Serial No. 12-245
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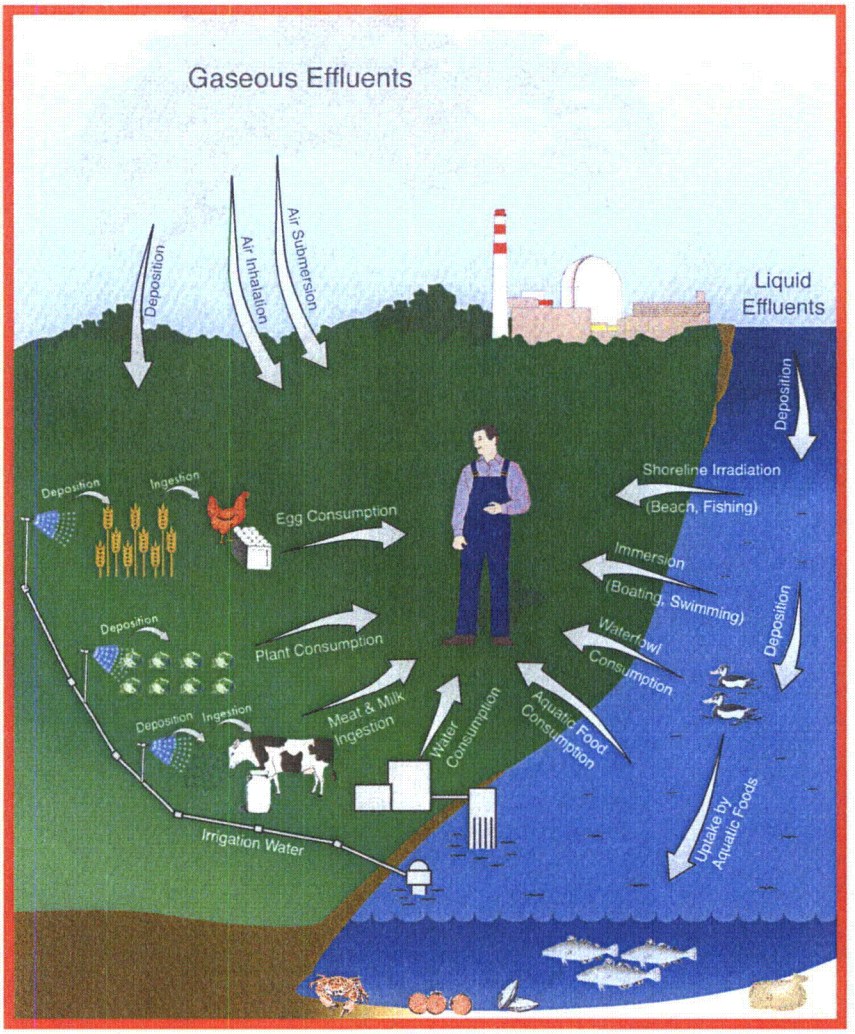
NPF-49

ATTACHMENT 1

2011 RADIOACTIVE EFFLUENTS RELEASE REPORT VOLUME 1

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

Millstone Power Station
2011
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

Dominion

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Introduction

This report, for the period of January through December of 2011, 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 (REMODCM), and the Station's Technical Specifications. A combined report, written in the US NRC Regulatory Guide 1.21 format, is submitted for all three units.

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 REMODCM, 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 REMODCM effective during the calendar year.

1.0 Off-Site Doses

This report provides a summary of the 2011 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.

Regulatory Guide 1.21 Revision 2 was issued in June 2009. This guide specifically states that Carbon-14 (C-14) needs to be reported in airborne effluents from US nuclear power plants. This reporting requirement became effective beginning with reporting year 2010. C-14 is not a new power plant emission. Because the overall quantity of radioactive releases has steadily decreased due to improvements in power plant operations, C-14 now qualifies as a "principle radionuclide" per the revised regulatory guide.

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 computer models DOSAIR and DOSLIQ, which were developed by Millstone Power Station. The methodology and input parameters for DOSAIR are those used in GASPAR II (Reference 11) and NRC Regulatory Guide 1.109 (Reference 3). The methodology and input parameters for DOSLIQ are those used in LADTAP II (Reference 6) and 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 the airborne 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 fruits, vegetables, leafy vegetables, grains, milk, poultry, meat, fish, and shellfish) and occupancy factors (for air submersion and ground irradiation, shoreline activity, swimming, boating, etc.). All these inputs are used in the appropriate dose models to calculate the maximum individual dose from radioactive airborne and liquid effluents.

1.1.1 Airborne Effluents

Maximum individual doses due to the release of noble gases, radioiodines, and particulates were calculated using the computer code DOSAIR (Reference 10). This is equivalent to the NRC code, GASPAR II, 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 (λ/Q) and average relative deposition (D/Q) used in the DOSAIR code 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 can be retrieved from computer storage.

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. However, the doses were conservatively calculated using mixed mode 142 foot meteorology since DOSAIR may underestimate the plume exposure (prior to plume touchdown) for elevated releases from the Millstone Power Station Stack. 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 including 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 releases 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. Because doses for releases from the MPS2 Vent and from the Millstone Power Station Stack are calculated using the same meteorology, the Containment Purge releases are not divided between the MPS2 Vent and Millstone Power Station Stack. Batch releases from the Waste Gas Decay Tanks and Containment Vents are discharged via the Millstone Power Station Stack. The doses for these elevated releases were conservatively calculated using mixed mode 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels. 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 doses for these elevated releases were conservatively calculated using mixed mode 142 foot meteorology. 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.

1.1.2 Liquid Effluents

Maximum individual doses from the release of radioactive liquid effluents were calculated using the DOSLIQ program (Reference 9). This program uses the dose models and parameters cited in NRC Regulatory Guide 1.109 with site-specific inputs to produce results similar to the LADTAP II code, (Reference 6).

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, DOSAIR calculates the dose to the whole body, gastroinstestinal (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, 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.

To determine compliance with 10 CFR 50, Appendix I (Reference 8), 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

The DOSLIQ code 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 storage during this year was within storage criteria and the maximum dose to a member of the public was approximately 0.19 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
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
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	8.06E-05	4.43E-05	4.48E-03	8.40E-06	4.62E-03
Skin	9.26E-05	4.43E-05	4.48E-03	8.40E-06	4.63E-03
Thyroid	8.04E-05	4.43E-05	4.48E-03	8.40E-06	4.62E-03
Max organ+	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
Beta	2.41E-04	3.75E-03	4.42E-04	1.23E-04	4.56E-03
Gamma	1.42E-04	8.17E-04	1.31E-04	1.23E-04	1.21E-03
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	2.46E-03	5.17E-02	7.57E-02	1.04E-02	1.40E-01
Skin	2.65E-03	5.33E-02	7.61E-02	1.05E-02	1.43E-01
Thyroid	2.75E-03	5.81E-02	7.66E-02	1.05E-02	1.48E-01
Max organ+	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
Beta	6.15E-05	9.15E-05	2.96E-04	4.85E-04	9.34E-04
Gamma	1.70E-05	1.81E-05	1.20E-04	1.58E-04	3.13E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	2.84E-03	4.59E-02	6.38E-02	1.47E-02	1.27E-01
Skin	2.88E-03	4.59E-02	6.39E-02	1.53E-02	1.28E-01
Thyroid	2.84E-03	4.64E-02	6.38E-02	1.48E-02	1.28E-01
Max organ+	1.04E-02	2.20E-01	3.04E-01	5.14E-02	5.85E-01

[+] 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 acronyn for radiation absorbed dose. One rad is equal to the absorption of 100 ergs of energy per gram of tissue.

Table 1-2
2011 Off-Site Dose Commitments from Liquid Effluents
Millstone Power Station Units 1, 2, 3

MPS1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Individual	(mrem*)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Thyroid	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Organ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

MPS2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	2.95E-04	8.86E-05	8.95E-04	6.10E-05	1.34E-03
Thyroid	1.31E-04	3.76E-05	4.59E-05	2.07E-05	2.36E-04
Max Organ	2.32E-03	1.96E-03	5.44E-03	4.36E-04	1.02E-02

MPS3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	5.15E-05	2.43E-04	3.24E-04	4.21E-04	1.04E-03
Thyroid	3.83E-05	1.47E-04	1.70E-04	1.54E-04	5.10E-04
Max Organ	1.93E-04	1.41E-03	1.85E-03	2.85E-03	6.30E-03

* 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 acronyn 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
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	4.56E-03	1.21E-03
Unit 3	1.27E-01	1.28E-01	5.85E-01	1.28E-01	9.34E-04	3.13E-04
Millstone Station	**2.72E-01**	**2.80E-01**	**1.28E+00**	**2.75E-01**	**5.49E-03**	**1.53E-03**
Limits	***5***	***15***	***15***	***15***	***20***	***10***

Liquid Effluents Dose

Max Individual Dose vs REMODCM & 10CFR50 Appendix I Limit

	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	2.72E-01	2.80E-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	**4.95E-01**	**5.01E-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, GI-LLI, Kidney, Liver, Lung

Table 1-4
2011 Offsite Dose Comparison
Natural Background vs Millstone Power Station

Average Resident	Natural Background Radiation Dose
Cosmic	27 mrem
Cosmogenic	1 mrem
Terrestial (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 Rower Station Whole Body Dose
Airborne Effluents	0.2700 mrem
Liquid Effluents	0.0024 mrem
On-site RadWaste Storage	0.2200 mrem
	0.4924 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
MPS3 Ventilation Vent
MPS3 SLCRS to Site Stack
MPS3 ESF Building Vent

Charcoal cartridges and particulate filters are used to collect iodines and particulates, respectively. These filters are periodically replaced (typically 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) (for all but 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 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.

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
- MPS2 and MPS3 RWST Vents
- 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.

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.

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 Carbon-14

Beginning in 2010 U. S. nuclear utilities are required to report airborne releases of C-14. This nuclide is not typically monitored because of its difficulty in measurement and analysis but the amount released can be estimated based upon its production rate. Reference 2 provides a method for this calculation. Also a key factor in the dose assessment is the percentage of C-14 that is in the form of carbon dioxide. Based on Reference 2, it was conservatively assumed that 30% of the C-14 exists as carbon dioxide (CO_2).

2.1.3 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

2.1.4 Airborne Batch Release Statistics

MPS1 – None

MPS2	Ctmt Purges	Ctmt Vents	WGDT
Number of Batches	3	57	7
Total Time (min)	2281	8822	3317
Maximum Time (min)	1423	244	726
Average Time (min)	760	155	474
Minimum Time (min)	198	68	252

MPS3	Ctmt Purges	Ctmt Vents*	Ctmt Drawdowns
Number of Batches	1	~350	1
Total Time (min)	101	*	59
Maximum Time (min)	101	*	59
Average Time (min)	101	*	59
Minimum Time (min)	101	*	59

* ~ 2-3 hrs per Vent

2.1.5 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.

2.1.5.1 MPS1 - None
2.1.5.2 MPS2 – None
2.1.5.3 MPS3 – None

2.1.6 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 Power Station Unit 1
Airborne Effluents - Release Summary

	Units	2011 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate *	uCi/sec	-	-	-	-	-
B. Iodines / Halogens						
1. Total Activity Released	Ci	na	na	na	na	na
2. Average Period Release Rate *	uCi/sec	na	na	na	na	na
C. Particulates						
1. Total Activity Released	Ci	2.16E-06	-	-	4.71E-06	6.87E-06
2. Average Period Release Rate *	uCi/sec	2.78E-07	-	-	5.93E-07	2.18E-07
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	3.32E-02	3.40E-02	3.16E+00	3.02E-02	3.26E+00
2. Average Period Release Rate *	uCi/sec	4.27E-03	4.32E-03	3.98E-01	3.79E-03	1.03E-01

* "Total Activity Released" ÷ Seconds in Quarter

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

"na" denotes not required to be analyzed

Table 2.1-A2

Millstone Power Station Unit 1

Airborne Effluents - Ground Continuous - BOP Vent & SFPI Vent

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
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	2.16E-06	-	-	-	2.16E-06
Be-7	Ci	-	-	-	4.71E-06	4.71E-06
Other γ Emitters	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	2.16E-06	-	-	4.71E-06	6.87E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	3.32E-02	3.40E-02	3.16E+00	3.02E-02	3.26E+00

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

"na" denotes not required to be analyzed

Table 2.2-A1

Millstone Power Station Unit 2

Airborne Effluents - Release Summary

		2011				
	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	2.82E-01	7.10E+00	1.12E+00	6.96E-01	9.20E+00
2. Average Period Release Rate *	uCi/sec	3.62E-02	9.03E-01	1.41E-01	8.75E-02	2.92E-01
B. Iodines / Halogens						
1. Total Activity Released	Ci	3.66E-04	3.78E-04	1.01E-04	2.64E-05	8.71E-04
2. Average Period Release Rate *	uCi/sec	4.70E-05	4.80E-05	1.27E-05	3.32E-06	2.76E-05
C. Particulates						
1. Total Activity Released	Ci	-	2.74E-05	2.12E-07	-	2.76E-05
2. Average Period Release Rate *	uCi/sec	-	3.49E-06	2.66E-08	-	8.76E-07
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.93E+00	2.28E+00	1.87E+00	1.69E+00	7.78E+00
2. Average Period Release Rate *	uCi/sec	2.48E-01	2.90E-01	2.36E-01	2.13E-01	2.47E-01
F. C-14						
1. Total Activity Released**	Ci					8.70E+00
2. Average Period Release Rate *	uCi/sec					2.76E-01

* "Total Activity Released" ÷ Seconds in Quarter

"-" 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. Calculated value is for the year; quarterly releases were not required to be calculated.

Table 2.2-A2

Millstone Power Station Unit 2
Airborne Effluents - Mixed Continuous
Auxiliary Building Ventilation, SGBD Tank Vent & Spent Fuel Pool Evaporation
Release Point - MPS2 Ventilation Vent

Nuclides Released	Units	2011 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	2.53E-02	-	-	2.53E-02
Kr-85	Ci	-	1.62E+00	1.80E-02	-	1.64E+00
Xe-131m	Ci	-	-	8.90E-05	-	8.90E-05
Xe-133	Ci	-	2.73E+00	7.40E-03	-	2.74E+00
Xe-133m	Ci	-	-	5.30E-05	-	5.30E-05
Xe-135	Ci	-	7.06E-02	-	-	7.06E-02
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	4.45E+00	2.55E-02	-	4.47E+00
B. Iodines / Halogens						
I-131	Ci	5.83E-05	1.22E-04	9.76E-06	6.17E-06	1.96E-04
I-132	Ci	-	1.07E-04	-	-	1.07E-04
I-133	Ci	2.44E-04	9.23E-05	4.53E-05	2.02E-05	4.02E-04
I-135	Ci	6.32E-05	2.15E-05	4.62E-05	-	1.31E-04
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	3.66E-04	3.42E-04	1.01E-04	2.64E-05	8.35E-04
C. Particulates						
Co-58	Ci	-	4.61E-07	-	-	4.61E-07
Cs-137	Ci	-	-	2.12E-07	-	2.12E-07
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	4.61E-07	2.12E-07	-	6.72E-07
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium *						
H-3	Ci	1.80E+00	2.06E+00	1.21E+00	1.57E+00	6.63E+00

* Includes estimated Spent Fuel Pool evaporation
"-" denotes less than Minimum Detectable Activity (MDA)

Table 2.2-A3

Millstone Power Station Unit 2

Airborne Effluents - Mixed Batch

Containment Purges

Release Point - MPS2 Ventilation Vent

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	*	6.48E-03	-	*	6.48E-03
Kr-85	Ci	*	1.47E-01	-	*	1.47E-01
Xe-133	Ci	*	3.42E-02	3.43E-03	*	3.77E-02
Xe-135	Ci	*	2.34E-03	-	*	2.34E-03
Other γ Emitters	Ci	*	-	-	*	-
Total Activity	Ci	*	1.90E-01	3.43E-03	*	1.93E-01
B. Iodines / Halogens						
I-131	Ci	*	1.93E-08	-	*	1.93E-08
I-133	Ci	*	2.40E-08	-	*	2.40E-08
Br-82	Ci	*	1.37E-07	-	*	1.37E-07
Other γ Emitters	Ci	*	-	-	*	-
Total Activity	Ci	*	1.80E-07	-	*	1.80E-07
C. Particulates						
Cr-51	Ci	*	9.42E-08	-	*	9.42E-08
Co-58	Ci	*	2.49E-08	-	*	2.49E-08
Co-60	Ci	*	9.25E-09	-	*	9.25E-09
Zr-95	Ci	*	9.47E-08	-	*	9.47E-08
Ag-110m	Ci	*	1.27E-07	-	*	-
Nb-95	Ci	*	9.79E-08	-	*	9.79E-08
Zr-97	Ci	*	1.03E-07	-	*	1.03E-07
γ Emitters	Ci	*	-	-	*	-
Total Activity	Ci	*	5.51E-07	-	*	5.51E-07
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	*	1.02E-01	5.09E-01	*	6.11E-01

* No activity released

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

"na" denotes Not Required to be Analyzed

Table 2.2-A4
Millstone Power Station Unit 2
Airborne Effluents - Elevated Batch
Waste Gas Decay Tanks
Release Point - Millstone Site Stack

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	2.18E-01	1.15E+00	1.09E+00	6.24E-01	3.08E+00
Xe-133	Ci	-	-	3.80E-04	-	3.80E-04
Xe-135	Ci	-	-	6.28E-06	-	6.28E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.18E-01	1.15E+00	1.09E+00	6.24E-01	3.08E+00
B. Iodines / Halogens						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	3.57E-04	1.00E-03	7.48E-04	2.33E-03	4.43E-03

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

"na" denotes not required to be analyzed

Table 2.2-A5

Millstone Power Station Unit 2

Airborne Effluents - Elevated Continuous Containment Vents

Release Point - Millstone Site Stack

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	4.54E-02	1.99E-02	3.02E-02	3.52E-02	1.31E-01
Xe-133	Ci	1.72E-02	3.08E-02	3.51E-03	3.55E-02	8.70E-02
Xe-135	Ci	1.20E-03	1.48E-03	3.31E-04	8.97E-04	3.91E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	6.38E-02	5.22E-02	3.41E-02	7.16E-02	2.22E-01
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Br-82	Ci	-	1.90E-06	-	-	1.90E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	1.90E-06	-	-	1.90E-06
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.28E-01	1.09E-01	1.58E-01	1.27E-01	5.22E-01

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

Table 2.2-A6

Millstone Power Station Unit 2

Airborne Effluents - Ground Batch

Containment Air

Release Point - Containment Equipment Hatch

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	*	7.60E-01	*	*	7.60E-01
Xe-135	Ci	*	9.47E-03	*	*	9.47E-03
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	7.69E-01	*	*	7.69E-01
B. Iodines / Halogens						
I-131	Ci	*	6.00E-07	*	*	6.00E-07
I-133	Ci	*	1.90E-07	*	*	1.90E-07
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	7.90E-07	*	*	7.90E-07
C. Particulates						
Co-58	Ci	*	3.40E-07	*	*	3.40E-07
Co-60	Ci	*	1.90E-07	*	*	1.90E-07
Nb-95	Ci	*	4.00E-07	*	*	4.00E-07
Cs-137	Ci	*	3.80E-08	*	*	3.80E-08
W-187	Ci	*	3.20E-07	*	*	3.20E-07
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	1.29E-06	*	*	1.29E-06
D. Gross Alpha						
Gross Alpha	Ci	*	na	*	*	na
E. Tritium						
H-3	Ci	*	na	*	*	na

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

* No activity released

"na" denotes Not Required to be Analyzed

Table 2.2-A7

Millstone Power Station Unit 2

Airborne Effluents - Ground Batch

Reactor Water Storage Tank

Reactor Water Storage Tank Vent

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	*	1.12E-01	*	*	1.12E-01
Xe-131m	Ci	*	8.22E-03	*	*	8.22E-03
Xe-133	Ci	*	3.69E-01	*	*	3.69E-01
Xe-133m	Ci	*	4.32E-03	*	*	4.32E-03
Xe-135	Ci	*	8.67E-05	*	*	8.67E-05
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	4.94E-01	*	*	4.94E-01
B. Iodines / Halogens						
I-131	Ci	*	2.01E-05	*	*	2.01E-05
I-132	Ci	*	1.27E-05	*	*	1.27E-05
I-133	Ci	*	-	*	*	-
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	3.28E-05	*	*	3.28E-05
C. Particulates						
Cr-51	Ci	*	1.48E-06	*	*	1.48E-06
Mn-54	Ci	*	2.77E-08	*	*	2.77E-08
Co-57	Ci	*	1.05E-08	*	*	1.05E-08
Co-58	Ci	*	5.50E-06	*	*	5.50E-06
Fe-59	Ci	*	8.56E-09	*	*	8.56E-09
Co-60	Ci	*	2.05E-07	*	*	2.05E-07
Nb-95	Ci	*	2.30E-07	*	*	2.30E-07
Zr-95	Ci	*	1.42E-07	*	*	1.42E-07
Mo-99	Ci	*	4.67E-09	*	*	4.67E-09
Tc-99m	Ci	*	4.61E-09	*	*	4.61E-09
Ru-103	Ci	*	9.29E-10	*	*	9.29E-10
Ag-110m	Ci	*	4.37E-06	*	*	4.37E-06
Sn-113	Ci	*	1.29E-07	*	*	1.29E-07
Sn-117m	Ci	*	1.03E-07	*	*	1.03E-07
Sb-122	Ci	*	2.76E-08	*	*	2.76E-08
Sb-124	Ci	*	2.43E-07	*	*	2.43E-07
Sb-125	Ci	*	7.91E-07	*	*	7.91E-07
Sb-126	Ci	*	1.90E-08	*	*	1.90E-08
Te-131m	Ci	*	2.40E-07	*	*	2.40E-07
Te-132	Ci	*	1.14E-05	*	*	1.14E-05
Cs-134	Ci	*	7.59E-08	*	*	7.59E-08
Cs-137	Ci	*	9.35E-08	*	*	9.35E-08
Ba-140	Ci	*	1.36E-09	*	*	1.36E-09
La-140	Ci	*	1.81E-09	*	*	1.81E-09
γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	2.51E-05	*	*	2.51E-05
D. Gross Alpha						
Gross Alpha	Ci	*	na	*	*	na
E. Tritium						
H-3	Ci	*	1.12E-02	*	*	1.12E-02

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

* No activity released

"na" denotes Not Required to be Analyzed

Table 2.3-A1

Millstone Power Station Unit 3

Airborne Effluents - Release Summary

		2011				
	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	2.85E-01	3.19E-01	1.02E+00	2.58E+00	4.20E+00
2. Average Period Release Rate *	uCi/sec	3.67E-02	4.05E-02	1.28E-01	3.25E-01	1.33E-01
B. Iodines / Halogens						
1. Total Activity Released	Ci	1.10E-05	2.16E-05	9.26E-06	1.96E-05	6.15E-05
2. Average Period Release Rate *	uCi/sec	1.41E-06	2.75E-06	1.16E-06	2.47E-06	1.95E-06
C. Particulates						
1. Total Activity Released	Ci	3.35E-08	2.29E-05	1.43E-05	4.44E-04	4.81E-04
2. Average Period Release Rate *	uCi/sec	4.31E-09	2.91E-06	1.80E-06	5.58E-05	1.52E-05
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.21E+01	9.33E+00	1.12E+01	3.40E+01	6.66E+01
2. Average Period Release Rate *	uCi/sec	1.56E+00	1.19E+00	1.41E+00	4.28E+00	2.11E+00
F. C-14						
1. Total Activity Released**	Ci					1.09E+01
2. Average Period Release Rate *	uCi/sec					3.46E-01

* "Total Activity Released" ÷ Seconds in Quarter

"-" 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. Calculated value is for the year; quarterly releases were not required to be calculated.

Table 2.3-A2

Millstone Power Station Unit 3
Airborne Effluents - Mixed Continuous
Auxiliary Building Ventilation & Spent Fuel Pool Evaporation
Release Point - MPS3 Ventilation Vent

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	-	-	-	4.37E-01	4.37E-01
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	4.37E-01	4.37E-01
B. Iodines / Halogens						
I-131	Ci	-	7.95E-06	-	6.34E-06	1.43E-05
I-133	Ci	-	-	4.98E-06	1.22E-05	1.72E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	7.95E-06	4.98E-06	1.85E-05	3.15E-05
C. Particulates						
Be-7	Ci	-	1.14E-05	-	-	1.14E-05
Cr-51	Ci	-	-	-	4.66E-05	4.66E-05
Co-58	Ci	-	-	-	3.59E-05	3.59E-05
Co-60	Ci	-	-	-	6.69E-06	6.69E-06
Hf-181	Ci	-	-	-	9.80E-07	9.80E-07
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	1.14E-05	-	9.02E-05	1.02E-04
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium *						
H-3	Ci	1.12E+01	8.71E+00	1.05E+01	3.35E+01	6.39E+01

* Includes estimated Spent Fuel Pool evaporation

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

Table 2.3-A3

Millstone Power Station Unit 3
Airborne Effluents - Ground Continuous
ESF Building Ventilation
Release Point - ESF Building Vent

Nuclides Released	Units	2011				
		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	8.96E-08	3.23E-07	-	9.81E-08	5.11E-07
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	8.96E-08	3.23E-07	-	9.81E-08	5.11E-07
C. Particulates						
Be-7	Ci	-	-	5.95E-07	2.40E-07	8.35E-07
Cs-137	Ci	3.35E-08	-	-		3.35E-08
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	3.35E-08	-	5.95E-07	2.40E-07	8.69E-07
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	2.85E-01	9.03E-02	1.47E-01	2.83E-02	5.51E-01

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

Table 2.3-A4

Millstone Power Station Unit 3
Airborne Effluents - Mixed Batch
Containment Drawdowns
Release Point - Auxiliary Building Roof Vent

Nuclides Released	Units	2011 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						
Co-58	Ci	*	*	*	1.39E-08	1.39E-08
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	1.39E-08	1.39E-08
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	*	*	*	2.02E-03	2.02E-03

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

* No activity released

"na" denotes not required to be analyzed

Table 2.3-A5

Millstone Power Station Unit 3
Airborne Effluents - Mixed Batch
Containment Purges
Release Point - Millstone Site Stack

Nuclides Released	Units	2011 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	*	*	*	4.63E-03	4.63E-03
Xe-135	Ci	*	*	*	1.70E-03	1.70E-03
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	6.33E-03	6.33E-03
B. Iodines / Halogens						
Br-82	Ci	*	*	*	2.06E-07	2.06E-07
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	2.06E-07	2.06E-07
C. Particulates						
γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	*	*	*	1.03E-02	1.03E-02

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

* No activity released

"na" denotes Not Analyzed

Table 2.3-A6

Millstone Power Station Unit 3
Airborne Effluents - Elevated Continuous
Gaseous Waste System
Release Point - Millstone Site Stack

Nuclides Released	Units	2011 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	2.63E-01	3.02E-01	3.01E-01	1.82E-01	1.05E+00
Kr-85m	Ci	-	-	2.68E-03	3.32E-04	3.01E-03
Xe-131m	Ci	-	-	-	7.76E-03	7.76E-03
Xe-133	Ci	-	-	5.46E-01	1.86E+00	2.41E+00
Xe-133m	Ci	-	-	-	8.27E-03	8.27E-03
Xe-135	Ci	-	-	1.42E-01	6.51E-02	2.07E-01
Ar-41	Ci	-	-	8.76E-03	-	8.76E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.63E-01	3.02E-01	1.00E+00	2.12E+00	3.69E+00
B. Iodines / Halogens						
I-131	Ci	-	5.75E-06	-	1.09E-07	5.86E-06
I-133	Ci	-	-	-	-	-
Br-82	Ci	1.09E-05	7.60E-06	4.28E-06	6.58E-07	2.34E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.09E-05	1.34E-05	4.28E-06	7.67E-07	2.93E-05
C. Particulates						
Co-58	Ci	-	-	-	2.33E-07	2.33E-07
Co-60	Ci	-	7.57E-08	-	-	7.57E-08
Be-7	Ci	-	1.14E-05	1.37E-05	-	2.51E-05
Hf-181	Ci	-	-	3.50E-08	-	3.50E-08
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	1.15E-05	1.37E-05	2.33E-07	2.54E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	6.34E-01	5.12E-01	5.21E-01	4.23E-01	2.09E+00

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

Table 2.3-A7

Millstone Power Station Unit 3
Airborne Effluents - Elevated Batch
Containment Vents
Release Point - Millstone Site Stack

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	1.62E-02	1.27E-02	8.55E-03	2.15E-03	3.96E-02
Xe-133	Ci	5.33E-03	3.34E-03	5.89E-03	4.49E-04	1.50E-02
Xe-133m	Ci	-	-	-	6.92E-05	6.92E-05
Xe-135	Ci	8.14E-04	7.56E-04	7.17E-04	6.22E-05	2.35E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.23E-02	1.68E-02	1.52E-02	2.73E-03	5.70E-02
B. Iodines / Halogens*						
γ Emitters		-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.58E-02	1.51E-02	9.34E-03	3.93E-03	4.42E-02

* Iodines, Particulates and Gross Aipha included in Table 2.3-A6

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

Table 2.3-A8

Millstone Power Station Unit 3
Airborne Effluents - Ground Batch
Containment Air
Containment Equipment Hatch

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	-	-
B. Iodines / Halogens						
γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	-	-
C. Particulates						
Cr-51	Ci	*	*	*	6.20E-07	6.20E-07
Co-58	Ci	*	*	*	1.40E-07	1.40E-07
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	7.60E-07	7.60E-07
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	na	na	na	na	na

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

* No activity released

"na" denotes not required to be analyzed

Table 2.3-A9

Millstone Power Station Unit 3
Airborne Effluents - Ground Batch
Reactor Water Storage Tank
Reactor Water Storage Tank Vent

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	na	na	na	1.24E-02	1.24E-02
Other γ Emitters	Ci	na	na	na	-	-
Total Activity	Ci	na	na	na	1.24E-02	1.24E-02
B. Iodines / Halogens						
γ Emitters	Ci	na	na	na	-	-
Total Activity	Ci	na	na	na	-	-
C. Particulates						
Cr-51	Ci	na	na	na	1.19E-04	1.19E-04
Mn-54	Ci	na	na	na	1.19E-05	1.19E-05
Co-57	Ci	na	na	na	4.70E-07	4.70E-07
Co-58	Ci	na	na	na	1.82E-04	1.82E-04
Fe-59	Ci	na	na	na	2.31E-06	2.31E-06
Co-60	Ci	na	na	na	1.38E-05	1.38E-05
Zr-95	Ci	na	na	na	5.03E-06	5.03E-06
Nb-95	Ci	na	na	na	9.34E-06	9.34E-06
Sb-124	Ci	na	na	na	7.52E-07	7.52E-07
Sb-125	Ci	na	na	na	5.54E-06	5.54E-06
Cs-134	Ci	na	na	na	1.11E-06	1.11E-06
Cs-137	Ci	na	na	na	8.19E-07	8.19E-07
Te-132	Ci	na	na	na	3.28E-08	3.28E-08
Other γ Emitters	Ci	na	na	na	-	-
Total Activity	Ci				3.52E-04	3.52E-04
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	na	na	na	2.55E-02	2.55E-02

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

"na" denotes not required to be analyzed

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 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	Reactor Building Sumps
	Underground Ventilation Duct
	Site Stack Sump
MPS2	Clean Waste Monitor Tanks (2)
	Aerated Waste Monitor Tanks
	CPF Waste Neutralization Sump
	Steam Generator and other Systems' Bulk Discharges
MPS3	High Level Waste Test Tanks (2)
	Low Level Waste Drain Tanks (2)
	CPF Waste Neutralization Sump
	Steam Generator Bulk
	Boron and Waste Test Tanks Berm (via DSN006)
	Foundation Drains Sumps (via DSN006)
	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 Groundwater Monitoring

The Groundwater Protection Program (GPP) describes the means by which Millstone Power Station implements the actions cited in the Nuclear Energy's Institute's (NEI) Groundwater Protection Initiative. The purpose of the GPP 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 GPP is on-site groundwater monitoring. The results of the onsite monitoring programs required by the Radiological Environmental Monitoring Program are documented in the Annual Radiological Environmental Monitoring Report.

Another key element in the GPP 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. The consequences of these measurements have been used to determine releases and doses.

2.2.3 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

2.2.4 Liquid Batch Release Statistics

	MPS1	MPS2	MPS3
Number of Batches	1	64	51
Total Time (min)	330	7466	6218
Maximum Time (min)	330	447	307
Average Time (min)	330	117	122
Minimum Time (min)	330	1	9
Average Stream Flow	Not Applicable - Ocean Site		

2.2.5 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 2011, the following abnormal liquid releases occurred:

2.2.5.1 MPS1 - None

2.2.5.2 MPS2 - None

2.2.5.3 MPS3 - None

2.2.6 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 Power Station Unit 1

Liquid Effluents - Release Summary

(Release Point - Quarry)

	Units	2011 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	*	*	*	*	*
2. Average Period Diluted Activity	uCi/ml	*	*	*	*	*
B. Tritium						
1. Total Activity Released	Ci	*	*	*	*	*
2. Average Period Diluted Activity	uCi/ml	*	*	*	*	*
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	*	*	*	*	*
2. Average Period Diluted Activity	uCi/ml	*	*	*	*	*
D. Gross Alpha						
1. Total Activity Released	Ci	*	*	*	*	*
E. Volume						
1. Released Waste Volume	Liters	*	*	*	*	*
2. Dilution Volume During Releases	Liters	*	*	*	*	*
3. Dilution Volume During Period	Liters	*	*	*	*	*

* No activity released

Table 2.1-L2

Millstone Power Station Unit 1

Liquid Effluents - Batch

(Release Point - Quarry)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	*	*	*	*	*
Sr-90	Ci	*	*	*	*	*
Fe-55	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*
B. Tritium						
H-3	Ci	*	*	*	*	*
C. Dissolved & Entrained Gases						
Kr-85	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	*	*

* No activity released

Table 2.2-L1

Millstone Power Station Unit 2

Liquid Effluents - Release Summary

(Release Point - Quarry)

		2011				
	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	4.28E-02	1.28E-02	6.96E-02	4.99E-03	1.30E-01
2. Average Period Diluted Activity *	uCi/ml	1.70E-10	7.42E-11	2.66E-10	2.07E-11	1.40E-10
B. Tritium						
1. Total Activity Released	Ci	1.74E+02	4.76E+01	1.04E+02	3.90E+01	3.65E+02
2. Average Period Diluted Activity *	uCi/ml	6.93E-07	2.77E-07	3.98E-07	1.62E-07	3.94E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	2.36E-01	1.31E-01	8.48E-02	2.31E-02	4.75E-01
2. Average Period Diluted Activity *	uCi/ml	9.42E-10	7.62E-10	3.24E-10	9.57E-11	5.13E-10
D. Gross Alpha						
1. Total Activity Released	Ci	9.71E-05	1.13E-05	-	-	1.08E-04
E. Volume						
1. Released Waste Volume						
Primary	Liters	7.70E+05	5.80E+05	8.29E+05	2.66E+05	2.44E+06
Secondary	Liters	2.79E+03	7.71E+04	2.27E+03	2.15E+04	1.04E+05
2. Dilution Volume During Releases						
Primary	Liters	3.20E+09	2.34E+09	3.86E+09	1.73E+09	1.11E+10
3. Dilution Volume During Period						
	Liters	2.51E+11	1.72E+11	2.62E+11	2.41E+11	9.26E+11

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

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

Table 2.2-L2

Millstone Power Station Unit 2
Liquid Effluents - Continuous
SGBD, Service Water (SW), RBCCW
(Release Point - Quarry)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Co-58	Ci	6.78E-07	-	-	-	6.78E-07
Co-60	Ci	3.19E-06	-	-	-	3.19E-06
Ni-63	Ci	9.18E-06	-	-	-	9.18E-06
Sb-125	Ci	1.56E-06	-	-	-	1.56E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.46E-05	-	-	-	1.46E-05
B. Tritium						
H-3	Ci	2.79E-04	8.12E-04	1.94E-05	1.53E-04	1.26E-03
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.2-L3

Millstone Power Station Unit 2

Liquid Effluents - Batch - Liquid Waste System (LWS)

(Release Point - Quarry)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Be-7	Ci	-	-	3.23E-05	-	3.23E-05
Cr-51	Ci	-	4.49E-04	-	-	4.49E-04
Mn-54	Ci	1.94E-04	1.61E-04	4.34E-05	1.02E-06	4.00E-04
Co-57	Ci	2.96E-04	3.11E-05	3.83E-06	-	3.31E-04
Co-58	Ci	2.59E-03	3.21E-03	1.14E-03	9.50E-05	7.03E-03
Fe-59	Ci	-	5.47E-06	-	-	5.47E-06
Co-60	Ci	4.20E-03	1.03E-03	6.87E-04	3.21E-05	5.95E-03
Nb-95	Ci	5.93E-05	1.93E-04	2.59E-04	-	5.11E-04
Zr-95	Ci	-	1.40E-04	5.90E-05	-	1.99E-04
Nb-97	Ci	-	-	-	1.53E-06	1.53E-06
Zr-97	Ci	-	1.07E-05	-	-	1.07E-05
Ru-105	Ci	-	-	1.29E-04	-	1.29E-04
Ag-110m	Ci	2.88E-04	3.14E-04	4.02E-04	7.06E-06	1.01E-03
Sn-113	Ci	-	7.46E-06	1.50E-06	-	8.96E-06
Sn-117m	Ci	-	1.60E-06	-	-	1.60E-06
Sb-124	Ci	5.12E-06	9.30E-05	-	5.85E-06	1.04E-04
Sb-125	Ci	3.07E-03	1.20E-03	2.18E-03	7.32E-04	7.19E-03
I-131	Ci	8.53E-05	2.60E-05	2.45E-05	1.27E-05	1.49E-04
Cs-134	Ci	2.48E-03	3.24E-05	3.77E-05	5.15E-06	2.55E-03
Cs-136	Ci	4.26E-06	-	-	-	4.26E-06
Cs-137	Ci	3.67E-03	1.01E-04	1.23E-04	3.89E-05	3.94E-03
Fe-55	Ci	2.06E-03	2.14E-03	6.13E-02	2.36E-03	6.79E-02
Ni-63	Ci	2.37E-02	3.59E-03	3.00E-03	1.69E-03	3.20E-02
Sr-89	Ci	5.97E-06	3.01E-05	1.53E-04	-	1.89E-04
Sr-90	Ci	9.99E-07	4.95E-07	-	-	1.49E-06
Total Activity	Ci	4.27E-02	1.28E-02	6.96E-02	4.99E-03	1.30E-01
B. Tritium						
H-3	Ci	1.74E+02	4.76E+01	1.04E+02	3.90E+01	3.65E+02
C. Dissolved & Entrained Gases						
Kr-85	Ci	2.30E-01	1.16E-01	8.22E-02	2.31E-02	4.52E-01
Xe-133	Ci	6.33E-03	1.48E-02	2.65E-03	-	2.38E-02
Xe-133m	Ci	-	9.56E-05	-	-	9.56E-05
Total Activity	Ci	2.36E-01	1.31E-01	8.48E-02	2.31E-02	4.75E-01
D. Gross Alpha						
Gross Alpha	Ci	9.71E-05	1.13E-05	-	-	1.08E-04

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

Table 2.2-L4

Millstone Power Station Unit 2

Liquid Effluents - Release Summary

(Release Point - Yard Drain - DSN 006)

		2011				
	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
B. Tritium						
1. Total Activity Released	Ci	1.29E-02	2.14E-03	4.03E-04	5.77E-03	2.12E-02
2. Average Period Diluted Activity *	uCi/ml	3.49E-07	5.56E-08	8.06E-09	1.12E-07	1.20E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume	Liters	2.22E+06	3.48E+05	1.89E+05	1.00E+06	3.75E+06
2. Dilution Volume During Releases	Liters	***	***	***	***	***
3. Dilution Volume During Period **	Liters	3.49E+07	3.81E+07	4.98E+07	5.05E+07	1.73E+08

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

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

** Includes all station dilution sources via Yard Drain - DSN 006

*** Continuous "Dilution Volume During Releases" is not quantified

Table 2.2-L5

Millstone Power Station Unit 2

Liquid Effluents -Continuous-Turbine Building Sump

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.29E-02	2.14E-03	4.03E-04	5.77E-03	2.12E-02
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L1

Millstone Power Station Unit 3

Liquid Effluents - Release Summary

(Release Point - Quarry)

		2011				
	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	2.98E-03	1.24E-02	3.00E-02	3.11E-02	7.65E-02
2. Average Period Diluted Activity *	uCi/ml	6.95E-12	3.12E-11	6.33E-11	9.50E-11	4.70E-11
B. Tritium						
1. Total Activity Released	Ci	4.46E+01	2.03E+02	3.39E+02	2.06E+02	7.93E+02
2. Average Period Diluted Activity *	uCi/ml	1.04E-07	5.11E-07	7.15E-07	6.30E-07	4.87E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	6.96E-05	6.96E-05
2. Average Period Diluted Activity *	uCi/ml	-	-	-	2.13E-13	4.28E-14
D. Gross Alpha						
1. Total Activity Released	Ci	6.63E-05	2.74E-04	-	-	3.40E-04
E. Volume						
1. Released Waste Volume						
Primary	Liters	2.23E+05	7.32E+05	9.56E+05	1.05E+06	2.96E+06
Secondary	Liters	8.45E+06	1.04E+07	8.10E+06	4.14E+06	3.11E+07
2. Dilution Volume During Releases						
Primary	Liters	9.28E+08	3.82E+09	4.84E+09	2.92E+09	1.25E+10
Secondary	Liters	1.05E+10	1.29E+10	1.95E+10	5.21E+09	4.81E+10
3. Dilution Volume During Period						
	Liters	4.29E+11	3.98E+11	4.74E+11	3.27E+11	1.63E+12

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

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

Table 2.3-L2

Millstone Power Station Unit 3

Liquid Effluents - Continuous - Steam Generator Blowdown & Service Water

(Release Point - Quarry)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.26E-01	1.69E-01	7.89E-02	1.63E-02	3.90E-01
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L3

Millstone Power Station Unit 3

Liquid Effluents - Batch - Liquid Waste System

(Release Point - Quarry)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Na-24	Ci	-	-	-	7.57E-06	7.57E-06
Cr-51	Ci	-	-	-	3.92E-03	3.92E-03
Mn-54	Ci	9.38E-06	3.50E-04	6.49E-04	5.98E-04	1.61E-03
Co-58	Ci	3.04E-05	7.91E-05	2.36E-04	3.18E-03	3.53E-03
Fe-59	Ci	-	-	-	7.79E-04	7.79E-04
Co-60	Ci	4.06E-04	4.11E-03	6.03E-03	5.56E-03	1.61E-02
Ni-63	Ci	4.15E-04	-	1.16E-02	9.25E-04	1.29E-02
Nb-95	Ci	-	-	-	2.92E-04	2.92E-04
Zr-95	Ci	-	-	-	4.22E-05	4.22E-05
Ag-110m	Ci	3.37E-05	2.11E-04	1.30E-04	1.44E-04	5.19E-04
Sb-122	Ci	-	-	-	2.11E-05	2.11E-05
Sb-124	Ci	-	-	3.31E-05	2.57E-05	5.88E-05
Sb-125	Ci	1.15E-03	2.04E-03	8.17E-04	5.21E-03	9.22E-03
I-133	Ci	-	-	-	1.58E-05	1.58E-05
Cs-134	Ci	8.46E-05	-	-	1.84E-04	2.69E-04
Cs-137	Ci	8.07E-05	1.03E-05	-	1.75E-04	2.66E-04
Ce-141	Ci	-	1.07E-05	-	-	1.07E-05
Other γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	7.70E-04	5.62E-03	1.05E-02	9.99E-03	2.69E-02
Total Activity	Ci	2.98E-03	1.24E-02	3.00E-02	3.11E-02	7.65E-02
B. Tritium						
H-3	Ci	4.45E+01	2.03E+02	3.39E+02	2.06E+02	7.93E+02
C. Dissolved & Entrained Gases						
Xe-133	Ci	-	-	-	6.96E-05	6.96E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	6.96E-05	6.96E-05
D. Gross Alpha						
Gross Alpha	Ci	6.63E-05	2.74E-04	-	-	3.40E-04

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

Table 2.3-L4

Millstone Power Station Unit 3

Liquid Effluents - Batch - CPF Waste Neutralization Sumps, Hotwell, Steam Generator Bulk

(Release Point - Quarry)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.41E-02	1.43E-02	1.00E-02	8.63E-04	3.93E-02
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L5

Millstone Power Station Unit 3

Liquid Effluents - Release Summary

(Release Point - Yard Drain - DSN 006)

		2011				
	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
B. Tritium						
1. Total Activity Released	Ci	1.07E-01	1.08E-01	7.24E-02	7.46E-03	2.95E-01
2. Average Period Diluted Activity *	uCi/ml	2.89E-06	2.81E-06	1.45E-06	1.45E-07	1.67E-06
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume	Liters	8.28E+06	9.71E+06	9.13E+06	6.07E+06	3.32E+07
2. Dilution Volume During Releases	Liters	***	***	***	***	***
3. Dilution Volume During Period **	Liters	2.88E+07	2.88E+07	4.09E+07	4.55E+07	1.44E+08

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

** Includes all station dilution sources via Yard Drain - DSN 006

*** Continuous "Dilution Volume During Releases" is not quantified

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

Table 2.3-L6

Millstone Power Station Unit 3

Liquid Effluents - Continuous - Turbine Building Sump, Waste Test Tank Berm

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.02E-01	1.04E-01	6.60E-02	3.45E-03	2.75E-01
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L7

Millstone Power Station Unit 3

Liquid Effluents - Continuous - Foundation Drain Sumps, Closed Cooling Water Drain, Service Water Drain

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2011				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	5.28E-03	4.02E-03	6.44E-03	4.01E-03	1.98E-02
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na

"-" 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 13):

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
MPS 1

January 1, 2011 through December 31, 2011

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

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	9.00E+01	2.55E+00	3.30E-04
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	9.00E+01	2.55E+00	3.30E-04

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	5.71%	1.89E-05
Sr-90	0.67%	2.20E-06
Cs-137	10.08%	3.33E-05
Pu-238	3.59%	1.19E-05
Pu-239	1.88%	6.21E-06
Pu-241	75.52%	2.49E-04
Cm-244	2.55%	8.43E-06
CURIES (TOTAL)		3.30E-04

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.20E+02	3.40E+00	3.67E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	1.20E+02	3.40E+00	3.67E-03

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	1.46%	5.37E-05
Fe-55	45.36%	1.67E-03
Co-58	0.59%	2.16E-05
Co-60	12.93%	4.75E-04
Ni-63	22.71%	8.34E-04
Nb-95	0.05%	1.90E-06
Cs-134	0.41%	1.49E-05
Cs-137	16.36%	6.01E-04
Pu-238	< 0.01%	2.03E-07
Pu-239	< 0.01%	1.01E-07
Pu-241	0.11%	3.94E-06
Am-241	0.01%	4.32E-07
Cm-244	< 0.01%	1.17E-07
CURIES (TOTAL)		3.67E-03

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

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

Major Nuclides for the Above Table:

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

Other Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	6.86E+01	1.94E+00	3.16E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**6.86E+01**	**1.94E+00**	**3.16E-03**

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	92.84%	2.93E-03
Mn-54	0.02%	6.99E-07
Fe-55	0.30%	9.50E-06
Co-58	0.05%	1.59E-06
Co-60	0.06%	2.03E-06
Ni-63	0.21%	6.50E-06
Nb-95	< 0.01%	3.68E-08
Cs-134	0.01%	4.03E-07
Cs-137	6.08%	1.92E-04
Th-232	< 0.01%	8.20E-12
U-234	0.02%	5.74E-07
U-235	< 0.01%	5.32E-10
U-238	< 0.01%	3.54E-09
Pu-238	0.07%	2.11E-06
Pu-239	0.13%	3.97E-06
Pu-241	< 0.01%	1.79E-09
Am-241	0.21%	6.65E-06
Cm-244	< 0.01%	3.26E-10
CURIES (TOTAL)		**3.16E-03**

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
Waste Class	ft^3	m^3	Curies
A	2.79E+02	7.89E+00	7.16E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	2.79E+02	7.89E+00	7.16E-03

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	41.96%	3.01E-03
Mn-54	< 0.01%	6.99E-07
Fe-55	23.40%	1.68E-03
Co-58	0.32%	2.32E-05
Co-60	6.66%	4.77E-04
Ni-63	11.74%	8.41E-04
Sr-90	0.03%	2.20E-06
Nb-95	0.03%	1.93E-06
Cs-134	0.21%	1.53E-05
Cs-137	11.54%	8.26E-04
Th-232	< 0.01%	8.20E-12
U-234	< 0.01%	5.74E-07
U-235	< 0.01%	5.32E-10
U-238	< 0.01%	3.54E-09
Pu-238	0.20%	1.42E-05
Pu-239	0.14%	1.03E-05
Pu-241	3.54%	2.53E-04
Am-241	0.10%	7.08E-06
Cm-244	0.12%	8.55E-06
CURIES (TOTAL)		7.16E-03

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

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.46E+02	4.14E+00	4.00E-01
B	8.13E+01	2.30E+00	6.35E+01
C	N/A	N/A	N/A
ALL	2.28E+02	6.45E+00	6.39E+01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.04%	2.33E-02
C-14	< 0.01%	1.47E-03
Cr-51	< 0.01%	3.21E-03
Mn-54	1.79%	1.14E+00
Fe-55	8.66%	5.54E+00
Fe-59	< 0.01%	1.12E-04
Co-57	0.26%	1.66E-01
Co-58	0.43%	2.73E-01
Co-60	8.32%	5.32E+00
Ni-63	67.19%	4.29E+01
Zn-65	< 0.01%	5.41E-05
Sr-89	< 0.01%	1.77E-04
Sr-90	0.03%	1.88E-02
Zr-95	0.02%	9.70E-03
Nb-95	< 0.01%	4.68E-03
Tc-99	< 0.01%	1.32E-04
Ag-110m	< 0.01%	3.56E-03
Sn-113	< 0.01%	1.79E-03
Sn-117m	< 0.01%	1.18E-05
Sb-124	< 0.01%	5.85E-04
Sb-125	5.94%	3.79E+00
Cs-134	2.51%	1.60E+00
Cs-137	4.78%	3.06E+00
Ce-144	< 0.01%	3.72E-05
Hf-181	< 0.01%	5.34E-05
Pu-238	< 0.01%	2.87E-04
Pu-239	< 0.01%	8.56E-05
Pu-241	< 0.01%	6.30E-03
Am-241	< 0.01%	9.83E-05
Cm-242	< 0.01%	4.68E-05
Cm-244	< 0.01%	2.62E-04
CURIES (TOTAL)		6.39E+01

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

Dry Active Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**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

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

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Other Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	9.23E+02	2.61E+01	3.72E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	9.23E+02	2.61E+01	3.72E-02

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	92.91%	3.46E-02
Mn-54	0.02%	8.26E-06
Fe-55	0.32%	1.19E-04
Co-57	< 0.01%	2.88E-09
Co-58	0.05%	1.82E-05
Co-60	0.07%	2.54E-05
Ni-63	0.22%	8.16E-05
Nb-95	< 0.01%	4.19E-07
Sb-125	< 0.01%	2.24E-07
Cs-134	0.01%	4.77E-06
Cs-137	5.89%	2.19E-03
Th-232	< 0.01%	1.16E-10
U-234	0.02%	8.09E-06
U-235	< 0.01%	7.51E-09
U-238	< 0.01%	4.99E-08
Pu-238	0.08%	2.97E-05
Pu-239	0.15%	5.60E-05
Pu-241	< 0.01%	2.53E-08
Am-241	0.25%	9.37E-05
Cm-244	< 0.01%	3.90E-09
CURIES (TOTAL)		3.72E-02

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
Waste Class	ft^3	m^3	Curies
A	1.25E+04	3.54E+02	3.18E+00
B	8.13E+01	2.30E+00	6.35E+01
C	N/A	N/A	N/A
ALL	1.26E+04	3.56E+02	6.67E+01

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.09%	5.99E-02
C-14	< 0.01%	1.52E-03
Cr-51	< 0.01%	3.41E-03
Mn-54	1.72%	1.15E+00
Fe-55	9.97%	6.65E+00
Fe-59	< 0.01%	1.16E-04
Co-57	0.25%	1.66E-01
Co-58	0.50%	3.32E-01
Co-60	8.37%	5.58E+00
Ni-63	66.08%	4.41E+01
Zn-65	< 0.01%	5.41E-05
Sr-89	< 0.01%	1.77E-04
Sr-90	0.03%	1.88E-02
Zr-95	0.03%	2.27E-02
Nb-95	0.03%	1.98E-02
Tc-99	< 0.01%	1.32E-04
Ag-110m	0.02%	1.30E-02
Sn-113	< 0.01%	1.86E-03
Sn-117m	< 0.01%	1.31E-05
Sb-124	< 0.01%	6.13E-04
Sb-125	5.73%	3.82E+00
Cs-134	2.42%	1.61E+00
Cs-137	4.73%	3.15E+00
Ce-144	< 0.01%	3.72E-05
Hf-181	< 0.01%	5.55E-05
Th-232	< 0.01%	1.16E-10
U-234	< 0.01%	8.09E-06
U-235	< 0.01%	7.51E-09
U-238	< 0.01%	4.99E-08
Pu-238	< 0.01%	3.47E-04
Pu-239	< 0.01%	1.42E-04
Pu-241	0.01%	7.28E-03
Am-241	< 0.01%	2.14E-04
Cm-242	< 0.01%	4.73E-05
Cm-244	< 0.01%	2.98E-04
CURIES (TOTAL)		6.67E+01

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

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.37E+02	3.88E+00	6.86E-01
B	2.81E+02	7.95E+00	1.73E+02
C	N/A	N/A	N/A
ALL	4.18E+02	1.18E+01	1.74E+02

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.03%	5.28E-02
C-14	< 0.01%	1.08E-03
Mn-54	3.42%	5.96E+00
Fe-55	10.06%	1.75E+01
Fe-59	< 0.01%	4.43E-05
Co-57	0.09%	1.54E-01
Co-58	1.14%	1.99E+00
Co-60	3.99%	6.94E+00
Ni-59	0.09%	1.60E-01
Ni-63	27.39%	4.77E+01
Sr-89	< 0.01%	3.28E-03
Sr-90	< 0.01%	1.47E-02
Nb-94	< 0.01%	9.94E-05
Zr-95	< 0.01%	9.43E-05
Nb-95	< 0.01%	1.16E-04
Tc-99	< 0.01%	1.62E-03
Ag-110m	< 0.01%	4.20E-04
Sb-125	0.12%	2.17E-01
Cs-134	26.63%	4.64E+01
Cs-137	27.01%	4.70E+01
Pu-238	< 0.01%	2.13E-05
Pu-239	< 0.01%	8.59E-06
Pu-241	< 0.01%	6.01E-03
Am-241	< 0.01%	2.26E-05
Cm-242	< 0.01%	1.26E-05
Cm-244	< 0.01%	2.07E-05
CURIES (TOTAL)		1.74E+02

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

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.29E+04	3.67E+02	2.36E+00
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	1.29E+04	3.67E+02	2.36E+00

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	6.13%	1.45E-01
Mn-54	1.26%	2.96E-02
Fe-55	44.36%	1.05E+00
Co-58	1.45%	3.42E-02
Co-60	16.36%	3.86E-01
Ni-63	22.83%	5.39E-01
Zr-95	< 0.01%	2.04E-05
Nb-95	< 0.01%	2.68E-05
Ag-110m	< 0.01%	1.30E-05
Cs-134	3.07%	7.25E-02
Cs-137	4.54%	1.07E-01
Pu-238	< 0.01%	9.28E-08
Pu-239	< 0.01%	1.71E-08
Pu-241	< 0.01%	1.07E-06
Am-241	< 0.01%	1.17E-07
Cm-244	< 0.01%	5.45E-08
CURIES (TOTAL)		2.36E+00

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

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
Waste Class	**ft^3**	**m^3**	**Curies**
A	2.93E+02	8.29E+00	2.11E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**2.93E+02**	**8.29E+00**	**2.11E-02**

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	92.39%	1.95E-02
Mn-54	0.03%	5.31E-06
Fe-55	0.30%	6.33E-05
Co-58	0.06%	1.20E-05
Co-60	0.07%	1.41E-05
Ni-63	0.20%	4.25E-05
Nb-95	< 0.01%	2.80E-07
Cs-134	0.01%	2.64E-06
Cs-137	6.88%	1.45E-03
Th-232	< 0.01%	8.20E-12
U-234	< 0.01%	5.74E-07
U-235	< 0.01%	5.32E-10
U-238	< 0.01%	3.54E-09
Pu-238	< 0.01%	2.11E-06
Pu-239	0.02%	3.97E-06
Pu-241	< 0.01%	1.79E-09
Am-241	0.03%	6.65E-06
Cm-244	< 0.01%	2.05E-09
CURIES (TOTAL)		**2.11E-02**

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
Waste Class	ft^3	m^3	Curies
A	1.34E+04	3.79E+02	3.07E+00
B	2.81E+02	7.95E+00	1.73E+02
C	N/A	N/A	N/A
ALL	**1.37E+04**	**3.87E+02**	**1.76E+02**

Major Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.12%	2.17E-01
C-14	< 0.01%	1.08E-03
Mn-54	3.39%	5.99E+00
Fe-55	10.52%	1.86E+01
Fe-59	< 0.01%	4.43E-05
Co-57	0.09%	1.54E-01
Co-58	1.15%	2.02E+00
Co-60	4.15%	7.33E+00
Ni-59	0.09%	1.60E-01
Ni-63	27.32%	4.82E+01
Sr-89	< 0.01%	3.28E-03
Sr-90	< 0.01%	1.47E-02
Nb-94	< 0.01%	9.94E-05
Zr-95	< 0.01%	1.15E-04
Nb-95	< 0.01%	1.44E-04
Tc-99	< 0.01%	1.62E-03
Ag-110m	< 0.01%	4.33E-04
Sb-125	0.12%	2.17E-01
Cs-134	26.31%	4.64E+01
Cs-137	26.71%	4.71E+01
Th-232	< 0.01%	8.20E-12
U-234	< 0.01%	5.74E-07
U-235	< 0.01%	5.32E-10
U-238	< 0.01%	3.54E-09
Pu-238	< 0.01%	2.35E-05
Pu-239	< 0.01%	1.26E-05
Pu-241	< 0.01%	6.01E-03
Am-241	< 0.01%	2.94E-05
Cm-242	< 0.01%	1.26E-05
Cm-244	< 0.01%	2.07E-05
CURIES (TOTAL)		**1.76E+02**

2.4 Groundwater Monitoring

The Groundwater Protection Program (GPP) describes the means by which Millstone Power Station implements the actions cited in the Nuclear Energy's Institute's (NEI) Groundwater Protection Initiative. The purpose of the GPP 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 GPP is on-site groundwater monitoring. The results of the GPP are documented in the Annual Radiological Environmental Operating Report (AREOR). Additional wells were sampled and the results are documented in Table 2.4-GW1 below.

Table 2.4-GW1 Additional Well Samples

Name	Date	H-3[1] (pCi/L)
MW-6B	10/20/11	<1,740
MW-7A	2/9/11	<1,720
MW-7B	2/9/11	<1,720
MW-7C	2/9/11	<1,720
MW-7D	2/9/11	<1,720
S12-MW-1	10/20/11	<1,740
DP-001B[2]	12/5/11	4,440
DP-002A[2]	2/9/11	3,400
DP-002A	6/20/11	7,530
DP-003A[2]	2/9/11	1,850
DP-003A	3/14/11	7,320
DP-003A	6/20/11	2,700
DP-003A	12/5/11	10,600
DP-004A[2]	2/9/11	3,080
DP-004A	6/20/11	2,290
DP-007[2]	2/9/11	1,900
DP-007	3/14/11	<1,740
DP-007	6/20/11	<1,740
DP-102	6/20/11	<1,740
DP-102[2]	12/5/11	2,960

Notes: 1 - There was no gamma radioactivity detected in these samples.
2 – These wells are located around the MPS3 RWST.
H-3 detected in these wells is from releases out of the RWST vent. The H-3 is captured in sumps and underground vaults and is measured and accounted before release to the environment. There is no communication with ground water. These releases and resultant doses to the public are accounted in earlier sections of this report.

3.0 Inoperable Effluent Monitors

During the period January 1 through December 31, 2011, the following effluent monitors were inoperable for more than 30 consecutive days:

3.1 MPS1 – None

3.2 MPS2 – None

3.3 MPS3 – Steam Generator Blowdown Effluent Line flow rate measurement device
On October 09, 2011 at 04:59 the steam generator blowdown radiation monitor (3SSR-RE08) was declared inoperable due to isolating steam generator blowdown sampling system for refueling outage 3R14. The monitor remained out of service due to lack of steam generator pressure until November 21, 2011 at 01:17 when it was made operable subsequent to completion of 3R14.

The monitor exceeded 30 days out of service due to the outage 3R14 lasting longer than expected. There was no failure of the monitor itself. Had the power plant been in service with the steam generators at pressure the monitor would have been restored.

4.0 Operating History

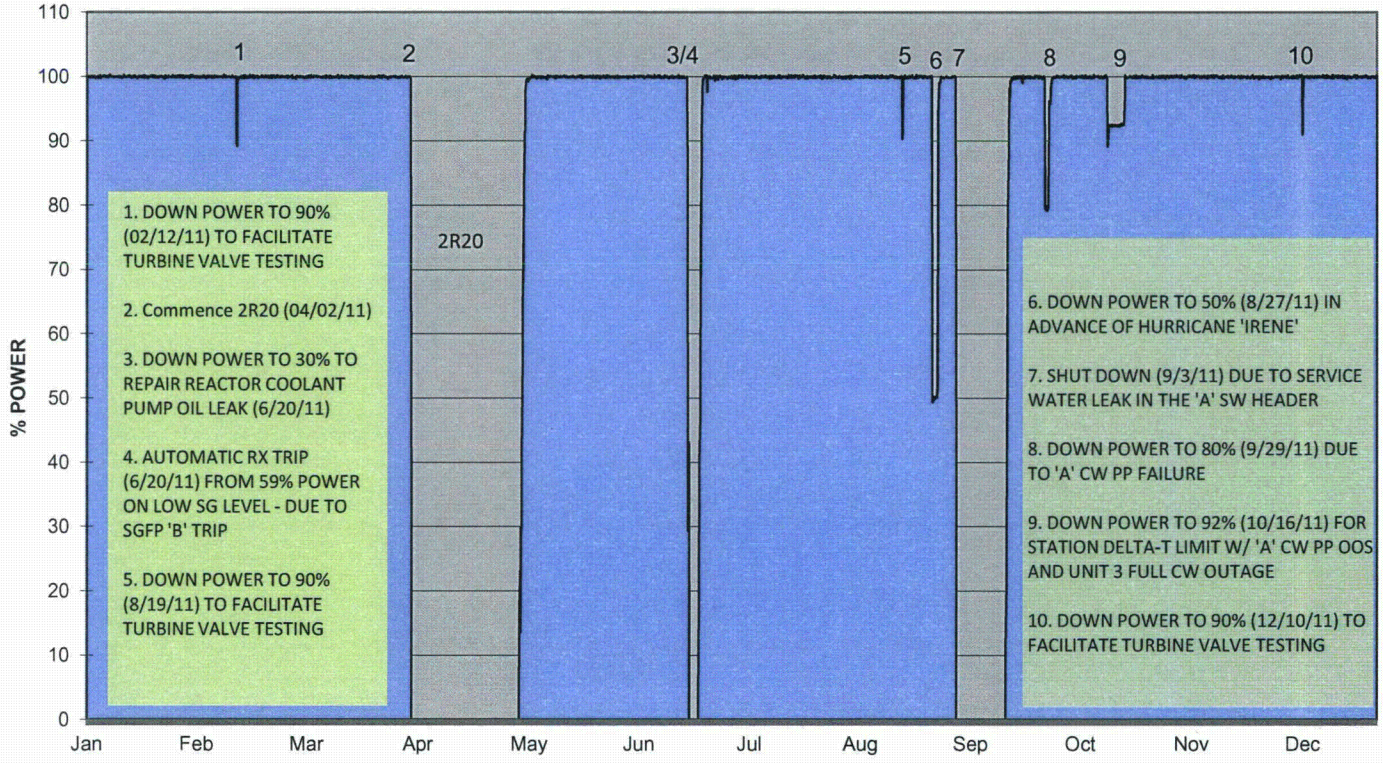
The operating history of the Millstone Power Station Units during this reporting period was as follows:

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

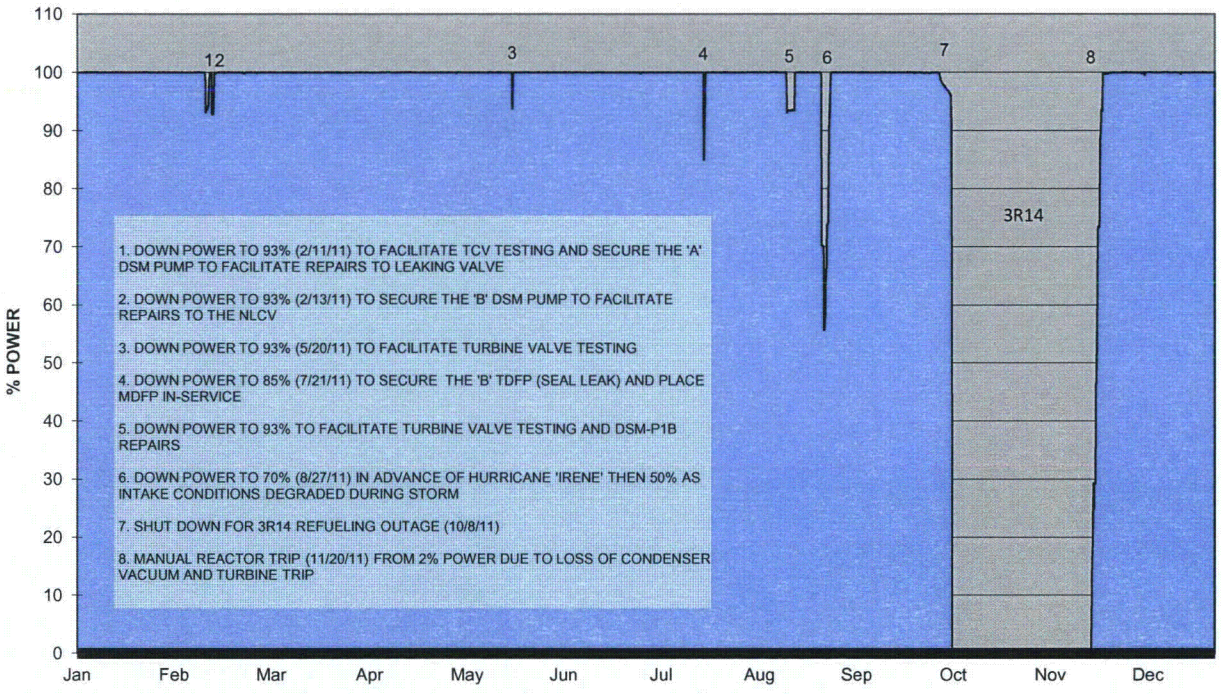
MPS2 operated with a capacity factor of 85.6% and MPS3 operated with a capacity factor of 87.6%

The power histograms for 2011 are on the following pages.

Millstone Power Station Unit 2 - Cycle 20 & 21 Power History
Year 2011



Millstone Power Station Unit 3 - Cycle 14 & 15 Power History
Year 2011



5.0 Errata

Tables 1-1 and 1-3 of the 2010 Radioactive Effluents Release Report are resubmitted to correct errors in the airborne doses to the maximum individual during the 3rd quarter for MPS2:

Table 1-1
2010 Off-Site Dose Commitments from Airborne Effluents
Millstone Power Station Units 1, 2, 3

MPS1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	1.04E-04	5.00E-05	1.20E-04	8.96E-05	3.64E-04
Skin	1.18E-04	5.00E-05	1.37E-04	8.96E-05	3.94E-04
Thyroid	1.04E-04	5.00E-05	1.20E-04	8.96E-05	3.64E-04
Max organ+	1.05E-04	5.00E-05	1.96E-04	8.96E-05	4.40E-04

MPS2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.16E-05	2.04E-03	4.58E-04	5.71E-05	2.56E-03
Gamma	3.14E-05	1.27E-04	7.19E-05	2.40E-05	2.54E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	2.36E-03	7.81E-02	7.60E-02	4.93E-03	1.61E-01
Skin	2.38E-03	7.95E-02	7.63E-02	4.97E-03	1.63E-01
Thyroid	2.39E-03	7.86E-02	7.66E-02	5.04E-03	1.63E-01
Max organ+	1.18E-02	3.91E-01	3.79E-01	2.37E-02	8.05E-01

MPS3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.44E-04	8.23E-03	9.06E-05	5.09E-05	8.51E-03
Gamma	2.28E-05	2.91E-03	8.34E-06	1.07E-05	2.96E-03
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	2.09E-03	6.24E-02	5.78E-02	8.09E-03	1.30E-01
Skin	2.18E-03	6.61E-02	5.78E-02	8.13E-03	1.34E-01
Thyroid	2.09E-03	1.74E-01	5.78E-02	8.09E-03	2.42E-01
Max organ+	9.17E-03	2.90E-01	2.77E-01	3.68E-02	6.13E-01

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

Table 1-3
2010 Off-Site Dose Comparison to Limits
Millstone Power Station Units 1, 2, 3

Airborne Effluents Dose

Max Individual Dose vs REMODCM & 10 CFR 50 Appendix I Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
MPS1	3.64E-04	3.64E-04	4.40E-04	3.94E-04	0.00E+00	0.00E+00
MPS2	1.61E-01	1.63E-01	8.05E-01	1.63E-01	2.56E-03	2.54E-04
MPS3	1.30E-01	2.42E-01	6.13E-01	1.34E-01	8.51E-03	2.96E-03
Millstone Power Station	**2.92E-01**	**4.05E-01**	**1.42E+00**	**2.98E-01**	**1.11E-02**	**3.21E-03**
Limits	***5***	***15***	***15***	***15***	***20***	***10***

Liquid Effluents Dose

Max Individual Dose vs REMODCM & 10 CFR 50 Appendix I Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)
MPS1	2.12E-07	6.08E-08	3.01E-07
MPS2	2.76E-04	1.87E-04	9.04E-03
MPS3	9.66E-04	7.39E-04	3.31E-03
Millstone Power Station	**1.24E-03**	**9.26E-04**	**1.24E-02**
Limits	***3***	***10***	***10***

Total Off-Site Dose from Millstone Station

Max Individual Dose vs REMODCM & 40 CFR 190 Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ * (mrem)
Airborne Effluents	2.92E-01	4.05E-01	1.42E+00
Liquid Effluents	1.24E-03	9.26E-04	1.24E-02
Radwaste Storage	1.90E-01	1.90E-01	1.90E-01
Millstone Power Station	**4.83E-01**	**5.96E-01**	**1.62E+00**
Limits	***25***	***75***	***25***

Note: REMODCM limits are listed in 10 CFR 50, Appendix I which contains additional limits not listed in the REMODCM

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

5.0 Errata (continued)

Table 2.1-A2 of the 2010 Radioactive Effluents Release Report is resubmitted to correct errors in the total curies for the year of particulate Cs-137 and total particulates from the MPS1 BOP Vent and SFPI Vent:

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

Nuclides Released	Units	2010 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
γ Emitters	Ci	na	na	na	na	na
Total Activity	Ci	na	na	na	na	na
C. Particulates						
Cs-137	Ci	1.07E-06	-	1.91E-06	-	2.99E-06
Other γ Emitters	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.07E-06	-	1.91E-06	-	2.99E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	
E. Tritium						
H-3	Ci	2.97E-01	5.20E-02	4.10E-02	6.59E-01	1.05E+00

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

5.0 Errata (continued)

Table 2.3-A9 of the 2010 Radioactive Effluents Release Report is resubmitted to correct an error in the total curies of Fission & Activation Gases released for the year from the MPS3 RWST Vent:

Table 2.3-A9
Millstone Power Station Unit 3
Airborne Effluents - Ground Batch - RWST Vent

Nuclides Released	Units	2010				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	na	8.42E-02	na	na	8.42E-02
Other γ emitters	Ci	na	-	na	na	-
Total Activity	Ci	na	8.42E-02	na	na	8.42E-02
B. Iodines / Halogens						
I-131	Ci	na	2.07E-04	na	na	2.07E-04
Other γ emitters	Ci	na	-	na	na	-
Total Activity	Ci	na	2.07E-04	na	na	2.07E-04
C. Particulates						
Cr-51	Ci	na	2.18E-05	na	na	2.18E-05
Mn-54	Ci	na	3.22E-06	na	na	3.22E-06
Co-57	Ci	na	1.66E-07	na	na	1.66E-07
Co-58	Ci	na	7.35E-05	na	na	7.35E-05
Fe-59	Ci	na	5.24E-07	na	na	5.24E-07
Co-60	Ci	na	2.77E-06	na	na	2.77E-06
Zr-95	Ci	na	1.32E-06	na	na	1.32E-06
Nb-95	Ci	na	1.91E-06	na	na	1.91E-06
Ag-110m	Ci	na	7.19E-07	na	na	7.19E-07
Sb-124	Ci	na	7.65E-08	na	na	7.65E-08
Sb-125	Ci	na	1.77E-06	na	na	1.77E-06
Cs-134	Ci	na	7.33E-06	na	na	7.33E-06
Cs-136	Ci	na	2.43E-07	na	na	2.43E-07
Cs-137	Ci	na	4.71E-06	na	na	4.71E-06
La-140	Ci	na	1.12E-07	na	na	1.12E-07
Other γ emitters	Ci	na	-	na	na	-
Total Activity	Ci	na	1.20E-04	na	na	1.20E-04
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	na	na	na	na	na

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

5.0 Errata (continued)

Table 2.3-A2 of the 2010 Radioactive Effluents Release Report is resubmitted to correct an error in the total curies of Particulates released for the 1st Qtr, 2nd Qtr and the year from the MPS3 Normal Ventilation and Spent Fuel Pool Evaporation:

Table 2.3-A2
Millstone Power Station Unit 3
Airborne Effluents - Mixed Continuous - Normal Ventilation & Spent Fuel Pool Evaporation

Nuclides Released	Units	2010				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	-	1.52E+01	-	-	1.52E+01
Other γ emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	1.52E+01	-	-	1.52E+01
B. Iodines / Halogens						
I-131	Ci	-	2.09E-03	-	-	2.09E-03
I-133	Ci	-	6.91E-05	-	-	6.91E-05
Other γ emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	2.16E-03	-	-	2.16E-03
C. Particulates						
Cr-51	Ci	-	1.56E-05	-	-	1.56E-05
Co-58	Ci	-	1.24E-05	-	-	1.24E-05
Nb-95	Ci	-	1.87E-06	-	-	1.87E-06
Sb-124	Ci	1.27E-06	-	-	-	1.27E-06
Cs-134	Ci	-	1.02E-06	-	-	1.02E-06
Ba-140	Ci	-	8.11E-06	-	-	8.11E-06
Other γ emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	1.27E-06	3.90E-05	-	-	4.03E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium *						
H-3	Ci	7.00E+00	1.30E+01	1.44E+01	1.42E+01	4.86E+01

* Includes estimated Spent Fuel Pool evaporation
"-" denotes less than Minimum Detectable Activity (MDA)

5.0 Errata (continued)

Table 2.2-L5 of the 2010 Radioactive Effluents Release Report is resubmitted to correct an error in the total curies of Fission & Activation Gases released for the year from the MPS2 Turbine Building Sump and Totes:

Table 2.2-L5

Millstone Power Station Unit 2

Liquid Effluents -Continuous-Turbine Building Sump/Totes

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2010				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Co-60	Ci	-	1.37E-06	-	-	1.37E-06
Cs-137	Ci	-	3.83E-07	-	3.67E-08	4.20E-07
Other γ emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Fe-55	Ci	-	-	-	-	-
Total Activity	Ci	-	1.75E-06	-	3.67E-08	1.79E-06
B. Tritium						
H-3	Ci	3.65E-03	1.36E-03	9.32E-04	1.25E-02	1.84E-02
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

6.0 REMODCM Changes

The description and the bases of the change(s) for REMODCM Revision 26-02 (effective March 15, 2011) 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.

DESCRIPTION OF CHANGES

1.1 In Section I.C.2, change Millstone Unit 1 waste stream 'reactor cavity water' to 'spent fuel water.'

1.2 Fig. I.C-3:
- Add "3" to end of title for Figure I.C-3.
- Change designation for Cesium Ion Exchanger in Figure I.C-3 from "CHS-DEMN1 A/B" to "BRS-DEMN1 A/B."

1.3 Table I.D-2 & I.D-3:
- Revise Footnote C to make sample applicable only to principle gamma emitters.
- In Footnote G delete the words "and there is fuel in the cavity."
- Revise Footnote K in Table I.D-2 and Footnote J in Table I.D-3 to make sampling and analyses applicable only for principle gamma emitters.

1.4 In Fig. 1.D-2, Change the following boxes to a broken line box format:
HEPA/Charcoal (L29A/B),
HEPA L25,
HEPA L27,
Waste gas compressor (F-1A/B), and
Decay tanks (T19A/B/C/D/E/F).
Also add a note at bottom that the components in the broken line boxes are those included in treatment equipment requirement.

1.5 Fig. 1.D-3:
- Change the boxes for Charcoal Beds (3GWS-AD1A/B) and HEPA (3GWS-FLT1A/B) to a broken line box format. Also add a note at bottom that the components in the broken line boxes are those included in treatment equipment requirement.
- Add rad monitor 3GWS-RE48 at output of gaseous waste system.
- Add footnote that only portion of ESF building vent is monitored.

1.6 In Table I.E-4, n first bullet in Footnote A change "uCi" to "pCi."

1.7 In Sections II.C & II.D, at the end of the first paragraph add the sentence "Method 2 may be used in lieu of Method 1."

1.8 In Sections II.C.6 & II.D.5, in the requirements for quarterly dose calculation for the Radioactive Effluent Release Report, allow methodology contained in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants."

1.9 In Section II.D.1.b(2), Change dose factor for Units 2&3 tritium vent releases from 4.2E-6 to 4.1E-6.

1.10 In Sections II.E.3 & II.E.8:

- In Step 1, change noble gas concentration from 5.7E-3 to 1.1E-2 uCi/ml and add "175 gpm discharge flow" to basis for this value.
- In Step 1, add requirement to adjust noble gas reduction factor when dilution flow is less than 100,000.
- In Step 2, allow credit for dilution flow from the other Unit as long as the other dilution flow is not being credited for a concurrent discharge from that Unit.
- In Step 2, change the minimum acceptable radiation monitor setpoint from 2.8E-5 to 5.6E-5 uCi/ml and the basis for this value (in Note 2) from 350 to 175 gpm discharge flow.

1.11 In Table V.C.1, change applicability for Steam Generator Blowdown Monitor from Modes 1-5 to Modes 1-4.

2.0 BASES FOR CHANGES

2.1 Section I.C-2: Requirement to sample and analyze water from Millstone Unit 1 reactor cavity and to report radioactivity released is being changed to apply to water from the spent fuel pool. All the cavity water has been discharged and water will no longer be added to the cavity. When the spent fuel is removed the water will need to be processed before discharge.

2.2 Figure I.C-3: Change is being made to correct a typographical error.

2.3 Tables I.D-2 & I.D-3:

- Footnote C is being revised to make samples, during power changes, of gaseous releases to the Units 2&3 vents and to the Millstone Stack applicable only to principle gamma emitters. During power changes the tritium concentration in reactor coolant remains constant. Therefore, only gamma emitters need to be analyzed during power changes.
- Footnote G is being revised to require weekly tritium analyses of gaseous samples of releases to the Units 2&3 vents and to the Millstone Stack when the reactor cavity is flooded regardless of whether or not there is fuel in the cavity. Water used to fill the cavity from the RWST contains tritium. Therefore tritium needs to be checked even when there is no fuel in the cavity.
- Footnote K in Table I.D-2 and Footnote J in Table I.D-3 are being revised to make sampling and analyses of gaseous releases to the Units 2&3 vents and to the Millstone Stack following increases in radiation monitor readings applicable only for principle gamma emitters. Experience has shown that tritium concentration in reactor coolant remains constant even with changes in gamma emitting radiation (i.e., noble gases).

2.4 Figure I.D-2: Figure is being revised to indicate gaseous processing equipment required per Section I.D.2 by a box with broken line format. These components are required to be operable when projected effluent doses exceed a specified amount. This practice is the same as in the liquid effluent diagrams of Figure I.C-2.

2.5 Figure I.D-3:

- Figure is being revised to indicate gaseous processing equipment required per Section I.D.2 by a box with broken line format. These components are required to be operable

when projected effluent doses exceed a specified amount. This practice is the same as in the liquid effluent diagrams of Figure I.C-3.

- Radiation monitor 3GWS-RE48 at output of gaseous waste system is being added to the figure. Although not an effluent monitor, this radiation monitor could be used to indicate releases of radioactivity from the gaseous waste system to the Millstone Stack.
- Another pathway and a footnote are being added to the figure to show that only a portion the release to the ESF building vent is monitored. This provides more detail to effluent releases from the ESF building which conforms to plant design.

2.6 Table I.E-4: Change is being made to correct a typographical error.

2.7 Sections II.C & II.D: Sections are being revised to allow the flexibility of bypassing the Method 1 dose methodology and to use the more exact Method 2 methodology. Method 1 is designed as a very conservative first estimate of dose.

2.8 Sections II.C.6 & II.D.5: Sections are being revised to allow methodology contained in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants" for quarterly dose calculations for the Radioactive Effluent Release Report. Millstone will be changing its dose calculation methodology using the vendor-supplied program "OpenEMS." Some of the methodology in this program uses guidance provided in NUREG-0133 which gives NRC approved methodology.

2.9 Section II.D.1.b(2): Change is being made to correct a typographical error.

2.10 Sections II.E.3 & II.E8:

- Sections are being revised to increase the allowable noble gas concentration and the radiation monitor setpoints by a factor of two. The concentration and the setpoint can be increased because the actual discharge flow rate cannot exceed 175 gpm which is a factor of two below the flow rate currently used to determine concentration limit and setpoint.
- Sections are being revised to adjust noble gas reduction factor when dilution flow is less than 100,000. This will allow discharges at times when dilution flow is limited. Discharges at very low dilution flow could be permitted as long as the discharge flow requirement in Step 2 and REMODCM limit on radioactivity concentrations in diluted discharged flow are met.
- Sections are being revised to allow credit for dilution flow from the other Unit as long as the other dilution flow is not being credited for a concurrent discharge from that Unit. Actual dilution occurs in the Millstone Quarry and the environmental limits apply at the Quarry cut discharge to Long Island Sound. Thus credit may be taken for dilution flow from the other Unit.

2.11 Table V.C-1: Table is being revised to change applicability for Steam Generator Blowdown Monitor from Modes 1-5 to Modes 1-4. During Mode 5 there is insufficient pressure in steam generators to generate blowdown. Therefore, the radiation monitor is not needed during Mode 5. This is consistent with the REMODCM requirements for the MPS2 S/G blowdown rad monitor.