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U.S. Nuclear Regulatory Commission
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Docket Nos.	50-245 50-336 50-423
License Nos.	DPR-21 DPR-65 NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 1, 2, AND 3
2015 RADIOACTIVE EFFLUENT RELEASE REPORT

In accordance with 10 CFR 50.36a, this letter transmits the annual Radioactive Effluent Release Report (RERR) for the period January 2015 through December 2015. This report meets the provisions of Section 5.7.3 of the Millstone Power Station Unit 1 Permanently Defueled Technical Specifications (PDTS), and Sections 6.9.1.6b and 6.9.1.4 of the Millstone Power Station Units 2 and 3 Technical Specifications, respectively.

Attachment 1 transmits Volume 1 of the 2015 RERR, in accordance with Regulatory Guide 1.21. The RERR contains information regarding airborne, liquid, and solid radioactivity released from Millstone Power Station, including the off-site dose from airborne and liquid effluents.

Attachment 2 transmits Volume 2 of the report, which consists of a complete copy of the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual (REMODCM) as of December 31, 2015. This satisfies the requirements of Sections 5.6.1c of the Millstone Power Station Unit 1 PDTS, and Sections 6.15c and 6.9.13c of the Millstone Power Station Units 2 and 3 Technical Specifications, respectively.

If you have any questions or require additional information, please contact Mr. Thomas G. Cleary at (860) 444-4377.

Sincerely,

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IE48
NRR

Attachments: 2

Commitments made in this letter:

1. None.

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NPF-49

ATTACHMENT 1

<u>2015 RADIOACTIVE EFFLUENTS RELEASE REPORT</u>
<u>VOLUME 1</u>

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

Millstone Power Station
2015
Radioactive Effluents Release Report

Dominion

Dominion Nuclear Connecticut, Inc.

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

Table of Contents

List of Tables

List of Acronyms

BOP – Balance of plant
CFR – Code of Federal Regulations
CPF – Condensate polishing facility
DOT – Department of Transportation
DSN – Discharge serial number
EBFS – Enclosure building filtration system
ESF – Engineering safeguards facility
GI - Gastrointestinal
GWPP – Groundwater protection program
HPGe – High purity germanium
ISFSI – Independent spent fuel storage installation
NPP – Nuclear power plant
NRC – Nuclear Regulatory Commission
RBCCW – Reactor building closed cooling water
REMODCM - Radiological Effluent Monitoring and Offsite Dose Calculation Manual
RWST – Reactor water storage tank
SFPI – Spent fuel pool island
SG – Steam generator
SGBD – Steam generator blowdown
SLCRS – Secondary Leakage Collection and Recovery System
SW – Service water
TB – Turbine building
WCT- Work Coordination Team
WGDT – Waste gas decay tank
WRGM – Wide range gas monitor
WTT – Waste test tank

Introduction

This report, for the period of January through December of 2015, is being submitted by Dominion Nuclear Connecticut, Inc. for Millstone Power Station Units 1, 2, and 3, in accordance with 10 CFR 50.36a, the Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM), and the Station's Technical Specifications. This report contains radiological and volumetric information on gaseous and liquid effluents, doses to the public from these effluents, shipments of solid waste & irradiated components, onsite well water results, information on effluent monitors inoperable for more than 30 consecutive days, operating history and corrections to previous reports.

Radioactive materials may be disposed of in solid waste shipments sent to licensed disposal sites or released in liquid or gas form in effluents to the local environment. The two basic characteristics used to describe radioactive effluents are activity and radiation dose. Activity is a term used to describe how often a substance emits radiation. The activity of any given radionuclide increases in direct proportion to the amount of the radionuclide present. This report lists the amounts of various radionuclides present in radioactive effluents. For this report, activity can be thought of as the amount of radioactive material present in radioactive effluents. Section 2.0 of this report gives the activity released from Millstone in 2015.

Although radionuclide activity is an important, inherent characteristic that helps to describe radioactive effluents, it is not—by itself—a good indicator of the potential health effects from exposure to radiation. Health effects are dependent on many factors, such as the radionuclide, the activity of the radionuclide, the type of radiation emitted by the radionuclide, the energy of the radiation, the uptake of the radionuclide into the human body, and the metabolism of the radionuclide by the human body. To properly describe the potential health effects from exposure to radioactive materials, a measure that accounts for all of these differences is needed. Dose is a measure of how much radiation energy is absorbed by organs or tissues of the body. Dose is a good indicator of the potential health effects from exposure to radiation. Section 1.0 of this report gives the dose from activity released from Millstone in 2015.

1.0 Off-Site Doses

This report provides a summary of the 2015 off-site radiation doses from releases of radioactive materials in gaseous and liquid effluents and from direct radiation from Units 1, 2 and 3. This includes the annual maximum dose in millirem (mrem) to any real member of the public as well the maximum gamma and beta air doses. To provide perspective, these doses are compared to the regulatory limits (in Table 1-3) and to the annual average dose that a member of the public could receive from natural background and other sources (in Table 1-4). The doses from radioactive effluents were much less than the doses from other sources of natural radiation that are commonly considered safe. This indicates radioactive effluents from Millstone in 2015 had no significant impact on the health and safety of the public or the environment.

1.1 Dose Calculations

Dose from radioactive effluents are calculated to ensure compliance with NRC requirements in 10 CFR Part 50, Appendix I (Ref. 7). The dose calculations are based on the measurements and computer models listed below:

- measurements of the radioactive materials released to the environment,
- models of how radionuclides are dispersed and diluted in the environment,
- models of how radionuclides are incorporated into animals, plants, and soil, and
- models of the biokinetic of human uptake and metabolism of radioactive materials.

The models are designed to calculate the dose to a real (or hypothetical) individual closest to Millstone or to an individual who may be exposed to the highest concentrations of radioactive materials from radioactive effluents. This person is often referred to as the maximum exposed individual. The parameters and assumptions used in these dose calculations include conservative assumptions that tend to overestimate the calculated exposures. 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. As a result, the actual doses received by real individuals are often much less than those calculated.

The off-site dose to humans from radioactive material in liquid and gaseous effluents have been calculated using measured radioactive effluent data and the dose computation algorithm in OpenEMS, an effluent tracking program (Ref. 9). For liquid dose OpenEMS uses equations which yield the same result as the methodology given in NRC Regulatory Guide 1.109 (Ref. 3). For airborne dose OpenEMS uses an algorithm equivalent to the NRC code, GASPAR II (Ref. 1), which uses a semi-infinite cloud model to implement the NRC Regulatory Guide 1.109 (Ref. 3) dose models. The values of average relative effluent concentration (X/Q) and average relative deposition (D/Q) used in OpenEMS were generated using EDAN, a meteorological computer code. The annual summary of hourly meteorological data (in 15-minute increments), which includes wind speed, direction, atmospheric stability, and joint frequency distribution, is not provided in the report but are available. Doses are based upon exposure to radioactivity in gaseous and liquid effluents over a one-year period and an associated dose commitment over a 50-year period from initial exposure. The portion of the doses due to inhalation and ingestion take into account radioactive decay and biological elimination of the radioactive materials.

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

1.1.1 Gaseous Effluents

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

The following release points are considered ground level:

- Unit 1 SFPI Vent (73 foot)
- Unit 1 BOP Vent (80 foot)
- Units 2 and 3 Containment Equipment Hatches
- Units 2 and 3 Reactor Water Storage Tank (RWST) Vents
- Unit 3 Engineered Safety Features Building (ESF) Ventilation
- Unit 3 Containment Drawdowns

Doses for releases from these points were calculated using the 33 foot meteorology.
Tritium (H-3) releases due to evaporation from the spent fuel pool water are released through the SFPI Vent. Continuous ventilation from other Unit 1 buildings is discharged to the BOP Vent. For each unit, doses from their respective release points were summed to determine the total unit gaseous effluent ground level dose.

The following release points are considered mixed mode (partially elevated and partially ground) releases:

- Unit 2 Auxiliary Building Ventilation (159 foot elevation)
- Unit 3 Auxiliary Building Ventilation (133 foot elevation)

Tritium (H-3) releases due to evaporation from the Units 2 and 3 spent fuel pool water are released through their respective vents. Containment purge releases are batch releases. At Unit 2 the purge is released to the Vent or to the Millstone Power Station Stack and at Unit 3 the purge is released to the stack. The doses for mixed mode releases are calculated using 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels.

The Millstone Power Station Stack release point at 374 foot elevation is considered an elevated release. The following are batch releases from the stack:

- Unit 2 Waste Gas Decay Tanks
- Unit 2 Containment Vents
- Unit 3 Containment Vents

At Unit 3, the Gaseous Waste System releases are continuous. The doses for elevated releases are calculated using the 374 foot meteorological parameters.

Based on Reference 11, it was conservatively assumed that 30% of the C-14 exists as carbon dioxide (CO_2) which may be deposited on surfaces. Thus only 30% of C-14 released yielded dose via ingestion pathways of milk, meat, produce and vegetation.

1.1.2 Liquid Effluents

Millstone Power Station discharges radioactivity in water through two release pathways – thru the Millstone Quarry to the Long Island Sound and thru Discharge Point DSN-006 to Niantic Bay. Discharges to the Millstone Quarry are from primary side water, primarily from liquid waste processing systems. Discharges to DSN-006 are from secondary side water, primarily turbine building sumps. Unit 1 discharges only to the Millstone Quarry from sumps and leakage collection systems. Discharges to both release pathways are considered either continuous or batch discharges. Sources of continuous and batch discharges are listed in Sections 2.2.1.1 and 2.2.1.2. Water containing radioactivity being discharged to the Millstone Quarry is diluted mainly by circulating water and, to a minor extent, by service water. Water containing radioactivity being discharged to DSN-006 is diluted by storm drains runoff.

1.2 Dose Results

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

1.2.1 Gaseous Effluents

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

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

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

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

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

1.2.2 Liquid Effluents

Maximum individual doses from the release of radioactive liquid effluents were calculated using OpenEMS which gives dose results equal to dose results calculated using NRC Regulatory Guide 1.109. OpenEMS performs calculations for the following pathways: fish, shellfish, shoreline activity, swimming, and boating. Doses are calculated for the whole body, skin, thyroid, and maximum organ (GI, bone, liver, kidney, and lung).

1.2.3 Analysis of Results

Table 1-3 provides a quantitative dose comparison with the limits specified in the REMODCM. Gaseous and liquid effluent doses are compared to limits required by technical specifications and contained in Appendix I of 10 CFR 50. Total offsite doses are compared to limits in 40 CFR 190 (Reference 8). 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. On-site radioactive waste and spent fuel storage during this year was within storage criteria and the maximum dose to a member of the public from these sources was approximately 0.15 mrem. The doses from gaseous and liquid effluents were added to the estimated dose from on-site radioactive waste storage to show compliance compared to 40 CFR 190.

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

Table 1-1
2015 Off-Site Dose Commitments from Gaseous Effluents
Millstone Units 1, 2, 3

Unit 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	3.44E-06	1.18E-05	7.83E-05	3.72E-05	1.31E-04
Skin	3.44E-06	1.18E-05	3.81E-05	3.72E-05	9.05E-05
Thyroid	3.44E-06	1.18E-05	7.83E-05	3.72E-05	1.31E-04
Max organ [2]	3.44E-06	1.18E-05	7.83E-05	3.72E-05	1.31E-04

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.61E-05	1.30E-3 [1]	1.05E-07	1.05E-07	1.32E-03
Gamma	3.95E-05	1.16E-5 [1]	2.50E-07	2.50E-07	5.16E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	1.24E-03	2.58E-02	1.73E-02	2.18E-03	4.65E-02
Skin	1.34E-04	1.75E-03	7.84E-04	8.91E-04	3.56E-03
Thyroid	1.27E-03	2.68E-02	1.78E-02	2.19E-03	4.81E-02
Max organ [2]	6.05E-03	1.50E-01	9.80E-02	7.56E-03	2.62E-01

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.11E-06	7.14E-05	4.36E-07	5.59E-07	7.35E-05
Gamma	1.43E-07	1.88E-05	2.07E-07	7.75E-08	1.92E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	2.04E-03	1.48E-02	1.38E-02	2.58E-03	3.32E-02
Skin	1.22E-03	1.95E-04	4.91E-04	7.90E-04	2.70E-03
Thyroid	2.04E-03	1.48E-02	1.38E-02	2.58E-03	3.32E-02
Max organ [2]	5.10E-03	9.09E-02	8.00E-02	1.07E-02	1.87E-01

NOTES:

1 - Air Beta and Air Gamma doses in 2nd quarter include dose from Kr-85 released during fuel loading (details i Section 2.1.4).

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

Table 1-2
2015 Off-Site Dose Commitments from Liquid Effluents
Millstone Units 1, 2, 3

Unit 1	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	0.00E+00	3.45E-05	0.00E+00	0.00E+00	3.45E-05
Thyroid	0.00E+00	1.00E-05	0.00E+00	0.00E+00	1.00E-05
Max Organ	0.00E+00	4.90E-05	0.00E+00	0.00E+00	4.90E-05

Unit 2	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	1.98E-05	8.69E-05	8.67E-05	5.79E-05	2.51E-04
Thyroid	2.32E-05	1.13E-04	8.51E-05	1.87E-05	2.40E-04
Max Organ	5.29E-04	3.44E-04	7.52E-04	1.75E-03	3.38E-03

Unit 3	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	3.88E-04	1.06E-04	1.14E-04	1.40E-04	7.48E-04
Thyroid	2.55E-04	6.47E-05	6.09E-05	1.17E-04	4.98E-04
Max Organ	6.44E-04	3.33E-04	3.63E-04	1.92E-04	1.53E-03

Table 1-3
2015 Off-Site Dose Comparison to Limits
Millstone Units 1, 2, 3

Gaseous Effluents Dose

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	1.31E-04	1.31E-04	1.31E-04	9.05E-05	0.00E+00	0.00E+00
Unit 2	4.65E-02	4.81E-02	2.62E-01	3.56E-03	1.32E-03	5.16E-05
Unit 3	3.32E-02	3.32E-02	1.87E-01	2.70E-03	7.35E-05	1.92E-05
Millstone Station	**7.99E-02**	**8.14E-02**	**4.48E-01**	**6.35E-03**	**1.39E-03**	**7.08E-05**
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Liquid Effluents Dose

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)
Unit 1	3.45E-05	1.00E-05	4.90E-05
Unit 2	2.51E-04	2.40E-04	3.38E-03
Unit 3	7.48E-04	4.98E-04	1.53E-03
Millstone Station	**1.03E-03**	**7.48E-04**	**4.96E-03**
Limits	*3*	*10*	*10*

Total Off-Site Dose from Millstone Station

	Whole Body (mrem)	Thyroid (mrem)	Max Organ * (mrem)
Gaseous	7.99E-02	8.14E-02	4.48E-01
Liquid	1.03E-03	7.48E-04	4.96E-03
Direct Shine**	1.50E-01	1.50E-01	1.50E-01
Millstone Station	**2.31E-01**	**2.32E-01**	**6.03E-01**
Limits	*25*	*75*	*25*

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

** Direct shine is radiation exposure from onsite storage of radwaste and spent fuel.

Table 1-4
2015 Offsite Dose Comparison
Natural Background vs Millstone Station

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

Courtesy UNSCEAR Report 2000

Maximum Off-Site Individual	**Millstone Station Whole Body Dose**	
Gaseous Effluents	0.080	mrem
Liquid Effluents	0.001	mrem
Direct Shine	0.150	mrem
	0.231	mrem

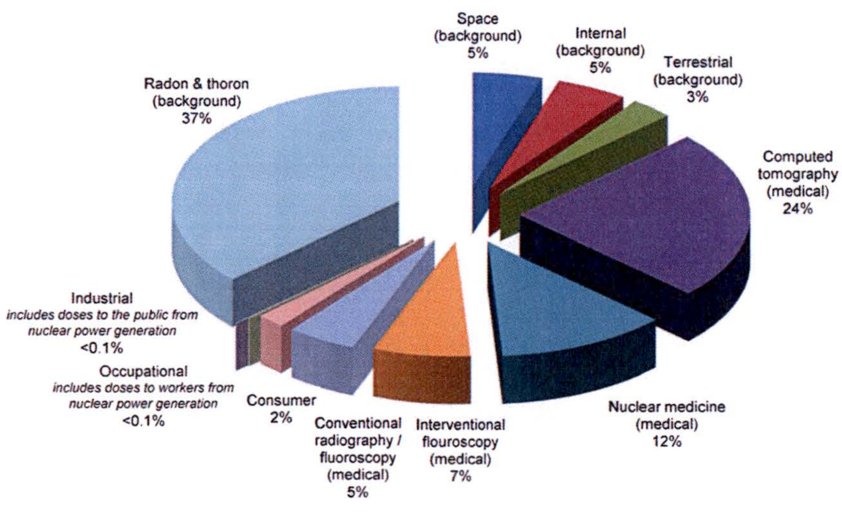
1.3 Other Sources of Radiation Dose to the Public (from Ref. 12)

This section discusses the doses that the average American typically receives each year from naturally occurring background radiation and all other sources of radiation. The reader can compare the doses received from Millstone effluents with the doses received from natural, medical, and other sources of radiation. This comparison provides some context to the concept of radiation dose effects. In March 2009, the National Council on Radiation Protection and Measurements (NCRP) published Report No. 160 as an update to the 1987 NCRP Report No. 93, Ionizing Radiation Exposure of the Population of the United States. Report No. 160 describes the doses to the U.S. population from all sources of ionizing radiation for 2006, the most recent data available at the time the NCRP report was written. The NCRP report also includes information on the variability of those doses from one individual to another. The NCRP estimated that the average person in the United States receives about 620 mrem of radiation dose each year. NCRP Report No. 160 describes each of the sources of radiation that contribute to this dose, including:

- Naturally occurring sources (natural background) such as cosmic radiation from space, terrestrial radiation from radioactive materials in the earth, and naturally occurring radioactive materials in the food people eat and in the air people breathe;
- medical sources from diagnosis and treatment of health disorders using radioactive pharmaceuticals and radiation-producing equipment;
- consumer products (such as household smoke detectors);
- industrial processes, security devices, educational tools, and research activities; and
- exposures of workers that result from their occupations.

Below is a pie chart showing the relative contributions of these sources of radiation to the dose received by the average American. Larger contributors to dose are represented by proportionally larger slices of the pie. Doses to the public from nuclear power plants are included in the industrial category; doses to workers from nuclear power generation are included in the category of occupational dose. Doses to the public due to effluents from nuclear power plants are less than 0.1% (one-tenth of one percent) of what the average person receives each year from all sources of radiation. Doses to workers from occupational exposures, including those received from work at NPPs, also are less than 0.1% of the average dose to a member of the public from all sources.

Sources of Radiation Exposure to the U.S. Population



2.0 Effluent Radioactivity

2.1 Gaseous Effluents

2.1.1 Measurement of Gaseous Radioactivity

2.1.1.1 Continuous Releases

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

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

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

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

When water is transferred to the RWST there is a potential for a release of radioactivity through the tank vent. Releases of particulates and H-3 from the Units 2 and 3 RWSTs were estimated using factors for release from water to air. For H-3 the release factor is based on the ratio of mass of water vapor to mass of dry air and adjusted for difference between water and air densities. For particulates the release factor is based on an assumed partitioning factor of 10,000.

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

C-14 has always been released from the plant but, previous to 2010, was not reported because it was not a significant release relative to other radioactive releases. This nuclide is not monitored because it is too difficult to measure and analyze. Because the overall quantity of other radioactive releases has steadily decreased due to improvements in power plant operations, C-14 now qualifies as a principle radionuclide. The amount of C-14 released is calculated using the guidance given in Regulatory Guide 1.21 (Reference 10) and the methodology of Reference 2. According to the regulatory guidance, releases of C-14 are reported in gaseous effluents but not in liquid effluents and the amount released is calculated based on a normalized source term. The calculation is for an annual source term which is then divided evenly between quarters in the year except that Unit 2 C-14 release was reduced in the fourth quarter because of its outage. For each Unit, it is assumed that half of the C-14 is released from the Millstone Stack and half from each unit's main ventilation vent.

2.1.1.2 Batch Releases

The following pathways have releases that are considered batches:

- Unit 2 Waste Gas Decay Tanks (WGDT) (via Unit 2 WRGM to Millstone Power Station Stack)
- Unit 2 and Unit 3 Containment Purges (via Unit Ventilation Vents, except for Unit 2 if using Enclosure Building Filtration System (EBFS) via WRGM to Millstone Power Station)
- Unit 2 and Unit 3 Containment Vents (via EBFS to Millstone Power Station Stack for Unit 2 and via SLCRS to Millstone Power Station Stack for Unit 3)
- Unit 3 Containment Drawdown (ground level release at containment)

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

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

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

Unit 3 containment is initially drawn down prior to startup. This is accomplished by using the containment vacuum steam jet ejector which releases through an unmonitored vent on the roof of the Auxiliary Building. Grab samples are performed prior to drawdown to document the amount of radioactivity released during these evolutions. During 2015 there were no drawdowns.

2.1.2 Estimate of Errors

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

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

*National Institute of Standards and Technology

2.1.3 Gaseous Batch Release Statistics

Unit 1 – None

Unit 2	Containment (Ctmt) Purges	Ctmt Vents	WGDT
Number of Batches	1	45	4
Total Time (min)	120	6126	1416
Maximum Time (min)	120	203	495
Average Time (min)	120	136	354
Minimum Time (min)	120	48	173

Unit 3	Ctmt Vents
Number of Batches	223
Total Time (min)	45759
Maximum Time (min)	335
Average Time (min)	205
Minimum Time (min)	48

2.1.4 Abnormal Gaseous Releases

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

2.1.4.1 Unit 1 – None

2.1.4.2 Unit 2 – There was one abnormal gaseous release from Unit 2.

On May 12 and 13 2015, an unplanned and uncontrolled release of Kr-85 occurred during loading of spent fuel into canisters at Millstone Unit 2. The loading of fuel into canisters was in preparation for transfer of the spent fuel to the Independent Spent Fuel Storage Installation (ISFSI). One of the fuel bundles being loading had a defect which allowed Kr-85 to escape into the spent fuel area of the Unit 2 auxiliary building where the operation was being conducted. There were two releases – one from 2332 on May 12 to 0009 on May 13 and one from 0305 to 0405 on May 13. After the second release the canister loading was suspended. Revisions to operating procedures were made before recommencing the operation on May 20, 2015. At that time there was additional release of Kr-85 but as a planned and controlled release. The total unplanned and uncontrolled release of Kr-85 was 0.38 curies out of the Unit 2 Ventilation Vent. There was an additional planned and controlled release of 1.41 curies of Kr-85. These releases are reported in Table 2.2-A7. Dose from these releases are part of the Air Beta and Air Gamma doses for the second quarter for Unit 2 as shown in Table 1-1.

2.1.4.3 Unit 3 - None

2.1.5 Gaseous Release Tables

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

Table 2.1-A1

Millstone Unit 1

Gaseous Effluents - Release Summary

	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
B. Iodines / Halogens						
1. Total Activity Released	Ci	na	na	na	na	na
2. Average Period Release Rate	uCi/sec	na	na	na	na	na
C. Particulates						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.64E-02	1.55E-02	8.68E-02	1.82E-01	3.01E-01
2. Average Period Release Rate	uCi/sec	2.11E-03	1.97E-03	1.09E-02	2.29E-02	9.54E-03

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

Table 2.1-A2

Millstone Unit 1

Gaseous Effluents - Ground Continuous - BOP Vent & SFPI Vent

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
I-131	Ci	na	na	na	na	na
I-133	Ci	na	na	na	na	na
Other γ Emitters	Ci	na	na	na	na	na
Total Activity	Ci	na	na	na	na	na
C. Particulates						
Cs-137	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.64E-02	1.55E-02	8.68E-02	1.82E-01	3.01E-01

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

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

	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	9.33E-02	1.84E+00	5.02E-02	3.47E-01	2.33E+00
2. Average Period Release Rate	uCi/sec	1.20E-02	2.34E-01	6.32E-03	4.36E-02	7.38E-02
B. Iodines / Halogens						
1. Total Activity Released	Ci	3.35E-05	5.71E-05	3.29E-05	1.67E-05	1.40E-04
2. Average Period Release Rate	uCi/sec	4.30E-06	7.26E-06	4.13E-06	2.10E-06	4.44E-06
C. Particulates						
1. Total Activity Released	Ci	-	-	-	1.63E-04	1.63E-04
2. Average Period Release Rate	uCi/sec	-	-	-	2.05E-05	5.16E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.17E+00	3.36E+00	4.80E+00	5.93E+00	1.53E+01
2. Average Period Release Rate	uCi/sec	1.51E-01	4.27E-01	6.03E-01	7.47E-01	4.84E-01
F. C-14						
1. Total Activity Released**	Ci	2.51E+00	2.51E+00	2.51E+00	1.46E+00	9.00E+00
2. Average Period Release Rate	uCi/sec	3.23E-01	3.20E-01	3.16E-01	1.83E-01	2.85E-01

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

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

Table 2.2-A2
Millstone Unit 2
Gaseous Effluents - Ground Level Release - Batch Mode
Release Point - No releases

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Total Activity	Ci	*	*	*	*	*
B. Iodines / Halogens						
Total Activity	Ci	*	*	*	*	*
C. Particulates						
Total Activity	Ci	*	*	*	*	*
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	*	*
E. Tritium						
H-3	Ci	*	*	*	*	*

* No activity released

Table 2.2-A3

Millstone Unit 2

Gaseous Effluents - Ground Level Release - Continuous Mode
Release Point - Reactor Water Storage Tank Vent, Equipment Hatch

Nuclides Released	Units	2015				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Gases

Xe-133	Ci	*	*	*	1.97E-01	1.97E-01
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	1.97E-01	1.97E-01

B. Iodines / Halogens

I-131	Ci	*	*	*	2.49E-07	2.49E-07
I-133	Ci	*	*	*	2.25E-06	2.25E-06
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	2.50E-06	2.50E-06

C. Particulates

Cr-51	Ci	*	*	*	2.90E-05	2.90E-05
Mn-54	Ci	*	*	*	2.06E-06	2.06E-06
Co-57	Ci	*	*	*	1.83E-07	1.83E-07
Co-58	Ci	*	*	*	1.10E-04	1.10E-04
Fe-59	Ci	*	*	*	2.15E-07	2.15E-07
Co-60	Ci	*	*	*	7.46E-06	7.46E-06
Zn-65	Ci	*	*	*	3.57E-09	3.57E-09
Nb-95	Ci	*	*	*	3.37E-06	3.37E-06
Zr-95	Ci	*	*	*	5.22E-08	5.22E-08
Ru-103	Ci	*	*	*	5.35E-09	5.35E-09
Ag-110m	Ci	*	*	*	3.92E-06	3.92E-06
Sn-113	Ci	*	*	*	2.46E-07	2.46E-07
Sn-117m	Ci	*	*	*	1.19E-07	1.19E-07
Sb-124	Ci	*	*	*	2.20E-06	2.20E-06
Sb-125	Ci	*	*	*	3.36E-06	3.36E-06
Sb-126	Ci	*	*	*	1.66E-07	1.66E-07
Cs-137	Ci	*	*	*	3.95E-07	3.95E-07
Ce-141	Ci	*	*	*	5.75E-09	5.75E-09
Ce-144	Ci	*	*	*	1.32E-08	1.32E-08
Hf-181	Ci	*	*	*	8.05E-09	8.05E-09
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	1.63E-04	1.63E-04

D. Gross Alpha

Gross Alpha	Ci	na	na	na	na	na

E. Tritium

H-3	Ci	2.44E-04	2.35E-04	5.75E-05	3.26E-02	3.31E-02

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

"na" denotes Not Required to be Analyzed

* No activity released

Table 2.2-A4

Millstone Unit 2

Gaseous Effluents - Elevated Release - Batch Mode

Release Point - Millstone Site Stack

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	2.51E-02	2.67E-02	2.97E-02	2.15E-02	1.03E-01
Kr-85	Ci	5.89E-03	1.48E-03	-	2.12E-02	2.86E-02
Xe-133	Ci	2.14E-02	1.93E-02	1.99E-02	9.05E-03	6.97E-02
Xe-135	Ci	4.97E-04	6.34E-04	5.98E-04	3.07E-04	2.04E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	5.29E-02	4.81E-02	5.02E-02	5.21E-02	2.03E-01
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	2.28E-01	1.95E-01	2.77E-01	2.05E-02	7.21E-01

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

"na" denotes not required to be analyzed

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

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
Br-82	Ci	-	-	-	5.96E-07	5.96E-07
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	5.96E-07	5.96E-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	-	-	8.38E-03	4.62E-02	5.46E-02
F. C-14						
C-14	Ci	1.26E+00	1.26E+00	1.26E+00	7.29E-01	4.50E+00

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

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

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	*	*	*	1.95E-02	1.95E-02
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	1.95E-02	1.95E-02
B. Iodines / Halogens						
Br-82	Ci	*	*	*	8.44E-06	8.44E-06
I-131	Ci	*	*	*	-	-
I-133	Ci	*	*	*	-	-
Other γ Emitters	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	8.44E-06	8.44E-06
C. Particulates						
γ Emitters	Ci	*	*	*	-	-
Sr-89	Ci	*	*	*	-	-
Sr-90	Ci	*	*	*	-	-
Total Activity	Ci	*	*	*	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	*	*	*	2.14E-01	2.14E-01

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

Table 2.2-A7

Millstone Unit 2

Gaseous Effluents - Mixed Mode Release - Continuous Mode

Release Point - Unit 2 Ventilation Vent

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	3.03E-02	-	-	-	3.03E-02
Kr-83m	Ci	-	-	-	7.82E-03	7.82E-03
Kr-85	Ci	-	1.79E+00	-	7.53E-04	1.79E+00
Kr-85m	Ci	-	-	-	1.83E-02	1.83E-02
Kr-88	Ci	-	-	-	4.73E-02	4.73E-02
Xe-131m	Ci	-	-	-	2.40E-04	2.40E-04
Xe-133	Ci	2.62E-03	-	-	3.31E-03	5.93E-03
Xe-133m	Ci	-	-	-	1.27E-04	1.27E-04
Xe-135	Ci	7.52E-03	-	-	4.42E-04	7.96E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	4.04E-02	1.79E+00	-	7.83E-02	1.91E+00
B. Iodines / Halogens						
I-131	Ci	6.96E-06	1.41E-05	9.83E-06	1.41E-06	3.23E-05
I-133	Ci	2.65E-05	4.30E-05	1.81E-05	3.73E-06	9.13E-05
Br-82	Ci	-	-	4.93E-06	-	4.93E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	3.35E-05	5.71E-05	3.29E-05	5.14E-06	1.29E-04
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	9.43E-01	3.16E+00	4.51E+00	5.63E+00	1.42E+01
F. C-14						
C-14	Ci	1.26E+00	1.26E+00	1.26E+00	7.29E-01	4.50E+00

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

Table 2.3-A1

Millstone Unit 3

Gaseous Effluents - Release Summary

	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	2.48E-01	1.48E-01	2.34E-01	2.92E-01	9.23E-01
2. Average Period Release Rate	uCi/sec	3.20E-02	1.89E-02	2.94E-02	3.68E-02	2.93E-02
B. Iodines / Halogens						
1. Total Activity Released	Ci	9.79E-06	2.92E-06	2.39E-06	4.03E-06	1.91E-05
2. Average Period Release Rate	uCi/sec	1.26E-06	3.71E-07	3.01E-07	5.07E-07	6.07E-07
C. Particulates						
1. Total Activity Released	Ci	-	6.97E-08	-	-	6.97E-08
2. Average Period Release Rate	uCi/sec	-	8.86E-09	-	-	2.21E-09
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.94E+01	1.03E+01	4.81E+00	1.04E+01	4.49E+01
2. Average Period Release Rate	uCi/sec	2.50E+00	1.31E+00	6.05E-01	1.31E+00	1.42E+00
F. C-14						
1. Total Activity Released**	Ci	3.13E+00	3.13E+00	3.13E+00	3.13E+00	1.25E+01
2. Average Period Release Rate	uCi/sec	4.02E-01	3.97E-01	3.93E-01	3.93E-01	3.96E-01

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

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

Table 2.3-A2
Millstone Unit 3
Gaseous Effluents - Ground Level Release - Batch Mode
Release Point -ESF Building Rooftop

Nuclides Released	Units	2015 1st Qtr	2015 2nd Qtr	2015 3rd Qtr	2015 4th Qtr	2015 Total
A. Fission & Activation Gases						
Total Activity	Ci	*	*	*	*	*
B. Iodines / Halogens						
Total Activity	Ci	*	*	*	*	*
C. Particulates						
Total Activity	Ci	*	*	*	*	*
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	*	*
E. Tritium						
H-3	Ci	*	*	*	*	*

* No activity released

Table 2.3-A3

Millstone Unit 3

Gaseous Effluents - Ground Level Release - Continuous Mode

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

Nuclides Released	Units	2015 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-60	Ci	-	6.97E-08	-	-	6.97E-08
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	6.97E-08	-	-	6.97E-08
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	8.31E-05	1.75E-04	2.67E-04	2.09E-04	7.34E-04

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

"na" denotes not required to be analyzed

* No activity released from equipment hatch.

** Only H-3 released from RWST Vent.

Table 2.3-A4
Millstone Unit 3
Gaseous Effluents - Elevated Release - Batch Mode
Release Point - Millstone Site Stack

Nuclides Released	Units	2015				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	6.38E-03	8.05E-03	9.79E-03	8.08E-03	3.23E-02
Xe-133	Ci	6.87E-05	9.48E-05	4.26E-03	1.09E-03	5.51E-03
Xe-135	Ci	6.83E-06	-	3.76E-05	-	4.44E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	6.46E-03	8.14E-03	1.41E-02	9.17E-03	3.79E-02
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.99E-02	3.23E-02	4.99E-02	2.78E-02	1.30E-01

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

Table 2.3-A5
Millstone Unit 3
Gaseous Effluents - Elevated Release - Continuous Mode
Release Point - Millstone Site Stack

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	3.70E-05	8.09E-03	-	8.13E-03
Kr-85	Ci	2.42E-01	1.40E-01	2.00E-01	2.83E-01	8.65E-01
Kr-85m	Ci	-	1.60E-05	4.38E-04	-	4.54E-04
Kr-87	Ci	-	5.10E-05	1.36E-03	-	1.41E-03
Kr-88	Ci	-	6.20E-05	1.35E-03	-	1.41E-03
Xe-133	Ci	-	-	2.56E-03	-	2.56E-03
Xe-135m	Ci	-	3.20E-05	7.03E-04	-	7.35E-04
Xe-135	Ci	-	7.40E-05	2.11E-03	-	2.18E-03
Xe-138	Ci	-	2.10E-05	3.05E-03	-	3.07E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.42E-01	1.40E-01	2.20E-01	2.83E-01	8.85E-01
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Br-82	Ci	1.45E-06	2.92E-06	2.39E-06	4.03E-06	1.08E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.45E-06	2.92E-06	2.39E-06	4.03E-06	1.08E-05
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	4.90E-01	6.41E-01	3.60E-01	7.55E-01	2.25E+00
F. C-14						
C-14	Ci	1.56E+00	1.56E+00	1.56E+00	1.56E+00	6.25E+00

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

Table 2.3-A6

Millstone Unit 3

Gaseous Effluents - Mixed Mode Release - Batch Mode

Release Point - Unit 3 Ventilation Vent

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*
B. Iodines / Halogens						
I-131	Ci	*	*	*	*	*
I-133	Ci	*	*	*	*	*
Other γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*
C. Particulates						
γ Emitters	Ci	*	*	*	*	*
Total Activity	Ci	*	*	*	*	*
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	*	*
E. Tritium						
H-3	Ci	*	*	*	*	*

* No activity released

Table 2.3-A7

Millstone Unit 3

Gaseous Effluents - Mixed Mode Release - Continuous Mode

Release Point - Unit 3 Ventilation Vent

Nuclides Released	Units	2015				
		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	-	-	-	-	-
Br-82	Ci	8.34E-06	-	-		8.34E-06
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	8.34E-06	-	-	-	8.34E-06
C. Particulates						
γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.89E+01	9.61E+00	4.40E+00	9.65E+00	4.26E+01
F. C-14						
C-14	Ci	1.56E+00	1.56E+00	1.56E+00	1.56E+00	6.25E+00

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

2.2 Liquid Effluents

2.2.1 Measurement of Liquid Radioactivity

2.2.1.1 Continuous Liquid Releases

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

2.2.1.2 Batch Liquid Releases from Tanks and Sumps

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

Unit 1 Radwaste Processing System – Includes sources from:
1. Reactor Building Sumps
2. Underground Ventilation Duct
3. Site Stack Sump

Unit 2 Radwaste Processing System:
1. Clean Waste Monitor Tanks (2)
2. Aerated Waste Monitor Tanks

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

Unit 3 Radwaste Processing
1. Waste Test Tanks (2)
2. Low Level Waste Test Tanks (2)
3. Boron Test Tanks (2)

Other Radwaste Sources:
1. CPF Waste Neutralization Sump
2. Steam Generator Bulk
3. Boron and Waste Test Tanks Berm (via DSN006)
4. Systems' Bulk Discharges (via DSN006)

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

2.2.2 Estimate of Errors

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

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

* National Institute of Standards and Technology

2.2.3 Liquid Batch Release Statistics

	Unit 1	Unit 2	Unit 3
Radwaste Processing System: Number of Batches	3	43	59
Total Time (min)	130	6,160	7,590
Maximum Time (min)	44	532	1,410
Average Time (min)	43	143	129
Minimum Time (min)	42	20	37

	Unit 1	Unit 2	Unit 3
Other Radwaste Sources: Number of Batches	NA	68	325
Total Time (min)	NA	239,000	1,170,000
Maximum Time (min)	NA	14,800	20,400
Average Time (min)	NA	3,514	3,600
Minimum Time (min)	NA	10	8

2.2.4 Abnormal Liquid Releases

An abnormal release of radioactivity is the discharge of a volume of liquid radioactive material to the environment that was unplanned or uncontrolled. In 2015, the following abnormal liquid releases occurred:

2.2.4.1 Unit 1 – None

2.2.4.2 Unit 2 – None

2.2.4.3 Unit 3 - None

2.2.5 Liquid Release Tables

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

Table 2.1-L1
Millstone Unit 1

Liquid Effluents - Release Summary

	Units	2015				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	*	1.80E-03	*	*	1.80E-03
2. Average Period Diluted Activity+	uCi/ml	*	7.59E-12	*	*	7.59E-12
B. Tritium						
1. Total Activity Released	Ci	*	3.77E-02	*	*	3.77E-02
2. Average Period Diluted Activity+	uCi/ml	*	1.59E-10	*	*	1.59E-10
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	*	2.66E+04	*	*	2.66E+04
2. Dilution Volume During Releases	Liters	*	9.93E+09	*	*	9.93E+09
3. Dilution Volume During Period++	Liters	*	2.37E+11	*	*	2.37E+11

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

Table 2.1-L2
Millstone Unit 1

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

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Cs-137	Ci	*	1.80E-03	*	*	1.80E-03
Other γ Emitters	Ci	*	-	*	*	-
Sr-90	Ci	*	-	*	*	-
Fe-55	Ci	*	-	*	*	-
Total Activity	Ci	*	1.80E-03	*	*	1.80E-03
B. Tritium						
H-3	Ci	*	3.77E-02	*	*	3.77E-02
C. Dissolved & Entrained Gases						
Kr-85	Ci	*	-	*	*	-
Other γ Emitters	Ci	*	-	*	*	-
Total Activity	Ci	*	-	*	*	-
D. Gross Alpha						
Gross Alpha	Ci	*	-	*	*	-

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

Table 2.2-L1

Millstone Unit No. 2
Liquid Effluents - Release Summary

	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	1.37E-03	8.06E-04	1.11E-03	1.23E-02	1.55E-02
2. Average Period Diluted Activity *	uCi/ml	5.05E-12	3.40E-12	3.86E-12	5.98E-11	1.55E-11
B. Tritium						
1. Total Activity Released	Ci	3.48E+01	2.11E+02	2.57E+02	2.77E+01	5.31E+02
2. Average Period Diluted Activity *	uCi/ml	1.28E-07	8.90E-07	8.99E-07	1.35E-07	5.31E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	1.69E-04	2.79E-04	1.58E-03	0.00E+00	2.03E-03
2. Average Period Diluted Activity *	uCi/ml	6.24E-13	1.18E-12	5.52E-12	0.00E+00	2.03E-12
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.54E+05	3.17E+05	5.54E+05	3.69E+05	1.39E+06
Secondary	Liters	2.37E+06	1.02E+06	5.39E+04	1.55E+06	4.99E+06
2. Dilution Volume During Releases						
Primary	Liters	7.66E+09	5.49E+09	9.67E+09	6.31E+09	2.91E+10
Secondary	Liters	1.36E+10	9.37E+10	1.15E+09	4.96E+10	1.58E+11
3. Dilution Volume During Period	Liters	2.71E+11	2.37E+11	2.86E+11	2.05E+11	9.99E+11

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

Table 2.2-L2

Millstone Unit 2
Liquid Effluents - Continuous

1. Release to Quarry: Steam Generator Blowdown, Service Water and Reactor Building Closed Cooling Water
2. Release to DSN006: Turbine Building Sumps and Tendon Gallery

Nuclides Released	Units	2015				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
γ Emitters	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Ni-63	Ci	5.23E-04	-	-	-	5.23E-04
Total Activity	Ci	5.23E-04	-	-	-	5.23E-04
B. Tritium						
H-3	Ci	1.60E-02	4.13E-03	2.44E-04	6.74E-03	2.71E-02
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.2-L3

Millstone Unit 2
Liquid Effluents - Batch

Release to Quarry: Liquid Radwaste Processing System

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Be-7	Ci	4.65E-05	6.36E-05	-	-	1.10E-04
Cr-51	Ci	-	-	-	3.55E-04	3.55E-04
Mn-54	Ci	1.57E-06	1.64E-06	-	3.84E-05	4.16E-05
Co-58	Ci	1.05E-05	2.20E-05	-	1.16E-03	1.19E-03
Co-60	Ci	1.08E-04	1.29E-04	1.19E-04	3.58E-04	7.14E-04
Zr-95	Ci	-	-	-	4.00E-05	4.00E-05
Nb-95	Ci	-	-	-	8.36E-05	8.36E-05
Nb-97	Ci	-	1.08E-05	1.86E-05	-	2.94E-05
Ag-110m	Ci	1.52E-04	4.56E-05	2.11E-04	4.57E-04	8.66E-04
Sb-124	Ci	-	-	-	8.01E-04	8.01E-04
Sb-125	Ci	1.17E-04	1.22E-05	7.15E-04	5.65E-03	6.49E-03
I-131	Ci	6.13E-05	1.61E-04	-	-	2.22E-04
I-134	Ci	-	3.59E-06	3.35E-05	-	3.71E-05
Cs-134	Ci	3.13E-08	-	-	-	3.13E-08
Cs-136	Ci	-	1.34E-06	-	-	1.34E-06
Cs-137	Ci	8.96E-05	4.77E-05	8.15E-06	2.97E-05	1.75E-04
La-140	Ci	-	-	-	2.55E-05	2.55E-05
Other γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	-	6.35E-05	-	2.85E-03	2.91E-03
Ni-63	Ci	2.58E-04	2.44E-04	-	3.82E-04	8.84E-04
Sr-89	Ci	-	-	-	2.21E-05	2.21E-05
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	8.45E-04	8.06E-04	1.11E-03	1.23E-02	1.50E-02
B. Tritium						
H-3	Ci	3.48E+01	2.11E+02	2.57E+02	2.77E+01	5.31E+02
C. Dissolved & Entrained Gases						
Xe-133	Ci	1.69E-04	2.79E-04	1.58E-03	-	2.03E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	1.69E-04	2.79E-04	1.58E-03	-	2.03E-03
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L1
Millstone Unit 3

Liquid Effluents - Release Summary

	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	1.88E-02	9.45E-03	9.58E-03	4.45E-03	4.23E-02
2. Average Period Diluted Activity *	uCi/ml	4.48E-11	2.47E-11	2.02E-11	9.66E-12	2.43E-11
B. Tritium						
1. Total Activity Released	Ci	1.55E+02	7.20E+01	1.14E+02	2.00E+02	5.42E+02
2. Average Period Diluted Activity *	uCi/ml	3.69E-07	1.88E-07	2.42E-07	4.35E-07	3.12E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.11E+06	1.00E+06	8.76E+05	5.44E+05	3.53E+06
Secondary	Liters	2.49E+07	1.04E+08	2.87E+07	2.62E+07	1.84E+08
2. Dilution Volume During Releases						
Primary	Liters	9.93E+09	7.49E+09	9.06E+09	3.98E+09	3.05E+10
Secondary	Liters	7.50E+11	3.89E+11	1.56E+11	1.25E+11	1.42E+12
3. Dilution Volume During Period	Liters	4.21E+11	3.83E+11	4.74E+11	4.61E+11	1.74E+12

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

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

Table 2.3-L2

Millstone Unit 3
Liquid Effluents - Continuous

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

Nuclides Released	Units	2015 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	1.88E-01	3.79E-01	4.83E-01	3.74E-01	1.42E+00
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L3

Millstone Unit 3
Liquid Effluents - Batch

**1. Release to Quarry: Liquid Radwaste Processing System,
CPF Waste Neutralization Sumps, Hotwell and Steam Generator Bulk**
2. Release to DSN006: Condensate Surge Tank and Waste Test Tank Berm

Nuclides Released	Units	2015 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Mn-54	Ci	2.06E-04	7.21E-04	1.03E-03	8.73E-04	2.83E-03
Co-57	Ci	-	5.29E-06	-	-	5.29E-06
Co-58	Ci	1.51E-03	1.80E-03	1.15E-03	3.41E-04	4.80E-03
Co-60	Ci	5.37E-04	1.35E-03	1.42E-03	7.93E-04	4.10E-03
Nb-95	Ci	3.99E-05	-	-	-	3.99E-05
Sb-125	Ci	3.25E-03	1.02E-03	8.21E-04	8.56E-04	5.95E-03
Cs-134	Ci	1.47E-03	2.66E-04	9.81E-05	1.58E-04	1.99E-03
Cs-137	Ci	6.01E-03	1.28E-03	8.94E-04	9.89E-04	9.17E-03
Other γ Emitters	Ci	-	-	-	-	-
Fe-55	Ci	3.55E-03	-	3.45E-03	-	7.00E-03
Ni-63	Ci	2.27E-03	3.01E-03	7.12E-04	4.42E-04	6.43E-03
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.88E-02	9.45E-03	9.58E-03	4.45E-03	4.23E-02
B. Tritium						
H-3	Ci	1.55E+02	7.16E+01	1.14E+02	2.00E+02	5.41E+02
C. Dissolved & Entrained Gases						
γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

2.3 Solid Waste

Solid waste shipment summaries for each unit are given in the following tables:

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

The principal radionuclides in these tables were from shipping manifests.

Solidification Agent(s): No solidification on site

Containers routinely used for radioactive waste shipment include:

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

* United States Department of Transportation

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

January 1, 2015 through December 31, 2015

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

Dry Active Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	9.00E+01	2.55E+00	1.02E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**9.00E+01**	**2.55E+00**	**1.02E-03**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
Fe-55	25.48%	2.61E-04
Co-60	13.08%	1.34E-04
Ni-63	28.11%	2.88E-04
Cs-137	33.28%	3.41E-04
Pu-238	0.01%	1.17E-07
Pu-239	< 0.01%	6.45E-08
Am-241	0.03%	2.69E-07
Cm-244	< 0.01%	7.71E-08
CURIES (TOTAL)		**1.02E-03**

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

January 1, 2015 through December 31, 2015

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**

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

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

January 1, 2015 through December 31, 2015

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	9.00E+01	2.55E+00	1.02E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**9.00E+01**	**2.55E+00**	**1.02E-03**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
Fe-55	25.48%	2.61E-04
Co-60	13.08%	1.34E-04
Ni-63	28.11%	2.88E-04
Cs-137	33.28%	3.41E-04
Pu-238	0.01%	1.17E-07
Pu-239	< 0.01%	6.45E-08
Am-241	0.03%	2.69E-07
Cm-244	< 0.01%	7.71E-08
CURIES (TOTAL)		**1.02E-03**

Table 2.2-S
Solid Waste and Irradiated Component Shipments
Millstone Unit 2

January 1, 2015 through December 31, 2015

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.94E+02	5.49E+00	1.32E+01
B	1.20E+02	3.41E+00	4.27E+01
C	1.78E+02	5.05E+00	3.22E+01
ALL	**4.92E+02**	**1.39E+01**	**8.81E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	1.22%	1.07E+00	Ru-103	< 0.01%	1.62E-25
C-14	0.15%	1.31E-01	Ru-106	< 0.01%	3.38E-06
Cr-51	0.02%	1.86E-02	Ag-108m	< 0.01%	2.44E-04
Mn-54	0.91%	8.00E-01	Ag-110m	0.11%	1.00E-01
Fe-55	16.67%	1.47E+01	Sn-113	< 0.01%	3.19E-04
Fe-59	< 0.01%	4.26E-09	Sn-117m	< 0.01%	4.00E-33
Co-57	0.03%	2.66E-02	Sb-124	< 0.01%	1.38E-05
Co-58	0.02%	1.51E-02	Sb-125	3.23%	2.84E+00
Co-60	16.21%	1.43E+01	Cs-134	0.75%	6.59E-01
Ni-59	0.49%	4.30E-01	Cs-137	12.60%	1.11E+01
Ni-63	47.46%	4.18E+01	Ba-140	< 0.01%	2.71E-58
Zn-65	< 0.01%	2.56E-04	Ce-144	< 0.01%	1.99E-04
Sr-89	< 0.01%	1.09E-03	Hf-181	< 0.01%	6.17E-13
Sr-90	0.06%	5.22E-02	Pu-238	< 0.01%	9.61E-04
Nb-94	0.02%	1.96E-02	Pu-239	< 0.01%	4.44E-04
Zr-95	< 0.01%	9.53E-05	Pu-241	0.03%	2.90E-02
Nb-95	< 0.01%	8.52E-09	Am-241	<0.01%	1.02E-03
Tc-99	0.02%	1.71E-02	Cm-242	<0.01%	989E-06
			Cm-244	<0.01%	1.45E-03
			CURIES (TOTAL)		8.81e+01

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

January 1, 2015 through December 31, 2015

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.05E+04	2.97E+02	3.27E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.05E+04**	**2.97E+02**	**3.27E-01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.03%	1.02E-04
C-14	< 0.01%	3.20E-05
Cr-51	0.23%	7.45E-04
Mn-54	2.94%	9.62E-03
Fe-55	17.66%	5.77E-02
Co-57	0.08%	2.76E-04
Co-58	6.63%	2.17E-02
Co-60	25.07%	8.19E-02
Ni-59	0.31%	1.01E-03
Ni-63	38.15%	1.25E-01
Sr-89	< 0.01%	1.43E-05
Sr-90	0.01%	4.43E-05
Zr-95	1.13%	3.68E-03
Nb-95	2.00%	6.55E-03
Tc-99	0.02%	7.01E-05
Ag-110m	0.77%	2.52E-03
Sn-113	0.25%	8.15E-04
Sb-124	0.05%	1.48E-04
Sb-125	3.17%	1.03E-02
Cs-134	0.05%	1.54E-04
Cs-137	1.27%	4.16E-03
Ce-144	< 0.01%	3.70E-06
Pu-238	< 0.01%	8.92E-06
Pu-239	< 0.01%	2.61E-06
Pu-241	0.14%	4.51E-04
Am-241	< 0.01%	6.49E-06
Cm-242	< 0.01%	2.99E-07
Cm-244	< 0.01%	5.53E-06
CURIES (TOTAL)		**3.27E-01**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 2
January 1, 2015 through December 31, 2015

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**

Other Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	2.93E+02	8.29E+00	1.80E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**2.93E+02**	**8.29E+00**	**1.80E-02**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	98.47%	1.77E-02	Tc-99	0.04%	7.30E-06
C-14	< 0.01%	1.97E-07	Ag-110m	< 0.01%	4.88E-07
Cr-51	< 0.01%	1.71E-07	Sn-113	< 0.01%	1.81E-07
Mn-54	0.04%	8.07E-06	Sb-124	< 0.01%	1.60E-07
Fe-55	0.32%	5.75E-05	Sb-125	0.03%	5.26E-06
Co-57	< 0.01%	1.32E-07	Cs-134	< 0.01%	4.56E-07
Co-58	0.02%	3.28E-06	Cs-137	0.30%	5.40E-05
Co-60	0.30%	5.38E-05	Pu-238	< 0.01%	6.60E-09
Ni-59	< 0.01%	6.06E-07	Pu-239	< 0.01%	2.24E-09
Ni-63	0.45%	8.13E-05	Pu-241	< 0.01%	2.73E-07
Sr-90	< 0.01%	2.45E-08	Am-241	< 0.01%	6.75E-09
Nb-94	< 0.01%	1.26E-07	Cm-242	< 0.01%	1.35E-10
Zr-95	< 0.01%	1.11E-06	Cm-244	< 0.01%	4.13E-09
Nb-95	< 0.01%	1.52E-06	CURIES (TOTAL)		**1.80E-02**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 2
January 1, 2015 through December 31, 2015

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.10E+04	3.11E+02	1.36E+01
B	1.20E+02	3.41E+00	4.27E+01
C	1.78E+02	5.05E+00	3.22E+01
ALL	**1.13E+04**	**3.20E+02**	**8.85E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	1.24%	1.09E+00	Ru-106	< 0.01%	3.38E-06
C-14	0.15%	1.31E-01	Ag-108m	< 0.01%	2.44E-04
Cr-51	0.02%	1.93E-02	Ag-110m	0.12%	1.03E-01
Mn-54	0.91%	8.09E-01	Sn-113	< 0.01%	1.13E-03
Fe-55	16.67%	1.47E+01	Sn-117m	< 0.01%	4.00E-33
Fe-59	< 0.01%	4.26E-09	Sb-124	< 0.01%	1.62E-04
Co-57	0.03%	2.69E-02	Sb-125	3.23%	2.85E+00
Co-58	0.04%	3.68E-02	Cs-134	0.74%	6.59E-01
Co-60	16.24%	1.44E+01	Cs-137	12.55%	1.11E+01
Ni-59	0.49%	4.31E-01	Ba-140	< 0.01%	2.71E-58
Ni-63	47.42%	4.20E+01	Ce-144	< 0.01%	2.02E-04
Zn-65	< 0.01%	2.56E-04	Hf-181	< 0.01%	6.17E-13
Sr-89	< 0.01%	1.10E-03	Pu-238	< 0.01%	9.70E-04
Sr-90	0.06%	5.22E-02	Pu-239	< 0.01%	4.47E-04
Nb-94	0.02%	1.96E-02	Pu-241	0.03%	2.95E-02
Zr-95	< 0.01%	3.77E-03	Am-241	< 0.01%	1.02E-03
Nb-95	< 0.01%	6.55E-03	Cm-242	< 0.01%	1.02E-05
Tc-99	0.02%	1.72E-02	Cm-244	< 0.01%	1.46E-03
Ru-103	< 0.01%	1.62E-25	**CURIES (TOTAL)**		8.85E+01

Table 2.3-S
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2015 through December 31, 2015

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	3.71E+02	1.05E+01	1.23E+01
B	1.32E+02	3.75E+00	2.67E+01
C	1.48E+02	4.19E+00	2.26E+01
ALL	**6.52E+02**	**1.85E+01**	**6.16E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	1.48%	9.12E-01	Ru-103	< 0.01%	1.07E-25
C-14	0.01%	7.23E-03	Ru-106	< 0.01%	2.22E-06
Cr-51	< 0.01%	2.30E-11	Ag-110m	< 0.01%	4.37E-03
Mn-54	10.41%	6.41E+00	Sn-113	0.03%	1.56E-02
Fe-55	22.29%	1.37E+01	Sn-117m	< 0.01%	3.67E-33
Fe-59	< 0.01%	4.04E-09	Sb-124	< 0.01%	1.82E-07
Co-57	0.09%	5.44E-02	Sb-125	0.93%	5.76E-01
Co-58	0.86%	5.30E-01	Cs-134	0.51%	3.17E-01
Co-60	14.84%	9.15E+00	Cs-137	2.92%	1.80E+00
Ni-59	0.44%	2.71E-01	Ba-140	< 0.01%	1.79E-58
Ni-63	45.12%	2.78E+01	Ce-144	< 0.01%	7.46E-05
Zn-65	< 0.01%	1.08E-04	Hf-181	< 0.01%	4.61E-13
Sr-89	< 0.01%	7.38E-04	Pu-238	< 0.01%	4.07E-04
Sr-90	0.01%	9.18E-03	Pu-239	< 0.01%	2.26E-04
Nb-94	< 0.01%	1.41E-03	Pu-241	0.03%	1.68E-02
Zr-95	< 0.01%	3.50E-05	Am-241	< 0.01%	4.22E-04
Nb-95	< 0.01%	1.67E-05	Cm-242	< 0.01%	2.66E-06
Tc-99	0.01%	8.98E-03	Cm-244	< 0.01%	6.07E-04
			CURIES (TOTAL)		6.16E+01

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2015 through December 31, 2015

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	6.05E+03	1.71E+02	1.13E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**6.05E+03**	**1.71E+02**	**1.13E-01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	1.92%	2.16E-03
Mn-54	3.12%	3.52E-03
Fe-55	55.78%	6.29E-02
Co-57	0.04%	4.95E-05
Co-58	1.54%	1.74E-03
Co-60	15.40%	1.74E-02
Ni-59	0.10%	1.16E-04
Ni-63	11.18%	1.26E-02
Nb-94	0.21%	2.38E-04
Nb-95	0.05%	5.92E-05
Tc-99	2.05%	2.31E-03
Sb-125	0.54%	6.08E-04
Cs-134	0.76%	8.59E-04
Cs-137	7.30%	8.23E-03
CURIES (TOTAL)		**1.13E-01**

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

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2015 through December 31, 2015

Other Waste	Volume		Curies Shipped
Waste Class	ft³	m³	Curies
A	3.02E+02	8.55E+00	1.90E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**3.02E+02**	**8.55E+00**	**1.90E-02**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	96.16%	1.83E-02
C-14	< 0.01%	1.99E-07
Cr-51	2.39%	4.54E-04
Mn-54	0.04%	8.09E-06
Fe-55	0.30%	5.76E-05
Co-57	< 0.01%	1.32E-07
Co-58	0.02%	3.28E-06
Co-60	0.28%	5.39E-05
Ni-59	< 0.01%	6.06E-07
Ni-63	0.43%	8.13E-05
Sr-90	< 0.01%	2.45E-08
Nb-94	< 0.01%	1.26E-07
Zr-95	< 0.01%	1.11E-06
Nb-95	< 0.01%	1.52E-06
Tc-99	0.04%	7.39E-06
Ag-110m	< 0.01%	4.88E-07
Sn-113	< 0.01%	1.81E-07
Sb-124	< 0.01%	1.62E-07
Sb-125	0.03%	5.26E-06
Cs-134	< 0.01%	4.56E-07
Cs-137	0.29%	5.46E-05
Pu-238	< 0.01%	6.61E-09
Pu-239	< 0.01%	2.24E-09
Pu-241	< 0.01%	2.73E-07
Am-241	< 0.01%	6.76E-09
Cm-242	< 0.01%	1.35E-10
Cm-244	< 0.01%	4.13E-09
CURIES (TOTAL)		**1.90E-02**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
Millstone Unit 3
January 1, 2015 through December 31, 2015

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	6.72E+03	1.90E+02	1.24E+01
B	1.32E+02	3.75E+00	2.67E+01
C	1.48E+02	4.19E+00	2.26E+01
ALL	**7.00E+03**	**1.98E+02**	**6.18E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies	Radionuclide	% of Total	Curies
H-3	1.51%	9.32E-01	Ru-103	< 0.01%	1.07E-25
C-14	0.01%	7.23E-03	Ru-106	< 0.01%	2.22E-06
Cr-51	< 0.01%	4.54E-04	Ag-110m	< 0.01%	4.37E-03
Mn-54	10.39%	6.42E+00	Sn-113	0.03%	1.56E-02
Fe-55	22.34%	1.38E+01	Sn-117m	< 0.01%	3.67E-33
Fe-59	< 0.01%	4.04E-09	Sb-124	< 0.01%	3.44E-07
Co-57	0.09%	5.44E-02	Sb-125	0.93%	5.76E-01
Co-58	0.86%	5.32E-01	Cs-134	0.52%	3.18E-01
Co-60	14.84%	9.16E+00	Cs-137	2.93%	1.81E+00
Ni-59	0.44%	2.71E-01	Ba-140	< 0.01%	1.79E-58
Ni-63	45.04%	2.78E+01	Ce-144	< 0.01%	7.46E-05
Zn-65	< 0.01%	1.08E-04	Hf-181	< 0.01%	4.61E-13
Sr-89	< 0.01%	7.38E-04	Pu-238	< 0.01%	4.07E-04
Sr-90	0.01%	9.18E-03	Pu-239	< 0.01%	2.26E-04
Nb-94	< 0.01%	1.65E-03	Pu-241	0.03%	1.68E-02
Zr-95	< 0.01%	3.61E-05	Am-241	< 0.01%	4.22E-04
Nb-95	< 0.01%	7.74E-05	Cm-242	< 0.01%	2.66E-06
Tc-99	0.02%	1.13E-02	Cm-244	< 0.01%	6.07E-04
			CURIES (TOTAL)		6.18e+01

2.4 Groundwater Monitoring

With the Groundwater Protection Program (GWPP) Millstone Power Station implements the actions cited in the Nuclear Energy's Institute's (NEI) Groundwater Protection Initiative (Reference 9). The purpose of the GWPP is to establish a program to assure timely and effective management of situations involving potential releases of radioactive material to groundwater. A key element in the GWPP is on-site groundwater monitoring. The results of the GWPP are documented in the Annual Radiological Environmental Operating Report (AREOR). Additional wells were sampled and the results are documented in tables below.

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

Table 2.4-GW (p. 1 of 3)
Additional Well Samples

Name	Date	H-3[1,3] (pCi/L)	Name	Date	H-3[1,3] (pCi/L)
MW-7C[2]	3/29/15	2910	MW-7D[2]	3/8/15	<mda
	3/30/15	2720		3/29/15	<mda
	4/6/15	2830		4/6/15	<mda
	4/15/15	<mda		4/16/15	<mda
	4/24/15	2370		4/24/15	<mda
	5/12/15	2260		5/12/15	<mda
	5/26/15	2240		5/26/15	<mda
	6/5/15	2430		6/5/15	<mda
	6/22/15	2740		6/22/15	3,250
	6/29/15	<mda		6/29/15	3,010
	7/13/15	2810		7/13/15	4,600
	7/27/15	<mda		7/20/15	4,810
	8/10/15	2060		7/27/15	4,160
	8/24/15	2020		8/4/15	4,790
	9/8/15	2670		8/10/15	4,980
	9/24/15	1910		8/24/15	4,800
	10/14/15	<mda		9/8/15	4,940
	11/2/15	2030		9/23/15	5,660
	11/16/15	4500		10/15/15	6,810
	12/1/15	2700		11/2/15	8,080
	12/8/15	3940		11/16/15	8,250
	12/15/15	2620		12/1/15	6,250
	12/28/15	2260		12/8/15	6,330
				12/15/15	4,380
				12/28/15	1,900

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

2 - These wells are located near the Unit 3 RWST which is downwind direction from the Unit 3 Ventilation Vent. All or some of the H-3 detected in these wells is from releases out of the RWST vent and Ventilation Vent. Gaseous releases from the Ventilation Vent are reported in Table 2.3-A7 and from the RWST vent in Table 2.3-A3. Any releases from RWST vent or Ventilation Vent which reach the groundwater are captured in sumps and underground vaults, and periodically monitored before release to the environment and reported in Table 2.3-L2. There has been no hydraulic communication with offsite groundwater. During 2012, an investigation was initiated to determine if there are additional sources of H-3 to onsite groundwater at these wells.

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

Table 2.4-GW (p. 2 of 3)
Additional Well Samples

Name	Date	H-3[1,3] (pCi/L)	Name	Date	H-3[1,3] (pCi/L)
DP-102[2]	3/25/15	10700	MW-GPI-4	3/19/15	<mda
	6/22/15	4890		5/18/15	<mda
	11/2/15	4690		7/22/15	<mda
M3-MW-1	12/3/15	<mda		10/22/15	<mda
	12/9/15	<mda	MW-GPI-6	03/25/15	17500
	12/14/15	<mda		03/26/15	8510
	12/28/15	<mda		03/27/15	6630
ME-2	3/16/15	<mda		03/28/15	6630
	4/14/15	<mda		03/29/15	8670
	8/5/15	<mda		03/30/15	7660
ME-5	3/11/15	<mda		03/31/15	7300
	4/14/15	<mda		04/01/15	5320
	8/5/15	<mda		04/02/15	5550
MW-5A	3/24/15	<mda		04/04/15	2990
	6/19/15	<mda		04/06/15	2850
MW-6A	3/16/15	<mda		04/08/15	2040
	6/11/15	<mda		04/10/15	<mda
	8/17/15	<mda		04/13/15	<mda
	11/4/15	<mda		04/15/15	<mda
MW-6B	3/16/15	<mda		04/22/15	<mda
	6/10/15	<mda		04/28/15	<mda
	9/8/15	<mda		05/11/15	<mda
	11/4/15	<mda		05/19/15	<mda
MW-GPI-2	3/8/15	<mda		06/22/15	<mda
	5/27/15	<mda		07/21/15	<mda
	7/20/15	<mda		08/27/15	<mda
	11/16/15	<mda		09/08/15	<mda
	12/3/15	<mda		11/2/15	<mda
	12/9/15	<mda	MW-GPI-8	3/19/15	<mda
	12/14/15	<mda		5/21/15	<mda
	12/28/15	<mda		7/28/15	<mda
MW-GPI-3	6/24/15	<mda		11/9/15	<mda
	8/5/15	<mda		12/3/15	<mda
				12/9/15	<mda
				12/14/15	<mda
				12/28/15	<mda

Notes: 1 - There was no gamma radioactivity from licensed radioactive material detected in these samples.

2 - These wells are located near the Unit 3 RWST which is downwind direction from the Unit 3 Ventilation Vent. All or some of the H-3 detected in these wells is from releases out of the RWST vent and Ventilation Vent. Gaseous releases from the Ventilation Vent are reported in Table 2.3-A7 and from the RWST vent in Table 2.3-A3. Any releases from RWST vent or Ventilation Vent which reach the groundwater are captured in sumps and underground vaults, and periodically monitored before release to the environment and reported in Table 2.3-L2. There has been no hydraulic communication with offsite groundwater. During 2012, an investigation was initiated to determine if there are additional sources of H-3 to onsite groundwater at these wells.

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

Table 2.4-GW (p. 3 of 3)
Additional Well Samples

Name	Date	H-3[1,2] (pCi/L)	Name	Date	H-3[1,2] (pCi/L)
MW-GPI-9	3/11/15	<mda	S1-MW-2	3/19/15	Dry
	5/21/15	<mda		5/21/15	Dry
	7/20/15	<mda		7/22/15	<mda
	11/30/15	2260	S3-MW-2	3/17/15	<mda
	12/2/15	3080		6/9/15	<mda
	12/7/15	2780		8/12/15	<mda
	12/14/15	2700		10/12/15	<mda
	12/28/15	1820	T10-MW-5e	3/24/15	<mda
S11-MW-1	3/25/15	<mda		8/18/15	<mda
	6/9/15	<mda		6/11/15	<mda
	8/12/15	<mda		10/19/15	<mda
	10/19/15	<mda	T10-MW-6a	3/24/15	<mda
S12-MW-1	3/11/15	<mda		6/3/15	<mda
	5/27/15	<mda		8/18/15	<mda
	7/16/15	<mda		10/22/15	<mda
	11/10/15	<mda	T10-MW-6b	3/24/15	<mda
S12-MW-3	3/16/15	<mda		6/3/15	<mda
	5/27/15	<mda		8/19/15	<mda
	7/16/15	<mda		10/21/15	<mda
	11/10/15	<mda	T1-MW-1	3/19/15	Dry
S13-MW-1	3/17/15	<mda		5/18/15	<mda
	6/9/15	<mda		9/25/15	Dry
	8/13/15	<mda		11/30/15	<mda
	10/12/15	<mda	T1-MW-3	3/19/15	<mda
S1-MW-1	3/11/15	<mda		5/18/15	<mda
	5/21/15	<mda		7/22/15	<mda
	7/28/15	<mda			
	11/9/15	<mda			

Notes: 1 - There was no gamma radioactivity from licensed radioactive material detected in these samples.
2 - MDA is typically 1,760 pCi/L.

3.0 Inoperable Effluent Monitors

During the period January 1 through December 31, 2015, the following effluent instrumentation were inoperable for more than 30 consecutive days:

3.1 Unit 1 - None

3.2 Unit 2 - None

3.3 Unit 3

Ventilation Vent Noble Gas Radioactivity Monitor, Iodine Sampler, Particulate Sampler and Vent Flow Rate Monitor

The three channels of the Ventilation Vent Radiation Monitor, 3HVR-RE10B, and the Vent Flow Rate Monitor were taken out of service on January 26, 2015 due to a false low reading on the process flow instrumentation, 3HVR-FT10. Sample flow follows process flow to maintain isokinetic sampling. Without isokinetic sampling the particulate channel of 3HVR-RE10B becomes nonfunctional which requires the compensatory action of use of temporary sampling equipment. Use of the temporary sampling equipment makes the iodine sampler and gas channel channels nonfunctional. On January 26 trouble shooting was initiated to determine cause of low reading on the process flow instrumentation. Maintenance removed the flow transmitter and flow element and sent them to the vendor for repair. The vendor reworked the signal linearity card and re-calibrated the instrument. In parallel with the vendor troubleshooting effort, Maintenance, Engineering, and Operations discussed the Technical Evaluation M3-EV-09-0003: "Technical Evaluation for Impact of Faulty Flow Indication from HVR-FT10" and how it could be applied to restore the gas channels to functional. This Technical Evaluation was used in 2009 to determine the particulate and iodine samplers were functional with low indicated process flow. The Technical Evaluation references ANSI N13.1-1969 to determine that if sample flow velocity is less than process flow velocity at the sample nozzle then the collected sample will contain more particulate matter and will be conservative with respect to the amount of particulate matter in the process. If the sample is conservative then it can be considered functional. Maintenance, Engineering, and Operations agreed the procedure for restoration of the radiation monitor could be modified to allow some loss of the process flow instrument indication while maintaining functionality of the gas, particulate and iodine channels of 3HVR-RE10B. Operations procedure was modified to ensure a minimum of process flow indication for proper functioning of the three channels. After this evaluation and procedure modifications, 3HVR-RE10B was restored to functional status on May 3, 2015.

Liquid Waste Effluent Radiation Monitor and Line Flow Monitor

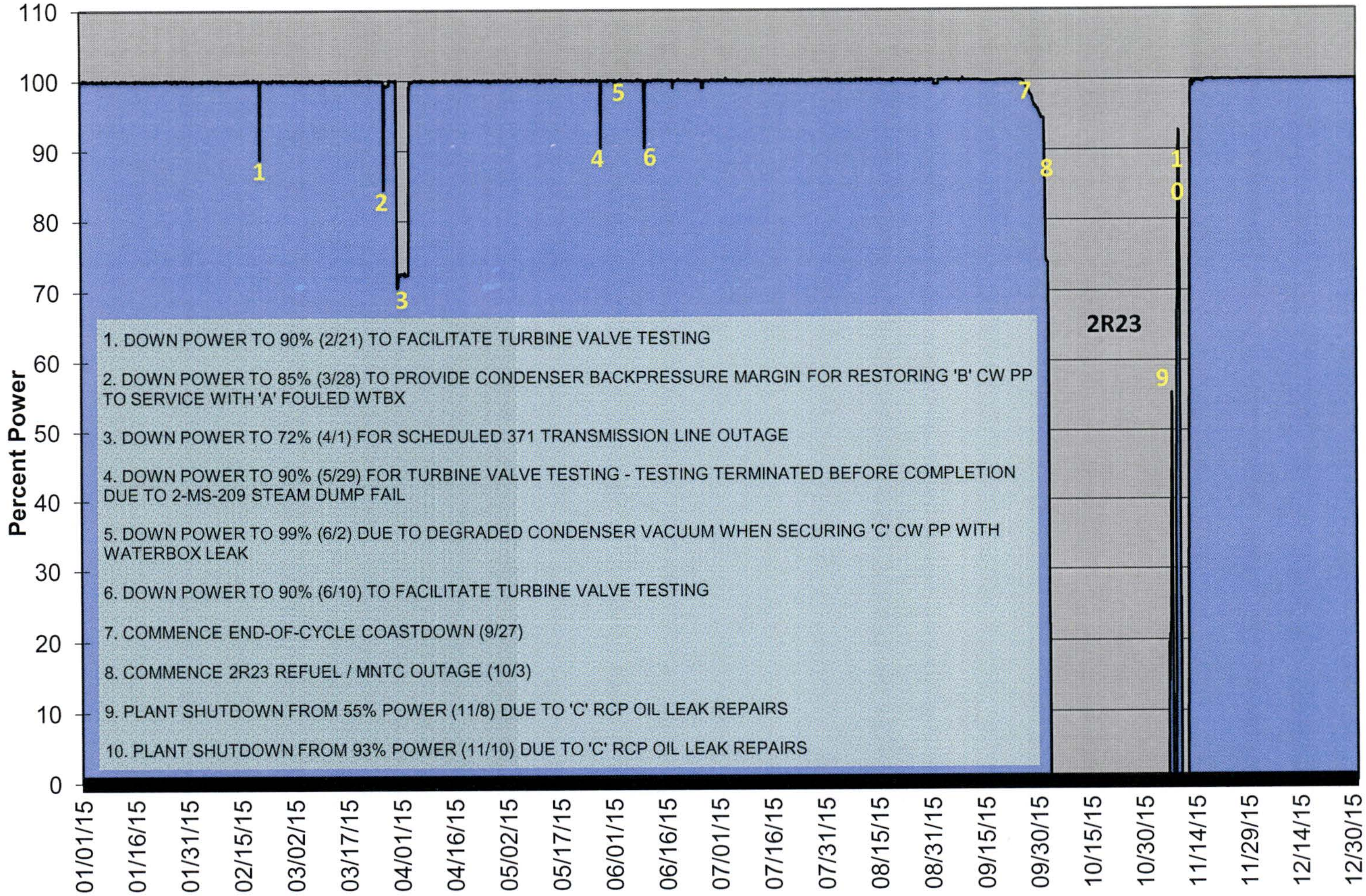
Liquid Waste Effluent Line flow rate monitor was declared nonfunctional on November 19, 2014 due to flow indication. A difference existed between the discharge flow rate recorded on the initial discharge permit and the flow rate recorded on the final permit. The initial flow rate was based on a reading from the differential pressure transmitter 3LWS-FT71, while the final flow rate was calculated by the OpenEMS software. Flow rate calculated by the OpenEMS software was higher than that reported by 3LWS-FT71. OpenEMS calculates flow rate based on the difference in tank levels and the start stop times of the discharge. The difference in initial and final flow rates was due to the difference in measurement based on flow rate versus measurement of tank level (volume) divided by duration of release. Work was planned to check transmitter 3LWS-FT71 to determine if the difference was due to inaccuracy of the transmitter. As of December 29, 2014, this work had not been scheduled. The lack of work was discussed with the Shift Manager and the work scheduler. To prevent a reoccurrence of inappropriate prioritization a separate loop table was developed listing all the instruments associated in an instrument loop that affect effluent instrumentation required by the REMODCM. This table was added to the work review process effective January 8, 2015. Calibration of the flow on January 20, 2015 determined that the loop was within tolerance. An evaluation concluded that the discrepancy between initial and final flow was not consequential.

Prior to returning the sample flow instrumentation to service it was decided that several discharges be performed to assess the functionality of the flow instrument. However, before that could be done the liquid waste radiation monitor (LWS-RE70) was declared non-functional on January 24, 2015, because of a failed sample pump. The radiation monitor sample pump was not repaired in a timely manner because the work was erroneously given a lower priority in the work management process. To avoid a repeat of priority assignment, the 'work coordination team' (WCT) was briefed on roles and responsibilities associated with the screening and prioritizing work per Procedure WM-AA-100. This included identification of condition reports and associated assignments and work orders that may have been screened incorrectly. Outage & Planning has enhanced the WCT report to included notification of 'REMODCM' components that require programmatic priorization to meet the 30 day return to functionality expectation.

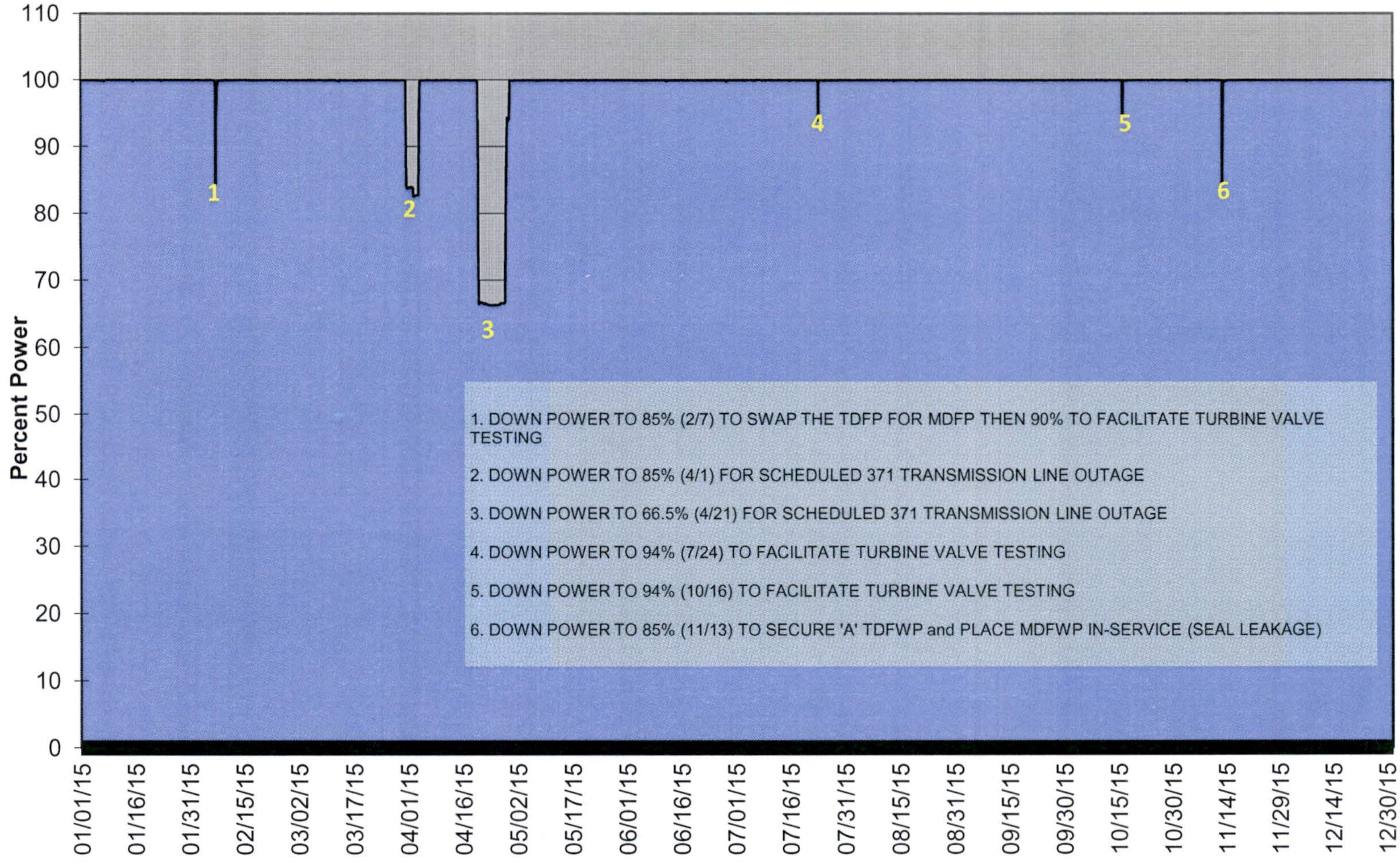
4.0 Operating History

The operating history of the Millstone Power Station Units during this reporting period was as follows:
Unit 1 was shut down November 11, 1995 with a cessation of operation declared
in July 1998.
Unit 2 operated with a capacity factor of 88.7%
Unit 3 operated with a capacity factor of 100.5%
The power histograms for 2015 are on the following pages.

MP2 - CYCLE 23/24 POWER HISTORY
YEAR 2015



MP3 - CYCLE 17 POWER HISTORY
YEAR 2015



5.0 Errata

Some of the doses from release of radioactivity in air to the environment in the 2013 and 2014 annual Radiological Effluents Release Reports were revised. In the 4th quarter of 2013 for Unit 2 there was an error in the dose calculation formula. A correction to the formula lowered these reported doses. In 2013 and 2014 the doses from ground level releases were not included in the total dose reported with Carbon-14. This correction caused a slight increase in most doses for Units 2&3 in 2013 and 2014 for the doses reported with Carbon-14. There were also several reported doses which changed because of rounding of numbers. Revised Tables 1-1 and 1-3 for 2013 and 2014 are included below. Revised doses are shown in bold type.

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

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

Unit 2	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.93E-07	1.14E-04	3.24E-05	3.24E-05	1.79E-04
Gamma	2.59E-07	3.24E-04	6.19E-07	6.19E-07	3.25E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	1.83E-04	1.61E-03	5.14E-04	**1.54E-04**	**2.46E-03**
Whole Body [2]	7.75E-04	1.49E-02	1.07E-02	1.34E-03	2.77E-02
Skin [1]	1.84E-04	1.66E-03	5.30E-04	**1.75E-04**	**2.55E-03**
Skin [2]	7.76E-04	1.50E-02	1.09E-02	1.36E-03	2.80E-02
Thyroid [1]	2.94E-04	3.79E-03	1.99E-03	**2.38E-04**	**6.31E-03**
Thyroid [2]	**9.07E-04**	1.71E-02	1.24E-02	1.49E-03	3.18E-02
Max organ [1,3]	1.84E-04	1.09E-02	5.20E-04	**1.55E-04**	**1.18E-02**
Max organ [2,3]	3.27E-03	6.68E-02	5.21E-02	6.33E-03	1.29E-01

Unit 3	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.85E-07	1.87E-06	6.15E-07	3.84E-07	3.06E-06
Gamma	4.36E-08	8.23E-07	5.36E-08	4.08E-08	9.61E-07
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	5.71E-04	1.51E-02	1.91E-03	1.04E-03	1.86E-02
Whole Body [2]	**6.01E-04**	**1.54E-02**	2.59E-03	**1.16E-03**	**1.98E-02**
Skin [1]	5.72E-04	1.51E-02	1.91E-03	1.07E-03	1.87E-02
Skin [2]	**6.02E-04**	**1.54E-02**	2.59E-03	**1.19E-03**	**1.98E-02**
Thyroid [1]	5.71E-04	1.50E-02	1.91E-03	1.04E-03	1.86E-02
Thyroid [2]	**6.01E-04**	**1.53E-02**	2.59E-03	**1.16E-03**	**1.97E-02**
Max organ [1,3]	5.71E-04	1.53E-02	1.92E-03	1.04E-03	1.88E-02
Max organ [2,3]	**6.64E-04**	**1.62E-02**	4.15E-03	**1.52E-03**	**2.26E-02**

NOTES:

1 - Dose without C-14

2 - Dose with C-14

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

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

Gaseous Effluents Dose (without C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	1.18E-03	1.13E-03	1.47E-03	1.20E-03	0.00E+00	0.00E+00
Unit 2	**2.46E-03**	**6.31E-03**	**1.18E-02**	**2.55E-03**	1.79E-04	3.25E-04
Unit 3	1.86E-02	1.86E-02	1.88E-02	1.87E-02	3.06E-06	9.61E-07
Millstone Station	**2.23E-02**	**2.60E-02**	**3.21E-02**	**2.24E-02**	1.82E-04	3.26E-04
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Gaseous Effluents Dose (with C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	1.18E-03	1.13E-03	1.47E-03	1.20E-03	0.00E+00	0.00E+00
Unit 2	2.77E-02	3.18E-02	1.29E-01	2.80E-02	1.79E-04	3.25E-04
Unit 3	**1.98E-02**	**1.97E-02**	**2.26E-02**	**1.98E-02**	3.06E-06	9.61E-07
Millstone Station	**4.86E-02**	**5.26E-02**	**1.53E-01**	**4.90E-02**	1.82E-04	3.26E-04
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Liquid Effluents Dose

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

Total Off-Site Dose from Millstone Station

	Whole Body (mrem)	Thyroid (mrem)	Max Organ * (mrem)
Gaseous without C-14	**2.23E-02**	**2.60E-02**	***3.21E-02***
Gaseous with C-14	**4.86E-02**	**5.26E-02**	**1.53E-01**
Liquid	1.45E-03	7.46E-04	1.18E-02
Direct Shine**	1.90E-01	1.90E-01	1.90E-01
Millstone Station	2.40E-01	2.43E-01	3.54E-01
Limits	*25*	*75*	*25*

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

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

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

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	9.60E-05	1.67E-04	3.95E-05	3.95E-05	3.42E-04
Gamma	2.46E-04	2.39E-04	7.30E-05	7.30E-05	6.31E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	2.90E-04	1.13E-03	7.89E-04	3.53E-04	2.56E-03
Whole Body [2]	1.41E-03	**1.70E-02**	1.94E-02	**2.26E-03**	**4.01E-02**
Skin [1]	3.95E-04	1.23E-03	8.08E-04	3.76E-04	2.81E-03
Skin [2]	**1.52E-03**	**1.71E-02**	**1.95E-02**	**2.27E-03**	**4.04E-02**
Thyroid [1]	3.48E-04	1.72E-03	9.93E-04	3.73E-04	3.43E-03
Thyroid [2]	1.48E-03	**1.76E-02**	**1.97E-02**	**2.29E-03**	**4.10E-02**
Max organ [1,3]	2.90E-04	1.14E-03	7.92E-04	3.54E-04	2.57E-03
Max organ [2,3]	**6.24E-03**	**7.99E-02**	9.37E-02	1.05E-02	1.90E-01

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	5.72E-05	7.64E-05	1.03E-04	3.96E-05	2.77E-04
Gamma	6.07E-06	3.17E-05	1.76E-05	3.01E-06	5.84E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body [1]	**1.02E-03**	1.89E-03	1.84E-03	**5.05E-03**	**9.80E-03**
Whole Body [2]	**1.93E-03**	1.48E-02	1.80E-02	**5.92E-03**	**4.06E-02**
Skin [1]	**1.06E-03**	**1.92E-03**	**1.88E-03**	**5.50E-03**	**1.04E-02**
Skin [2]	**1.97E-03**	1.48E-02	1.80E-02	**6.37E-03**	**4.12E-02**
Thyroid [1]	**1.02E-03**	1.89E-03	1.84E-03	**6.14E-03**	**1.09E-02**
Thyroid [2]	**1.93E-03**	1.48E-02	1.80E-02	**7.01E-03**	**4.17E-02**
Max organ [1,3]	**1.02E-03**	1.89E-03	1.84E-03	**5.06E-03**	**9.82E-03**
Max organ [2,3]	**5.51E-03**	6.46E-02	8.12E-02	**1.02E-02**	**1.62E-01**

NOTES:

1 - Dose without C-14

2 - Dose with C-14

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

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

Gaseous Effluents Dose (without C-14)

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

Gaseous Effluents Dose (with C-14)

	Whole Body (mrem)	Thyroid (mrem)	Max Organ* (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	2.02E-03	2.02E-03	2.02E-03	2.02E-03	0.00E+00	0.00E+00
Unit 2	**4.01E-02**	**4.10E-02**	1.90E-01	**4.04E-02**	3.42E-04	6.31E-04
Unit 3	**4.06E-02**	**4.17E-02**	**1.62E-01**	**4.12E-02**	2.77E-04	5.84E-05
Millstone Station	**8.28E-02**	**8.47E-02**	**3.54E-01**	**8.35E-02**	6.19E-04	6.90E-04
Limits	*5*	*15*	*15*	*15*	*20*	*10*

Liquid Effluents Dose

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

Total Off-Site Dose from Millstone Station

	Whole Body (mrem)	Thyroid (mrem)	Max Organ * (mrem)
Gaseous with C-14	**8.28E-02**	**8.47E-02**	**3.54E-01**
Liquid	1.56E-03	8.97E-04	1.62E-02
Direct Shine**	1.80E-01	1.80E-01	1.80E-01
Millstone Station	2.64E-01	**2.66E-01**	**5.50E-01**
Limits	*25*	*75*	*25*

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

6.0 REMODCM Changes

There were no changes to the REMODCM in 2015

7.0 References

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

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

3. NRC Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1, October 1977.

4. UNSCEAR 2000 Report Vol. I, Sources and Effects of Ionizing Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation

5. NRC Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, Revision 1, July 1977.

6. NUREG/CR-1276, ORNL/NUREG/TDMC-1, User's Manual for LADTAP II - A Computer Program for Calculating Radiation Exposure to Man from Routine Release of Nuclear Reactor Liquid Effluents, DB Simpson, BL McGill, prepared by Oak Ridge National Laboratory, Oak Ridge, TN 37830, for Office of Administration, US Nuclear Regulatory Commission, manuscript completed 17 March 1980.

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

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

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

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

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

12. NUREG/CR-2907, Vol. 15, Radioactive Effluents from Nuclear Power Plants Annual Report 2009, R. Conatser,US Nuclear Regulatory Commission and N. Daugherty, Oak Ridge Associated Universities, Aug., 2013.

Serial No. 16-167
Docket Nos. 50-245
50-336
50-423
License Nos. DPR-21
DPR-65
NPF-49

ATTACHMENT 2

2015 RADIOACTIVE EFFLUENT RELEASE REPORT
VOLUME 2

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

MILLSTONE POWER STATION
STATION PROCEDURE

STOP THINK ACT REVIEW

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

MP-22-REC-BAP01

Rev. 027-01

Approval Date: 04/15/14

Effective Date: 07/01/14

Millstone All Units
Station Procedure

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

TABLE OF CONTENTS

TABLES AND FIGURES

TABLES

FIGURES

SECTION I.

Radiological Effluent Monitoring Manual (REMM)

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

Docket Nos. 50–245, 50–336, 50–423

SECTION I. RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

I.A. Introduction

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

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

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

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

I.B. Responsibilities

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

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

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

I.C. Liquid Effluents

1. Liquid Effluent Sampling and Analysis Program

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

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

①

Table I.C.–1
TABLE NOTATIONS

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

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

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

Where:

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

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

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

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

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

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

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

TABLE I.C.–2
TABLE NOTATIONS

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TABLE I.C.–3
TABLE NOTATIONS

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2. Liquid Radioactive Waste Treatment

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

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

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

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

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

b. Required Equipment for Each Millstone Unit

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

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

c. Report Requirement For All Three Millstone Units

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

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

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

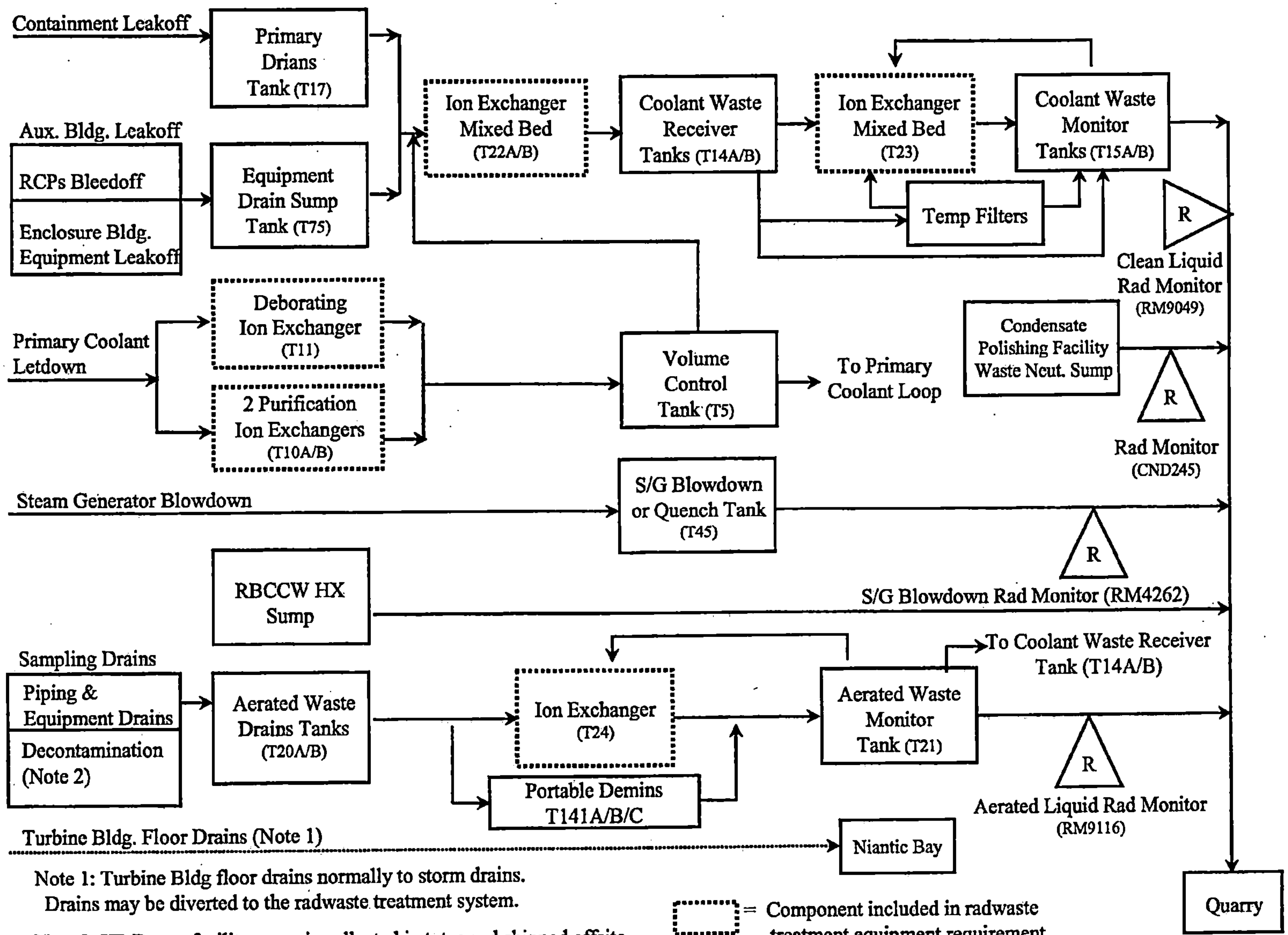
Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid effluents during the past 12 months of plant operation. The indicated liquid surveillance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

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

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

Figure I.C.–1, "Reserved

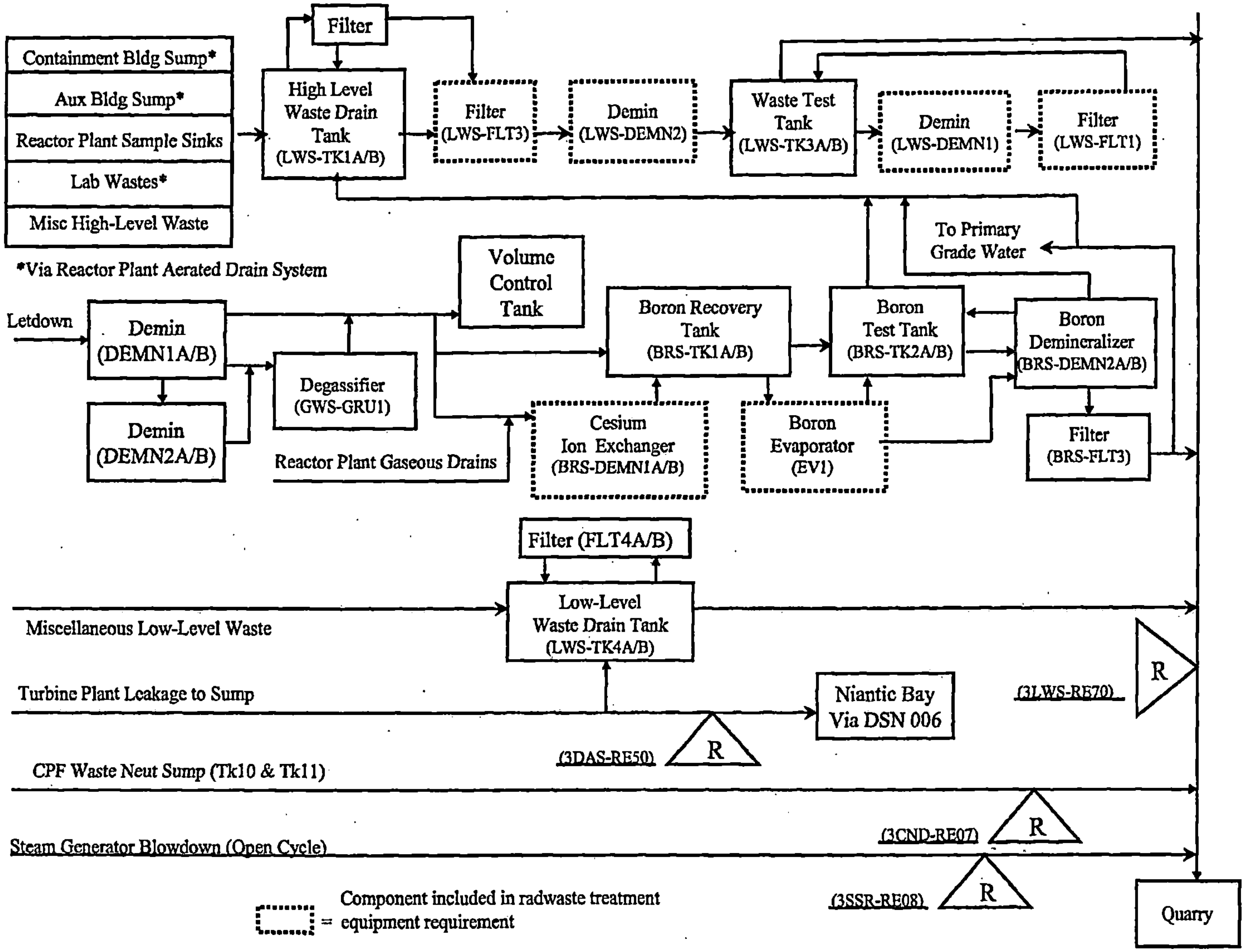
Figure I.C.–2, "Simplified Liquid Effluent Flow Diagram Millstone Unit 2"



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

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

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



I.D. Gaseous Effluents

1. Gaseous Effluent Sampling and Analysis Program

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

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

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

Table I.D.–1
TABLE NOTATIONS

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

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

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

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

E. Continuous when exhaust fans are in operation.

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

TABLE I.D.–2
TABLE NOTATIONS

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

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

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

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

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

E. RESERVED

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

For Unit 2 vent only

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TABLE I.D.–3
TABLE NOTATIONS

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

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

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

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

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

E. RESERVED

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

   For Unit 3 Vent only:

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

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

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

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

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

2. Gaseous Radioactive Waste Treatment

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

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

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

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

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

b. Required Equipment for Each Millstone Unit

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

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

c. Report Requirement For All Three Millstone Units

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

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

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

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

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

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

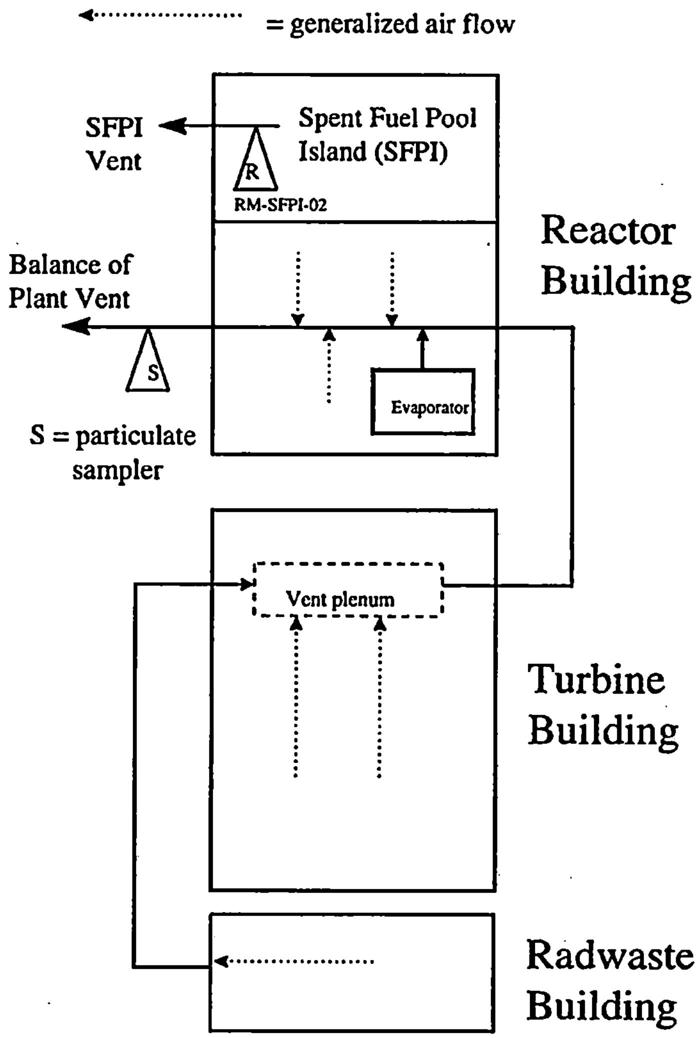


Figure I.D.–2, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Two"

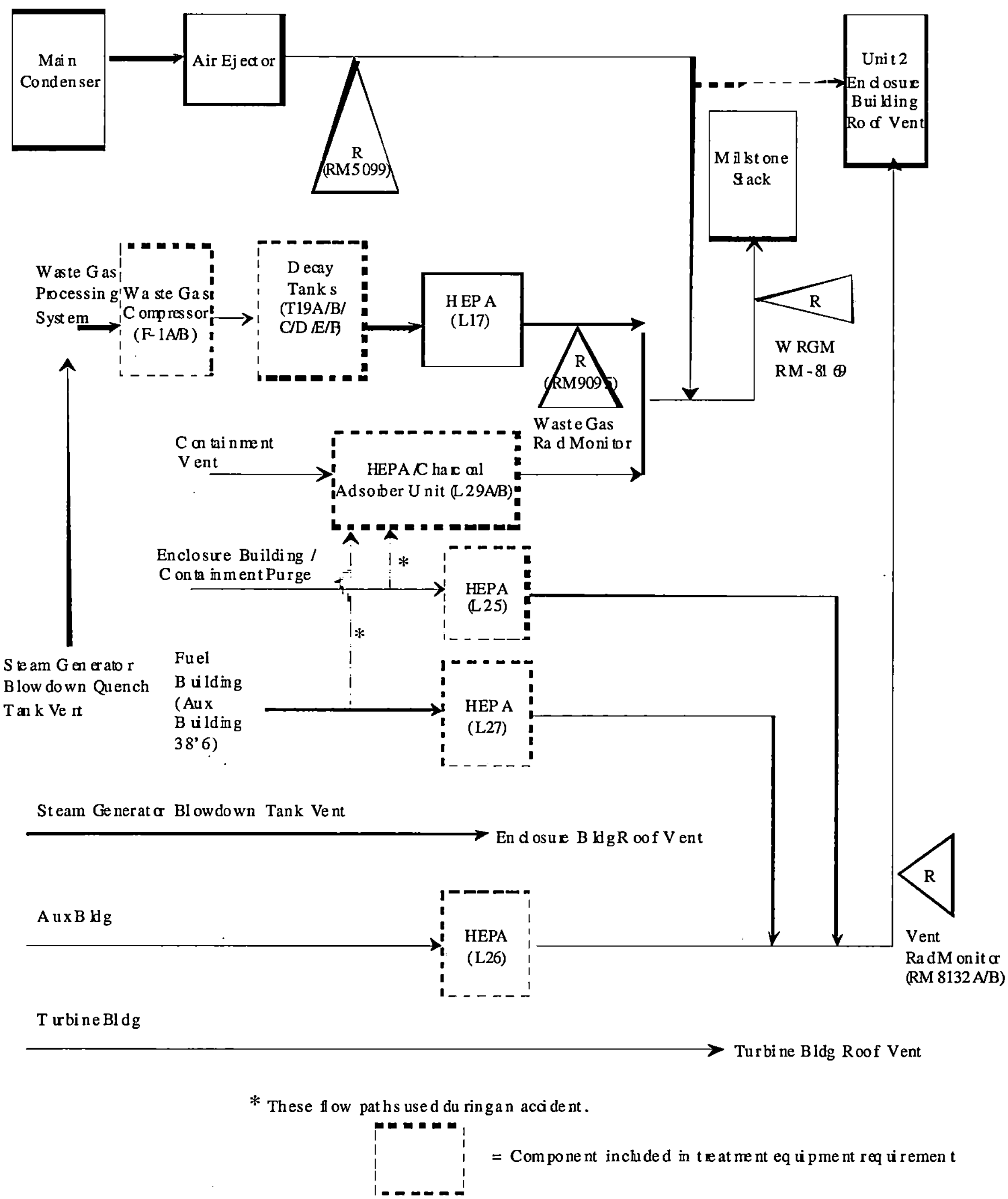
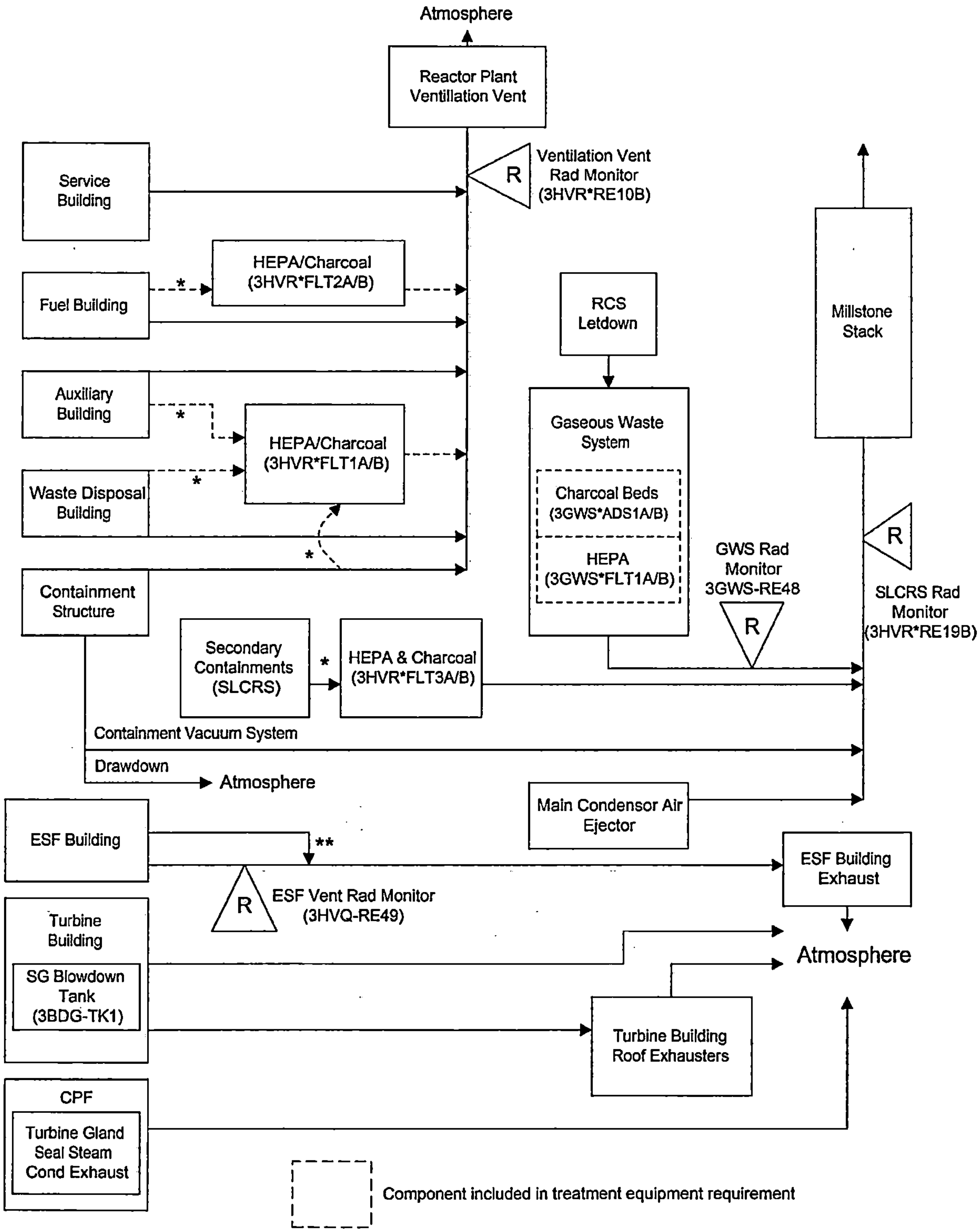


Figure I.D.–3, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Three"



* These flow paths used during an accident

** Releases from Mechanical Rooms A-D not monitored

I.E. **Radiological Environmental Monitoring**

1. Sampling and Analysis

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

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

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

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

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

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

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

Table I.E.–1
Millstone Radiological Environmental Monitoring Program

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

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

(b) Not required during 1st quarter.

Table I.E.–2

Environmental Monitoring Program Sampling Locations

The following lists the environmental sampling locations and the types of samples obtained at each location. Sampling locations are also shown on Figures I.E.–1 and I.E.–2:

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

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

①

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

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

* I = Indicator; C = Control.

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

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

STOP THINK ACT REVIEW

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

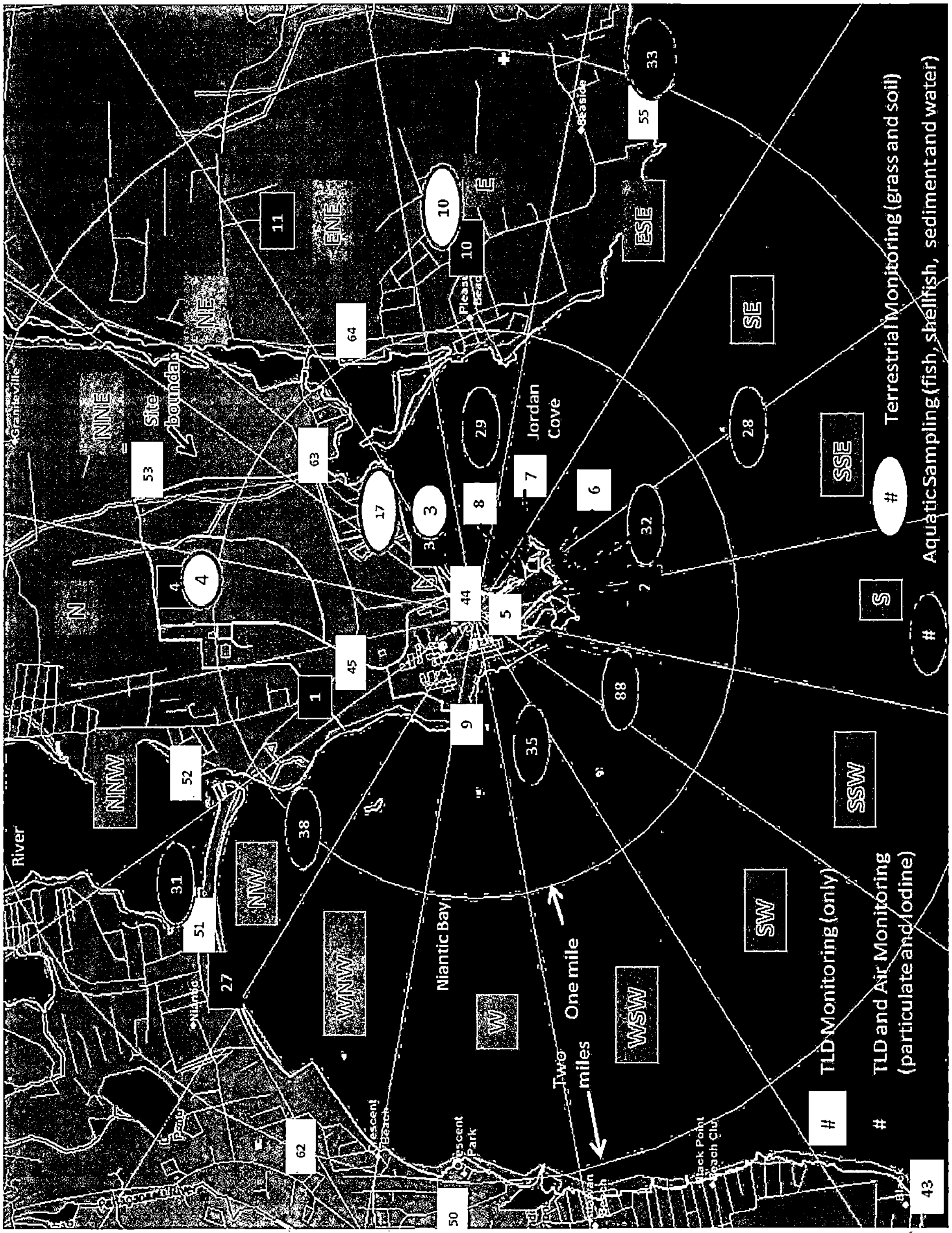


Figure I.E.–2, "Outer TLD and Aquatic Locations"

①

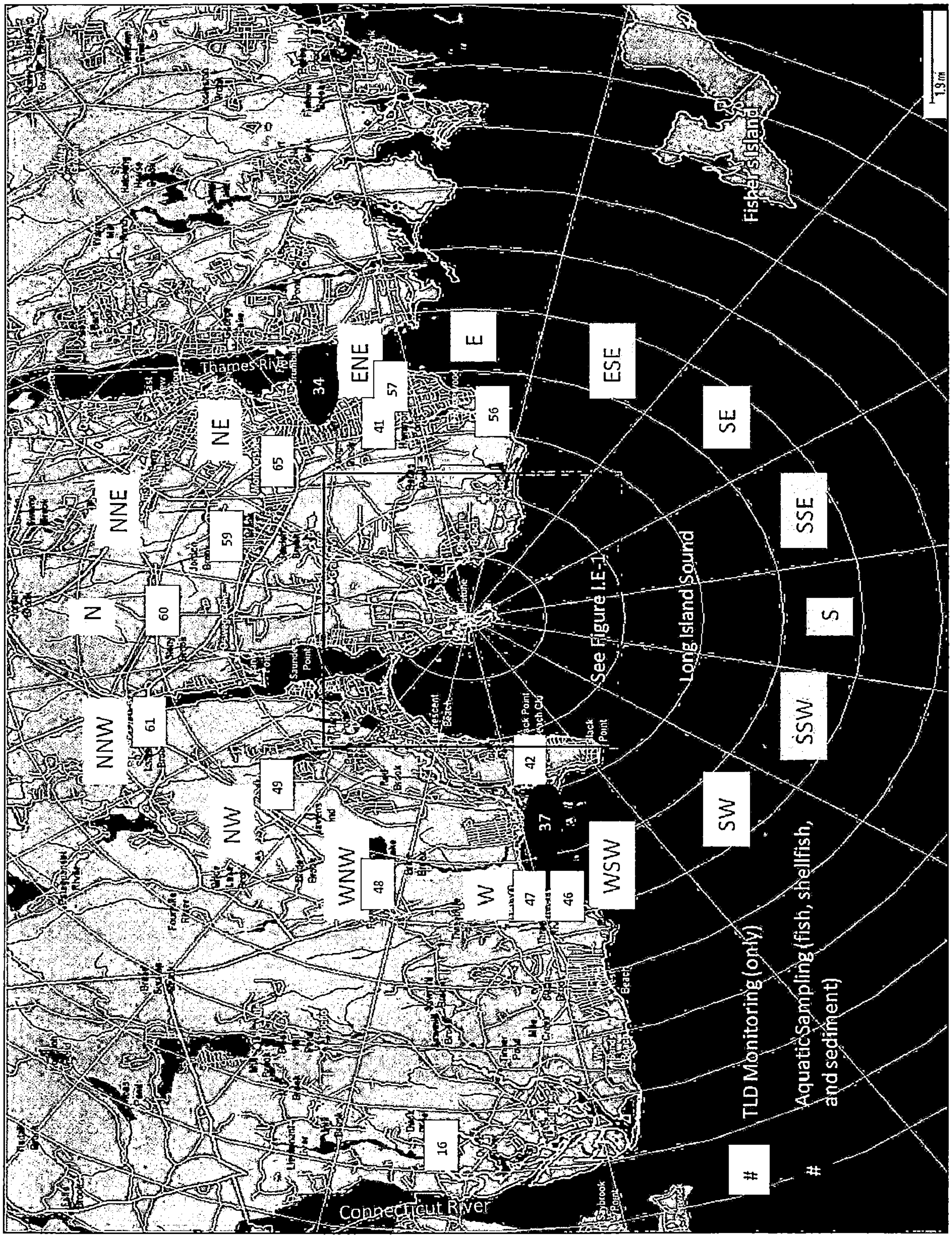


Table I.E.–3 Reporting Levels For Radioactivity Concentrations In Environmental Samples							
Analysis	**Water (pCi/l)**	**Airborne Particulate or Gases (pCi/m^3)**	**Fish (pCi/g, wet)**	**Shellfish[C.] (pCi/g, wet)**	**Milk (pCi/l)**	**Vegetables (pCi/g, wet)**
H–3	20,000[A.]					
Mn–54	1,000		30	140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

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

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

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

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

TABLE NOTATIONS
Table I.E.–4

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

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

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

Where:

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

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

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

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

B. LLD for leafy vegetables.

C. From end of sample period.

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

2. Land Use Census

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

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

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

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

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

3. Interlaboratory Comparison Program

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

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

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

4. Bases for the Radiological Environmental Monitoring Program

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

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

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

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

I.F. Report Content

1. Annual Radiological Environmental Operating Report

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

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

1) Total number of analyses performed at indicator locations.

2) Total number of analyses performed at control locations.

3) Lower limit of detection (LLD).

4) Mean and range of all indicator locations together.

5) Mean and range of all control locations together.

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

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

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

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

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

2. Radioactive Effluent Release Report

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

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

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

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

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

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

SECTION II.

Offsite Dose Calculation Manual (ODCM)

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

Docket Nos. 50–245, 50–336, 50–423

SECTION II. OFFSITE DOSE CALCULATION MANUAL (ODCM)

II.A. Introduction

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

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

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

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

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

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

II.B. Responsibilities

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

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

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

II.C. Liquid Dose Calculations

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

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

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

2. Monthly Dose Projections

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

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

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

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

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

Where:

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

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

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

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

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

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

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

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

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

3. Bases for Liquid Pathway Dose Calculations

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

II.D. **Gaseous Dose Calculations**

1. Site Release Rate Limits ("Instantaneous")

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

   a. Method 1 for Noble Gas Release Rate Limits

      Instantaneous noble gas release rate for the site:

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

      Where:

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

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

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

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

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

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

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

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

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

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

Where the contribution from each Unit is calculated from:

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

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

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

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

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

Where the contribution from each Unit is calculated from:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

* includes releases via the steam generator blowdown tank vent.

c. Method 2

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

2. 10 CFR50 Appendix I – Noble Gas Limits

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. Gaseous Effluent Monthly Dose Projections

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

a. Unit 1 Projection Method

None required.

b. Unit 2 Projection Method

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

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

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

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

Where:

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

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

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

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

2) (Reserved)

3) Due to Ventilation Releases (Unit 2)

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

i. Method 1

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

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

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

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

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

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

D_O = maximum organ dose from the previous month.

ii. Method 2

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

c. Unit 3 Projection Method

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

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

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

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

Where:

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

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

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

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

5. Compliance with 40CFR190

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

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

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

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

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

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

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

6. Bases for Gaseous Pathway Dose Calculations

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

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

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

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

II.E. Liquid Discharge Flow Rates And Monitor Setpoints

1. Unit 1 Spent Fuel Pool Water Discharge

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

STEP 1:

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

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

STEP 2:

Determine the allowable discharge flow (F)

F = 0.1 x R x D

Where:

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

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

STEP 3:

Calculate the monitor setpoint as follows:

Rset = 2 x AC x RCF + Background

Where:

Rset = The setpoint of the monitor.

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

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

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

Option setpoint:

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

2. Reserved

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

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

STEP 1:

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

For Nuclides Other Than Noble Gases:

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

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

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

R = the smaller of R_1 or R_2

STEP 2:

Determine the allowable discharge flow (F) in gpm:

F = 0.1 x R x D

Where:

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

NOTE

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

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

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

Where:

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

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

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

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

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

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

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

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

   The setpoint shall be determined as for the Clean and Aerated Liquid Monitors in Section II.E.3. ①

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

5a. Unit 2 Steam Generator Blowdown – RM4262

Alarm ≤800 CPM + background (1)

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

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

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

5b. Unit 2 Steam Generator Blowdown Effluent Concentration Limitation

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

6. Unit 2 Condenser Air Ejector – RM5099

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

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

7a. Unit 2 Reactor Building Closed Cooling Water RM6038

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

SETPOINT DURING POWER OPERATIONS:

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

SETPOINT DURING SHUTDOWN:

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

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

PROVISIONS FOR ALTERNATE DILUTION FLOWS:

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

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

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

8. Unit 3 Liquid Waste Monitor – LWS–RE70

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

Step 1:

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

For Nuclides Other Than Noble Gases:

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

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

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

R = the smaller of R1 or R2

Step 2:

Determine the allowable discharge flow (F)

F = 0.1 x R x D

Where:

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

NOTE

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

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

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

Where:

Rset= The setpoint of the monitor.

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

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

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

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

NOTE

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

①

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

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

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

    Same as Section II.E.8.

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

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

    The alarm setpoint for this monitor assumes:

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

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

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

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

Therefore, the alarm setpoint corresponds to a concentration of:

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

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

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

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

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

NOTE

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

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

11b. Unit 3 Steam Generator Blowdown Effluent Concentration Limitation

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

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

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

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

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

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

13. Bases for Liquid Monitor Setpoints

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

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

II.F. Gaseous Monitor Setpoints

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

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

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

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

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

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

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

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

3. Reserved

4. Unit 3 SLCRS – HVR–RE19B

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

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

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

5. Unit 2 Vent – Noble Gas Monitor – RM8132B

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

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

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

6. Unit 2 Waste Gas Decay Tank Monitor RM9095

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

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

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

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

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

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

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

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

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

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

9. Bases for Gaseous Monitor Setpoints

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

APPENDIX II.A
REMODCM METHODOLOGY CROSS–REFERENCES

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

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

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

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

SECTION III.

Millstone Unit 1

Radiological Effluent Controls

Docket Nos. 50–245

SECTION III. REMODCM UNIT ONE CONTROLS

III.A. Introduction

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

a. the effluent radiation monitor controls and surveillance requirements,

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

c. the bases for the controls and surveillance requirements.

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

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

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

III.B.1 – Definitions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Radioactive Liquid Effluent Monitoring Instrumentation

CONTROLS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

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

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

Action A

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

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

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

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

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

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

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

2. Radioactive Gaseous Effluent Monitoring Instrumentation

CONTROLS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENT

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

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

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

ACTION STATEMENTS

Action A

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

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum number FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that a 24 hour sample is collected with auxiliary sampling equipment once every seven (7) days, or anytime significant generation of airborne radioactivity is expected, and analyzed for principal gamma emitters with half lives greater than 8 days within 24 hours after the end of the sampling period. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once during the Chemistry compensatory sampling time period as specified in Action A or Action B. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

TABLE III.C.–4 **Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Instrument Calibration	Functional Test	Source Check
1.Spent Fuel Pool Island Vent				
(a) Noble Gas Radioactivity Monitor	D(3)	T(6)	Q(7)	M
(b) Particulate Sampler	TM	NA	NA	NA
(c) Vent Flow Rate Monitor	D	T	NA	NA
(d) Sampler Flow Rate Monitor	D	T	NA	NA
2.Balance of Plant Vent				
(a) Particulate Sampler	TM	NA	NA	NA
(b) Sampler Flow Monitor	D	T	NA	NA

①

D = Daily
W = Weekly
TM = Twice per month
M = Monthly
Q = Once every 3 months
T = Once every two years
NA = Not Applicable

Table III.C.–4
TABLE NOTATION

(1) RESERVED

(2) RESERVED

(3) Instrument check daily only when there exist releases via this pathway.

(4) RESERVED

(5) RESERVED

(6) Calibration shall include the use of a known source whose strength is determined by a detector which has been calibrated to a source which is traceable to the NIST. These sources shall be in a known reproducible geometry.

(7) The INSTRUMENT FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

1. Instrument indicates measured levels above the alarm/trip setpoint.
2. Instrument indicates a downscale failure.

III.D. **Radioactive Effluents Concentrations And Dose Limitations**

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATIONS

The concentration of radioactive material released from the site (see Figure III.D.–1) shall not exceed ten times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 2×10^{-4} μCi/ml total radioactivity. ①

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released from the site exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

SURVEILLANCE REQUIREMENT

Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.
The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Specification III.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATIONS

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 1 released from the site (see Figure III.D.–1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ; and,

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

CONTROLS

The dose rate, at any time, offsite (See Figure III.D.–1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

a. The dose rate limit for noble gases shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin; and,

b. The dose rate limit for Tritium and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate to comply with the limit(s) given in Control III.D.2.a. within 15 minutes.

SURVEILLANCE REQUIREMENT

1) The instantaneous release rate corresponding to the above dose rate shall be determined in accordance with the methodology of Section II.

2) The instantaneous release rate shall be monitored in accordance with the requirements of Section III.C.2.

3) Sampling and analysis shall be performed in accordance with Section I to assure that the limits of Control III.D.2.a. are met.

b. Radioactive Gaseous Effluents Noble Gas Dose

CONTROLS

The air dose offsite (see Figure III.D.–1) due to noble gases released in gaseous effluents from Unit 1 shall be limited to the following:

a. During any calendar quarter, to less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation;

b. During any calendar year to less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

c. Gaseous Effluents – Dose from Radionuclides Other than Noble Gas

CONTROLS

The dose to any REAL MEMBER OF THE PUBLIC from Tritium and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 1 (see Figure III.D.–1) shall be limited to the following:

a. During any calendar quarter to less than or equal to 7.5 mrem [to any organ];

b. During any calendar year to less than or equal to 15 mrem [to any organ].

APPLICABILITY: At all times.

ACTION:

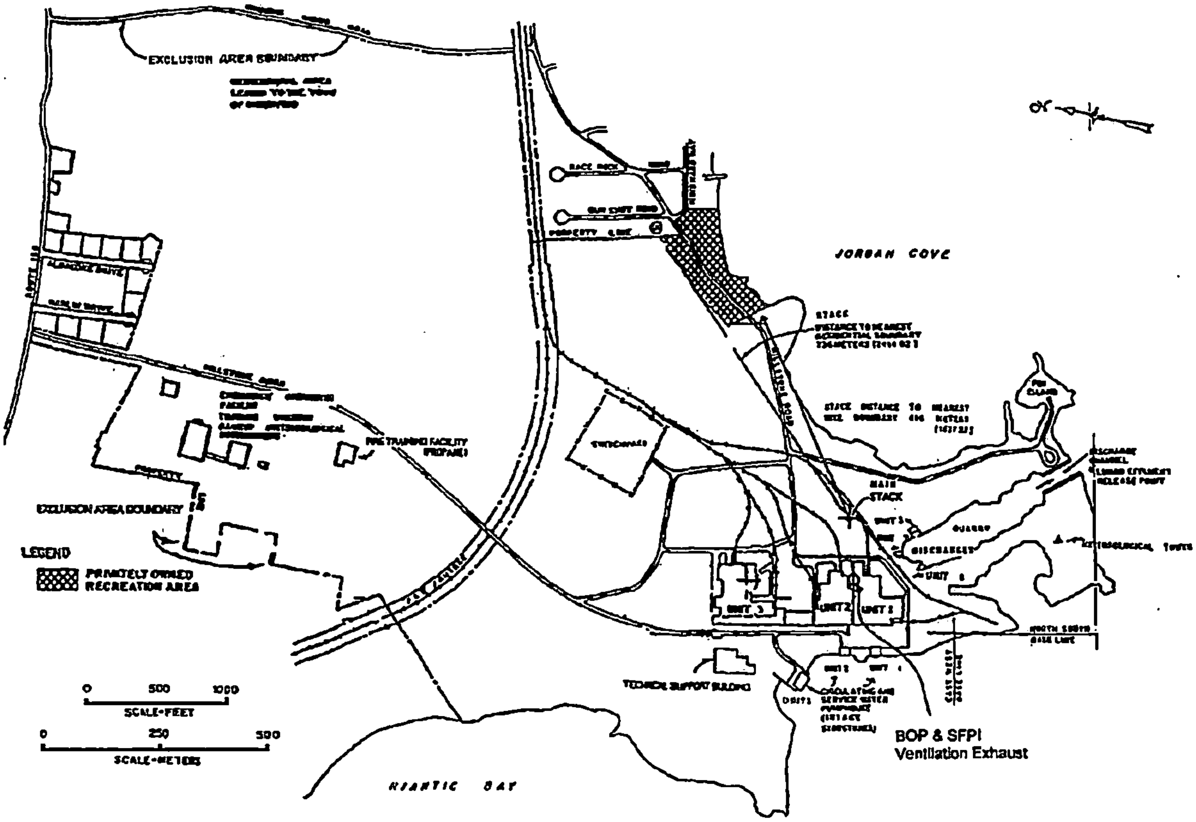
With the calculated dose from the release of Tritium and radioactive materials in particulate form exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases of radioactive materials in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

Figure III.D.–1, "Site Boundary for Liquid and Gaseous Effluents"



III.E. Total Radiological Dose From Station Operations Controls

CONTROLS

The annual dose or dose commitment to any REAL MEMBER OF THE PUBLIC, beyond the site boundary, from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which is limited to less than or equal to 75 mrem).

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls III.D.1.b., III.D.2.b. or III.D.2.c. prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the dose commitment from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. This Special Report shall include an analysis which demonstrates that radiation exposures from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site (including all effluent pathways and direct radiation) are less than the 40 CFR 190 Standard.

If the estimated doses exceed the above limits, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with Section II once per 31 days.

III.F. Bases

Section III.C.1 – Radioactive Liquid Effluent Monitoring Instrumentation

No controls required; Unit 1 is not currently releasing radioactivity in liquid effluents

Section III.C.2 – Radioactive Gaseous Effluent Monitoring Instrumentation

The Spent Fuel Pool Island Vent is the only gaseous pathway currently requiring radiation monitoring for Unit 1.

Section III.D.1.a. – Radioactive Liquid Effluents Concentrations

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A. design objectives of Appendix I, 10 CFR 50, to an individual and (2) the limits of 10 CFR 20 to the population. The concentration limit for noble gases is based upon the assumption that Xe–135 is the controlling radioisotope and its concentration in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Section III.D.1.b. – Radioactive Liquid Effluents Doses

This specification is provided to implement the requirements of Sections II.A., III.A, and IV.A of Appendix I, 10 CFR 50. The specification implements the guides set forth in Section II.A of Appendix I. The Action statements provide the required operating flexibility and at the same time implement the guides set forth in Section III.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I,” Revision 1, October 1977, and Regulatory Guide 1.113, “Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I,” April 1977.

Section III.D.2.a. – Radioactive Gaseous Effluents Dose Rate

This control is provided to ensure that the dose rate at anytime from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR 20, Appendix B, Table 2. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual offsite to annual average concentrations exceeding the limits specified in Appendix B, Table 2 of 10 CFR 20. For individuals who may, at times, be within the site boundary, the occupancy of that individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to an infant via the cow–milk–infant pathway to less than or equal to 1500 mrem/year for the nearest cow to the plant.

Section III.D.2.b. – Radioactive Gaseous Effluents Noble Gas Dose

This control is provided to implement the requirements of Sections II.B., III.A., and IV.A. of Appendix I, 10 CFR 50. The control implements the guides set forth in Section II.B of Appendix I. The action statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculational of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision 1, July 1977.

The ODCM equations provided for determining the air doses at the site boundary were based upon utilizing successively more realistic dose calculational methodologies. More realistic dose calculational methods are used whenever simplified calculations indicate a dose approaching a substantial portion of the regulatory limits. The methods used are, in order, previously determined air dose per released radioactivity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released. ①

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

These controls is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR 50. The controls are the guides set forth in Section II.C of Appendix I. The action statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides for Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials will to be consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I," Revision I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision I, July 1977. These equations provide for determining the doses based upon either conservative atmospheric dispersion and an assumed critical nuclide mix or using real time meteorology and specific nuclides released. The release rate specifications for radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man. The pathways which are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Section III.E. – Total Radiological Dose from Station Operations

This control is provided to meet the reporting requirements of 40 CFR 190. For the purpose of the Special Report, it may be assumed that the dose commitment to any REAL MEMBER OF THE PUBLIC from other fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered.

SECTION IV.

Millstone Unit 2

Radiological Effluent Controls

Docket Nos. 50–336

SECTION IV. REMODCM UNIT TWO CONTROLS

IV.A. Introduction

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

a. the effluent radiation monitor controls and surveillance requirements,

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

c. the bases for the controls and surveillance requirements.

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

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

IV.B. Definitions, Applicability and Surveillance Requirements

IV.B.1 – Definitions

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

1. ACTION – Those additional requirements specified as corollary statements to each principal control and shall be part of the control.

2. FUNCTIONAL / FUNCTIONALITY – An instrument shall be FUNCTIONAL or have FUNCTIONALITY when it is capable of performing its specified functions(s) and when all necessary attendant instrumentation, controls, normal and emergency electrical power sources, or other auxiliary equipment that are required for the instrument to perform its functions are also capable of performing their related support functions.

3. CHANNEL CALIBRATION – A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to know values of the parameter which the channel monitors. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm and/or trip functions, and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

4. CHANNEL CHECK – A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

5. CHANNEL FUNCTIONAL TEST – A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify FUNCTIONALITY including alarm and/or trip functions. For digital instruments, the computer database may be manipulated, in lieu of a signal injection, to verify functionality of alarm and/or trip functions.

6. SOURCE CHECK – A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to radiation.

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

   The term "REAL MEMBER OF THE PUBLIC" means an individual who is exposed to existing dose pathways at one particular location.

8. MODE – Refers to Mode of Operation as defined in Safety Technical Specifications.

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

10. UNRESTRICTED AREA – Any area at or beyond the site boundary to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the site boundary used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

11. DOSE EQUIVALENT I–131 – DOSE EQUIVALENT I–131 shall be that concentration of I–131 (μCi/gram) which alone would produce the same CDE–thyroid dose as the quantity and isotopic mixture of I–131, I–132, I–133, I–134, and I–135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed under Inhalation in Federal Guidance Report No. 11 (FGR 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion."

IV.B.2 – Applicability

IV.B.2a – LIMITING CONDITIONS FOR OPERATION

1. Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

2. Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and associated ACTION requirements are not met within the specified time intervals, except as provided in Condition IV.B.2.a(6). If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3. NOT USED.

4. NOT USED.

5. When a system, subsystem, train, component or device is determined to be nonfunctional solely because its emergency power source is nonfunctional, or solely because its normal power source is nonfunctional, it may be considered FUNCTIONAL for the purpose of satisfying the requirements of its applicable Limiting Condition for Operation, provided: (1) its corresponding normal or emergency power source is FUNCTIONAL; and (2) all of its redundant system(s), subsystem(s), train(s), component(s) and device(s) are FUNCTIONAL, or likewise satisfy the requirements of this specification.

6. Equipment removed from service or declared nonfunctional to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its FUNCTIONALITY or the FUNCTIONALITY of other equipment. This is an exception to Condition IV.B.2.a(2) for the system returned to service under administrative control to perform the testing required to demonstrate FUNCTIONALITY.

IV.B2.b – SURVEILLANCE REQUIREMENTS

1. Surveillance Requirements shall be applicable during any condition specified for individual Limiting Conditions for Operation unless otherwise stated in an individual Surveillance Requirement.

2. Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance time interval.

3. Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Condition IV.B2.b(2), shall constitute a failure to meet the FUNCTIONALITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on nonfunctional equipment.

4. Entry into any specified condition shall not be made unless the Surveillance Requirement(s) associated with the Limiting Condition for Operation have been performed within the stated surveillance interval or as otherwise specified.

IV.C. Radioactive Effluent Monitoring Instrumentation

1. Radioactive Liquid Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATIONS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE IV.C.–1 **Radioactive Liquid Effluent Monitoring Instrumentation**				
Instrument	Minimum # Functional	Alarm Setpoints Required	Applicability	Action
1.Gross Radioactivity Monitors Providing Automatic Termination Of Release				
(a) Clean Liquid Radwaste Effluent Line	1	Yes	*	A
(b) Aerated Liquid Radwaste Effluent Line	1	Yes	***	A
(c) Steam Generator Blowdown Monitor	1	Yes	****	B
(d) Condensate Polishing Facility Waste Neut Sump	1	Yes	***	E
2.Gross Radioactivity Monitors Not Providing Automatic Termination Of Release				
(a) Reactor Building Closed Cooling Water Monitor#	1	Yes	*	C
3.Flow Rate Measurements				
(a) Clean Liquid Radwaste Effluent Line	1	No	*	D
(b) Aerated Liquid Radwaste Effluent Line	1	No	*	D
(c) Condensate Polishing Facility	1	No	*	D

TABLE IV.C.–1
TABLE NOTES

* At all times – which means that channels shall be FUNCTIONAL and in service on a continuous, uninterrupted basis, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

** Deleted.

*** Whenever the pathway is being used except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

**** MODEs 1–4, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

Since the only source of service water contamination is the reactor building closed cooling water, monitoring of the closed cooling water and conservative leakage assumptions will provide adequate control of service water effluents.

ACTION STATEMENTS

Action A

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

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

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

Action B

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, either:

(1) Suspend all effluent releases via this pathway, or

(2) Make best efforts to repair the instrument and obtain grab samples and analyze for gamma radioactivity at lower limits of detection as specified in Table I.C.–2;

   a) Once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 μCi/gm DOSE EQUIVALENT I–131.

   b) Once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 μCi/gm DOSE EQUIVALENT I–131.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that once per 12 hours grab samples of the service water effluent are collected and analyzed for gamma radioactivity at LLD as specified in Table I.C.–2;

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

Action E

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

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

(2) If one of the samples has gamma radioactivity greater than any of the LLDs in Table I.C.–2, the original release rate calculations and discharge valving are independently verified by a second individual.

TABLE IV.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Gross Radioactivity Monitors Providing Alarm and Automatic Termination Of Release				
a. Clean Liquid Radwaste Effluent Line	D*	P	R(1)	Q(2)
b. Aerated Liquid Radwaste Effluent Line	D*	P	R(1)	Q(2)
c. Steam Generator Blowdown Monitor	D*	M	R(1)	Q(2)
d.Condensate Polishing Facility Waste Neut Sump	D*	P	R(1)	Q(2)
2.Gross Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination Of Release				
a. Reactor Building Closed Cooling Water Monitor	D*	M	R(1)	Q(2)
3.Flow Rate Measurements				
a. Clean Liquid Radwaste Effluent Line	D*	N/A	R	Q
b. Aerated Liquid Radwaste Effluent Line	D*	N/A	R	Q
c. Condensate Polishing Facility Waste Neut Sump	D*	N/A	R	Q

D = Daily
M = Monthly
P = Prior to each batch release
R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

TABLE IV.C.–2
TABLE NOTATION

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

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

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

a) Instrument indicates measured levels above the alarm/trip setpoint.

b) Instrument indicates a downscale or circuit failure.
– Automatic isolation of the discharge stream shall also be demonstrated for this case for each monitor except the reactor building closed cooling water monitor.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATIONS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE IV.C.–3 Radioactive Gaseous Effluent Instrumentation				
Instrument	Minimum Channels Functional	Alarm Setpoints Required	Applicability	Action
1.MP2 Vent (normal range, RM–8132 only; high range monitor, RM–8168, requirements are in the TS)				
a. Noble Gas Radioactivity Monitor	1	Yes***	**	A
b. Iodine Sampler	1	No	**	B
c. Particulate Sampler	1	No	**	B
d. Vent Flow Rate Monitor	1	No	**	C
e. Sampler Flow Rate Monitor	1	No	**	C
2.Millstone Stack – applicable to the WRGM (RM–8169, normal range, channel 1, only; mid range channel 2 and high range channel 3 requirements are contained in TRM LCO 3.3.3.8)				
a. Noble Gas Radioactivity Monitor	1	Yes***	**	E
b. Iodine Sampler	1	No	**	B
c. Particulate Sampler	1	No	**	B
d. Stack Flow Rate Monitor	1	No	**	C
e. Sampler Flow Rate Monitor	1	No	**	C
3.Waste Gas Holdup System				
a. Noble Gas Monitor Providing Automatic Termination of Release	1	Yes	*	D

* During waste gas holdup system discharge.

** At all times when air is being released to the environment by the pathway being monitored. The channel shall be FUNCTIONAL and in service on a continuous, uninterrupted basis. Outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

*** No automatic isolation features.

ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours. If the monitor flow and readout are not adversely affected by the loss of functionality, the daily CHANNEL CHECK may be performed in lieu of the grab sample.

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum number FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Auxiliary sampling must be initiated within 12 hours of initiation of this action statement. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 5 hours. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement:

Releases from the Millstone Unit 2 waste gas system may continue provided that best efforts are made to repair the instrument and that prior to initiating the release:

a) At least two independent samples of the tank's contents are analyzed; and

b) The original release rate calculations and discharge valve lineups are independently verified by a second individual. Otherwise, suspend releases from the waste gas holdup system.

Action E

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, Millstone Unit 2 releases via the Millstone Stack may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours. If the monitor flow and readout are not adversely affected by the loss of functionality, the daily CHANNEL CHECK may be performed in lieu of the grab sample. ①

TABLE IV.C.–4 Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.MP2 Vent (normal range, RM–8132 only; high range monitor, RM–8168, requirements are in the TS)				
a. Noble Gas Radioactivity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Vent Flow Rate Monitor	D	NA	R	Q
e. Sampler Flow Rate Monitor	D	NA	R	NA
2.Millstone Stack – applicable to the WRGM (RM–8169, normal range, channel 1, only; mid range channel 2 and high range channel 3 requirements are contained in TRM LCO 3.3.3.8)				
a. Noble Gas Radioactivity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Stack Flow Rate Monitor	D	NA	R	Q(2)
e. Sampler Flow Rate Monitor	D	NA	R	NA
3.Waste Gas Holdup System				
a. Noble Gas Monitor	D*	P	R(1)	Q(2)

*During releases via this pathway and when the monitor is required FUNCTIONAL per Table IV.C.–3. The CHANNEL CHECK should be performed when the discharge is in progress.

P = Prior to discharge
D = Daily
W = Weekly
M = Monthly
R = Once every 18 months
Q = Once every 3 months
NA= Not Applicable

TABLE IV.C.–4
TABLE NOTATION

(1) Calibration shall include the use of a known source whose strength is determined by a detector which has been calibrated to a source which is traceable to the NIST. These sources shall be in a known, reproducible geometry.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation* occurs if any of the following conditions exist:

a) Instrument indicates measured levels above the alarm/trip setpoint.

b) Instrument indicates a downscale failure.

* – Also demonstrate automatic isolation for the waste gas system noble gas monitor.

IV.D. Radioactive Effluents Concentrations And Dose Limitations

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATIONS

The concentration of radioactive material released from the site (see Figure IV.D.−1) shall not exceed ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 2×10^{-4} μCi/ml total radioactivity. ①

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released from the site exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

2) The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Specification IV.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATIONS

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 2 released from the site (see Figure IV.D.–1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ; and,

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations. Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in Section II at least once per 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATIONS

The dose rate, at any time, offsite (see Figure IV.D.–1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

a. The dose rate limit for noble gases shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin; and,

b. The dose rate limit for Iodine–131, Iodine–133, Tritium, and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate to comply with the limit(s) given in Specification IV.D.2.a. within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) The release rate, at any time, of noble gases in gaseous effluents shall be controlled by the offsite dose rate as established above in Specification IV.D.2.a. The corresponding release rate shall be determined in accordance with the methodology of Section II.

2) The noble gas effluent monitors of Table IV.C.–3 shall be used to control release rates to limit offsite doses within the values established in Specification IV.D.2.a.

3) The release rate of radioactive materials in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATIONS

The air dose offsite (see Figure IV.D.–1) due to noble gases released in gaseous effluents from Unit 2 shall be limited to the following:

a. During any calendar quarter, to less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation;

b. During any calendar year to less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

c. Gaseous Effluents – Doses from Radionuclides Other than Noble Gas

LIMITING CONDITIONS OF OPERATIONS

The dose to any REAL MEMBER OF THE PUBLIC from Iodine–131, Iodine–133, Tritium, C–14, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 2 (see Figure IV.D.–1) shall be limited to the following: ①

a. During any calendar quarter to less than or equal to 7.5 mrem to any organ;

b. During any calendar year to less than or equal to 15 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

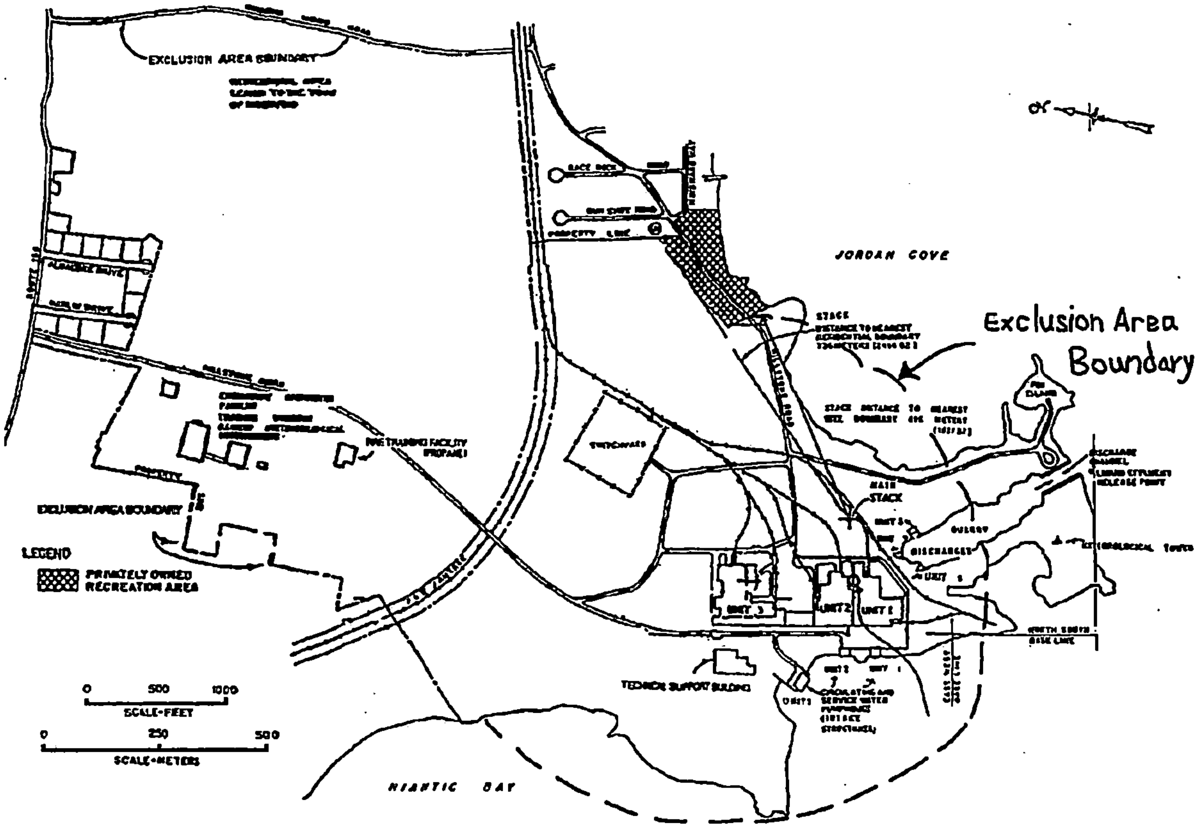
a. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

Figure IV.D.–1, "Site Boundary for Liquid and Gaseous Effluents"



IV.E. Total Radiological Dose From Station Operation

CONTROLS

The annual dose or dose commitment to any REAL MEMBER OF THE PUBLIC, beyond the site boundary, from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which is limited to less than or equal to 75 mrem).

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls IV.D.2.a., IV.D.1.b., or IV.D.2.c. prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the dose commitment from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. This Special Report shall include an analysis which demonstrates that radiation exposures from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site (including all effluent pathways and direct radiation) are less than the 40 CFR 190.

If the estimated doses exceed the above limits, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with Section II once per 31 days.

IV.F. Bases

Section IV.C.1. – Radioactive Liquid Effluent Monitoring Instrumentation

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the approved methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding ten times the limits of 10 CFR 20. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 50. Monitoring of the turbine building sumps and condensate polishing facility floor drains is not required due to relatively low concentrations of radioactivity possible.

Section IV.C.2. – Radioactive Gaseous Effluent Monitoring Instrumentation

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm setpoints for these instruments shall be calculated in accordance with the approved methods in the REMODCM to ensure that the alarm will occur prior to exceeding the dose rate limits, at any time, as specified in Section IV.D.2.a. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 50.

Two types of radioactive gaseous effluent monitoring instrumentation, monitors and samplers, are being used at MP2 vent and Millstone Stack. Monitors have alarm setpoints and are demonstrated functional by performing one or more of the following operations: CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST. Samplers are strictly collection devices made of canisters and filters. The CHANNEL CHECK surveillance requirements are met through (1) documented observation of the in–service rad monitor sample flow prior to filter replacement; (2) documented replacement of in–line iodine and particulate filters; and (3) documented observation of sample flow following the sampler return to service. The flow indicator is the only indication available for comparison. These observations adequately provide assurance that the sampler is operating and is capable of performing its design function.

There are a number of gaseous release points which could exhibit very low concentrations of radioactivity. For all of these release paths, dose consequences would be insignificant due to the intermittent nature of the release and/or the extremely low concentrations of radioactivity. Since it is not cost–beneficial (nor in many cases practical due to the nature of the release (steam) or the impossibility of detecting such low levels), to monitor these pathways, it has been determined that these release paths require no monitoring or sampling.

Section IV.D.1.a. – Radioactive Liquid Effluents Concentrations

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR 50, to an individual and (2) the limits of 10 CFR 20 to the population. The concentration limit for noble gases is based upon the assumption that Xe−135 is the controlling radioisotope and its concentration in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Section IV.D.1.b. – Radioactive Liquid Effluents Doses

This specification is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR 50. The specification implements the guides set forth in Section II.A of Appendix I. The Action statements provide the required operating flexibility and at the same time implement the guides set forth in Section III.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, Revision 1, October 1977, and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Section IV.D.2.a. – Radioactive Gaseous Effluents Dose Rate

This specification is provided to ensure that the dose rate at anytime from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR 20, Appendix B, Table 2. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual offsite to annual average concentrations exceeding the limits specified in Appendix B, Table 2 of 10 CFR 20. For individuals who may, at times, be within the site boundary, the occupancy of that individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid or any other organ dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

SECTION V.

Millstone Unit 3

Radiological Effluent Controls

Docket Nos. 50–423

SECTION V. REMODCM UNIT THREE CONTROLS

V.A. Introduction

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

a. the effluent radiation monitor controls and surveillance requirements,

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

c. the bases for the controls and surveillance requirements.

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

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

V.B. Definitions and Applicability and Surveillance Requirements

V.B.1 – Definitions

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

1. ACTION – ACTION shall be that part of the control which prescribes remedial measures required under designated conditions.

2. CHANNEL FUNCTIONAL TEST – A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify FUNCTIONALITY of alarm, interlock and/or trip functions. For digital instruments, the computer database may be manipulated, in lieu of a signal injection, to verify functionality of alarm and/or trip functions.

   The CHANNEL FUNCTIONAL TEST shall include adjustments, as necessary, of the alarm, interlock and/or trip setpoints such that the setpoints are within the required range and accuracy.

3. CHANNEL CALIBRATION – A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock and/or trip functions and may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

4. CHANNEL CHECK – A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

5. DOSE EQUIVALENT I–131 – DOSE EQUIVALENT I–131 shall be that concentration of I–131 (μCi/gram) which alone would produce the same CDE–thyroid dose as the quantity and isotopic mixture of I–131, I–132, I–133, I–134, and I–135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed under Inhalation in Federal Guidance Report No. 11 (FGR 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion."

6. MEMBER(S) OF THE PUBLIC – MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors or its vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

   The term "REAL MEMBER OF THE PUBLIC" means an individual who is exposed to existing dose pathways at one particular location.

7. MODE – Refers to Mode of Operation as defined in Safety Technical Specifications.

8. FUNCTIONAL – FUNCTIONALITY – An instrument shall be FUNCTIONAL or have FUNCTIONALITY when it is capable of performing its specified functions(s) and when all necessary attendant instrumentation, controls, electrical power, or other auxiliary equipment that are required for the instrument to perform its functions(s) are also capable of performing their related support function(s).

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

10. SOURCE CHECK – A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to radiation.

11. UNRESTRICTED AREA – Any area at or beyond the SITE BOUNDARY to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the SITE BOUNDARY used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

V.B.2 – Applicability

V.B.2.a – LIMITING CONDITIONS FOR OPERATION

1. Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

2. Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and associated ACTION requirements are not met within the specified time intervals. If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

V.B.2.b – SURVEILLANCE REQUIREMENTS

1. Surveillance Requirements shall be applicable during any condition specified for individual Limiting Conditions for Operation unless otherwise stated in an individual Surveillance Requirement.

2. Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance time interval.

3. Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Condition V.B.2.b(2), shall constitute a failure to meet the FUNCTIONALITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on nonfunctional equipment. ①

4. Entry into any specified condition shall not be made unless the Surveillance Requirement(s) associated with the Limiting Condition for Operation have been performed within the stated surveillance interval or as otherwise specified.

V.C. Radioactive Effluent Monitoring Instrumentation

1. Radioactive Liquid Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE V.C.–1
Radioactive Liquid Effluent Monitoring Instrumentation

Instrument	Minimum # Functional	Applicability	Action
1.Radioactivity Monitors Providing Alarm and Automatic Termination Of Release			
a. Waste Neutralization Sump Monitor Condensate Polishing Facility	1*	##	D
b. Turbine Building Floor Drains	1	#	B
c. Liquid Waste Monitor	1	#	A
d. RESERVED			
e. Steam Generator Blowdown Monitor	1	###	B
2.Flow Rate Measurement Devices – No Alarm Setpoint Requirements			
a. Waste Neutralization Sump Effluents	1*	#	C
b. RESERVED			
c. Liquid Waste Effluent Line	1	#	C
d. RESERVED			
e. Steam Generator Blowdown Effluent Line	1	###	C

* NA if tritium in the steam generators is less than detectable, or gamma radioactivity in the steam generators is less than 5×10^{-7} μCi/ml, or the sump is being directed to radwaste.

At all times – which means that channels shall be FUNCTIONAL and in service on a continuous, uninterrupted basis, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

MODEs 1–5, and MODE 6 when pathway is being used, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument. The monitor must be on-line with no unexpected alarms. When the affected discharge path is isolated in MODE 6, the applicable LCO and Surveillance Requirements are not applicable.

MODEs 1–4, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument. The monitor must be on-line with no unexpected alarms.

TABLE V.C.–1
ACTION STATEMENTS

Action A

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

1. At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification V.D.1.a. and;
2. The original release rate calculations and discharge line valving are independently verified by a second individual.

Action B

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that grab samples are analyzed for gamma radioactivity at the lower limits of detection specified in Table I.C.–3:

1. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 μCi/gram DOSE EQUIVALENT I–131, or
2. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 μCi/gram DOSE EQUIVALENT I–131.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

Action D

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

1. At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification V.D.1.a., and;
2. If one of the samples has gamma radioactivity greater than any of the lower limits of detection specified in Table I.C.–3, the original release rate calculations and discharge valving are independently verified by a second individual.

TABLE V.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Radioactivity Monitors Providing Alarm and Automatic Termination Of Release				
a. Waste Neutralization Sump Monitor Condensate Polishing Facility	D	P	R(2)	Q(1)
b. Turbine Building Floor Drains	D	M	R(2)	Q(1)
c. Liquid Waste Monitor	D	P	R(2)	Q(1)
d. Deleted				
e. Steam Generator Blowdown Monitor	D	M	R(2)	Q(1)
2.Flow Rate Measurements				
a. Waste Neutralization Sump Effluents	D(3)	NA	R	Q
b. RESERVED				
c. Liquid Waste Effluent Line	D(3)	N/A	R	Q
d. Deleted				
e. Steam Generator Blowdown Effluent Line	D(3)	N/A	R	Q

D = Daily
M = Monthly
P = Prior to each batch release
R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

TABLE V.C.–2
TABLE NOTATION

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur if any of the following conditions exists:

a) Instrument indicates measured levels above the alarm/trip setpoint, or

b) Circuit failure (Alarm only), or Instrument indicates a downscale failure (Alarm only).

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities of NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(3) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

The radioactive gaseous effluent monitoring instrumentation channels shown in Table V.C.–3 shall be FUNCTIONAL with their Alarm Setpoints set to ensure that the limits of Specification V.D.2.a. are not exceeded. The Alarm Setpoints of these channels shall be determined in accordance with the methodology and parameters in Section II.

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

ACTION:

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

b. With the number of FUNCTIONAL radioactive gaseous effluent monitoring instrumentation channels less than the Minimum Channels FUNCTIONAL, take the ACTION shown in Table V.C.–3. Exert best efforts to restore the nonfunctional instrumentation to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Release need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENT

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

TABLE V.C.–3
Radioactive Gaseous Effluent Monitoring Instrumentation

Instrument	Minimum Channels Functional	Applicability	Action
1.Millstone Unit 3 Ventilation Vent (Turbine Building – HVR–RE10B, normal range only; high range monitor, HVR–RE10A, requirements are in the TRM)			
a. Noble Gas Radioactivity Monitor Providing Alarm	1	*	A
b. Iodine Sampler	1	*	B
c. Particulate Sampler	1	*	B
d. Vent Flow Rate Monitor	1	*	C
e. Sampler Flow Rate Monitor	1	*	C
2.Millstone Stack – applicable to SLCRS (HVR–RE19B, normal range only; high range monitor, HVR–RE19A, requirements are in the TRM)			
a. Noble Gas Radioactivity Monitor Providing Alarm	1	*	A
b. Iodine Sampler	1	*	B
c. Particulate Sampler	1	*	B
d. Process Flow Rate Monitor	1	*	C
e. Sampler Flow Rate Monitor	1	*	C
3.Engineered Safeguards Building Monitor (HVQ–RE49)			
a. Noble Gas Radioactivity Monitor	1	*	D
b. Iodine Sampler	1	*	B
c. Particulate Sampler	1	*	B
d. Discharge Flow Rate Monitor	1	*	E
e. Sampler Flow Rate Monitor	1	*	C

①
①
①

TABLE V.C.–3
Table Notations

* Whenever the release path is in service. Outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

TABLE V.C.–3
ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that

a) best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours, OR

b) if the cause of the nonfunctionality is solely due to a loss of annunciation in the control room and the Remote Indicating Controller (RIC) remains FUNCTIONAL, perform a channel check at the RIC at least once per twelve hours and verify the indication has not alarmed.

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that effluent is continuously sampled with auxiliary sampling equipment at least once per seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Auxiliary sampling must be initiated within 12 hours after initiation of this ACTION statement. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated at least once per 5 hours. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours.

Action E

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument.

TABLE V.C.–4 **Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements**					
Instrument	Channel Check	Source-Check	Channel Calibra-tion	Channel Functional Check	When Surveil-lance is Required
1.Millstone Unit 3 Ventilation Vent (Turbine Building – HVR–RE10B, normal range only; high range monitor, HVR–RE10A, requirements are in the TRM)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Vent Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*
2.Millstone Stack – applicable to SLCRS (HVR–RE19B, normal range only; high range monitor, HVR–RE19A, requirements are in the TRM)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Process Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*
3.Engineered Safeguards Building Monitor (HVQ–RE49)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Discharge Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*

* At all times except when the vent path is isolated.

D = Daily
W = Weekly
M = Monthly

R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

TABLE V.C.–4
Table Notations

(1) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities of NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exist:

a) Instrument indicates measured levels above the Alarm Setpoint, or

b) Circuit failure, or

c) Instrument indicates a downscale failure.

(3) The CHANNEL CALIBRATION shall include the use of a known source whose strength is determined by a detector which has been calibrated to an NIST source. These sources shall be in know, reproducible geometry.

V.D. Radioactive Effluents Concentrations And Dose Limitations

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATION

The concentration of radioactive material released from the site (see Figure V.D.–1) shall be limited to ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 2 x 10^{-4} μCi/ml total radioactivity. ①

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released from the site exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

2) The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Specification V.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATION

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 3 released from the site (see Figure V.D.–1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ; and,

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations. Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in Section II at least once per 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATION

The dose rate, at any time, offsite (see Figure V.D.−1) due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

a. The dose rate limit for noble gases shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin; and,

b. The dose rate limit due to inhalation for Iodine−131, Iodine−133, Tritium, and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate to comply with the limit(s) given in Specification V.D.2.a. within 15 minutes.

SURVEILLANCE REQUIREMENTS

1) The release rate, at any time, of noble gases in gaseous effluents shall be controlled by the offsite dose rate as established in Specification V.D.2.a. The corresponding release rate shall be determined in accordance with the methodology of Section II.

2) The noble gas effluent monitors of TableV.C.−3 shall be used to control release rates to limit offsite doses within the values established in Specification V.D.2.a.

3) The release rate of radioactive materials in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program, specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATION

The air dose offsite (see Figure V.D.–1) due to noble gases released from Unit 3 in gaseous effluents shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

c. Gaseous Effluents – Doses from Radionuclides Other than Noble Gas

LIMITING CONDITIONS OF OPERATION

The dose to any REAL MEMBER OF THE PUBLIC from Iodine–131, Iodine–133, Tritium, C–14, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 3 released offsite (see Figure V.D.–1) shall be limited to the following: ①

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,

b. During any calendar year: Less than or equal to 15 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

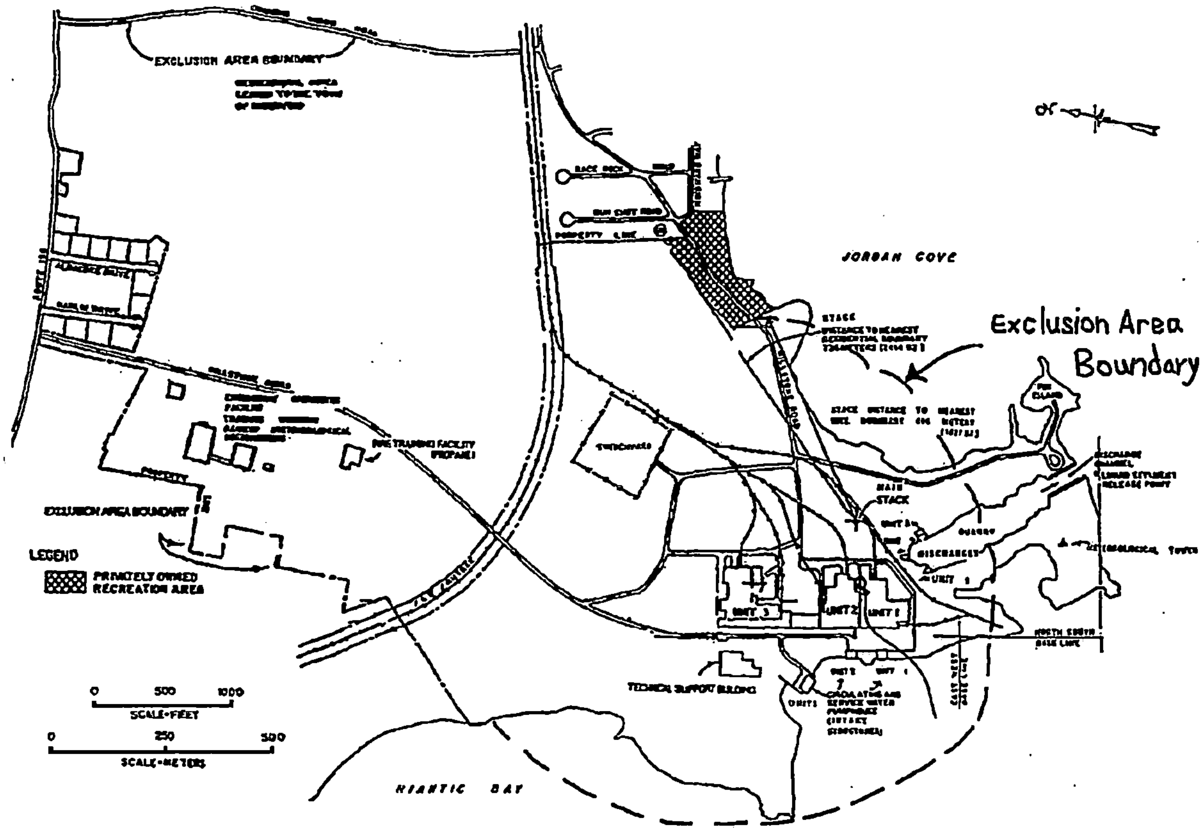
c. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limit.

SURVEILLANCE REQUIREMENTS

1) Dose Calculations – Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with Section II once every 31 days.

2) Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in Section I.

Figure V.D.–1, "Site Boundary for Liquid and Gaseous Effluents"



V.E. Total Radiological Dose From Station Operations

CONTROLS

The annual dose or dose commitment to any REAL MEMBER OF THE PUBLIC, beyond the site boundary, from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which is limited to less than or equal to 75 mrem).

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls V.D.1.b., V.D.2.b., or V.D.2.c. prepare and submit a Special Report to the Commission within 30 days and limit the subsequent releases such that the dose commitment from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site is limited to less than or equal to 25 mrem to the total body or any organ (except thyroid, which is limited to less than or equal to 75 mrem) over 12 consecutive months. ① This Special Report shall include an analysis which demonstrates that radiation exposures from the site to any REAL MEMBER OF THE PUBLIC from the Millstone Site (including all effluent pathways and direct radiation) are less than the 40 CFR 190 Standard.

If the estimated doses exceed the above limits, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with Section II once per 31 days.

V.F. Bases

Section V.C.1. – Radioactive Liquid Effluent Monitoring Instrumentation

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section II to ensure that the alarm/trip will occur prior to exceeding ten times the limits of 10 CFR 20. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 20 Part 50.

FUNCTIONALITY of a radiation monitor is determined by its ability to perform its specified function. The specified function of the radioactivity monitors listed in Table V.C.–1 is to provide Control Room alarm annunciation and automatic termination of release. The monitor must be on-line with no unexpected alarms in order to perform its specified function.

Definition B.7 states a component is FUNCTIONAL when it is capable of performing its specified function. The monitors are described in Tables V.C.–1 and V.C.–2 as "Radioactivity Monitors Providing Alarm and Automatic Termination of Releases." Table V.C.–2 Note 1 requires that the Analog Channel Operational Test (ACOT) demonstrate that automatic isolation and "control room annunciation" occur. Control room annunciation cannot occur unless the monitor is on line (i.e. in communication with the RMS computer.). Section V.C.1. Surveillance Requirement requires that the ACOT be performed to demonstrate FUNCTIONALITY. General Design Criteria 64 states in part: "Means shall be provided for monitoring effluent discharge paths for radioactivity." Regulatory Guide 1.21 Appendix A describes a monitor program that is acceptable to the Regulatory staff. Under Section B of Appendix A, "LIQUID EFFLUENTS," the first paragraph states in part: "During the release of radioactive wastes, the effluent control monitor should be set to alarm and to initiate automatic closure..."

Certain of the monitors listed in Table V.C.–1 are designed to operate without sample pumps. These monitors utilize pressure in the effluent line during discharge to provide sample flow and sample pressure. Low sample flow and/or low sample pressure alarms may be received when no discharge is in progress. These are expected alarms. Sample flow and/or sample pressure will return to normal when the discharge is initiated. These alarms will clear when discharge begins. The monitors are FUNCTIONAL since they are able to perform their specified function with the expected alarms in.

Table V.C.–1 note ## requires entry into the radioactive liquid effluent monitoring action statements whenever the radiation monitors are not available in the required MODE. This note applies to items 1.a (3CND-RE07, Waste Neutralization Sump), 1.d (3LWC-RE65, Regenerate Evaporator Monitor), and 1.e (3SSR-RE08, Steam Generator Blowdown Monitor) in Table V.C.–1. The original issue of this requirement (as a Technical Specification) in January 1986 stated the applicability was "At all times." Technical Specification Amendment 22 added "APPLICABILITY" (now defined as functionality) to Table V.C.–1 (then Tech Spec Table 3.3-). The applicability (now defined as functionality) added in Amendment 22 is the present wording. The letter 1312821, dated February 24, 1988, in the following sections discusses the change request and are quoted below:

- In "Discussion": "The proposed changes will now explicitly allow a monitor to be taken out of service for up to hours for maintenance/testing without entering the ACTION statement."

- In "Significant Hazards Consideration" item 1: "the proposed changes would only allow these radiation monitors to be out of service for a short period of time (12 hours)."

- In "Significant Hazards Consideration" item 2: "The proposed changes also have no effect on alarm setpoints or control functions. Further, no operator actions that are required to mitigate any accident rely solely on these monitors, and these monitors provide no protective functions."

  Technical Specification Amendment 22 provided for the following:

- allowance for planned nonfunctionality of monitoring instrumentation for up to hours for the purpose of maintenance and performance of required test, check, calibration or sampling

- a requirement to initiate auxiliary sampling within hours after nonfunctionality of certain gaseous effluent monitors

- allowance for nonfunctionality of certain effluent monitoring instrumentation, during MODE 6 (refueling) when the effluent pathway is not being used.

<u>Section V.C.2.– Radioactive Gaseous Effluent Monitoring Instrumentation</u>

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section II to ensure that the alarm/trip will occur prior to exceeding the limits of SectionV.D.2.a. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR 20 Part 50.

The sensitivity of any noble gas radioactivity monitors used to show compliance with the gaseous effluent release requirements of Specification V.C.2.a shall be such that concentrations as low as 1 x 10^{-6} μCi/cc are measurable. ①

The vent normal range radiation monitor, HVR*10B, satisfies the requirements of SectionV.C.2. for Unit 3 releases to the vent which is located on the turbine building. There are no requirements in the REMODCM associated with the vent high range radiation monitor, HVR*10A.

The SLCRS normal range radiation monitor, HVR*19B, satisfies the requirements of SectionV.C.2. for Unit 3 releases to the Millstone Stack. There are no requirements in the REMODCM associated with the SLCRS high range radiation monitor, HVR*19A.

Section V.D.1.a. – Radioactive Liquid Effluents Concentrations

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR 20.1301 to the population. The concentration limit for noble gases is based upon the assumption that Xe–135 is the controlling radioisotope and its concentrations in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Section V.D.1.b. – Radioactive Liquid Effluents Doses

This specification is provided to implement the requirements of Sections II.A., III.A., and IV.A. of Appendix I, 10 CFR Part 50. The specification implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section III.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable." The dose calculation methodology and parameters in Section II implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I is to be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in Section II for calculating the doses due to the actual release rates of radioactive materials in liquid effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1, October 1977, and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Section V.D.2.a. – Radioactive Gaseous Effluents Dose Rate

This specification will ensure that the dose from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for all areas offsite. The annual dose limits specified in this section are the dose limits from the version of 10 CFR Part 20 prior to 1994. Annual dose limit in the current version of 10CFR20 were reduced from 500 to 100 mrem. But REMODCM restrictions will not allow the current annual dose limit to be exceeded because the REMODCM requires termination, within fifteen minutes, of any release which exceed the setpoint and much lower annual dose limits from 10CFR50, Appendix I are implemented. For individuals who may, at times, be within the SITE BOUNDARY, the occupancy of that individual will be usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid or any other organ dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

Section V.D.2.b. – Radioactive Gaseous Effluents Noble Gas Dose

This specification is provided to implement the requirements of Sections II.B., III.A., and IV.A. of Appendix I, 10 CFR Part 50. The specification implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section V.A. of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A. of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in Section II for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculational of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision 1, July 1977.

The Section II equations provided for determining the air doses at the site boundary are based upon utilizing successively more realistic dose calculational methodologies. More realistic dose calculational methods are used whenever simplified calculations indicate a dose approaching a substantial portion of the regulatory limits. The methods used are, in order, previously determined air dose per released radioactivity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released. ①

Section V.D.2.c. – Radioactive Gaseous Effluents for Radionuclides Other Than Noble Gas

These specifications are provided to implement the requirements of Sections II.C., III.A., and IV.A. of Appendix I, 10 CFR Part 50. The specifications are the guides set forth in Section II.C. of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A. of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The Section II calculational methods specified in the surveillance requirements implement the requirements in Section III.A. of Appendix I that conformance with the guides for Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The Section II calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light–Water–Cooled Reactors," Revision I, July 1977. The release rate specifications for radioiodines, radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man. The pathways that are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Section V.E. – Total Radiological Dose from Station Operations

This specification is provided to meet the dose limitations of 40 CFR 190. For the purpose of the Special Report, it may be assumed that the dose commitment to any REAL MEMBER OF THE PUBLIC from other fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered.