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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 1, 2, AND 3
2012 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 2012 through December 2012. 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 2012 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 contains changes made to the REMODCM through 2012. Volume 2 consists of a complete copy of the REMODCM as of December 31, 2012, which 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. William D. Bartron at (860) 444 4301.

Sincerely,

A handwritten signature in blue ink, appearing to read "R. K. MacManus", with a long horizontal flourish extending to the right.

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Attachments: 2

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1. None.

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ATTACHMENT 1

2012 RADIOACTIVE EFFLUENTS RELEASE REPORT
VOLUME 1

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

Millstone Power Station 2012

Radioactive Effluents Release Report Volume 1



Dominion Nuclear Connecticut, Inc.



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

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Introduction

This report, for the period of January through December of 2012, is being submitted by Dominion Nuclear Connecticut, Inc. for Millstone Power Station Units 1, 2, and 3 (MPS1, 2 and 3), in accordance with 10 CFR 50.36a, the Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODOCM), and the Station's Technical Specifications.

Volume 1 contains radiological and volumetric information on airborne and liquid effluents, shipments of solid waste & irradiated components, calculated offsite radiological doses, all changes to the REMODOCM, information on effluent monitors inoperable for more than 30 consecutive days, and corrections to previous reports. Volume 2 contains a full copy of the complete revision to the REMODOCM effective during the calendar year.



1.0 Off-Site Doses

This report provides a summary of the 2012 off-site radiation doses from releases of radioactive materials in airborne and liquid effluents from MPS1, MPS2 and MPS3. 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 airborne and liquid effluents have been calculated using measured radioactive effluent data, measured meteorological data, and the dose computation algorithm in OpenEMS, an effluent tracking program (Reference 9). OpenEMS gives 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 air 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 airborne 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 airborne effluents, and dilution factors for liquid effluents. The generic factors include the average annual consumption rates (for inhalation of air and ingestion of vegetables, produce, milk, meat, fish, and shellfish) and occupancy factors (for air submersion, ground irradiation, shoreline activity, swimming, boating, etc.).

1.1.1 Airborne Effluents

Maximum individual doses due to the release of noble gases, radioiodines, particulates, tritium (H-3) and Carbon-14 were calculated using OpenEMS. This is equivalent to the NRC code, GASPARI (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 OpenEMS were generated using EDAN4, 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 MPS2 and MPS3 discharge to the Millstone Power Station Stack. In March 2001, MPS1 was separated from the stack and two new release points were added to MPS1, the Spent Fuel Pool Island (SFPI) Vent and the Balance of Plant (BOP) Vent.

MPS1 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 include tritium (H-3) releases due to evaporation from the spent fuel pool water release through the SFPI Vent. Continuous

ventilation from other MPS1 buildings are discharged to the BOP Vent. Doses from these release points were summed to determine the total MPS1 airborne effluent dose.

MPS2 Auxiliary Building Ventilation, Steam Generator Blowdown Tank Vent and Containment Purge release via the MPS2 Vent at 159 foot are considered mixed mode (partially elevated and partially ground) releases. The first two of these are continuous releases while the Containment Purge is a batch release. Containment Purges can also be released via the Millstone Power Station Stack. Batch releases from the Waste Gas Decay Tanks and Containment Vents are discharged via the Millstone Power Station Stack. 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 MPS2 airborne effluent dose.

The MPS3 Vent (142.5 foot) is considered a mixed mode (partially elevated and partially ground) release point. The Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels. Auxiliary Building Ventilation is a mixed mode continuous release while Containment Purge and the "initial" Containment Drawdown (released at the roof of the Auxiliary Building) are considered mixed mode batch releases. Gaseous waste and operational containment drawdowns (also called containment vents) are released through the MPS3 Supplementary Leak Collection and Recovery System (SLCRS) system to the Millstone Power Station Stack (375 foot). The Engineered Safety Features Building (ESF) Ventilation, the Containment Equipment Hatch, 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 MPS3 airborne effluent dose.

Based on Reference 2, it was conservatively assumed that 30% of the C-14 exists as carbon dioxide (CO₂) 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 airborne effluents and Table 1-2 for liquid effluents.

1.2.1 Airborne Effluents

For the dose to the maximum individual, OpenEMS 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 noble gases in the plume and 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.

For the vegetation pathway, the maximum individual dose is calculated at the vegetable garden of the highest D/Q . For the vegetation pathway, the calculated dose is included in the maximum individual's dose only at locations and times where these pathways actually exist. Similarly, for meat, cow's milk, and goat's milk pathways, the calculated dose is included in the maximum individual's dose only at locations and times where these pathways actually exist.

Beginning with this report (2012), doses 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 was approximately 0.18 mrem/yr. The doses from airborne 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. The total dose to the maximum individual received from Millstone Power Station is small (< 0.1%) in comparison to the dose received from natural background radiation.

**Table 1-1
2012 Off-Site Dose Commitments from Airborne 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
<i>Beta</i>	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<i>Gamma</i>	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
<i>Whole Body</i>	8.21E-06	2.58E-05	1.47E-05	4.35E-06	5.31E-05
<i>Skin</i>	8.21E-06	1.35E-05	1.47E-05	4.35E-06	4.08E-05
<i>Thyroid</i>	8.21E-06	2.58E-05	1.47E-05	4.35E-06	5.31E-05
<i>Max organ</i> ³	8.21E-06	2.58E-05	1.47E-05	4.35E-06	5.31E-05

Jnit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
<i>Beta</i>	2.39E-05	1.69E-06	2.72E-05	3.44E-05	8.72E-05
<i>Gamma</i>	1.35E-05	2.34E-06	1.01E-05	1.59E-05	4.18E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
<i>Whole Body</i> ¹	1.82E-05	1.87E-03	8.06E-04	4.48E-04	3.14E-03
<i>Whole Body</i> ²	1.78E-02	2.49E-03	3.24E-02	7.37E-04	5.34E-02
<i>Skin</i>	3.52E-05	1.16E-03	4.17E-04	4.73E-04	2.09E-03
<i>Thyroid</i> ¹	1.23E-04	7.93E-03	3.49E-03	4.69E-04	1.20E-02
<i>Thyroid</i> ²	1.79E-02	8.56E-03	3.51E-02	7.93E-04	6.24E-02
<i>Max organ</i> ^{1,3}	9.90E-06	1.89E-03	8.09E-04	4.40E-04	3.15E-03
<i>Max organ</i> ^{2,3}	8.90E-02	3.16E-03	1.58E-01	2.25E-03	2.52E-01

Jnit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
<i>Beta</i>	1.36E-05	3.92E-06	7.01E-07	2.78E-07	1.85E-05
<i>Gamma</i>	1.50E-06	2.84E-07	9.38E-08	4.18E-08	1.92E-06
Max Individual	mrem	mrem	mrem	mrem	mrem
<i>Whole Body</i> ¹	4.04E-03	6.50E-03	1.37E-03	4.45E-04	1.24E-02
<i>Whole Body</i> ²	4.05E-03	7.43E-03	1.67E-03	4.58E-04	1.36E-02
<i>Skin</i>	2.82E-03	3.74E-03	6.84E-04	4.45E-04	7.69E-03
<i>Thyroid</i> ¹	4.04E-03	6.50E-03	1.37E-03	4.45E-04	1.24E-02
<i>Thyroid</i> ²	4.05E-03	7.43E-03	1.67E-03	4.58E-04	1.36E-02
<i>Max organ</i> ^{1,3}	4.04E-03	6.50E-03	1.37E-03	4.45E-04	1.24E-02
<i>Max organ</i> ^{2,3}	4.05E-03	7.43E-03	4.39E-03	8.15E-04	1.67E-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

** The term 'mrad' used in this report is a unit of radiation dose. The letter 'm' is for 'milli', or one-thousandth of a 'rad.' 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.

Table 1-2
2012 Off-Site Dose Commitments from Liquid Effluents
Millstone Units 1, 2, 3

Unit 1	<i>1st Quarter</i>	<i>2nd Quarter</i>	<i>3rd Quarter</i>	<i>4th Quarter</i>	<i>Annual Total</i>
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
<i>Whole Body</i>	6.48E-06	1.01E-05	0.00E+00	0.00E+00	1.66E-05
<i>Thyroid</i>	7.56E-07	2.93E-06	0.00E+00	0.00E+00	3.69E-06
<i>Max Organ</i> ⁺	3.70E-05	1.43E-05	0.00E+00	0.00E+00	5.13E-05

Unit 2	<i>1st Quarter</i>	<i>2nd Quarter</i>	<i>3rd Quarter</i>	<i>4th Quarter</i>	<i>Annual Total</i>
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
<i>Whole Body</i>	6.64E-05	6.36E-05	1.07E-03	8.46E-05	1.28E-03
<i>Thyroid</i>	3.40E-05	4.21E-05	1.40E-04	3.10E-05	2.47E-04
<i>Max Organ</i> ⁺	1.92E-03	6.13E-04	6.57E-03	8.05E-03	1.72E-02

Unit 3	<i>1st Quarter</i>	<i>2nd Quarter</i>	<i>3rd Quarter</i>	<i>4th Quarter</i>	<i>Annual Total</i>
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
<i>Whole Body</i>	2.49E-04	4.77E-04	4.93E-05	1.35E-04	9.10E-04
<i>Thyroid</i>	8.25E-05	3.56E-04	2.30E-05	1.02E-04	5.64E-04
<i>Max Organ</i> ⁺	1.62E-03	9.45E-04	4.20E-04	2.48E-04	3.23E-03

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

* The term 'mrem' used in this report is a unit of radiation dose. The letter 'm' is for 'milli', or one-thousandth of a 'rem.' The word 'rem' is an acronym for roentgen equivalent man. One rem is equal to a rad (see definition on previous page) multiplied by factors to account for type of radiation and distribution within the body.

**Table 1-3
2012 Off-Site Dose Comparison to Limits
Millstone Units 1, 2, 3**

Airborne Effluents Dose (without C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	5.31E-05	5.31E-05	5.31E-05	4.08E-05	0.00E+00	0.00E+00
Unit 2	3.14E-03	1.20E-02	3.15E-03	2.09E-03	8.72E-05	4.18E-05
Unit 3	1.24E-02	1.24E-02	1.67E-02	7.69E-03	1.85E-05	1.92E-06
Millstone Station	1.56E-02	2.44E-02	1.99E-02	9.81E-03	1.06E-04	4.38E-05
10CFR50 App I Limits	5	15	15	15	20	10

Airborne Effluents Dose (with C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	5.31E-05	5.31E-05	5.31E-05	4.08E-05	0.00E+00	0.00E+00
Unit 2	5.34E-02	6.24E-02	2.52E-01	2.09E-03	8.72E-05	4.18E-05
Unit 3	1.36E-02	1.36E-02	1.67E-02	7.69E-03	1.85E-05	1.92E-06
Millstone Station	6.71E-02	7.60E-02	2.69E-01	9.81E-03	1.06E-04	4.38E-05
10CFR50 App I Limits	5	15	15	15	20	10

Liquid Effluents Dose

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)
Unit 1	1.66E-05	3.69E-06	5.13E-05
Unit 2	1.28E-03	2.47E-04	1.72E-02
Unit 3	9.10E-04	5.64E-04	3.23E-03
Millstone Station	2.21E-03	8.14E-04	2.04E-02
10CFR50 App I Limits	3	10	10

Total Off-Site Dose from Millstone Station

	Whole Body (mrem)	Thyroid (mrem)	Max Organ * (mrem)
Airborne without C-14	1.56E-02	2.44E-02	1.99E-02
Airborne with C-14	6.71E-02	7.60E-02	2.69E-01
Liquid	2.21E-03	8.14E-04	2.04E-02
Direct Shine **	1.80E-02	1.80E-02	1.80E-02
Total without C-14	3.58E-02	4.32E-02	5.83E-02
Total with C-14	8.73E-02	9.48E-02	3.08E-01
40CFR190 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 radioactive waste and spent fuel

Table 1-4
2012 Offsite Dose Comparison
Natural Background vs Millstone Station

Average Resident	Natural Background Radiation Dose
Cosmic	27 mrem
Cosmogenic	1 mrem
Terrestrial (Atlantic and Gulf Coastal Plain)	16 mrem
Inhaled	200 mrem
In the Body	40 mrem
~ 284 mrem	

Courtesy NCRP Report 94 (1987)

Maximum Off-Site Individual	Millstone Station Whole Body Dose
Airborne Effluents	0.0156 mrem
Liquid Effluents	0.0022 mrem
On-site RadWaste Storage	0.0180 mrem
0.0397 mrem	

2.0 Effluent Radioactivity

2.1 Airborne Effluents

2.1.1 Measurement of Airborne Radioactivity

2.1.1.1 Continuous Releases

The following pathways have continuous radiation monitors that include particulate filters and, except for MPS1, charcoal cartridges for monitoring the activity being released:

- MPS1 SFPI Island (no charcoal cartridge)
- MPS1 BOP Vent (no charcoal cartridge)
- MPS2 Ventilation Vent
- MPS2 Wide Range Gas Monitor (WRGM) to Site Stack
- MPS2 RWST Vent
- MPS2 Turbine Building Vent
- MPS3 Ventilation Vent
- MPS3 SLCRS to Site Stack
- MPS3 ESF Building Vent
- MPS3 RWST Vent

Charcoal cartridges and particulate filters are used to collect iodines and particulates, respectively. These filters are replaced weekly (except every two weeks for MPS1) and then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Strontium-89 (Sr-89) (except for MPS1), 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 water lost and measured concentrations of H-3 in the pool water. Grab samples from the MPS1 SFPI Vent and the MPS2 and MPS3 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.

Another continuous airborne pathway is the MPS2 Steam Generator Blowdown (SGBD) tank vent. A decontamination factor (DF) across the SGBD tank vent was determined for iodines by comparing the results of gamma spectrometry, analysis of the SGBD water and grab samples of the condensed steam exiting the vent. This DF was applied to the total iodine releases via the SGBD water to calculate the iodine release out the vent. An additional factor of 0.33 was utilized to account for the fraction of blowdown water actually flashing to steam in the SGBD tank.

When water is transferred to RWST there is a potential for a release of radioactivity through the tank vent. Releases of noble gases, iodines, particulates and H-3 are estimated. A DF was applied to the total particulates and iodines contained in the water transferred to the RWST to estimate the releases. All noble gases are assumed to be released through the tank vent.

During the fourth quarter there was a small release via the Unit 2 Turbine Building vents during work performed in the Unit 1 Turbine Building during the refueling outage. The radioactivity was measured using portable monitors and the volume released estimated based on a measurement of air flow.

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 of its difficulty in measurement and analysis. 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 airborne 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. It is assumed that C-14 is released from the Millstone Stack and each units main ventilation vent in the same relative proportion as noble gases released.

2.1.1.2 Batch Releases

The following pathways periodically have releases that are considered batches:

- MPS2 Waste Gas Decay Tanks (WGDT) (via MPS2 WRGM to Millstone Power Station Stack)
- MPS2 and MPS3 Containment Purges (via Unit Ventilation Vents, except for MPS2 if using Enclosure Building Filtration System (EBFS) via WRGM to Millstone Power Station)
- MPS2 and MPS3 Containment Vents (via EBFS to Millstone Power Station Stack for MPS2 and via SLCRS to Millstone Power Station Stack for MPS3)
- MPS2 and MPS3 Containment Equipment Hatch Openings
- MPS3 Containment Drawdown

Waste Gases from the MPS2 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.

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. MPS2 typically performs this process of discharging air from containment to maintain pressure approximately once per week while at MPS3 it is more often (typically at least daily). 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 vent 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.

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.

MPS3 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.

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 Airborne Batch Release Statistics

MPS1 – None

MPS2	Ctmt Purges	Ctmt Vents	WGDT
Number of Batches	5	62	32
Total Time (min)	2410	9680	12930
Maximum Time (min)	1000	221	1000
Average Time (min)	483	156	404
Minimum Time (min)	120	42	24

MPS3	Ctmt Purges	Ctmt Vents*	Ctmt Drawdowns
Number of Batches	0	~350	0
Total Time (min)	NA	*	NA
Maximum Time (min)	NA	*	NA
Average Time (min)	NA	*	NA
Minimum Time (min)	NA	*	NA

* ~ 2-3 hrs per Vent

2.1.4 Abnormal Airborne Releases

An abnormal airborne release of radioactivity is defined as an increase in airborne radioactive material released 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 MPS1 - None

2.1.4.2 MPS2 – None

2.1.4.3 MPS3 – None

2.1.5 Airborne Release Tables

The following tables provide the details of the airborne 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
 Airborne Effluents - Release Summary

Units	2012				
	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	-	-	-	8.89E-06	8.89E-06
2. Average Period Release Rate	uCi/sec	-	-	-	1.12E-06	2.81E-07

D. Gross Alpha

1. Total Activity Released	Ci	-	-	-	-	-
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E. Tritium

1. Total Activity Released	Ci	2.53E-02	2.25E-02	2.59E-02	2.41E-02	9.78E-02
2. Average Period Release Rate	uCi/sec	3.22E-03	2.86E-03	3.26E-03	3.03E-03	3.09E-03

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

"na" denotes not required to be analyzed

Table 2.1-A2
 Millstone Unit 1
 Airborne Effluents - Ground Continuous - BOP Vent & SFPI Vent

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Kr-85	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-

B. Iodines / Halogens

	Ci	na	na	na	na	na
Total Activity	Ci	na	na	na	na	na

C. Particulates

Cs-137	Ci	-	-	-	-	-
Be-7	Ci	-	-	2.91E-10	8.89E-06	8.89E-06
Other γ Emitters	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	2.91E-10	8.89E-06	8.89E-06

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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E. Tritium

H-3	Ci	2.53E-02	2.25E-02	2.59E-02	2.41E-02	9.78E-02
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"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes not required to be analyzed

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

Units	2012				
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Gases

1. Total Activity Released	Ci	4.12E-01	1.24E-01	1.60E-01	4.59E-01	1.31E+00
2. Average Period Release Rate	uCi/sec	5.24E-02	1.57E-02	2.01E-02	5.77E-02	4.15E-02

B. Iodines / Halogens

1. Total Activity Released	Ci	6.88E-05	2.71E-04	2.13E-04	2.97E-04	8.50E-04
2. Average Period Release Rate	uCi/sec	8.75E-06	3.45E-05	2.68E-05	3.74E-05	2.69E-05

C. Particulates

1. Total Activity Released	Ci	3.18E-07	-	-	3.04E-06	3.36E-06
2. Average Period Release Rate	uCi/sec	4.04E-08	-	-	3.83E-07	1.06E-07

D. Gross Alpha

1. Total Activity Released	Ci	-	-	-	-	-
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E. Tritium

1. Total Activity Released	Ci	1.18E+00	7.77E+00	2.19E+00	5.59E+00	1.67E+01
2. Average Period Release Rate	uCi/sec	1.50E-01	9.88E-01	2.75E-01	7.03E-01	5.29E-01

F. C-14

1. Total Activity Released**	Ci	2.10E+00	2.10E+00	2.10E+00	2.10E+00	8.40E+00
2. Average Period Release Rate	uCi/sec	2.70E-01	2.67E-01	2.64E-01	2.64E-01	2.66E-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
Airborne Effluents - Mixed Continuous
Aux Bldg Ventilation, SGBD Tank Vent & Spent Fuel Pool Evaporation
Release Point - Unit 2 Ventilation Vent

Nuclides Released	Units	2012				
		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	-	-	1.87E-05	1.19E-05	3.06E-05
I-131	Ci	1.48E-05	4.26E-05	3.63E-05	1.33E-05	1.07E-04
I-132	Ci	-	-	-	2.56E-04	2.56E-04
I-133	Ci	5.40E-05	1.90E-04	1.56E-04	2.79E-05	4.28E-04
I-135	Ci	-	3.84E-05	2.09E-05	-	5.93E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	6.88E-05	2.71E-04	2.13E-04	2.97E-04	8.50E-04

C. Particulates

Co-60	Ci	3.18E-07	-	-	-	3.18E-07
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	3.18E-07	-	-	-	3.18E-07

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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E. Tritium *

H-3	Ci	8.63E-01	7.41E+00	1.71E+00	5.33E+00	1.53E+01
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F. C-14

C-14	Ci	-	-	1.00E+00	2.00E-01	1.20E+00
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"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.2-A3
Millstone Unit 2
Airborne Effluents - Mixed Batch
Containment Purges, Liquid Radwaste System Gas Space
Release Point - Unit 2 Ventilation Vent

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Ar-41	Ci	*	*	-	7.68E-03	7.68E-03
Kr-85	Ci	*	*	-	9.10E-03	9.10E-03
Xe-133	Ci	*	*	9.22E-02	3.24E-02	1.25E-01
Xe-135	Ci	*	*	1.60E-03	1.62E-03	3.22E-03
Other γ Emitters	Ci	*	*	-	-	-
Total Activity	Ci	*	*	9.38E-02	5.08E-02	1.45E-01

B. Iodines / Halogens

I-131	Ci	*	*	-	-	-
I-133	Ci	*	*	-	-	-
Br-82	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
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E. Tritium

H-3	Ci	*	*	3.33E-01	1.02E-01	4.35E-01
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* No activity released

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

"na" denotes not required to be analyzed

Table 2.2-A4
Millstone Unit 2
Airborne Effluents - Elevated Batch
Containment Vents and Purges, Waste Gas Decay Tanks Discharges
Release Point - Millstone Site Stack

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Ar-41	Ci	4.51E-02	4.84E-02	4.29E-02	2.14E-02	1.58E-01
Kr-85	Ci	2.86E-01	6.01E-02	2.82E-02	3.47E-01	7.21E-01
Kr-85m	Ci	8.53E-06	-	-	-	8.53E-06
Xe-131m	Ci	6.20E-04	1.64E-04	-	-	7.84E-04
Xe-133	Ci	1.19E-01	6.19E-02	3.64E-02	2.92E-03	2.20E-01
Xe-133m	Ci	1.38E-03	4.49E-05	-	-	1.42E-03
Xe-135	Ci	4.82E-03	1.38E-03	1.31E-03	2.46E-04	7.76E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	4.12E-01	1.24E-01	6.59E-02	3.50E-01	1.11E+00

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
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E. Tritium

H-3	Ci	2.46E-01	3.60E-01	1.43E-01	1.42E-02	7.63E-01
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"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes not required to be analyzed

Table 2.2-A5
Millstone Unit 2
Airborne Effluents - Elevated Continuous
Condenser Air Ejector, Ventilation of Containment Enclosure, C-14
Release Point - Millstone Site Stack

Nuclides Released	Units	2012				
		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	-	-	-	1.81E-07	1.81E-07
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	6.69E-02	-	-	1.39E-01	2.06E-01
F. C-14						
C-14	Ci	2.10E+00	2.10E+00	1.10E+00	1.90E+00	7.20E+00

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

Table 2.2-A6
Millstone Unit 2
Airborne Effluents - Ground Continuous
Containment Air, Reactor Water Storage Tank (RWST)
Release Point - Containment Equipment Hatch, RWST Vent

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Xe-133	Ci	*	*	*	5.69E-02	5.69E-02
Xe-135	Ci	*	*	*	1.10E-03	1.10E-03
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	5.80E-02	5.80E-02

B. Iodines / Halogens

I-131	Ci	*	*	*	-	-
I-132	Ci	*	*	*	2.32E-07	2.32E-07
I-133	Ci	*	*	*	-	-
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	2.32E-07	2.32E-07

C. Particulates

Co-58	Ci	*	*	*	7.88E-07	7.88E-07
Co-60	Ci	*	*	*	6.18E-07	6.18E-07
Zr-95	Ci	*	*	*	1.08E-07	1.08E-07
Nb-95	Ci	*	*	*	1.23E-07	1.23E-07
Cs-137	Ci	*	*	*	8.56E-07	8.56E-07
Ba-140	Ci	*	*	*	3.91E-08	3.91E-08
Ce-144	Ci	*	*	*	8.16E-08	8.16E-08
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	2.61E-06	2.61E-06

D. Gross Alpha

Gross Alpha	Ci	*	*	*	na	na
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E. Tritium

H-3	Ci	*	*	*	1.83E-03	1.83E-03
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"-" denotes less than Minimum Detectable Activity (MDA)

* No activity released

"na" denotes Not Required to be Analyzed

Table 2.2-A7
 Millstone Unit 2
Airborne Effluents - Mixed Continuous
Turbine Building Ventilation
Release Point - Unit 2 Turbine Building Roof Vents

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

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

B. Iodines / Halogens

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

C. Particulates

Co-60	Ci	*	*	-	3.40E-07	3.40E-07
Cs-137	Ci	*	*	-	8.90E-08	8.90E-08
Other γ Emitters	Ci	*	*	-	-	-
Total Activity	Ci	*	*	-	4.29E-07	4.29E-07

D. Gross Alpha

Gross Alpha	Ci	*	*	-	-	-
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E. Tritium

H-3	Ci	*	*	-	-	-
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"-" denotes less than Minimum Detectable Activity (MDA)

* No activity released

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

Units	2012				
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Gases

1. Total Activity Released	Ci	2.44E-01	4.06E-01	2.32E-01	1.64E-01	1.05E+00
2. Average Period Release Rate	uCi/sec	3.10E-02	5.16E-02	2.92E-02	2.06E-02	3.31E-02

B. Iodines / Halogens

1. Total Activity Released	Ci	1.29E-06	8.35E-07	9.12E-07	7.89E-07	3.83E-06
2. Average Period Release Rate	uCi/sec	1.64E-07	1.06E-07	1.15E-07	9.93E-08	1.21E-07

C. Particulates

1. Total Activity Released	Ci	4.54E-11	1.56E-11	1.58E-11	1.42E-11	9.10E-11
2. Average Period Release Rate	uCi/sec	5.77E-12	1.99E-12	1.99E-12	1.79E-12	2.88E-12

D. Gross Alpha

1. Total Activity Released	Ci	-	-	-	-	-
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E. Tritium

1. Total Activity Released	Ci	2.08E+01	1.95E+01	1.10E+01	3.45E+01	8.58E+01
2. Average Period Release Rate	uCi/sec	2.65E+00	2.48E+00	1.38E+00	4.34E+00	2.71E+00

F. C-14

1. Total Activity Released**	Ci	3.10E+00	3.10E+00	3.10E+00	3.10E+00	1.24E+01
2. Average Period Release Rate	uCi/sec	3.99E-01	3.94E-01	3.90E-01	3.90E-01	3.93E-01

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

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

Table 2.3-A2
 Millstone Unit 3
Airborne Effluents - Mixed Continuous
Aux Bldg Ventilation & Spent Fuel Pool Evaporation
Release Point - Unit 3 Ventilation Vent

Nuclides Released	Units	2012				
		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

γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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E. Tritium

H-3	Ci	2.05E+01	1.91E+01	1.05E+01	3.35E+01	8.36E+01
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F. C-14

C-14	Ci	-	-	-	-	-
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"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A3
 Millstone Unit 3
Airborne Effluents - Ground Continuous
ESF Building Ventilation, Reactor Water Storage Tank (RWST)
Release Point - ESF Building Vent, RWST Vent

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

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	5.27E-12	1.18E-12	5.90E-13	2.56E-13	7.30E-12
Mn-54	Ci	2.45E-12	9.90E-13	1.22E-12	1.29E-12	5.95E-12
Fe-59	Ci	1.60E-12	4.60E-13	3.30E-13	2.14E-13	2.60E-12
Co-58	Ci	2.52E-11	8.50E-12	7.90E-12	6.10E-12	4.77E-11
Co-60	Ci	4.18E-12	1.77E-12	2.34E-12	2.63E-12	1.09E-11
Zr-95	Ci	6.25E-13	2.06E-13	1.82E-13	1.37E-13	1.15E-12
Nb-95	Ci	4.97E-13	1.27E-13	7.90E-14	4.28E-14	7.46E-13
Sb-125	Ci	2.40E-12	1.02E-12	1.34E-12	1.48E-12	6.24E-12
Cs-134	Ci	1.46E-12	6.10E-13	8.10E-13	8.90E-13	3.77E-12
Cs-137	Ci	1.72E-12	7.50E-13	1.00E-12	1.15E-12	4.62E-12
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	4.54E-11	1.56E-11	1.58E-11	1.42E-11	9.10E-11

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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E. Tritium

H-3	Ci	1.24E-04	7.50E-05	1.01E-04	9.90E-05	3.99E-04
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"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A4
 Millstone Unit 3
Airborne Effluents - Mixed Batch
Containment Drawdowns
Release Point - Aux Building Roof Vent

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

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

Co-58	Ci	*	*	*	*	*
Other γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

D. Gross Alpha

Gross Alpha	Ci	*	*	*	*	*
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E. Tritium

H-3	Ci	*	*	*	*	*
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* No activity released

Table 2.3-A5
 Millstone Unit 3
Airborne Effluents - Mixed Batch
Containment Purges
Release Point - Millstone Site Stack

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Xe-133	Ci	*	*	*	*	*
Xe-135	Ci	*	*	*	*	*
Other γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

B. Iodines / Halogens

Br-82	Ci	*	*	*	*	*
Other γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

C. Particulates

γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

D. Gross Alpha

Gross Alpha	Ci	*	*	*	*	*
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E. Tritium

H-3	Ci	*	*	*	1.03E-02	1.03E-02
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* No activity released

Table 2.3-A6
 Millstone Unit 3
Airborne Effluents - Elevated Continuous
Gaseous Waste System
Release Point - Millstone Site Stack

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Kr-85	Ci	2.38E-01	3.99E-01	2.24E-01	1.57E-01	1.02E+00
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.38E-01	3.99E-01	2.24E-01	1.57E-01	1.02E+00

B. Iodines / Halogens

I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Br-82	Ci	1.29E-06	8.35E-07	9.12E-07	7.89E-07	3.83E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.29E-06	8.35E-07	9.12E-07	7.89E-07	3.83E-06

C. Particulates

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

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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E. Tritium

H-3	Ci	3.26E-01	3.87E-01	5.01E-01	9.57E-01	2.17E+00
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F. C-14

C-14	Ci	3.10E+00	3.10E+00	3.10E+00	3.10E+00	1.24E+01
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"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A7
 Millstone Unit 3
Airborne Effluents - Elevated Batch
Containment Vents
Release Point - Millstone Site Stack

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

Ar-41	Ci	5.19E-03	5.41E-03	6.10E-03	4.87E-03	2.16E-02
Xe-133	Ci	7.14E-04	1.06E-03	2.24E-03	1.73E-03	5.74E-03
Xe-135	Ci	1.23E-04	1.46E-04	1.40E-04	3.32E-05	4.42E-04
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	6.03E-03	6.62E-03	8.48E-03	6.63E-03	2.78E-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	-	-	-	-	-
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E. Tritium

H-3	Ci	3.83E-03	5.38E-03	7.47E-03	7.02E-03	2.37E-02
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"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.3-A8
 Millstone Unit 3
Airborne Effluents - Ground Batch
Containment Air
Containment Equipment Hatch

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Gases

γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

B. Iodines / Halogens

γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

C. Particulates

Cr-51	Ci	*	*	*	*	*
Co-58	Ci	*	*	*	*	*
Other γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*

D. Gross Alpha

Gross Alpha	Ci	*	*	*	*	*
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E. Tritium

H-3	Ci	*	*	*	*	*
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* No activity released

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 MPS3 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, Service Water Effluent for MPS2 and MPS3 and Reactor Building Closed Cooling Water (RBCCW) Sump for MPS2. Pathways for continuous liquid effluent releases via DSN006 include Turbine Building Sump discharge from MPS2 and MPS3.

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 MPS3 to DSN006 they are discharged via the Millstone Quarry. The sources are:

MPS1 Radwaste Processing System – Includes sources from:

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

MPS2 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

MPS3 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

	MPS1	MPS2	MPS3
Radwaste Processing System:			
Number of Batches	4	59	48
Total Time (min)	178	7,200	5,010
Maximum Time (min)	46	511	221
Average Time (min)	44.5	120	104
Minimum Time (min)	43	51	73
	MPS1	MPS2	MPS3
Other Radwaste Sources:			
Number of Batches	NA	15	261
Total Time (min)	NA	26,400	1,131,400
Maximum Time (min)	NA	13,800	44,700
Average Time (min)	NA	1,650	4,320
Minimum Time (min)	NA	3	1

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 2012, the following abnormal liquid releases occurred:

2.2.5.1 MPS1 - None

2.2.5.2 MPS2 - None

2.2.5.3 MPS3 – In 2012 the condensate surge tank leaked. Leakage was collected and discharged via the DSN006 pathway. Tritium was the only radioactivity in this discharge. It totaled about 3E-5 Curies and is included in Table 2.3-L2 of this report.

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	2012					
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	
A. Fission and Activation Products						
1. Total Activity Released	Ci	3.63E-04	5.30E-04	*	*	8.93E-04
2. Average Period Diluted Activity+	uCi/ml	1.48E-15	2.23E-15	*	*	*
B. Tritium						
1. Total Activity Released	Ci	1.15E-03	7.56E-04	*	*	1.91E-03
2. Average Period Diluted Activity+	uCi/ml	4.69E-15	3.19E-15	*	*	-
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	-	2.86E-06	*	*	2.86E-06
E. Volume						
1. Released Waste Volume	Liters	7.38E+04	7.01E+04	*	*	1.44E+05
2. Dilution Volume During Releases++	Liters	1.72E+08	1.59E+08	*	*	3.31E+08
3. Dilution Volume During Period+++	Liters	2.45E+11	2.37E+11	*	*	4.82E+11

* No activity released

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

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

++ Dilution Volume During Period x (Total release time ÷ Total quarter time)

+++ 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	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	
A. Fission & Activation Products						
Cs-137	Ci	1.28E-04	5.30E-04	*	*	6.58E-04
Other γ Emitters	Ci	-	-	*	*	-
Sr-90	Ci	-	-	*	*	-
Fe-55	Ci	2.35E-04	-	*	*	2.35E-04
Total Activity	Ci	3.63E-04	5.30E-04	*	*	8.93E-04
B. Tritium						
H-3	Ci	1.15E-03	7.56E-04	*	*	1.91E-03
C. Dissolved & Entrained Gases						
Kr-85	Ci	-	-	*	*	-
Other γ Emitters	Ci	-	-	*	*	-
Total Activity	Ci	-	-	*	*	-
D. Gross Alpha						
Gross Alpha	Ci	-	2.86E-06	*	*	2.86E-06

* No activity released

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

Table 2.2-L1

**Millstone Unit No. 2
Liquid Effluents - Release Summary**

Units	2012				
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission and Activation Products

1. Total Activity Released	Ci	7.82E-03	7.23E-03	7.92E-02	1.78E-02	1.12E-01
2. Average Period Diluted Activity *	uCi/ml	3.19E-11	3.05E-11	2.96E-10	1.06E-10	1.22E-10

B. Tritium

1. Total Activity Released	Ci	3.31E+01	9.60E+01	3.56E+02	3.19E+01	5.17E+02
2. Average Period Diluted Activity *	uCi/ml	1.35E-07	4.05E-07	1.33E-06	1.90E-07	5.63E-07

C. Dissolved and Entrained Gases

1. Total Activity Released	Ci	5.81E-03	1.94E-02	1.19E-01	2.33E-02	1.68E-01
2. Average Period Diluted Activity *	uCi/ml	2.37E-11	8.19E-11	4.44E-10	1.39E-10	1.83E-10

D. Gross Alpha

1. Total Activity Released	Ci	-	1.36E-05	-	-	1.36E-05
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E. Volume

1. Released Waste Volume	Primary	Liters	1.32E+05	2.41E+05	1.06E+06	5.71E+05	2.00E+06
	Secondary	Liters	2.49E+06	4.65E+05	7.08E+05	2.04E+06	5.70E+06
2. Dilution Volume During Releases	Primary	Liters	2.99E+09	3.64E+09	1.68E+10	9.39E+09	3.28E+10
	Secondary	Liters	1.09E+11	1.87E+10	5.46E+09	8.24E+10	2.16E+11
3. Dilution Volume During Period		Liters	2.45E+11	2.37E+11	2.68E+11	1.68E+11	9.18E+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**

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Products

Cs-137	Ci	-	-	-	2.00E-06	2.00E-06
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	2.00E-06	2.00E-06

B. Tritium

H-3	Ci	9.35E-03	2.47E-03	1.08E-03	1.12E-02	2.41E-02
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C. Dissolved & Entrained Gases

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

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes Not Analyzed

Table 2.2-L3

**Millstone Unit 2
Liquid Effluents - Batch**

Release to Quarry: Liquid Radwaste Processing System

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Products

Cr-51	Ci	-	-	-	4.11E-05	4.11E-05
Mn-54	Ci	7.33E-04	9.52E-06	2.28E-05	3.76E-05	8.03E-04
Co-57	Ci	1.08E-04	-	-	1.57E-05	1.24E-04
Co-58	Ci	2.11E-03	2.18E-05	1.17E-04	9.16E-03	1.14E-02
Co-60	Ci	1.54E-03	3.66E-04	1.12E-03	1.19E-03	4.22E-03
Nb-95	Ci	-	-	-	1.40E-04	1.40E-04
Zr-95	Ci	-	-	-	9.04E-05	9.04E-05
Nb-97	Ci	8.15E-06	-	1.64E-05	2.35E-05	4.81E-05
Ag-110m	Ci	4.87E-04	5.46E-05	1.66E-04	2.08E-03	2.79E-03
Sn-113	Ci	-	-	-	1.42E-04	1.42E-04
Sb-124	Ci	-	-	-	2.15E-04	2.15E-04
Sb-125	Ci	8.62E-04	4.28E-05	8.19E-04	1.17E-03	2.89E-03
I-131	Ci	-	-	2.52E-05	7.57E-06	3.28E-05
Cs-134	Ci	1.68E-04	1.67E-05	-	-	1.85E-04
Cs-137	Ci	1.03E-03	7.34E-05	1.36E-05	7.91E-05	1.20E-03
Ba-140	Ci	-	-	5.30E-06	-	5.30E-06
La-140	Ci	-	-	4.61E-06	9.00E-06	1.36E-05
Other γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	2.00E-04	4.05E-04	6.63E-02	1.47E-03	6.84E-02
Ni-63	Ci	5.76E-04	6.24E-03	9.42E-03	1.94E-03	1.82E-02
Sr-89	Ci	-	-	1.19E-03	-	1.19E-03
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	7.82E-03	7.23E-03	7.92E-02	1.78E-02	1.12E-01

B. Tritium

H-3	Ci	3.31E+01	9.60E+01	3.56E+02	3.19E+01	5.17E+02
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C. Dissolved & Entrained Gases

Kr-85	Ci	5.81E-03	1.93E-02	1.08E-01	2.27E-02	1.56E-01
Xe-133	Ci	-	1.04E-04	1.11E-02	5.98E-04	1.18E-02
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	5.81E-03	1.94E-02	1.19E-01	2.33E-02	1.68E-01

D. Gross Alpha

Gross Alpha	Ci	-	1.36E-05	-	-	1.36E-05
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"-" denotes less than Minimum Detectable Activity (MDA)

**Table 2.3-L1
Millstone Unit 3**

Liquid Effluents - Release Summary

Units	2012				
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission and Activation Products

1. Total Activity Released	Ci	2.47E-02	1.53E-02	7.43E-03	5.12E-03	5.26E-02
2. Average Period Diluted Activity *	uCi/ml	5.59E-11	3.84E-11	1.57E-11	1.10E-11	2.95E-11

B. Tritium

1. Total Activity Released	Ci	1.34E+02	1.24E+02	5.47E+01	2.79E+02	5.92E+02
2. Average Period Diluted Activity *	uCi/ml	3.03E-07	3.11E-07	1.16E-07	5.99E-07	3.33E-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	-	-	-	-	-
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E. Volume

1. Released Waste Volume						
Primary	Liters	1.04E+06	6.51E+05	4.50E+05	4.82E+05	2.62E+06
Secondary	Liters	1.83E+07	1.72E+07	1.38E+07	4.70E+07	9.63E+07
2. Dilution Volume During Releases						
Primary	Liters	9.82E+09	5.64E+09	5.63E+09	4.39E+09	2.55E+10
Secondary	Liters	1.06E+11	1.18E+11	1.37E+11	3.43E+11	7.04E+11
3. Dilution Volume During Period						
	Liters	4.42E+11	3.99E+11	4.73E+11	4.66E+11	1.78E+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, Miscellaneous**

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Products

γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-

B. Tritium

H-3	Ci	4.31E-02	6.01E-02	2.79E-02	4.02E-02	1.71E-01
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C. Dissolved & Entrained Gases

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

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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"-" denotes less than Minimum Detectable Activity (MDA)

"na" denotes Not Analyzed

Table 2.3-L3

**Millstone Unit 3
Liquid Effluents - Batch**

**Release to Quarry: Liquid Radwaste Processing System,
CPF Waste Neutralization Sumps, Hotwell and Steam Generator Bulk**

Nuclides Released	Units	2012				Total
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	

A. Fission & Activation Products

Cr-51	Ci	3.35E-04	-	-	-	3.35E-04
Mn-54	Ci	3.31E-04	2.64E-05	-	7.06E-06	3.64E-04
Co-58	Ci	1.70E-03	3.96E-04	4.99E-05	1.29E-05	2.16E-03
Fe-59	Ci	2.71E-04	2.94E-05	-	-	3.00E-04
Co-60	Ci	2.23E-03	4.71E-04	1.43E-04	1.69E-04	3.01E-03
Zn-65	Ci	-	7.22E-06	-	-	7.22E-06
As-76	Ci	1.21E-05	-	-	-	1.21E-05
Nb-95	Ci	1.21E-04	-	-	-	1.21E-04
Zr-95	Ci	-	6.72E-06	-	-	6.72E-06
Nb-97	Ci	1.95E-05	1.91E-05	-	-	3.86E-05
Ag-110m	Ci	1.58E-05	1.56E-05	-	-	3.14E-05
Sn-117m	Ci	1.13E-05	1.39E-05	-	-	2.52E-05
Sb-125	Ci	1.24E-04	3.73E-03	1.06E-03	1.49E-03	6.40E-03
Cs-134	Ci	-	1.42E-04	1.81E-04	2.95E-04	6.18E-04
Cs-137	Ci	-	3.43E-04	3.11E-04	5.08E-04	1.16E-03
La-140	Ci	-	1.81E-05	-	-	1.81E-05
Other γ Emitters	Ci	-	-	-	-	-
Ni-63	Ci	9.77E-03	-	4.13E-03	5.78E-04	1.45E-02
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	9.77E-03	1.01E-02	1.56E-03	2.06E-03	2.35E-02
Total Activity	Ci	2.47E-02	1.53E-02	7.43E-03	5.12E-03	5.26E-02

B. Tritium

H-3	Ci	1.34E+02	1.24E+02	5.47E+01	2.79E+02	5.92E+02
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C. Dissolved & Entrained Gases

Ar-41	Ci	3.47E-05	8.82E-06	-	-	4.35E-05
Kr-87	Ci	1.19E-05	-	-	-	1.19E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	4.66E-05	8.82E-06	-	-	5.54E-05

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-
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"-" 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 MPS1 Solid Waste and Irradiated Component Shipments

Table 2.2-S MPS2 Solid Waste and Irradiated Component Shipments

Table 2.3-S MPS3 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, 2012 through December 31, 2012

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

Resins, Filters, and Evaporator Bottoms Waste Class	Volume		Curies Shipped
	ft ³	m ³	Curies
A	9.00E+01	2.55E+00	2.65E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	9.00E+01	2.55E+00	2.65E-03

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
Fe-55	7.63%	2.02E-04
Co-60	2.97%	7.86E-05
Ni-63	4.84%	1.28E-04
Cs-137	84.56%	2.24E-03
Pu-238	< 0.01%	5.20E-08
Pu-239	< 0.01%	2.83E-08
Am-241	< 0.01%	1.18E-07
Cm-244	< 0.01%	3.68E-08
CURIES (TOTAL)		2.65E-03

Dry Active Waste Waste Class	Volume		Curies Shipped
	ft ³	m ³	Curies
A	3.56E+02	1.01E+01	5.59E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	3.56E+02	1.01E+01	5.59E-03

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
Fe-55	38.28%	2.14E-03
Co-60	13.88%	7.76E-04
Ni-63	21.37%	1.19E-03
Cs-137	26.38%	1.47E-03
Pu-238	< 0.01%	4.86E-07
Pu-239	< 0.01%	2.63E-07
Pu-241	0.04%	2.27E-06
Am-241	0.02%	1.10E-06
Cm-244	< 0.01%	3.48E-07
CURIES (TOTAL)		5.59E-03

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

Irradiated Components	Volume		Curies Shipped
	ft ³	m ³	
Waste Class	ft³	m³	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

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Other Waste	Volume		Curies Shipped
	ft ³	m ³	
Waste Class	ft³	m³	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

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

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

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
	ft ³	m ³	Curies
A	4.46E+02	1.26E+01	8.23E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	4.46E+02	1.26E+01	8.23E-03

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
Fe-55	28.43%	2.34E-03
Co-60	10.38%	8.54E-04
Ni-63	16.06%	1.32E-03
Cs-137	45.08%	3.71E-03
Pu-238	< 0.01%	5.38E-07
Pu-239	< 0.01%	2.92E-07
Pu-241	0.03%	2.27E-06
Am-241	0.01%	1.22E-06
Cm-244	< 0.01%	3.85E-07
CURIES (TOTAL)		8.23E-03

Table 2.2-S
Solid Waste and Irradiated Component Shipments
MPS 2

January 1, 2012 through December 31, 2012

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
	ft ³	m ³	Curies
A	5.82E+01	1.65E+00	6.47E-02
B	9.55E+01	2.70E+00	3.49E+01
C	2.34E+01	6.63E-01	2.61E+00
ALL	1.77E+02	5.01E+00	3.76E+01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.18%	6.95E-02
C-14	1.11%	4.19E-01
Cr-51	< 0.01%	9.30E-05
Mn-54	3.10%	1.17E+00
Fe-55	16.97%	6.38E+00
Fe-59	< 0.01%	5.92E-06
Co-57	0.14%	5.42E-02
Co-58	0.48%	1.80E-01
Co-60	11.79%	4.44E+00
Ni-59	0.56%	2.09E-01
Ni-63	42.77%	1.61E+01
Zn-65	< 0.01%	3.04E-05
Sr-89	< 0.01%	2.55E-04
Sr-90	0.06%	2.09E-02
Zr-95	< 0.01%	1.29E-03
Nb-95	< 0.01%	1.88E-04
Tc-99	< 0.01%	2.02E-03
Ag-110m	0.07%	2.59E-02
Sn-113	0.02%	7.11E-03
Sn-117m	< 0.01%	1.19E-07
Sb-124	< 0.01%	9.50E-05
Sb-125	1.95%	7.35E-01
Cs-134	7.32%	2.75E+00
Cs-137	13.24%	4.98E+00
Ce-144	< 0.01%	1.44E-04
Hf-181	< 0.01%	2.61E-06
Pu-238	< 0.01%	4.65E-04
Pu-239	< 0.01%	1.76E-04
Pu-241	0.22%	8.15E-02
Am-241	< 0.01%	2.88E-04
Cm-242	< 0.01%	2.86E-05
Cm-244	< 0.01%	5.84E-04
CURIES (TOTAL)		3.76E+01

**Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 2**

Dry Active Waste	Volume		Curies Shipped
	ft ³	m ³	
Waste Class			Curies
A	1.14E+04	3.23E+02	2.75E+00
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	1.14E+04	3.23E+02	2.75E+00

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.07%	2.01E-03
C-14	< 0.01%	5.52E-05
Cr-51	< 0.01%	1.96E-04
Mn-54	0.15%	4.06E-03
Fe-55	40.43%	1.11E+00
Fe-59	< 0.01%	4.34E-06
Co-57	< 0.01%	1.39E-06
Co-58	2.14%	5.88E-02
Co-60	9.73%	2.67E-01
Ni-63	41.12%	1.13E+00
Sr-89	< 0.01%	1.42E-07
Sr-90	< 0.01%	9.81E-07
Zr-95	0.47%	1.30E-02
Nb-95	0.55%	1.51E-02
Ag-110m	0.34%	9.43E-03
Sn-113	< 0.01%	7.22E-05
Sn-117m	< 0.01%	1.37E-06
Sb-124	< 0.01%	2.80E-05
Sb-125	1.06%	2.91E-02
Cs-134	0.42%	1.16E-02
Cs-137	3.45%	9.48E-02
Hf-181	< 0.01%	2.16E-06
Pu-238	< 0.01%	3.05E-05
Pu-239	< 0.01%	4.54E-07
Pu-241	0.04%	9.81E-04
Am-241	< 0.01%	2.24E-05
Cm-242	< 0.01%	4.92E-07
Cm-244	< 0.01%	3.62E-05
CURIES (TOTAL)		2.75E+00

**Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 2**

Dry Active Waste	Volume		Curies Shipped
	ft ³	m ³	Curies
A	1.31E+04	3.71E+02	2.28E-01
B	N/A	N/A	N/A
C	2.50E+00	7.08E-02	5.04E-01
ALL	1.31E+04	3.72E+02	7.32E-01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.03%	2.12E-04
C-14	< 0.01%	3.55E-05
Cr-51	< 0.01%	1.21E-07
Mn-54	0.96%	7.01E-03
Fe-55	70.20%	5.14E-01
Fe-59	< 0.01%	2.79E-06
Co-57	0.02%	1.62E-04
Co-58	0.78%	5.69E-03
Co-60	8.43%	6.17E-02
Ni-63	15.31%	1.12E-01
Zn-65	0.01%	7.45E-05
Sr-89	< 0.01%	3.97E-09
Zr-95	0.58%	4.23E-03
Nb-95	0.89%	6.49E-03
Tc-99	0.07%	5.40E-04
Ag-110m	0.06%	4.28E-04
Sn-113	< 0.01%	3.97E-05
Sb-124	< 0.01%	2.73E-07
Sb-125	0.74%	5.44E-03
Cs-137	1.89%	1.39E-02
Pu-238	< 0.01%	6.75E-06
Pu-239	< 0.01%	2.16E-06
Pu-241	0.01%	1.00E-04
Am-241	< 0.01%	4.12E-06
Cm-242	< 0.01%	9.73E-07
Cm-244	< 0.01%	2.93E-06
CURIES (TOTAL)		7.32E-01

**Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 2**

Irradiated Components Waste Class	Volume		Curies Shipped
	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

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Other Waste Waste Class	Volume		Curies Shipped
	ft ³	m ³	Curies
A	5.54E+02	1.57E+01	1.14E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	5.54E+02	1.57E+01	1.14E-01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	99.55%	1.14E-01
C-14	0.01%	1.47E-05
Mn-54	0.04%	4.31E-05
Fe-55	0.02%	2.33E-05
Co-57	< 0.01%	5.50E-07
Co-58	0.09%	1.00E-04
Co-60	0.07%	8.17E-05
Ni-63	0.04%	5.07E-05
Zn-65	< 0.01%	3.79E-06
Sr-89	< 0.01%	8.25E-08
Sr-90	< 0.01%	5.62E-08
Tc-99	< 0.01%	2.97E-06
Ag-110m	< 0.01%	5.45E-07
Sb-125	0.02%	2.71E-05
Cs-134	0.01%	1.28E-05
Cs-137	0.13%	1.49E-04
Ce-144	< 0.01%	2.86E-07
Pu-238	< 0.01%	3.01E-09
Pu-239	< 0.01%	1.29E-09
Pu-241	< 0.01%	7.34E-10
Am-241	< 0.01%	1.28E-09
CURIES (TOTAL)		1.14E-01

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 2

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
	ft ³	m ³	
Waste Class	ft³	m³	Curies
A	1.37E+04	3.89E+02	4.07E-01
B	9.55E+01	2.70E+00	3.49E+01
C	2.59E+01	7.34E-01	3.12E+00
ALL	1.39E+04	3.92E+02	3.85E+01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.48%	1.83E-01
C-14	1.09%	4.19E-01
Cr-51	< 0.01%	9.31E-05
Mn-54	3.05%	1.17E+00
Fe-55	17.94%	6.90E+00
Fe-59	< 0.01%	8.71E-06
Co-57	0.14%	5.44E-02
Co-58	0.48%	1.85E-01
Co-60	11.69%	4.50E+00
Ni-59	0.54%	2.09E-01
Ni-63	42.13%	1.62E+01
Zn-65	< 0.01%	1.09E-04
Sr-89	< 0.01%	2.55E-04
Sr-90	0.05%	2.09E-02
Zr-95	0.01%	5.52E-03
Nb-95	0.02%	6.68E-03
Tc-99	< 0.01%	2.57E-03
Ag-110m	0.07%	2.63E-02
Sn-113	0.02%	7.15E-03
Sn-117m	< 0.01%	1.19E-07
Sb-124	< 0.01%	9.53E-05
Sb-125	1.92%	7.40E-01
Cs-134	7.16%	2.75E+00
Cs-137	12.98%	4.99E+00
Ce-144	< 0.01%	1.44E-04
Hf-181	< 0.01%	2.61E-06
Pu-238	< 0.01%	4.72E-04
Pu-239	< 0.01%	1.78E-04
Pu-241	0.21%	8.16E-02
Am-241	< 0.01%	2.93E-04
Cm-242	< 0.01%	2.96E-05
Cm-244	< 0.01%	5.87E-04
CURIES (TOTAL)		3.85E+01

Table 2.3-S
Solid Waste and Irradiated Component Shipments
MPS 3

January 1, 2012 through December 31, 2012

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
	ft ³	m ³	Curies
A	4.85E+02	1.37E+01	6.81E-02
B	1.74E+02	4.93E+00	1.22E+02
C	4.21E+01	1.19E+00	2.28E+01
ALL	7.01E+02	1.99E+01	1.45E+02

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	3.20%	4.62E+00
C-14	< 0.01%	1.93E-03
Cr-51	< 0.01%	3.81E-05
Mn-54	2.05%	2.97E+00
Fe-55	38.67%	5.59E+01
Fe-59	< 0.01%	1.20E-05
Co-57	0.05%	7.56E-02
Co-58	0.19%	2.77E-01
Co-60	9.18%	1.33E+01
Ni-59	0.17%	2.51E-01
Ni-63	24.56%	3.55E+01
Zn-65	< 0.01%	1.43E-02
Sr-89	< 0.01%	7.19E-09
Sr-90	< 0.01%	1.26E-02
Nb-94	< 0.01%	4.66E-04
Zr-95	< 0.01%	1.34E-03
Nb-95	< 0.01%	5.61E-06
Tc-99	< 0.01%	2.52E-03
Ag-110m	< 0.01%	4.62E-04
Sn-113	< 0.01%	2.65E-03
Sn-117m	< 0.01%	2.96E-32
Sb-124	< 0.01%	6.14E-07
Sb-125	0.28%	4.11E-01
Cs-134	9.81%	1.42E+01
Cs-137	11.79%	1.71E+01
Ce-144	< 0.01%	1.31E-05
Hf-181	< 0.01%	1.96E-11
Pu-238	< 0.01%	2.62E-04
Pu-239	< 0.01%	1.69E-04
Pu-241	0.02%	2.79E-02
Am-241	< 0.01%	2.43E-04
Cm-242	< 0.01%	7.07E-05
Cm-244	< 0.01%	4.81E-04
CURIES (TOTAL)		1.45E+02

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 3

Dry Active Waste	Volume		Curies Shipped
	ft ³	m ³	Curies
A	4.02E+03	1.14E+02	3.37E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	4.02E+03	1.14E+02	3.37E-02

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.72%	2.42E-04
Cr-51	0.31%	1.05E-04
Mn-54	3.47%	1.17E-03
Fe-55	24.88%	8.38E-03
Co-58	2.58%	8.68E-04
Co-60	54.45%	1.83E-02
Ni-63	10.16%	3.42E-03
Sb-125	1.56%	5.24E-04
Cs-134	0.39%	1.31E-04
Cs-137	1.48%	5.00E-04
CURIES (TOTAL)		3.37E-02

Irradiated Components	Volume		Curies Shipped
	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

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

**Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 3**

Other Waste	Volume		Curies Shipped
	ft ³	m ³	
Waste Class	ft³	m³	Curies
A	7.31E+02	2.07E+01	1.59E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	7.31E+02	2.07E+01	1.59E-01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	99.55%	1.58E-01
C-14	0.01%	1.73E-05
Mn-54	0.04%	6.29E-05
Fe-55	0.02%	3.18E-05
Co-57	< 0.01%	8.10E-07
Co-58	0.09%	1.47E-04
Co-60	0.07%	1.12E-04
Ni-63	0.04%	6.92E-05
Zn-65	< 0.01%	5.57E-06
Sr-89	< 0.01%	1.22E-07
Sr-90	< 0.01%	8.28E-08
Tc-99	< 0.01%	4.17E-06
Ag-110m	< 0.01%	6.39E-07
Sb-125	0.02%	3.86E-05
Cs-134	0.01%	1.84E-05
Cs-137	0.13%	2.08E-04
Ce-144	< 0.01%	4.21E-07
Pu-238	< 0.01%	4.11E-09
Pu-239	< 0.01%	1.75E-09
Pu-241	< 0.01%	8.62E-10
Am-241	< 0.01%	1.88E-09
CURIES (TOTAL)		1.59E-01

**Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS 3**

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
	ft ³	m ³	
Waste Class			Curies
A	5.24E+03	1.48E+02	2.61E-01
B	1.74E+02	4.93E+00	1.22E+02
C	4.21E+01	1.19E+00	2.28E+01
ALL	5.45E+03	1.54E+02	1.45E+02

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	3.30%	4.78E+00
C-14	< 0.01%	1.95E-03
Cr-51	< 0.01%	1.43E-04
Mn-54	2.05%	2.97E+00
Fe-55	38.62%	5.59E+01
Fe-59	< 0.01%	1.20E-05
Co-57	0.05%	7.56E-02
Co-58	0.19%	2.78E-01
Co-60	9.18%	1.33E+01
Ni-59	0.17%	2.51E-01
Ni-63	24.53%	3.55E+01
Zn-65	< 0.01%	1.44E-02
Sr-89	< 0.01%	1.29E-07
Sr-90	< 0.01%	1.26E-02
Nb-94	< 0.01%	4.66E-04
Zr-95	< 0.01%	1.34E-03
Nb-95	< 0.01%	5.61E-06
Tc-99	< 0.01%	2.52E-03
Ag-110m	< 0.01%	4.63E-04
Sn-113	< 0.01%	2.65E-03
Sn-117m	< 0.01%	2.96E-32
Sb-124	< 0.01%	6.14E-07
Sb-125	0.28%	4.12E-01
Cs-134	9.80%	1.42E+01
Cs-137	11.77%	1.71E+01
Ce-144	< 0.01%	1.35E-05
Hf-181	< 0.01%	1.96E-11
Pu-238	< 0.01%	2.62E-04
Pu-239	< 0.01%	1.69E-04
Pu-241	0.02%	2.79E-02
Am-241	< 0.01%	2.43E-04
Cm-242	< 0.01%	7.07E-05
Cm-244	< 0.01%	4.81E-04
CURIES (TOTAL)		1.45E+02

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. 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 MPS3 and channels this water via the storm drain system to Long Island Sound.

**Table 2.4-GW1
Additional Well Samples**

Name	Date	H-3 ¹ (pCi/L)
MW-6A	9/13/12	<1,770
	9/26/12	<1,770
	10/11/12	<1,770
MW-6B	9/13/12	<1,770
	9/26/12	<1,770
	10/11/12	<1,770
MW-7A	9/11/12	<1,720
	9/19/12	<1,720
MW-7C	6/7/12	<1,720
	9/10/12	<1,720
	9/11/12	<1,720
	9/19/12	<1,720
	9/26/12	<1,770
MW-GPI-4	3/8/12	<767
	10/26/12	<1,770
MW-GPI-5	3/21/12	<690
	9/27/12	<1,770
	10/20/12	<1,770
MW-GPI-6	3/21/12	<691
	9/27/12	<1,770
	10/20/12	<1,770
MW-GPI-8	3/7/12	<745
MW-GPI-9	3/8/12	<778
S12-MW-1	3/8/12	<761
DP-003A ²	9/6/12	6,720
DP-004A ²	9/6/12	<1,720
DP-102 ²	9/6/12	1,760

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

2 - These wells are located near the MPS3 RWST. All or some of the H-3 detected in these wells is from releases out of the RWST vent. Airborne 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, measured before release to the environment and reported in Table 2.3-L2. There has been no communication with offsite groundwater. During 2012, an investigation was initiated to determine if there are additional sources of H-3 to onsite groundwater at Well MW-7D.

**Table 2.4-GW2
Well MW-7D² Results**

Date	H-3 ¹ (pCi/L)	Date	H-3 ¹ (pCi/L)
6/7/12	<1,720	10/17/12	6,160
9/10/12	3,450	10/18/12	5,990
9/11/12	2,950	10/19/12	7,180
9/11/12	2,570	10/20/12	6,740
9/11/12	2,480	10/21/12	6,330
9/12/12	3,540	10/22/12	6,550
9/12/12	2,960	10/23/12	6,120
9/12/12	3,160	10/24/12	6,580
9/12/12	3,720	10/25/12	6,410
9/12/12	2,470	10/26/12	5,600
9/12/12	2,650	10/27/12	6,330
9/14/12	2,510	10/28/12	6,620
9/17/12	2,860	10/29/12	6,950
9/17/12	4,190	10/29/12	7,190
9/18/12	3,300	10/31/12	6,530
9/19/12	3,600	11/1/12	6,290
9/20/12	3,530	11/2/12	6,440
9/22/12	3,100	11/5/12	6,110
9/24/12	2,740	11/6/12	5,790
9/26/12	3,180	11/9/12	6,280
9/28/12	3,670	11/12/12	4,840
9/30/12	3,590	11/13/12	5,740
10/2/12	3,800	11/14/12	5,190
10/4/12	4,250	11/16/12	5,040
10/6/12	6,370	11/19/12	5,760
10/7/12	4,850	11/21/12	5,860
10/7/12	5,730	11/26/12	5,660
10/8/12	5,170	12/3/12	4,950
10/9/12	5,910	12/6/12	5,180
10/10/12	6,460	12/10/12	4,810
10/11/12	5,910	12/13/12	5,420
10/12/12	5,910	12/17/12	5,370
10/13/12	5,760	12/20/12	4,060
10/14/12	7,010	12/26/12	3,600
10/15/12	6,500	12/31/12	2,820
10/16/12	6,230		

- Notes:
- 1 - There was no gamma radioactivity detected in these samples.
 - 2 - This well is located near the MPS3 RWST. All or some of the H-3 detected in this well is from releases out of the RWST vent. Airborne 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, measured before release to the environment and reported in Table 2.3-L2. There has been no communication with offsite groundwater. During 2012, an investigation was initiated to determine if there are additional sources of H-3 to onsite groundwater at Well MW-7D.

3.0 Inoperable Effluent Monitors

During the period January 1 through December 31, 2012, the following effluent monitors were inoperable for more than 30 consecutive days:

3.1 MPS1 – None

3.2 MPS2 – Condensate Polishing Facility Waste Neutralization Sump Radiation Monitor

Operations removed the CPF Waste Neut Sump Monitor (RM-245) from service on June 3, 2012 at 2300 for calibration per procedure SP2404AQ. I&C started the calibration June 5 and determined the detector had failed on June 6 and needed replacement. Work on detector replacement could not proceed because tanks had to be discharged to prevent overflow. Procedure requires simulation of satisfactory monitor sample flow through an inoperable monitor before performing a discharge. A condition report was generated on July 3, 2012 to identify the monitor out of service for 30 days. On July 11, technicians identified a difference between the replacement detector and the installed detector which was resolved by reuse of the detector preamp and replacing only the photomultiplier tube. The detector was repaired on July 12 and Operations restored RM-245 to service July 18, 2012 at 12:06.

MPS2 – Waste Gas Holdup System Radiation Monitor

The Waste Gas Monitor (RM-9095) was removed from service on June 8, 2012 at 0118 because of low sample flow. Initial troubleshooting was completed June 14. Troubleshooting resumed June 21 with inspection of a valve for blockage. Technicians did not find any blockage but did find leakage. This was fixed and the system restored by replacing detector o-rings, cleaning instrument tubing lines, and cycling the valve. RM-9095 was declared operable on July 3 at 20:08. It was declared inoperable again the next day due to low sample flow. Troubleshooting included three major attempts including boroscope inspection, reassembly, testing and failure. RM-9095 was returned to service on July 20 at 1523.

3.3 MPS3 – None

4.0 Operating History

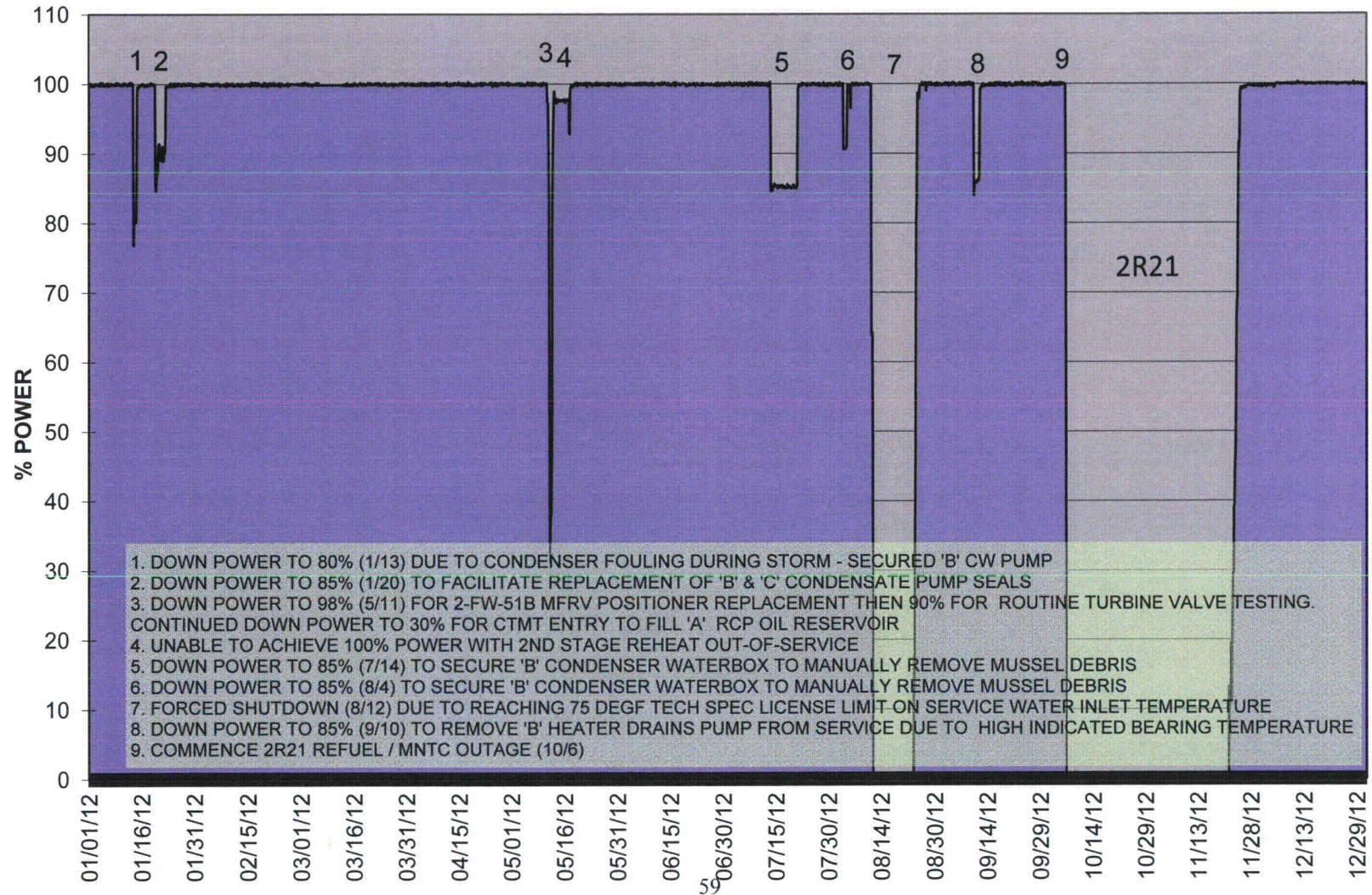
The operating history of the Millstone Power Station Units during this reporting period was as follows:

MPS1 was shut down November 11, 1995 with a cessation of operation declared in July 1998.

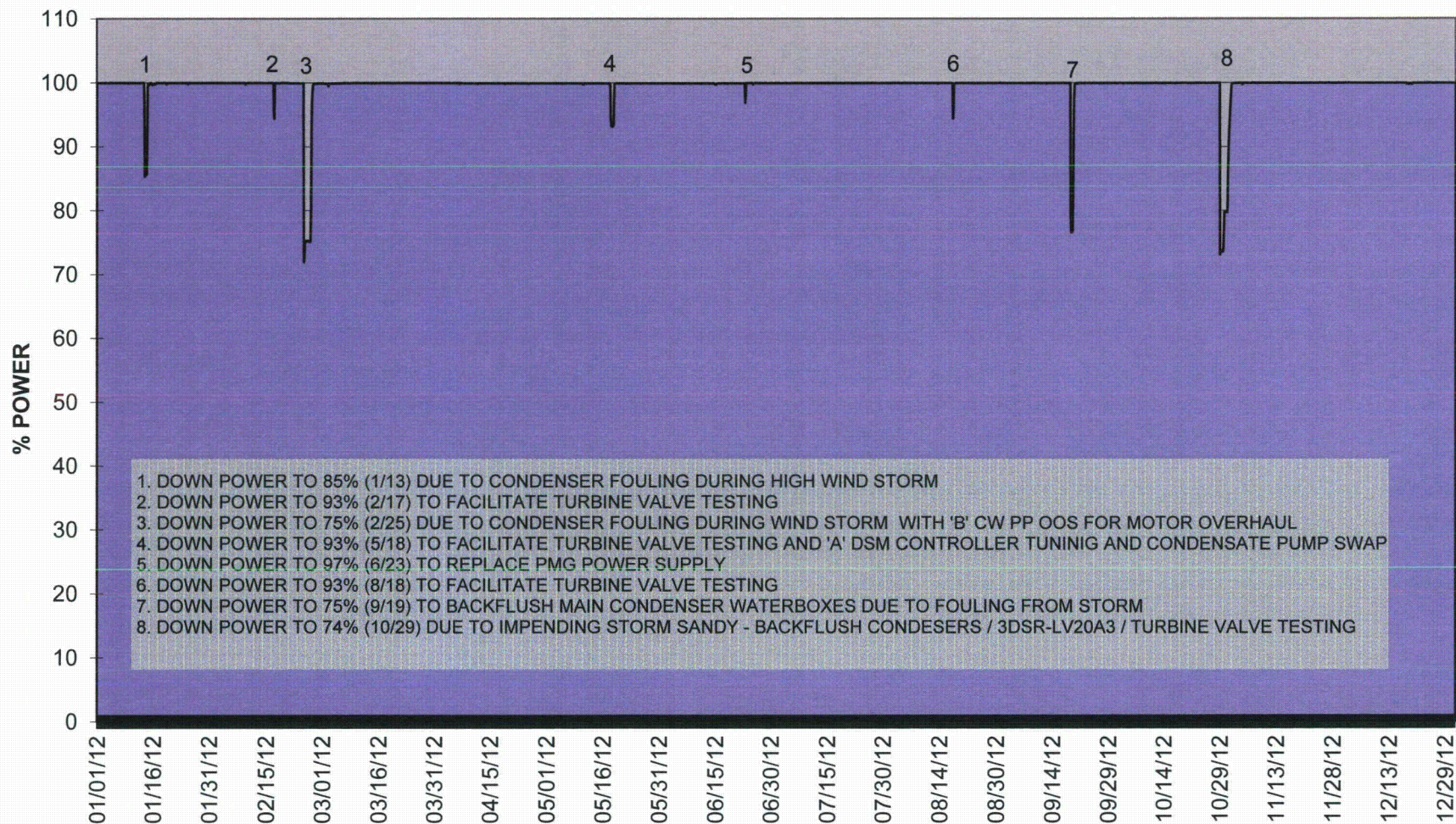
MPS2 operated with a capacity factor of 82.06% and MPS3 operated with a capacity factor of 100.49%

The power histograms for 2012 are on the following pages.

MP2 - CYCLE 21 POWER HISTORY YEAR 2012



MP3 - CYCLE 15 POWER HISTORY YEAR 2012



5.0 Errata

Tables 1-1 and 1-3 of the 2011 Radioactive Effluents Release Report are resubmitted to correct errors in the airborne doses from Beta and Gamma during the 3rd quarter for MPS2 and airborne doses in all categories during the 4th quarter for MPS3:

Table 1-1
2011 Off-Site Dose Commitments from Airborne 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
<i>Beta</i>	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<i>Gamma</i>	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
<i>Whole Body</i>	8.06E-05	4.43E-05	4.48E-03	8.40E-06	4.62E-03
<i>Skin</i>	9.26E-05	4.43E-05	4.48E-03	8.40E-06	4.63E-03
<i>Thyroid</i>	8.04E-05	4.43E-05	4.48E-03	8.40E-06	4.62E-03
<i>Max organ+</i>	8.10E-05	4.43E-05	4.48E-03	8.40E-06	4.62E-03

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
<i>Beta</i>	2.41E-04	3.75E-03	4.30E-04	1.23E-04	4.54E-03
<i>Gamma</i>	1.42E-04	8.17E-04	1.30E-04	1.23E-04	1.21E-03
Max Individual	mrem	mrem	mrem	mrem	mrem
<i>Whole Body</i>	2.46E-03	5.17E-02	7.57E-02	1.04E-02	1.40E-01
<i>Skin</i>	2.65E-03	5.33E-02	7.61E-02	1.05E-02	1.43E-01
<i>Thyroid</i>	2.75E-03	5.81E-02	7.66E-02	1.05E-02	1.48E-01
<i>Max organ+</i>	1.17E-02	2.53E-01	3.76E-01	5.16E-02	6.92E-01

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
<i>Beta</i>	6.15E-05	9.15E-05	2.96E-04	6.30E-06	4.55E-04
<i>Gamma</i>	1.70E-05	1.81E-05	1.20E-04	2.47E-06	1.57E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
<i>Whole Body</i>	2.84E-03	4.59E-02	6.38E-02	1.26E-02	1.25E-01
<i>Skin</i>	2.88E-03	4.59E-02	6.39E-02	1.30E-02	1.26E-01
<i>Thyroid</i>	2.84E-03	4.64E-02	6.38E-02	1.27E-02	1.26E-01
<i>Max organ+</i>	1.04E-02	2.20E-01	3.04E-01	5.40E-02	5.88E-01

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

5.0 Errata (continued)

**Table 1-3
2011 Off-Site Dose Comparison to Limits
Millstone Units 1, 2, 3**

Airborne Effluents Dose

Max Individual Dose vs REMODCM & 10CFR50 Appendix I Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	4.62E-03	4.62E-03	4.62E-03	4.63E-03	0.00E+00	0.00E+00
Unit 2	1.40E-01	1.48E-01	6.92E-01	1.43E-01	4.54E-03	1.21E-03
Unit 3	1.25E-01	1.26E-01	5.88E-01	1.26E-01	4.55E-04	1.57E-04
Millstone Station	2.70E-01	2.78E-01	1.28E+00	2.73E-01	5.00E-03	1.37E-03
Limits	5	15	15	15	20	10

Liquid Effluents Dose

Max Individual Dose vs REMODCM & 10CFR50 Appendix I Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)
Unit 1	0.00E+00	0.00E+00	0.00E+00
Unit 2	1.34E-03	2.37E-04	1.02E-02
Unit 3	1.04E-03	5.09E-04	6.30E-03
Millstone Station	2.38E-03	7.46E-04	1.65E-02
Limits	3	10	10

Total Off-Site Dose from Millstone Station

Max Individual Dose vs REMODCM & 40CFR190 Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)
Airborne Effluents	2.70E-01	2.78E-01	1.28E+00
Liquid Effluents	2.38E-03	7.46E-04	1.65E-02
Radwaste Storage	2.20E-01	2.20E-01	2.20E-01
Millstone Station	4.92E-01	4.99E-01	1.52E+00
Limits	25	75	25

Note: REMODCM limits are listed in 10CFR50, Appendix I which contains additional limits not listed in the REMODCM

* Maximum of the following organs (not including Thyroid): Bone, G-LLI, Kidney, Liver, Lung

6.0 REMODCM Changes

The description and the bases of the change(s) for REMODCM Revision 27-00 (effective March 13, 2012) 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.

1. Description Of Change

- 1.1 In Table I.C-1, Footnote D is added which allows exception to performing quarterly analyses for gross alpha, Sr-90 and Fe-55 if there has been no discharge from the source in the last quarter for batch releases of any Unit 1 liquid source.
- 1.2 In Tables I.C-2 & IC-3 in last sentence of Footnote B, “prior to batch discharge, samples” is changed to “prior to batch discharge, a sample” for liquid batch releases from Units 2 and 3.
- 1.3 In Table I.D-2 for Unit 2 gaseous sampling and analyses:
 - a) Analysis frequency for containment purges and vents is changed from “Prior to Purge” and “Same as sample frequency for vent samples” to “Same as sample frequency.”
 - b) For Spent Fuel Pool releases, the requirement to sample at Aux Bldg Rollup Door for I-131 and I-133 and Noble Gases under ‘Sample Type and Frequency’ was deleted.
 - c) For Containment releases, the requirement to sample at Equipment Hatch for Noble Gases under ‘Sample Type and Frequency’ was deleted. With this change Footnote L is deleted.
 - d) In Footnote C:
 - Time for sampling and analysis was changed from “24 to 72 hours” to “within 72 hours.”
 - Description of reactor power change was changed from “maximum power” to “rated thermal power.”
 - Exception was added to sampling and analysis if the noble gas monitor has not increased by more than 50%.
 - e) In Footnote F the words "as defined in Technical Specifications" would be added after "rated thermal power."
 - f) In Condition (2) of Method A in Footnote H, change "gaseous processing system" to "tank."
- 1.4 In Tables I.D-3 for Unit 3 gaseous sampling and analyses:
 - a) In the column “Sample Type and Frequency”, the description of the gaseous grab sample every two weeks was revised to more specifically identify it with the containment vent.
 - b) Analysis frequency for containment purges and vents was changed from “Prior to Purge” and “Same as sample frequency for vent samples” to “Same as sample frequency.”
 - c) In the column “Type of Activity Analysis” for containment purge and vent samples the analyses for I-131 and I-133 was specifically identified for the charcoal sample and the analyses for principle gamma emitters was specifically identified for the particulate sample.
 - d) In the column “Sample Type and Frequency” the continuous charcoal sample at the containment equipment hatch will specify “open” containment equipment hatch.

- e) For Spent Fuel Pool releases, the requirement to sample at Aux Bldg Rollup Door for I-131 and I-133 and Noble Gases under ‘Sample Type and Frequency’ was deleted.
- f) For Containment releases, the requirement to sample at Equipment Hatch for Noble Gases was deleted. With this change Footnote K was deleted.
- g) In Footnote C:
 - Time for sampling and analysis was changed from “24 to 72 hours” to “within 72 hours.”
 - Description of reactor power change was changed from “maximum power” to “rated thermal power as defined in Technical Specifications.”
 - Exception was added if the noble gas monitor has not increased by more than 50%.
- h) In Footnote F the words "as defined in Technical Specifications" would be added after "rated thermal power."
- 1.5 In the Radiological Environmental Monitoring Program described in Table I.E-1 a footnote was added that pasture grass sample is not required during the 1st quarter.
- 1.6 In the Radiological Environmental Monitoring Program deleted TLD location 12-C at Fisher’s Island, NY.
- 1.7 Section II.C (Sub-sections 1-4 and 6) and Section II.D (Sub-sections 2,3 and 5) on calculation of public dose from release of radioactivity in liquid and gaseous effluents have been extensively revised. The revision replaced the two step methodology with a comprehensive one step methodology. In the old methodology the first step (“Method 1”) consisted of a simplified and conservative estimate of dose using a pre-determined factor of dose per curies released. The second step, which was used if Method 1 exceeded a pre-determined dose, was a detailed dose calculation using computer models (i.e., “Method 2”). Method 2 was also used for the annual dose determination. The Method 2 methodology is now required for determining monthly, quarterly and annual public doses. In the revision all old methodology was deleted including any specific references to dose codes and introductory paragraphs were rewritten. Now dose determination is required to be performed using any methodology which is compatible with Regulatory Guide 1.109, Rev.1, which is the current method acceptable to the NRC.
- 1.8 In Section II.C.5 on monthly dose projections required when any liquid waste processing equipment is inoperable:
 - a) In Section a on Unit 1 estimation of doses has been deleted.
 - b) In Section b, the 2nd footnote has been deleted.
- 1.9 Section II.C.6, “Quarterly Dose Calculations for Radioactive Effluent Release Report”, has been deleted.
- 1.10 In Section II.C.7, “Bases for Liquid Pathway Dose Calculations”, the first paragraph has been revised to removed references to Methods 1 and 2 dose calculations, to the computer code LADTAP and to methodology used to determine compliance with 40CFR190 and the second paragraph has been deleted.
- 1.11 The introductory paragraph for Section II.D, “Gaseous Dose Calculations”, has been deleted.
- 1.12 In Section II.D.1.c, “Method 2” (for instantaneous release rate limit on I-131, I-133, tritium and particulates), reference to the code GASPARG has been deleted.

- 1.13 In Section II.D.2, “10 CFR 50 Appendix I - Noble Gas Limits”:
- First two sentences of introductory paragraph have been reworded.
 - Section a on Method 1 Air Dose has been deleted.
 - Section b on Method 2 Air Dose has been revised to describe the primary method for calculation of monthly, quarterly and annual doses.
 - Section c on Estimation of Annual Air Dose has been deleted.
- 1.14 In Section II.D.3, “10 CFR 50 Appendix I - Iodine, Tritium and Particulate Doses”:
- First sentence of introductory paragraph has been reworded.
 - Sections a, Methods 1 and 2, and b, Method 1, on critical organ doses has been deleted.
 - Section b, Method 2, has been revised to describe the primary method for calculating iodine, tritium and particulate dose for all releases from the site.
 - Section c on Estimation of Annual Critical Organ Doses Due to Iodines, Tritium and Particulates has been deleted.
- 1.15 In Section II.D.4.c on monthly dose projection required when Unit 3 gaseous waste system is inoperable, the definition of C_N^E was revised to apply generally to any increase of radioactivity in effluents due to the inoperable processing system.
- 1.16 Section II.D.5, “Quarterly Dose Calculations for Radioactive Effluent Release Report”, has been deleted.
- 1.17 In Section II.D.6 on compliance with 40CFR190:
- In first sentence “a real individual” was changed to “any real member of the public at or beyond the site boundary.”
 - Exception to sources from other uranium fuel cycle (source d) was deleted.
 - Added the Independent Spent Fuel Storage Installation (ISFSI) as a source.
 - The last two paragraphs were entirely revised.
- 1.18 In Section II.D.7, “Bases for Gaseous Dose Calculations”:
- 2nd sentence in 2nd paragraph has been moved down in the paragraph and a new sentence has been added to explain that instantaneous release rate limits from the Millstone Stack was adjusted for change in flow with Unit 1 shutdown.
 - The phrase “(assumed to be nearest resident)” has been deleted.
 - The last two sentences of the 3rd paragraph have been deleted.
 - The last sentence in the section has been deleted.
- 1.19 Title of Section II.E.1 was changed from “Unit 1 Reactor Cavity Water Discharge Line” to “Unit 1 Spent Fuel Pool Water Discharge”, and in Step 3 ‘background’ was added to calculation of rad monitor setpoint.
- 1.20 For Unit 2 (Section II.E.3) and Unit 3 (Section II.E.8) liquid radwaste radiation monitors an alternate threshold for noble gas concentration was added. The alternate threshold is $2E-5$ uCi/ml noble gas concentration when diluted.
- 1.21 In Section II.F.6 for Unit 2 waste gas radiation monitor a requirement was added to automatically isolate discharge if monitor setpoint is reached.
- 1.22 In Section II.F.8 for Unit 3 Engineering Safeguards Building Monitor the basis for the setpoint was added.
- 1.23 In Table II.A-1 Unit 2 Tech Spec 6.20 and Unit 3 Tech Spec 6.15 were added as applicable to REMODCM Sections I.C.2; II.C.5; Tables I.D-1,2,3; and II.D.1.a&b. For REMODCM Sections II.D.2 and II.D.4 Unit 3 Tech Spec 6.16 was changed to Unit 3 Tech Spec 6.14&15.

- 1.24 In REMODCM Section III for Unit One controls:
- a) The words ‘operable’, ‘inoperable’ and ‘inoperability’ were replaced with ‘functional’, ‘nonfunctional’ and ‘nonfunctionality’ respectively throughout the section.
 - b) “Instrument Check” was changed to “Channel Check” in the definitions section and in Table III.C-4.
 - c) Title of the instrument in Table III.C-1 was changed from “Radioactivity Monitor Liquid Effluent Line” to “Spent Fuel Pool Radioactivity Monitor Liquid Effluent Line.”
 - d) In Action A of Table III.C-3 “gross activity” was changed to “gamma activity.”
 - e) Actions to be taken if any dose limit in LCOs in Sections III.D.1.b, III.D.2.b and III.D.2.c is exceeded were revised.
- 1.25 In REMODCM Section IV for Unit Two controls:
- a) The words ‘operable’, ‘inoperable’ and ‘inoperability’ were replaced with ‘functional’, ‘nonfunctional’ and ‘nonfunctionality’ respectively throughout the section.
 - b) In the LCO and Action for gaseous effluent monitoring instrumentation (Section IV.C.2), ‘trip’ was deleted from “alarm trip setpoint.”
 - c) In Actions A and E of Table IV.C-3 for gaseous effluent monitoring instrumentation:
 - The words “gross activity” were changed to “gamma activity.”
 - Daily channel check in lieu of a grab sample was added as an alternative action if monitor flow and readout are not adversely affected by instrument inoperability.
 - d) In Action B of Table IV.C-3 for gaseous effluent monitoring instrumentation, the words “samples are continuously collected with auxiliary sampling equipment for periods of seven” with “effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven.”
 - e) Actions to be taken if any dose limit in LCOs in Sections IV.D.1.b, IV.D.2.b and IV.D.2.c is exceeded were revised.
- 1.26 In REMODCM Section V for Unit Three controls:
- a) The words ‘operable’, ‘inoperable’ and ‘inoperability’ were replaced with ‘functional’, ‘nonfunctional’ and ‘nonfunctionality’ respectively throughout the section.
 - b) In the LCO and Action for gaseous effluent monitoring instrumentation (Section V.C.2), ‘trip’ was deleted from “alarm trip setpoint.”
 - c) In Table V.C-1 the applicability of the flow rate measurement device for the Steam Generator Blowdown Effluent Line was changed from ‘At All Times’ to ‘MODEs 1-4.’
 - d) In Actions A and D of Table V.C-3 for gaseous effluent monitoring instrumentation, The word “gamma” was added before “radioactivity.”
 - e) In Action B of Table V.C-3 for gaseous effluent monitoring instrumentation, the words “samples are continuously collected with auxiliary sampling equipment for periods of seven” with “effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven.”
 - f) In Table V.C-4 for gaseous effluent monitoring instrumentation surveillance requirements, the 2nd column title was changed from “Check” to “Channel Check.”

- g) Actions to be taken if any dose limit in LCOs in Sections V.D.1.b, V.D.2.b and V.D.2.c is exceeded were revised.

2. Discussion

- 2.1 When there has been no discharge in the last quarter analyses for gross alpha, Sr-90 and Fe-55 is not needed. Therefore an exception to performing quarterly for batch releases of any Unit 1 liquid source has been added in Table I.C-1, Footnote D.
- 2.2 In Footnote B of Tables I.C-2 & IC-3 the word “samples” implies that multiple composite samples for steam generator bulk releases from Units 2 and 3 would be required. Only a single composited sample, comprised of multiple individual samples is required. Therefore “samples” was changed to “a sample.”
- 2.3 In Table I.D-2 for Unit 2 gaseous sampling and analyses:
- a) Analysis frequency for containment purges and vents is changed from “Prior to Purge” and “Same as sample frequency for vent samples” to “Same as sample frequency.” This was done to simplify the wording.
 - b) For Spent Fuel Pool releases, the requirement to sample at Aux Bldg Rollup Door for I-131 and I-133 and Noble Gases under ‘Sample Type and Frequency’ was deleted. Per Footnote L this sampling was only required during fuel movement. Release of radioactivity from fuel during movement is excepted to be zero or minimal. There are area radiation monitors around the Spent Fuel Pool and Health Physics monitors the air during fuel movement. Movement of fuel would be suspended upon detection of abnormal levels of radioactivity. Potential releases to the environmental would then be calculated using available data.
 - c) For Containment releases, the requirement to sample at Equipment Hatch for Noble Gases under ‘Sample Type and Frequency’ was deleted. Per Footnote L this sampling was only required during fuel movement. Release of noble gases from fuel during movement is excepted to be zero or minimal. Health Physics monitors radiation and airborne radioactivity during fuel movement. Movement of fuel would be suspended upon detection of abnormal levels of radioactivity. The requirement to continuously sample at the Equipment Hatch for radioiodines and particulates remains. Potential releases to the environmental would be calculated using available data.
 - d) In Footnote C:
 - Time for sampling and analysis was changed from “24 to 72 hours” to “within 72 hours.” There is no reason to require that sampling and analysis not be performed before 24 hours . This change would offer more flexibility.
 - Description of reactor power change was changed from “maximum power” to “rated thermal power as defined in Technical Specifications.” This provides an exact number and follows the guidance given in NUREG-1301, NRC’s guidance for ODCMs. Referencing tech specs instead of putting a number in the REMODCM avoids having to revise the REMODCM of the defined rated thermal power were to be changed in tech spec.
 - Exception was added to sampling and analysis if the noble gas monitor reading has not increased by more than 50%. Any increase less than 50% is not significant enough to warrant extra sampling.

- e) In Footnote F the words "as defined in Technical Specifications" would be added after "rated thermal power." See discussion for Footnote C above.
 - g) In Footnote H, each tank in the gaseous waste system can be isolated from the system and vented or purged. Therefore Condition (2) was changed so that gas could have been introduced into the gaseous processing system as long as it was not introduced in whole or part into the tank being vented or purge.
- 2.4 In Tables I.D-3 for Unit 3 gaseous sampling and analyses:
- a) In the column "Sample Type and Frequency", the description of the gaseous grab sample every two weeks was revised to more specifically identify it with the containment vent. This change was made to make the requirement more clear.
 - b) Analysis frequency for containment purges and vents was changed from "Prior to Purge" and "Same as sample frequency for vent samples" to "Same as sample frequency." This was done to simplify the wording.
 - c) In the column "Type of Activity Analysis" for containment purge and vent samples the analyses for I-131 and I-133 was specifically identified for the charcoal sample and the analyses for principle gamma emitters was specifically identified for the particulate sample. This change more clearly identifies the analysis with the sample type.
 - d) For Containment releases, the requirement to sample at Equipment Hatch was specified as an open equipment hatch. There is no need to sample when the hatch is closed.
 - d) For Spent Fuel Pool releases, the requirement to sample at Aux Bldg Rollup Door for I-131 and I-133 and Noble Gases under 'Sample Type and Frequency' was deleted. Per Footnote K this sampling was only required during fuel movement. (Note: Although there is no 'rollup door' between the spent fuel pool and the environment, this requirement was applied at the door which opened to the environment.) Release of radioactivity from fuel during movement is excepted to be zero or minimal. There are area radiation monitors and a fixed airborne monitor around the Spent Fuel Pool and Health Physics monitors the air during fuel movement. Movement of fuel would be suspended upon detection of abnormal levels of radioactivity. Potential releases to the environmental would then be calculated using available data.
 - e) For Containment releases, the requirement to sample at Equipment Hatch for Noble Gases was deleted. Per Footnote K this sampling was only required during fuel movement. Release of noble gases from fuel during movement is excepted to be zero or minimal. Health Physics monitors radiation and airborne radioactivity during fuel movement. Movement of fuel would be suspended upon detection of abnormal levels of radioactivity. The requirement to continuously sample at the Equipment Hatch for radioiodines and particulates remains. Potential releases to the environmental would be calculated using available data.
 - f) In Footnote C:
 - Time for sampling and analysis was changed from "24 to 72 hours" to "within 72 hours." There is no reason to require that sampling and analysis not be performed before 24 hours . This change would offer more flexibility.

- Description of reactor power change was changed from “maximum power” to “rated thermal power as defined in Technical Specifications.” This provides an exact number and follows the guidance given in NUREG-1301, NRC’s guidance for ODCMs. Referencing tech specs instead of putting a number in the REMODCM avoids having to revise the REMODCM if the defined rated thermal power were to be changed in tech spec.
 - Exception was added if the noble gas monitor reading has not increased by more than 50%. Any increase less than 50% is not significant enough to warrant extra sampling.
- g) In Footnote F the words "as defined in Technical Specifications" would be added after "rated thermal power." See discussion for Footnote C above.
- 2.5 Sufficient grass is not available during the first three months of the year. Therefore an exception to sampling for pasture grass sample during the 1st quarter was added to the Radiological Environmental Monitoring Program.
- 2.6 The time and expense of travel (typically one man day effort) to Fisher’s Island to collect a single TLD is not cost effective. This TLD is one of five control TLDs which are used to characterize background radiation reading away from the plant. Four control TLDs are sufficient for this purpose. Table 3.12-1 of NUREG-1301, which is NRC’s guidance for ODCMs, recommends one or two control TLDs.
- 2.7 Section II.C (Sub-sections 1-4 and 6) and Section II.D (Sub-sections 2,3 and 5) on calculation of public dose from release of radioactivity in liquid and gaseous effluents have been extensively revised. The “Method 1” dose calculation methodology was developed over 25 years ago to provide a simplified and conservative estimate of dose. “Method 2” required the use of a computer which, at that time, was only available in a mainframe configuration and it took time and effort to calculate the dose. With present technology the public dose from radioactivity released in liquid and gaseous effluents can be easily setup and calculated on desktop computers. About ten years ago Millstone developed an in-house spreadsheet calculation methodology. This has been successfully used as the Method 2 methodology. The Millstone Chemistry Department is implementing a more sophisticated spreadsheet calculation methodology developed by a vendor. This vendor-supplied methodology, OpenEMS, will calculate dose based on Regulatory Guide 1.109 which is the NRC approved method. The in-house spreadsheet will serve as a backup. Both spreadsheet methodologies are controlled by Millstone Software Quality Assurance Program as outlined in Procedure IT-AA-SQA-101.
- 2.8 In Section II.C.5 on monthly dose projections required when any liquid waste processing equipment is inoperable:
- a) In Section a on Unit 1 estimation of doses has been deleted because Unit 1 no longer has any processing equipment required by the REMODCM.
 - b) In Section b, the 2nd footnote has been deleted. This footnote adjusted the dose projected for the coming month by the ratio of dilution flow in a previous month to the estimated dilution flow for the coming month. Dilution flow will always be almost identical for the previous month and the coming month because the projected dose is based on comparison to a previous month which is typical to the coming month. Therefore the ratio required by the 2nd footnote will always be one or almost one and is not needed.

- 2.9 Requirements for dose calculations for Radioactive Effluent Release Report have been moved to Section II.C.1.
- 2.10 Bases in Section II.C.7 have been revised to reflect changes made for this revision.
- 2.11 Introductory paragraph for Section II.D was deleted because it was no longer applicable to changes for this revision.
- 2.12 In Section II.D.1.c, reference to GASPAR code was deleted because this code is no longer used.
- 2.13 See discussion in 2.7 above.
- 2.14 See discussion in 2.7 above.
- 2.15 In Section II.D.4.c on monthly dose projection required when Unit 3 gaseous waste system is inoperable, the definition of C_N^E assumed that any release increased would be via the Millstone Stack. However, some releases could occur via the Unit 3 Vent. Therefore the definition was revised to apply generally to any increase of radioactivity in effluents due to the inoperable processing system.
- 2.16 Requirements for dose calculations for Radioactive Effluent Release Report have been moved to Sections II.D.2 and II.D.3.
- 2.17 In Section II.D.6 on compliance with 40CFR190:
- In first sentence “a real individual” was changed to “any real member of the public at or beyond the site boundary” to make it consistent with the requirements for 40CFR190 compliance in Sections III.E, IV.E and V.E.
 - Exception to sources from other uranium fuel cycle sources (source d) was deleted. The regulatory wording in 40CFR190 explicitly requires inclusion of dose from other uranium fuel cycle facilities only if they are within five miles. This exception need not be mentioned in the REMODCM.
 - Added the Independent Spent Fuel Storage Installation (ISFSI) as a source because it could contribute direct shine dose which needs to be accounted when showing compliance with 40CFR190.
 - The last two paragraphs were entirely revised. In the rewrite of the dose calculation sections (II.C and II.D) the requirement to use calculated liquid and gaseous effluent doses to show 40CFR190 compliance was deleted. That requirement is carried forward to this section in the rewrite of the next to last paragraph in this section. The methodology for calculating the 40CFR190 dose has changed and is no longer reflected by the wording in the last paragraph.
- 2.18 Bases in Section II.D.7 have been revised to reflect changes made for this revision.
- 2.19 Title of Section II.E.1 was changed from “Unit 1 Reactor Cavity Water Discharge Line” to “Unit 1 Spent Fuel Pool Water Discharge”, and in Step 3 ‘background’ was added to calculation of rad monitor setpoint. The reactor cavity water has been discharged and there are no plans to refill the Unit 1 reactor cavity. The spent fuel pool is the only remaining liquid source at Unit 1 containing significant radioactivity. For the rad monitor setpoint background needs to be added or the setpoint could be set too low to allow discharge.
- 2.20 For Unit 2 (Section II.E.3) and Unit 3 (Section II.E.8) liquid radwaste radiation monitors an alternate threshold for noble gas concentration was added. The alternate threshold is $2E-5$ uCi/ml noble gas concentration when diluted. The LCOs in Sections III.D.1.a, IV.D.1.a and V.D.1.a. require total noble gas concentration at discharge (after dilution) to be less $2E-4$ uCi/ml. OpenEMS, a vendor supplied code, will calculate noble gas

- concentration at discharge providing a convenient method for checking if the concentration of total noble gases at discharge meets the LCOs. Therefore the alternate threshold is provided to allow checking at point of discharge as opposed to checking concentration in liquid radwaste prior to dilution. It sets a concentration at one-tenth the LCO value to ensure that the LCO limit is not exceeded.
- 2.21 In Section II.F.6 for Unit 2 waste gas radiation monitor a requirement was added to automatically isolate discharge if monitor setpoint is reached. This was added to reinforce the requirement in Table IV.C-3 for a noble gas monitoring providing automatic termination of releases.
- 2.22 In Section II.F.8 for Unit 3 Engineering Safeguards Building Monitor the basis for the setpoint was added. This basis is consistent with the bases given for the Vent monitor in Section II.F.7 and the SLCRS monitor in Section II.F.4.
- 2.23 In Table II.A-1 Unit 2 Tech Spec 6.20 and Unit 3 Tech Spec 6.15 were added as applicable to REMODCM Sections I.C.2; II.C.5; Tables I.D-1,2,3; and II.D.1.a&b. For REMODCM Sections II.D.2 and II.D.4 Unit 3 Tech Spec 6.16 was changed to Unit 3 Tech Spec 6.14&15. This adds tech specs which were originally omitted from the table and corrects the reference to Unit 3 TS 6.16.
- 2.24 In REMODCM Section III for Unit One controls:
- a) The words ‘operable’, ‘inoperable’ and ‘inoperability’ were replaced with ‘functional’, ‘nonfunctional’ and ‘nonfunctionality’ respectively throughout the section. This implements the NRC expectation that the ‘operable’, ‘inoperable’ and ‘inoperability’ be reserved for use only in technical specifications. See CR411347.
 - b) “Instrument Check” was changed to “Channel Check” in the definitions section and in Table III.C-4. Channel Check is the preferred name for this function. This change makes the use of this term in these sections consistent with the rest of the REMODCM.
 - c) Title of the instrument in Table III.C-1 was changed from “Radioactivity Monitor Liquid Effluent Line” to “Spent Fuel Pool Radioactivity Monitor Liquid Effluent Line.” The spent fuel pool is the only remaining liquid source at Unit 1 containing significant radioactivity. By changing the title of this section it makes the requirements applicable to discharge of water from the spent fuel pool, if and when it is discharged.
 - d) In Action A of Table III.C-3 “gross activity” was changed to “gamma activity.” The standard and preferred method for analyses of these samples is by gamma spectroscopy.
 - e) Actions to be taken if any dose limit in LCOs in Sections III.D.1.b, III.D.2.b and III.D.2.c is exceeded were revised. The previous wording for the actions created a non-sequitur. It required corrective actions to prevent exceeding the annual dose limits if those same dose limits had already been exceeded. Moreover the previous wording required corrective action applicable only to the remainder of the current year. The revised wording requires corrective actions to avoid any repetition of exceeding either the quarterly or annual dose limits for the remainder of the year and all subsequent (i.e.; future quarters and years).
- 2.25 In REMODCM Section IV for Unit Two controls:
- a) The words ‘operable’, ‘inoperable’ and ‘inoperability’ were replaced with ‘functional’, ‘nonfunctional’ and ‘nonfunctionality’ respectively throughout the

section. This implements the NRC expectation that the 'operable', 'inoperable' and 'inoperability' be reserved for use only in technical specifications. See CR411347.

- b) In the LCO and Action for gaseous effluent monitoring instrumentation (Section IV.C.2), 'trip' was deleted from "alarm trip setpoint." Except for the waste gas holdup system, the radiation monitors listed in Table IV.C-3 are not designed with a trip function, nor are they required anywhere to have a trip function.
 - c) In Actions A and E of Table IV.C-3 for gaseous effluent monitoring instrumentation:
 - The words "gross activity" were changed to "gamma activity." The standard and preferred method for analyses of these samples is by gamma spectroscopy.
 - Daily channel check in lieu of a grab sample was added as an alternative action if monitor flow and readout are not adversely affected by instrument inoperability. As previously worded, the actions required Chemistry to obtain grab samples even if the radiation monitor was still providing a valid readout. This situation would occur when the monitor was declared inoperable because of lost of alarm function. Recording instrument readout which is done with the daily channel check provides a more efficient and accurate compensatory action. Previously this same alternative was added for gaseous radiation monitors for Unit 3 in Table V.C-3.
 - d) In Action B of Table IV.C-3 for gaseous effluent monitoring instrumentation, the words "samples are continuously collected with auxiliary sampling equipment for periods of seven" with "effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven." This provides a more precise definition of the required sampling period.
 - e) Actions to be taken if any dose limit in LCOs in Sections IV.D.1.b, IV.D.2.b and IV.D.2.c is exceeded were revised. The previous wording for the actions created a non-sequitur. It required corrective actions to prevent exceeding the annual dose limits if those same dose limits had already been exceeded. Moreover the previous wording required corrective action applicable only to the remainder of the current year. The revised wording requires corrective actions to avoid any repetition of exceeding either the quarterly or annual dose limits for the remainder of the year and all subsequent (i.e.; future quarters and years).
- 2.26 In REMODCM Section V for Unit Three controls:
- a) The words 'operable', 'inoperable' and 'inoperability' were replaced with 'functional', 'nonfunctional' and 'nonfunctionality' respectively throughout the section. This implements the NRC expectation that the 'operable', 'inoperable' and 'inoperability' be reserved for use only in technical specifications. See CR411347.
 - b) In the LCO and Action for gaseous effluent monitoring instrumentation (Section V.C.2), 'trip' was deleted from "alarm trip setpoint." The radiation monitors listed in Table V.C-3 are not designed with a trip function, nor are they required anywhere to have a trip function.
 - c) In Table V.C-1 the applicability of the flow rate measurement device for the Steam Generator Blowdown Effluent Line was changed from 'At All Times' to 'MODES 1-4.' Because blowdown is secured during Modes 5 and 6 flow does not need to be monitored. This makes it consistent with the applicability for the Steam Generator Blowdown Radiation Monitor.

- d) In Actions A and D of Table V.C-3 for gaseous effluent monitoring instrumentation, The word “gamma” was added before “radioactivity.” The standard and preferred method for analyses of these samples is by gamma spectroscopy.
- e) In Action B of Table V.C-3 for gaseous effluent monitoring instrumentation, the words “samples are continuously collected with auxiliary sampling equipment for periods of seven” with “effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven.” This provides a more precise definition of the required sampling period.
- f) In Table V.C-4 for gaseous effluent monitoring instrumentation surveillance requirements, the 2nd column title was changed from “Check” to “Channel Check.” The word ‘channel’ was inadvertently dropped in the last revision of the REMODCM.
- g) Actions to be taken if any dose limit in LCOs in Sections V.D.1.b, V.D.2.b and V.D.2.c is exceeded were revised. The previous wording for the actions created a non-sequitur. It required corrective actions to prevent exceeding the annual dose limits if those same dose limits had already been exceeded. Moreover the previous wording required corrective action applicable only to the remainder of the current year. The revised wording requires corrective actions to avoid any repetition of exceeding either the quarterly or annual dose limits for the remainder of the year and all subsequent (i.e.; future quarters and years).

Serial No. 13-215
Docket Nos. 50-245
50-336
50-423
License Nos. DPR-21
DPR-65
NPF-49

ATTACHMENT 2

2012 RADIOACTIVE EFFLUENT RELEASE REPORT
VOLUME 2

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

Millstone Power Station 2012

Radioactive Effluents Release Report Volume 2

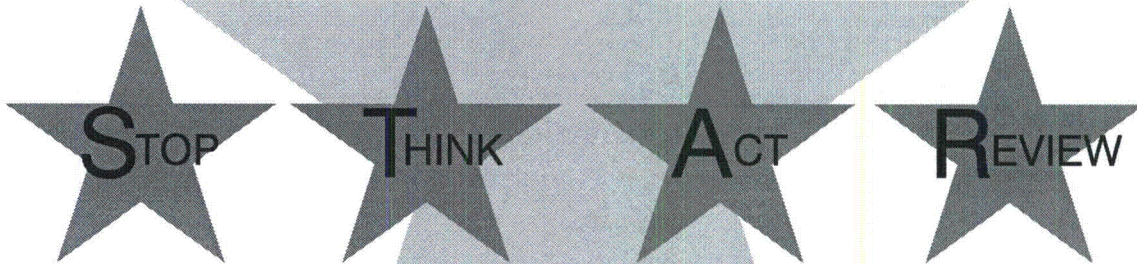


Dominion Nuclear Connecticut, Inc.



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

MILLSTONE POWER STATION
STATION PROCEDURE



**Radiological Effluent Monitoring and Off-Site
Dose Calculation Manual (REMODOCM)**

MP-22-REC-BAP01

Rev. 027-00

Approval Date: 02/28/12

Effective Date: 03/13/12

**Millstone All Units
Station Procedure**

**Radiological Effluent Monitoring and Off-Site 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



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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, "REMDCM 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



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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).



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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 Activity 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 x 10 ⁻⁷
			Kr-85	1 x 10 ⁻⁵
		Prior to initial batch release from any one source and monthly composite thereafter ^C	H-3	1 x 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 x 10 ⁻⁷
			Sr-90	5 x 10 ⁻⁸
			Fe-55	1 x 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):

$$LLD = \frac{4.66 S_b}{(E)(V)(2.22 \times 10^6)(Ye^{-\lambda \Delta t})}$$

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 10⁶** 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 Activity 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 x 10 ⁻⁷
			I-131	1 x 10 ⁻⁶
			Ce-144	5 x 10 ⁻⁶
			Dissolved & Entrained Gases ^K .	1 x 10 ⁻⁵
2. Condensate Polishing Facility - Waste Neutralization Sump ^E .		Monthly Composite ^{F,G} .	H-3	1 x 10 ⁻⁵
			Quarterly Composite ^{F,G} .	Gross alpha
		Quarterly Composite ^{F,G} .	Sr-89, Sr-90	5 x 10 ⁻⁸
			Fe-55	1 x 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 x 10 ⁻⁷
			I-131	1 x 10 ⁻⁶
			Ce-144	5 x 10 ⁻⁶
3. Turbine Sumps ^L .	Monthly Grab Sample	Monthly	Dissolved & Entrained Gases ^K .	1 x 10 ⁻⁵
4. RBCCW Sump ^M .	Weekly Grab or Composite	Monthly Composite ^{F,G} .	H-3 ^N .	1 x 10 ⁻⁵
			Weekly Composite	Quarterly Composite ^{F,G} .
				Sr-89, Sr-90
			Fe-55	1 x 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):

$$LLD = \frac{4.66 S_b}{(E)(V)(2.22 \times 10^6)(Ye^{-\lambda \Delta t})}$$



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 10⁶** 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 $5 \times 10^{-7} \mu\text{Ci/ml}$. 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 $5 \times 10^{-6} \mu\text{Ci/ml}$. 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 activity is not greater than $5 \times 10^{-7} \mu\text{Ci/ml}$, **THEN** the sampling and analysis schedule for gross alpha, Sr-89, Sr-90, Fe-55 are not required.



- 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 activity in the grab sample taken prior to release does not exceed 5×10^{-7} $\mu\text{Ci/ml}$, **THEN** the sampling and analysis schedule for gross alpha, Sr-89, Sr-90 and Fe-55 are not required.
- 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 activity does not exceed 5×10^{-7} $\mu\text{Ci/ml}$, **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.
- 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 activity greater than 5×10^{-7} $\mu\text{Ci/ml}$, **THEN** the sampling and analysis schedule for gross alpha, Sr-89, Sr-90, Fe-55 are not required.
- 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 steam generators, **THEN** tritium sampling and analyses is not required.
IF the steam generator gross gamma activity does not exceed 5×10^{-7} $\mu\text{Ci/ml}$, **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} $\mu\text{Ci/ml}$ and for gross alpha 1×10^{-8} $\mu\text{Ci/ml}$.
- 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 activity is not greater than 5×10^{-7} $\mu\text{Ci/ml}$, **THEN** sampling and analysis schedule for gross alpha, Sr-89, Sr-90, Fe-55 are not required.
- 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 Activity 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 .	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}	
2. Service Water Effluent ^J .	Monthly Grab Sample	Monthly	Dissolved & Entrained Gases ^K .	1×10^{-5}	
			Weekly Grab or Composite	Monthly Composite ^{F,G} .	H-3 ^M .
3. Turbine Building Sumps ^L .	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):

$$LLD = \frac{4.66 S_b}{(E)(V)(2.22 \times 10^6)(Ye^{-\lambda \Delta t})}$$

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 10⁶** 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 $5 \times 10^{-7} \mu\text{Ci/ml}$. 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 $5 \times 10^{-6} \mu\text{Ci/ml}$. 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 activity is not greater than $5 \times 10^{-7} \mu\text{Ci/ml}$, **THEN** the sampling and analysis schedule for gross alpha, Sr-89, Sr-90, Fe-55 are not required.



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- 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 activity in the grab sample taken prior to release does not exceed 5×10^{-7} $\mu\text{Ci/ml}$, **THEN** the sampling and analysis schedule for gross alpha, Sr-89, Sr-90 and Fe-55 are not required.
- 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 activity does not exceed 5×10^{-7} $\mu\text{Ci/ml}$, **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.
- 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 activity greater than 5×10^{-7} $\mu\text{Ci/ml}$, **THEN** the sampling and analysis schedule for gross alpha, Sr-89, Sr-90, Fe-55 are not required.
- 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 steam generators, **THEN** tritium sampling and analyses is not required.
IF the steam generator gross gamma activity does not exceed 5×10^{-7} $\mu\text{Ci/ml}$, **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} $\mu\text{Ci/ml}$ and for gross alpha 1×10^{-8} $\mu\text{Ci/ml}$.
- 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 Operability Applicable to All Millstone Units

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 routinely operating, **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.
- 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 operating 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.

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) <u>OR</u> Purification ion exchanger (T10A or T10B) <u>OR</u> Equivalent ion exchanger
	Primary demineralizer (T22 A or B) <u>OR</u> Equivalent demineralizer
	Secondary demineralizer (T23 A or B) <u>OR</u> Equivalent demineralizer//Aerated liquid
Aerated liquid	Demineralizer (T24) <u>OR</u> Equivalent demineralizer
3. Millstone Unit No. 3	
Waste Stream	Processing Equipment or Radioactivity Concentration
High level	Demineralizer filter (LWS-FLT3) and Demineralizer (LWS-DEM2) <u>OR</u> Demineralizer (LWS-DEM1) and Demineralizer filter (LWS-FLT1)
Boron recovery	Cesium ion exchanger (DEMNA or B)
	Boron evaporator (EV-1)
Low level	High level processing equipment
Steam generator blowdown	Blowdown recovery when total gamma activity exceeds $5E-7$ $\mu\text{Ci/ml}$ or tritium activity exceeds 0.02 $\mu\text{Ci/ml}$.

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 off-site 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.

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"

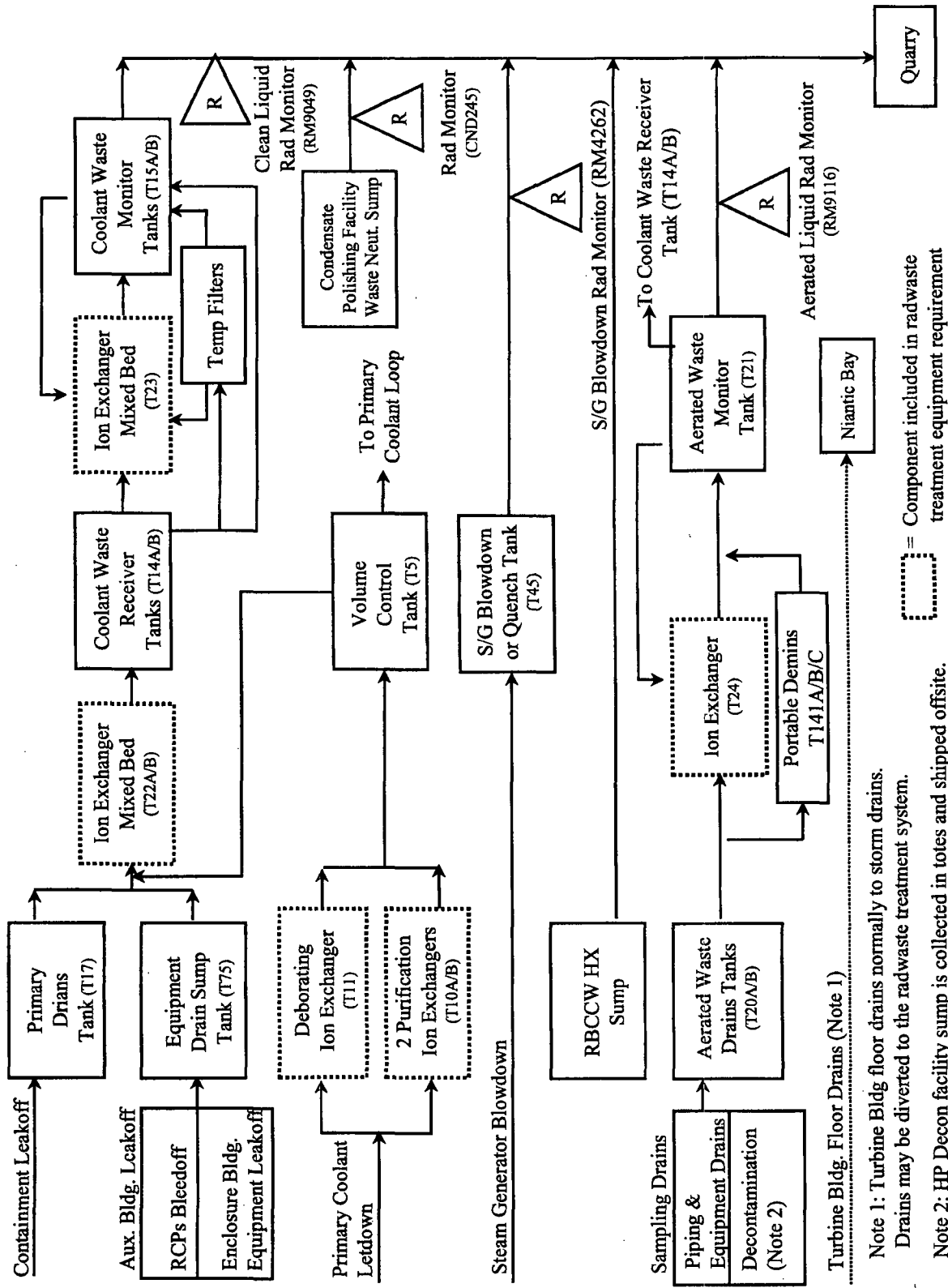
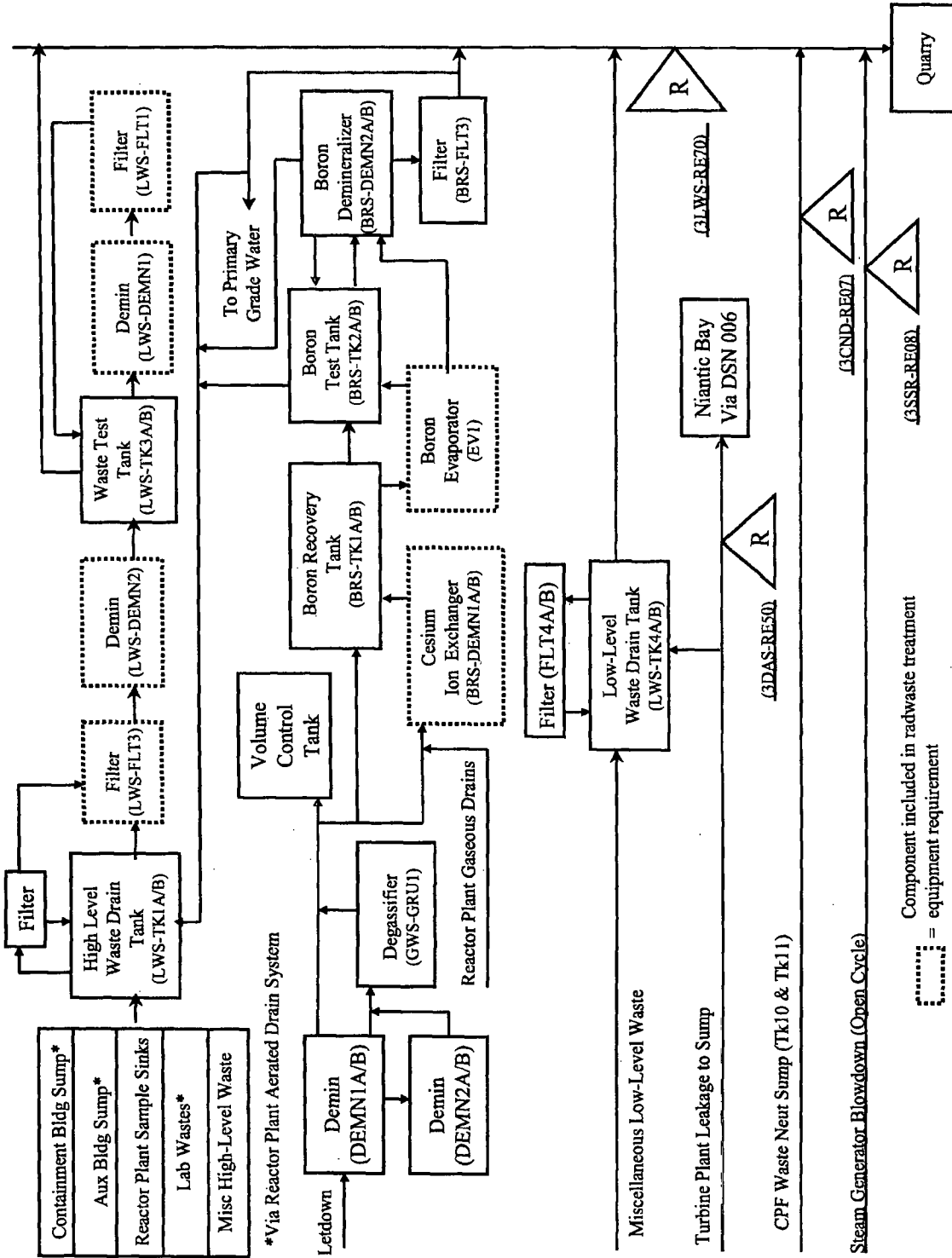


Figure I.C.-3, "Simplified Liquid Effluent Flow Diagram Millstone Unit 3"



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 Activity Analysis	Lower Limit of Detection (LLD) ^A (μCi/ml)
A. Spent Fuel Pool Island Vent	Monthly ^D – Gaseous Grab Sample	Monthly	Kr-85	1 x 10 ⁻⁴
			H-3	1 x 10 ⁻⁶
	Continuous ^{B,E} Particulate Sample	Twice per month	Principal Gamma Emitters ^C – (with half lives greater than 8 days)	1 x 10 ⁻¹¹
	Continuous ^{B,E} Particulate Sample	Quarterly Composite	Sr-90, Gross alpha	1 x 10 ⁻¹¹
	Continuous ^{B,E} Noble Gas	Continuous Monitor	Kr-85	1 x 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 x 10 ⁻¹¹
		Quarterly Composite	Sr-90, Gross alpha	1 x 10 ⁻¹¹
	Grab sample of Reactor Bldg evaporator staging tank prior to processing	Prior to processing of each batch	H-3	1 x 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} $\mu\text{Ci/cc}$. 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 $8.8\text{E}-5$ $\mu\text{Ci/cc}$ 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 Activity 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 x 10 ⁻⁴
			H-3	1 x 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 ^L	1. Prior to Each Purge 2. Every two weeks for Venting	Principal Gamma Emitters ^B	1 x 10 ⁻⁴
			Monthly	H-3
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, K}	Monthly ^{C, K}	Principal Gamma Emitters ^B	1 x 10 ⁻⁴
			H-3 ^G	1 x 10 ⁻⁶
2. Millstone Stack (RM8169-1)	Continuous Charcoal Sample ^{D, F}	Weekly	I-131 I-133	1 x 10 ⁻¹² 1 x 10 ⁻¹⁰
	Continuous Particulate Sample ^{D, F}	Weekly	Principal Gamma Emitters ^B - (I-131, others with half lives greater than 8 days)	1 x 10 ⁻¹¹
	Continuous Particulate Sample ^D	Quarterly Composite	Sr-89, Sr-90 - Gross alpha	1 x 10 ⁻¹¹ 1 x 10 ⁻¹¹
	Continuous Noble Gas ^D	Continuous Monitor	Noble Gases - Gross Activity	1 x 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 1×10^{-4} $\mu\text{Ci/cc}$ and for particulate samples, the LLD will be 1×10^{-11} $\mu\text{Ci/cc}$. 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. Sampling and analysis for principal gamma emitters shall also be performed within 72 hours after:

(1) reactor shutdown or startup, or

(2) reactor power change greater than 15% of rated thermal power, as defined in Technical Specification, within a one hour period. If power change is part of a series of step changes, the sample may be collected 24 to 72 hours after last power change step.

This requirement does not apply if the noble gas monitor has not increased more than 50%.

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 activity has not increased more than a factor of three.

G. **IF** the refueling cavity is flooded, **THEN** 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 previous batch of radioactive waste gas has been discharged to a final tank pressure of less than 5 PSIG.

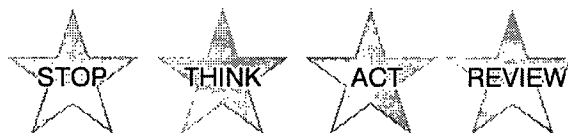


- (2) No radioactive gases have been added to the tank since the previous discharge.
- (3) Valve lineups are verified to ensure that no radioactive waste gases will be added to the tank.
- (4) Prior to initiation of the vent or purge, a sample of the gas in the tank will be taken and analyzed for any residual gamma emitters and tritium. The tank may be released if:
 - a) Tank activity is less than 1% of the activity released in the previous batch release from the tank, or less than 1% of the activity released to date for the calendar year, and
 - b) the activity of Kr-85 and Xe-133 is less than 0.01 Ci and the activity 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 or a particulate channel increases by a factor of two, **THEN** a new containment air sample shall be taken.
IF containment noble gas activity exceeds $1E-6$ $\mu\text{Ci}/\text{cc}$ as indicated by the last grab sample, **THEN** sampling frequency shall be increased to weekly until such time that the activity is less than $1E-6$ $\mu\text{Ci}/\text{cc}$.
- J. During an outage a sample is only required prior to the initial purge.
- K. **IF** there is an increase of the Millstone Stack or Unit 2 Vent noble gas monitor of greater than 50%, **THEN** sampling and analysis for principal gamma emitters shall also be performed within 24 hours, except for the following conditions:
 - (1) the increase is already accounted for, or
 - (2) the monitor has returned to within 20% of the average reading prior to the increase.

IF the Millstone Stack or Unit 2 Vent noble gas monitor increased greater than 50% for more than one hour and has decreased 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.



**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 Activity Analysis	Lower Limit of Detection (LLD)^A. (μCi/ml)		
A. Containment and Fuel Building Release						
1. Containment	Gaseous, particulate and charcoal grab prior to each drawdown (via air ejector)	Same as sample frequency.	Principal gamma emitters ^B .	1×10^{-4}		
2. Fuel Building	Gaseous grab prior to each purge ^H .	Same as sample frequency.	On charcoal sample: I-131 I-133	1×10^{-12} 1×10^{-10}		
			On particulate sample: Principal gamma emitters ^B . - (I-131, others with half lives greater than 8 days)	1×10^{-11}		
	Gaseous Grab every two weeks for vents (i.e., releases to maintain sub-atmospheric pressure via containment vacuum pump) ^I .	Monthly for purge, vents, and drawdowns	H-3	1×10^{-6}		
			Continuous particulate at open containment equipment hatch during outages.	Weekly	Gamma emitters for 1/2 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)	Monthly - Gaseous Grab Sample ^{C,J} .	Monthly ^{C,J} .	Principal gamma emitters ^B	1×10^{-4}		
			H-3 ^G	1×10^{-6}		
2. Engineered Safeguards Building (HVQ-RE49)	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}		
3. Millstone Stack via SLCRS (HVR-RE19B)	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 activity	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 1×10^{-4} $\mu\text{Ci/cc}$ and for particulate samples, the LLD will be 1×10^{-11} $\mu\text{Ci/cc}$. 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. For the ventilation vent and SLCRS, sampling and analysis for principal gamma emitters shall also be performed within 72 hours after:
- (1) reactor shutdown or startup, or
 - (2) reactor power change greater than 15% of rated thermal power, as defined in Technical Specification, within a one hour period. If power change is part of a series of step changes, the sample may be collected 24 to 72 hours after the last power change step.
- This requirement does not apply if the noble gas monitor has not increased more than 50%.
- 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 activity has not increased more than a factor of three.

- 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 or particulate channel increases by a factor of two, **THEN** a new containment air sample shall be taken.

IF containment noble gas activity exceeds $1\text{E}-6$ $\mu\text{Ci/cc}$ as indicated by the last grab sample, **THEN** sampling frequency shall be increased to weekly until such time that the activity is less than $1\text{E}-6$ $\mu\text{Ci/cc}$.



J. **IF** there is an unexplained increase of the Unit 3 ventilation vent or SLCRS noble gas monitor of greater than 50%, **THEN** appropriate sampling and analysis for principal gamma emitters shall also be performed within 24 hours, except for the following conditions:

(1) the increase is already accounted for, or

(2) the monitor has returned to within 20% of the reading prior to the increase.

IF the SLCRS or Unit 3 Vent noble gas monitor increased greater than 50% for more than one hour and has decreased 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.



2. Gaseous Radioactive Waste Treatment

a. Dose Criteria for Equipment Operability Applicable to All Millstone Units

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 routinely operating 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.
- 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 operating exceed 10% any of these limits, **THEN** prepare and submit to the Commission a report as specified in Section I.D.2.c.

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.



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 inoperable equipment to service, and
- 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"

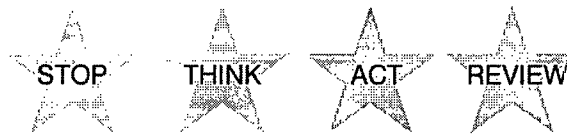
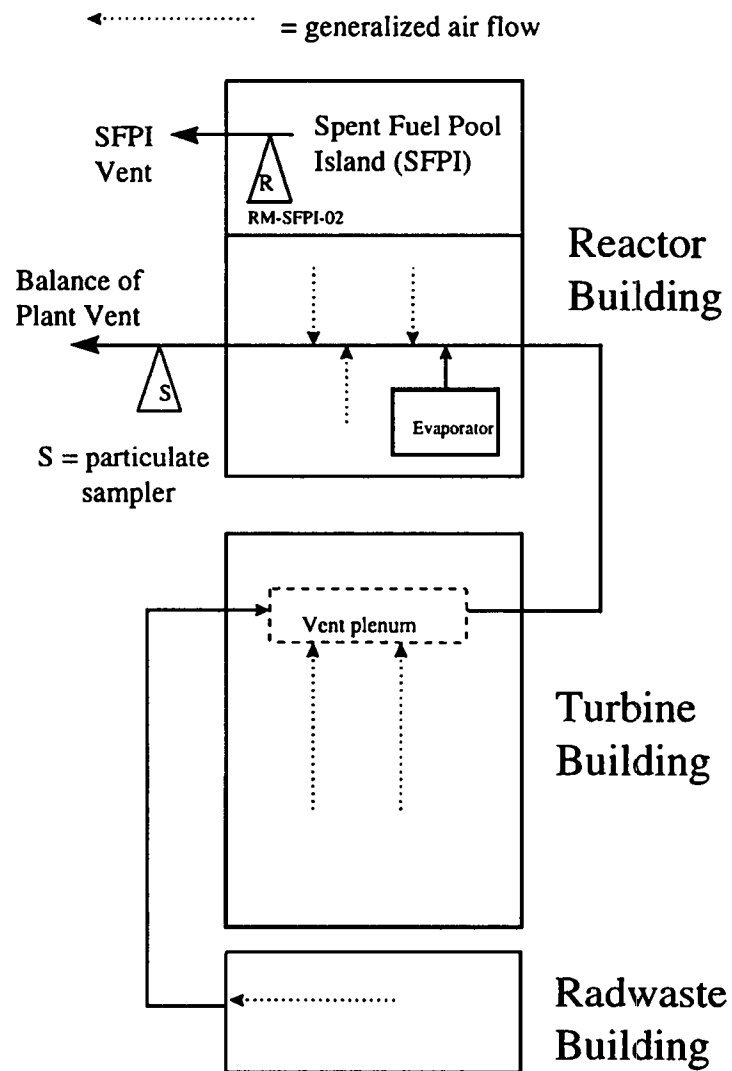


Figure I.D.-2, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Two"

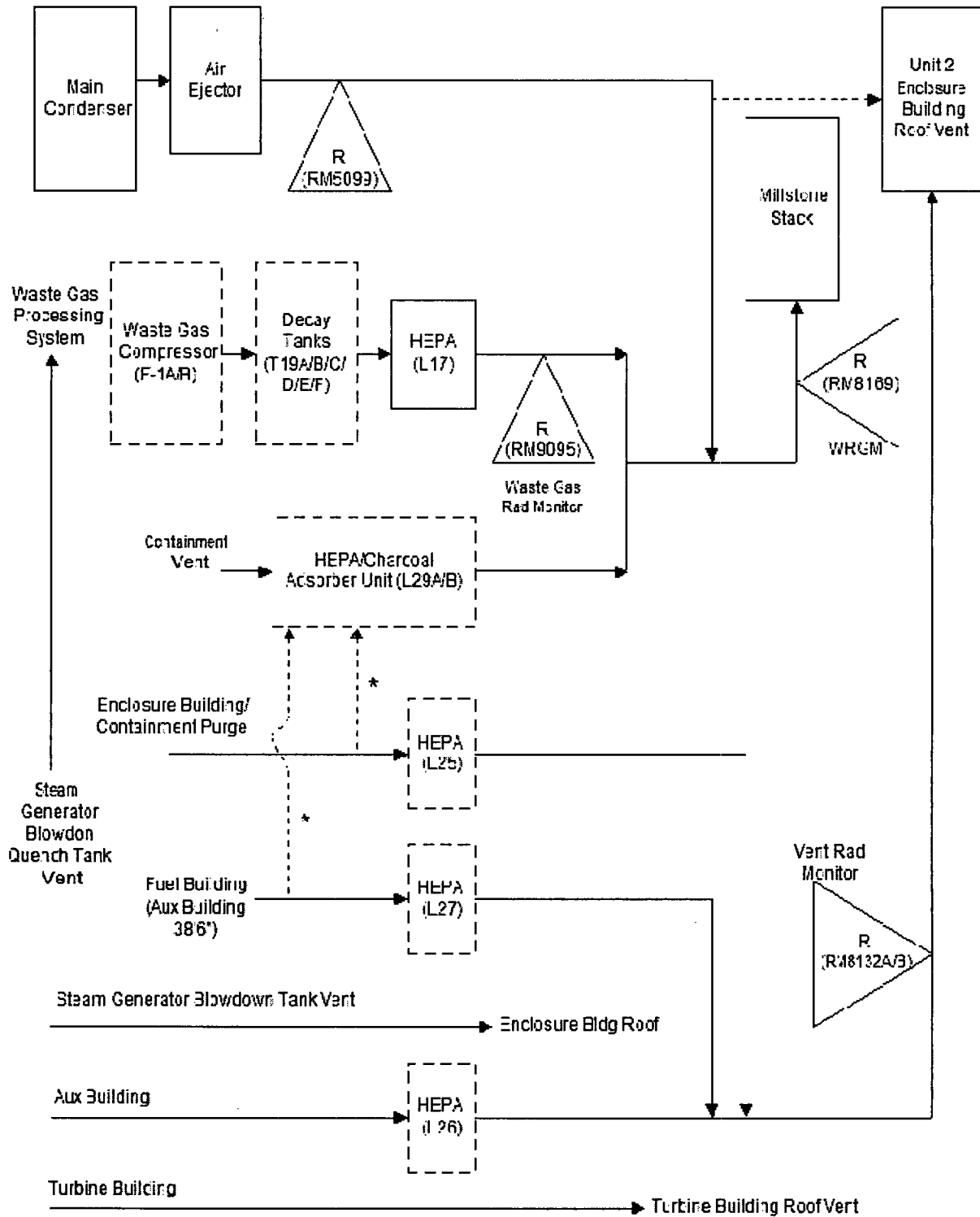
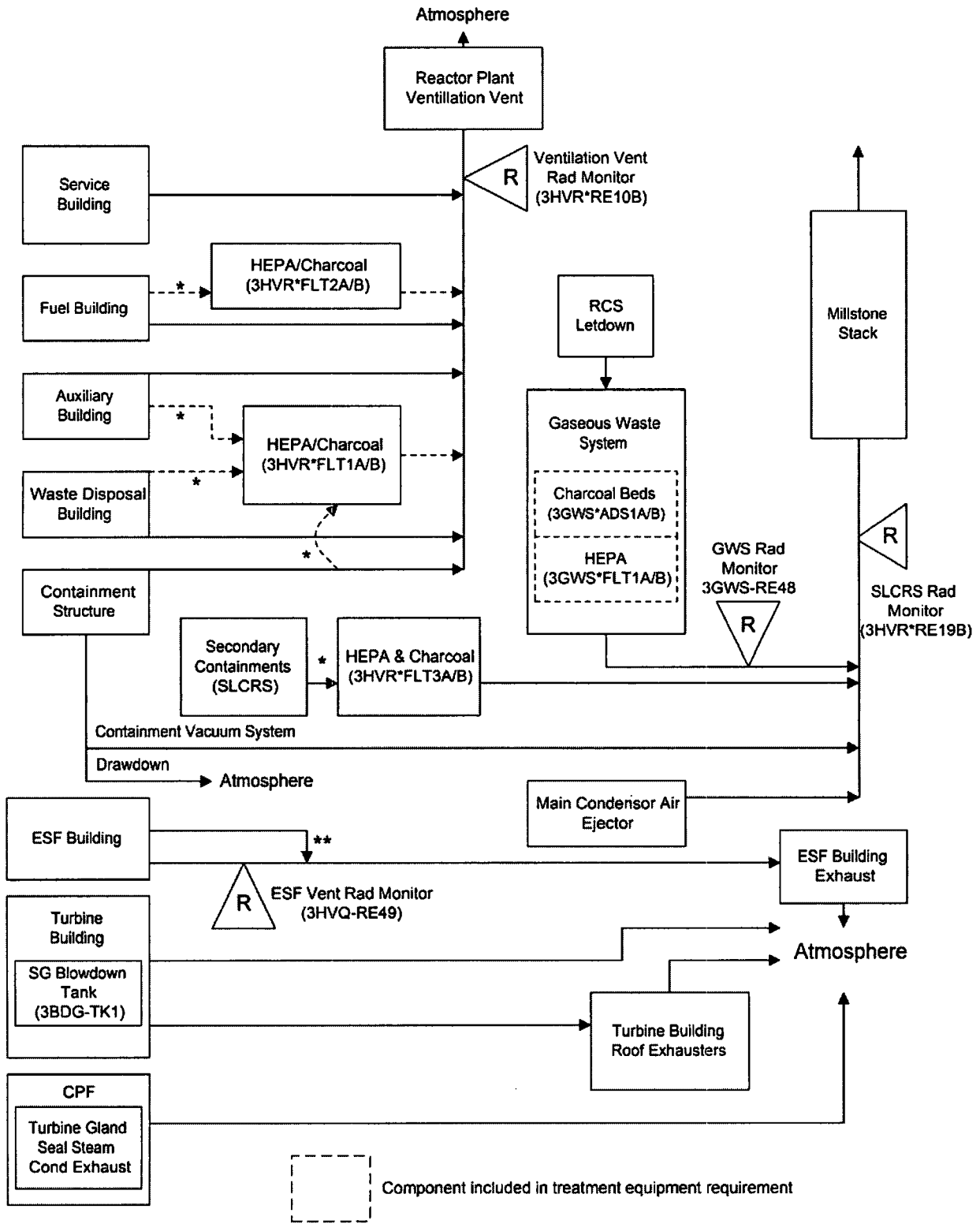


Figure I.D.-3, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Three"



* These flow paths used during an accident

** Releases from Mechanical Rooms A-D not monitored



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 continue to obtain samples of the media of choice (excluding milk) at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathways in questions and appropriate substitutions made within 30 days in the radiological environmental monitoring program.

If milk samples are temporarily unavailable from any one or more of the milk sample locations required by Table I.E.–2, a grass sample shall be substituted during the growing season (Apr. – Dec.) and analyzed for gamma isotopes and I–131 until milk is again available. Upon notification that milk samples will be unavailable for a prolonged period (>9 months) from any one or more of the milk sample locations required by Table I.E.–2, a suitable replacement milk location shall be evaluated and appropriate changes made in the radiological environmental monitoring program. Reasonable attempts shall be made to sample the replacement milk location prior to the end of the next sampling period. 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.

Changes to sampling locations shall be identified in a revised Table I.E.–2 and, as necessary, Figure(s) I.E.–1 through I.E.–3.



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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:

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

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 – weekly filter change	Gross Beta – Weekly Gamma Spectrum – Quarterly on composite (by location), and on individual sample if gross beta is greater than 10x the mean of the weekly control station's gross beta results
3. Airborne Iodine	8	Continuous sampler – weekly canister change	I-131 – Weekly
4. Vegetation	5	One sample near middle and one near end of growing season	Gamma Isotopic on each sample
5. Milk	2	Semimonthly when animals are on pasture; monthly at other times	Gamma Isotopic and I-131 on each sample; Sr-89 and Sr-90 on Quarterly Composite
5.a. Pasture Grass ^(b)	2	Sample as necessary to substitute for unavailable milk	Gamma Isotopic and I-131
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-Flounder and one other type of edible fin fish (edible portion)	2	Quarterly	Gamma Isotopic on each sample
11. Mussels (edible portion)	2	Quarterly	Gamma Isotopic on each sample
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	New London Country Club	1.6 Mi, ENE	TLD, Air Particulate, Iodine
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
21-I	Goat Location No. 1	2.0 Mi., N	Milk
24-C	Goat Location No. 3	29 Mi, NNW	Milk
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	Mussels, Fish ¹
29-I	West Jordan Cove	0.4 Mi, NNE	Clams, Fish ¹
30-I	Niantic Shoals	1.5 Mi, NNW	Mussels
31-I	Niantic Shoals	1.8 Mi, NW	Bottom Sediment, Oysters
32-I	Vicinity of Discharge ²		Bottom Sediment, Oysters, Lobster, Fish ¹ , Seawater
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	0.3 Mi, WNW	Lobster, Fish
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	DEP dock near barge slip	0.2 Mi, WNW	Oysters

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

²Vicinity 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 Air Particulate And Vegetation Monitoring Stations"

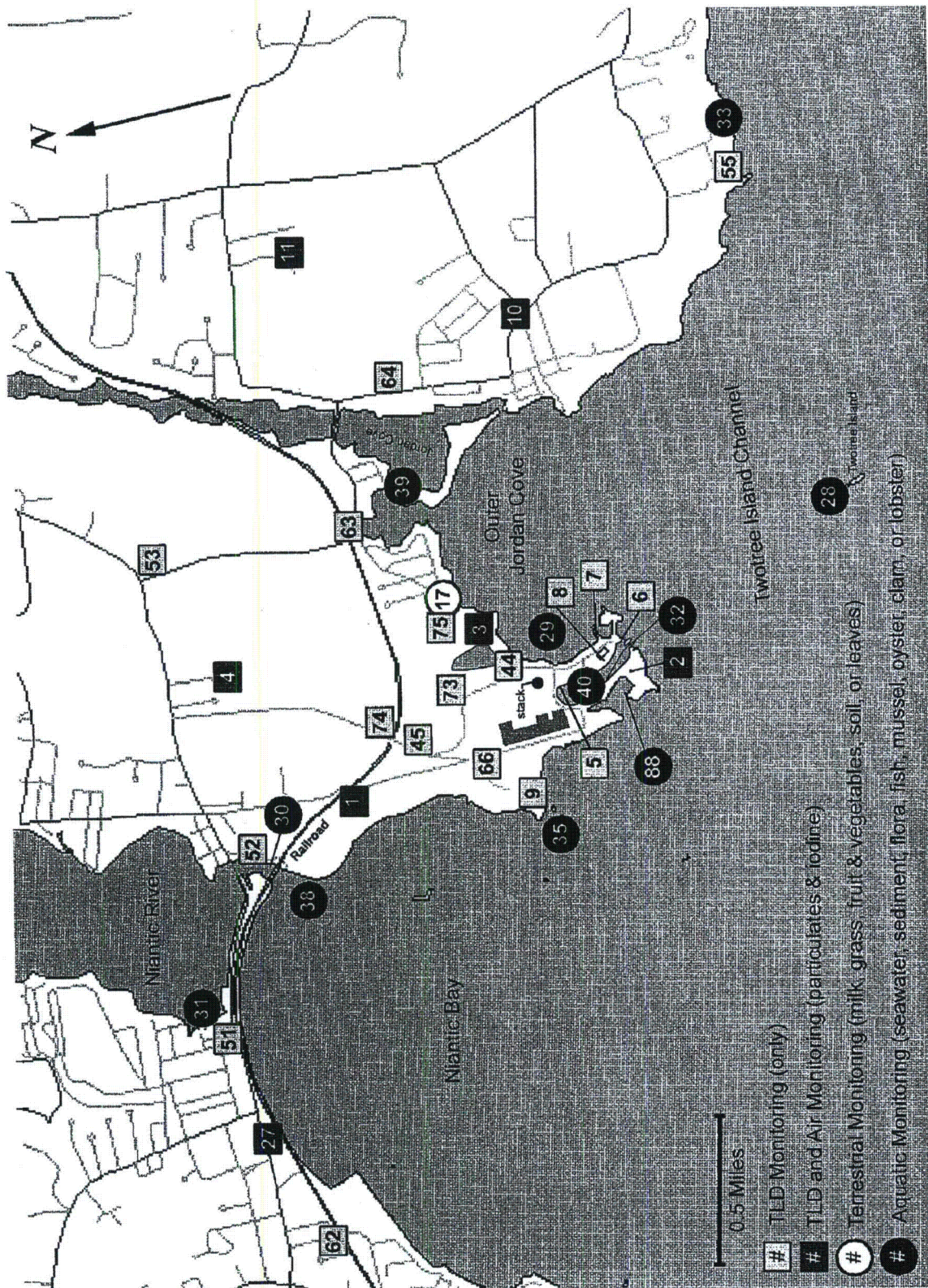
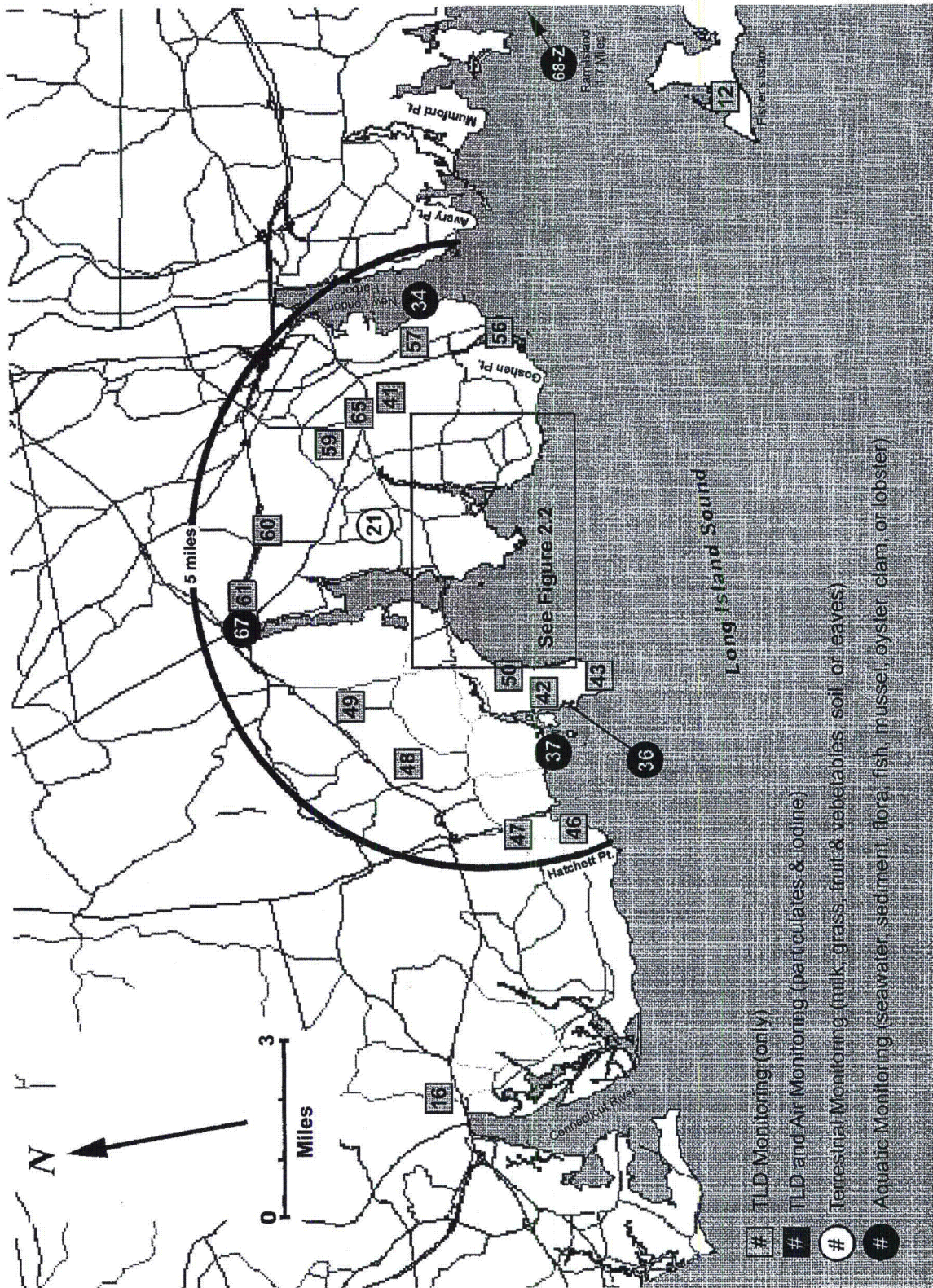


Figure I.E.-2, "Outer Terrestrial Monitoring Stations"



**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 x 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 x 10 ⁻²		1	0.06 ^B .	
Cs-134	15	5 x 10 ⁻²	0.130	15	0.060	0.150
Cs-137	18	6 x 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 milk animals in each of the 16 meteorological sectors within a distance of five miles.

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

With a land use census identifying a location(s) which yields a calculated dose or dose commitment greater than the doses currently being calculated in the off-site dose models, make the appropriate changes in the sample locations used.

With a land use census identifying a location(s) which has a higher D/Q than a current indicator location the following shall apply:

- 1) If the D/Q is at least 20% greater than the previously highest D/Q, replace one of the present sample locations with the new one within 30 days if milk is available.
- 2) If the D/Q is not 20% greater than the previously highest D/Q, consider direction, distance, availability of milk, and D/Q in deciding whether to replace one of the existing sample locations. If applicable, replacement shall be within 30 days. If no replacement is made, sufficient justification shall be given in the annual report.

Sample location changes shall be noted in the Annual Radiological Environmental Operating Report.

*Broad leaf vegetation (a composite of at least 3 different kinds of vegetation) may be sampled at the site boundary in each of 2 different direction sectors with high D/Qs in lieu of a garden census.

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 the observed impacts of the plant operation on the environment. The report shall also include the results of the land use census required by Section I.E.2. of this manual. 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.

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.



This report shall include a comparison of dose assessments of the measured environmental results of the calculated effluent results to confirm the relative accuracy or conservatism of effluent monitoring dose calculations.

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.

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 an hour-by-hour listing on a magnetic medium 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.

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 activity)
- 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, "REMODOCM 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 (REMODOCM)," 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



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SECTION II. OFF-SITE DOSE CALCULATION MANUAL (ODCM)

II.A. Introduction

The purpose of the Off-Site 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 operability 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.

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 Off-Site Dose Calculation Manual (ODCM) shall be reviewed and approved by the Facilities 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 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 Activity is less than $5E-7$ $\mu\text{Ci/ml}$ and Steam Generator Tritium is less than 0.02 $\mu\text{Ci/ml}$ (Applicable to Units 2 and 3)



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 activity 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.

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 Activity Exceeds $5E-7$ $\mu\text{Ci/ml}$ or Steam Generator Tritium Exceeds 0.02 $\mu\text{Ci/ml}$ (Applicable to Units 2 and 3)

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:

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

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

R_4 = the ratio of estimated primary coolant activity 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 ($\mu\text{Ci}/\text{sec}$)

Q_{2S} = Noble gas release rate from MP2 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

Q_{2V} = Noble gas release rate from MP2 Vent ($\mu\text{Ci}/\text{sec}$)

Q_{3V} = Noble gas release rate from MP3 Vent ($\mu\text{Ci}/\text{sec}$)

Q_{3S} = Noble gas release rate from MP3 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

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



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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:

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

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

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

- 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:

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

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

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

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

${}^{131}Q_{I2V}$ = Release rate of I-131 from MP2 Vent ($\mu\text{Ci/sec}$)*

${}^{131}Q_{I2S}$ = Release rate of I-131 from MP2 to Millstone Stack ($\mu\text{Ci/sec}$)

${}^{133}Q_{I2V}$ = Release rate of I-133 from MP2 Vent ($\mu\text{Ci/sec}$)*

${}^{133}Q_{I2S}$ = Release rate of I-133 from MP2 to Millstone Stack ($\mu\text{Ci/sec}$)



$^{131}Q_{I3V}$ = Release rate of I-131 from MP3 Vents (Normal and ESF) ($\mu\text{Ci}/\text{sec}$)*

$^{131}Q_{I3S}$ = Release rate of I-131 from MP3 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

$^{133}Q_{I3V}$ = Release rate of I-133 from MP3 Vents (Normal and ESF) ($\mu\text{Ci}/\text{sec}$)*

$^{133}Q_{I3S}$ = Release rate of I-133 from MP3 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

Q_{H1V} = Release rate of tritium from the Spent Fuel Pool Island and Balance of Plant Vents ($\mu\text{Ci}/\text{sec}$)

Q_{H2V} = Release rate of tritium from MP2 Vent ($\mu\text{Ci}/\text{sec}$)*

Q_{H2S} = Release rate of tritium from MP2 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

Q_{H3V} = Release rate of tritium from MP3 Vents (Normal and ESF) ($\mu\text{Ci}/\text{sec}$)*

Q_{H3S} = Release rate of tritium from MP3 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

Q_{P1V} = Release rate of total particulates with half-lives greater than 8 days from the Spent Fuel Pool Island Vent ($\mu\text{Ci}/\text{sec}$)

Q_{P1B} = Release rate of total particulates with half-lives greater than 8 days from the Balance of Plant Vent ($\mu\text{Ci}/\text{sec}$)

Q_{P2V} = Release rate of total particulates with half-lives greater than 8 days from the MP2 Vent ($\mu\text{Ci}/\text{sec}$)

Q_{P2S} = Release rate of total particulates with half-lives greater than 8 days from MP2 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

Q_{P3V} = Release rate of total particulates with half-lives greater than 8 days from MP3 Vents (Normal and ESF) ($\mu\text{Ci}/\text{sec}$)

Q_{P3S} = Release rate of total particulates with half-lives greater than 8 days from MP3 to Millstone Stack ($\mu\text{Ci}/\text{sec}$)

* 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 III, IV, and V) limit the off-site 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. 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.

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:

$$D_{MG}^E \text{ (mrad)} = 1.81 \times 10^{-4} C_N^E$$

$$D_{MB}^E \text{ (mrad)} = 1.81 \times 10^{-6} C_N^E$$

Where:

C_N^E = the number of curies of noble gas estimated to be released from the waste gas storage tanks during the next month.

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

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

(The dose conversion factor is from MP-22-REC-REF03, "REMDCM 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_{MO}^E) from the following:

i. Method 1

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

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

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 inoperable during the last quarter.

R_3 = the fraction of the time which the equipment is expected to be inoperable 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:

$$D_{MG}^E \text{ (mrad)} = 1.81 \times 10^{-4} C_N^E$$

$$D_{MB}^E \text{ (mrad)} = 1.81 \times 10^{-6} C_N^E$$

Where:

C_N^E = the number of additional curies of noble gas estimated to be released from Unit 3 during the next month due to the inoperable processing equipment.

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

D_{MB}^E = 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 activity) 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.

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 GASPARG code. The GASPARG 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, “REMODOCM 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:

STEP 1:

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

$$R = \text{Required Reduction Factor} = \frac{1}{\sum \frac{\mu\text{Ci/ml of nuclide } i}{10 \times \text{EC of nuclide } i}}$$

STEP 2:

Determine the allowable discharge flow (F)

$$F = 0.1 \times R \times D$$

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.

STEP 3:

Calculate the monitor setpoint as follows:

$$R_{\text{set}} = 2 \times AC \times RCF + \text{Background}$$

Where:

Rset = The setpoint of the monitor.

AC = The total radwaste effluent concentration ($\mu\text{Ci/ml}$) 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} $\mu\text{Ci/ml}$ 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 activity. 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.

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:

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

For Noble Gases: If the noble gas concentration is less than $1.1 \times 10^{-2} \mu\text{Ci/ml}$ or the calculated diluted concentration is less than $2 \times 10^{-5} \mu\text{Ci/ml}$, the reduction factor need not be determined. The concentration of $1.1 \times 10^{-2} \mu\text{Ci/ml}$ 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).

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

R = the smaller of R₁ or R₂

STEP 2:

Determine the allowable discharge flow (F) in gpm:

$$F = 0.1 \times R \times D$$

Where:

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



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:

$$R_{\text{set}} = 2 \times AC \times RF \text{ (See Note 1 below.)}$$

Where:

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

AC = the total radwaste effluent concentration ($\mu\text{Ci/ml}$) 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 $5.6 \times 10^{-5} \mu\text{Ci/ml}$ (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 1×10^{-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 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 not being credited for dilution of a Unit 3 discharge during the time of the Unit 2 discharge.

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

When the grab sample prior to release required by Table I.C.–2 is greater than 5×10^{-7} $\mu\text{Ci/ml}$, the setpoint shall be determined as for the Clean and Aerated Liquid Monitors in Section II.E.3. except the CPF monitor has the capability to readout in CPM or $\mu\text{Ci/ml}$. If the grab sample is less than 5×10^{-7} $\mu\text{Ci/ml}$, use a setpoint of the lower of ten times background or the value as specified in II.E.3. A setpoint based on ten times background shall not exceed a reading corresponding to 2.8×10^{-5} $\mu\text{Ci/ml}$, which is approximately 6,300 CPM based on recent calibration data.



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

5a. Unit 2 Steam Generator Blowdown – RM4262

Assumptions used in determining the Alarm setpoint for this monitor are:

- a. Total S.G. blowdown flow rate = 700 gpm.
- b. Minimum circulating water dilution flow during periods of blowdown = 100,000 gpm.
- c. The release rate limit is conservatively set at 3×10^{-8} $\mu\text{Ci/ml}$ which is lower than any 10CFR20 Effluent Concentration (EC) limit except for some transuranics *
- d. Background can be added after above calculations are performed.

Therefore, the alarm setpoint corresponds to a concentration of:

$$\text{Alarm } (\mu\text{Ci/ml}) = \frac{100,000}{700} \times 3 \times 10^{-8} + \text{background}^{**} = 4.3 \times 10^{-6} \mu\text{Ci/ml} + \text{background}$$

The latest monitor calibration curve shall be used to determine the alarm setpoint in cpm corresponding to 4.3×10^{-6} $\mu\text{Ci/ml}$.

This setpoint may be adjusted (increased or decreased) through proper administrative controls if the steam generator blowdown rate is maintained other than 700 gpm and/or other than 100,000 gpm circulating water flow are available. The adjustment would correspond to the ratio of flows to those assumed above or:

$$\text{Alarm } (\mu\text{Ci/ml}) = 4.3 \times 10^{-6} \mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{100,000} \times \frac{700}{S/G_{\text{blowdown}} \text{ (gpm)}} +$$

$$\text{Background} = 3 \times 10^{-8} \mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{\text{total S/G blowdown (gpm)}} + \text{Background}$$



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 3×10^{-8} $\mu\text{Ci/ml}$, the identified EC limits from 10CFR20 may be used.

**Background of monitor at monitor location (i.e., indication provided by system monitor with no activity present in the monitored system).

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 the 10CFR20 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



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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.

SETPPOINT 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.



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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:

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

For Noble Gases: If the noble gas concentration is less than 0.013 $\mu\text{Ci/ml}$ or the calculated diluted concentration is less than $2 \times 10^{-5} \mu\text{Ci/ml}$, the reduction factor need not be determined. The concentration of 0.013 $\mu\text{Ci/ml}$ is based on 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).

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

R = the smaller of R1 or R2

Step 2:

Determine the allowable discharge flow (F)

$$F = 0.1 \times R \times D$$

Where:

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



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:

$$R_{set} = 2 \times AC \times RCF \text{ (see Note 1)}$$

Where:

R_{set} = The setpoint of the monitor.

AC = The total radwaste effluent concentration ($\mu\text{Ci/ml}$) 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 $6.6 \times 10^{-5} \mu\text{Ci/ml}$ (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} $\mu\text{Ci/ml}$ 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 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 Unit 2 flow not being credited for dilution of a Unit 2 discharge during the time of the Unit 3 discharge.

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} $\mu\text{Ci/ml}$ 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.



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

Therefore, the alarm setpoint corresponds to a concentration of:

$$\text{Alarm } (\mu\text{Ci/ml}) = \frac{100,000}{400} \times 3 \times 10^{-8} + \text{background} = 7.5 \times 10^{-6} \mu\text{Ci/ml} + \text{background}$$

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:

$$\text{Alarm } (\mu\text{Ci/ml}) = 7.5 \times 10^{-6} \mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{100,000} \times \frac{400}{\text{S/G blowdown (gpm)}}$$

$$\text{Background} = 3 \times 10^{-8} \mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{\text{total S/G blowdown (gpm)}} + \text{Background}$$

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 $3 \times 10^{-8} \mu\text{Ci/ml}$, 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.



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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} $\mu\text{Ci/ml}$.

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 $\mu\text{Ci}/\text{sec}$. 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 $\mu\text{Ci}/\text{sec}$, 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. “REMODOCM Technical Information Document,” in making this determination.

The alarm setpoint shall be set at or below the monitor reading in $\mu\text{Ci}/\text{cc}$ corresponding to the Unit 1 portion of the limit. The setpoint shall be set at or below $1.71\text{E}-3$ $\mu\text{Ci}/\text{cc}$. 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 $\mu\text{Ci}/\text{sec}$. 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 $\mu\text{Ci}/\text{sec}$, 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, “REMODOCM Technical Information Document,” in making this determination.

The alarm setpoint shall be set at or below the monitor reading in $\mu\text{Ci}/\text{cc}$ corresponding to the Unit 2 release to the stack portion of the limit. The setpoint shall be set at or below $1.3\text{E}-2$ $\mu\text{Ci}/\text{cc}$.

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 $\mu\text{Ci}/\text{sec}$. 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 $\mu\text{Ci}/\text{sec}$, 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, “REMODOCM Technical Information Document,” in making this determination.

The alarm setpoint shall be set at or below the monitor reading in $\mu\text{Ci}/\text{cc}$ corresponding to the Unit 3 release to the stack portion of the limit. The setpoint shall be set at or below $1.16 \text{ E}^{-2} \mu\text{Ci}/\text{cc}$.

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 $\mu\text{Ci}/\text{sec}$. 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 $\mu\text{Ci}/\text{sec}$, 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, “REMODOCM 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 $\mu\text{Ci}/\text{sec}$ (see the MP–22–REC–REF03, “REMODOCM 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 $\mu\text{Ci}/\text{sec}$. If the setpoint exceeds 7,200 $\mu\text{Ci}/\text{sec}$, the release shall be automatically terminated.

The MP2 waste gas decay tank monitor (given $\mu\text{Ci}/\text{cc}$ per cpm) calibration curve and the tank discharge rate is used to assure that the concentration of gaseous activity being released from a waste gas decay tank does not cause the setpoint of 7,200 $\mu\text{Ci}/\text{sec}$ to be exceeded.

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 $\mu\text{Ci}/\text{sec}$. 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 $\mu\text{Ci}/\text{sec}$, 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, “REMODOCM 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 3 vent portion of the limit. The setpoint shall be set at or below 8.4×10^{-4} $\mu\text{Ci}/\text{cc}$.

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 $\mu\text{Ci}/\text{sec}$. 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 $\mu\text{Ci}/\text{sec}$, 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, “REMODOCM Technical Information Document,” in making this determination.

The Alarm setpoint shall be set at or below the value of $5.9\text{E}-4$ $\mu\text{Ci}/\text{cc}$. 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 REMODOCM 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 REMODOCM.

Table App. II.A-1 provides a cross-reference guide between liquid and gaseous effluent release limits and those sections of the REMODOCM, which are used to determine compliance. It also shows the administrative Technical Specifications which reference the REMODOCM 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 REMODOCM should be reviewed directly for a full explanation of the requirements.



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**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/VE.1.a Liquid Effluent Concentration	Tables I.C.-2 and I.C.-3	Ten times 10CFR20App.B, Table 2, Column 2, & 2×10^{-4} $\mu\text{Ci/mL}$ for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 mins.
IV/VE.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/VD.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/VD.2.b Dose 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/VD.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/VF 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/VE.1.2, IV/VE.2.2, or IV/VE.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.



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SECTION III.

Millstone Unit 1

Radiological Effluent Controls

Docket Nos. 50-245



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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

III.B.1 – Definitions

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 operability by observation of behavior during operation. This determination shall include, where possible, comparison of the instrument with other independent instruments measuring the same variable.
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.



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**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 Activity 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 activity within 24 hours.

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 Activity 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 2×10^{-4} $\mu\text{Ci/ml}$ total activity.

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:

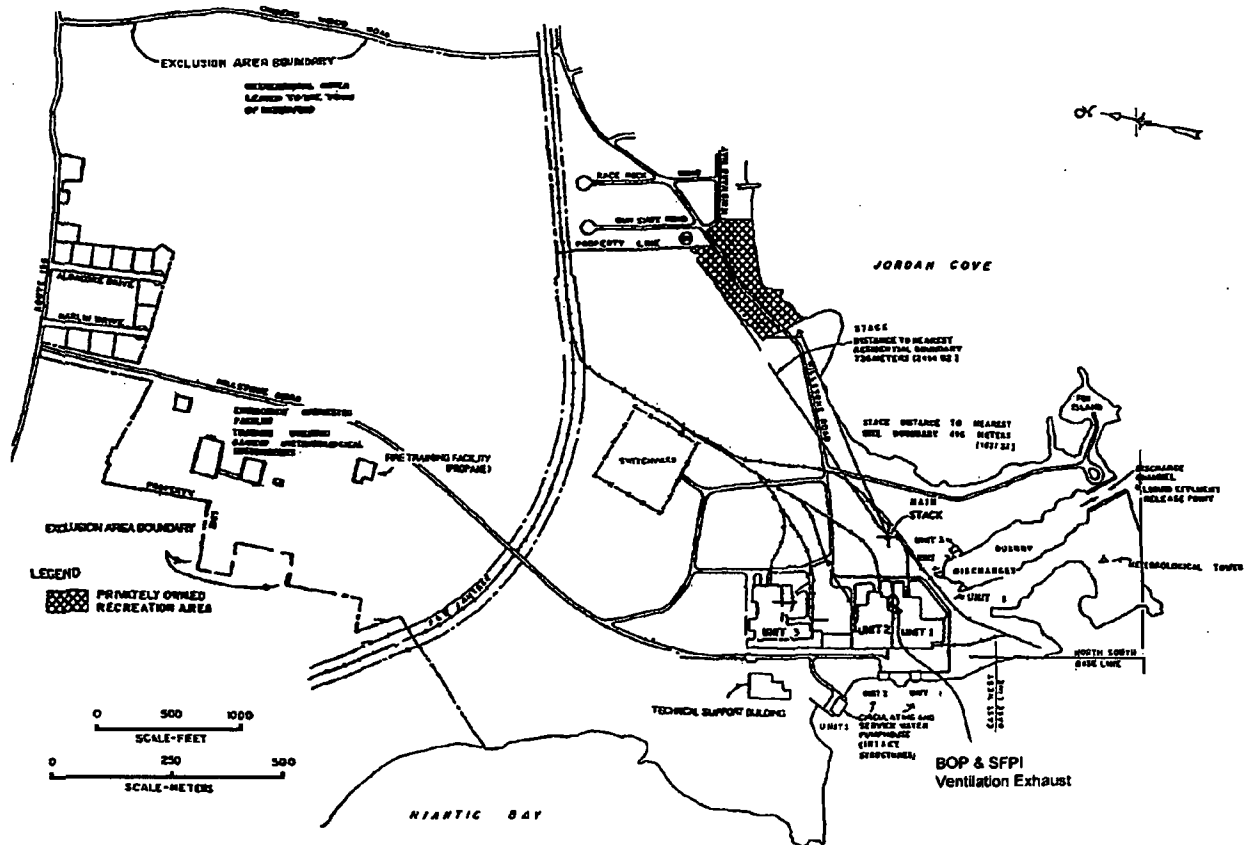
With the calculated dose from the release of Tritium and radioactive materials in particulate form exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken 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 activity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released.

Section III.D.2.c. – Radioactive Gaseous Effluents, Particulates, and Gas Other Than Noble Gas Doses



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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.



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SECTION IV.

Millstone Unit 2

Radiological Effluent Controls

Docket Nos. 50-336



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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 ($\mu\text{Ci}/\text{gram}$) 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

LIMITING CONDITIONS OF OPERATIONS

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.

APPLICABILITY: As shown in Table IV.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 IV.C.–1. Exert best efforts to restore the inoperable 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 IV.C.–2.



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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 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 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 $\mu\text{Ci/gm}$ 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 $\mu\text{Ci/gm}$ 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 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 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.



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**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 Activity 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 Activity 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 activity 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.



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 activity 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.



**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 Activity 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 Activity 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
TABLE NOTATION**

- (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} $\mu\text{Ci/ml}$ total activity.

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, 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:

- 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:

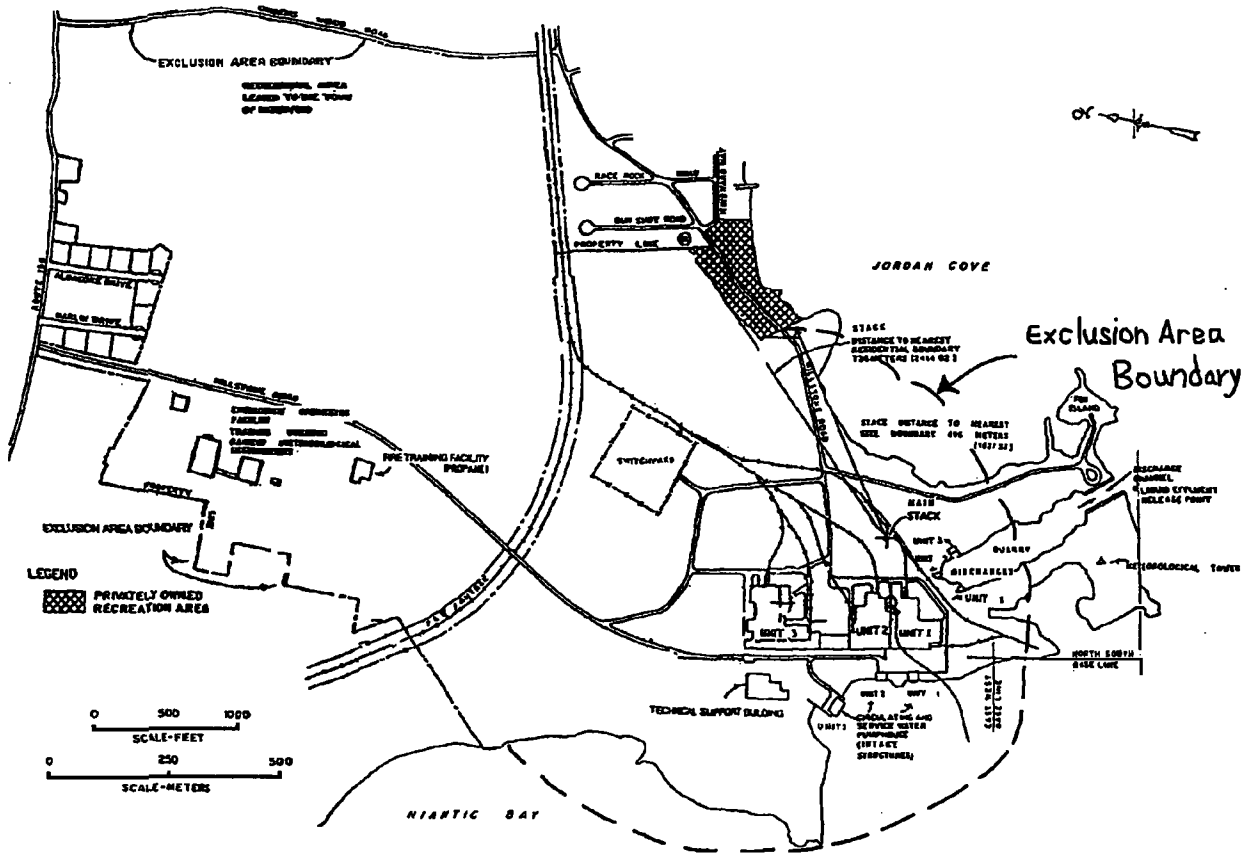
- a. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) 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



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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



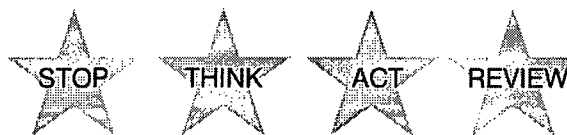
based upon the assumption that Xe-135 is the controlling radioisotope and its concentration in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

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



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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 ($\mu\text{Ci}/\text{gram}$) 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 inoperable 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.

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 5×10^{-7} $\mu\text{Ci/ml}$, 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 $\mu\text{Ci}/\text{gram}$ 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 $\mu\text{Ci}/\text{gram}$ 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.



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**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 Activity Monitor Providing Alarm	1	*	A
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 Activity Monitor Providing Alarm	1	*	A
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 Activity Monitor	1	*	D
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.

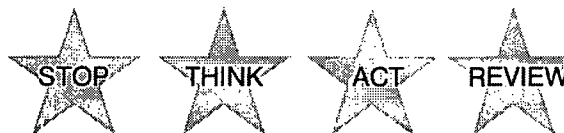


TABLE V.C. –3
ACTION STATEMENTS

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 Calibration	Channel Functional Check	When Surveillance 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 Activity 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 Activity 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 Activity 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

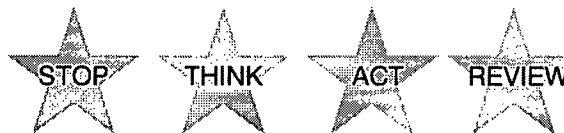


TABLE V.C.-4
Table Notations

- (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 2×10^{-4} $\mu\text{Ci/ml}$ total activity.

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 Table V.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, 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:

- 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:

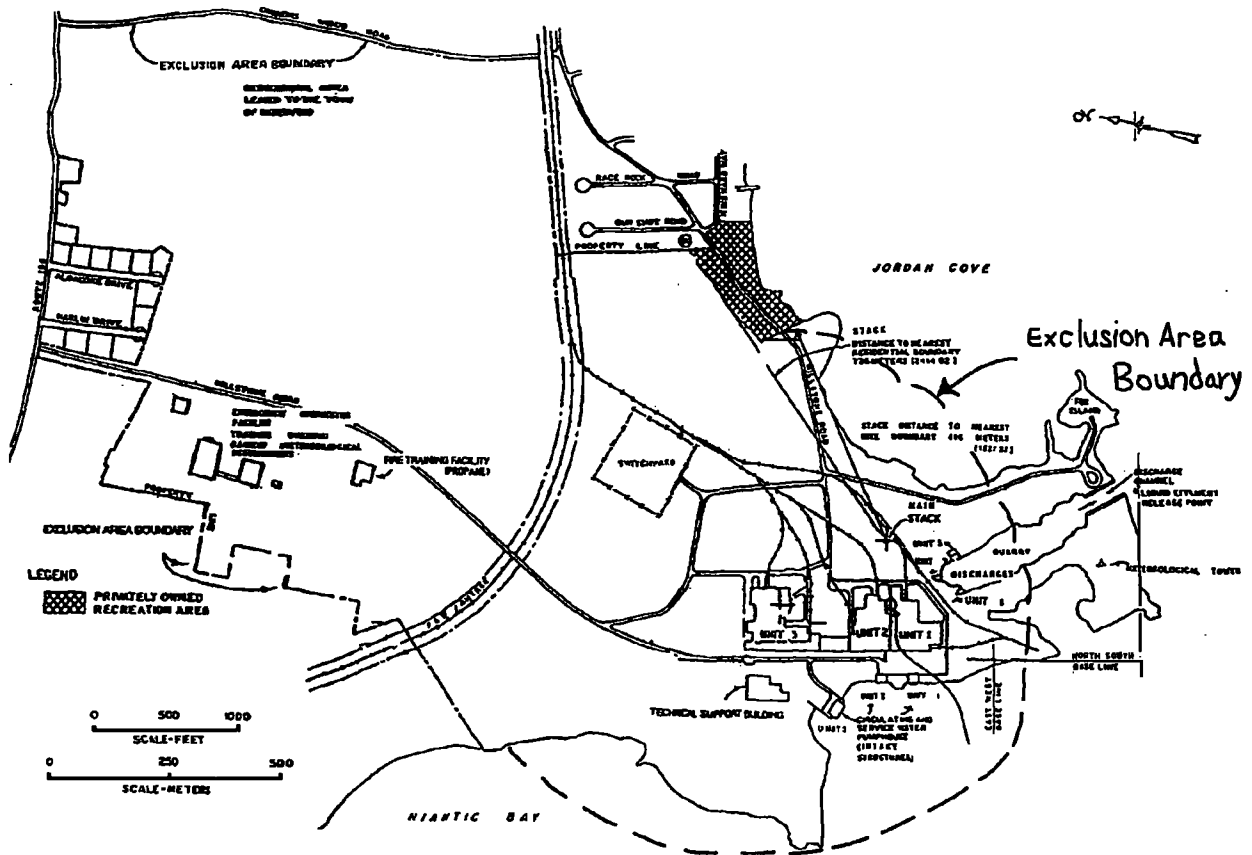
- c. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) 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 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.

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 Section V.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 activity 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 1×10^{-6} $\mu\text{Ci/cc}$ are measurable.



The vent normal range radiation monitor, HVR*10B, satisfies the requirements of Section V.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 Section V.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.

Section V.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 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.

Section V.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 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 activity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released.

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.

