation, Steam Generator Blowdown Tank Vent, Spent Fuel Pool Evaporation, Liquid Radwaste System Gas Space and Containment Purge releases via the Unit 2 Vent at 159 foot are considered mixed mode (partially elevated and partially ground) releases. The first three of these are continuous releases and the latter three are batch releases. The doses for mixed mode releases are calculated using 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels. Containment Purges can also be released via the Millstone Power Station Stack, an elevated release point. Batch releases from the Waste Gas Decay Tanks and Containment Vents are discharged via the Millstone Power Station Stack. The doses for elevated releases are calculated using the 374 foot meteorological parameters except that noble gases released from the Millstone Power Station Stack are included with the mixed mode releases. This is done to calculate dose from noble gases released from the Stack as a submersion dose at the mixed mode level rather than as a plume shine dose from elevated level. This yields a conservatively higher dose. The Containment Equipment Hatch and the Reactor Water Storage Tank (RWST) Tank Vent releases are considered ground level where the 33 foot meteorology was used for the dose calculations. Each of the doses for the various release points were summed to determine the total Unit 2 gaseous effluent dose.

Unit 3 Auxiliary Building Ventilation, Spent Fuel Pool Evaporation and Containment Purge releases via the Unit 3 Vent at 133 foot are considered mixed mode (partially elevated and partially ground) releases. The first two of these are continuous releases and the latter is a batch release. The doses for mixed mode releases are calculated using 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels. Gaseous Waste System and Containment Vents are released through the Unit 3 Supplementary Leak Collection and Recovery System (SLCRS) system to the Millstone Power Station Stack, an elevated release at 375 foot. The doses for elevated releases are calculated using the 374 foot meteorological parameters except that noble gases released from the Millstone Power Station Stack are included with the mixed mode releases. This is done to calculate dose from noble gases released from the Stack as a submersion dose at the mixed mode level rather than as a plume shine dose from elevated level. This yields a conservatively higher dose. The Engineered Safety Features Building (ESF) Ventilation, the Containment Equipment Hatch, Containment Drawdowns and RWST Vent releases are considered ground level where the doses were calculated using 33 foot meteorology. Each of the doses for the various release points were summed to determine the total Unit 3 gaseous effluent dose.

Based on Reference 2, it was conservatively assumed that 30% of the C-14 exists as carbon dioxide (CO_2) which may be deposited on surfaces. Thus only 30% of C-14 released yielded dose via ingestion pathways of milk, meat, produce and vegetation.

1.1.2 Liquid Effluents

Maximum individual doses from the release of radioactive liquid effluents were calculated using OpenEMS which gives dose results equal to dose results calculated using NRC Regulatory Guide 1.109.

1.2 Dose Results

The calculated maximum off-site doses are presented in Table 1-1 for gaseous effluents and Table 1-2 for liquid effluents. The units 'mrad' and 'mrem' used in this report are units of radiation dose. The letter 'm' is for 'milli', or one-thousandth of a 'rad' or a 'rem.' The word 'rad' is an acronym for radiation absorbed dose. One rad is equal to the absorption of 100 ergs of energy per gram of tissue. The word 'rem' is an acronym for roentgen equivalent man. One rem is equal to a rad multiplied by factors to account for type of radiation and distribution within the body.

1.2.1 Gaseous Effluents

For the dose to the maximum individual, DOSAIR calculates the dose to the whole body, gastrointestinal (GI), bone, liver, kidney, thyroid, lung, and skin from each of the following pathways: direct exposure from submersion in noble gases in the plume, direct exposure from ground deposition, inhalation, and ingestion of vegetation, produce, cow or goat milk, and meat. The values presented are a total from all pathways. However, only the whole body, skin, thyroid and maximum organ (other than thyroid) doses are presented.

For the plume and inhalation pathways, the maximum individual dose is calculated at the off-site location of the highest decayed χ/Q where a potential for dose exists.

For ground deposition, the maximum individual dose is calculated at both the off-site maximum land location of the highest χ/Q and highest D/Q where a potential for dose exists.

Table 1-1
2013 Off-Site Dose Commitments from Gaseous Effluents
Millstone Units 1, 2, 3

Unit 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	6.02E-06	3.59E-05	5.32E-04	6.08E-04	1.18E-03
Skin	6.02E-06	3.59E-05	5.46E-04	6.08E-04	1.20E-03
Thyroid	6.02E-06	3.59E-05	4.81E-04	6.08E-04	1.13E-03
Max organ [3]	6.02E-06	3.59E-05	8.24E-04	6.08E-04	1.47E-03

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	3.97E-05	1.73E-04	6.00E-05	6.00E-05	3.33E-04
Gamma	5.32E-05	4.81E-04	7.48E-05	7.48E-05	6.84E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	2.14E-04	1.65E-03	5.34E-04	1.54E-04	2.55E-03
Whole Body [2]	8.06E-04	1.49E-02	1.09E-02	1.34E-03	2.80E-02
Skin [1]	2.50E-04	1.74E-03	5.63E-04	1.75E-04	2.73E-03
Skin [2]	8.42E-04	1.50E-02	1.09E-02	1.34E-03	2.81E-02
Thyroid [1]	3.25E-04	3.83E-03	2.00E-03	2.39E-04	6.40E-03
Thyroid [2]	9.38E-04	1.71E-02	1.24E-02	1.49E-03	3.20E-02
Max organ [1,3]	2.15E-04	1.66E-03	5.39E-04	1.55E-04	2.57E-03
Max organ [2,3]	3.30E-03	6.69E-02	5.21E-02	6.33E-03	1.29E-01

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	2.79E-05	4.67E-05	9.84E-05	5.64E-05	2.29E-04
Gamma	6.58E-06	4.91E-06	8.57E-06	6.00E-06	2.61E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	5.76E-04	1.51E-02	1.91E-03	1.05E-03	1.86E-02
Whole Body [2]	6.02E-04	1.51E-02	2.59E-03	9.82E-04	1.92E-02
Skin [1]	5.96E-04	1.51E-02	1.94E-03	1.12E-03	1.88E-02
Skin [2]	6.22E-04	1.50E-02	2.62E-03	1.02E-03	1.92E-02
Thyroid [1]	5.76E-04	1.50E-02	1.91E-03	1.05E-03	1.85E-02
Thyroid [2]	6.02E-04	1.50E-02	2.59E-03	9.82E-04	1.91E-02
Max organ [1,3]	5.76E-04	1.53E-02	1.92E-03	1.05E-03	1.88E-02
Max organ [2,3]	6.64E-04	1.58E-02	4.14E-03	1.35E-03	2.19E-02

NOTES:

1 - Dose without C-14

2 - Dose with C-14

3 - Maximum of the following organs (not including thyroid): Bone, GI-LLI, Kidney, Liver, Lung

Table 1-3
2013 Off-Site Dose Comparison to Limits
Millstone Units 1, 2, 3

Gaseous Effluents Dose (without C-14)

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*	Skin *(mrem)*	Beta Air *(mrad)*	Gamma Air *(mrad)*
Unit 1	1.18E-03	1.13E-03	1.47E-03	1.20E-03	0.00E+00	0.00E+00
Unit 2	2.55E-03	6.40E-03	2.57E-03	2.73E-03	3.33E-04	6.84E-04
Unit 3	1.86E-02	1.85E-02	1.88E-02	1.88E-02	2.29E-04	2.61E-05
Millstone Station	**2.23E-02**	**2.60E-02**	**2.29E-02**	**2.27E-02**	**5.62E-04**	**7.10E-04**
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Gaseous Effluents Dose (with C-14)

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*	Skin *(mrem)*	Beta Air *(mrad)*	Gamma Air *(mrad)*
Unit 1	1.18E-03	1.13E-03	1.47E-03	1.20E-03	0.00E+00	0.00E+00
Unit 2	2.80E-02	3.20E-02	1.29E-01	2.81E-02	3.33E-04	6.84E-04
Unit 3	1.92E-02	1.91E-02	2.19E-02	1.92E-02	2.29E-04	2.61E-05
Millstone Station	**4.84E-02**	**5.22E-02**	**1.52E-01**	**4.85E-02**	**5.62E-04**	**7.10E-04**
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Liquid Effluents Dose

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*
Unit 1	1.61E-05	4.67E-06	2.28E-05
Unit 2	1.39E-04	1.05E-04	3.15E-03
Unit 3	1.30E-03	6.37E-04	8.64E-03
Millstone Station	**1.45E-03**	**7.46E-04**	**1.18E-02**
Limits	*3*	*10*	*10*

Total Off-Site Dose from Millstone Station

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ * *(mrem)*
Gaseous without C-14	2.23E-02	2.60E-02	*2.29E-02*
Gaseous with C-14	4.84E-02	5.22E-02	1.52E-01
Liquid	1.45E-03	7.46E-04	1.18E-02
Direct Shine**	1.90E-01	1.90E-01	1.90E-01
Millstone Station	**2.40E-01**	**2.43E-01**	**3.54E-01**
Limits	*25*	*75*	*25*

* Maximum of the following organs (not including Thyroid): Bone, GI-LLI, Kidney, Liver, Lung
** Direct shine is radiation exposure from onsite storage of radwaste and spent fuel.

Table 2.3-A1

Millstone Unit 3

Gaseous Effluents - Release Summary

	Units	2013 1st Qtr	2013 2nd Qtr	2013 3rd Qtr	2013 4th Qtr	2013 Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	1.41E-01	1.10E-01	2.44E-01	2.69E-01	7.64E-01
2. Average Period Release Rate	uCi/sec	1.82E-02	1.40E-02	3.07E-02	3.38E-02	2.42E-02
B. Iodines / Halogens						
1. Total Activity Released	Ci	2.87E-06	1.19E-05	4.81E-06	1.62E-06	2.12E-05
2. Average Period Release Rate	uCi/sec	3.69E-07	1.51E-06	6.06E-07	2.04E-07	6.71E-07
C. Particulates						
1. Total Activity Released	Ci	1.10E-07	2.90E-04	3.31E-06	1.53E-06	2.95E-04
2. Average Period Release Rate	uCi/sec	1.41E-08	3.69E-05	4.16E-07	1.92E-07	9.36E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	8.97E+00	4.54E+01	8.07E+00	1.21E+01	7.46E+01
2. Average Period Release Rate	uCi/sec	1.15E+00	5.78E+00	1.01E+00	1.52E+00	2.36E+00
F. C-14						
1. Total Activity Released**	Ci	3.33E+00	1.33E+00	3.11E+00	3.33E+00	1.11E+01
2. Average Period Release Rate	uCi/sec	4.29E-01	1.70E-01	3.91E-01	4.19E-01	3.52E-01

"-" denotes less than Minimum Detectable Activity (MDA)

**Calculated value per "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents" EPRI Final Report, 12/2010.

Table 2.2-L1

Millstone Unit No. 2
Liquid Effluents - Release Summary

	Units	2013 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	4.34E-03	6.11E-04	5.25E-03	1.06E-03	1.13E-02
2. Average Period Diluted Activity *	uCi/ml	1.72E-11	2.59E-12	1.84E-11	4.10E-12	1.09E-11
B. Tritium						
1. Total Activity Released	Ci	1.52E+01	3.34E+01	3.35E+01	1.38E+02	2.20E+02
2. Average Period Diluted Activity *	uCi/ml	6.04E-08	1.42E-07	1.18E-07	5.35E-07	2.14E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	1.31E-07	4.94E-03	1.76E-02	2.25E-02
2. Average Period Diluted Activity *	uCi/ml	-	5.55E-16	1.73E-11	6.82E-11	2.19E-11
D. Gross Alpha						
1. Total Activity Released	Ci	-	6.15E-06	-	-	6.15E-06
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.33E+05	1.09E+05	1.74E+05	4.14E+05	8.30E+05
Secondary	Liters	2.46E+06	3.31E+05	3.94E+04	1.75E+06	4.58E+06
2. Dilution Volume During Releases						
Primary	Liters	5.16E+09	3.31E+09	6.27E+09	1.46E+10	2.93E+10
Secondary	Liters	1.93E+09	1.78E+09	8.71E+08	4.05E+08	4.99E+09
3. Dilution Volume During Period	Liters	2.52E+11	2.36E+11	2.85E+11	2.58E+11	1.03E+12

* "Total Activity Released" ÷ (Primary "Released Waste Volume" + "Dilution Volume During Period")
"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-L1
Millstone Unit 3

Liquid Effluents - Release Summary

	Units	2013 1st Qtr	2013 2nd Qtr	2013 3rd Qtr	2013 4th Qtr	2013 Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	3.26E-02	8.19E-02	1.97E-02	2.57E-02	1.60E-01
2. Average Period Diluted Activity *	uCi/ml	7.42E-11	2.58E-10	4.23E-11	5.64E-11	9.53E-11
B. Tritium						
1. Total Activity Released	Ci	4.02E+02	1.99E+02	1.20E+02	9.21E+01	8.14E+02
2. Average Period Diluted Activity *	uCi/ml	9.14E-07	6.26E-07	2.58E-07	2.02E-07	4.85E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	8.23E+05	8.70E+05	7.96E+05	9.51E+05	3.44E+06
Secondary	Liters	2.54E+07	2.07E+07	3.90E+07	3.64E+07	1.22E+08
2. Dilution Volume During Releases						
Primary	Liters	7.99E+09	6.95E+09	8.02E+09	9.15E+09	3.21E+10
Secondary	Liters	3.51E+11	1.37E+11	1.85E+11	1.68E+11	8.41E+11
3. Dilution Volume During Period	Liters	4.40E+11	3.18E+11	4.65E+11	4.55E+11	1.68E+12

"-" denotes less than Minimum Detectable Activity (MDA)

* "Total Activity Released" ÷ (Primary "Released Waste Volume" + "Dilution Volume During Period")

6.0 REMODCM Changes

The description and the bases of the change(s) for REMODCM Revision 27-01 (effective July 1, 2014) are included here in Volume 1 of the Radioactive Effluent Release Report. In addition, a complete copy of the REMODCM revision is provided to the Nuclear Regulatory Commission as Volume 2 of the Radioactive Effluent Release Report.

6.1 Summary of Changes

Programmatic and technical changes include:

- Requirements for sampling for tritium in turbine building sumps for both Units 2 and 3 were modified.
- Requirements for increased air sampling after a power change or increase in radiation monitor reading were modified.
- Condition for discharging a Waste Gas Decay Tank (WGDT) without a permit during tank maintenance was modified.
- Requirement to obtain an additional containment air sample after an increase in the particulate channel of the radiation monitor was deleted.
- Milk sampling was deleted from the Radiological Environmental Monitoring Program (REMP).
- The requirement to identify changes in the REMP sampling locations in REMODCM table and figures was deleted.
- The frequency of sample collection for airborne particulate and iodines in the REMP was changed from one week to two.
- Flounder was deleted as a fish type in the REMP.
- The requirement to take mussel samples was deleted from the REMP.
- Directions and distances for several REMP locations were changed.
- Lobster as a sample type was deleted from one REMP location and a new lobster location was added.
- Changes were made to requirements for "Land Use Census."
- Requirements for assessments of radioactivity from plant operations found in the environment were modified.
- A specification on record keeping of meteorological data was revised.
- Radioactive iodines and C-14 were removed from Unit 1 effluent controls.
- Alarm setpoint requirement for the Unit 2 steam generator blowdown radiation monitor was simplified and the setpoint units were changed.
- Definition for credited dilution flow from another unit was revised.
- Methods for determining setpoints for Unit 2 CPF and steam generator blowdown radiation monitors were changed.
- Condition was added for use of adjusted alarm for Units 2 and 3 SG blowdown radiation monitors.
- Added C-14 to Units 2 & 3 effluent controls on dose

Changes which are editorial in nature include:

- The words "off-site" and "activity" were changed to "offsite" and "radioactivity" respectively.
- The words "operability", "routinely operating" and "inoperable" were changed to "functionality", "operating" and "nonfunctional" respectively.

- Figure I.D-2 was revised by adding missing lines and Figures I.E-1 and I.E-2 were revised to provide better quality images.
- A missing footnote was added to Tables I.D-2 and I.D-3.
- Editorial changes were made in the 3rd paragraph of Section I.E.1.
- The names for two REMP sample locations were changed.
- A sentence in Section I.F.1 was moved.
- A typographical error of a missing number was corrected.
- Changes were made to enhance Figures I.E-1 and I.E-2:
- In Section I.F.1, the 2nd sentence in the 1st paragraph was moved to the end of the section.
- In the last paragraph of Section II.F.7, delete the words "in cpm."
- In Action for LCO V.E, add "12" before the words "consecutive months."

6.2 Discussion of Changes

The bases and justifications for the changes to REMODCM Revision 27 are given below.

6.2.1 Modifications to requirements for sampling for tritium in turbine building sumps for both Units 2 and 3:

In Footnote L of Table I.C-2 (pgs. 11&13), the exception sampling and analyzing for tritium in the Unit 2 turbine building sumps when there is no detectable tritium in steam generators was modified to not sampling during an outage when there is no detectable tritium in the secondary before an outage. This effectively removes any exception to sampling turbine building sumps except during an outage at Unit 2 when tritium has not been detected in the secondary. Tritium may be present in the turbine building sumps before being detected in the steam generators because of buildup in the other secondary systems besides the steam generators. An exception is provided for Unit 2 because Unit 2 normally does not see tritium in the secondary.

In Table I.C-3 (pgs. 14&16), the 1st sentence of Footnote L was deleted. This removes the exception to sampling and analyzing for tritium in the Unit 3 turbine building sumps when there is no detectable tritium in steam generators. Tritium may be present in the turbine building sumps before being detected in the steam generators. Tritium has built up over time in secondary liquids and is normally present in Unit 3 secondary even when not detected in the steam generators. Sampling and analyzing for tritium without detectable tritium in the steam generators is already required in procedures (SP 3874).

6.2.2 Modifications to increased air sampling after a power change or increase in radiation monitor reading:

In Table I.D-2 (pgs. 25-27) and Table I.D-3 (pgs. 28-30), Footnote K (in Table I.D-2) or Footnote J (in Table I.D-3) was revised and combined with Footnote C. This change relaxes the time for sampling and analysis after an increase in radiation monitor reading from 24 hours to 72 hours. The requirement to sample and analyze after a reactor shutdown, startup or power change is deleted. The condition to sample and analyze after a 50% increase of radiation monitor reading remains. This change meets the intent in NRC guidance for ODCM content given in NUREG-1301 in that any increase of radioactivity in gaseous effluents following a power change would still be sampled and analyzed because of increased radiation monitor reading.

This change simplifies the requirements by combining the two footnotes. The time requirement for sampling and analysis following an increase of 50% of radiation monitor reading is changed from 24 to 72 hours. NRC guidance in NUREG-1301 does not specify any time requirement for this sample. A time limit of 24 hours was overly restrictive when the results are not needed for any operational adjustments. Intent is to determine the amount of radioactivity being released and the isotopic content of the release. There is a requirement to estimate radioactivity if the monitor reading returns to it prior reading before sampling. The 24 hour time requirement was in the original issue of the REMODCM. At that time there was no easily retrievable record of radiation monitor readings as currently available on the PPC.

6.2.3 Modification to condition for discharging a WGDT during tank maintenance: The first condition in Method A of Footnote H in Table I.D-2 (p.26) was modified by specifying that the pressure of the tank being discharged be less than 5 PSIG. A new first condition is added to specify that the footnote is only applicable to tanks which have been discharged using a permit. Footnote H covers the case of maintenance or evolution on one WGDT which requires venting or purging of the tank. Linking permitting of the venting or purging to any previous WGDT system discharge even if it was from another tank is not necessary. The conditions that the tank has been discharged, that no radioactivity has been added and sampling for residual radioactivity is sufficient to ensure that there will be no unaccounted radioactivity discharged.

6.2.4 Deletion of requirement to obtain a containment air sample after increase in particulate channel of radiation monitor:
In Tables I.D-2 and I.D-3 (pgs. 27&29), Footnote I was revised by deleting the words "or (a) particulate channel." This change removes the requirement to get another gaseous grab sample of containment air following an increase in containment air radiation monitor particulate channel. Releases from containment are continually monitored for radioactive particulates by filters installed on effluent radiation monitors. The purpose of an additional grab samples is to detect any increase in gaseous radioactivity. The requirement to obtain another sample following an increase in the containment air radiation monitor gaseous channel remains.

6.2.5 Deletion of milk sampling from the REMP:
The requirement to take milk samples was deleted from the REMP by making the following changes:
a) In the 2nd sentence of the 3rd paragraph of Section I.E.1 (p.37), the words "excluding milk" with parentheses were deleted.
b) The first three sentences of the 4th paragraph of Section I.E.1 (p.37) were deleted and the last sentence in that paragraph was made the last sentence

of the 3rd paragraph.

c) In Table I.E-1 (p. 39), milk and pasture grass (Samples #5 and #5a) were deleted.

d) In Table I.E-2 (p. 40), goats (Sample Locations 21-I and 24-C) were deleted.

The requirement to take milk samples was deleted because of a lack of availability of milk within ten miles of Millstone. The closest milking goat of prior years (Location #21 at 2 miles) has not given any milk for over two years and the goat owner has no immediate plans to milk goats. The next closest milk location is cow milk at a dairy located 10.5 miles away. NRC guidance given in NUREG-1301 specifies sampling of milk from locations within five miles of the plant.

6.2.6 Deletion of the requirement to identify changes in REMP sampling locations: The last sentence on page 37 was deleted. This change removes the requirement to identify changes in sampling locations in a revised Table I.E-2 and Figures I.E-1 and I.E-3. This requirement was not needed because any change to sampling locations are always implemented by revising Table I.E-2 and the figures are intended only as visual aids.

6.2.7 Change in the frequency of sample collection of airborne particulates and iodines in the REMP:
The frequency was changed from one week to two weeks in Table I.E-1 (p. 39). This is a cost-saving change and is supported by NRC guidance in Regulatory Guide 4.1, Revision 2. This guide states:

> *"Reduction in sample frequency may be appropriate if it is shown that the reduction does not impact the effectiveness of the REMP. Advances in remote telemetry of some air samplers may provide sufficient justification for reducing the frequency of air samples. For example, it may be appropriate to reduce the frequency of analysis associated with an air sampler (from once per week to once per 2 weeks) if the licensee can demonstrate that the new equipment is more reliable and results in fewer missed samples. In all cases where sample or analysis frequencies are reduced, the changes should not reduce the overall effectiveness of the environmental monitoring program. If sample or analysis frequencies are reduced, the justification should also include an evaluation showing that the increased sampling interval does not impact the ability to detect radionuclides (e.g., because of half-life considerations)."*

Routine maintenance and continuous automated remote monitoring of the vital system parameters increase system sample collection reliability and supports an extended filter change-out cycle. Air sampling equipment is checked at each filter change and, if needed, needed maintenance is performed. The flow meter and vacuum gauge are calibrated annually. Continuous automated remote monitoring of vital system parameters is performed with telemetry that detects power outage and high or low flow rates. The telemetry communicates by cellular transmission to a web server that communicates to a shift technician's pager when set-point thresholds are reached, providing 24/7 alert notification.

The following is from a study at Seabrook supporting their two week air sample frequency (HPSTID-04, "REMP Airborne Sample Collection Frequency Change From Weekly to Biweekly"): *An iodine decay analysis compared a 1-week vs. 2-week air sampling cycle and the ability to detect iodine. For the assumption of chronic air concentrations of I-131, the longer collection time results in a higher total deposition of I-131 that remains on the cartridge at counting time and therefore an MDA (Minimum Detectable Activity) equal to or better than the one week cycle. The Framatome Environmental lab conducted a test on their counting system (gamma spectrometry) and software for an assumed one and two week collections and verified this conclusion.*

6.2.8 Deletion of flounder as a fish type.
The specification of flounder as one type of fish to sample was deleted in Table I.E-1 (p.39). The requirement to sample fin fish (edible portion) remains. Flounder is becoming increasingly difficult to capture because of a dwindling population. With requirements to sample fish and three types of invertebrates (oysters, clams and lobsters) remaining there is sufficient monitoring of aquatic foods in the vicinity of Millstone.

6.2.9 Deletion of the requirement to take mussel samples in the REMP:
The change was implemented by deleting Sample #11 in Table I.E-1 (p. 39) and deleting mussels at Sample Locations 28-I and 30-I in Table I.E-2 (p. 40). The requirement was deleted because of a lack of availability of mussels. This is a loss of two shellfish samples per quarter. There are sufficient other shellfish samples required every quarter including four oysters, two clams and one lobster (one of two required indicator lobster has been changed to a control, or background, lobster – see below). Thus, there is not a decrease in overall effectiveness of the environmental monitoring program with the loss of mussels.

6.2.10 Change in directions and distances for several REMP locations:
In Table I.E-2 (p. 40), directions and distances for Location 29-I were changed from 0.4 Mi, NNE to ≤0.5 Mi, ENE to ESE and for Location 35-I from 0.3 Mi, WNW to ≤0.5 Mi, SSW to W. The locations, West Jordan Cove and Niantic Bay, are fairly large bodies of water with no specific landmark in the area where the aquatic samples (clams, fish and lobster) are collected. By changing distances to within half mile and directions to several sectors it allows a larger area for collection and lessens the chance of not finding the required samples. Radioactivity released from the plant is dispersed evenly over the required area of sampling.

6.2.11 Changes in REMP lobster sampling:
In Table I.E-2, lobster as a sample type was deleted from location Vicinity of Discharge because of a lack of availability. As compensation, a control (or background) location was added beyond 4 miles from discharge.

6.2.12 Changes to REMP "Land Use Census":
Several changes were made to Section I.E.2, "Land Use Census" (p. 47).

The asterisk footnote on broad leaf vegetation was deleted. This removes the option of sampling vegetation in lieu of a garden census. A garden census, which identifies any critical garden relative to frequency of disposition of radioactivity, is more efficient use of resources than sampling of vegetation. It is also the preferred method given in NRC guidance in NUREG-1301.

In the last sentence of the 1st paragraph the words "milk animals" were changed to "any other land-based food sources." This is an enhancement to the land use census. It requires identification of any food source (in addition to gardens) and not just milk.

In the last sentence of the 1st paragraph the number "16" was deleted, the word "land" before the word "sectors" was added and a new last sentence defining which sectors are not land sectors was added. These changes clarify that some sectors are entirely over water and cannot be surveyed in a land census.

In the 2nd paragraph the words "door-to-door" were changed to "land" and the words "or state" were added after the word "local." Also, state authorities were added as a source of information. Surveys can be conducted with by driving by residents and gardens; a door visit is not necessarily needed. Information is available from the state as well as local authorities.

In the 3rd paragraph the word "With" was changed to "When", the words "identifying a location(s)" were changed to "identifies a food source location other than the nearest garden in a sector" and the words "doses" and "locations" were changed from plural to singular. Nearest gardens are excepted because public dose from ingestion of vegetation is always calculated at the nearest point of land in each sector regardless of actual garden location. Other changes are editorial and/or made to align with other changes being made.

The 4th paragraph was revised to read apply use of meteorological parameters to food sources in general (other than gardens) and not just for milk.

In the 5th (last) paragraph the words "for food sources other than the nearest garden" were added after the word "changes." Food source locations on land (such as milk, vegetables, etc) need to be identified to the NRC. Gardens are not included because the nearest garden in each sector is required.

6.2.13 Changes in requirement for assessments of radioactivity from plant operations found in the environment:
The following changes were made to implement this change:

a) In Section I.F.1 (p. 49), the 1st sentence in the 1st paragraph was revised to clarify that "observed impacts" is "radioactivity from plant operations."
b) In Section I.F.1 (p. 49), a new 2nd sentence was added to the 1st paragraph

to require comparison of any radioactivity from plant operation in the environment to be compared to levels of radioactivity expected based on the effluent monitoring program and modeling of environmental exposure pathways.

c) The 4th paragraph in Section I.F.1 (top of p. 50) was deleted.

This changes the method of assessment of results of the REMP. These results are assessed to provide judgment on the effectiveness of the radiological effluent control program. Technical specification requires that the REMP include a verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. Previously, compliance with the technical specification had been done by calculating dose to a member of the public based on any radioactivity from plant operation detected in the environment and comparing the result to dose calculated based on effluent monitoring dose calculations. Because of increasingly lower levels of radioactivity being released to the environment and the rarity of detecting radioactivity from plant operations, this comparison has become very difficult to perform. Therefore the REMODCM has been revised to specify that levels of radioactivity found in the environment be compared to expected levels. Expected levels are obtained from radioactivity detected in analyses of radioactivity in effluents and dose modeling, both required by the radiological effluent control program. This meets the technical specifications and is a more efficient method of assessing the accuracy of the effluent monitoring program.

6.2.14 Change to specification on record keeping of meteorological data:
In the 6th sentence in Section I.F.2 (p. 50), the words "an hour-by-hour listing on a magnetic medium" was changed to "a listing." The requirement for maintaining meteorological data was too prescriptive. The code "EDAN" is used to output meteorological data. EDAN is programmed to list meteorological data in 15 minute increments which is more than the required one hour increment. Removing "hour-by-hour listing" eliminated a potential non-compliance issue.

6.2.15 Removal of radioactive iodines and C-14 from Unit 1 effluent controls:
In the 1st paragraph of Section II.D.3 (p. 62), the 1st sentence is modified by deleting reference to the Radiological Effluent Controls in Section III and a 2nd sentence is added to state that tritium and particulates are included in the Section III for Unit 1. The 1st sentence was not correct as written because Section III does not include controls for I-131, I-133 and C-14. These radionuclides are not produced at Unit 1 which has been shutdown for over ten years.

6.2.16 Definition for credited dilution flow from another unit revision
In Section II.E.3 (pgs. 70&72) and Section II.E.8 (pgs. 76&78) in the definition for dilution flow, the words "or portion of Unit 2 (or 3) flow" were added after "Unit 2 (or 3) flow" and "Unit 2 (or 3) discharge" was changed to "Unit 2 (or 3) radioactivity discharge."

This revises the definition for credited dilution flow from either Unit 2 or Unit 3 to clarify that it would be acceptable to credit only a portion of the other unit's flow. It also would clarify that the restriction would be on the other unit's flow being used for a radioactivity release. All the dilution flow during a non-radioactive discharge could be used for credit.

6.2.17 Methodology change on determining setpoint for Unit 2 CPF radiation monitor CND245:
In Section II.E.4 (p. 72), delete all wording except for "The setpoint shall be determined as for the Clean and Aerated Liquid Monitors in Section II.E.3."

This change was made to simplify the setpoint method. It removes the specification for a setpoint for cases with low concentrations of radioactivity. The methodology in Section II.E.3 provides a method for determining setpoint in the case of low radioactivity concentration.

6.2.18 Changes to section on Unit 2 Steam Generator Blowdown radiation monitor setpoint:

a. In Section II.E.5 (pgs. 73-74), the bases for the radiation monitor setpoint was deleted and the units for the setpoint were changed from uCi/ml to cpm. These changes do not change the setpoint but they do simplify the section by removing unnecessary wording and specifying the setpoint in the same units as used in the field. Bases for the setpoint will be moved to the REMODCM bases document MP-22-REC-REF03.
b. After the adjusted alarm added "When using the adjusted alarm, ensure that any other simultaneous discharge does not cause an exceedance of regulatory limits."

6.2.19 Addition of C-14 to Units 2 & 3 effluent controls on dose:
In LCOs IV.D.2.c (p. 125) and V.D.2.c (p. 148), add "C-14" after "Tritium" to include C-14 in the dose limits applied to radionuclides other than noble gases released in air. A change was made several years ago to account for C-14 released in airborne effluents. The requirement to account for C-14 has been added. This change would apply the dose limit to include C-14.

6.2.20 Editorial changes:

a. Throughout the REMODCM, the words "off-site" and "activity" were changed to "offsite" and "radioactivity" respectively. This was an editorial change to make the use of the words consistent throughout the REMODCM.
b. Throughout the REMODCM, the words "operable", "inoperable" and "inoperability" were changed to "functional", "nonfunctional" and "nonfunctionality" respectively. This implements the NRC expectation that 'operable', 'inoperable' and 'inoperability' be reserved for use only in technical specifications. See CR411347.
c. In Tables I.D-2 and I.D-3, Footnote G (pgs. 25 & 28) was added to vents' gaseous grab sampling and analyses because it had been inadvertently deleted in a prior revision to the REMODCM. The footnote had not been

deleted from the REMODCM. The requirement was still being implemented in station procedures.

d. Figure I.D-2 (p. 35) was revised by adding missing lines.
e. In the 3rd paragraph of Section I.E.1 the words "to continue" were deleted in the 2nd sentence and "questions" was changed to "question" in the 3rd sentence.
f. In Table I.E-2, "New London Country Club" was changed to "Great Neck Country Club" because the club had changed its name. Also, "DEP dock" was changed to "DEEP dock" because of a change in name.
g. Following changes were made to Figures I.E-1 and I.E-2:
   - Table names were changed to more descriptive names.
   - Polar grid with directional labeling for each grid was added as an enhancement. These correspond with directions shown in Table I.E-2.
   - Sample locations which have been deleted in the past were deleted from the figures.
   - Milk, leaves, fruit & vegetables and flora (seaweed) were deleted in the legend for sample types. Milk has been deleted with this revision. Leaves were, at one time, collected along with grass samples. The intent now is to make the sample consist of only grass. Fruit & vegetables are collected as a required vegetable type at locations 25-I and 26-C but, because distances are specified as within or beyond ten miles, they cannot be put on a map. Flora (seaweed) is collected but is not required by the REMODCM.
   - On Figure I.E-2 the reference to Figure 2-2 was corrected to Figure I.E-1.
h. In Section I.F.1 (p. 49), the 2nd sentence in the 1st paragraph was moved to the end of the section (on p. 50) because it was out of place.
i. In the last paragraph of Section II.F.7 (p. 83), delete the words "in cpm." This corrects an error; the Unit 3 Vent Noble Gas Monitor RE10B reads out in uCi/cc and not in cpm.
j. In Action for LCO V.E (p. 150), add "12" before the words "consecutive months." This corrects a typographical error where the number 12 was inadvertently left out.

Serial No. 15-194
Docket Nos. 50-245
50-336
50-423
License Nos. DPR-21
DPR-65
NPF-49

ATTACHMENT 2

2014 RADIOACTIVE EFFLUENT RELEASE REPORT
VOLUME 2

MILLSTONE POWER STATION UNITS 1, 2, AND 3
DOMINION NUCLEAR CONNECTICUT, INC. (DNC)

Millstone Power Station
2014
Radioactive Effluents Release Report
Volume 2

Dominion Nuclear Connecticut, Inc.

Dominion

Unit	License	Docket
1	DPR-21	50-245
2	DPR-65	50-336
3	NPF-49	50-423

MILLSTONE POWER STATION
STATION PROCEDURE

STOP THINK ACT REVIEW

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

MP–22–REC–BAP01

Rev. 027–01

Approval Date: 04/15/14

Effective Date: 07/01/14

Millstone All Units
Station Procedure

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

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SECTION I.

Radiological Effluent Monitoring Manual (REMM)

For the
Millstone Nuclear Power Station
Nos. 1, 2, & 3

Docket Nos. 50–245, 50–336, 50–423

SECTION I. RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

I.A. Introduction

The purpose of Section I of this manual is to provide the sampling and analysis programs which provide input to Section II for calculating liquid and gaseous effluent concentrations and offsite doses. Guidelines are provided for operating radioactive waste treatment systems in order that offsite doses are kept As–Low–As–Reasonably–Achievable (ALARA).

The Radiological Environmental Monitoring Program outlined within this manual provides confirmation that the measurable concentrations of radioactive material in the environment as a result of operations at the Millstone Site are not higher than expected.

In addition, this manual outlines the information required to be submitted to the NRC in both the Annual Radiological Environmental Operating Report and the Radioactive Effluent Release Report.

MP–22–REC–REF03, "REMODCM Technical Information Document (TID)," has additional bases and technical information. It also contains a list of exceptions to Regulatory Guide 1.21 (see Section 2 of the TID).

I.B. Responsibilities

All changes to the Radiological Effluent Monitoring Manual (REMM) shall be reviewed and approved by the Facility Safety Review Committee prior to implementation.

All changes and their rationale shall be documented in the Radioactive Effluent Release Report.

It shall be the responsibility of the Site Vice President Millstone to ensure that this manual is used as required by the administrative controls of the Technical Specifications. The delegation of implementation responsibilities is delineated in MP–22–REC–PRG, "Radiological Effluent Program."

I.C. Liquid Effluents

1. Liquid Effluent Sampling and Analysis Program

   Radioactive liquid wastes shall be sampled and analyzed in accordance with the program specified in Table I.C.–1 for Millstone Unit No. 1, Table I.C.–2 for Millstone Unit No. 2, and Table I.C.–3 for Millstone Unit No. 3. The results of the radioactive analyses shall be input to the methodology of Section II to assure that the concentrations at the point of release are maintained within the limits of Radiological Effluent Controls (Section III.D.1.a. for Millstone Unit No. 1, Section IV.D.1.a. for Millstone Unit No. 2, and Section V.D.1.a. for Millstone Unit No. 3).

Table I.C.–1
Millstone Unit 1 Radioactive Liquid Waste Sampling and Analysis Program

Liquid Release Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Radioactivity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
Any Batch Release from any source	Grab sample prior to each batch release[B]	Prior to each batch release	Principal Gamma Emitters	5×10^{-7}
			Kr–85	1×10^{-5}
		Prior to initial batch release from any one source and monthly composite thereafter[C]	H–3	1×10^{-5}
	Grab sample prior to initial batch release from any one source and quarterly composite thereafter	Prior to initial batch release from each source. Quarterly for each source.[D]	Gross alpha	1×10^{-7}
			Sr–90	5×10^{-8}
			Fe–55	1×10^{-6}

Table I.C.–1
TABLE NOTATIONS

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{(E)(V)(2.22x10^6)(Ye^{-\lambda\Delta t})}$$

Where:

- **LLD** is the lower limit of detection as defined above (as μCi per unit mass or volume)
- $\mathbf{S_b}$ is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)
- **E** is the counting efficiency (as counts per transformation)
- **V** is the sample size (in units of mass or volume)
- $\mathbf{2.22 \times 10^6}$ is the number of transformations per minute per μCi
- **Y** is the fractional radiochemical yield (when applicable)
- **λ** is the radioactive decay constant for the particular radionuclide
- **Δt** is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for the particular sample.

B. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided.

C. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

D. For sources with no release during previous quarter, a quarterly sample is not required.

Table I.C.–2 Millstone Unit 2 Radioactive Liquid Waste Sampling and Analysis Program				
Liquid Release Source	**Sample Type and Frequency**	**Minimum Analysis Frequency**	**Type of Radioactivity Analysis**	**Lower Limit of Detection (LLD)[A] (µCi/ml)**
A. Batch Release[B.]				
1. Clean Waste Monitor Tank, Aerated Waste Monitor Tank and Steam Generator Bulk[D.]	Grab sample prior to each batch release	Prior to each batch release	Principal Gamma Emitters[C.]	5×10^{-7}
			I–131	1×10^{-6}
			Ce–144	5×10^{-6}
			Dissolved & Entrained Gases[K.]	1×10^{-5}
2. Condensate Polishing Facility – Waste Neutralization Sump[E.]		Monthly Composite[F.,G.]	H–3	1×10^{-5}
		Quarterly Composite[F.,G.]	Gross alpha	1×10^{-7}
			Sr–89, Sr–90	5×10^{-8}
			Fe–55	1×10^{-6}
B. Continuous Release				
1. Steam Generator Blowdown[H.] 2. Service Water Effluent[J.]	Daily Grab Sample[I.] & prior to aligning to Long Island Sound for RBCCW sump	Weekly Composite[F.,G.]	Principal Gamma Emitters[C.]	5×10^{-7}
			I–131	1×10^{-6}
			Ce–144	5×10^{-6}
3. Turbine Sumps[L.]	Monthly Grab Sample	Monthly	Dissolved & Entrained Gases[K.]	1×10^{-5}
4. RBCCW Sump[M.]	Weekly Grab or Composite	Monthly Composite[F.,G.]	H–3[N.]	1×10^{-5}
	Weekly Composite	Quarterly Composite[F.,G.]	Gross alpha	1×10^{-7}
			Sr–89, Sr–90	5×10^{-8}
			Fe–55	1×10^{-6}

TABLE I.C.–2
TABLE NOTATIONS

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{(E)(V)(2.22x10^6)(Ye^{-\lambda\Delta t})}$$

Where:

- **LLD** is the lower limit of detection as defined above (as µCi per unit mass or volume)
- S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)
- **E** is the counting efficiency (as counts per transformation)
- **V** is the sample size (in units of mass or volume)
- **2.22 x 10^6** is the number of transformations per minute per µCi
- **Y** is the fractional radiochemical yield (when applicable)
- **λ** is the radioactive decay constant for the particular radionuclide
- **Δt** is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for the particular sample.

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided. If the steam generator bulk can not be recirculated prior to batch discharge, a sample will be obtained by representative compositing during discharge.

C. The LLD will be 5 x 10^{-7} µCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn−54, Fe−59, Co−58, Co−60, Zn−65, Mo−99, Cs−134, Cs−137, and Ce−141. Ce−144 shall also be measured, but with an LLD of 5 x 10^{-6} µCi/ml. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

D. For the Steam Generator Bulk:
IF the applicable batch gamma radioactivity is not greater than 5 x 10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for gross alpha, Sr−89, Sr−90, Fe−55 are not required. ①

E. For the Condensate Polishing Facility (CPF) waste neutralization sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analyses is not required.
IF the gross gamma radioactivity in the grab sample taken prior to release does not exceed 5×10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for gross alpha, Sr–89, Sr–90 and Fe–55 are not required. ①

F. For Batch Releases and Steam Generator Blowdown only, a composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

G. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

H. For the Steam Generator Blowdown:
IF the steam generator gross gamma radioactivity does not exceed 5×10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for all principal gamma, I–131, Ce–144, noble gases, gross alpha, Sr–89, Sr–90 and Fe–55 are not required. ①

I. Daily grab samples shall be taken at least five days per week. For service water, daily grabs shall include each train that is in–service.

J. For the Service Water:
IF a weekly gamma analysis does not indicate a gamma radioactivity greater than 5×10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for gross alpha, Sr–89, Sr–90, Fe–55 are not required. ①

K. LLD applies exclusively to the following radionuclides: Kr–87, Kr–88, Xe–133, Xe–133m, Xe–135, and Xe–138. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the "Radioactive Effluent Release Report."

L. For the Turbine Building Sump:
IF there is no detectable tritium in the secondary side before an outage, **THEN** tritium sampling and analyses is not required during an outage. ①
IF the steam generator gross gamma radioactivity does not exceed 5×10^{-7} µCi/ml, **OR** sump is directed to radwaste treatment, **THEN** the sampling and analysis schedule for all principal gamma, I–131, Ce–144, noble gases, gross alpha, Sr–89, Sr–90 and Fe–55 are not required.
IF the release pathway is directed to yard drains, **THEN** the LLD for I–131 shall be 1.5×10^{-7} µCi/ml and for gross alpha 1×10^{-8} µCi/ml.

M. For the RBCCW Sump:
IF the RBCCW Sump is directed to radwaste treatment or is not aligned to Long Island Sound, **THEN** sampling is not required.
IF the applicable batch gamma radioactivity is not greater than 5×10^{-7} µCi/ml, **THEN** sampling and analysis schedule for gross alpha, Sr–89, Sr–90, Fe–55 are not required. ①

N. Detectable tritium shall be used to estimate tritium releases to the atmosphere via the blowdown tank vent.

Table I.C.-3
Millstone Unit 3 Radioactive Liquid Waste Sampling and Analysis Program

Liquid Release Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Radioactivity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
A. Batch Release[B.]				
1. Condensate Polishing Facility Waste Neutralization Sump[E.]	Grab sample prior to each batch release	Prior to each batch release	Principal Gamma Emitters[C.]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
			Dissolved & Entrained Gases[K.]	1×10^{-5}
2. Waste Test Tanks, Low Level Waste Tank, Boron Test Tanks and Steam Generator Bulk [D.]		Monthly Composite[F.,G.]	H-3	1×10^{-5}
		Quarterly Composite[F.,G.]	Gross alpha	1×10^{-7}
			Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Release				
1. Steam Generator Blowdown[H.] 2. Service Water Effluent[J.] 3. Turbine Building Sumps[L.]	Daily Grab Sample[I.]	Weekly Composite[F.,G.]	Principal Gamma Emitters[C.]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
	Monthly Grab Sample	Monthly	Dissolved & Entrained Gases[K.]	1×10^{-5}
	Weekly Grab or Composite	Monthly Composite[F.,G.]	H-3[M.]	1×10^{-5}
	Weekly Composite	Quarterly Composite[F.,G.]	Gross alpha	1×10^{-7}
			Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

TABLE I.C.-3
TABLE NOTATIONS

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{(E)(V)(2.22x10^6)(Ye^{-\lambda\Delta t})}$$

Where:

- **LLD** is the lower limit of detection as defined above (as µCi per unit mass or volume)
- **S_b** is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)
- **E** is the counting efficiency (as counts per transformation)
- **V** is the sample size (in units of mass or volume)
- **2.22 x 10^6** is the number of transformations per minute per µCi
- **Y** is the fractional radiochemical yield (when applicable)
- **λ** is the radioactive decay constant for the particular radionuclide
- **Δt** is the elapsed time between midpoint of sample collection and midpoint of counting time

It should be recognized that the LLD is defined as an <u>a priori</u> *(before the fact) limit representing* the capability of a measurement system and not as an <u>a posteriori</u> (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and recorded on the analysis sheet for the particular sample.

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided. If the steam generator bulk can not be recirculated prior to batch discharge, a sample will be obtained by representative compositing during discharge.

C. The LLD will be 5 x 10^{-7} µCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn–54, Fe–59, Co–58, Co–60, Zn–65, Mo–99, Cs–134, Cs–137, and Ce–141. Ce–144 shall also be measured, but with an LLD of 5 x 10^{-6} µCi/ml. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in <u>a priori</u> LLDs higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

D. <u>For the Steam Generator Bulk:</u>
<u>**IF**</u> the applicable batch gamma radioactivity is not greater than 5 x 10^{-7} µCi/ml, <u>**THEN**</u> the sampling and analysis schedule for gross alpha, Sr–89, Sr–90, Fe–55 are not required. ①

E. For the Condensate Polishing Facility (CPF) waste neutralization sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analyses is not required.
IF the gross gamma radioactivity in the grab sample taken prior to release does not exceed 5×10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for gross alpha, Sr–89, Sr–90 and Fe–55 are not required. ①

F. For Batch Releases and Steam Generator Blowdown only, a composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

G. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluents released.

H. For the Steam Generator Blowdown:
IF the steam generator gross gamma radioactivity does not exceed 5×10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for all principal gamma, I–131, Ce–144, noble gases, gross alpha, Sr–89, Sr–90 and Fe–55 are not required. ①

Steam Generator Blowdown samples are not required when blowdown is being recovered.

I. Daily grab samples shall be taken at least five days per week. For service water, daily grabs shall include each train that is in–service.

J. For the Service Water:
IF a weekly gamma analysis does not indicate a gamma radioactivity greater than 5×10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for gross alpha, Sr–89, Sr–90, Fe–55 are not required. ①

K. LLD applies exclusively to the following radionuclides: Kr–87, Kr–88, Xe–133, Xe–133m, Xe–135, and Xe–138. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the "Radioactive Effluent Release Report."

L. For the Turbine Building Sump:
IF the steam generator gross gamma radioactivity does not exceed 5×10^{-7} µCi/ml, **OR** sump is directed to radwaste treatment, **THEN** the sampling and analysis schedule for all principal gamma, I–131, Ce–144, noble gases, gross alpha, Sr–89, Sr–90 and Fe–55 are not required. ①
IF the release pathway is directed to yard drains, **THEN** the LLD for I–131 shall be 1.5×10^{-7} µCi/ml and for gross alpha 1×10^{-8} µCi/ml.

M. Detectable tritium shall be used to estimate tritium releases to the atmosphere via the blowdown tank vent.

2. Liquid Radioactive Waste Treatment

   a. Dose Criteria for Equipment Functionality Applicable to All Millstone Units ①

      The following dose criteria shall be applied separately to each Millstone unit.

      1) **IF** the radioactivity concentration criteria for the Unit 3 steam generator blowdown is exceeded with blowdown recovery not available to maintain releases to as low as reasonably achievable; or, **IF** any of the other radioactive waste processing equipment listed in Section b. are not functional, **THEN** doses due to liquid effluents from the applicable waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section II.C.2. ①

      2) **IF** any of these dose projections exceeds 0.006 mrem to the total body or 0.02 mrem to any organ, **THEN** best efforts shall be made to return the processing equipment to service, or to limit discharges via the applicable waste stream.

      3) **IF** an actual dose due to liquid effluents exceeds 0.06 mrem to the total body or 0.2 mrem to any organ **AND** the dose from the waste stream with processing equipment not functional exceeds 10% of one of these limits, **THEN** prepare and submit to the Commission a Special Report within 30 days as specified in Section 2.c. ①

   b. Required Equipment for Each Millstone Unit

      Best efforts shall be made to return the applicable liquid radioactive waste treatment system equipment specified below for each unit to service or to limit discharge via the applicable waste stream if the projected doses exceed any of the doses specified above.

1. Millstone Unit No. 1	
Waste Stream	**Processing Equipment**
Spent Fuel Pool water	One filter and one demineralizer
2. Millstone Unit No. 2	
Waste Stream	**Processing Equipment**
Clean liquid	Deborating ion exchanger (T11) **OR** Purification ion exchanger (T10A or T10B) **OR** Equivalent ion exchanger
	Primary demineralizer (T22 A or B) **OR** Equivalent demineralizer
	Secondary demineralizer (T23 A or B) **OR** Equivalent demineralizer//Aerated liquid
Aerated liquid	Demineralizer (T24) **OR** Equivalent demineralizer
3. Millstone Unit No. 3	
Waste Stream	**Processing Equipment or Radioactivity Concentration**
High level	Demineralizer filter (LWS–FLT3) and Demineralizer (LWS–DEMN2) **OR** Demineralizer (LWS–DEMN1) and Demineralizer filter (LWS–FLT1)
Boron recovery	Cesium ion exchanger (DEMN A or B)
	Boron evaporator (EV–1)
Low level	High level processing equipment
Steam generator blowdown	Blowdown recovery when total gamma radioactivity exceeds 5E–7 μCi/ml or tritium exceeds 0.02 μCi/ml. ①

c. Report Requirement For All Three Millstone Units

If required by Section 2.a.3), prepare and submit to the Commission a Special Report within 30 days with the following content:

- Explanation of why liquid radwaste was being discharged without treatment, identification of any equipment not in service, and the reason for the equipment being out of service,
- Action(s) taken to restore the equipment to service, and
- Summary description of action(s) taken to prevent a recurrence.

3. Basis for Liquid Sampling, Analysis and Radioactive Treatment System Use

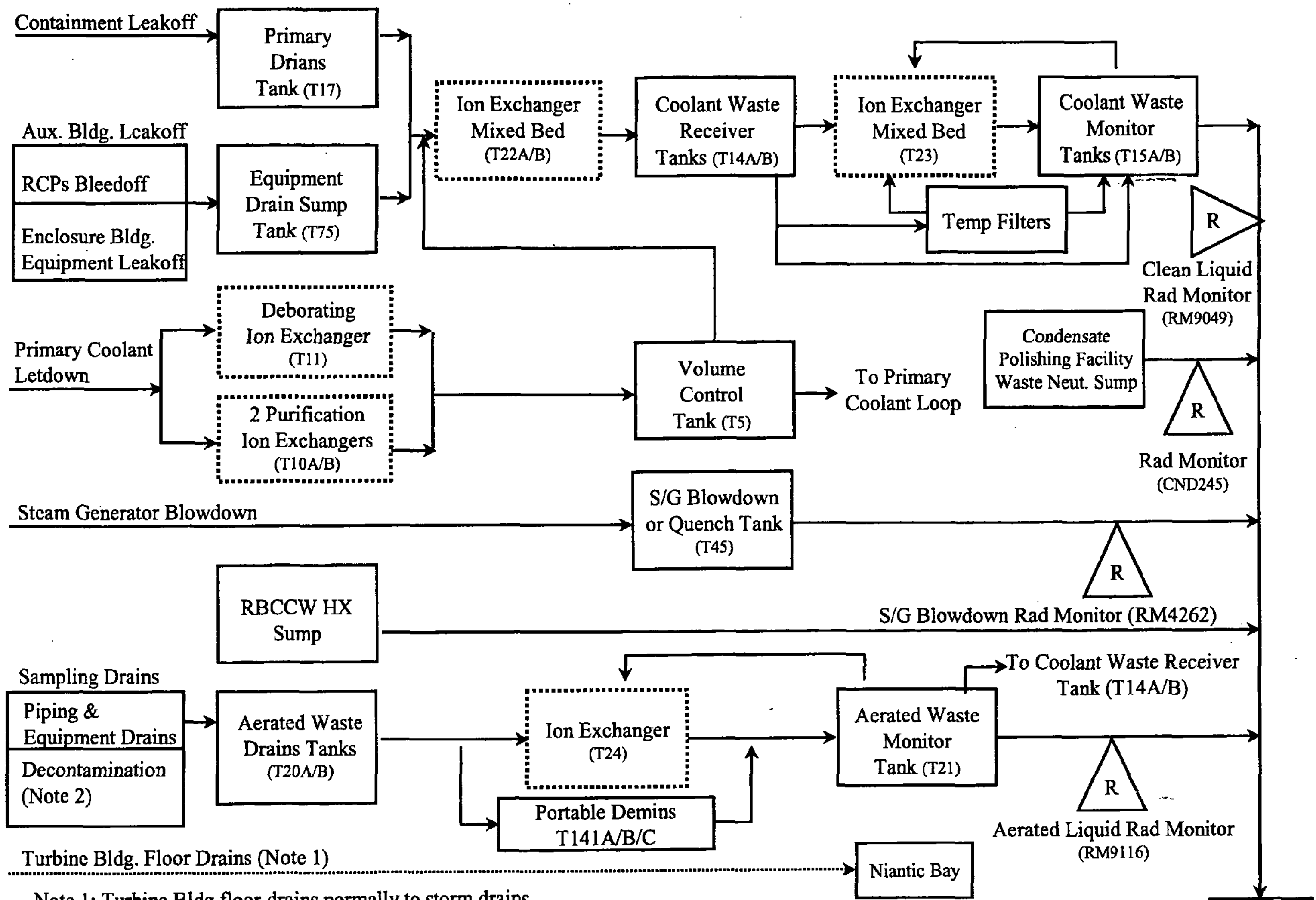
Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid effluents during the past 12 months of plant operation. The indicated liquid surveillance programs (as directed by surveillance requirements for Radiological Effluent Controls in Sections III.D.1.a., IV.D.1.a., and V.D.1.a.) provides the means to quantify and report on liquid discharges from release pathways. As specified in Regulatory Guide 1.21, this program monitors all major and potentially significant paths for release of radioactive material in liquid effluents during normal reactor operations, including anticipated operational occurrences. There are many minor release pathways which are not routinely monitored. The Millstone Effluent Control Program includes, as needed, evaluations to determine if any release point should be added to the REMODCM surveillance program. This information also provides for the assessment of effluent concentrations and environmental dose impacts for the purpose of demonstration compliance with the effluent limits of 10 CFR 20, and dose objectives of 10 CFR 50, Appendix I. The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of Lower Limits of Detection (LLDs) and are selected such that the detection of radioactivity in effluent releases will occur at levels below which effluent concentration limits and offsite dose objectives would be exceeded. The LLDs are listed in Table 4.11–1 of NUREG–1301 except for the LLD for Ce–144 which is contained in Footnote (3) of Table 4.11–1 of NUREG–1301. ①

The indicated liquid radwaste treatment equipment for each Unit have been determined, using the GALE code, to be capable to minimize radioactive liquid effluents such that the dose objectives of Appendix I can be met for expected routine (and anticipated operational occurrence) effluent releases. This equipment is maintained and routinely operated to treat appropriate liquid waste streams without regards to projected environmental doses.

If not already in use, the requirement that the appropriate portions of the liquid radioactive waste treatment system for each Unit be returned to service when the specified effluent doses are exceeded provides assurance that the release of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This condition of equipment usage implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR 50, and the design objective given in Section II.D. of Appendix I to 10 CFR 50. The specified dose limits governing the required use of appropriate portions of the liquid radwaste treatment system were selected as a suitable fraction of the dose design objectives set forth in Section II.A. of Appendix I, 10 CFR 50 for liquid effluents following the guidance given in NUREG–1301.

Figure I.C.–1, "Reserved

Figure I.C.–2, "Simplified Liquid Effluent Flow Diagram Millstone Unit 2"

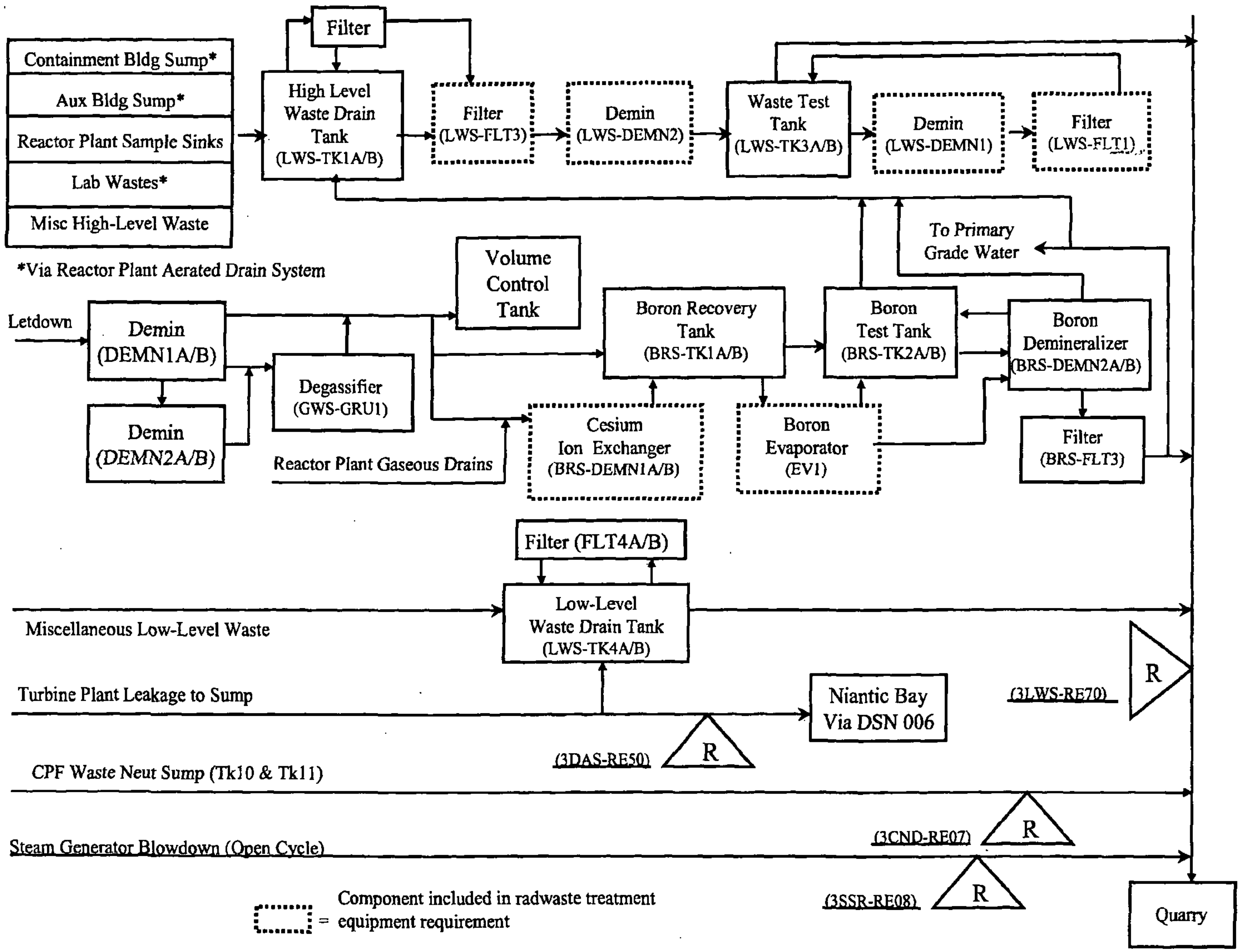


Note 1: Turbine Bldg floor drains normally to storm drains.
Drains may be diverted to the radwaste treatment system.

Note 2: HP Decon facility sump is collected in totes and shipped offsite.

[dotted box] = Component included in radwaste treatment equipment requirement

Figure I.C.-3, "Simplified Liquid Effluent Flow Diagram Millstone Unit 3"



I.D. **Gaseous Effluents**

1. Gaseous Effluent Sampling and Analysis Program

   Radioactive gaseous wastes shall be sampled and analyzed in accordance with the program specified in Table I.D.–1 for Millstone Unit No. 1, Table I.D.–2 for Millstone Unit No. 2, and Table I.D.–3 for Millstone Unit No. 3. The results of the radioactive analyses shall be input to the methodology of Section II to assure that offsite dose rates are maintained within the limits of Radiological Effluent Controls (Section III.D.2.a. for Millstone Unit No. 1, Section IV.D.2.a. for Millstone Unit No. 2, and Section V.D.2.a. for Millstone Unit No. 3).

Table I.D.–1
Millstone Unit 1 Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Point or Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Radioactivity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
A. Spent Fuel Pool Island Vent	Monthly[D] – Gaseous Grab Sample	Monthly	Kr–85	1×10^{-4}
			H–3	1×10^{-6}
	Continuous[B.,E.] Particulate Sample	Twice per month	Principal Gamma Emitters[C.] – (with half lives greater than 8 days)	1×10^{-11}
	Continuous[B.,E.] Particulate Sample	Quarterly Composite	Sr–90, Gross alpha	1×10^{-11}
	Continuous[B.,E.] Noble Gas	Continuous Monitor	Kr–85	1×10^{-6}
B. Balance of Plant Vent	Continuous[B.,E.] Particulate Sample	Twice per month	Principal Gamma Emitters[C.] – (with half lives greater than 8 days)	1×10^{-11}
		Quarterly Composite	Sr–90, Gross alpha	1×10^{-11}
	Grab sample of Reactor Bldg evaporator staging tank prior to processing	Prior to processing of each batch	H–3	1×10^{-5}

Table I.D.–1
TABLE NOTATIONS

A. The lower limit of detection (LLD) is defined in Table Notations, Item a, of Tables I.C.–1, I.C.–2, or I.C.–3.

B. The ratio of the sample flow rate to the sampled stream flow rate shall be known.

C. For particulate samples, the LLD will be 1×10^{-11} µCi/cc. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn−54, Co−60, Zn−65, Cs−134, Cs−137, and Ce−144. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

D. IF there is an unexplained increase of the SFPI Vent noble gas monitor of greater than a factor of ten, OR the monitor reads 8.8E−5 µCi/cc or greater, THEN sampling and analysis shall also be performed within 24 hours.

E. Continuous when exhaust fans are in operation.

Table I.D.–2 Millstone Unit 2 Radioactive Gaseous Waste Sampling and Analysis Program				
Gaseous Release Point or Source	**Sample Type and Frequency**	**Minimum Analysis Frequency**	**Type of Radioactivity Analysis**	**Lower Limit of Detection (LLD)A (μCi/ml)**
A.Batch Release 1.Waste Gas Storage Tank[H]	Gaseous Grab Prior to each Waste Gas Tank Discharge	Each Tank Discharge	Principal Gamma Emitters[B]	1×10^{-4}
			H–3	1×10^{-6}
B.Containment&Aux Building Releases				
1.Containment	Gaseous Grab of purges and vents 1. Prior to Each Purge[J] 2. Every two weeks for Venting[I]	1. Prior to Each Purge 2. Every two weeks for Venting	Principal Gamma Emitters[B]	1×10^{-4}
		Monthly	H–3	1×10^{-6}
2.Spent Fuel Pool	Continuous Particulate for Open Containment Equipment Hatch during Outage	Weekly	Gamma emitters for 1/2 hr count (I–131, others with half–life greater than 8 days)	NA
	Continuous Charcoal for Open Containment Equipment Hatch during Outage	Weekly	I–131 and I–133 for one hour count	NA
C.Continuous Release				
1.Vent (RM8132B)	Monthly – Gaseous Grab Sample[C.,G.]	Monthly[C, G.]	Principal Gamma Emitters[B]	1×10^{-4}
			H–3[G]	1×10^{-6}
2.Millstone Stack (RM8169–1)	Continuous Charcoal Sample[D.,F.]	Weekly	I–131 I–133	1×10^{-12} 1×10^{-10}
	Continuous Particulate Sample[D.,F.]	Weekly	Principal Gamma Emitters[B] – (I–131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous Particulate Sample[D.]	Quarterly Composite	Sr–89, Sr–90 – Gross alpha	1×10^{-11} 1×10^{-11}
	Continuous Noble Gas[D.]	Continuous Monitor	Noble Gases – Gross Radioactivity	1×10^{-6}

TABLE I.D.–2
TABLE NOTATIONS

A. The lower limit of detection (LLD) is defined in Table Notations, Item a, of Tables I.C.–1, I.C.–2, or I.C.–3.

B. For gaseous samples, the LLD will be 1 x 10^{-4} µCi/cc and for particulate samples, the LLD will be 1 x 10^{-11} µCi/cc. The principal gamma emitters for which these LLDs apply are exclusively the following radionuclides: Kr–87, Kr–88, Xe–133, Xe–133m, Xe–135, and Xe–138 for gaseous emission and Mn–54, Fe–59, Co–58, Co–60, Zn–65, Mo–99, I–131, Cs–134, Cs–137, Ce–141, and Ce–144 for particulate emissions. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the "Radioactive Effluent Release Report."

C. **<u>IF</u>** there is an unexplained increase of the Millstone Stack or Unit 2 Vent noble gas monitor of greater than 50%, **<u>THEN</u>** sampling and analysis for principal gamma emitters shall be performed within 72 hours. Sampling and analysis is not required if the monitor reading has returned to within 20% of the average reading prior to the increase. ①

<u>IF</u> the Millstone Stack or Unit 2 Vent noble gas monitor increased greater than 50% and then has decreased to within 20% of the average reading prior to collecting a sample representative of the elevated reading, **<u>THEN</u>** an estimate of radioactivity released during the period of elevated reading shall be made.

D. The ratio of the sample flow rate to the sampled stream flow rate shall be known.

E. RESERVED

F. Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing.

For Unit 2 vent only

Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or thermal power change exceeding 15% of rated thermal power, as defined in Technical Specification, within a 1–hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the Dose Equivalent I–131 concentration in the reactor coolant has not increased more than a factor of three; and (2) the noble gas monitor shows that effluent radioactivity has not increased more than a factor of three. ①

G. **<u>IF</u>** the refueling cavity is flooded, **<u>THEN</u>** grab samples for tritium shall be taken weekly. The grab sample shall be taken from the Millstone Stack or vent where the containment ventilation is being discharged at the time of sampling.

H. Waste Gas Storage Tanks are normally released on a batch basis via the Millstone Stack. However, for the purpose of tank maintenance, inspection, or reduction of oxygen concentration, a waste gas tank may be vented or purged with nitrogen and released to the environment via the normal or alternate pathway using one of the following methods:

Method A: Without a permit provided the following conditions are met:

(1) The tank has been previously discharged with a permit. ①

(2) The current tank pressure is less than 5 PSIG.

(3) No radioactive gases have been added to the tank since the previous discharge from the tank. ①

(4) Valve lineups are verified to ensure that no radioactive waste gases will be added to the tank.

(5) Prior to initiation of the vent or purge, a sample of the gas in the tank will be taken and analyzed for any residual gamma emitters and tritium. The tank may be released if:

a) Tank radioactivity is less than 1% of the activity released in the previous batch release from the tank, or less than 1% of the radioactivity released to date for the calendar year, and ①

b) the radioactivity of Kr−85 and Xe−133 is less than 0.01 Ci and the radioactivity of all other gases is less than 0.001 Ci.

Method B: With a permit provided valve lineups are verified to ensure that no radioactive waste gases will be added to the tank.

I. **IF**, compared to the radioactivity at the time of the air sample, a Radiation Monitor RM8123 or RM8262 gas channel increases by a factor of two, **THEN** a new containment air sample shall be taken.
IF, containment noble gas radioactivity exceeds 1E−6 μCi/cc as indicated by the last grab sample, **THEN** sampling frequency shall be increased to weekly until such time that the radioactivity is less than 1E−6 μCi/cc. ①

J. During an outage a sample is only required prior to the initial purge.

Table I.D.–3
Millstone Unit 3 Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Point or Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Radioactivity Analysis	Lower Limit of Detection (LLD)[A.] (μCi/ml)
A. Containment and Fuel Building Release				
1.Containment 2.Fuel Building	Gaseous, particulate and charcoal grab prior to each drawdown (via air ejector)	Same as sample frequency.	Principal gamma emitters[B.]	1×10^{-4}
	Gaseous grab prior to each purge[H.]	Same as sample frequency.	On charcoal sample: I–131 I–133	1×10^{-12} 1×10^{-10}
	Gaseous Grab every two weeks for vents (i.e., releases to maintain sub–atmospheric pressure via containment vacuum pump)[I.]		On particulate sample: Principal gamma emitters[B.] – (I–131, others with half lives greater than 8 days)	1×10^{-11}
		Monthly for purge, vents, and drawdowns	H–3	1×10^{-6}
	Continuous particulate at open containment equipment hatch during outages.	Weekly	Gamma emitters for ½ hour count (I–131, others with half–life greater than 8 days)	NA
	Continuous charcoal at open containment equipment hatch during outages.	Weekly	I–131 and I–133 for one hour count	NA
B.Continuous Release				
1.Unit 3 Ventilation Vent (HVR–RE10B) 2.Engineered Safeguards Building (HVQ–RE49) 3.Millstone Stack via SLCRS (HVR–RE19B)	Monthly – Gaseous Grab Sample[C., G.]	Monthly[C., G.]	Principal gamma emitters[B]	1×10^{-4}
			H–3[G]	1×10^{-6}
	Continuous charcoal sample[D.,F.]	Weekly	I–131 I–133	1×10^{-12} 1×10^{-10}
	Continuous particulate sample[D.,F.]	Weekly	Principal gamma emitters[B.] – (I–131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous particulate sample[D.]	Quarterly composite	Sr–89, Sr–90 Gross alpha	1×10^{-11} 1×10^{-11}
	Continuous noble gas[D.]	Continuous monitor	Noble gases – gross radioactivity	1×10^{-6}

TABLE I.D.–3
TABLE NOTATIONS

A. The lower limit of detection (LLD) is defined in Table Notations, Item a, of Tables I.C.–1, I.C.–2, or I.C.–3.

B. For gaseous samples, the LLD will be 1 x 10^{-4} μCi/cc and for particulate samples, the LLD will be 1 x 10^{-11} μCi/cc. The principal gamma emitters for which these LLDs apply are exclusively the following radionuclides: Kr–87, Kr–88, Xe–133, Xe–133m, Xe–135, and Xe–138 for gaseous emission and Mn–54, Fe–59, Co–58, Co–60, Zn–65, Mo–99, I–131, Cs–134, Cs–137, Ce–141, and Ce–144 for particulate emissions. The list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

C. **IF** there is an unexplained increase of the Unit 3 ventilation vent or SLCRS noble gas monitor of greater than 50%, **THEN** sampling and analysis for principal gamma emitters shall be performed within 72 hours. Sampling and analysis is not required if the monitor reading has returned to within 20% of the average reading prior to the increase. ①

IF the SLCRS or Unit 3 Vent noble gas monitor increased greater than 50% and then has decreased to within 20% of the reading prior to collecting a sample representative of the elevated reading, **THEN** an estimate of radioactivity released during the period of elevated reading shall be made.

D. The ratio of the sample flow rate to the sampled stream flow rate shall be known.

E. RESERVED

F. Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing.

For Unit 3 Vent only:

Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or thermal power change exceeding 15% of rated thermal power as defined in Technical Specification within a 1–hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the Dose Equivalent I–131 concentration in the reactor coolant has not increased more than a factor of three; and (2) the noble gas monitor shows that effluent radioactivity has not increased more than a factor of three. ①

G. **IF** the refueling cavity is flooded, **THEN** grab samples for tritium shall be taken weekly from the ventilation vent.

H. During an outage a sample is only required prior to the initial purge.

I. **IF**, compared to the radioactivity at the time of the air sample, Radiation Monitor CMS22 gas channel increases by a factor of two, **THEN** a new containment air sample shall be taken. ①

IF, containment noble gas radioactivity exceeds 1E–6 μCi/cc as indicated by the last grab sample, **THEN** sampling frequency shall be increased to weekly until such time that the radioactivity is less than 1E–6 μCi/cc.

2. Gaseous Radioactive Waste Treatment

a. Dose Criteria for Equipment Functionality Applicable to All Millstone Units ①

The following dose criteria shall be applied separately to each Millstone unit.

1) IF any of the radioactive waste processing equipment listed in Section 2.b. are not functional or are being bypassed, THEN doses due to gaseous effluents from the untreated waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section II.D.4. For each waste stream, only those doses specified in Section II.D.4. need to be determined for compliance with this section. ①

2) IF any of these dose projections exceed 0.02 mrad for gamma radiation, 0.04 mrad for beta radiation or 0.03 mrem to any organ due to gaseous effluents, THEN best efforts shall be made to return the processing equipment to service.

3) IF actual doses exceed 0.2 mrad for gamma radiation, 0.4 mrad for beta radiation or 0.3 mrem to any organ AND the dose from a waste stream with equipment not functional exceed 10% any of these limits, THEN prepare and submit to the Commission a report as specified in Section I.D.2.c. ①

b. Required Equipment for Each Millstone Unit

Best efforts shall be made to return the gaseous radioactive waste treatment system equipment specified below for each unit to service if the projected doses exceed any of doses specified above. For the Unit 2 gas decay tanks, the tanks shall be operated to allow enough decay time of radioactive gases to ensure that the Radiological Effluent Control dose limits are not exceeded.

Waste Stream	Processing Equipment
1. Millstone Unit No. 1	
Waste Stream	**Processing Equipment**
None Specified	None required
2. Millstone Unit No. 2	
Waste Stream	**Processing Equipment**
Gaseous Radwaste Treatment System	Five (5) gas decay tanks
	One waste gas compressor
Ventilation Exhaust Treatment System	Auxiliary building ventilation HEPA filter (L26 or L27)
	Containment purge HEPA filter (L25)
	Containment vent HEPA/charcoal filter (L29 A or B)
3. Millstone Unit No. 3	
Waste Stream	**Processing Equipment or Radioactivity Concentration**
Gaseous Radwaste Treatment System	Charcoal bed adsorbers
	One HEPA filter

c. Report Requirement For All Three Millstone Units

If required by Section I.D.2.a.3), prepare and submit to the Commission a Special Report within 30 days with the following content:

- Explanation of why gaseous radwaste was being discharged without treatment, identification of any equipment out of service, and the reason for being out of service,
- Action(s) taken to restore the nonfunctional equipment to service, and ①
- Summary description of action(s) taken to prevent a recurrence.

3. Basis for Gaseous Sampling, Analysis, and Radioactive Treatment System Use

Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in gaseous effluents during the past 12 months of plant operation. The indicated gaseous surveillance programs (as directed by surveillance requirements for Radiological Effluent Controls in Sections III.D.2.a., IV.D.2.a. and V.D.2.a.) provides the means to quantify and report on radioactive materials released to the atmosphere. As specified in Regulatory Guide 1.21, this program monitors all major and potentially significant paths for release of radioactive material in gaseous effluents during normal reactor operations, including anticipated operational occurrences. There are many minor release pathways which are not routinely monitored. The Millstone Effluent Control Program includes, as needed, evaluations to determine if any release point should be added to the REMODCM surveillance program. This information also provides for the assessment of effluent dose rates and environmental dose impacts for the purpose of demonstration compliance with the effluent limits of 10 CFR 20, and dose objectives of 10 CFR 50, Appendix I. The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of lower limits of detection (LLDs) and are selected, based on NUREG–1301, such that the detection of radioactivity in releases will occur at levels below which effluent offsite dose objectives would be exceeded. The indicated gaseous radwaste treatment equipment for each Unit have been determined, using the GALE code, to be capable to minimize radioactive gaseous effluents such that the dose objectives of Appendix I can be met for expected routine (and anticipated operational occurrence) effluent releases. This equipment is maintained and routinely operated to treat appropriate gaseous waste streams without regards to projected environmental doses.

If not already in use, the requirement that the appropriate portions of the gaseous radioactive waste treatment system for each Unit be returned to service when the specified effluent doses are exceeded provides assurance that the release of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This condition of equipment usage implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR 50, and the design objective given in Section II.D. of Appendix I to 10 CFR 50. The specified dose limits governing the required use of appropriate portions of the gaseous radwaste treatment system were selected as a suitable fraction of the dose design objectives set forth in Section II.A. of Appendix I, 10 CFR 50 for gaseous effluents following the guidance in NUREG–1301.

Figure I.D.–1, "Simplified Gaseous Effluent Flow Diagram Millstone Unit One"

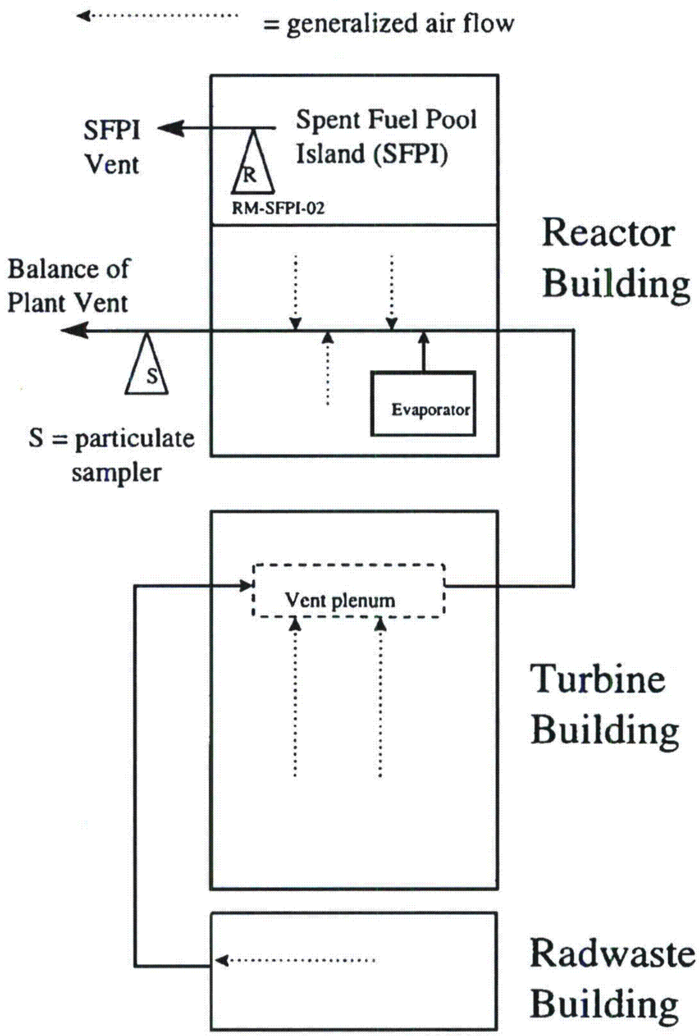


Figure I.D.–2, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Two"

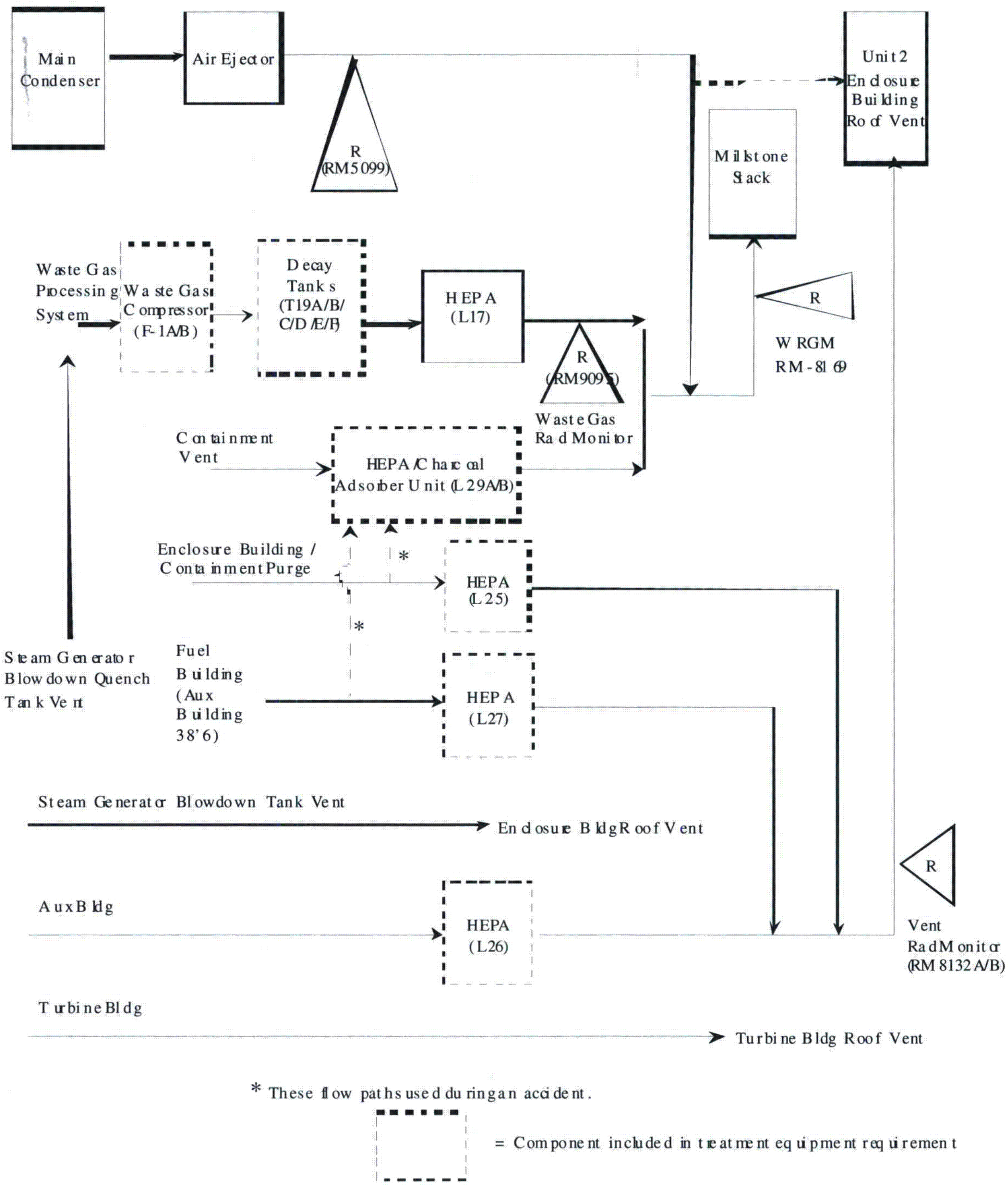
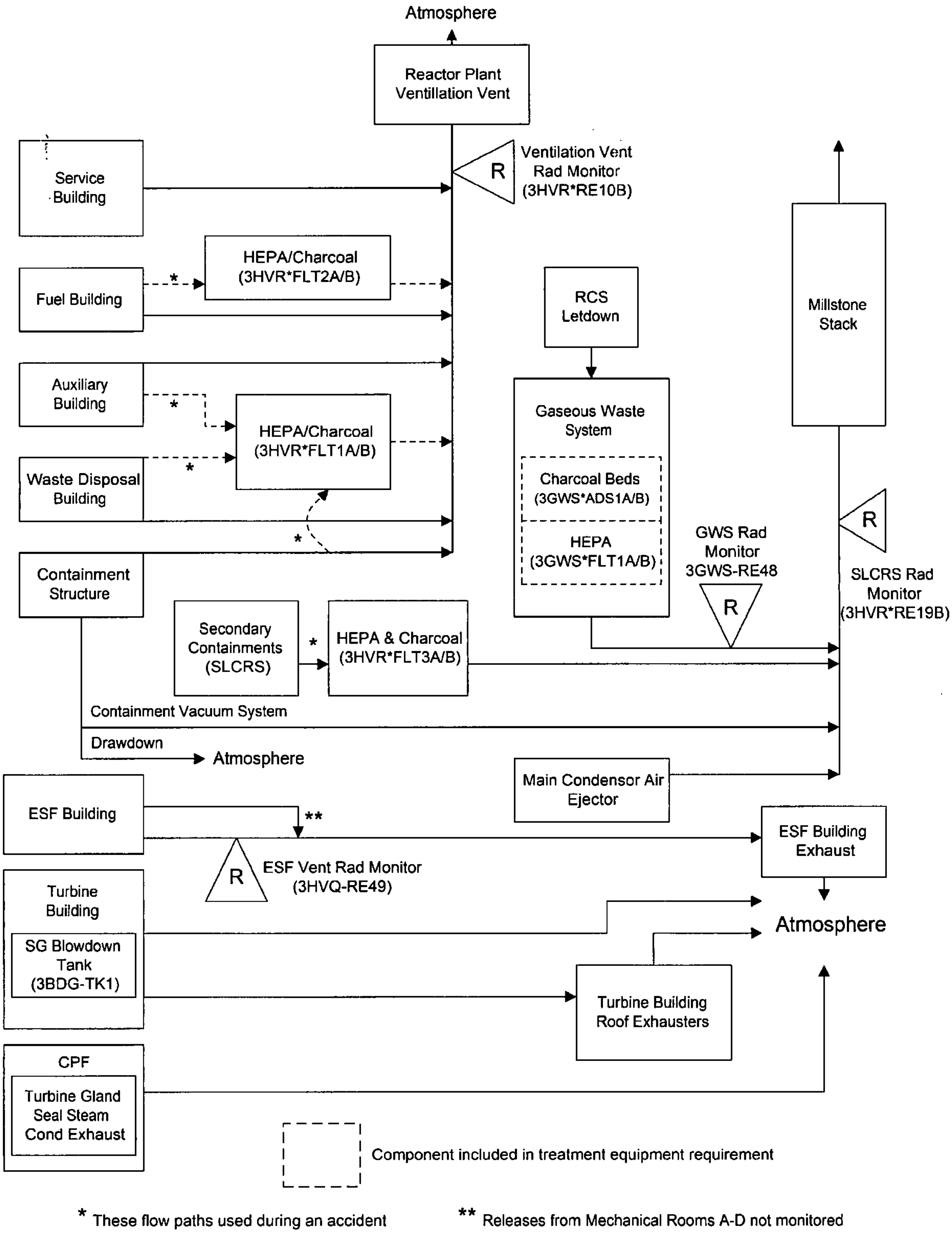


Figure I.D.–3, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Three"



I.E. Radiological Environmental Monitoring

1. Sampling and Analysis

The radiological sampling and analyses provide measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from plant operation. This monitoring program thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. Program changes may be made based on operational experience.

The sampling and analyses shall be conducted as specified in Table I.E.−1 for the locations shown Table I.E.−2. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment or other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period.

All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Section I.F.1. It is recognized that, at times, it may not be possible or practicable to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. Any of the above occurrences shall be documented in the Annual Radiological Environmental Operating Report, which is submitted to the U. S. Nuclear Regulatory Commission prior to May 1 of each year. ①

If the level of radioactivity in an environmental sampling medium at one or more of the locations specified in Table I.E.−2 exceeds the report levels of Table I.E.−3 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days from receipt of sample results, a Special Report which includes an evaluation of any release conditions, environmental factors or other aspects which caused the limits of Table I.E.−3 to be exceeded. When more than one of the radionuclides in Table I.E.−3 are detected in the sampling medium, this report shall be submitted if:

$$\frac{concentration\ (1)}{reporting\ level\ (1)} + \frac{concentration\ (2)}{reporting\ level\ (2)} + \ldots \geq 1.0$$

When radionuclides other than those in Table I.E.–3 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to an individual is equal to or greater than the appropriate calendar year limit of the Radiological Effluent Controls (Sections III.D.1.b., III.D.2.b., or III.D.2.c. for Unit 1; Sections IV.D.1.b., IV.D.2.b., or IV.D.2.c. for Unit 2; and Sections V.D.1.b., V.D.2.b., or V.D.2.c. for Unit 3). This report is not required if the measured level of radioactivity was not the result of plant effluents, however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

The detection capabilities required by Table I.E.–4 are state-of-the-art for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. All analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

Table I.E.–1 Millstone Radiological Environmental Monitoring Program			
Exposure Pathway and/or Sample	**No. of Locations**	**Sampling and Collection Frequency**	**Type and Frequency of Analysis**
1.Gamma Dose – Environmental TLD	39[(a)]	Quarterly	Gamma Dose – Quarterly
2.Airborne Particulate	8	Continuous sampler – filter change every two weeks	Gross Beta – Every two weeks Gamma Spectrum – Quarterly on composite (by location), and on individual sample if gross beta is greater than 10x the mean of the control station's gross beta results
3.Airborne Iodine	8	Continuous sampler – canister change every two weeks	I–131 – Every two weeks
4.Vegetation	5	One sample near middle and one near end of growing season	Gamma Isotopic on each sample
5.Reserved			
6.Sea Water	2	Continuous sampler with a monthly collection at indicator location. Quarterly at control location – Composite of 6 weekly grab samples	Gamma Isotopic & Tritium on each sample
7.Well Water	6	Semiannual	Gamma Isotopic & Tritium on each sample
8.Bottom Sediment	5	Semiannual	Gamma Isotopic on each sample
9.Soil	3	Annually	Gamma Isotopic on each sample
10.Fin Fish-(edible portion)	2	Quarterly	Gamma Isotopic on each sample
11.Reserved			
12.Oysters (edible portion)	4	Quarterly	Gamma Isotopic on each sample
13.Clams (edible portion)	2	Quarterly	Gamma Isotopic on each sample
14.Lobsters (edible portion)	2	Quarterly	Gamma Isotopic on each sample

(a) Two or more TLDs or TLD with two or more elements per location.

(b) Not required during 1st quarter.

Table I.E.–2 **Environmental Monitoring Program Sampling Locations**			
The following lists the environmental sampling locations and the types of samples obtained at each location. Sampling locations are also shown on Figures I.E.–1 and I.E.–2:			
Location		Direction & Distance from Release Point**	Sample Types
No.*	**Name**		
1–I	Onsite – Old Millstone Road	0.6 Mi, NNW	TLD, Air Particulate, Iodine, Vegetation
2–I	Onsite – Weather Shack	0.3 Mi, S	TLD, Air Particulate, Iodine
3–I	Onsite – Bird Sanctuary	0.3 Mi, NE	TLD, Air Particulate, Iodine, Soil
4–I	Onsite – Albacore Drive	1.0 Mi, N	TLD, Air Particulate, Iodine, Soil
5–I	Onsite – MP3 Discharge	0.1 Mi, SSE	TLD
6–I	Onsite – Quarry Discharge	0.3 Mi, SSE	TLD
7–I	Onsite – Environmental Lab Dock	0.3 Mi, SE	TLD
8–I	Onsite – Environmental Lab	0.3 Mi, SE	TLD
9–I	Onsite – Bay Point Beach	0.4 Mi, W	TLD
10–I	Pleasure Beach	1.2 Mi, E	TLD, Air Particulate, Iodine, Vegetation
11–I	Great Neck Country Club	1.6 Mi, ENE	TLD, Air Particulate, Iodine ①
13–C	Mystic, CT	11.5 Mi, ENE	TLD
14–C	Ledyard, CT	12.0 Mi, NE	TLD, Soil
15–C	Norwich, CT	14.0 Mi, N	TLD, Air Particulate, Iodine
16–C	Old Lyme, CT	8.8 Mi, W	TLD
17–I	Site Boundary	0.5 Mi, NE	Vegetation
25–I	Fruits & Vegetables	Within 10 Miles	Vegetation
26–C	Fruits & Vegetables	Beyond 10 Mi	Vegetation
27–I	Niantic	1.7 Mi, WNW	TLD, Air Particulate, Iodine
28–I	Two Tree Island	0.8 Mi, SSE	Fish[1] ①
29–I	West Jordan Cove	≤0.5 Mi, ENE to ESE	Clams, Fish[1]
31–I	Niantic Shoals	1.8 Mi, NW	Bottom Sediment, Oysters
32–I	Vicinity of Discharge[2]		Bottom Sediment, Oysters, Fish[1], Seawater ①
33–I	Seaside Point	1.8 Mi, ESE	Bottom Sediment
34–I	Thames River Yacht Club	4.0 Mi, ENE	Bottom Sediment
35–I	Niantic Bay	≤0.5 Mi, SSW to W	Lobster, Fish ①
37–C	Giant's Neck	3.5 Mi, WSW	Bottom Sediment, Oysters, Seawater
38–I	Waterford Shellfish Bed No. 1	1.0 Mi, NW	Clams
41–I	Myrock Avenue	3.2 Mi, ENE	TLD
42–I	Billow Road	2.4 Mi, WSW	TLD

Table I.E.–2, Cont.			
Location		Direction & Distance from Release Point**	Sample Types
No*	Name		
43–I	Black Point	2.6 Mi, SW	TLD
44–I	Onsite – Schoolhouse	0.1 Mi, NNE	TLD
45–I	Onsite Access Road	0.5 Mi, NNW	TLD
46–I	Old Lyme – Hillcrest Ave.	4.6 Mi, WSW	TLD
47–I	East Lyme – W. Main St.	4.5 Mi, W	TLD
48–I	East Lyme – Corey Rd.	3.4 Mi, WNW	TLD
49–I	East Lyme – Society Rd.	3.6 Mi, NW	TLD
50–I	East Lyme – Manwaring Rd.	2.1 Mi, W	TLD
51–I	East Lyme – Smith Ave.	1.5 Mi, NW	TLD
52–I	Waterford – River Rd.	1.1 Mi, NNW	TLD
53–I	Waterford – Gardiners Wood Rd.	1.4 Mi, NNE	TLD
55–I	Waterford – Magonk Point	1.8 Mi, ESE	TLD
56–I	New London – Mott Ave.	3.7 Mi, E	TLD
57–I	New London – Ocean Ave.	3.6 Mi, ENE	TLD
59–I	Waterford –Miner Ave.	3.4 Mi, NNE	TLD
60–I	Waterford – Parkway South	4.0 Mi, N	TLD
61–I	Waterford – Boston Post Rd.	4.3 Mi, NNW	TLD
62–I	East Lyme – Columbus Ave.	1.9 Mi, WNW	TLD
63–I	Waterford – Jordon Cove Rd.	0.8 Mi, NE	TLD
64–I	Waterford – Shore Rd.	1.1 Mi, ENE	TLD
65–I	Waterford – Bank St.	3.2 Mi, NE	TLD
71–I	Onsite well	Onsite	Well water
72–I	Onsite well	Onsite	Well water
79–I	Onsite well	Onsite	Well water
80–I	Onsite well	Onsite	Well water
81–I	Onsite well	Onsite	Well water
82–I	Onsite well	Onsite	Well water
88–I	DEEP dock near barge slip	0.2 Mi, WNW	Oysters
89–C	Aquatic Background	Beyond 4 Mi. Of discharge	Lobster

(1)

[1]Fish to be sampled from one of three locations –28, 29, or 32.

[2]Vicinity of discharge includes the Quarry and shoreline area from Fox Island to western point of Red Barn Recreation Area and offshore out to 500 feet.

* I = Indicator; C = Control.

** = The release points are the Millstone Stack for terrestrial locations and the end of the quarry for aquatic location.

NOTE: Environmental TLDs also function as accident TLDs in support of the Millstone Emergency Plan.

Figure I.E.–1, "Inner TLD, Air, Grass, Soil, and Aquatic Locations" ①

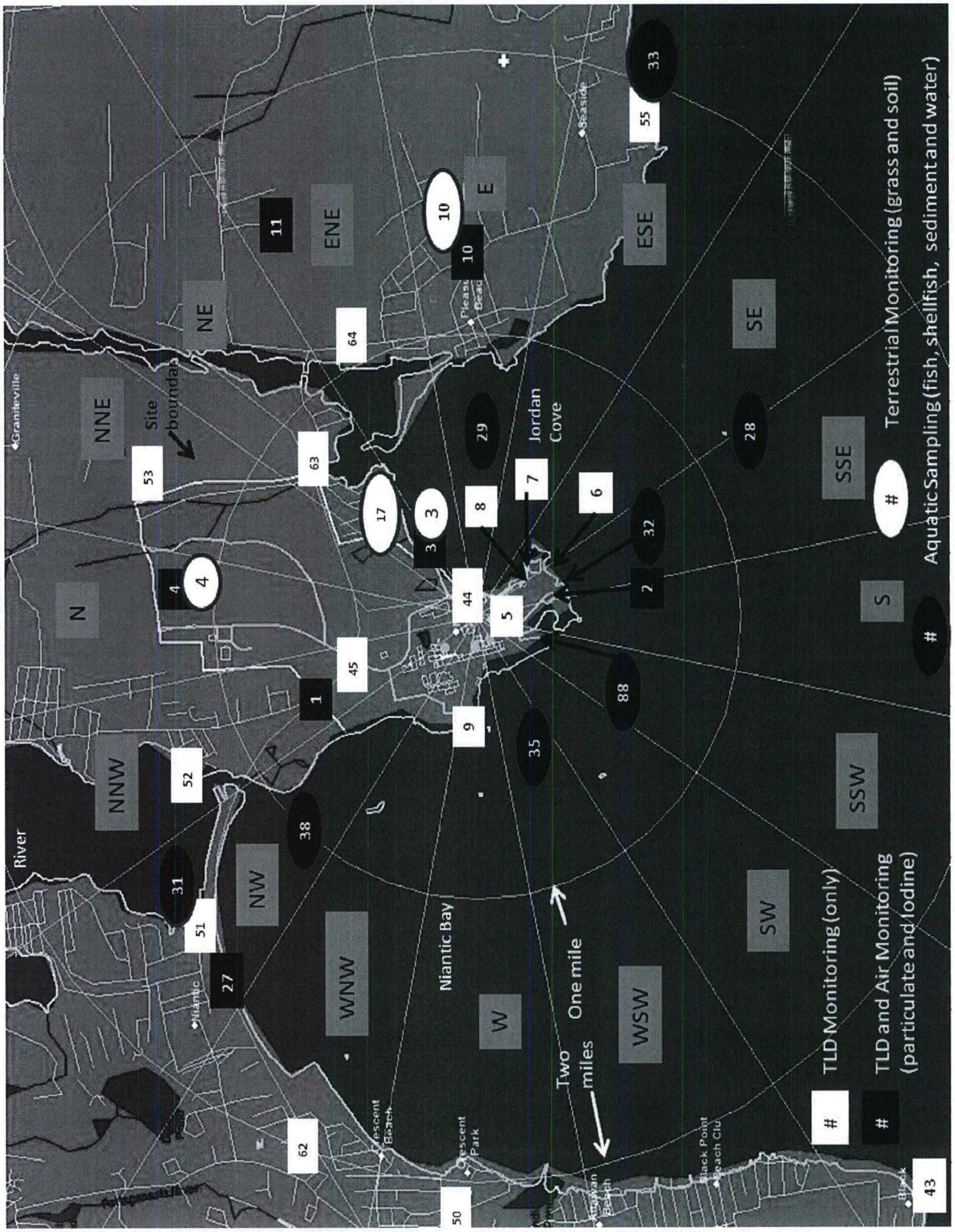


Figure I.E.–2, "Outer TLD and Aquatic Locations"

①

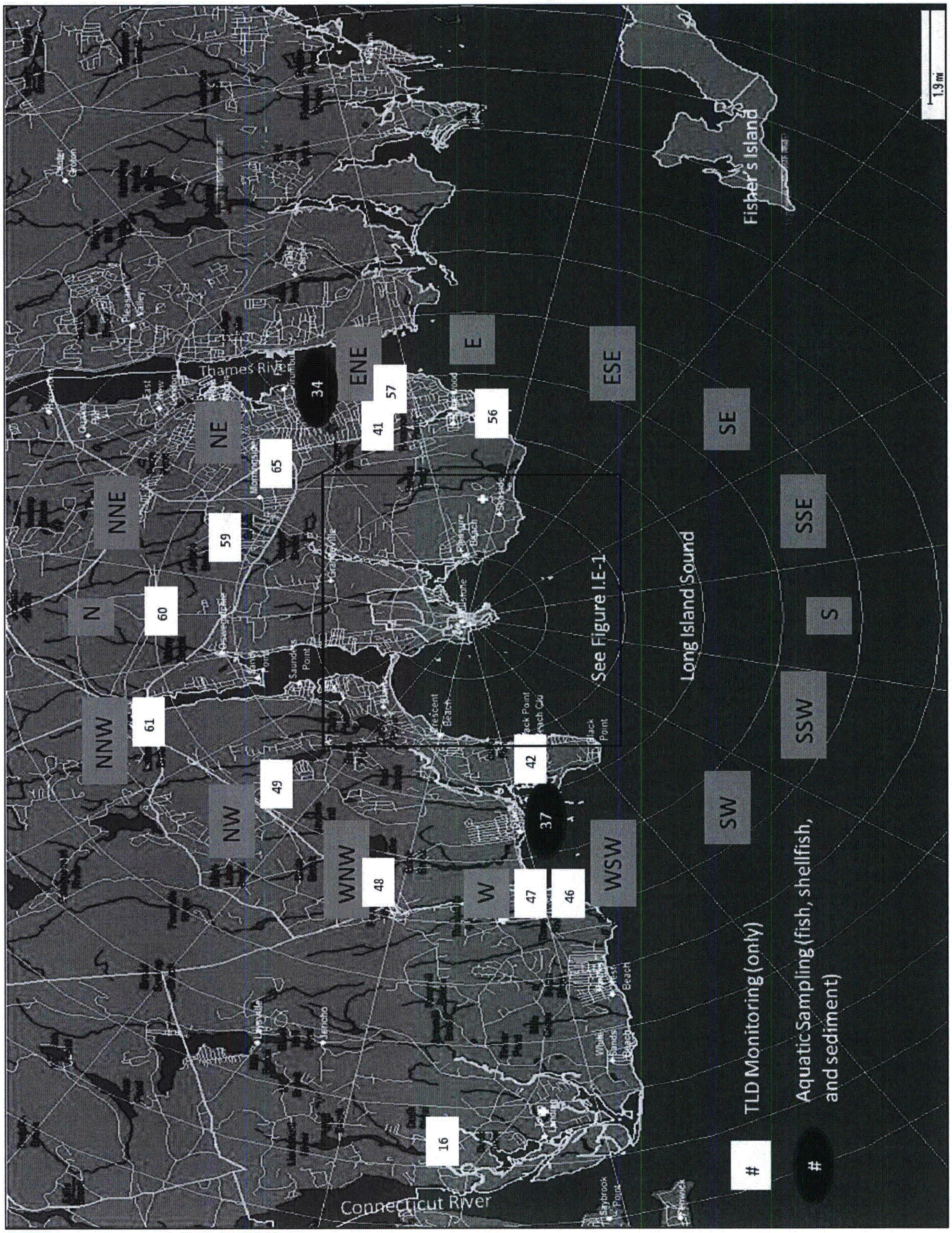


Table I.E.–3 Reporting Levels For Radioactivity Concentrations In Environmental Samples						
Analysis	**Water (pCi/l)**	**Airborne Particulate or Gases (pCi/m^3)**	**Fish (pCi/g, wet)**	**Shellfish[C.] (pCi/g, wet)**	**Milk (pCi/l)**	**Vegetables (pCi/g, wet)**
H–3	20,000[A.]					
Mn–54	1,000		30	140		
Fe–59	400		10	60		
Co–58	1,000		30	130		
Co–60	300		10	50		
Zn–65	300		20	80		
Zr–95	400					
Nb–95	400					
Ag–110m			8	30		
I–131	20[B.]	0.9	0.2	1	3	0.1
Cs–134	30	10	1	5	60	1
Cs–137	50	20	2	8	70	2
Ba–140	200				300	
La–140	200				300	

A. 20,000 pCi/l for drinking water samples. (This is 40 CFR Part 141 value.) For non–drinking water pathways, a value of 30,000 pCi/l may be used.

B. Reporting level for I–131 applies to non–drinking water pathways (i.e., seawater). If drinking water pathways are sampled, a value of 2 pCi/l is used.

C. For on–site samples, these values can be multiplied by 3 to account for the near field dilution factor

Table I.E.–4 Maximum Values For Lower Limits Of Detection (LLD)[A.]						
Analysis	**Water (pCi/l)**	**Airborne Particulate or Gases (pCi/m^3)**	**Fish Shellfish (pCi/g, wet)**	**Milk (pCi/l)**	**Food Products (pCi/g, wet)**	**Sediment (pCi/g, dry)**
gross beta		1×10^{-2}				
H–3	2000[D.]					
Mn–54	15		0.130			
Fe–59	30		0.260			
Co–58, 60	15		0.130			
Zn–65	30		0.260			
Zr–95	30					
Nb–95	15					
I–131	15[C.]	7×10^{-2}		1	0.06[B.]	
Cs–134	15	5×10^{-2}	0.130	15	0.060	0.150
Cs–137	18	6×10^{-2}	0.150	18	0.080	0.180
Ba–140	60[C.]			70		
La–140	15[C.]			25		

TABLE NOTATIONS
Table I.E.–4

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a “real” signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ S_b}{(E)(V)(2.22)(Ye^{-\lambda\Delta t})}$$

Where:

- **LLD** is the lower limit of detection as defined above (as pCi per unit mass or volume)
- **S_b** is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)
- **E** is the counting efficiency (as counts per transformation)
- **V** is the sample size (in units of mass or volume)
- **2.22** is the number of transformations per minute per pCi
- **Y** is the fractional radiochemical yield (when applicable)

- λ is the radioactive decay constant for the particular radionuclide
- Δt is the elapsed time between midpoint of sample collection and midpoint of counting time (or end of the sample collection period) and time of counting.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified in the Annual Radiological Environmental Operating Report.

B. LLD for leafy vegetables.

C. From end of sample period.

D. If no drinking water pathway exists (i.e., seawater), a value of 3,000 pCi/l may be used.

2. Land Use Census

The land use census ensures that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR 50. The land use census shall be maintained and shall identify the location of the nearest resident, nearest garden, and any other land–based food sources in each of the meteorological land sectors within a distance of five miles. Sectors SE, SSE, S, and SSW, are not land sectors because they are over water. ①

The validity of the land use census shall be verified within the last half of every year by either a land survey, aerial survey, consulting local or state agriculture authorities, or any combination of these methods.

When a land use census identifies a food source location other than the nearest garden in a sector which yields a calculated dose greater than the dose currently being calculated in the off–site dose models, make the appropriate changes in the sample location used. ①

For each type of food source (milk, fruits, etc.) other than the nearest garden in a sector, when a land use census identifies a location which has a D/Q 20% or greater than the D/Q for a current indicator location begin sampling from the new location within 30 days.

Sample location changes for food sources other than nearest garden shall be noted in the Annual Radiological Environmental Operating Report.

3. Interlaboratory Comparison Program

The Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of a quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

4. Bases for the Radiological Environmental Monitoring Program

Federal regulations (10 CFR Parts 20 and 50) require that radiological environmental monitoring programs be established to provide data on measurable levels of radiation and radioactive materials in the site environs. In addition, Appendix I to 10 CFR 50 requires that the relationship between quantities of radioactive material released in effluents during normal operation, including anticipated operational occurrences, and the resultant radiation doses to individuals from principal pathways of exposure be evaluated. The Millstone Environmental Radiological Monitoring Program (REMP) has been established to verify the effectiveness of in-plant measures used for controlling the release of radioactive materials from the plant, as well as provide for the comparison of measurable concentrations of radioactive materials found in the environment with expected levels based on effluent measurements and the modeling of the environmental exposure pathways.

The REMP detailed in Table I.E.–1 provides measurements of radioactive materials or exposures in the environment along all principal exposure pathways to man that could be impacted by plant effluents. These include direct radiation exposure, inhalation exposure, and ingestion of food products (both aquatic and land grown). In addition, intermediate media such as vegetation and bottom sediments are included as potential early indicators of radioactive material buildup. The selections of sample locations include areas subject to plant effluents that would be expected to exhibit early indication of any buildup of plant related radioactive materials.

The required detection capabilities for environmental sample analyses are tabulated in terms of lower limits of detection (LLDs). Except for Ba–140 and La–140 in milk, the required LLDs are from NUREGs–1301 and 1302. The NUREGs specify an LLD of 15 pCi/l for the parent–daughter combination of Ba–La–140. An LLD of 25 pCi/l is specified for the daughter La–140 and 70 pCi/l for the parent Ba–140.

Annual reports of environmental radiation monitoring summaries are filed with the NRC in accordance with the requirements of 10 CFR 50.36b and the guidance contained in Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plant," and NUREG–0472 (NUREG–0473) Revision 3, "Standard Radiological Effluent Technical Specifications for Pressurized Water Reactors (Boiling Water Reactors)."

I.F. Report Content

1. Annual Radiological Environmental Operating Report

The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with previous environmental surveillance reports and an assessment of radioactivity from plant operation in the environment. Any radioactivity from plant operation detected in the environment shall be compared to levels of radioactivity expected based on the effluent monitoring program and modelling of environment exposure pathways for the purpose of verifying the accuracy of the program and modelling. If levels of radioactivity are detected that result in calculated doses greater than 10CFR50 Appendix I Guidelines, the report shall provide an analysis of the cause and a planned course of action to alleviate the cause. ①

The report shall include a summary table of all radiological environmental samples which shall include the following information for each pathway sampled and each type of analysis:

1) Total number of analyses performed at indicator locations.

2) Total number of analyses performed at control locations.

3) Lower limit of detection (LLD).

4) Mean and range of all indicator locations together.

5) Mean and range of all control locations together.

6) Name, distance and direction from discharge, mean and range for the location with the highest annual mean (indicator or control).

7) Number of non–routine reported measurements as defined in these specifications.

In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in the next annual report.

The report shall also include a map of sampling locations keyed to a table giving distances and directions from the discharge; the report shall also include a summary of the Interlaboratory Comparison Data required by Section I.E.3. of this manual.

The report shall include the results of the land use census required by Section I.E.2. of this manual. ①

2. Radioactive Effluent Release Report

The Radioactive Effluent Release Report (RERR) shall include quarterly quantities of and an annual summary of radioactive liquid and gaseous effluents released from the unit in the Regulatory Guide 1.21 (Rev. 1, June 1974) format. Radiation dose assessments for these effluents shall be provided in accordance with 10 CFR 50.36a and the Radiological Effluent Controls. An annual assessment of the radiation doses from the site to the most likely exposed REAL MEMBER OF THE PUBLIC shall be included to demonstrate conformance with 40 CFR 190. Gaseous pathway doses shall use meteorological conditions concurrent with the quarter of radioactive gaseous effluent releases. Doses shall be calculated in accordance with the Offsite Dose Calculation Manual. The licensee shall maintain an annual summary of the hourly meteorological data (i.e., wind speed, wind direction and atmospheric stability) either in the form of a listing or in the form of a joint frequency distribution. The licensee has the option of submitting this annual meteorological summary with the RERR or retaining it and providing it to the NRC upon request. The RERR shall be submitted prior to May 1 of each year for the period covering the previous calendar year. ①

The RERR shall include a summary of each type of solid radioactive waste shipped offsite for burial or final disposal during the report period and shall include the following information for each type:

- type of waste (e.g., spent resin, compacted dry waste, irradiated components, etc.)
- solidification agent (e.g., cement)
- total curies
- total volume and typical container volumes
- principal radionuclides (those greater than 10% of total radioactivity) ①
- types of containers used (e.g., LSA, Type A, etc.)

The RERR shall include a list of all abnormal releases of radioactive gaseous and liquid effluents (i.e., all unplanned or uncontrolled radioactivity releases, including reportable quantities) from the site to unrestricted areas. Refer To MP-22-REC-REF03, "REMODCM Technical Information Document (TID)," for guidance on classifying releases as normal or abnormal. The following information shall be included for each abnormal release:

- total number of and curie content of releases (liquid and gas)
- a description of the event and equipment involved
- cause(s) for the abnormal release
- actions taken to prevent recurrence
- consequences of the abnormal release

Changes to the MP–22–REC–BAP01, “Radiological Effluent Monitoring And Offsite Dose Calculation Manual (REMODCM),” shall be submitted to the NRC as appropriate, as a part of or concurrent with the RERR for the period in which the changes were made.

SECTION II.

Offsite Dose Calculation Manual (ODCM)

For the
Millstone Nuclear Power Station
Nos. 1, 2, & 3

Docket Nos. 50–245, 50–336, 50–423

SECTION II. OFFSITE DOSE CALCULATION MANUAL (ODCM)

II.A. Introduction

The purpose of the Offsite Dose Calculation Manual (Section II of the REMODCM) is to provide the parameters and methods to be used in calculating offsite doses and effluent monitor setpoints at the Millstone Nuclear Power Station. Included are methods for determining maximum individual whole body and organ doses due to liquid and gaseous effluents to assure compliance with the regulatory dose limitations in 10 CFR 50, Appendix I. Also included are methods for performing dose projections to assure compliance with the liquid and gaseous treatment system functionality sections of the Radiological Effluent Monitoring Manual (REMM – Section I of the REMODCM). The manual also includes the methods used for determining quarterly and annual doses for inclusion in the Radioactive Effluent Release Report. ①

The bases for selected site-specific factors used in the dose calculation methodology are provided in MP–22–REC–REF03, "REMODCM Technical Information."

Another section of this manual discusses the methods to be used in determining effluent monitor alarm/trip setpoints to be used to ensure compliance with the instantaneous release rate limits in Sections III.D.2.a., IV.D.2.a., and V.D.2.a.

This manual includes the methods to be used in performance of the surveillance requirements in the Radiological Effluent Controls of Sections III, IV, and V. Appendix A, Tables App.A-1 provide a cross-reference of effluent requirements and applicable methodologies contained in the REMODCM.

Most of the calculations in this manual have several methods given for the calculation of the same parameter. These methods are arranged in order of simplicity and conservatism, Method 1 being the easiest and most conservative. As long as releases remain low, one should be able to use Method 1 as a simple estimate of the dose. If release calculations approach the limit, however, more detailed yet less conservative calculations may be used. At any time a more detailed calculation may be used in lieu of a simple calculation.

This manual is written common to all three units since some release pathways are shared and there are also site release limits involved. These facts make it impossible to completely separate the three units.

II.B. Responsibilities

All changes to the Offsite Dose Calculation Manual (ODCM) shall be reviewed and approved by the Facilities Safety Review Committee prior to implementation. ①

All changes and their rationale shall be documented in the Radioactive Effluent Release Report.

It shall be the responsibility of the Site Vice President Millstone to ensure that this manual is used as required by the administrative controls of the Technical Specifications. The delegation of implementation responsibilities is delineated in the MP-22-REC-PRG, "Radiological Effluent Control."

II.C. Liquid Dose Calculations

Radiological Effluent Controls (Sections III, IV, and V) limit whole body and maximum organ doses to an individual member of the public to 1.5 mrem whole body and 5 mrem maximum organ per calendar quarter and 3 mrem whole body and 10 mrem maximum organ per year from liquid effluents released from each unit. (See Appendix A, Table App.A-1 for cross-reference effluent control requirements and applicable sections in the REMODCM which are used to determine compliance). In addition, installed portions of liquid radwaste treatment system are required to be operated to reduce radioactive materials in liquid effluents when the projected dose over 31 days from applicable waste streams exceeds 0.006 mrem whole body or 0.02 mrem maximum organ. This part of the REMODCM provides the calculation methodology for determining the doses from radioactive materials released into liquid pathways of exposure associated with routine discharges.

1. Monthly, Quarterly, and Annual Dose Calculation (Applicable to All Units)

   For each Unit, whole body and maximum organ doses from liquid effluents shall be calculated at least once per 31 days (or monthly) using the methodology of Regulatory Guide 1.109, Rev. 1. The calculation shall include contributions from all analyses required by Table I.C-1 for Unit 1, Table I.C-2 for Unit 2, and Table I.C-3 for Unit 3 recorded to date. If any required analyses have not yet been completed for the dose period, an estimate of dose from unanalyzed isotopes shall be included in the dose total. Results of these dose calculations shall be summed to determine compliance with quarterly and annual dose limits for each Unit.

2. Monthly Dose Projections

   Section I.C.2.a. of the REMM requires that certain portions of the liquid radwaste treatment equipment be used to reduce radioactive liquid effluents when the projected doses for each Unit (made at least once per 31 days) exceeds 0.006 mrem whole body or 0.02 mrem to any organ. The following methods are applied in the estimation of monthly dose projections:

   a. Whole Body and Maximum Organ when Steam Generator Total Gamma Radioactivity is less than 5E-7 μCi/ml and Steam Generator Tritium is less than 0.02 μCi/ml (Applicable to Units 2 and 3) ①

The projected monthly whole body dose (Units 2 or 3) is determined from:

$$D^{E}_{MW} = D_{MW}\ [R_1\ R_4\ F_2]$$

The monthly projected maximum organ dose (Units 2 or 3) is determined from:

$$D^{E}_{MO} = D_{MO}\ [R_1\ R_4\ F_2]$$

Where:

D'_{MW} = the whole body dose from the last typical previously completed month as calculated per the methods in Section II.C.1.

D'_{MO} = the maximum organ dose from the last typical previously completed month as calculated per the methods in Section II.C.1.

R_1 = the ratio of the total estimated volume of liquid batches to be released in the present month to the volume released in the past month.

R_4 = the ratio of estimated primary coolant radioactivity for the present month to that for the past month. ①

F_2 = the factor to be applied to the estimated ratio of final curies released if there are expected differences in treatment of liquid waste for the present month as opposed to the past month (e.g., bypass of filters or demineralizers). NUREG-0017 or past experience shall be used to determine the effect of each form of treatment which will vary. $F_2 = 1$ if there are no expected differences.

The last month should be typical without significant operational differences from the projected month. If there were no releases during last month, do not use that month as the base month if it is estimated that there will be releases for the coming month.

b. Whole Body and Maximum Organ when Steam Generator Total Gamma radioactivity Exceeds 5E−7 µCi/ml or Steam Generator Tritium Exceeds 0.02 µCi/ml (Applicable to Units 2 and 3) ①

The projected monthly whole body dose (Units 2 or 3) is determined from:

$$D^{E}_{MW} = D_{MW}\ [(1 - F_1)\ R_1\ R_4\ F_2 + F_1\ R_2\ R_3]$$

The monthly projected maximum organ dose (Units 2 or 3) is determined from:

$$D^{E}_{MO} = D_{MO}\ [(1 - F_1)\ R_1\ R_4\ F_2 + F_1\ R_2\ R_3]$$

Where:

D'_{MW} = the whole body dose from the last typical previously completed month as calculated per the methods in Section II.C.1.

D'_{MO} = the maximum organ dose from the last typical previously completed month as calculated per the methods in Section II.C.1.

R_1 = the ratio of the total estimated volume of liquid batches to be released in the present month to the volume released in the past month.

R_2 = the ratio of estimated volume of steam generator blowdown to be released in present month to the volume released in the past month.

F_1 = the fraction of curies released last month coming from steam generator blowdown calculated as:

$$\frac{\text{curies from blowdown}}{\text{curies from blowdown + curies from batch tanks}}$$

R_3 = the ratio of estimated secondary coolant radioactivity for the present month to that for the past month. ①

R_4 = the ratio of estimated primary coolant radioactivity for the present month to that for the past month.

F_2 = the factor to be applied to the estimated ratio of final curies released if there are expected differences in treatment of liquid waste for the present month as opposed to the past month (e.g., bypass of filters or demineralizers). NUREG-0017 or past experience shall be used to determine the effect of each form of treatment which will vary. $F_2 = 1$ if there are no expected differences.

3. Bases for Liquid Pathway Dose Calculations

The dose calculation methodology and parameters used in Section II of the REMODCM implement the requirements in Section III.A of Appendix I (10CFR50) which states that conformance with the dose objectives of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. The dose calculations are based on the liquid models presented in Regulatory Guide 1.109, Rev.1; "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I". Input parameter values typically used in the dose models are listed in MP–22–REC–REF03, "REMODCM Technical Information Document."

II.D. Gaseous Dose Calculations

1. Site Release Rate Limits ("Instantaneous")

   Radiological Effluent Controls (Sections III, IV, and V) for each unit require that the instantaneous off–site dose rates from noble gases released to the atmosphere be limited such that they do not exceed 500 mrem/year at any time to the whole body or 3000 mrem/year to the skin at any time from the external cloud. For iodine–131, 133, tritium, and particulates (half–lives > 8 days), the inhalation pathway critical organ dose rate from all units shall not exceed 1500 mrem/year at any time. These limits apply to the combination of releases from all three Units on the site, and are directly related to the radioactivity release rates measured for each Unit. By limiting gaseous release rates for both classes of radionuclides (i.e., noble gases; and iodines, tritium, and particulates) to within values which correlate to the above dose rate limits, assurance is provided that the Radiological Effluent Controls dose rate limits are not exceeded.

   a. Method 1 for Noble Gas Release Rate Limits

      Instantaneous noble gas release rate for the site:

$$Q_{1V}/90{,}000 + Q_{2S}/560{,}000 + Q_{2V}/290{,}000 + Q_{3S}/560{,}000 + Q_{3V}/290{,}000 \leq 1$$

      Where:

      Q_{1V} = Noble gas release rate from Spent Fuel Pool Island Vent (μCi/sec)

      Q_{2S} = Noble gas release rate from MP2 to Millstone Stack (μCi/sec)

      Q_{2V} = Noble gas release rate from MP2 Vent (μCi/sec)

      Q_{3V} = Noble gas release rate from MP3 Vent (μCi/sec)

      Q_{3S} = Noble gas release rate from MP3 to Millstone Stack (μCi/sec)

      As long as the above is less than or equal to 1, the doses will be less than or equal to 500 mrem to the total body and less than 3000 mrem to the skin. The limiting factor for the Unit 1 SFPI vent of 90,000 is based on the skin dose limit of 3,000 mrem/year, while all the other factors are based on the whole body dose limit of 500 mrem/year.

   b. Method 1 Release Rate Limit – I–131, I–133, H–3 and Particulates Half Lives Greater Than 8 Days

With releases satisfying the following limit conditions, the dose rate to the maximum organ will be less than 1500 mrem/year from the inhalation pathway:

1) Site release rate of I–131, I–133, and tritium (where the thyroid is the critical organ for these radionuclides):

$$DR_{thy1} + DR_{thy2} + DR_{thy3} \leq 1$$

Where the contribution from each Unit is calculated from:

Unit 1: $DR_{thy1} = 9.36 \times 10^{-6}\ Q_{H1V}$

Unit 2: $DR_{thy2} = 5.1 \times 10^{-2}\ {}_{131}Q_{I2V} + 2.38 \times 10^{-3}\ {}_{131}Q_{I2S} + 1.25 \times 10^{-2}\ {}_{133}Q_{I2V} + 5.75 \times 10^{-4}\ {}_{133}Q_{I2S} + 4.2 \times 10^{-6}\ Q_{H2V} + 1.9 \times 10^{-7}\ Q_{H2S}$

Unit 3: $DR_{thy3} = 5.1 \times 10^{-2}\ {}_{131}Q_{I3V} + 2.38 \times 10^{-3}\ {}_{131}Q_{I3S} + 1.25 \times 10^{-2}\ {}_{133}Q_{I3V} + 5.75 \times 10^{-4}\ {}_{133}Q_{I3S} + 4.2 \times 10^{-6}\ Q_{H3V} + 1.9 \times 10^{-7}\ Q_{H3S}$

2) Site release rate of particulates with half–lives greater than 8 days and tritium (where the critical organ is a composite of target organs for a mix of radionuclides):

$$DR_{org1} + DR_{org2} + DR_{org3} \leq 1$$

Where the contribution from each Unit is calculated from:

Unit 1: $DR_{org1} = 1.05 \times 10^{-1}\ [Q_{P1V} + Q_{P1B}] + 9.36 \times 10^{-6}\ Q_{H1V}$

Unit 2: $DR_{org2} = 2.38 \times 10^{-3}\ Q_{P2S} + 5.1 \times 10^{-2}\ Q_{P2V} + 1.9 \times 10^{-7}\ Q_{H2S} + 4.1 \times 10^{-6}\ Q_{H2V}$

Unit 3: $DR_{org3} = 2.38 \times 10^{-3}\ Q_{P3S} + 5.1 \times 10^{-2}\ Q_{P3V} + 1.9 \times 10^{-7}\ Q_{H3S} + 4.1 \times 10^{-6}\ Q_{H3V}$

Each of the release rate quantities in the above equations are defined as:

${}_{131}Q_{I2V}$ = Release rate of I–131 from MP2 Vent (μCi/sec)*

${}_{131}Q_{I2S}$ = Release rate of I–131 from MP2 to Millstone Stack (μCi/sec)

${}_{133}Q_{I2V}$ = Release rate of I–133 from MP2 Vent (μCi/sec)*

${}_{133}Q_{I2S}$ = Release rate of I–133 from MP2 to Millstone Stack (μCi/sec)

$_{131}Q_{I3V}$ = Release rate of I–131 from MP3 Vents (Normal and ESF) (μCi/sec)*

$_{131}Q_{I3S}$ = Release rate of I–131 from MP3 to Millstone Stack (μCi/sec)

$_{133}Q_{I3V}$ = Release rate of I–133 from MP3 Vents (Normal and ESF) (μCi/sec)*

$_{133}Q_{I3S}$ = Release rate of I–133 from MP3 to Millstone Stack (μCi/sec)

Q_{H1V} = Release rate of tritium from the Spent Fuel Pool Island and Balance of Plant Vents (μCi/sec)

Q_{H2V} = Release rate of tritium from MP2 Vent (μCi/sec)*

Q_{H2S} = Release rate of tritium from MP2 to Millstone Stack (μCi/sec)

Q_{H3V} = Release rate of tritium from MP3 Vents (Normal and ESF) (μCi/sec)*

Q_{H3S} = Release rate of tritium from MP3 to Millstone Stack (μCi/sec)

Q_{P1V} = Release rate of total particulates with half–lives greater than 8 days from the Spent Fuel Pool Island Vent (μCi/sec)

Q_{P1B} = Release rate of total particulates with half–lives greater than 8 days from the Balance of Plant Vent (μCi/sec)

Q_{P2V} = Release rate of total particulates with half–lives greater than 8 days from the MP2 Vent (μCi/sec)

Q_{P2S} = Release rate of total particulates with half–lives greater than 8 days from MP2 to Millstone Stack (μCi/sec)

Q_{P3V} = Release rate of total particulates with half–lives greater than 8 days from MP3 Vents (Normal and ESF) (μCi/sec)

Q_{P3S} = Release rate of total particulates with half–lives greater than 8 days from MP3 to Millstone Stack (μCi/sec)

* includes releases via the steam generator blowdown tank vent.

c. Method 2

The above Method 1 equations assume a conservative nuclide mix. If necessary, use the methodology given in Regulatory Guide 1.109 to estimate the dose rate from either noble gases or iodines, tritium, and particulates with half-lives greater than 8 days.

2. 10 CFR50 Appendix I – Noble Gas Limits

Radiological Effluent Controls (Sections III, IV, and V) limit the off–site air dose from noble gases released in gaseous effluents to 5 mrad gamma and 10 mrad beta for a calendar quarter and to 10 mrad gamma and 20 mrad beta for a calendar year. Effluent dose is calculated at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.02 mrad air gamma or 0.04 mrad air beta. (See Appendix A, Tables App.A–1 for a cross reference of effluent control requirements and applicable sections of the REMODCM which are used to determine compliance.) This part of the REMODCM provides the calculation methodology for determining air doses from noble gases.

Use the methodology of Regulatory Guide 1.109 Rev.1, to calculate the critical site boundary gamma air and beta air doses at least once per 31 days (monthly).

For calculations performed once every 31 days, enter the following meteorology:

Release Point	**χ/Q**	**D/Q**
Site Stack	8.92E–7	8.84E–9
Mixed–mode or rooftop (e.g., vents)	8.1E–6	1.5E–7
Ground	3.28E–5	1.68E–7

If the calculated air dose exceeds one half the quarterly Radiological Effluent Control limit, use meteorology concurrent with quarter of release.

Results of these dose calculations shall be summed to determine compliance with quarterly and annual dose limits for each Unit.

For calculations of quarterly doses for the Radioactive Effluent Release Report, use average quarterly or real–time meteorology.

3. 10 CFR50 Appendix I – Iodine, Tritium, C–14, and Particulate Doses

Radiological Effluent Controls (Section IV and V) limit the offsite dose to any organ from I–131, I–133, tritium, C–14, and particulates with half–lives greater than 8 days released in gaseous effluents to 7.5 mrem for a calendar quarter and to 15 mrem per calendar year. The Radiological Effluent Controls in Section III apply the same limits to tritium and particulates. Effluent dose calculations are performed at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.03 mrem. (See Appendix A, Table App.A–1 for a cross reference of effluent control requirements and applicable sections of the REMODCM which are used to determine compliance.) This part of the REMODCM provides the calculation methodology for determining critical organ doses from atmospheric releases of iodines, tritium and particulates. ①

For each Unit, whole body and maximum organ doses from I–131, I–133, tritium, C–14 and particulates with half–lives greater than 8 days in gaseous effluents shall be calculated at least once per 31 days (or monthly) using the methodology of Regulatory Guide 1.109, Rev.1.

For calculations performed once every 31 days, enter the following meteorology:

Release Point	χ/Q	D/Q
Site Stack	8.92E–7	8.84E–9
Mixed–mode or rooftop (e.g., vents)	8.1E–6	1.5E–7
Ground	3.28E–5	1.68E–7

The calculation shall include contributions from all analyses required by Table I.D–1 for Unit 1, Table I.D–2 for Unit 2, and Table I.D–3 for Unit 3 recorded to date. If any required analyses have not yet been completed for the dose period, an estimate of dose from unanalyzed isotopes shall be included in the dose total. If the calculated dose exceeds one–half the quarterly Radiological Effluent Control limit, use meteorology concurrent with the dose period.

Results of these dose calculations shall be summed to determine compliance with quarterly and annual dose limits for each Unit.

For calculations of quarterly doses for the Radioactive Effluent Release Report, use average quarterly or real–time meteorology.

4. Gaseous Effluent Monthly Dose Projections

Section I.D.2.a. of the REMM requires that certain portions of the gaseous radwaste treatment equipment be returned to service to reduce radioactive gaseous effluents when the projected doses for each Unit (made at least once per 31 days) exceed 0.02 mrad gamma air, 0.04 mrad beta air, or 0.03 mrem to any organ from gaseous effluents. The following methods are applied in the estimation of monthly dose projections.

a. Unit 1 Projection Method

None required.

b. Unit 2 Projection Method

1) Due to Gaseous Radwaste Treatment System (Unit 2)

Determine the beta and gamma monthly air dose projection from noble gases from the following:

$$D^{E}_{MG} \text{ (mrad)} = 1.81 \times 10^{-4} \ C^{E}_{N}$$

$$D^{E}_{MB} \text{ (mrad)} = 1.81 \times 10^{-6} \ C^{E}_{N}$$

Where:

C^{E}_{N} = the number of curies of noble gas estimated to be released from the waste gas storage tanks during the next month.

D^{E}_{MG} = the estimated monthly gamma air dose.

D^{E}_{MB} = the estimated monthly beta air dose.

(The dose conversion factor is from MP–22–REC–REF03, "REMODCM Technical Information Document," Section 4.2, for the Millstone Stack releases since the Unit 2 waste gas tanks are discharged via the Millstone Stack. This factor is conservative because the isotopic mix assumed for the dose conversion factor consists of shorter–lived noble gases which have higher dose conversion factors than the typical mix from Unit 2 waste gas tank discharges.)

2) (Reserved)

3) Due to Ventilation Releases (Unit 2)

If portions of the ventilation treatment system are expected to be out of service during the month, determine the monthly maximum organ dose projection (D^{E}_{MO}) from the following:

i. Method 1

Determine D^{E}_{MO} which is the estimated monthly dose to the maximum organ from the following:

$$D^{E}_{MO} = 1/3\ R_1\ (1.01 - R_2)\ (R_3 + 0.01)\ D_O$$

For the last quarter of operation, determine D_O as determined per Section II.D.3.

R_1 = the expected reduction factor for the HEPA filter. Typically this should be 100 (see NUREG–0016 or 0017 for additional guidance).

R_2 = the fraction of the time which the equipment was nonfunctional during the last quarter. ①

R_3 = the fraction of the time which the equipment is expected to be nonfunctional during the next month.

D_O = maximum organ dose from the previous month.

ii. Method 2

If necessary, estimate the curies expected to be released for the next month and applicable method for dose calculation from Section II.D.3.

c. Unit 3 Projection Method

1) Due to Radioactive Gaseous Waste System (Unit 3)

Determine the beta and gamma monthly air dose projection from noble gases from the following:

D^E_{MG} (mrad) = $1.81 \times 10^{-4}\ C^E_N$

D^E_{MB} (mrad) = $1.81 \times 10^{-6}\ C^E_N$

Where:

C^E_N = the number of additional curies of noble gas estimated to be released from Unit 3 during the next month due to the nonfunctional processing equipment. ①

D^E_{MG} = the estimated monthly gamma air dose.

D^E_{MB} = the estimated monthly beta air dose.

(The dose conversion factor is from the MP–22–REC–REF03, "REMODCM Technical Information Document," for the Millstone Stack releases since the Unit 3 reactor plant gaseous vents are discharged via the Millstone Stack.)

5. Compliance with 40CFR190

The following sources shall be considered in determining the total dose to any real member of the public, at or beyond the site boundary, from uranium fuel cycle sources:

a. Gaseous Releases from Units 1, 2, and 3.

b. Liquid Releases from Units 1, 2, and 3.

c. Direct and Scattered Radiation from Radioactive Material on Site.

d. Direct and Scattered Radiation from the Independent Spent Fuel Storage Installation (ISSFSI).

Doses shall be obtained per the requirements of Section II.C.1 for liquid releases and Section II.D.2 and II.D.3 for gaseous releases.

Direct and scattered radiation doses shall be calculated. Doses from all sources shall be added to determine compliance with 40CFR190.

6. Bases for Gaseous Pathway Dose Calculations

The dose calculation methodology and parameters used in Section II of the REMODCM implement the requirements in Section III.A. of Appendix I (10CFR50) which states that conformance with the ALARA dose objectives of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. Operational flexibility is provided by controlling the instantaneous release rate of noble gas (as well as iodines and particulate radioactivity) such the maximum off-site dose rates are less than the equivalent of 500 mrem/year to the whole body, 3000 mrem/year to the skin from noble gases, or 1500 mrem/year to a critical organ from the inhalation of iodines, tritium and particulates. The dose rate limits are based on the 10CFR20 annual dose limits, but applied as an instantaneous limit to assure that the actual dose over a year will be well below these numbers. ①

The equivalent instantaneous release rate limits for Millstone Stack were determined using the EPA AIREM code. These limits were adjusted for reduced stack flow after Unit 1 shutdown. The AIREM code calculates cloud gamma doses using dose tables from a model that considers the finite extent of the cloud in the vertical direction. Beta doses are calculated assuming semi-infinite cloud concentrations, which are based upon a standard sector averaged diffusion equation. For Units 2 & 3, these doses were calculated using the NRC GASPAR code. The GASPAR code implements the models of NRC Regulatory Guide 1.109, Rev. 1, "Calculation of Annual Doses to

Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I." Input parameter values typically used in the dose models are listed in MP–22–REC–REF03, "REMODCM Technical Information Document." This same methodology is used in the determination of compliance with the 40CFR190 total dose standard for the gaseous pathways.

In the determination of compliance with the dose and dose rate limits, maximum individual dose calculations are performed at the nearest land site boundary with maximum decayed X/Q, and at the nearest vegetable garden and cow and goat farms with maximum D/Qs.

II.E. Liquid Discharge Flow Rates And Monitor Setpoints

1. Unit 1 Spent Fuel Pool Water Discharge

The limit on discharge flow rate and setpoint on the Unit 1 liquid waste monitor depend on dilution water flow, radwaste discharge flow, the isotopic composition of the liquid, the background count rate of the monitor and the efficiency of the monitor. Due to the variability of these parameters, the alert and alarm setpoints will be determined prior to the release of each batch. The following method will be used:

<u>STEP 1:</u>

From the isotopic analysis and the Effluent Concentration (EC) values for each identified nuclide determine the required reduction factor, i.e.:

$$R = Required\ Reduction\ Factor = \frac{1}{\frac{\frac{\mu Ci}{ml}\ of\ nuclide\ i}{10\ x\ EC\ of\ nuclide\ i}}$$

<u>STEP 2:</u>

Determine the allowable discharge flow (F)

F = 0.1 x R x D

Where:

D = The existing dilution flow which is the any dilution flow from Millstone Unit 2 and/or Unit 3 not being credited for any other radioactivity discharge during discharge of Unit 1 water.

0.1 = safety factor to limit discharge concentration to 10% of the Radiological Effluent Control Limit.

<u>STEP 3:</u>

Calculate the monitor setpoint as follows:

Rset = 2 x AC x RCF + Background

Where:

Rset = The setpoint of the monitor.

AC = The total radwaste effluent concentration (µCi/ml) in the tank.

RCF = The response correction factor for the effluent line monitor using the current calibration factor or isotopic–specific responses.

2 = Tolerance limit which brings the setpoint at twice the expected response of the monitor based on sample analysis. With the safety factor of 0.1 the setpoint would be at 20% of the Radiological Effluent Control Limit.

Option setpoint:

A setpoint based upon worst case conditions may be used. Assume the maximum possible discharge flow, a minimum dilution flow not to exceed 100,000 gpm, and a limit of 1×10^{-7} μCi/ml which is lower than any 10CFR20 EC limit except for transuranics. This will assure that low level releases are not terminated due to small fluctuations in radioactivity. When using this option setpoint independent verification of discharge lineup shall be performed. The optional setpoint may be adjusted (increased or decreased) by factors to account for the actual discharge flow and actual dilution flow; however, controls shall be established to ensure that the allowable discharge flow is not exceeded and the dilution flow is maintained. ①

2. Reserved

3. Unit 2 Clean Liquid Radwaste Effluent Line – RM9049 and Aerated Liquid Radwaste Effluent Line – RM9116

The setpoint on the Unit 2 clean and aerated liquid waste effluent lines depend on dilution water flow, radwaste discharge flow, the isotopic composition of the liquid, the background count rate of the monitor and the efficiency of the monitor. Due to the variability of these parameters, an alarm/trip setpoint will be determined prior to the release of each batch. The following method will be used:

STEP 1:

From the tank isotopic analysis and the Effluent Concentrations (EC) in 10CFR20, App. B, Table 2, Col. 2 for each identified nuclide determine the required reduction factor, i.e.:

For Nuclides Other Than Noble Gases:

$$R_1 = Required\ Reduction\ Factor = \frac{1}{\frac{\frac{\mu Ci}{ml}\ of\ nuclide\ i}{10\ x\ EC\ of\ nuclide\ i}}$$

For Noble Gases: If the noble gas concentration is less than 1.1×10^{-2} μCi/ml or the calculated diluted concentration is less than 2×10^{-5} μCi/ml, the reduction factor need not be determined. The concentration of 1.1×10^{-2} μCi/ml is based on 175 gpm discharge flow, 100,000 gpm dilution flow, and a safety factor of 0.1 (See Note below.) If dilution flow is less than 100,000 gpm, the noble gas concentration limit shall be decreased by the ratio of actual dilution flow to 100,000gpm. For example, if dilution flow is 50,000 gpm, the limit would be reduced by a factor of 0.5 (50,000/100,000).

$$R_2 = Required\ Reduction\ Factor = \frac{1}{\frac{\frac{\mu Ci}{ml}\ of\ noble\ gases}{2\ x\ 10^{-4}\frac{\mu Ci}{ml}}} = \frac{2\ x\ 10^{-4}\frac{\mu Ci}{ml}}{\frac{\mu Ci}{ml}\ noble\ gases}$$

R = the smaller of R_1 or R_2

STEP 2:

Determine the allowable discharge flow (F) in gpm:

F = 0.1 x R x D

Where:

D = the existing dilution flow (D) from circulating and service water pumps. It may include any Unit 3 flow, or portion of Unit 3 flow, not being credited for dilution of a Unit 3 radioactivity discharge during the time of the Unit 2 discharge. ①

NOTE

Note that discharging at this flow rate would yield a discharge concentration corresponding to 10% of the Radiological Effluent Control Limit due to the safety factor of 0.1.

With this condition on discharge flow rate met, the monitor setpoint can be calculated:

Rset = 2 x AC x RF (See Note 1 below.)

Where:

R_{set} = the setpoint of the monitor (cpm).

AC = the total radwaste effluent concentration (µCi/ml) in the tank.

RF = the response factor for the effluent line monitor using the current calibration factor or isotopic–specific responses.

2 = the multiple of expected count rate on the monitor based on the radioactivity concentration in the tank.

This value or that corresponding to 5.6×10^{-5} µCi/ml (Note 2 below), whichever is greater, plus background is the trip setpoint. For the latter setpoint, independent valve verification shall be performed and minimum dilution flow in Note 2 shall be verified and if necessary, appropriately adjusted.

Note 1: If discharging at the allowable discharge rate (F) as determined in above, this setpoint would correspond to 20% of the Radiological Effluent Control limit.

Note 2: This value is based upon assuming maximum discharge flow (175 gpm), dilution water flow of 100,000 gpm and a limit of 1 x 10^{-7} which is lower than any Technical Specification limit (ten times 10CFR20 EC values) except for transuranics. This will assure that low level releases are not terminated due to small fluctuations in radioactivity activity. However, to verify that the correct tank is being discharged when using this value, independent valve verification shall be performed. This value may be adjusted (increased or decreased) by factors to account for the actual discharge flow and actual dilution flow; however, controls shall be established to ensure that the allowable discharge flow is not exceeded and the dilution flow is maintained. Dilution flow may include any Unit 3 flow, or a portion of Unit 3 flow, not being credited for dilution of a Unit 3 radioactive discharge during the time of the Unit 2 discharge.

4. Condensate Polishing Facility Waste Neutralization Sump Effluent Line – CND245

The setpoint shall be determined as for the Clean and Aerated Liquid Monitors in Section II.E.3.

5. Unit 2 Steam Generator Blowdown – RM4262 and Unit 2 Steam Generator Blowdown Effluent Concentration Limitation

5a. Unit 2 Steam Generator Blowdown – RM4262

Alarm ≤ 800 CPM + background (1)

This setpoint may be adjusted (increased or decreased) through proper administrative controls.

$$Adjusted\ alarm \ \le\ 6\ CPM\ x\ \frac{circulating\ \&\ service\ water\ flow\ (gpm)}{total\ SG\ blowdown\ (gpm)}\ +\ Background$$ (1)

When using the adjusted alarm, ensure that any other simultaneous discharge does not cause an exceedance of regulatory limits. (1)

5b. Unit 2 Steam Generator Blowdown Effluent Concentration Limitation

The results of analysis of blowdown samples required by Table I.C.–2 of Section I of the REMODCM shall be used to ensure that blowdown effluent releases do not exceed ten times the concentration limits in 10CFR20, Appendix B.

6. Unit 2 Condenser Air Ejector – RM5099

N/A since this monitor is no longer a final liquid effluent monitor.

7. Unit 2 Reactor Building Closed Cooling Water RM6038 and Unit 2 Service Water, and RBCCW Sump and Turbine Building Sump Effluent Concentration Limitation

7a. Unit 2 Reactor Building Closed Cooling Water RM6038

The purpose of the Reactor Building Closed Cooling Water (RBCCW) radiation monitor is to give warning of abnormal radioactivity in the RBCCW system and to prevent releases to the Service Water system which, upon release to the environment, would exceed ten times the concentration values in 10CFR20. According to Calculation RERM–02665–R2, radioactivity in RBCCW water which causes a monitor response of greater than the setpoint prescribed below could exceed ten times the10CFR20 concentrations upon release to the Service Water system.

SETPOINT DURING POWER OPERATIONS:

To give adequate warning of abnormal radioactivity, the setpoint shall be two times the radiation monitor background reading, provided that the background reading does not exceed 2,000 cpm. The monitor background reading shall be the normal monitor reading. If the monitor background reading exceeds 2,000 cpm, the setpoint shall be set at the background reading plus 2,000 cpm and provisions shall be made to adjust the setpoint if the background decreases.

SETPOINT DURING SHUTDOWN:

1) During outages not exceeding three months the setpoint shall be two times the radiation monitor background reading, provided that the background reading does not exceed 415 cpm. If the monitor background reading exceeds 415 cpm, the setpoint shall be set at the background reading plus 415 cpm and provisions shall be made to adjust the setpoint if the background decreases.

2) During extended outages exceeding three months, but not exceeding three years, the setpoint shall be two times the radiation monitor background reading, provided that the background reading does not exceed 80 cpm. If the monitor background reading exceeds 80 cpm, the setpoint shall be set at the background reading plus 80 cpm and provisions shall be made to adjust the setpoint if the background decreases.

PROVISIONS FOR ALTERNATE DILUTION FLOWS:

These setpoints are based on a dilution flow of 4,000 gpm from one service water train. If additional dilution flow is credited, the setpoint may be adjusted proportionately. For example, the addition of a circulating water pump dilution flow of 100,000 gpm would allow the setpoint to be increased by a factor of 25.

7b. Unit 2 Service Water, and RBCCW Sump and Turbine Building Sump Effluent Concentration Limitation

Results of analyses of service water, RBCCW sump and turbine building sump samples taken in accordance with Table I.C.−2 of Section I of the REMODCM shall be used to limit radioactivity concentrations in the service water, RBCCW sump and turbine building sump effluents to less than ten times the limits in 10CFR20, Appendix B.

8. Unit 3 Liquid Waste Monitor – LWS–RE70

The setpoints on the Unit 3 liquid waste monitor depend on dilution water flow, radwaste discharge flow, the isotopic composition of the liquid, the background count rate of the monitor and the efficiency of the monitor. Due to the variability of these parameters, the alert and alarm setpoints will be determined prior to the release of each batch. The following method will be used:

Step 1:

From the tank isotopic analysis and the Effluent Concentration (EC) values for each identified nuclide determine the required reduction factor, i.e.:

For Nuclides Other Than Noble Gases:

$$R_1 = Required\ Reduction\ Factor = \frac{1}{\frac{\frac{\mu Ci}{ml}\ of\ nuclide\ i}{10\ x\ EC\ of\ nuclide\ i}}$$

For Noble Gases: If the noble gas concentration is less than 0.013 μCi/ml or the calculated diluted concentration is less than 2 x 10^{-5} μCi/ml, the reduction factor need not be determined. The concentration of 0.013 μCi/ml is based on 100,00 gpm dilution flow and a safety factor of 0.1 (See Note Below.) If dilution flow is less than 100,000 gpm, the noble gas concentration limit shall be decreased by the ratio of actual dilution flow to 100,000gpm. For example, if dilution flow is 50,000 gpm, the limit would be reduced by a factor of 0.5 (50,000/100,000).

$$R_2 = Required\ Reduction\ Factor = \frac{1}{\frac{\frac{\mu Ci}{ml}\ of\ noble\ gases}{2\ x\ 10^{-4}\frac{\mu Ci}{ml}}} = \frac{2\ x\ 10^{-4}\frac{\mu Ci}{ml}}{\frac{\mu Ci}{ml} noble\ gases}$$

R = the smaller of R1 or R2

Step 2:

Determine the allowable discharge flow (F)

F = 0.1 x R x D

Where:

D = The existing dilution flow (D) from circulating and service water pumps. It may include any Unit 2 flow, or portion of Unit 2 flow, not being credited for dilution of a Unit 2 radioactivity discharge during the time of the Unit 3 discharge. ①

NOTE

Note that discharging at this flow rate would yield a discharge concentration corresponding to 10% of the Radiological Effluent Control Limit due to the safety factor of 0.1.

With this condition on discharge flow rate met, the monitor setpoint can be calculated:

Rset = 2 x AC x RCF (see Note 1)

Where:

Rset= The setpoint of the monitor.

AC= The total radwaste effluent concentration (μCi/ml) in the tank.

RCF= The response correction factor for the effluent line monitor using the current calibration factor or isotopic–specific responses.

2 = The multiple of expected count rate on the monitor based on the radioactivity concentration in the tank.

This value, or that corresponding to 6.6×10^{-5} μCi/ml (Note 2 below), whichever is greater, plus background is the trip setpoint. For the latter setpoint, independent valve verification shall be performed and minimum dilution flow in Note 2 shall be verified and if necessary, appropriately adjusted.

NOTE

1. If discharging at the allowable discharge rate (F) as determined above, this Alarm setpoint would yield a discharge concentration corresponding to 20% of the Radiological Effluent Control limit.
2. This value is based upon assuming maximum discharge flow (150 gpm), dilution water flow of 100,000 gpm, and a limit of 1×10^{-7} µCi/ml which is lower than any Technical Specification limit (ten times 10CFR20 EC values) except for transuranics. This will assure that low level releases are not terminated due to small fluctuations in radioactivity. However, to verify that the correct tank is being discharged when using this value, independent valve verification shall be performed. This value may be adjusted (increased or decreased) by factors to account for the actual discharge flow and actual dilution flow; however, controls shall be established to ensure that the allowable discharge flow is not exceeded and the dilution flow is maintained. Dilution flow may include Unit 2 flow, or portion of Unit 2 flow, not being credited for dilution of a Unit 2 discharge during the time of the Unit 3 discharge.

①

9. Unit 3 Regenerant Evaporator Effluent Line – LWC–RE65

   The MP3 Regenerant Evaporator has been removed from service with DCR M3–97–041. Therefore a radiation monitor alarm is not needed.

10. Unit 3 Waste Neutralization Sump Effluent Line – CND–RE07

    Same as Section II.E.8.

11. Unit 3 Steam Generator Blowdown – SSR–RE08 and Unit 3 Steam Generator Blowdown Effluent Concentration Limitation

    11a. Unit 3 Steam Generator Blowdown – SSR–RE08

    The alarm setpoint for this monitor assumes:

    a. Steam generator blowdown rate of 400 gpm (maximum blowdown total including weekly cleaning of generators – per ERC 25212–ER–99–0133).

    b. The release rate limit is conservatively set at 3×10^{-8} µCi/ml which is well below any 10CFR20 Effluent Concentration except for transuranics*.

c. Circulating and service water dilution flow during periods of blowdown = 100,000 gpm.

d. Background can be added after above calculations are performed.

Therefore, the alarm setpoint corresponds to a concentration of:

$$Alarm\ (\mu Ciml) = \frac{100,000}{400}\ x\ 3x10^{-8}\ +\ background\ =\ 7.5x10^{-6}\ \mu Ciml\ +\ background$$

This setpoint may be increased through proper administrative controls if the steam generator blowdown rate is maintained less than 400 gpm and/or more than 100,000 gpm dilution flow are available. The amount of the increase would correspond to the ratio of flows to those assumed above or:

$$Alarm\ (\mu Ci\ ml) = 7.5x10^{-6}\mu Ci\ ml\ x\ \frac{circulating\ \&\ service\ water\ flow\ (gpm)}{100,000} x \frac{400}{S\ G\ blowdown\ (gpm)}\ +$$

$$Background = 3x10^{-8}\mu Ci\ ml\ x\ \frac{circulating\ \&\ service\ water\ flow\ (gpm)}{total\ S\ G\ blowdown\ (gpm)}\ +\ Background$$

When using the adjusted alarm, ensure that any other simultaneous discharge does not cause an exceedance of regulatory limits. ①

NOTE

The Steam Generator Blowdown alarm criteria is in practice based on setpoints required to detect allowable levels of primary to secondary leakage. This alarm criteria is typically more restrictive than that required to meet discharge limits. This fact shall be verified, however, whenever the alarm setpoint is recalculated.

* In lieu of using 3 x 10^{-8} μCi/ml, ten times the identified 10CFR20 EC values may be used.

11b. Unit 3 Steam Generator Blowdown Effluent Concentration Limitation

The results of analysis of blowdown samples required by Table I.C.−3 of Section I of the REMODCM shall be used to ensure that blowdown effluent releases do not exceed ten times the concentration limits in 10CFR20, Appendix B.

12. Unit 3 Turbine Building Floor Drains Effluent Line – DAS–RE50 and Unit 3 Service Water and Turbine Building Sump Effluent Concentration Limitation

12a. Unit 3 Turbine Building Floor Drains Effluent Line – DAS–RE50

The alarm setpoint for this monitor shall be set to four times (4X) the reading of the monitor when there is no gamma radioactivity present in the turbine building sumps. As determined in Calculation RERM–04101R3, the setpoint shall not exceed 1.4×10^{-5} µCi/ml.

12b. Unit 3 Service Water and Turbine Building Sump Effluent Concentration Limitation

Results of analyses of service water and turbine building sump samples taken in accordance with Table I.C.–3 of Section I of the REMODCM shall be used to limit radioactivity concentrations in the service water and turbine building sump effluents to less than ten times the limits in 10CFR20, Appendix B.

13. Bases for Liquid Monitor Setpoints

Liquid effluent monitors are provided on discharge pathways to control, as applicable, the release of radioactive materials in liquid effluents during actual or potential releases of liquid waste to the environment. The alarm / trip setpoints are calculated to ensure that the alarm / trip function of the monitor will occur prior to exceeding ten times the Effluent Concentration (EC) limits of 10 CFR 20 (Appendix B, Table 2, Column 2), which applies to the release of radioactive materials from all units on the site. This limitation also provides additional assurance that the levels of radioactive materials in bodies of water in Unrestricted Areas will result in exposures within the Section II.A. design objectives of Appendix I to 10CFR50 to a member of the public.

In application, the typical approach is to determine the expected concentration in a radioactive release path and set the allowable discharge rate past the monitor such the existing dilution flow will limit the effluent release concentration to 10% of the limit for the mix. The setpoint is then selected to be only 2 times the expected concentration, or 20% of the limit. As a result, considerable margin is included in the selection of the setpoint for the monitor to account for unexpected changes in the discharge concentration or the contribution from other potential release pathways occurring at the same time as the planned effluent release. For those monitors on systems that are not expected to be contaminated, the alarm point is usually selected to be two times the ambient background to give notice that normal conditions may have changed and should be evaluated.

II.F. Gaseous Monitor Setpoints

1. Unit 1 Spent Fuel Pool Island Monitor – RM–SFPI–02

   The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a. in order to satisfy Unit 1 Radiological Effluent Controls III.C.2. and III.D.2.a.

   The Unit 1 allocated portion of the site instantaneous release rate limit is 30,000 μCi/sec. This assumes that 7% of the site limit for skin dose of 3000 mrem per year is assigned to the Unit 1 Spent Fuel Pool Island vent. If effluent conditions from the Unit 1 Spent Fuel Pool Island vent reach 30,000 μCi/sec, releases from Units 2 and 3 vents and from the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not cause the site skin dose limit to be exceeded. Use Section II.D.1.a. and Section 4.2 of MP–22–REC–REF03. "REMODCM Technical Information Document," in making this determination.

   The alarm setpoint shall be set at or below the monitor reading in μCi/cc corresponding to the Unit 1 portion of the limit. The setpoint shall be set at or below 1.71E–3 μCi/cc. NOTE: This setpoint is the basis for emergency classification in Unit 1 EAL Table (OA–1 and OU–1). A change to this setpoint would require a concurrent change to the EAL.

2. Unit 2 Wide Range Gas Monitor (WRGM) – RM8169

   The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a. in order to satisfy Units 2 Radiological Effluent Controls IV.C.2. and IV.D.2.a.

   For releases from Unit 2 to the Millstone Stack, the allocated portion of the site instantaneous release rate limit is 72,000 μCi/sec. This assumes that 13% of the site limit is assigned to Unit 2 releases to the Millstone Stack. If effluent conditions from Unit 2 releases to the Millstone Stack reach 72,000 μCi/sec, releases from Units 1, 2, and 3 vents and from Unit 3 releases to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not cause the site limit to be exceeded. Use Section II.D.1.a. and Section 4.2 of MP–22–REC–REF03, "REMODCM Technical Information Document," in making this determination.

   The alarm setpoint shall be set at or below the monitor reading in μCi/cc corresponding to the Unit 2 release to the stack portion of the limit. The setpoint shall be set at or below 1.3E–2 μCi/cc.

3. Reserved

4. Unit 3 SLCRS – HVR–RE19B

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a. in order to satisfy Unit 3 Radiological Effluent Controls V.C.2. and V.D.2.a.

For releases from Unit 3 to the Millstone Stack, the allocated portion of the site instantaneous release rate limit is 72,000 μCi/sec. This assumes that 13% of the site limit is assigned to Unit 3 releases to the Millstone Stack. If effluent conditions from Unit 3 releases to the Millstone Stack reach 72,000 μCi/sec, releases from Units 1 and 2 vents, Unit 3 ESF vent and from Unit 2 releases to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not cause the site dose limit to be exceeded. Use Section II.D.1.a. and Section 4.2 of MP–22–REC–REF03, "REMODCM Technical Information Document," in making this determination.

The alarm setpoint shall be set at or below the monitor reading in μCi/cc corresponding to the Unit 3 release to the stack portion of the limit. The setpoint shall be set at or below 1.16 E–2 μCi/cc.

5. Unit 2 Vent – Noble Gas Monitor – RM8132B

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a. in order to satisfy the Unit 2 Radiological Effluent Controls in Sections IV.C.2. and IV.D.2.a.

For releases from Unit 2 vent, the allocated portion of the site instantaneous release rate limit is 95,000 μCi/sec. This assumes that 33% of the site limit is assigned to Unit 2 vent releases. If effluent conditions from Unit 2 vent releases reach 95,000 μCi/sec, releases from Units 1 and 3 vents and from Units 2 and 3 releases to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not cause the site limit to be exceeded. Use Section II.D.1.a. and Section 4.2 of MP–22–REC–REF03, "REMODCM Technical Information Document," in making this determination.

The alarm setpoint shall be set at or below the monitor reading in cpm corresponding to the Unit 2 vent portion of the limit. The setpoint shall be set at or below 42,000 CPM.

6. Unit 2 Waste Gas Decay Tank Monitor RM9095

Administratively all waste gas decay tank releases are via the Millstone Stack. Unit 2 has a release rate limit to the Millstone Stack of 72,000 μCi/sec (see the MP–22–REC–REF03, "REMODCM Technical Information Document," Section 4.2 for bases).

Batch releases of waste gas shall be limited to less than 10% of the Unit 2 releases to the Millstone Stack release rate limits. Therefore, the waste gas decay tank monitor setpoint should be set not to exceed 7,200 μCi/sec. If the setpoint exceeds 7,200 μCi/sec, the release shall be automatically terminated.

The MP2 waste gas decay tank monitor (given μCi/cc per cpm) calibration curve and the tank discharge rate is used to assure that the concentration of gaseous radioactivity being released from a waste gas decay tank does not cause the setpoint of 7,200 μCi/sec to be exceeded. ①

7. Unit 3 Vent Noble Gas Monitor – HVR–RE10B

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a. in order to satisfy Unit 3 Radiological Effluent Controls in Sections V.C.2. and V.D.2.a.

For releases from Unit 3 vent, the allocated portion of the site instantaneous release rate limit is 95,000 μCi/sec. This assumes that 33% of the site limit is assigned to Unit 3 vent releases. If effluent conditions from Unit 3 vent releases reach 95,000 μCi/sec, releases from Units 1 and 2 vents, Unit 3 ESF vent and from Units 2 and 3 releases to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not cause the site limit to be exceeded. Use Section II.D.1.a. and Section 4.2 of MP–22–REC–REF03, "REMODCM Technical Information Document," in making this determination.

The alarm setpoint shall be set at or below the monitor reading corresponding to the Unit 3 vent portion of the limit. The setpoint shall be set at or below 8.4×10^{-4} μCi/cc.

8. Unit 3 Engineering Safeguards Building Monitor – HVQ–RE49

For releases from Unit 3 ESF vent, the allocated portion of the site instantaneous release rate limit is 2,900 μCi/sec. This applies 1% of the Unit 3 Vent release rate limit (see Section II.D.1.a.) to Unit 3 ESF vent releases. If effluent conditions from Unit 3 ESF vent releases reach 2,900 μCi/sec, releases from Units 1 and 2 vents, Unit 3 vent and from Units 2 and 3 releases to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not cause the site limit to be exceeded. Use Section II.D.1.a. and Section 4.2 of MP–22–REC–REF03, "REMODCM Technical Information Document," in making this determination.

The Alarm setpoint shall be set at or below the value of 5.9E–4 μCi/cc. This setpoint assumes a monitor flow rate of 10,500 cfm. However, only 6,000 cfm is monitored. By assuming 10,500 cfm the setpoint is conservatively low.

9. Bases for Gaseous Monitor Setpoints

Gaseous effluent monitors are provided on atmospheric release pathways to control, as applicable, the release of radioactive materials in gaseous effluents to the environment. The alarm / trip setpoints are calculated to ensure that the alarm / trip function of the monitor will occur prior to exceeding the dose rate limits required by the Technical Specifications (Units 2 and 3) or Radiological Effluent Controls (Sections III. IV, and V) requirements for each unit. Monitor setpoint selection is based on a conservative set of conditions for each release pathway such that the dose rate at any time at and beyond the site boundary from all gaseous effluents from all units on the site will be within the numerical values of the annual dose limits of 10 CFR 20 in Unrestricted Areas. Since the Radiological Effluent Controls are constructed such that the numerical values of the annual dose limits of 10 CFR 20 be applied on an instantaneous basis (i.e., no time averaging over the year), and the integrated dose objectives of 10 CFR 50, Appendix I provide for corrective actions to reduce effluents if the ALARA dose values are exceeded, assurance is obtained that compliance with the revised annual dose limits of 10 CFR 20.1301 (100 mrem total effective dose equivalent to a member of the public) will also be met. The use of the stated instantaneous release rate values, which equate to the site dose rate limits, also provides operational flexibility to accommodate short periods of higher than normal effluent releases that may occur during plant operations.

APPENDIX II.A
REMODCM METHODOLOGY CROSS–REFERENCES

Radiological effluent controls (Sections III, IV, and V) identify the requirements for monitoring and limiting liquid and gaseous effluents releases from the site such the resulting dose impacts to members of the public are kept to "As Low As Reasonably Achievable" (ALARA). The demonstration of compliance with the dose limits is by calculational models that are implemented by Section II of the REMODCM.

Table App. II.A–1 provides a cross–reference guide between liquid and gaseous effluent release limits and those sections of the REMODCM, which are used to determine compliance. It also shows the administrative Technical Specifications which reference the REMODCM for operation of radioactive waste processing equipment. This table also provides a quick outline of the applicable limits or dose objectives and the required actions if those limits are exceeded. Details of the effluent control requirements and the implementing sections of the REMODCM should be reviewed directly for a full explanation of the requirements.

Table II.A.–1
Millstone Effluent Requirements and Methodology Cross Reference

Radiological Effluent Controls & Technical Specifications	REMODCM Methodology Section	Applicable Limit or Objective	Exposure Period	Required Action
IV/V.E.1.a Liquid Effluent Concentration	Tables I.C.–2 and I.C.–3	Ten times 10CFR20App.B, Table 2, Column 2, & 2x10^{-4} μCi/mL for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 mins.
IV/V.E.1.b Dose–Liquids	II.C.1.	≤ 1.5 mrem T.B. ≤ 5 mrem Organ	Calendar Quarter**	30–day report if exceeded. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the REMP in Section I.
	II.C.1.	≤ 3 mrem T.B. ≤ 10 mrem Organ	Calendar Year	
T.S. 6.16 & 6.20(Unit 2) T.S. 6.14 & 6.15 (Unit 3) Liquid Radwaste Treatment	I.C.2. II.C.2.	≤ 0.06 mrem T.B. ≤ 0.2 mrem Organ	Projected for 31 days (if system not in use)	Return to operation Liquid Waste Treatment System
III.D.2.a IV/V.D.2.a T.S. 6.20 (Unit 2) T.S. 6.15 (Unit 3) Gaseous Effluents Dose Rate	Tables I.D.–1, I.D.–2, & I.D–3	≤ 500 mrem/yr T.B. from noble gases*	Instantaneous	Restore release rates to within specifications within 15 minutes
	II.D.1.a.	≤ 3000 mrem/yr skin from noble gases*		
	II.D.1.b.	≤ 1500 mrem/yr organ from particulates with $T_{1/2}$ > 8d., I-131, I-133 & tritium*		
III.D.2.b IV/V.D.2.bDose Noble Gases	II.D.2.	≤ 5 mrad gamma air ≤ 10 mrad beta air	Calendar Quarter**	30–day report if exceeded
		≤ 10 mrad gamma air ≤ 20 mrad beta air	Calendar Year	
III.D.2.c IV/V.D.2.c Dose I-131, I-133, Particulates, H-3	II.D.3.	≤ 7.5 mrem organ	Calendar Quarter**	30–day report if exceeded. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the REMP in Section I.
		≤ 15 mrem organ	Calendar Year	
T.S. 5.6.4 (Unit 1) T.S. 6.14 (Unit 2) T.S 6.14 & T.S 6.15 (U3) Gaseous Radwaste Treatment	II.D.2. II.D.4.	> 0.02 mrad gamma air > 0.04 mrad beta air > 0.03 mrem organ	Projected for 31 Days (if system not in use)	Return to operation Gaseous Radwaste Treatment System
II.E IVI /V.F Total Dose	II.D.5.	≤ 25 mrem T.B.* ≤ 25 mrem organ* ≤ 75 mrem thyroid*	12 Consecutive Months**	30–day report if Unit 1 Effluent Control III.D.1.2, III.D.2.2, or III.D.2.3 or Units 2/3 Effluent Control IV/V.E.1.2, IV/V.E.2.2, or IV/V.E.2.3 are exceeded by a factor of 2. Restore dose to public to within the applicable EPA limit(s) or obtain a variance

NOTE: T.B. means total or whole body.
* Applies to the entire site (Units 1, 2, and 3) discharges combined.
**Cumulative dose contributions calculated once per 31 days.

SECTION III.

Millstone Unit 1

Radiological Effluent Controls

Docket Nos. 50–245

SECTION III. **REMODCM UNIT ONE CONTROLS**

III.A. **Introduction**

The purpose of this section is to provide the following for Millstone Unit One:

a. the effluent radiation monitor controls and surveillance requirements,

b. the effluent radioactivity concentration and dose controls and surveillance requirements, and

c. the bases for the controls and surveillance requirements.

Definitions of certain terms are provided as an aid for implementation of the controls and requirements.

Some surveillance requirements refer to specific sub–sections in Sections I and II as part of their required actions

III.B. **Definitions and Surveillance Requirement (SR) Applicability**

<u>III.B.1 – Definitions</u>

The defined terms of this sub–section appear in capitalized type and are applicable throughout Section III.

1. ACTION – that part of a Control that prescribes remedial measures required under designated conditions.

2. INSTRUMENT CALIBRATION – the adjustment, as necessary, of the instrument output such that it responds within the necessary range and accuracy to know values of the parameter that the instrument monitors. The INSTRUMENT CALIBRATION shall encompass those components, such as sensors, displays, and trip functions, required to perform the specified safety function(s). The INSTRUMENT CALIBRATION shall include the INSTRUMENT FUNCTIONAL TEST and may be performed by means of any series of sequential, overlapping, or total channel steps so that the entire channel is calibrated.

3. INSTRUMENT FUNCTIONAL TEST – the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify that the instrument is FUNCTIONAL, including all components in the channel, such as alarms, interlocks, displays, and trip functions, required to perform the specified safety function(s). For digital instruments, the computer database may be manipulated, in lieu of a signal injection, to verify operability of alarm and/or trip functions. The INSTRUMENT FUNCTIONAL TEST may be performed by means of any series of sequential, overlapping, or total channel steps so that the entire channel is tested.

4. CHANNEL CHECK – the qualitative determination of functionality by observation of behavior during operation. This determination shall include, where possible, comparison of the instrument with other independent instruments measuring the same variable. ①

5. FUNCTIONAL – An instrument shall be FUNCTIONAL when it is capable of performing its specified functions(s). Implicit in this definition shall be the assumption that all necessary attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the instrument to perform its functions(s) are also capable of performing their related support function(s).

6. REAL MEMBER OF THE PUBLIC – an individual, not occupationally associated with the Millstone site, who is exposed to existing dose pathways at one particular location. This does not include employees of the utility or utilities which own a Millstone plant and utility contractors and vendors. Also excluded are persons who enter the Millstone site to service equipment or to make deliveries. This does include persons who use portions of the Millstone site for recreational, occupational, or other purposes not associated with any of the Millstone plants.

7. SITE BOUNDARY – that line beyond which the land is not owned, leased, or otherwise controlled by the licensee.

8. SOURCE CHECK – the qualitative assessment of channel response when the channel is exposed to radiation.

9. RADIOACTIVE WASTE TREATMENT SYSTEMS – Radioactive Waste Treatment Systems are those liquid, gaseous, and solid waste systems which are required to maintain control over radioactive materials in order to meet the controls set forth in this section.

III.B.2 – Surveillance Requirement (SR) Applicability

1. SRs shall be met during specific conditions in the Applicability for individual LCOs unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in III.B.2 3. Surveillances do not have to be performed on nonfunctional equipment or variables outside specified limits.

2. The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the frequency is met.

3. If it is discovered that a Surveillance was not performed within its specified frequency, then compliance with the requirement to declare the LCO not met may be delayed from the time of discovery up to 24 hours or up to the limit of the specified frequency, whichever is less. This delay period is permitted to allow performance of the surveillance. If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met and the applicable Condition(s) must be entered. The Completion Times of the Required Actions begin immediately upon expiration of the delay period. When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met and the applicable Condition(s) must be entered. The Completion Times of the Required Actions begin immediately upon failure to meet the Surveillance.

III.C. **Radioactive Effluent Monitoring Instrumentation**

1. Radioactive Liquid Effluent Monitoring Instrumentation

CONTROLS

The radioactive liquid effluent monitoring instrumentation channels shown in Table III.C.–1 shall be FUNCTIONAL with applicable alarm/trip setpoints set to ensure that the limits of Specification III.D.1.a. are not exceeded. The setpoints shall be determined in accordance with methods and parameters described in Section II.

APPLICABILITY: As shown in Table III.C.–1

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above Specification, without delay suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels FUNCTIONAL requirement, take the action shown in Table III.C.–1. Exert best efforts to restore the nonfunctional monitor to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Releases need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENTS

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table III.C.–2.

TABLE III.C.-1 Radioactive Liquid Effluent Monitoring Instrumentation				
Instrument	Minimum # Functional	Alarm Setpoints Required	Applicability	Action
1. Spent Fuel Pool Radioactivity Monitor Liquid Effluent Line	1	Yes	*	A

* Whenever the pathway is being used except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling.

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirements, effluent releases may continue provided that best efforts are made to repair the instrument and that prior to initiating a release:

(1) At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification III.D.1.a. and;

(2) The original release rate calculations and discharge valving are independently verified by a second individual.

TABLE III.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Spent Fuel Pool Radioactivity Monitor Liquid Effluent Line	D*	P	T(1)	Q

D = Daily
P = Prior to each batch release
T = Once every two years
Q = Once every 3 months

* During releases via this pathway and when the monitor is required FUNCTIONAL per Table III.C.–1. The CHANNEL CHECK should be done when the discharge is in progress.

(1) Calibration shall include the use of a radioactive liquid or solid source which is traceable to an NIST source.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

CONTROLS

The radioactive gaseous effluent monitoring instrumentation channels shown in Table III.C.–3 shall be FUNCTIONAL with applicable alarm setpoints set to ensure that the limits of Control III.D.2.a. are not exceeded. The setpoints shall be determined in accordance with methods and parameters described in Section II.F.1.

APPLICABILITY: As shown in Table III.C.–3

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm setpoint less conservative than required by the above Control, without delay suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels functional requirements, take the action shown in Table III.C.–3. Exert best efforts to restore the nonfunctional monitor to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radiological Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Release need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENT

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the INSTRUMENT CHECK, INSTRUMENT CALIBRATION, INSTRUMENT FUNCTIONAL TEST, and SOURCE CHECK operations at the frequencies shown in Table III.C.–4.

TABLE III.C.–3 Radioactive Gaseous Effluent Monitoring Instrumentation				
Instrument	Minimum # Functional	Alarm Setpoints Required	Applicability	Action
1.Spent Fuel Pool Island Vent				
(a) Noble Gas Radioactivity Monitor	1	Yes	*	A
(b) Particulate Sampler	1	No	*	B
(c) Vent Flow Rate Monitor	1	No	*	C
(d) Sampler Flow Rate Monitor	1	Yes	*	D
2.Balance of Plant Vent				
(a) Particulate Sampler	1	No	*	B
(b) Sampler Flow Monitor	1	Yes	*	D

* Channels are FUNCTIONAL and in service on a continuous, uninterrupted basis when exhaust fans are operating, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required tests, checks, calibrations, and sampling associated with the instrument or any system or component which affects functioning of the instrument.

ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken daily when fuel is being moved, or during any evolution or event which would threaten fuel integrity, and these samples are analyzed for gamma radioactivity within 24 hours. ①

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum number FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that a 24 hour sample is collected with auxiliary sampling equipment once every seven (7) days, or anytime significant generation of airborne radioactivity is expected, and analyzed for principal gamma emitters with half lives greater than 8 days within 24 hours after the end of the sampling period. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once during the Chemistry compensatory sampling time period as specified in Action A or Action B. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

TABLE III.C.–4 **Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Instrument Calibration	Functional Test	Source Check
1.Spent Fuel Pool Island Vent				
(a) Noble Gas Radioactivity Monitor	D(3)	T(6)	Q(7)	M
(b) Particulate Sampler	TM	NA	NA	NA
(c) Vent Flow Rate Monitor	D	T	NA	NA
(d) Sampler Flow Rate Monitor	D	T	NA	NA
2.Balance of Plant Vent				
(a) Particulate Sampler	TM	NA	NA	NA
(b) Sampler Flow Monitor	D	T	NA	NA

D = Daily
W = Weekly
TM = Twice per month
M = Monthly
Q = Once every 3 months
T = Once every two years
NA = Not Applicable

Table III.C.–4
TABLE NOTATION

(1) RESERVED

(2) RESERVED

(3) Instrument check daily only when there exist releases via this pathway.

(4) RESERVED

(5) RESERVED

(6) Calibration shall include the use of a known source whose strength is determined by a detector which has been calibrated to a source which is traceable to the NIST. These sources shall be in a known reproducible geometry.

(7) The INSTRUMENT FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

1. Instrument indicates measured levels above the alarm/trip setpoint.
2. Instrument indicates a downscale failure.

III.D. **Radioactive Effluents Concentrations And Dose Limitations**

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATIONS

The concentration of radioactive material released from the site (see Figure III.D.–1) shall not exceed ten times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 2 x 10^{-4} μCi/ml total radioactivity. ①

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released from the site exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

SURVEILLANCE REQUIREMENT

Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.
The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Specification III.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATIONS

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 1 released from the site (see Figure III.D.–1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ; and,

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

CONTROLS

The dose rate, at any time, offsite (See Figure III.D.–1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

a. The dose rate limit for noble gases shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin; and,

b. The dose rate limit for Tritium and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate to comply with the limit(s) given in Control III.D.2.a. within 15 minutes.

SURVEILLANCE REQUIREMENT

1) The instantaneous release rate corresponding to the above dose rate shall be determined in accordance with the methodology of Section II.

2) The instantaneous release rate shall be monitored in accordance with the requirements of Section III.C.2.

3) Sampling and analysis shall be performed in accordance with Section I to assure that the limits of Control III.D.2.a. are met.

b. Radioactive Gaseous Effluents Noble Gas Dose

CONTROLS

The air dose offsite (see Figure III.D.–1) due to noble gases released in gaseous effluents from Unit 1 shall be limited to the following:

a. During any calendar quarter, to less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation;

b. During any calendar year to less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

c. Gaseous Effluents – Dose from Radionuclides Other than Noble Gas

CONTROLS

The dose to any REAL MEMBER OF THE PUBLIC from Tritium and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 1 (see Figure III.D.–1) shall be limited to the following:

a. During any calendar quarter to less than or equal to 7.5 mrem [to any organ];

b. During any calendar year to less than or equal to 15 mrem [to any organ].

APPLICABILITY: At all times.

ACTION:

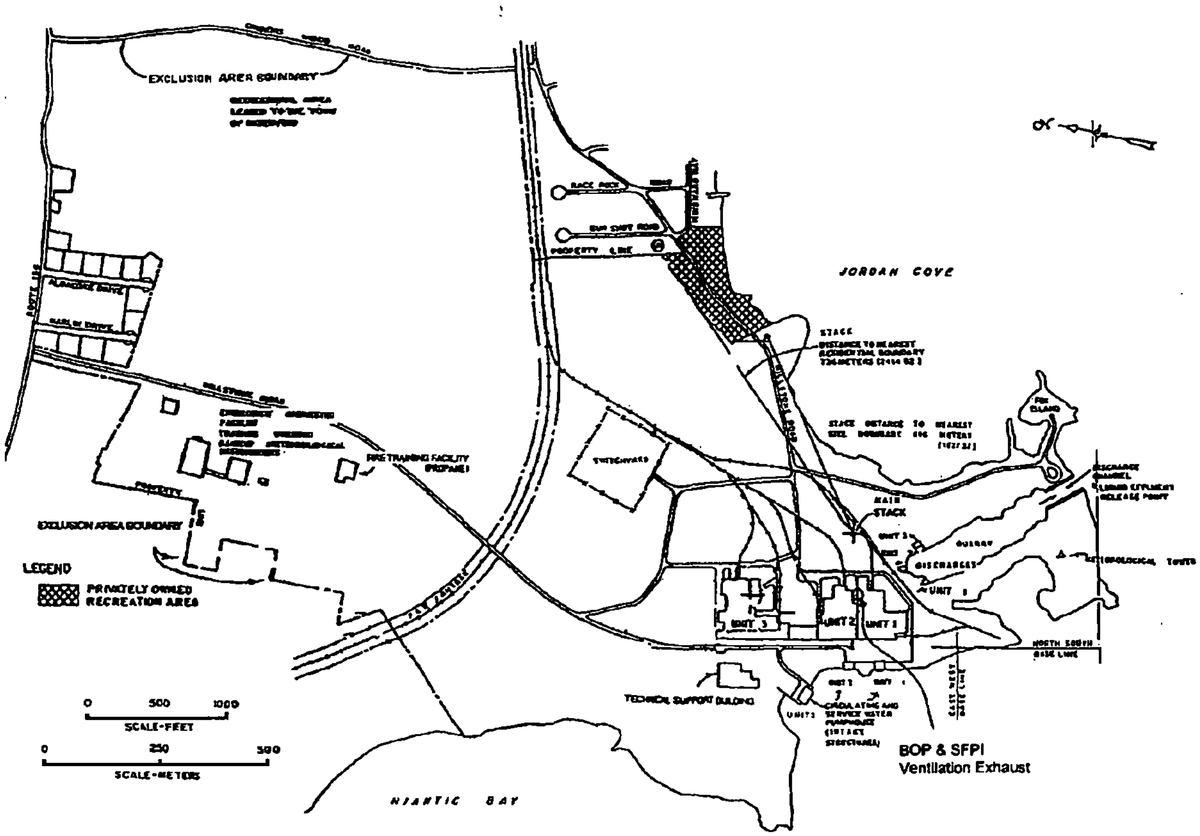
With the calculated dose from the release of Tritium and radioactive materials in particulate form exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases of radioactive materials in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

Figure III.D.−1, “Site Boundary for Liquid and Gaseous Effluents”



III.E. Total Radiological Dose From Station Operations Controls

CONTROLS

The annual dose or dose commitment to any REAL MEMBER OF THE PUBLIC, beyond the site boundary, from the Millstone Site 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).

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls III.D.1.b., III.D.2.b. or III.D.2.c. prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the dose commitment from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. This Special Report shall include an analysis which demonstrates that radiation exposures from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site (including all effluent pathways and direct radiation) are less than the 40 CFR 190 Standard.

If the estimated doses exceed the above limits, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with Section II once per 31 days.

III.F. Bases

Section III.C.1 – Radioactive Liquid Effluent Monitoring Instrumentation

No controls required; Unit 1 is not currently releasing radioactivity in liquid effluents

Section III.C.2 – Radioactive Gaseous Effluent Monitoring Instrumentation

The Spent Fuel Pool Island Vent is the only gaseous pathway currently requiring radiation monitoring for Unit 1.

Section III.D.1.a. – Radioactive Liquid Effluents Concentrations

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A. design objectives of Appendix I, 10 CFR 50, to an individual and (2) the limits of 10 CFR 20 to the population. The concentration limit for noble gases is based upon the assumption that Xe–135 is the controlling radioisotope and its concentration in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Section III.D.1.b. – Radioactive Liquid Effluents Doses

This specification is provided to implement the requirements of Sections II.A., III.A, and IV.A of Appendix I, 10 CFR 50. The specification implements the guides set forth in Section II.A of Appendix I. The Action statements provide the required operating flexibility and at the same time implement the guides set forth in Section III.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in 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," Revision 1, October 1977, and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Section III.D.2.a. – Radioactive Gaseous Effluents Dose Rate

This control is provided to ensure that the dose rate at anytime from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR 20, Appendix B, Table 2. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual offsite to annual average concentrations exceeding the limits specified in Appendix B, Table 2 of 10 CFR 20. For individuals who may, at times, be within the site boundary, the occupancy of that individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to an infant via the cow–milk–infant pathway to less than or equal to 1500 mrem/year for the nearest cow to the plant.

Section III.D.2.b. – Radioactive Gaseous Effluents Noble Gas Dose

This control is provided to implement the requirements of Sections II.B., III.A., and IV.A. of Appendix I, 10 CFR 50. The control implements the guides set forth in Section II.B of Appendix I. The action statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculational of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision 1, July 1977.

The ODCM equations provided for determining the air doses at the site boundary were based upon utilizing successively more realistic dose calculational methodologies. More realistic dose calculational methods are used whenever simplified calculations indicate a dose approaching a substantial portion of the regulatory limits. The methods used are, in order, previously determined air dose per released radioactivity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released. ①

Section III.D.2.c. – Radioactive Gaseous Effluents, Particulates, and Gas Other Than Noble Gas Doses

These controls is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR 50. The controls are the guides set forth in Section II.C of Appendix I. The action statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides for Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials will to be consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I," Revision I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision I, July 1977. These equations provide for determining the doses based upon either conservative atmospheric dispersion and an assumed critical nuclide mix or using real time meteorology and specific nuclides released. The release rate specifications for radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man. The pathways which are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Section III.E. – Total Radiological Dose from Station Operations

This control is provided to meet the reporting requirements of 40 CFR 190. For the purpose of the Special Report, it may be assumed that the dose commitment to any REAL MEMBER OF THE PUBLIC from other fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered.

SECTION IV.

Millstone Unit 2

Radiological Effluent Controls

Docket Nos. 50–336

SECTION IV. REMODCM UNIT TWO CONTROLS

IV.A. Introduction

The purpose of this section is to provide the following for Millstone Unit Two:

a. the effluent radiation monitor controls and surveillance requirements,

b. the effluent radioactivity concentration and dose controls and surveillance requirements, and

c. the bases for the controls and surveillance requirements.

Definitions of certain terms are provided as an aid for implementation of the controls and requirements.

Some surveillance requirements refer to specific sub–sections in Sections I and II as part of their required actions.

IV.B. Definitions, Applicability and Surveillance Requirements

IV.B.1 – Definitions

The defined terms of this sub–section appear in capitalized type and are applicable throughout Section IV.

1. ACTION – Those additional requirements specified as corollary statements to each principal control and shall be part of the control.

2. FUNCTIONAL / FUNCTIONALITY – An instrument shall be FUNCTIONAL or have FUNCTIONALITY when it is capable of performing its specified functions(s) and when all necessary attendant instrumentation, controls, normal and emergency electrical power sources, or other auxiliary equipment that are required for the instrument to perform its functions are also capable of performing their related support functions.

3. CHANNEL CALIBRATION – A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to know values of the parameter which the channel monitors. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm and/or trip functions, and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

4. CHANNEL CHECK – A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

5. CHANNEL FUNCTIONAL TEST – A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify FUNCTIONALITY including alarm and/or trip functions. For digital instruments, the computer database may be manipulated, in lieu of a signal injection, to verify functionality of alarm and/or trip functions.

6. SOURCE CHECK – A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to radiation.

7. MEMBER(S) OF THE PUBLIC – MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or its 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 plant.

   The term "REAL MEMBER OF THE PUBLIC" means an individual who is exposed to existing dose pathways at one particular location.

8. MODE – Refers to Mode of Operation as defined in Safety Technical Specifications.

9. SITE BOUNDARY – The SITE BOUNDARY shall be that line beyond which the land is not owned, leased, or otherwise controlled by the licensee.

10. UNRESTRICTED AREA – Any area at or beyond the site boundary to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the site boundary used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

11. DOSE EQUIVALENT I−131 – DOSE EQUIVALENT I−131 shall be that concentration of I−131 (μCi/gram) which alone would produce the same CDE−thyroid dose as the quantity and isotopic mixture of I−131, I−132, I−133, I−134, and I−135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed under Inhalation in Federal Guidance Report No. 11 (FGR 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion."

IV.B.2 – Applicability

IV.B.2a – LIMITING CONDITIONS FOR OPERATION

1. Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

2. Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and associated ACTION requirements are not met within the specified time intervals, except as provided in Condition IV.B.2.a(6). If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3. NOT USED.

4. NOT USED.

5. When a system, subsystem, train, component or device is determined to be nonfunctional solely because its emergency power source is nonfunctional, or solely because its normal power source is nonfunctional, it may be considered FUNCTIONAL for the purpose of satisfying the requirements of its applicable Limiting Condition for Operation, provided: (1) its corresponding normal or emergency power source is FUNCTIONAL; and (2) all of its redundant system(s), subsystem(s), train(s), component(s) and device(s) are FUNCTIONAL, or likewise satisfy the requirements of this specification.

6. Equipment removed from service or declared nonfunctional to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its FUNCTIONALITY or the FUNCTIONALITY of other equipment. This is an exception to Condition IV.B.2.a(2) for the system returned to service under administrative control to perform the testing required to demonstrate FUNCTIONALITY.

IV.B2.b – SURVEILLANCE REQUIREMENTS

1. Surveillance Requirements shall be applicable during any condition specified for individual Limiting Conditions for Operation unless otherwise stated in an individual Surveillance Requirement.

2. Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance time interval.

3. Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Condition IV.B2.b(2), shall constitute a failure to meet the FUNCTIONALITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on nonfunctional equipment.

4. Entry into any specified condition shall not be made unless the Surveillance Requirement(s) associated with the Limiting Condition for Operation have been performed within the stated surveillance interval or as otherwise specified.

IV.C. **Radioactive Effluent Monitoring Instrumentation**

1. Radioactive Liquid Effluent Monitoring Instrumentation

<u>LIMITING CONDITIONS OF OPERATIONS</u>

The radioactive liquid effluent monitoring instrumentation channels shown in Table IV.C.–1 shall be FUNCTIONAL with applicable alarm/trip setpoints set to ensure that the limits of Specification IV.D.1.a. are not exceeded. The setpoints shall be determined in accordance with methods and parameters described in Section II.

<u>APPLICABILITY:</u> As shown in Table IV.C.–1

<u>ACTION:</u>

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above Specification, without delay suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels FUNCTIONAL requirement, take the action shown in Table IV.C.–1. Exert best efforts to restore the nonfunctional monitor to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Releases need not be terminated after 30 days provided the specified actions are continued. ①

<u>SURVEILLANCE REQUIREMENTS</u>

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table IV.C.–2.

TABLE IV.C.–1 **Radioactive Liquid Effluent Monitoring Instrumentation**				
Instrument	Minimum # Functional	Alarm Setpoints Required	Applicability	Action
1.Gross Radioactivity Monitors Providing Automatic Termination Of Release				
(a) Clean Liquid Radwaste Effluent Line	1	Yes	*	A
(b) Aerated Liquid Radwaste Effluent Line	1	Yes	***	A
(c) Steam Generator Blowdown Monitor	1	Yes	****	B
(d) Condensate Polishing Facility Waste Neut Sump	1	Yes	***	E
2.Gross Radioactivity Monitors Not Providing Automatic Termination Of Release				
(a) Reactor Building Closed Cooling Water Monitor#	1	Yes	*	C
3.Flow Rate Measurements				
(a) Clean Liquid Radwaste Effluent Line	1	No	*	D
(b) Aerated Liquid Radwaste Effluent Line	1	No	*	D
(c) Condensate Polishing Facility	1	No	*	D

TABLE IV.C.–1

TABLE NOTES

* At all times – which means that channels shall be FUNCTIONAL and in service on a continuous, uninterrupted basis, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

** Deleted.

*** Whenever the pathway is being used except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

**** MODEs 1–4, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

Since the only source of service water contamination is the reactor building closed cooling water, monitoring of the closed cooling water and conservative leakage assumptions will provide adequate control of service water effluents.

ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirements, effluent releases may continue provided that best efforts are made t repair the instrument and that prior to initiating a release:

(1) At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification IV.D.1.a. and;

(2) The original release rate calculations and discharge valving are independently verified by a second individual.

Action B

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, either:

(1) Suspend all effluent releases via this pathway, or

(2) Make best efforts to repair the instrument and obtain grab samples and analyze for gamma radioactivity at lower limits of detection as specified in Table I.C.−2;

   a) Once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 μCi/gm DOSE EQUIVALENT I−131.

   b) Once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 μCi/gm DOSE EQUIVALENT I−131.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that once per 12 hours grab samples of the service water effluent are collected and analyzed for gamma radioactivity at LLD as specified in Table I.C.−2;

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

Action E

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirements, effluent releases may continue provided that best efforts are made t repair the instrument and that prior to initiating a release:

(1) At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification IV.D.1.a., and;

(2) If one of the samples has gamma radioactivity greater than any of the LLDs in Table I.C.–2, the original release rate calculations and discharge valving are independently verified by a second individual.

TABLE IV.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Gross Radioactivity Monitors Providing Alarm and Automatic Termination Of Release				
a. Clean Liquid Radwaste Effluent Line	D*	P	R(1)	Q(2)
b. Aerated Liquid Radwaste Effluent Line	D*	P	R(1)	Q(2)
c. Steam Generator Blowdown Monitor	D*	M	R(1)	Q(2)
d.Condensate Polishing Facility Waste Neut Sump	D*	P	R(1)	Q(2)
2.Gross Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination Of Release				
a. Reactor Building Closed Cooling Water Monitor	D*	M	R(1)	Q(2)
3.Flow Rate Measurements				
a. Clean Liquid Radwaste Effluent Line	D*	N/A	R	Q
b. Aerated Liquid Radwaste Effluent Line	D*	N/A	R	Q
c. Condensate Polishing Facility Waste Neut Sump	D*	N/A	R	Q

D = Daily
M = Monthly
P = Prior to each batch release

R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

TABLE IV.C.–2
TABLE NOTATION

* During releases via this pathway and when the monitor is required FUNCTIONAL per Table IV.C.–1. The CHANNEL CHECK should be done when the discharge is in progress.

(1) Calibration shall include the use of a radioactive liquid or solid source which is traceable to an NIST source.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

a) Instrument indicates measured levels above the alarm/trip setpoint.

b) Instrument indicates a downscale or circuit failure.
– Automatic isolation of the discharge stream shall also be demonstrated for this case for each monitor except the reactor building closed cooling water monitor.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATIONS

The radioactive gaseous effluent monitoring instrumentation channels shown in Table IV.C.–3 shall be FUNCTIONAL with applicable alarm setpoints set to ensure that the limits of Specifications IV.D.2.a. are not exceeded. The setpoints shall be determined in accordance with methods and parameters described in Section II.

APPLICABILITY: As shown in Table IV.C.–3

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm setpoint less conservative than required by the above specification, without delay suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels FUNCTIONAL requirement, take the action shown in Table IV.C.–3. Exert best efforts to restore the nonfunctional monitor to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Release need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENTS

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table IV.C.–4.

TABLE IV.C.–3 Radioactive Gaseous Effluent Instrumentation				
Instrument	Minimum Channels Functional	Alarm Setpoints Required	Applicability	Action
1.MP2 Vent (normal range, RM–8132 only; high range monitor, RM–8168, requirements are in the TS)				
a. Noble Gas Radioactivity Monitor	1	Yes***	**	A
b. Iodine Sampler	1	No	**	B
c. Particulate Sampler	1	No	**	B
d. Vent Flow Rate Monitor	1	No	**	C
e. Sampler Flow Rate Monitor	1	No	**	C
2.Millstone Stack – applicable to the WRGM (RM–8169, normal range, channel 1, only; mid range channel 2 and high range channel 3 requirements are contained in TRM LCO 3.3.3.8)				
a. Noble Gas Radioactivity Monitor	1	Yes***	**	E
b. Iodine Sampler	1	No	**	B
c. Particulate Sampler	1	No	**	B
d. Stack Flow Rate Monitor	1	No	**	C
e. Sampler Flow Rate Monitor	1	No	**	C
3.Waste Gas Holdup System				
a. Noble Gas Monitor Providing Automatic Termination of Release	1	Yes	*	D

* During waste gas holdup system discharge.

** At all times when air is being released to the environment by the pathway being monitored. The channel shall be FUNCTIONAL and in service on a continuous, uninterrupted basis. Outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

*** No automatic isolation features.

ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours. If the monitor flow and readout are not adversely affected by the loss of functionality, the daily CHANNEL CHECK may be performed in lieu of the grab sample. ①

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum number FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Auxiliary sampling must be initiated within 12 hours of initiation of this action statement. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 5 hours. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement:

Releases from the Millstone Unit 2 waste gas system may continue provided that best efforts are made to repair the instrument and that prior to initiating the release:

a) At least two independent samples of the tank's contents are analyzed; and

b) The original release rate calculations and discharge valve lineups are independently verified by a second individual. Otherwise, suspend releases from the waste gas holdup system.

Action E

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, Millstone Unit 2 releases via the Millstone Stack may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours. If the monitor flow and readout are not adversely affected by the loss of functionality, the daily CHANNEL CHECK may be performed in lieu of the grab sample. ①

TABLE IV.C.–4 Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.MP2 Vent (normal range, RM–8132 only; high range monitor, RM–8168, requirements are in the TS)				
a. Noble Gas Radioactivity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Vent Flow Rate Monitor	D	NA	R	Q
e. Sampler Flow Rate Monitor	D	NA	R	NA
2.Millstone Stack – applicable to the WRGM (RM–8169, normal range, channel 1, only; mid range channel 2 and high range channel 3 requirements are contained in TRM LCO 3.3.3.8)				
a. Noble Gas Radioactivity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Stack Flow Rate Monitor	D	NA	R	Q(2)
e. Sampler Flow Rate Monitor	D	NA	R	NA
3.Waste Gas Holdup System				
a. Noble Gas Monitor	D*	P	R(1)	Q(2)

*During releases via this pathway and when the monitor is required FUNCTIONAL per Table IV.C.–3. The CHANNEL CHECK should be performed when the discharge is in progress.

P = Prior to discharge
D = Daily
W = Weekly
M = Monthly

R = Once every 18 months
Q = Once every 3 months
NA= Not Applicable

TABLE IV.C.–4
<u>TABLE NOTATION</u>

(1) Calibration shall include the use of a known source whose strength is determined by a detector which has been calibrated to a source which is traceable to the NIST. These sources shall be in a known, reproducible geometry.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation* occurs if any of the following conditions exist:

a) Instrument indicates measured levels above the alarm/trip setpoint.

b) Instrument indicates a downscale failure.

* – Also demonstrate automatic isolation for the waste gas system noble gas monitor.

IV.D. **Radioactive Effluents Concentrations And Dose Limitations**

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

   LIMITING CONDITIONS OF OPERATIONS

   The concentration of radioactive material released from the site (see Figure IV.D.–1) shall not exceed ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 2×10^{-4} μCi/ml total radioactivity. ①

   APPLICABILITY: At all times.

   ACTION:

   With the concentration of radioactive material released from the site exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

   SURVEILLANCE REQUIREMENTS

   1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

   2) The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Specification IV.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATIONS

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 2 released from the site (see Figure IV.D.–1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ; and,

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations. Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in Section II at least once per 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATIONS

The dose rate, at any time, offsite (see Figure IV.D.–1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

a. The dose rate limit for noble gases shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin; and,

b. The dose rate limit for Iodine–131, Iodine–133, Tritium, and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate to comply with the limit(s) given in Specification IV.D.2.a. within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) The release rate, at any time, of noble gases in gaseous effluents shall be controlled by the offsite dose rate as established above in Specification IV.D.2.a. The corresponding release rate shall be determined in accordance with the methodology of Section II.

2) The noble gas effluent monitors of Table IV.C.–3 shall be used to control release rates to limit offsite doses within the values established in Specification IV.D.2.a.

3) The release rate of radioactive materials in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATIONS

The air dose offsite (see Figure IV.D.–1) due to noble gases released in gaseous effluents from Unit 2 shall be limited to the following:

a. During any calendar quarter, to less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation;

b. During any calendar year to less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

c. Gaseous Effluents – Doses from Radionuclides Other than Noble Gas

LIMITING CONDITIONS OF OPERATIONS

The dose to any REAL MEMBER OF THE PUBLIC from Iodine–131, Iodine–133, Tritium, C–14, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 2 (see Figure IV.D.–1) shall be limited to the following: ①

a. During any calendar quarter to less than or equal to 7.5 mrem to any organ;

b. During any calendar year to less than or equal to 15 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

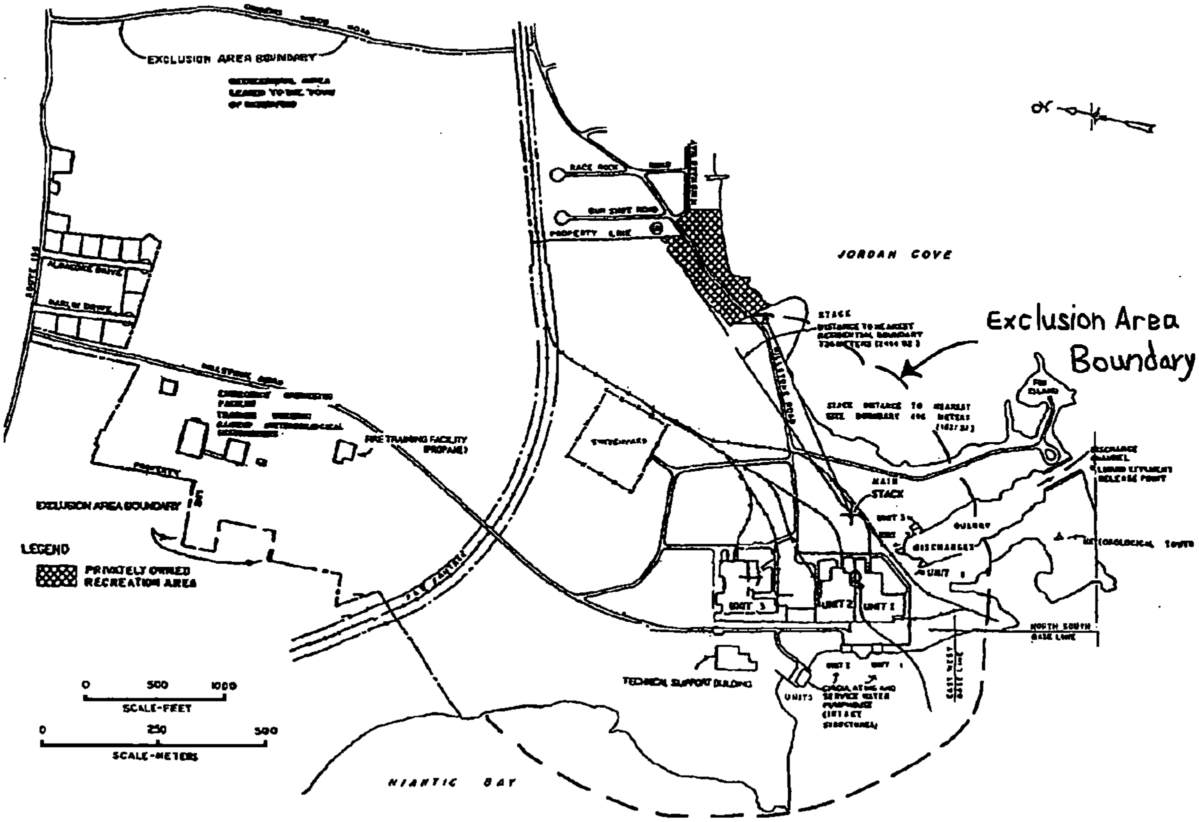
a. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

Figure IV.D.–1, “Site Boundary for Liquid and Gaseous Effluents”



IV.E. Total Radiological Dose From Station Operation

CONTROLS

The annual dose or dose commitment to any REAL MEMBER OF THE PUBLIC, beyond the site boundary, from the Millstone Site 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).

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls IV.D.2.a., IV.D.1.b., or IV.D.2.c. prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the dose commitment from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. This Special Report shall include an analysis which demonstrates that radiation exposures from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site (including all effluent pathways and direct radiation) are less than the 40 CFR 190.

If the estimated doses exceed the above limits, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with Section II once per 31 days.

IV.F. Bases

Section IV.C.1. – Radioactive Liquid Effluent Monitoring Instrumentation

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the approved methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding ten times the limits of 10 CFR 20. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 50. Monitoring of the turbine building sumps and condensate polishing facility floor drains is not required due to relatively low concentrations of radioactivity possible.

Section IV.C.2. – Radioactive Gaseous Effluent Monitoring Instrumentation

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm setpoints for these instruments shall be calculated in accordance with the approved methods in the REMODCM to ensure that the alarm will occur prior to exceeding the dose rate limits, at any time, as specified in Section IV.D.2.a. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 50.

Two types of radioactive gaseous effluent monitoring instrumentation, monitors and samplers, are being used at MP2 vent and Millstone Stack. Monitors have alarm setpoints and are demonstrated functional by performing one or more of the following operations: CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST. Samplers are strictly collection devices made of canisters and filters. The CHANNEL CHECK surveillance requirements are met through (1) documented observation of the in–service rad monitor sample flow prior to filter replacement; (2) documented replacement of in–line iodine and particulate filters; and (3) documented observation of sample flow following the sampler return to service. The flow indicator is the only indication available for comparison. These observations adequately provide assurance that the sampler is operating and is capable of performing its design function.

There are a number of gaseous release points which could exhibit very low concentrations of radioactivity. For all of these release paths, dose consequences would be insignificant due to the intermittent nature of the release and/or the extremely low concentrations of radioactivity. Since it is not cost–beneficial (nor in many cases practical due to the nature of the release (steam) or the impossibility of detecting such low levels), to monitor these pathways, it has been determined that these release paths require no monitoring or sampling.

Section IV.D.1.a. – Radioactive Liquid Effluents Concentrations

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR 50, to an individual and (2) the limits of 10 CFR 20 to the population. The concentration limit for noble gases is based upon the assumption that Xe−135 is the controlling radioisotope and its concentration in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Section IV.D.1.b. – Radioactive Liquid Effluents Doses

This specification is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR 50. The specification implements the guides set forth in Section II.A of Appendix I. The Action statements provide the required operating flexibility and at the same time implement the guides set forth in Section III.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in 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, Revision 1, October 1977, and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Section IV.D.2.a. – Radioactive Gaseous Effluents Dose Rate

This specification is provided to ensure that the dose rate at anytime from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR 20, Appendix B, Table 2. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual offsite to annual average concentrations exceeding the limits specified in Appendix B, Table 2 of 10 CFR 20. For individuals who may, at times, be within the site boundary, the occupancy of that individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid or any other organ dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

SECTION V.

Millstone Unit 3

Radiological Effluent Controls

Docket Nos. 50–423

SECTION V. REMODCM UNIT THREE CONTROLS

V.A. Introduction

The purpose of this section is to provide the following for Millstone Unit Three:

a. the effluent radiation monitor controls and surveillance requirements,

b. the effluent radioactivity concentration and dose controls and surveillance requirements, and

c. the bases for the controls and surveillance requirements.

Definitions of certain terms are provided as an aid for implementation of the controls and requirements.

Some surveillance requirements refer to specific sub–sections in Sections I and II as part of their required actions.

V.B. Definitions and Applicability and Surveillance Requirements

V.B.1 – Definitions

The defined terms of this sub–section appear in capitalized type and are applicable throughout Section V.

1. ACTION – ACTION shall be that part of the control which prescribes remedial measures required under designated conditions.

2. CHANNEL FUNCTIONAL TEST – A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify FUNCTIONALITY of alarm, interlock and/or trip functions. For digital instruments, the computer database may be manipulated, in lieu of a signal injection, to verify functionality of alarm and/or trip functions.

   The CHANNEL FUNCTIONAL TEST shall include adjustments, as necessary, of the alarm, interlock and/or trip setpoints such that the setpoints are within the required range and accuracy.

3. CHANNEL CALIBRATION – A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock and/or trip functions and may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

4. CHANNEL CHECK – A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

5. DOSE EQUIVALENT I–131 – DOSE EQUIVALENT I–131 shall be that concentration of I–131 (µCi/gram) which alone would produce the same CDE–thyroid dose as the quantity and isotopic mixture of I–131, I–132, I–133, I–134, and I–135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed under Inhalation in Federal Guidance Report No. 11 (FGR 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion."

6. MEMBER(S) OF THE PUBLIC – MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors or its 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 plant.

   The term "REAL MEMBER OF THE PUBLIC" means an individual who is exposed to existing dose pathways at one particular location.

7. MODE – Refers to Mode of Operation as defined in Safety Technical Specifications.

8. FUNCTIONAL – FUNCTIONALITY – An instrument shall be FUNCTIONAL or have FUNCTIONALITY when it is capable of performing its specified functions(s) and when all necessary attendant instrumentation, controls, electrical power, or other auxiliary equipment that are required for the instrument to perform its functions(s) are also capable of performing their related support function(s).

9. SITE BOUNDARY – The SITE BOUNDARY shall be that line beyond which the land is not owned, leased, or otherwise controlled by the licensee.

10. SOURCE CHECK – A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to radiation.

11. UNRESTRICTED AREA – Any area at or beyond the SITE BOUNDARY to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the SITE BOUNDARY used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

V.B.2 – Applicability

V.B.2.a – LIMITING CONDITIONS FOR OPERATION

1. Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

2. Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and associated ACTION requirements are not met within the specified time intervals. If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

V.B.2.b – SURVEILLANCE REQUIREMENTS

1. Surveillance Requirements shall be applicable during any condition specified for individual Limiting Conditions for Operation unless otherwise stated in an individual Surveillance Requirement.

2. Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance time interval.

3. Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Condition V.B.2.b(2), shall constitute a failure to meet the FUNCTIONALITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on nonfunctional equipment. ①

4. Entry into any specified condition shall not be made unless the Surveillance Requirement(s) associated with the Limiting Condition for Operation have been performed within the stated surveillance interval or as otherwise specified.

V.C. Radioactive Effluent Monitoring Instrumentation

1. Radioactive Liquid Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

The radioactive liquid effluent monitoring instrumentation channels shown in Table V.C.–1 shall be FUNCTIONAL with their Alarm/Trip setpoints set to ensure that the limits of Specification V.D.1.a are not exceeded. The alarm/trip setpoints shall be determined in accordance with methodology and parameters as described in Section II.

APPLICABILITY: As shown in Table V.C.–1

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel Alarm/Trip setpoint less conservative than required by the above specification, without delay suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels FUNCTIONAL, take the action shown in Table V.C.–1. Exert best efforts to restore the nonfunctional instrumentation to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Releases need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENTS

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL OPERATIONAL TEST at the frequencies shown in Table V.C.–2.

TABLE V.C.–1 Radioactive Liquid Effluent Monitoring Instrumentation			
Instrument	Minimum # Functional	Applicability	Action
1.Radioactivity Monitors Providing Alarm and Automatic Termination Of Release			
a. Waste Neutralization Sump Monitor Condensate Polishing Facility	1*	##	D
b. Turbine Building Floor Drains	1	#	B
c. Liquid Waste Monitor	1	#	A
d. RESERVED			
e. Steam Generator Blowdown Monitor	1	###	B
2.Flow Rate Measurement Devices – No Alarm Setpoint Requirements			
a. Waste Neutralization Sump Effluents	1*	#	C
b. RESERVED			
c. Liquid Waste Effluent Line	1	#	C
d. RESERVED			
e. Steam Generator Blowdown Effluent Line	1	###	C

* NA if tritium in the steam generators is less than detectable, or gamma radioactivity in the steam generators is less than 5 x 10^{-7} μCi/ml, or the sump is being directed to radwaste.

At all times – which means that channels shall be FUNCTIONAL and in service on a continuous, uninterrupted basis, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

MODEs 1–5, and MODE 6 when pathway is being used, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument. The monitor must be on-line with no unexpected alarms. When the affected discharge path is isolated in MODE 6, the applicable LCO and Surveillance Requirements are not applicable.

MODEs 1–4, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument. The monitor must be on-line with no unexpected alarms.

TABLE V.C.-1
ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirements, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that prior to initiating a release:

1. At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification V.D.1.a. and;
2. The original release rate calculations and discharge line valving are independently verified by a second individual.

Action B

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that grab samples are analyzed for gamma radioactivity at the lower limits of detection specified in Table I.C.-3:

1. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 μCi/gram DOSE EQUIVALENT I-131, or
2. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 μCi/gram DOSE EQUIVALENT I-131.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirements, effluent releases may continue provided that best efforts are made to repair the instrument and that prior to initiating a release:

1. At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification V.D.1.a., and;
2. If one of the samples has gamma radioactivity greater than any of the lower limits of detection specified in Table I.C.-3, the original release rate calculations and discharge valving are independently verified by a second individual.

TABLE V.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Radioactivity Monitors Providing Alarm and Automatic Termination Of Release				
a. Waste Neutralization Sump Monitor Condensate Polishing Facility	D	P	R(2)	Q(1)
b. Turbine Building Floor Drains	D	M	R(2)	Q(1)
c. Liquid Waste Monitor	D	P	R(2)	Q(1)
d. Deleted				
e. Steam Generator Blowdown Monitor	D	M	R(2)	Q(1)
2.Flow Rate Measurements				
a. Waste Neutralization Sump Effluents	D(3)	NA	R	Q
b. RESERVED				
c. Liquid Waste Effluent Line	D(3)	N/A	R	Q
d. Deleted				
e. Steam Generator Blowdown Effluent Line	D(3)	N/A	R	Q

D = Daily
M = Monthly
P = Prior to each batch release
R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

TABLE V.C.–2
TABLE NOTATION

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur if any of the following conditions exists:

a) Instrument indicates measured levels above the alarm/trip setpoint, or

b) Circuit failure (Alarm only), or Instrument indicates a downscale failure (Alarm only).

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities of NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(3) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

The radioactive gaseous effluent monitoring instrumentation channels shown in Table V.C.–3 shall be FUNCTIONAL with their Alarm Setpoints set to ensure that the limits of Specification V.D.2.a. are not exceeded. The Alarm Setpoints of these channels shall be determined in accordance with the methodology and parameters in Section II.

APPLICABILITY: As shown in Table V.C.–3.

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel Alarm Setpoint less conservative than required by the above specification, without delay suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

b. With the number of FUNCTIONAL radioactive gaseous effluent monitoring instrumentation channels less than the Minimum Channels FUNCTIONAL, take the ACTION shown in Table V.C.–3. Exert best efforts to restore the nonfunctional instrumentation to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Release need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENT

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table V.C.–4.

TABLE V.C.–3 **Radioactive Gaseous Effluent Monitoring Instrumentation**			
Instrument	Minimum Channels Functional	Applicability	Action
1.Millstone Unit 3 Ventilation Vent (Turbine Building – HVR–RE10B, normal range only; high range monitor, HVR–RE10A, requirements are in the TRM)			
a. Noble Gas Radioactivity Monitor Providing Alarm	1	*	A ①
b. Iodine Sampler	1	*	B
c. Particulate Sampler	1	*	B
d. Vent Flow Rate Monitor	1	*	C
e. Sampler Flow Rate Monitor	1	*	C
2.Millstone Stack – applicable to SLCRS (HVR–RE19B, normal range only; high range monitor, HVR–RE19A, requirements are in the TRM)			
a. Noble Gas Radioactivity Monitor Providing Alarm	1	*	A ①
b. Iodine Sampler	1	*	B
c. Particulate Sampler	1	*	B
d. Process Flow Rate Monitor	1	*	C
e. Sampler Flow Rate Monitor	1	*	C
3.Engineered Safeguards Building Monitor (HVQ–RE49)			
a. Noble Gas Radioactivity Monitor	1	*	D ①
b. Iodine Sampler	1	*	B
c. Particulate Sampler	1	*	B
d. Discharge Flow Rate Monitor	1	*	E
e. Sampler Flow Rate Monitor	1	*	C

TABLE V.C.–3
Table Notations

* Whenever the release path is in service. Outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

TABLE V.C.–3
ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that

a) best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours, OR

b) if the cause of the nonfunctionality is solely due to a loss of annunciation in the control room and the Remote Indicating Controller (RIC) remains FUNCTIONAL, perform a channel check at the RIC at least once per twelve hours and verify the indication has not alarmed.

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that effluent is continuously sampled with auxiliary sampling equipment at least once per seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Auxiliary sampling must be initiated within 12 hours after initiation of this ACTION statement. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated at least once per 5 hours. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours.

Action E

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument.

TABLE V.C.–4
Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	Channel Check	Source-Check	Channel Calibra-tion	Channel Functional Check	When Surveil-lance is Required
1. Millstone Unit 3 Ventilation Vent (Turbine Building – HVR–RE10B, normal range only; high range monitor, HVR–RE10A, requirements are in the TRM)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Vent Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*
2. Millstone Stack – applicable to SLCRS (HVR–RE19B, normal range only; high range monitor, HVR–RE19A, requirements are in the TRM)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Process Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*
3. Engineered Safeguards Building Monitor (HVQ–RE49)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Discharge Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*

* At all times except when the vent path is isolated.

D = Daily
W = Weekly
M = Monthly

R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

TABLE V.C.–4
Table Notations

(1) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities of NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

a) Instrument indicates measured levels above the Alarm Setpoint, or

b) Circuit failure, or

c) Instrument indicates a downscale failure.

(3) The CHANNEL CALIBRATION shall include the use of a known source whose strength is determined by a detector which has been calibrated to an NIST source. These sources shall be in know, reproducible geometry.

V.D. Radioactive Effluents Concentrations And Dose Limitations

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATION

The concentration of radioactive material released from the site (see Figure V.D.–1) shall be limited to ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 2 x 10^{-4} μCi/ml total radioactivity. ①

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released from the site exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

2) The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Specification V.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATION

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 3 released from the site (see Figure V.D.–1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ; and,

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations. Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in Section II at least once per 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATION

The dose rate, at any time, offsite (see Figure V.D.–1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

a. The dose rate limit for noble gases shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin; and,

b. The dose rate limit due to inhalation for Iodine–131, Iodine–133, Tritium, and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate to comply with the limit(s) given in Specification V.D.2.a. within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) The release rate, at any time, of noble gases in gaseous effluents shall be controlled by the offsite dose rate as established in Specification V.D.2.a. The corresponding release rate shall be determined in accordance with the methodology of Section II.

2) The noble gas effluent monitors of TableV.C.–3 shall be used to control release rates to limit offsite doses within the values established in Specification V.D.2.a.

3) The release rate of radioactive materials in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program, specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATION

The air dose offsite (see Figure V.D.–1) due to noble gases released from Unit 3 in gaseous effluents shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

c. Gaseous Effluents – Doses from Radionuclides Other than Noble Gas

LIMITING CONDITIONS OF OPERATION

The dose to any REAL MEMBER OF THE PUBLIC from Iodine–131, Iodine–133, Tritium, C–14, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 3 released offsite (see Figure V.D.–1) shall be limited to the following: ①

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,

b. During any calendar year: Less than or equal to 15 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

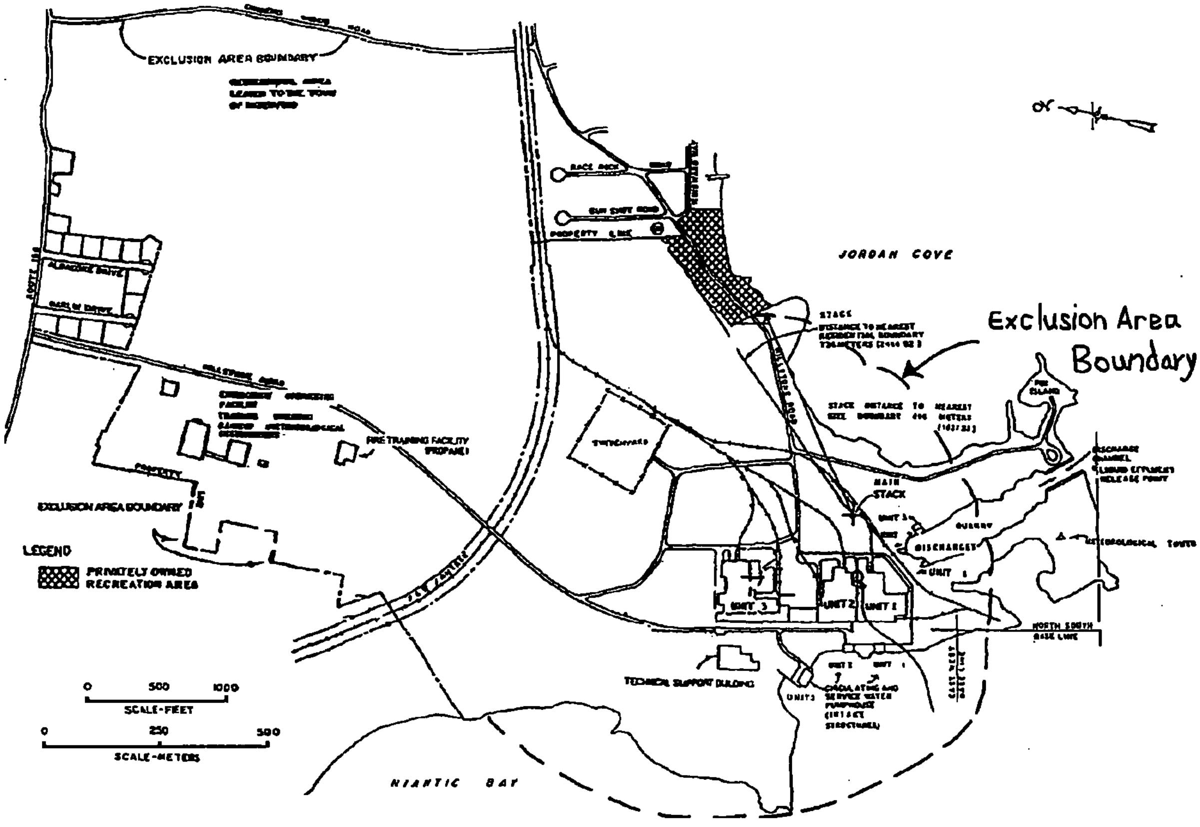
c. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

Figure V.D. – 1, "Site Boundary for Liquid and Gaseous Effluents"



V.E. Total Radiological Dose From Station Operations

CONTROLS

The annual dose or dose commitment to any REAL MEMBER OF THE PUBLIC, beyond the site boundary, from the Millstone Site 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).

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls V.D.1.b., V.D.2.b., or V.D.2.c. prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the dose commitment from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. ① This Special Report shall include an analysis which demonstrates that radiation exposures from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site (including all effluent pathways and direct radiation) are less than the 40 CFR 190 Standard.

If the estimated doses exceed the above limits, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with Section II once per 31 days.

V.F. Bases

Section V.C.1. – Radioactive Liquid Effluent Monitoring Instrumentation

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section II to ensure that the alarm/trip will occur prior to exceeding ten times the limits of 10 CFR 20. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 20 Part 50.

FUNCTIONALITY of a radiation monitor is determined by its ability to perform its specified function. The specified function of the radioactivity monitors listed in Table V.C.−1 is to provide Control Room alarm annunciation and automatic termination of release. The monitor must be on-line with no unexpected alarms in order to perform its specified function.

Definition B.7 states a component is FUNCTIONAL when it is capable of performing its specified function. The monitors are described in Tables V.C.−1 and V.C.−2 as "Radioactivity Monitors Providing Alarm and Automatic Termination of Releases." Table V.C.−2 Note 1 requires that the Analog Channel Operational Test (ACOT) demonstrate that automatic isolation and "control room annunciation" occur. Control room annunciation cannot occur unless the monitor is on line (i.e. in communication with the RMS computer.). Section V.C.1. Surveillance Requirement requires that the ACOT be performed to demonstrate FUNCTIONALITY. General Design Criteria 64 states in part: "Means shall be provided for monitoring effluent discharge paths for radioactivity." Regulatory Guide 1.21 Appendix A describes a monitor program that is acceptable to the Regulatory staff. Under Section B of Appendix A, "LIQUID EFFLUENTS," the first paragraph states in part: "During the release of radioactive wastes, the effluent control monitor should be set to alarm and to initiate automatic closure..."

Certain of the monitors listed in Table V.C.−1 are designed to operate without sample pumps. These monitors utilize pressure in the effluent line during discharge to provide sample flow and sample pressure. Low sample flow and/or low sample pressure alarms may be received when no discharge is in progress. These are expected alarms. Sample flow and/or sample pressure will return to normal when the discharge is initiated. These alarms will clear when discharge begins. The monitors are FUNCTIONAL since they are able to perform their specified function with the expected alarms in.

Table V.C.−1 note ## requires entry into the radioactive liquid effluent monitoring action statements whenever the radiation monitors are not available in the required MODE. This note applies to items 1.a (3CND-RE07, Waste Neutralization Sump), 1.d (3LWC-RE65, Regenerate Evaporator Monitor), and 1.e (3SSR-RE08, Steam Generator Blowdown Monitor) in Table V.C.−1. The original issue of this requirement (as a Technical Specification) in January 1986 stated the applicability was "At all times." Technical Specification Amendment 22 added "APPLICABILITY" (now defined as functionality) to Table V.C.−1 (then Tech Spec Table 3.3-). The applicability (now defined as functionality) added in Amendment 22 is the present wording. The letter 1312821, dated February 24, 1988, in the following sections discusses the change request and are quoted below:

- In "Discussion": "The proposed changes will now explicitly allow a monitor to be taken out of service for up to hours for maintenance/testing without entering the ACTION statement."

- In "Significant Hazards Consideration" item 1: "the proposed changes would only allow these radiation monitors to be out of service for a short period of time (12 hours)."

- In "Significant Hazards Consideration" item 2: "The proposed changes also have no effect on alarm setpoints or control functions. Further, no operator actions that are required to mitigate any accident rely solely on these monitors, and these monitors provide no protective functions."

  Technical Specification Amendment 22 provided for the following:

- allowance for planned nonfunctionality of monitoring instrumentation for up to hours for the purpose of maintenance and performance of required test, check, calibration or sampling

- a requirement to initiate auxiliary sampling within hours after nonfunctionality of certain gaseous effluent monitors

- allowance for nonfunctionality of certain effluent monitoring instrumentation, during MODE 6 (refueling) when the effluent pathway is not being used.

Section V.C.2.– Radioactive Gaseous Effluent Monitoring Instrumentation

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section II to ensure that the alarm/trip will occur prior to exceeding the limits of SectionV.D.2.a. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 20 Part 50.

The sensitivity of any noble gas radioactivity monitors used to show compliance with the gaseous effluent release requirements of Specification V.C.2.a shall be such that concentrations as low as 1 x 10^{-6} μCi/cc are measurable. ①

The vent normal range radiation monitor, HVR*10B, satisfies the requirements of SectionV.C.2. for Unit 3 releases to the vent which is located on the turbine building. There are no requirements in the REMODCM associated with the vent high range radiation monitor, HVR*10A.

The SLCRS normal range radiation monitor, HVR*19B, satisfies the requirements of SectionV.C.2. for Unit 3 releases to the Millstone Stack. There are no requirements in the REMODCM associated with the SLCRS high range radiation monitor, HVR*19A.

<u>Section V.D.1.a. – Radioactive Liquid Effluents Concentrations</u>

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR 20.1301 to the population. The concentration limit for noble gases is based upon the assumption that Xe–135 is the controlling radioisotope and its concentrations in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

<u>Section V.D.1.b. – Radioactive Liquid Effluents Doses</u>

This specification is provided to implement the requirements of Sections II.A., III.A., and IV.A. of Appendix I, 10 CFR Part 50. The specification implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section III.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable." The dose calculation methodology and parameters in Section II implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in Section II for calculating the doses due to the actual release rates of radioactive materials in liquid effluents will be consistent with the methodology provided in 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 Part 50, Appendix I, Revision 1, October 1977, and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Section V.D.2.a.– Radioactive Gaseous Effluents Dose Rate

This specification will ensure that the dose from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for all areas offsite. The annual dose limits specified in this section are the dose limits from the version of 10 CFR Part 20 prior to 1994. Annual dose limit in the current version of 10CFR20 were reduced from 500 to 100 mrem. But REMODCM restrictions will not allow the current annual dose limit to be exceeded because the REMODCM requires termination, within fifteen minutes, of any release which exceed the setpoint and much lower annual dose limits from 10CFR50, Appendix I are implemented. For individuals who may, at times, be within the SITE BOUNDARY, the occupancy of that individual will be usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid or any other organ dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

Section V.D.2.b. – Radioactive Gaseous Effluents Noble Gas Dose

This specification is provided to implement the requirements of Sections II.B., III.A., and IV.A. of Appendix I, 10 CFR Part 50. The specification implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section V.A. of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A. of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in Section II for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculational of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision 1, July 1977.

The Section II equations provided for determining the air doses at the site boundary are based upon utilizing successively more realistic dose calculational methodologies. More realistic dose calculational methods are used whenever simplified calculations indicate a dose approaching a substantial portion of the regulatory limits. The methods used are, in order, previously determined air dose per released radioactivity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released. ①

Section V.D.2.c. – Radioactive Gaseous Effluents for Radionuclides Other Than Noble Gas

These specifications are provided to implement the requirements of Sections II.C., III.A., and IV.A. of Appendix I, 10 CFR Part 50. The specifications are the guides set forth in Section II.C. of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A. of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The Section II calculational methods specified in the surveillance requirements implement the requirements in Section III.A. of Appendix I that conformance with the guides for Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The Section II calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision I, July 1977. The release rate specifications for radioiodines, radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man. The pathways that are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Section V.E. – Total Radiological Dose from Station Operations

This specification is provided to meet the dose limitations of 40 CFR 190. For the purpose of the Special Report, it may be assumed that the dose commitment to any REAL MEMBER OF THE PUBLIC from other fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered.