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Dominion

APR 27 2006

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

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Docket Nos.	50-245
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	50-423
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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 1, 2, AND 3
2005 RADIOACTIVE EFFLUENT RELEASE REPORT

In accordance with 10 CFR 50.36a, this letter transmits the annual Radioactive Effluent Release Report for the period January 2005 through December 2005. This report meets the provisions of Section 5.7.3 of the Millstone Unit 1 Permanently Defueled Technical Specifications (PDTS), and Sections 6.9.1.6b and 6.9.1.4 of the Millstone Units 2 and 3 Technical Specifications, respectively.

Attachment 1 transmits Volume I of the 2005 Radioactive Effluent Release Report, in accordance with Regulatory Guide 1.21. Volume I contains information regarding airborne, liquid, and solid radioactivity released from Millstone, as well as off-site dose from airborne and liquid effluents, and a description of changes made to the Radioactive Effluent Monitoring and Off-site Dose Calculation Manual (REMODCM) during the year 2005.

Attachment 2 transmits Volume II of the report, which contains those changes made to the REMODCM through 2005. Volume II consists of a complete copy of the REMODCM as of December 31, 2005, which satisfies the requirements of Sections 5.6.1c of the Millstone Unit 1 PDTS, and Sections 6.15c and 6.9.13c of the Millstone Units 2 and 3 Technical Specifications, respectively.

If you have any questions or require additional information, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

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JE48
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Attachments: 2

Commitments made in this letter: None.

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Serial No. 06-333
Docket Nos. 50-245
50-336
50-423
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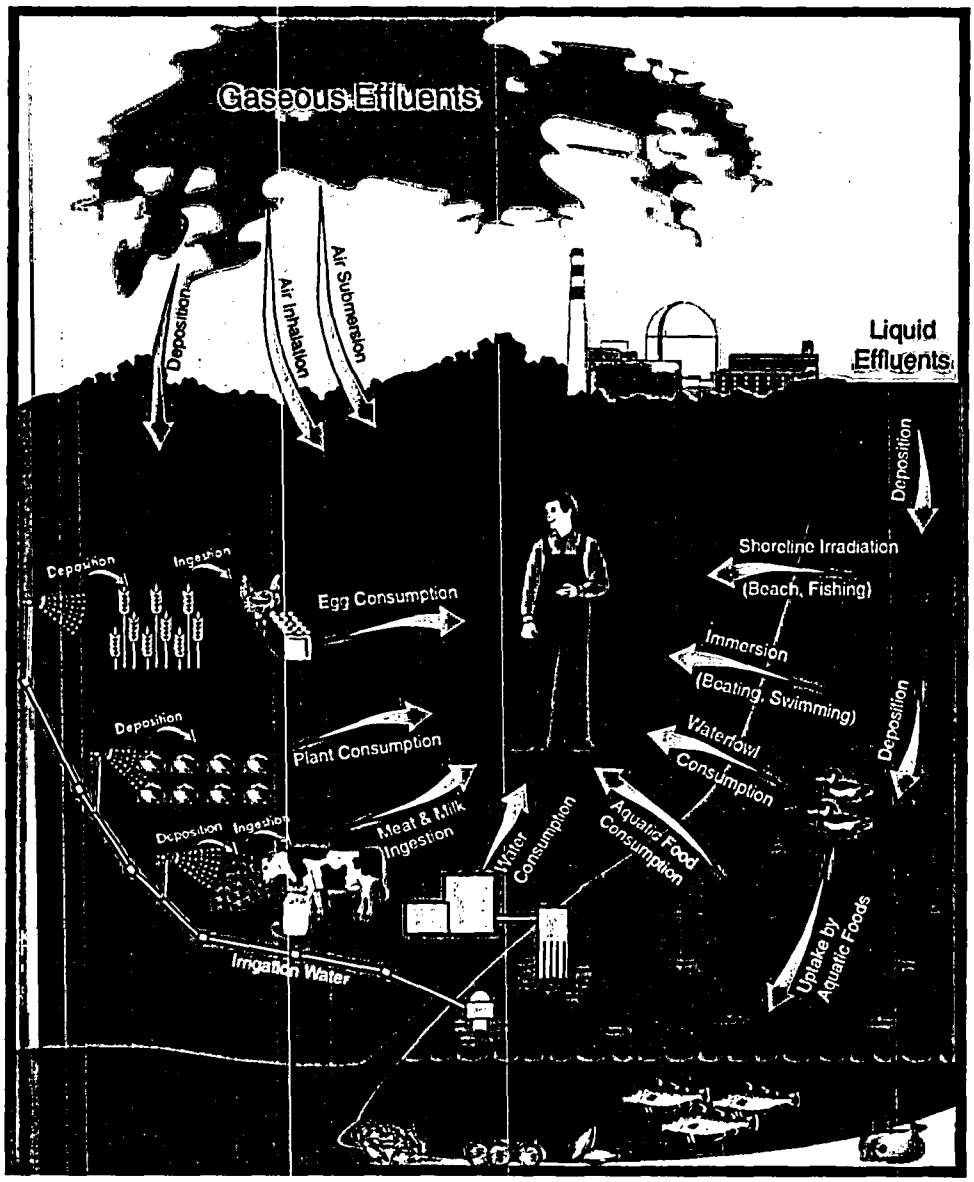
DPR-65
NPF-49

Attachment 1

2005 Radioactive Effluent Release Report
Volume I

Millstone Power Station Units 1, 2, and 3
Dominion Nuclear Connecticut, Inc. (DNC)

Millstone Power Station
2005 Radioactive Effluent Release Report
Volume I



Dominion

Dominion Nuclear Connecticut, Inc.

MILLSTONE UNIT	LICENSE	DOCKET
1	DPR-21	50-245
2	DPR-65	50-336
3	NPF-49	50-423

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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. Intentionally left blank

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. Intentionally left blank

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 Energy, 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 Environmental Protection Agency, Part 190 Environmental Radiation Protection Standard for Nuclear Power Operation.

9. Memo No. MP-HPO-05-016, 2004 Report on Solid Waste and Irradiated Component Shipments, March 18, 2005.

10. DOSLIQ-Dose Excel Code for Liquid Effluents,Software Document File, Rev 1, February 2002

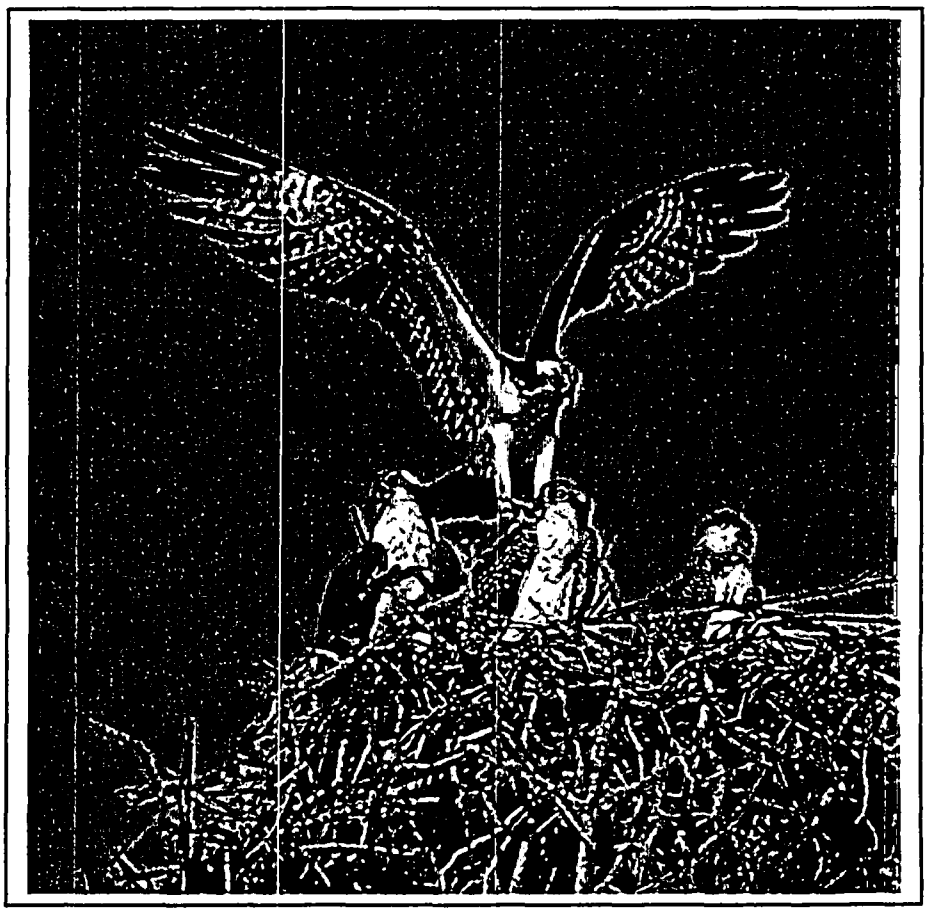
11. DOSAIR-Dose Excel Code for Airborne Effluents,Software Document File, Rev 0, February, 2002

12. GASPAR II - Technical Reference and User Guide (NUREG/CR-4653), March 1987.

Introduction

This report, for the period of January through December of 2005, is being submitted by Dominion Nuclear Connecticut, Inc. for Millstone Power Station's Units 1, 2, and 3, in accordance with 10CFR50.36a, the REMODCM, and the Station's Technical Specifications. A combined report, written in the US NRC Regulatory Guide 1.21 format, is submitted for all three units.

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



Nesting Ospreys

1.0 Off-Site Doses

This report provides a summary of the 2005 off-site radiation doses from releases of radioactive materials in airborne and liquid effluents from Millstone Units 1, 2, and 3. This includes the annual maximum dose (mrem) to any real member of the public as well the maximum gamma and beta air doses.

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

1.1 Dose Calculations

The off-site dose to humans from radioactive airborne and liquid effluents have been calculated using measured radioactive effluent data, measured meteorological data, and the dose computer models DOSAIR and DOSLIQ, which were developed by Millstone. The methodology and input parameters for DOSAIR are those used in GASPAR II (Reference 12) and NRC Regulatory Guide 1.109 (Reference 3). The methodology and input parameters for DOSLIQ are those used in LADTAP II (Reference 6) and NRC Regulatory Guide 1.109 (Reference 3). The calculated doses generally tend to be conservative due to the conservative model assumptions. More realistic estimates of the off-site dose can be obtained by analysis of environmental monitoring data. A comparison of doses estimated by each of the above methods is presented in the Annual Radiological Environmental Operating Report.

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

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

The dose calculations are based upon three types of input: radioactive source term, site-specific data, and generic factors. The radioactive source terms (Curies) are characterized in Section 2, Radioactivity, of this report. The site-specific data includes: meteorological data (e.g. wind speed, wind direction, atmospheric stability, etc.) to calculate the transport and dispersion of airborne effluents, and dilution factors for liquid effluents. The generic factors include the average annual consumption rates (for inhalation of air and ingestion of fruits, vegetables, leafy vegetables, grains, milk, poultry, meat, fish, and shellfish) and occupancy factors (for air submersion and ground irradiation, shoreline activity, swimming, boating, etc.). All these inputs are used in the appropriate dose models to calculate the maximum individual dose from radioactive airborne and liquid effluents.

1.1.1 Airborne Effluents

Maximum Individual doses due to the release of noble gases, radioiodines, and particulates were calculated using the computer code DOSAIR (Reference 11). This is equivalent to the NRC code, GASPAR II, which uses a semi-infinite cloud model to implement the NRC Regulatory Guide 1.109 (Reference 3) dose models.

The values of average relative effluent concentration (χ/Q) and average relative deposition (D/Q) used in the DOSAIR code were generated using EDAN 3, a meteorological computer code which

implements the assumptions cited in NRC Regulatory Guide 1.111 (Reference 5), Section C. The annual summary of hourly meteorological data (in 15-minute increments), which includes wind speed, direction, atmospheric stability, and joint frequency distribution, is not provided in the report but can be retrieved from computer storage.

Millstone Stack (375 ft) releases are normally considered elevated with Pasquill stability classes determined based upon the temperature gradient between the 33 ft and 374 ft meteorological tower levels. The doses were conservatively calculated using mixed mode 142 ft meteorology since DOSAIR may underestimate the plume exposure (prior to plume touchdown) for elevated releases from the Millstone Stack. All three units previously had the ability to discharge effluents to the Millstone Stack. However, in March 2001, Unit 1 was separated from releasing to the stack and modifications were made to add two new release points, the Spent Fuel Pool Island Vent (SFPI) and the Balance of Plant Vent (BOP).

Unit 1 Spent Fuel Pool Island Vent (73 ft) and the Balance of Plant Vent (80 ft) releases are considered ground level, therefore these doses were calculated using the 33 ft meteorology. Continuous ventilation of the spent fuel pool island and evaporation from the spent fuel pool water (H-3) release to the Spent Fuel Pool Island Vent. Continuous ventilation from other Unit 1 buildings and airborne releases from the reactor building evaporator are discharged to the BOP Vent. Each of these doses were summed to determine the total Unit 1 airborne effluent dose.

Unit 2 Auxiliary Building Ventilation, Steam Generator Blowdown Tank Vent, and Containment Purge (through the Unit 2 Vent)(159 ft) releases are considered mixed mode (partially elevated and partially ground) continuous releases. The first two of these are continuous releases while the Containment Purge is typically a batch release. For these, Pasquill stability classes are determined based upon the temperature gradient between the 33 ft and 142 ft meteorological tower levels. Batch Waste Gas Decay Tanks and Containment Vents are typically discharged via the Millstone Stack. The doses for these elevated releases were conservatively calculated using mixed mode 142 ft meteorology. The Containment Equipment Hatch and the RWST Tank Vent releases are considered ground level where the 33 ft meteorology was used for the dose calculations. Each of the doses for the various release points were summed to determine the total Unit 2 airborne effluent dose.

The Unit 3 (142.5 ft) Vent is considered a mixed mode (partially elevated and partially ground) release point. The Pasquill stability classes are determined based upon the temperature gradient between the 33 ft and 142 ft meteorological tower levels. Auxiliary Building Ventilation is a mixed mode continuous release while Containment Purge and "initial" Containment Drawdown (through the roof of the Auxiliary Building) are considered mixed mode batch releases. Gaseous waste and operational containment drawdowns are released through the Unit 3 SLCRS system to the Millstone Stack (375 ft). The doses for these elevated releases were conservatively calculated using mixed mode 142 ft meteorology. The Engineered Safety Features Building (ESF) Ventilation, the Containment Equipment Hatch, and RWST Vent releases are considered ground level where the doses were calculated using 33 ft meteorology. Similar to Unit 2, each of the doses for the various release points was summed to determine the total Unit 3 airborne effluent dose.

1.1.2 Liquid Effluents

Maximum individual doses from the release of radioactive liquid effluents were calculated using the DOSLIQ program (Reference 10). This program uses the dose models and parameters cited in NRC Regulatory Guide 1.109 with site-specific inputs to produce results similar to the LADTAP II code, (Reference 6).

1.2 Dose Results

The calculated maximum off-site doses are presented in Table 1-1 for airborne effluents and Table 1-2 for liquid effluents.

1.2.1 Airborne Effluents

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

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

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

For the vegetation pathway, the maximum individual dose is calculated at the vegetable garden of the highest D/Q (or highest χ/Q when only tritium is released). For the vegetation pathway, the calculated dose is included in the maximum individual's dose only at locations and times where these pathways actually exist.

For the meat, cow's milk, and goat's milk pathways, the calculated dose is included in the maximum individual's dose only at locations and times where these pathways actually exist.

To determine compliance with 10CFR50, 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

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

1.2.3 Analysis of Results

Table 1-3 provides a quantitative dose comparison with the limits specified in the REMODCM. The data indicates that the total whole body and organ doses to the maximum offsite individual from Millstone Station including all sources of the fuel cycle are well within the limits of 40CFR190 (Reference 8). On-site radioactive waste storage during this year was within storage criteria and the maximum dose to a member of the public was approximately 0.12 mrem/yr. The doses from airborne and liquid effluents were added to the estimated dose from on-site radioactive waste storage to show compliance with 40CFR190.

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

Table 1-1
2005 Off-Site Dose Commitments from Airborne Effluents
Millstone Units 1, 2, 3

Unit 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	(mrad)	(mrad)	(mrad)	(mrad)	(mrad)
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	1.98E-04	1.85E-04	2.02E-04	1.50E-04	7.34E-04
Skin	2.22E-04	1.87E-04	2.02E-04	1.70E-04	7.81E-04
Thyroid	1.97E-04	1.78E-04	2.02E-04	1.49E-04	7.26E-04
Max organ+	1.99E-04	2.29E-04	2.02E-04	1.50E-04	7.80E-04

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	(mrad)	(mrad)	(mrad)	(mrad)	(mrad)
Beta	3.73E-04	4.91E-03	6.59E-04	2.95E-04	6.24E-03
Gamma	2.06E-04	9.70E-04	3.57E-04	3.66E-05	1.57E-03
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	2.48E-04	2.11E-03	1.84E-03	1.63E-04	4.37E-03
Skin	5.31E-04	4.57E-03	2.09E-03	3.65E-04	7.56E-03
Thyroid	1.09E-03	2.37E-02	6.14E-03	1.63E-03	3.26E-02
Max organ+	2.54E-04	2.18E-03	1.86E-03	1.67E-04	4.46E-03

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	(mrad)	(mrad)	(mrad)	(mrad)	(mrad)
Beta	2.67E-06	3.15E-05	4.34E-04	1.37E-05	4.81E-04
Gamma	7.11E-06	7.06E-05	4.00E-04	1.50E-05	4.93E-04
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	7.51E-04	6.23E-03	3.61E-03	4.27E-03	1.49E-02
Skin	7.54E-04	6.25E-03	3.78E-03	4.74E-03	1.55E-02
Thyroid	7.51E-04	6.24E-03	3.61E-03	4.27E-03	1.49E-02
Max organ+	7.51E-04	6.24E-03	3.71E-03	4.31E-03	1.50E-02

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

Table 1-2
2005 Off-Site Dose Commitments from Liquid Effluents
Millstone Units 1, 2, 3

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

Unit 2	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	1.15E-04	2.15E-04	3.96E-05	4.95E-05	4.19E-04
Thyroid	9.32E-05	1.10E-04	2.17E-05	2.60E-05	2.51E-04
Max Organ	6.00E-04	3.60E-03	4.64E-04	1.97E-04	4.86E-03

Unit 3	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	2.88E-04	9.03E-04	3.72E-04	1.54E-04	1.72E-03
Thyroid	5.43E-05	3.46E-04	2.56E-04	1.27E-04	7.83E-04
Max Organ	1.43E-03	3.75E-03	9.15E-04	6.24E-04	6.72E-03

Table 1-3
2005 Off-Site Dose Comparison to Limits
Millstone Units 1, 2, 3

Airborne Effluents

Max Individual Dose vs REMODCM Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ** (mrem)	Skin (mrem)	Beta Air (mrad)	Gamma Air (mrad)
Unit 1	7.34E-04	7.26E-04	7.80E-04	7.81E-04	0.00E+00	0.00E+00
Unit 2	4.37E-03	3.26E-02	4.46E-03	7.56E-03	6.24E-03	1.57E-03
Unit 3	1.49E-02	1.49E-02	1.50E-02	1.55E-02	4.81E-04	4.93E-04
Millstone Station	**2.00E-02**	**4.82E-02**	**2.02E-02**	**2.39E-02**	**6.72E-03**	**2.06E-03**
REMODCM Limits	5*	75	75	15*	20	10

Liquid Effluents

Max Individual Dose vs REMODCM Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ** (mrem)
Unit 1	0.00E+00	0.00E+00	0.00E+00
Unit 2	4.19E-04	2.51E-04	4.86E-03
Unit 3	1.72E-03	7.83E-04	6.72E-03
Millstone Station	**2.14E-03**	**1.03E-03**	**1.16E-02**
REMODCM Limits	3*	10*	10*

Millstone Station Total Off-Site Dose

Max Individual Dose vs 40CFR190 Limits

	Whole Body (mrem)	Thyroid (mrem)	Max Organ ** (mrem)
Airborne Effluents	2.00E-02	4.82E-02	2.02E-02
Liquid Effluents	2.14E-03	1.03E-03	1.16E-02
Radwaste Storage	1.20E-01	1.20E-01	1.20E-01
Millstone Station	**1.42E-01**	**1.69E-01**	**1.52E-01**
40CFR190 Limit	25	75	25

* 10CFR50, Appendix I Guidelines

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

Table 1-4
2005 Offsite Dose Comparison
Natural Background vs. Millstone Station

Average Resident	Natural Background Radiation Dose (NCRP 94)
Cosmic	27 mrem
Cosmogenic	1 mrem
Terrestial (Atlantic and Gulf Coastal Plain)	16 mrem
Inhaled	200 mrem
In the Body	40 mrem
	~ 284 mrem

Maximum Off-Site Individual	Millstone Station Whole Body Dose
Airborne Effluents	0.020 mrem
Liqud Effluents	0.002 mrem
On site RadWaste Storage	0.120 mrem
	0.142 mrem

2.0 Radioactivity

2.1 Airborne Effluents

2.1.1 Measurement of Airborne Radioactivity

2.1.1.1 Continuous Releases

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

Unit 1 Spent Fuel Pool (SFPI) Island
Unit 1 Balance of Plant (BOP) Vent
Unit 2 Ventilation Vent
Unit 2 Wide Range Gas Monitor (WRGM)
Unit 3 Ventilation Vent
Unit 3 Supplementary Leak Collection and Recovery System (SLCRS)
Unit 3 Emergency Safeguards Facility (ESF) Building Vent

Charcoal cartridges and particulate filters are used to collect iodines and particulates, respectively. These filters are periodically replaced (typically weekly, except every two weeks for Unit 1) and then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Sr-89 (for all but Unit 1), Sr-90 and gross alpha. At least monthly gaseous grab samples are taken and analyzed for noble gasses and tritium. The gas washing bottle (bubbler) method is utilized for tritium 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 tritium is evaporation of water from the spent fuel pools, tritium releases were also estimated based upon amount of water lost and measured concentrations of the pool water. When the grab samples from the Unit 1 SFPI Vent and the Unit 2 and 3 Vents are less than detectable, the measured evaporation technique is used to determine the amount of tritium released. If the grab samples from these vents are detectable, the higher amount from either the vent or from the measured evaporation technique is used to determine the amount of tritium released.

Another continuous airborne pathway is the Unit 2 Steam Generator Blowdown Tank Vent. A decontamination factor (DF) across the SGBD Tank vent was determined for iodines by comparing the results of gamma spectrometry, HPGe, analysis of the Steam Generator Blowdown water and grab samples of the condensed steam exiting the vent. This DF was applied to the total iodine releases via the Steam Generator Blowdown water to calculate the iodine release out the vent. An additional factor of 0.33 was utilized to account for the fraction of blowdown water actually flashing to steam in the Steam Generator Blowdown Tank.

2.1.1.2 Batch Releases

The following pathways periodically have releases that are considered batches:

- Unit 1 Reactor Building Evaporator (via BOP Vent)
- Unit 2 Waste Gas Decay Tanks (via Unit 2 WRGM to Millstone Stack)
- Unit 2 and 3 Containment Purges (via Unit Ventilation Vents, except for Unit 2 if using Enclosure Building Filtration System (EBFS) via WRGM to Millstone Stack)
- Unit 2 and 3 Containment Equipment Hatch Openings
- Unit 2 and 3 Refueling Water Storage Tank (RWST) Vents
- Unit 3 Containment Drawdown

Prior to processing each batch from the Reactor Building Evaporator a sample is collected and counted on a liquid scintillation detector. Concentration is multiplied by volume to get the total activity released.

Waste Gases from the Unit 2 Gaseous Waste Processing System are held for decay in waste gas decay tanks (6) prior to discharge through the Unit 1 Stack. Calculated volume discharged is multiplied by the isotopic concentrations (noble gas and tritium) from the analysis of grab samples to determine the total activity released.

Containment air is sampled periodically for gamma and tritium 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 while at Unit 3 it is daily.

Containment air is sampled prior to each purge for gamma and tritium to determine the activity released from containment purging. Similar to containment venting, the measured concentrations are multiplied by the containment vent volume to obtain the total activity released.

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 together with the sample results are used to determine the radioactivity released.

When reactor water is transferred to Refueling Water Storage Tank (RWST) there is a potential for a release of radioactivity through the tank vent. A decontamination factor (DF) is applied to the total iodine transferred from the water that is transferred to the RWST water to estimate the iodine released. All noble gases are assumed to be released through the tank vent.

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 Curies released during these evolutions.

2.1.2 Estimate of Errors

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

Sampling/Data Collection	10%	Variation in data collection
Sample Line Loss	20%	Deposition of some nuclides
Calibration	10%	Calibration to NBS standards
Sample Counting	10%	Error for counting statistics
Flow & Level Measurements	10%	Error for release volumes

2.1.3 Airborne Batch Release Statistics

Unit 1 – None

Unit 2	Ctmt Purges	Ctmt Vents	WGDT
Number of Batches	1	39	21
Total Time (min)	230	6050	9537
Maximum Time (min)	230	225	717
Average Time (min)	230	155	454
Minimum Time (min)	230	80	3

Unit 3	Ctmt Purges	Ctmt Vents	Drawdowns
Number of Batches	1	384	1
Total Time (min)	259	*	384
Maximum Time (min)	259	*	384
Average Time (min)	259	*	384
Minimum Time (min)	259	*	384

* ~ 2-3 hrs per Vent

2.1.4 Abnormal Airborne Releases

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

2.1.4.1 Unit 1 - None

2.1.4.2 Unit 2 – None

2.1.4.3 Unit 3 – Two: April 17 and December 1

On April 17, 2005, a charging system leak, caused by valve packing leakage, resulted in water from the RWST and primary system to collect on the floor of the Auxiliary Building prior to removal transfer to waste drain tank. The evaporation of the liquid was discharged to the atmosphere via the Auxiliary Building & SLCRS Ventilation. In addition, small levels of tritium in the secondary system were discharged via the steam generator safety valves and atmospheric steam relief valves. The release of radioactivity from this event can be found in Table 2.3-A.9 in section 2.1 of this report. The off-site doses were as follows:

Maximum Individual (mrem)	
Whole Body:	6.91E-04
Skin:	6.94E-04
Thyroid:	6.91E-04
Maximum Organ:	6.92E-04

On Dec 1, 2005, primary packing valve seal failure resulted in approximately 1920 gallons of degassed reactor coolant to accumulate in the CDTT with gases entering the Vapor Recovery

System (VRS) and then discharged through SLCRS and into the atmosphere via the Millstone Stack. The release of radioactivity from this event can be found in Table 2.3-A.9 in section 2.1 of this report. The off-site doses were as follows:

Maximum Individual (mrem)	
Whole Body:	1.54E-06
Skin:	2.85E-06
Thyroid:	1.54E-06
Maximum Organ:	1.55E-06

2.1.5 Airborne Release Tables

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

Table 2.1-A1

Millstone Unit 1 Airborne Effluents

Release Summary

	Units	2005 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. Iodine-131						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
C. Particulates						
1. Total Activity Released	Ci	6.47E-06	9.56E-07	-	4.66E-06	1.21E-05
2. Average Period Release Rate	uCi/sec	8.32E-07	1.23E-07	-	6.00E-07	1.55E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	2.52E-01	1.07E-01	1.65E-01	1.32E-01	6.56E-01
2. Average Period Release Rate	uCi/sec	3.24E-02	1.37E-02	2.12E-02	1.70E-02	8.43E-02

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

Table 2.1-A2

Millstone Unit 1 Airborne Effluents

Ground Continuous - Balance of Plant Vent & Spent Fuel Pool Island Vent

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines						
I-131	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Cs-137	Ci	6.47E-06	9.56E-07	-	4.66E-06	1.21E-05
Total Activity	Ci	6.47E-06	9.56E-07	-	4.66E-06	1.21E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	2.52E-01	1.07E-01	1.65E-01	1.32E-01	6.56E-01

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

Table 2.2-A1

Millstone Unit No. 2

Airborne Effluents - Release Summary

	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	1.41E+00	8.21E+00	1.55E+00	8.92E-01	1.21E+01
2. Average Period Release Rate	uCi/sec	1.81E-01	1.04E+00	1.94E-01	1.12E-01	3.82E-01
B. Iodine-131						
1. Total Activity Released	Ci	1.98E-04	3.44E-04	7.32E-05	6.59E-05	6.81E-04
2. Average Period Release Rate	uCi/sec	2.55E-05	4.38E-05	9.21E-06	8.29E-06	2.16E-05
C. Particulates						
1. Total Activity Released	Ci	1.25E-06	5.18E-05	9.55E-07	-	5.40E-05
2. Average Period Release Rate	uCi/sec	1.61E-07	6.59E-06	1.20E-07	-	1.71E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	8.43E-01	3.02E+00	4.55E+00	1.48E+00	9.89E+00
2. Average Period Release Rate	uCi/sec	1.08E-01	3.84E-01	5.73E-01	1.87E-01	3.14E-01

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

Table 2.2-A2

Millstone Unit No. 2

Airborne Effluents - Mixed Continuous - Aux Bldg Vent & SGBD Tank Vent & Spent Fuel Pool Evaporation

Nuclides Released	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	2.90E-01	3.13E+00	3.90E-01	-	3.81E+00
Xe-135	Ci	5.81E-03	3.64E-01	4.06E-01	-	7.76E-01
Total Activity	Ci	2.96E-01	3.50E+00	7.95E-01	-	4.59E+00
B. Iodines						
I-131	Ci	1.98E-04	2.82E-04	7.32E-05	6.59E-05	6.19E-04
I-132	Ci	1.83E-04	1.74E-04	2.65E-05	5.79E-05	4.42E-04
I-133	Ci	9.55E-04	2.93E-04	2.86E-04	2.56E-04	1.79E-03
I-135	Ci	8.37E-04	1.54E-04	1.44E-04	1.02E-04	1.24E-03
Total Activity	Ci	2.17E-03	9.03E-04	5.30E-04	4.82E-04	4.09E-03
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	-	2.43E-06	2.85E-07	-	2.72E-06
Ru-103	Ci	-	-	3.40E-07	-	3.40E-07
Cs-137	Ci	1.18E-06	-	2.76E-07	-	1.45E-06
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.18E-06	2.43E-06	9.02E-07	-	4.51E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium *						
H-3	Ci	6.75E-01	2.66E+00	4.50E+00	1.30E+00	9.14E+00

* includes estimated spent fuel pool evaporation

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

Table 2.2-A3

Millstone Unit No. 2

Airborne Effluents - Mixed Batch - Containment Purges

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	1.99E+00	-	-	1.99E+00
Xe-133	Ci	-	4.92E-01	-	-	4.92E-01
Xe-135	Ci	-	1.46E-02	-	-	1.46E-02
Total Activity	Ci	-	2.50E+00	-	-	2.50E+00
B. Iodines *						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
C. Particulates *						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Cs-137	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
D. Gross Alpha *						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	-	2.38E-01	-	-	2.38E-01

* Iodines, Particulates and Gross α included in Table 2.2-A2 or 2.2-A5

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

Table 2.2-A4

Millstone Unit No. 2

Airborne Effluents - Elevated Batch - WGDT

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	4.59E-01	1.50E+00	6.42E-01	4.47E-01	3.05E+00
Xe-131m	Ci	-	1.46E-02	7.89E-04	1.91E-03	1.73E-02
Xe-133	Ci	-	2.83E-01	6.92E-03	3.10E-02	3.20E-01
Xe-133m	Ci	-	1.85E-04	-	-	1.85E-04
Xe-135	Ci	-	-	3.38E-06	-	3.38E-06
Total Activity	Ci	4.59E-01	1.80E+00	6.50E-01	4.80E-01	3.39E+00
B. Iodines *						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
C. Particulates *						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Cs-137	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
D. Gross Alpha *						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	1.54E-04	6.93E-03	6.58E-04	4.66E-04	8.21E-03

* Iodines, Particulates and Gross α included in Table 2.2-A2 or 2.2-A5

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

Table 2.2-A5

Millstone Unit No. 2

Airborne Effluents - Elevated - Containment Vents/Site Stack

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	3.46E-02	1.68E-02	2.40E-02	2.37E-02	9.91E-02
Kr-85	Ci	4.73E-01	7.47E-02	1.31E-02	3.03E-01	8.64E-01
Xe-133	Ci	1.44E-01	7.16E-02	6.19E-02	8.39E-02	3.61E-01
Xe-133m	Ci	-	7.31E-04	-	-	7.31E-04
Xe-135	Ci	1.16E-03	3.21E-03	1.11E-03	8.90E-04	6.37E-03
Total Activity	Ci	6.52E-01	1.67E-01	1.00E-01	4.12E-01	1.33E+00
B. Iodines						
I-131	Ci	-	9.12E-07	-	-	9.12E-07
Total Activity	Ci	-	9.12E-07	-	-	9.12E-07
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	-	4.62E-05	-	-	4.62E-05
Co-60	Ci	-	5.21E-07	-	-	5.21E-07
Ru-103	Ci	-	8.56E-09	-	-	8.56E-09
Cs-137	Ci	7.46E-08	5.93E-08	5.29E-08	-	1.87E-07
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	7.46E-08	4.68E-05	5.29E-08	-	4.69E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.67E-01	1.14E-01	4.83E-02	1.82E-01	5.12E-01

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

Table 2.2-A6

Millstone Unit No. 2

Airborne Effluents - Ground Batch - Containment Equipment Hatch

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	N/A	-	N/A	N/A	-
Xe-133	Ci	N/A	-	N/A	N/A	-
Total Activity	Ci	N/A	-	N/A	N/A	-
B. Iodines						
I-131	Ci	N/A	3.82E-06	N/A	N/A	3.82E-06
I-133	Ci	N/A	3.06E-07	N/A	N/A	3.06E-07
Total Activity	Ci	N/A	4.13E-06	N/A	N/A	4.13E-06
C. Particulates						
I-131	Ci	N/A	-	N/A	N/A	-
Cr-51	Ci	N/A	4.82E-07	N/A	N/A	4.82E-07
Co-58	Ci	N/A	1.22E-06	N/A	N/A	1.22E-06
Co-60	Ci	N/A	3.13E-07	N/A	N/A	3.13E-07
Zr-95	Ci	N/A	1.69E-07	N/A	N/A	1.69E-07
Nb-95	Ci	N/A	2.12E-07	N/A	N/A	2.12E-07
Cs-137	Ci	N/A	1.37E-07	N/A	N/A	1.37E-07
Sb-125	Ci	N/A	9.90E-08	N/A	N/A	9.90E-08
Total Activity	Ci	N/A	2.63E-06	N/A	N/A	2.63E-06
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.2-A7

Millstone Unit No. 2

Airborne Effluents - Ground Batch - RWST Vent

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	N/A	2.48E-01	N/A	N/A	2.48E-01
Total Activity	Ci	N/A	2.48E-01	N/A	N/A	2.48E-01
B. Iodines						
I-131	Ci	N/A	5.78E-05	N/A	N/A	5.78E-05
I-133	Ci	N/A	-	N/A	N/A	-
Total Activity	Ci	N/A	5.78E-05	N/A	N/A	5.78E-05
C. Particulates						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.3-A1

Millstone Unit No. 3

Airborne Effluents - Release Summary

	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	1.21E-02	3.92E-02	2.24E-01	1.60E-01	4.35E-01
2. Average Period Release Rate	uCi/sec	1.56E-03	4.98E-03	2.82E-02	2.01E-02	1.38E-02
B. Iodine-131						
1. Total Activity Released	Ci	-	2.02E-07	-	4.84E-08	2.50E-07
2. Average Period Release Rate	uCi/sec	-	2.57E-08	-	6.09E-09	7.94E-09
C. Particulates						
1. Total Activity Released	Ci	1.54E-05	6.25E-06	2.22E-05	1.84E-04	2.28E-04
2. Average Period Release Rate	uCi/sec	1.98E-06	7.94E-07	2.79E-06	2.32E-05	7.23E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.37E+01	1.51E+01	1.16E+01	2.49E+01	6.53E+01
2. Average Period Release Rate	uCi/sec	1.76E+00	1.92E+00	1.46E+00	3.13E+00	2.07E+00

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

Table 2.3-A2

Millstone Unit No. 3

Airborne Effluents - Mixed Continuous - Normal Ventilation & Spent Fuel Pool Evaporation

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	-	-	-	5.00E-05	5.00E-05
Co-60	Ci	-	-	-	3.65E-05	3.65E-05
Cr-51	Ci	-	-	-	7.09E-05	7.09E-05
Mn-54	Ci	-	-	-	1.01E-05	1.01E-05
Nb-95	Ci	-	-	-	6.52E-06	6.52E-06
Ba-140	Ci	-	-	-	5.43E-06	5.43E-06
Ce-141	Ci	-	-	2.63E-06	-	2.63E-06
Ce144	Ci	-	-	5.23E-06	-	5.23E-06
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	7.86E-06	1.79E-04	1.87E-04
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.28E+01	1.20E+01	1.02E+01	2.41E+01	5.91E+01

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

Table 2.3-A3

Millstone Unit No. 3

Airborne Effluents - Ground Continuous - ESF Building Ventilation

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines						
I-131	Ci	-	-	-	2.330E-08	2.330E-08
I-133	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	2.330E-08	2.330E-08
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	-	-	2.00E-07	-	2.00E-07
Cr-51	Ci	-	-	6.66E-08	-	6.66E-08
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	-	-	2.67E-07	-	2.67E-07
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	-	5.68E-01	5.07E-01	3.67E-01	1.44E+00

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

Table 2.3-A4

Millstone Unit No. 3

Airborne Effluents - Mixed Batch - Containment Drawdowns

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
B. Iodines						
I-131	Ci	N/A	N/A	N/A	-	-
I-133	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
C. Particulates						
I-131	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	N/A	N/A	N/A	7.29E-04	7.29E-04

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

Table 2.3-A5

Millstone Unit No. 3

Airborne Effluents - Mixed Batch - Containment Purges

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	N/A	N/A	N/A	2.76E-03	2.76E-03
Xe-135	Ci	N/A	N/A	N/A	3.30E-04	3.30E-04
Total Activity	Ci	N/A	N/A	N/A	3.09E-03	3.09E-03
B. Iodines *						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
I-133	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
C. Particulates *						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Br-82	Ci	N/A	N/A	N/A	9.32E-07	9.32E-07
Total Activity	Ci	N/A	N/A	N/A	9.32E-07	9.32E-07
D. Gross Alpha *						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	N/A	N/A	N/A	3.86E-02	3.86E-02

* Iodines, Particulates and Gross α included in Table 2.3-A2 or 2.3-A6

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

Table 2.3-A6

Millstone Unit No. 3

Airborne Effluents - Elevated Continuous - Gaseous Waste System & Containment Vents

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	1.00E-02	2.81E-02	6.10E-02	9.86E-03	1.09E-01
Xe-133	Ci	1.76E-03	4.44E-03	1.54E-01	7.57E-02	2.36E-01
Xe-135	Ci	3.22E-04	8.60E-04	8.23E-03	1.11E-02	2.05E-02
Kr-85m	Ci	-	-	2.43E-04	-	2.43E-04
Xe-135m	Ci	-	-	-	1.20E-03	1.20E-03
Total Activity	Ci	1.21E-02	3.34E-02	2.24E-01	9.78E-02	3.67E-01
B. Iodines						
I-131	Ci	-	2.02E-07	-	2.51E-08	2.27E-07
Total Activity	Ci	-	2.02E-07	-	2.51E-08	2.27E-07
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	-	7.55E-07	-	5.16E-07	1.27E-06
Co-60	Ci	-	7.54E-07	3.47E-07	-	1.10E-06
Hf-181	Ci	-	-	-	5.63E-08	5.63E-08
Br-82	Ci	1.54E-05	4.69E-06	1.37E-05	2.08E-06	3.59E-05
Mn-54	Ci	-	4.76E-08	-	-	4.76E-08
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.54E-05	6.25E-06	1.40E-05	2.65E-06	3.83E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	9.29E-01	1.45E+00	8.87E-01	4.03E-01	3.67E+00

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

Table 2.3-A7

Millstone Unit No. 3

Airborne Effluents - Ground Batch - Containment Equipment Hatch

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
B. Iodines						
I-131	Ci	N/A	N/A	N/A	-	-
I-133	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
C. Particulates						
I-131	Ci	N/A	N/A	N/A	-	-
Cr-51	Ci	N/A	N/A	N/A	6.86E-07	6.86E-07
Co-58	Ci	N/A	N/A	N/A	3.41E-07	3.41E-07
Co-60	Ci	N/A	N/A	N/A	9.44E-08	9.44E-08
Mn-54	Ci	N/A	N/A	N/A	3.10E-08	3.10E-08
Nb-95	Ci	N/A	N/A	N/A	6.30E-08	6.30E-08
Zr-95	Ci	N/A	N/A	N/A	6.40E-08	6.40E-08
Ru-105	Ci	N/A	N/A	N/A	1.19E-08	1.19E-08
Sn-117m	Ci	N/A	N/A	N/A	6.62E-09	6.62E-09
Cs-137	Ci	N/A	N/A	N/A	1.21E-08	1.21E-08
Total Activity	Ci	N/A	N/A	N/A	1.31E-06	1.31E-06
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.3-A8

Millstone Unit No. 3

Airborne Effluents - Ground Batch - RWST Vent

<< No Release >>

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
B. Iodines						
I-131	Ci	N/A	N/A	N/A	-	-
I-133	Ci	N/A	N/A	N/A	-	-
Total Activity	Ci	N/A	N/A	N/A	-	-
C. Particulates						
I-131	Ci	N/A	N/A	N/A	N/A	N/A
Total Activity	Ci	N/A	N/A	N/A	N/A	N/A
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Tritium						
H-3	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.3-A9

Millstone Unit No. 3

Airborne Effluents - Special Batch - Abnormal Release(s)

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
A-41	Ci	N/A	-	N/A	1.42E-02	1.42E-02
Kr-85m	Ci	N/A	7.06E-04	N/A	1.63E-03	2.34E-03
Kr-87	Ci	N/A	-	N/A	4.93E-03	4.93E-03
Kr-88	Ci	N/A	-		3.87E-03	3.87E-03
Xe-133	Ci	N/A	-	N/A	7.20E-03	7.20E-03
Xe-135	Ci	N/A	5.05E-03	N/A	1.19E-02	1.70E-02
Xe-135m	Ci	N/A	-	N/A	3.79E-03	3.79E-03
Xe-138	Ci	N/A	-	N/A	1.11E-02	1.11E-02
Total Activity	Ci	N/A	5.76E-03	N/A	5.86E-02	6.44E-02
B. Iodines						
I-131	Ci	N/A	-	N/A	-	-
I-133	Ci	N/A	-	N/A	-	-
Total Activity	Ci	N/A	-	N/A	-	-
C. Particulates						
I-131	Ci	N/A	-	N/A	-	-
Co-60	Ci	N/A	-	N/A	-	-
Total Activity	Ci	N/A	-	N/A	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	-	N/A	-	-
E. Tritium						
H-3	Ci	N/A	1.11E+00	N/A	6.39E-03	1.12E+00

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

2.2 Liquid Effluents

2.2.1 Measurement of Radioactivity

2.2.1.1 Liquid Tanks/Sumps

There are numerous tanks & sumps that are used to discharge liquids containing radioactivity to the environs; they are:

Unit 1	Reactor Cavity Water
Unit 2	Clean Waste Monitor Tanks (2) Aerated Waste Monitor Tank CPF Waste Neutralization Sump & Turbine Building Sump Steam Generator Bulk
Unit 3	High Level Waste Test Tanks (2) Low Level Waste Drain Tanks (2) Boron Test Tanks CPF Waste Neutralization Sump & Turbine Building Sump Steam Generator Bulk

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. A proportional aliquot of each discharge is retained for composite analysis for Sr-89, Sr-90, Fe-55 and gross alpha.

2.2.1.2 Unit 2 and Unit 3 Continuous Liquid Releases

Grab samples are taken for continuous liquid release pathways and analyzed on the HPGe gamma spectrometer and liquid scintillation detector (for tritium) 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 include, Steam Generator Blowdown, Service Water Effluent, and Turbine Building Sump discharge from Units 2 & 3.

2.2.2 Estimate of Errors

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

Sampling/Data Collection	10%	Variation in data collection
Calibration	10%	Calibration to NBS standards
Sample Counting	10%	Error for counting statistics
Flow & Level Measurements	10%	Error for release volumes

2.2.3 Liquid Batch Release Statistics

	Unit 1	Unit 2	Unit 3
Number of Batches	0	72	484
Total Time (min)	0	6337	57212
Maximum Time (min)	0	239	338
Average Time (min)	0	88	118
Minimum Time (min)	0	1	35
Average Stream Flow		Not Applicable - Ocean Site	

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 2005, 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 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 No. 1
Liquid Effluents - Release Summary
(Release Point - Quarry)

<< No Liquid Discharges>>

	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	N/A	N/A	N/A	N/A	N/A
2. Average Period Diluted Activity	uCi/ml	N/A	N/A	N/A	N/A	N/A
B. Tritium						
1. Total Activity Released	Ci	N/A	N/A	N/A	N/A	N/A
2. Average Period Diluted Activity	uCi/ml	N/A	N/A	N/A	N/A	N/A
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	N/A	N/A	N/A	N/A	N/A
2. Average Period Diluted Activity	uCi/ml	N/A	N/A	N/A	N/A	N/A
D. Gross Alpha						
1. Total Activity Released	Ci	N/A	N/A	N/A	N/A	N/A
E. Volume						
1. Released Waste Volume	Liters	0	0	0	0	0
2. Dilution Volume During Releases	Liters	0	0	0	0	0
3. Dilution Volume During Period	Liters	0	0	0	0	0

Table 2.2-L1

Millstone Unit No. 2
Liquid Effluents - Release Summary
(Release Point - Quarry)

	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	4.07E-03	2.64E-02	6.56E-03	4.39E-03	4.14E-02
2. Average Period Diluted Activity	uCi/ml	1.53E-11	1.52E-10	2.29E-11	1.53E-11	4.08E-11
B. Tritium						
1. Total Activity Released	Ci	2.50E+02	1.96E+02	1.86E+01	3.13E+01	4.96E+02
2. Average Period Diluted Activity	uCi/ml	9.35E-07	1.13E-06	6.47E-08	1.09E-07	4.89E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	1.85E-01	2.73E-01	1.75E-02	1.64E-02	4.92E-01
2. Average Period Diluted Activity	uCi/ml	6.94E-10	1.57E-09	6.10E-11	5.72E-11	4.85E-10
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume	Liters	2.94E+09	8.45E+05	3.26E+05	3.52E+05	2.94E+09
2. Dilution Volume During Releases	Liters	2.25E-09	2.41E-09	2.24E+09	2.18E+09	4.42E+09
3. Dilution Volume During Period	Liters	2.64E+11	1.74E+11	2.87E+11	2.86E+11	1.01E+12

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

Table 2.2-L2

Millstone Unit No. 2
Liquid Effluents - Continuous - SGBD, SW, RBCCW
(Quarry Release Point)

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.89E-03	1.47E-03	1.98E-04	8.61E-05	3.65E-03
C. Dissolved & Entrained Gases						
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.2-L3

Millstone Unit No. 2
Liquid Effluents - Batch - LWS

Nuclides Released	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Ag-110m	Ci	1.38E-04	7.94E-04	1.03E-04	4.16E-05	1.08E-03
Co-57	Ci	-	-	2.18E-06	-	2.18E-06
Co-58	Ci	4.56E-06	1.10E-02	7.81E-04	2.84E-04	1.21E-02
Co-60	Ci	1.70E-03	3.28E-03	3.81E-04	2.00E-04	5.56E-03
Cr-51	Ci	-	1.34E-03	1.45E-04	-	1.49E-03
Cs-134	Ci	3.19E-05	6.93E-05	3.56E-04	7.19E-04	1.18E-03
Cs-137	Ci	6.29E-05	1.57E-04	5.57E-04	1.13E-03	1.91E-03
Fe-55	Ci	1.47E-03	4.93E-03	1.70E-03	5.98E-04	8.69E-03
Fe-59	Ci	-	1.47E-04	-	-	1.47E-04
I-131	Ci	-	1.05E-05	9.38E-05	5.52E-05	1.60E-04
I-133	Ci	-	-	1.05E-05	4.73E-06	1.52E-05
La-140	Ci	-	5.96E-05	-	-	5.96E-05
Mn-54	Ci	3.91E-05	3.25E-04	3.34E-05	5.99E-06	4.03E-04
Na-24	Ci	-	1.31E-06	-	-	1.31E-06
Nb-95	Ci	2.25E-06	9.99E-05	6.23E-05	5.69E-06	1.70E-04
Sb-124	Ci	-	2.21E-04	1.58E-05	-	2.37E-04
Sb-125	Ci	6.23E-04	3.74E-03	2.26E-03	1.34E-03	7.97E-03
Sn-113	Ci	-	2.70E-05	-	-	2.70E-05
Sr-89	Ci	-	6.32E-05	6.24E-05	-	1.26E-04
Sr-90	Ci	-	1.08E-05	-	-	1.08E-05
Zr-95	Ci	-	6.70E-05	-	-	6.70E-05
Total Activity	Ci	4.07E-03	2.64E-02	6.56E-03	4.39E-03	4.14E-02
B. Tritium						
H-3	Ci	2.50E+02	1.96E+02	1.86E+01	3.13E+01	4.96E+02
C. Dissolved & Entrained Gases						
Kr-85	Ci	1.64E-01	1.83E-01	1.73E-02	1.56E-02	3.80E-01
Xe-131m	Ci	-	2.90E-03	-	-	2.90E-03
Xe-133	Ci	2.16E-02	8.68E-02	1.63E-04	8.09E-04	1.09E-01
Xe-135	Ci	2.39E-05	-	2.43E-06	-	2.64E-05
Total Activity	Ci	1.85E-01	2.73E-01	1.75E-02	1.64E-02	4.92E-01
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.2-L4

Millstone Unit No. 2

Liquid Effluents -Continuous-Turbine Building Sump

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.67E-02	1.51E-02	-	2.63E-03	3.44E-02
Average Period Diluted Activity	uCi/ml	9.41E-07	8.52E-07	-	1.49E-07	3.46E-07
C. Dissolved & Entrained Gases						
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Volume						
Released Waste Volume	Liters	1.97E+06	9.28E+05	0.00E+00	8.58E+05	3.75E+06
Dilution Volume During Period *	Liters	1.77E+07	1.77E+07	1.77E+07	1.77E+07	9.95E+07

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

* from Yard Drains (based on 36 gpm; Ref: Calc MP05LIQ-04048RG)

Table 2.3-L1

Millstone Unit No. 3
Liquid Effluents - Release Summary
(Release Point - Quarry)

	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	2.58E-02	7.25E-02	1.86E-02	9.89E-03	1.27E-01
2. Average Period Diluted Activity	uCi/ml	5.77E-11	1.64E-10	3.98E-11	2.71E-11	7.37E-11
B. Tritium						
1. Total Activity Released	Ci	2.91E+01	5.77E+02	7.72E+02	3.37E+02	1.72E+03
2. Average Period Diluted Activity	uCi/ml	6.51E-08	1.31E-06	1.65E-06	9.23E-07	9.97E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume	Liters	1.10E+07	1.04E+07	9.50E+06	4.74E+06	3.56E+07
2. Dilution Volume During Releases	Liters	4.83E+09	9.74E-09	1.38E+10	1.13E+10	2.99E+10
3. Dilution Volume During Period	Liters	4.47E+11	4.41E+11	4.68E+11	3.65E+11	1.72E+12

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

Table 2.3-L2

Millstone Unit No. 3

Liquid Effluents - Continuous - SGBD & SW & TK2

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	1.38E-01	9.12E-02	1.53E-02	4.93E-03	2.49E-01
C. Dissolved & Entrained Gases						
Xe-133	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.3-L3

Millstone Unit No. 3
Liquid Effluents - Batch - LWS

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Ag-110m	Ci	-	9.96E-05	9.46E-05	1.85E-05	2.13E-04
As-76	Ci	2.21E-05	-	-	-	2.21E-05
Co-57	Ci	-	5.12E-05	-	-	5.12E-05
Co-58	Ci	1.19E-03	3.40E-03	8.27E-04	1.09E-03	6.51E-03
Co-60	Ci	4.39E-03	1.44E-02	3.48E-03	9.53E-04	2.32E-02
Cr-51	Ci	-	-	-	1.11E-03	1.11E-03
Cs-137	Ci	1.43E-04	1.38E-04	1.06E-05	1.40E-05	3.06E-04
Fe-55	Ci	1.82E-02	4.08E-02	1.17E-02	2.08E-03	7.28E-02
Hf-181	Ci	-	-	7.38E-06	-	7.38E-06
Mn-54	Ci	5.98E-04	1.87E-03	5.84E-04	1.56E-04	3.21E-03
Nb-95	Ci	1.05E-04	3.81E-04	-	1.67E-04	6.53E-04
Nb-95m	Ci	-	1.33E-05	-	-	1.33E-05
Sb-124	Ci	-	6.85E-05	4.19E-05	1.20E-04	2.30E-04
Sb-125	Ci	1.15E-03	1.13E-02	1.86E-03	4.14E-03	1.85E-02
Sn-117m	Ci	-	-	1.20E-05	2.33E-05	3.53E-05
Te-132	Ci	-	-	-	4.59E-06	4.59E-06
Zr-95	Ci	-	-	-	1.50E-05	1.50E-05
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	2.58E-02	7.25E-02	1.86E-02	9.89E-03	1.27E-01
B. Tritium						
H-3	Ci	2.64E+01	5.77E+02	7.72E+02	3.37E+02	1.71E+03
C. Dissolved & Entrained Gases						
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L4

Millstone Unit No. 3

Liquid Effluents - Batch - CPF Waste Neutralization Sumps, Hotwell, S/G Bulk

(Quarry Release Point)

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	2.57E+00	4.64E-02	4.17E-02	3.07E-03	2.66E+00
C. Dissolved & Entrained Gases						
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A

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

Table 2.3-L5

Millstone Unit No. 3
Liquid Effluents - Release Summary
(Release Point - Yard Drain - DSN 006)

	Units	2005 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity	uCi/ml	-	-	-	-	-
B. Tritium						
1. Total Activity Released	Ci	5.25E-02	3.61E-02	2.66E-02	6.88E-03	1.22E-01
2. Average Period Diluted Activity	uCi/ml	1.86E-06	1.55E-06	8.36E-07	1.11E-07	8.41E-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	N/A	N/A	N/A	N/A	N/A
E. Volume						
1. Released Waste Volume	Liters	1.71E+06	8.68E+05	2.35E+06	2.10E+06	7.02E+06
3. Dilution Volume During Period	Liters	2.65E+07	2.25E+07	2.94E+07	5.97E+07	1.38E+08

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

* from Yard Drains (Ref: Calc MP05LIQ-04048RG)

Table 2.3-L6

Millstone Unit No. 3

Liquid Effluents - Continuous - Turbine Building Sump

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	5.15E-02	3.58E-02	2.56E-02	6.72E-03	1.20E-01
Average Period Diluted Activity	uCi/ml	1.94E-06	1.59E-06	8.07E-07	1.09E-07	8.25E-07
C. Dissolved & Entrained Gases						
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Volume						
Released Waste Volume	Liters	1.70E+06	8.54E+05	2.32E+06	2.09E+06	6.96E+06
Dilution Volume During Period *	Liters	2.65E+07	2.25E+07	2.94E+07	5.97E+07	1.38E+08

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

** from Yard Drains (Ref: Calc MP05LIQ-04048RG)*

Table 2.3-L7

Millstone Unit No. 3

Liquid Effluents - Continuous - WTT Berm Water

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2005				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	9.53E-04	3.24E-04	9.51E-04	1.64E-04	2.39E-03
Average Period Diluted Activity	uCi/ml	3.60E-08	1.44E-08	3.23E-08	2.75E-09	1.73E-08
C. Dissolved & Entrained Gases						
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	N/A	N/A	N/A	N/A	N/A
E. Volume						
Released Waste Volume	Liters	6.57E+03	1.36E+04	2.87E+04	1.16E+04	6.05E+04
Dilution Volume During Period *	Liters	2.65E+07	2.25E+07	2.94E+07	5.97E+07	1.38E+08

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

* from Yard Drains (Ref: Calc MP05LIQ-04048RG)

2.3 Solid Waste

2005 Solid waste shipment radioactivity 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 for 2004

Containers routinely used for radioactive waste shipment include:

55-gal Steel Drum DOT 17-H container	7.5 ft3
Steel Boxes	45 ft3
87	ft3
95	ft3
122	ft3
Steel Container	202.1 ft3
Steel "Sea Van"	1280 ft3
Polyethylene High Integrity Containers	120.3 ft3
132.4	ft3
173.4	ft3
202.1	ft3

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

January 1, 2005 through December 31, 2005

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

1. Type of Waste

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Chem-Nuclear Systems, LLC, Barnwell, SC for Burial.	m^3	3.4069E+00	25%
	Ci	1.2622E+02	

b. Dry compressible waste, Contaminated equipment, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, Free Release, etc..	m^3	4.9906E+01	25%
	Ci	2.8016E-05	
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, Free Release, etc..	m^3	4.0080E+01	25%
	Ci	3.7360E-01	

c. Irradiated components, Control rods, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Metal Melt, etc..	m^3	2.1030E+00	25%
	Ci	7.6002E-02	

d. Other - (Grease, Oil, Oily waste)

Disposition	Units	Annual Totals	Est. Total Error

d. Other - (Mixed Waste)

Disposition	Units	Annual Totals	Est. Total Error

d. Other - (Water)

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Incineration.	m^3	5.2296E+00	25%
	Ci	4.4927E-03	

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

b. Dry compressible waste, Contaminated equipment, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, Free Release, etc..

Radionuclide	% of Total	Curies
H-3		
C-14		
Cr-51		
Mn-54		
Fe-55	44.49	1.2465E-05
Fe-59		
Co-57		
Co-58		
Co-60	8.95	2.5069E-06
Ni-59		
Ni-63	2.10	5.8785E-07
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134		
Cs-137	44.41	1.2441E-05
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	1.2791E-09
Pu-241		
Am-241	0.03	7.5368E-09
Cm-242		
Cm-244	0.01	3.8953E-09
CURIES (TOTAL)		2.8016E-05

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

b. Dry compressible waste, Contaminated equipment, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, Free Release, etc.,

Radionuclide	% of Total	Curies
H-3	<0.01	4.3163E-07
C-14	<0.01	7.4491E-06
Cr-51		
Mn-54	<0.01	1.9116E-05
Fe-55	53.78	2.0090E-01
Fe-59		
Co-57		
Co-58		
Co-60	24.53	9.1639E-02
Ni-59	<0.01	2.4907E-05
Ni-63	8.46	3.1611E-02
Zn-65		
Sr-89		
Sr-90	<0.01	3.8991E-08
Nb-94	<0.01	1.1289E-07
Zr-95		
Nb-95		
Tc-99	<0.01	1.8442E-08
Ag-110m		
Sb-125		
I-129		
Cs-134		
Cs-137	12.04	4.4969E-02
Ce-144	0.13	4.8927E-04
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	0.02	6.7559E-05
Pu-241	0.91	3.3861E-03
Am-241	0.06	2.3174E-04
Cm-242		
Cm-244	0.03	1.2023E-04
CURIES (TOTAL)		3.7360E-01

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

c. Irradiated components, Control rods, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Metal Melt, etc..

Radionuclide	% of Total	Curies
H-3	<0.01	6.7987E-07
C-14	0.02	1.1733E-05
Cr-51		
Mn-54	0.04	3.0111E-05
Fe-55	49.12	3.7331E-02
Fe-59		
Co-57		
Co-58		
Co-60	32.51	2.4708E-02
Ni-59	0.05	3.9232E-05
Ni-63	12.64	9.6099E-03
Zn-65		
Sr-89		
Sr-90	<0.01	6.1416E-08
Nb-94	<0.01	1.7781E-07
Zr-95		
Nb-95		
Tc-99	<0.01	2.9049E-08
Ag-110m		
Sb-125		
I-129		
Cs-134		
Cs-137	5.09	3.8710E-03
Ce-144	0.06	4.2615E-05
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	6.0993E-06
Pu-241	0.40	3.0713E-04
Am-241	0.03	2.1087E-05
Cm-242		
Cm-244	0.01	1.0828E-05
CURIES (TOTAL)		7.6002E-02

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

d. Other - (Water)

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Incineration.

Radionuclide	% of Total	Curies
H-3	97.85	4.3960E-03
C-14	<0.01	2.3202E-08
Cr-51		
Mn-54	0.01	4.8424E-07
Fe-55	0.58	2.5992E-05
Fe-59		
Co-57	<0.01	3.9201E-07
Co-58	0.05	2.0817E-06
Co-60	0.27	1.2312E-05
Ni-59		
Ni-63	0.19	8.7495E-06
Zn-65	0.02	8.1070E-07
Sr-89		
Sr-90	<0.01	9.8846E-08
Nb-94		
Zr-95		
Nb-95		
Tc-99	<0.01	1.3568E-09
Ag-110m	<0.01	1.7918E-07
Sb-125	0.04	1.8811E-06
I-129	<0.01	9.3617E-10
Cs-134	0.33	1.4878E-05
Cs-137	0.63	2.8476E-05
Ce-144		
Eu-154	<0.01	4.6483E-09
Ra-226	<0.01	1.8350E-10
Th-230	<0.01	4.1916E-10
Th-232	<0.01	1.2882E-10
U-234	<0.01	4.7390E-09
Pu-239	<0.01	6.1376E-09
Pu-241	<0.01	2.3262E-07
Am-241	<0.01	1.6014E-08
Cm-242		
Cm-244	<0.01	7.3101E-09
CURIES (TOTAL)		4.4927E-03

3. Solid Waste Disposition (Shipments from Millstone)

Number of Shipments*	Mode of Transportation	Destination
1	Truck (Sole Use Vehicle)	Chem-Nuclear Systems, LLC, Barnwell, SC
3	Truck (Sole Use Vehicle)	Duratek, Inc., Kingston, TN
7	Truck (Sole Use Vehicle)	Duratek, Inc., Oak Ridge, TN

* Indicates the number of shipments in this category which contained *any* unit-1 waste. (Example: A shipment containing wastes from units 1, 2 *and* 3 will be counted once on *each* of the three unit-specific sections of this report.) 39 physical shipments were made from this station in 2005.

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
No Shipments in 2005	N/A	N/A

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

January 1, 2005 through December 31, 2005

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

1. Type of Waste

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..	m^3	4.1630E-01	25%
	Ci	1.5348E-01	
From Millstone Nuclear Power Station to Studsvik Processing Facility, Erwin, TN for Thermal Destruction, Incineration, etc..	m^3	2.5137E+00	25%
	Ci	2.7095E+01	

b. Dry compressible waste, Contaminated equipment, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, Free Release, etc..	m^3	1.6653E+02	25%
	Ci	4.5572E-02	
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, Free Release, etc..	m^3	7.3255E+02	25%
	Ci	1.6914E+00	

c. Irradiated components, Control rods, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Metal Melt, etc..	m^3	2.8855E+00	25%
	Ci	7.2596E+00	

d. Other - (Grease, Oil, Oily waste)

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, etc..	m^3	6.2446E-01	25%
	Ci	8.3289E-08	
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..	m^3	5.0616E+00	25%
	Ci	1.7125E-03	

d. Other - (Mixed Waste)

Disposition	Units	Annual Totals	Est. Total Error

d. Other - (Water)

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Incineration.	m^3	4.5910E+01	25%
	Ci	1.0138E-01	

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

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3	0.07	1.0226E-04
C-14		
Cr-51		
Mn-54	0.67	1.0302E-03
Fe-55	28.33	4.3478E-02
Fe-59		
Co-57		
Co-58	9.83	1.5093E-02
Co-60	15.35	2.3556E-02
Ni-59		
Ni-63	20.04	3.0756E-02
Zn-65		
Sr-89	0.01	2.2488E-05
Sr-90	0.02	3.2776E-05
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m	0.28	4.3628E-04
Sb-125		
I-129		
Cs-134	11.93	1.8313E-02
Cs-137	11.23	1.7234E-02
Ce-144	1.98	3.0320E-03
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	5.4560E-06
Pu-241	0.23	3.5693E-04
Am-241	<0.01	9.0599E-06
Cm-242	<0.01	3.4733E-06
Cm-244	<0.01	1.1346E-05
CURIES (TOTAL)		1.5348E-01

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

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

From Millstone Nuclear Power Station to Studsvik Processing Facility, Erwin, TN for Thermal Destruction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3	0.09	2.4579E-02
C-14		
Cr-51		
Mn-54	0.27	7.3999E-02
Fe-55	8.87	2.4043E+00
Fe-59		
Co-57		
Co-58		
Co-60	6.41	1.7379E+00
Ni-59		
Ni-63	40.54	1.0985E+01
Zn-65		
Sr-89		
Sr-90	0.07	1.9901E-02
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134	14.97	4.0567E+00
Cs-137	28.74	7.7867E+00
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	6.8596E-05
Pu-241	0.02	4.4873E-03
Am-241	<0.01	1.0085E-04
Cm-242	<0.01	1.1287E-05
Cm-244	<0.01	1.7722E-04
CURIES (TOTAL)		2.7095E+01

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

b. Dry compressible waste, Contaminated equipment, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, Free Release, etc..

Radionuclide	% of Total	Curies
H-3	0.15	6.7237E-05
C-14	0.02	1.0968E-05
Cr-51	<0.01	2.9781E-06
Mn-54	0.04	1.9532E-05
Fe-55	28.37	1.2928E-02
Fe-59		
Co-57		
Co-58	5.19	2.3645E-03
Co-60	10.66	4.8581E-03
Ni-59		
Ni-63	15.40	7.0186E-03
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134	15.50	7.0620E-03
Cs-137	24.46	1.1149E-02
Ce-144	0.08	3.7703E-05
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	0.01	6.2917E-06
Pu-241	0.07	3.0740E-05
Am-241	0.02	8.3880E-06
Cm-242		
Cm-244	<0.01	6.7692E-07
CURIES (TOTAL)		4.5572E-02

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

b. Dry compressible waste, Contaminated equipment, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, Free Release, etc..

Radionuclide	% of Total	Curies
H-3	0.37	6.3053E-03
C-14	0.06	1.0845E-03
Cr-51	2.49	4.2184E-02
Mn-54	1.78	3.0037E-02
Fe-55	35.50	6.0045E-01
Fe-59	0.15	2.5164E-03
Co-57		
Co-58	3.62	6.1192E-02
Co-60	22.64	3.8298E-01
Ni-59	<0.01	1.2443E-04
Ni-63	15.93	2.6948E-01
Zn-65		
Sr-89		
Sr-90		
Nb-94	<0.01	1.2568E-07
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134	7.11	1.2033E-01
Cs-137	9.94	1.6817E-01
Ce-144	0.20	3.3087E-03
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	6.3148E-05
Pu-241	0.18	2.9753E-03
Am-241	<0.01	1.0266E-04
Cm-242		
Cm-244	<0.01	6.1225E-05
CURIES (TOTAL)		1.6914E+00

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

c. Irradiated components, Control rods, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Metal Melt, etc..

Radionuclide	% of Total	Curies
H-3	0.04	3.1594E-03
C-14	<0.01	4.7283E-04
Cr-51	1.34	9.7148E-02
Mn-54	4.84	3.5169E-01
Fe-55	52.64	3.8217E+00
Fe-59	0.15	1.1124E-02
Co-57		
Co-58	2.67	1.9356E-01
Co-60	34.96	2.5380E+00
Ni-59	0.02	1.7235E-03
Ni-63	3.26	2.3639E-01
Zn-65		
Sr-89		
Sr-90		
Nb-94	<0.01	1.7378E-06
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134		
Cs-137	<0.01	5.1890E-04
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	4.8985E-05
Pu-241	0.05	3.8235E-03
Am-241	<0.01	9.0924E-05
Cm-242		
Cm-244	<0.01	7.8859E-05
CURIES (TOTAL)		7.2596E+00

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

d. Other - (Grease, Oil, Oily waste)

From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3		
C-14		
Cr-51		
Mn-54		
Fe-55		
Fe-59		
Co-57		
Co-58	5.50	4.5840E-09
Co-60	0.71	5.9389E-10
Ni-59		
Ni-63		
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134		
Cs-137	93.78	7.8111E-08
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239		
Pu-241		
Am-241		
Cm-242		
Cm-244		
CURIES (TOTAL)		8.3289E-08

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

d. Other - (Grease, Oil, Oily waste)

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3	0.68	1.1608E-05
C-14	0.10	1.7219E-06
Cr-51		
Mn-54	0.15	2.5349E-06
Fe-55	26.85	4.5979E-04
Fe-59		
Co-57		
Co-58	3.25	5.5583E-05
Co-60	17.93	3.0704E-04
Ni-59		
Ni-63	22.36	3.8284E-04
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134	12.36	2.1165E-04
Cs-137	15.70	2.6882E-04
Ce-144	0.36	6.1168E-06
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	5.6001E-08
Pu-241	0.26	4.4446E-06
Am-241	<0.01	1.0396E-07
Cm-242		
Cm-244	<0.01	9.1294E-08
CURIES (TOTAL)		1.7125E-03

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

d. Other - (Water)

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Incineration.

Radionuclide	% of Total	Curies
H-3	99.10	1.0047E-01
C-14	<0.01	2.3107E-07
Cr-51		
Mn-54	<0.01	3.8874E-06
Fe-55	0.24	2.4816E-04
Fe-59		
Co-57	<0.01	3.6553E-06
Co-58	0.03	3.5337E-05
Co-60	0.12	1.2102E-04
Ni-59		
Ni-63	0.08	8.5530E-05
Zn-65	<0.01	2.5078E-06
Sr-89		
Sr-90	<0.01	7.6171E-07
Nb-94		
Zr-95		
Nb-95		
Tc-99	<0.01	1.0454E-08
Ag-110m	<0.01	1.6708E-06
Sb-125	0.02	2.1949E-05
I-129	<0.01	7.2131E-09
Cs-134	0.14	1.4283E-04
Cs-137	0.24	2.3960E-04
Ce-144		
Eu-154	<0.01	3.5817E-08
Ra-226	<0.01	1.4141E-09
Th-230	<0.01	3.2299E-09
Th-232	<0.01	9.9269E-10
U-234	<0.01	3.7649E-08
Pu-239	<0.01	5.5567E-08
Pu-241	<0.01	2.3202E-06
Am-241	<0.01	1.4979E-07
Cm-242		
Cm-244	<0.01	7.1967E-08
CURIES (TOTAL)		1.0138E-01

3. Solid Waste Disposition (Shipments from Millstone)

Number of Shipments*	Mode of Transportation	Destination
6	Truck (Sole Use Vehicle)	Duratek, Inc., Kingston, TN
24	Truck (Sole Use Vehicle)	Duratek, Inc., Oak Ridge, TN
1	Truck (Sole Use Vehicle)	Studsvik Processing Facility, Erwin, TN

* Indicates the number of shipments in this category which contained *any* unit-2 waste. (Example: A shipment containing wastes from units 1, 2 *and* 3 will be counted once on *each* of the three unit-specific sections of this report.) 39 physical shipments were made from this station in 2005.

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
No Shipments in 2005	N/A	N/A

Table 2.3-S
Solid Waste and Irradiated Component Shipments
Millstone Unit 3

January 1, 2005 through December 31, 2005

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

1. Type of Waste

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..	m^3	9.9463E+00	25%
	Ci	9.6739E+00	
From Millstone Nuclear Power Station to Studsvik Processing Facility, Erwin, TN for Thermal Destruction, Incineration, etc..	m^3	5.8781E+00	25%
	Ci	6.2276E+01	

b. Dry compressible waste, Contaminated equipment, etc.

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, Free Release, etc..	m^3	1.0195E+01	25%
	Ci	6.5322E-03	
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, Free Release, etc..	m^3	1.1552E+02	25%
	Ci	9.5314E-01	

c. Irradiated components, Control rods, etc.

Disposition	Units	Annual Totals	Est. Total Error

d. Other - (Grease, Oil, Oily waste)

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, etc..	m^3	6.2446E-01	25%
	Ci	8.3289E-08	
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..	m^3	9.8472E-01	25%
	Ci	4.9898E-05	

d. Other - (Mixed Waste)

Disposition	Units	Annual Totals	Est. Total Error

d. Other - (Water)

Disposition	Units	Annual Totals	Est. Total Error
From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Incineration.	m^3	3.5298E+01	25%
	Ci	2.9208E-02	

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

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3	0.29	2.7812E-02
C-14		
Cr-51		
Mn-54	2.44	2.3619E-01
Fe-55	67.91	6.5694E+00
Fe-59		
Co-57	0.04	3.9487E-03
Co-58	0.27	2.6072E-02
Co-60	15.06	1.4565E+00
Ni-59		
Ni-63	13.29	1.2853E+00
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95	0.03	2.9793E-03
Tc-99		
Ag-110m		
Sb-125	0.43	4.1553E-02
I-129		
Cs-134		
Cs-137	0.05	5.1140E-03
Ce-144	0.17	1.6361E-02
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	1.2757E-05
Pu-241	0.03	2.4927E-03
Am-241	<0.01	2.9357E-05
Cm-242	<0.01	1.3542E-05
Cm-244	<0.01	8.4400E-05
CURIES (TOTAL)		9.6739E+00

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

a. Spent resins, Filter sludges, Evaporator bottoms, etc.

From Millstone Nuclear Power Station to Studsvik Processing Facility, Erwin, TN for Thermal Destruction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3	0.24	1.4765E-01
C-14		
Cr-51		
Mn-54	6.94	4.3242E+00
Fe-55	32.73	2.0386E+01
Fe-59		
Co-57	0.08	5.1213E-02
Co-58	2.20	1.3704E+00
Co-60	9.55	5.9503E+00
Ni-59		
Ni-63	47.63	2.9661E+01
Zn-65		
Sr-89	<0.01	1.4479E-03
Sr-90	0.01	6.2296E-03
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125	0.35	2.1889E-01
I-129		
Cs-134		
Cs-137	0.26	1.5888E-01
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	1.6905E-05
Pu-241		
Am-241	<0.01	1.1556E-05
Cm-242	<0.01	4.2680E-05
Cm-244	<0.01	5.0089E-05
CURIES (TOTAL)		6.2276E+01

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

b. Dry compressible waste, Contaminated equipment, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, Free Release, etc..

Radionuclide	% of Total	Curies
H-3	1.73	1.1301E-04
C-14	<0.01	3.7949E-07
Cr-51	2.12	1.3851E-04
Mn-54	2.39	1.5642E-04
Fe-55	53.57	3.4993E-03
Fe-59		
Co-57		
Co-58	9.29	6.0663E-04
Co-60	14.28	9.3286E-04
Ni-59		
Ni-63	10.69	6.9819E-04
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95	0.54	3.5351E-05
Nb-95	0.56	3.6538E-05
Tc-99		
Ag-110m		
Sb-125	0.37	2.3987E-05
I-129		
Cs-134	0.90	5.8896E-05
Cs-137	3.47	2.2667E-04
Ce-144	0.02	1.3926E-06
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	1.1723E-07
Pu-241	0.05	3.4022E-06
Am-241	<0.01	2.8282E-07
Cm-242		
Cm-244	<0.01	1.1511E-07
CURIES (TOTAL)		6.5322E-03

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

b. Dry compressible waste, Contaminated equipment, etc.

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, Free Release, etc..

Radionuclide	% of Total	Curies
H-3	0.52	5.0017E-03
C-14	<0.01	2.8566E-07
Cr-51	2.88	2.7438E-02
Mn-54	2.35	2.2359E-02
Fe-55	58.47	5.5725E-01
Fe-59		
Co-57		
Co-58	12.59	1.2002E-01
Co-60	9.98	9.5134E-02
Ni-59		
Ni-63	8.90	8.4831E-02
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95	0.81	7.7128E-03
Nb-95	0.79	7.5707E-03
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134	0.15	1.4475E-03
Cs-137	2.56	2.4354E-02
Ce-144	<0.01	1.0637E-06
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	1.4336E-06
Pu-241	<0.01	2.5630E-06
Am-241	<0.01	1.9356E-06
Cm-242		
Cm-244	<0.01	8.6704E-08
CURIES (TOTAL)		9.5314E-01

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

d. Other - (Grease, Oil, Oily waste)

From Millstone Nuclear Power Station to Duratek, Inc., Kingston, TN for Super-Compaction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3		
C-14		
Cr-51		
Mn-54		
Fe-55		
Fe-59		
Co-57		
Co-58	5.50	4.5840E-09
Co-60	0.71	5.9389E-10
Ni-59		
Ni-63		
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134		
Cs-137	93.78	7.8111E-08
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239		
Pu-241		
Am-241		
Cm-242		
Cm-244		
CURIES (TOTAL)		8.3289E-08

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

d. Other - (Grease, Oil, Oily waste)

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Super-Compaction, Incineration, etc..

Radionuclide	% of Total	Curies
H-3	1.49	7.4216E-07
C-14	<0.01	1.5272E-09
Cr-51		
Mn-54	1.69	8.4497E-07
Fe-55	3.89	1.9423E-06
Fe-59		
Co-57		
Co-58	0.21	1.0446E-07
Co-60	1.76	8.7881E-07
Ni-59		
Ni-63	1.32	6.5714E-07
Zn-65		
Sr-89		
Sr-90		
Nb-94		
Zr-95		
Nb-95		
Tc-99		
Ag-110m		
Sb-125		
I-129		
Cs-134	34.11	1.7021E-05
Cs-137	55.52	2.7705E-05
Ce-144		
Eu-154		
Ra-226		
Th-230		
Th-232		
U-234		
Pu-239	<0.01	6.6156E-11
Pu-241		
Am-241	<0.01	8.4787E-11
Cm-242		
Cm-244		
CURIES (TOTAL)		4.9898E-05

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

d. Other - (Water)

From Millstone Nuclear Power Station to Duratek, Inc., Oak Ridge, TN for Incineration.

Radionuclide	% of Total	Curies
H-3	97.49	2.8474E-02
C-14	<0.01	1.3811E-07
Cr-51		
Mn-54	<0.01	2.3544E-06
Fe-55	0.75	2.1896E-04
Fe-59		
Co-57	<0.01	2.8251E-06
Co-58	0.05	1.4641E-05
Co-60	0.30	8.8344E-05
Ni-59		
Ni-63	0.24	6.9879E-05
Zn-65	<0.01	2.3240E-06
Sr-89		
Sr-90	<0.01	1.1783E-07
Nb-94		
Zr-95		
Nb-95		
Tc-99	<0.01	1.6178E-09
Ag-110m	<0.01	1.2913E-06
Sb-125	0.05	1.4102E-05
I-129	<0.01	1.1164E-09
Cs-134	0.35	1.0118E-04
Cs-137	0.74	2.1672E-04
Ce-144		
Eu-154	<0.01	5.5421E-09
Ra-226	<0.01	2.1874E-10
Th-230	<0.01	4.9972E-10
Th-232	<0.01	1.5356E-10
U-234	<0.01	5.2390E-09
Pu-239	<0.01	4.2182E-08
Pu-241	<0.01	1.3922E-06
Am-241	<0.01	1.0165E-07
Cm-242		
Cm-244	<0.01	4.4124E-08
CURIES (TOTAL)		2.9208E-02

3. Solid Waste Disposition (Shipments from Millstone)

Number of Shipments*	Mode of Transportation	Destination
3	Truck (Sole Use Vehicle)	Duratek, Inc., Kingston, TN
12	Truck (Sole Use Vehicle)	Duratek, Inc., Oak Ridge, TN
2	Truck (Sole Use Vehicle)	Studsvik Processing Facility, Erwin, TN

* Indicates the number of shipments in this category which contained *any* unit-3 waste. (Example: A shipment containing wastes from units 1, 2 *and* 3 will be counted once on *each* of the three unit-specific sections of this report.) 39 physical shipments were made from this station in 2005.

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
No Shipments in 2005	N/A	N/A

3.0 Inoperable Effluent Monitors

During the period January 1 through December 31, 2005, the following effluent monitors were inoperable for more than 30 consecutive days:

3.1 **Unit 1** – None

3.2 **Unit 2** – None

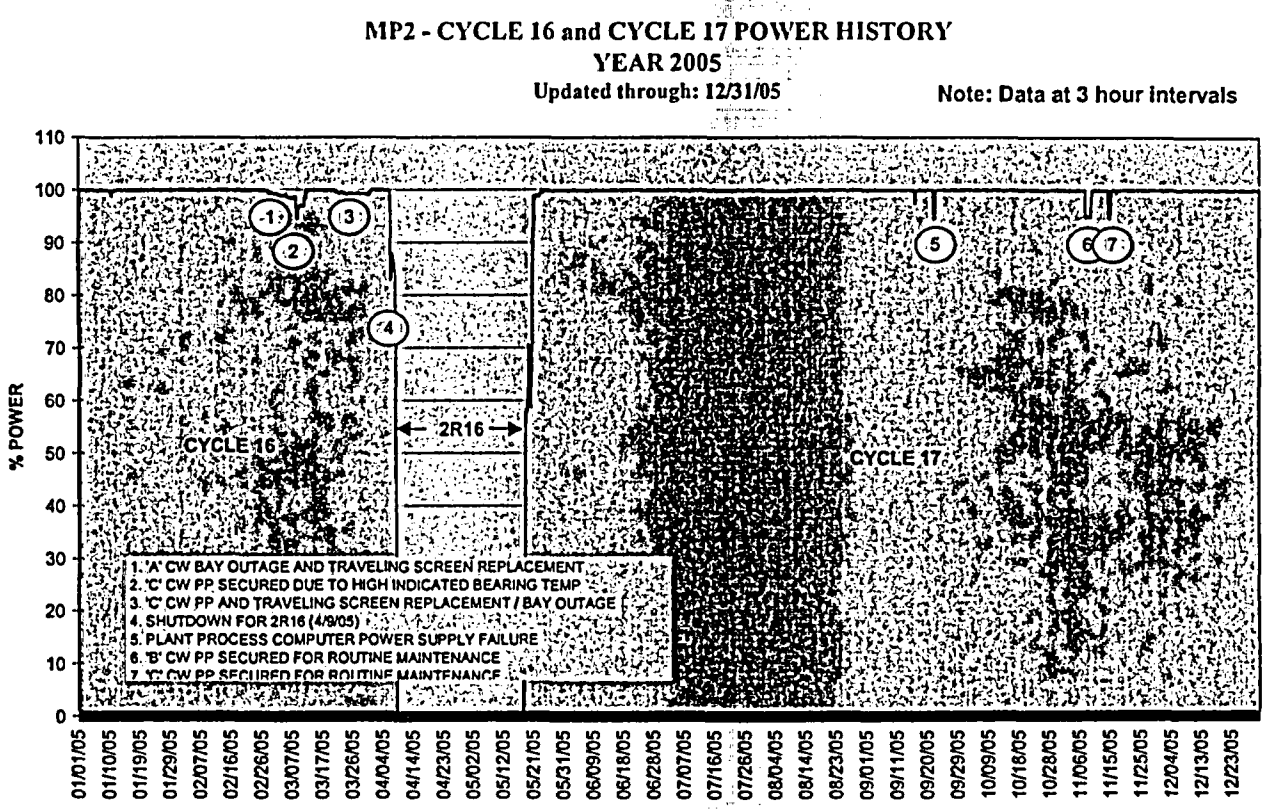
3.3 **Unit 3** - None

4.0 Operating History

The operating history of the Millstone 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.

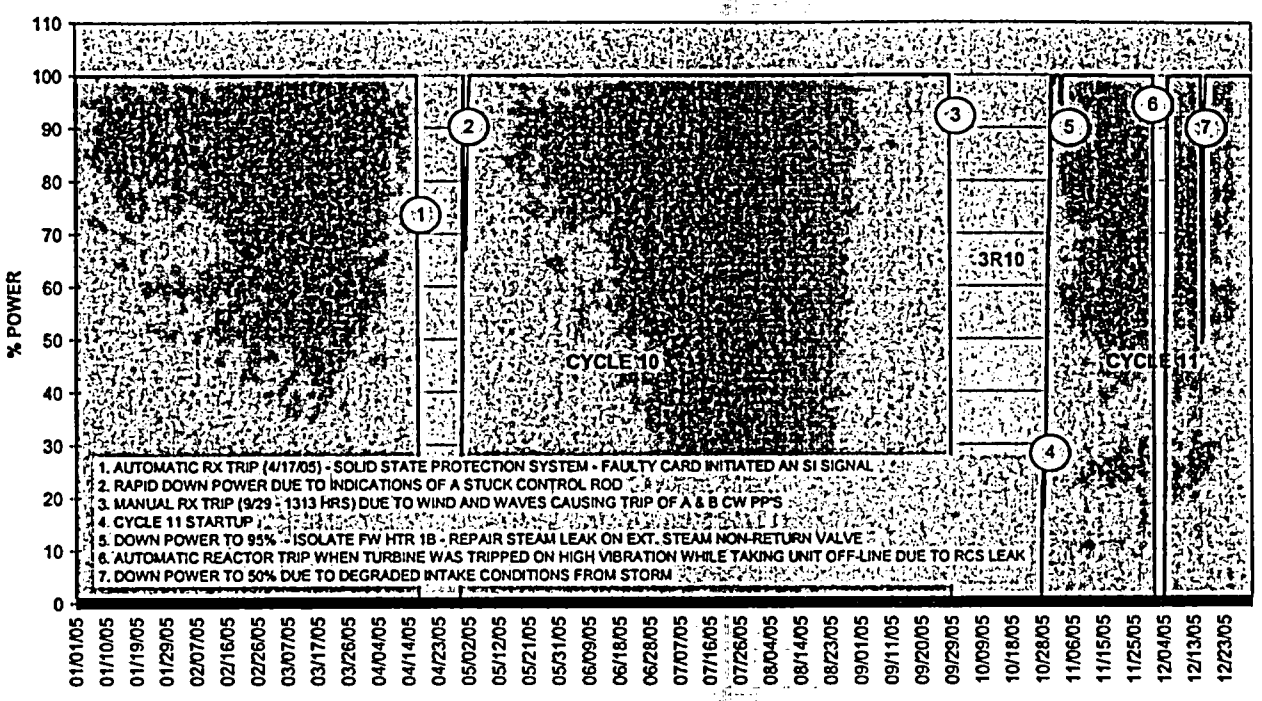
Unit 2 operated with a DER capacity factor of 88.2% and the power history for 2005 is shown below.



Unit 3 operated with a DER capacity factor of 86.3% and the power history for 2005 is shown below.

MP3 - CYCLE 10 and CYCLE 11 POWER HISTORY
YEAR 2005
Updated through: 12/31/05

Note: Data at 3 hour intervals



5.0 Errata

5.1 In section 2.1.1.12 of the 2004 Report The RWST was incorrectly identified as a radwaste storage tank. The correct name is the Refueling Water Storage Tank

5.2 Unit 2 – Table 2.2-A8 – Iodine 131 activity for LWS batch liquid releases did not include the 1st qtr in the total activity column. The corrected total activity is 1.39E-04.

5.3 Unit 2 – Table 2.2-A3 – This table indicated with an asterisk that I 131 was prior to charcoal filtration for report years 2001 through 2004. This footnote was not applicable for these report years

6.0 REMODCM Changes

In 2005, the following changes were made to the Millstone REMODCM:

Rev	Effective Date
25	April 8, 2005

The description and the bases of the change(s) for each REMODCM revision are included here in Volume I of the Radioactive Effluent Release Report. In addition, a complete copy of the REMODCM revision(s) for the calendar year 2005 is provided to the Nuclear Regulatory Commission as Volume II of the Radioactive Effluent Release Report.

6.1 REMODCM Rev 25 - Description of Changes

Approval 02/24/04 Effective 04/01/04

REMODCM Change Request - Routing and Cover Sheet

Change Request #: 04-01 **Page 1 of 8.**

I. Description of changes (include markup pages) and affected documents

Originator name (Print): **Claude Flory**

Section/Page	Section Title and Description of Change with Basis
Table I.C-1 Pg. 9	Requirement is changed from for reactor cavity water to any source of water which is released from Unit 1. Unit 1 reactor cavity water has been fully discharged. This change provides a general requirement to cover future discharges from Unit 1.
Fig. I.C-3/ Pg. 24	1) Figure is corrected by moving location of radwaste radiation monitor (3LWS-RE70) from the low-level waste line to downstream of both the high-level and low-level waste systems. 2) Regenerant evaporator feed tank is changed to CPF waste neut sump to be consistent with plant terminology. 3) The condensate discharge radiation monitor (3CND-RE07) is added because this is an REMODCM required monitor. 4) A line which incorrectly shows circulating water coming from the high-level waste systems is removed and the figure no longer labels circulating water flow. 5) Turbine plant leakage to sump is redrawn to show it's primary discharge to Niantic Bay via DSN006 and alternate routing to the low-level waste system. This lineup was explained in a footnote but is now better shown pictorially. 6) Turbine building sump radiation monitor (3DAS-RE50) is added because this is an REMODCM required monitor.
Table I.D-2/ Pgs.27-29	1) Added requirements for sampling and monitoring of Aux Building Rollup Door during fuel movement. Continuous sampling for iodines with weekly analysis and a daily gaseous grab sample will be required. These requirements are being added to provide compensatory monitoring in support of Alternate Source Term (AST) licensing actions. 2) Added daily gaseous grab sample for equipment hatch. This requirement is being added to provide compensatory monitoring in support of Alternate Source Term (AST) licensing actions. 3) Divided Footnote C into two footnotes (C+K) in order to make the requirements easier to understand. 4) [continued next page]

If more space is needed, go to next page Yes ☒ No ☐

Originator signature: Claude Flory **Date:** 12/15/04

REMODCM Change Request – Continuation Sheet

Change Request #: 04-01 **Page 2 of 8.**

Section/Page	Section Title and Description of Change with Basis
Table I.D-2/ Pgs.27-29	4) In Footnote C specified that the change in power exceeding 15% of maximum power would occur within one hour. This helps in implementation of the requirement and is consistent with the guidance in NUREG-1301 and with the similar requirement in Footnote F. 5) Revised the wording of Footnote F. Criteria for additional samples will now be based on reactor operation with exceptions based on coolant iodine radioactivity <u>and</u> on radiation monitor reading. Previous wording criteria was based on coolant iodine radioactivity <u>or</u> radiation monitor reading with no exceptions. This revision also removes some of the ambiguity present in the previous wording and is identical to guidance given by NRC in NUREG-1301. 6) Footnote H is revised to allow for venting of gas from the gaseous waste system to the Auxiliary Building with final discharge to the environment via Unit 2 Vent with monitoring by radiation monitor RM-8132B. This revision is needed because some residual gas in the system cannot be flushed out by normal discharge path to the Millstone Stack. 7) In Footnote I the criteria for requiring an additional sample is changed from a gas channel increase of 50% to a gas channel increase of a factor of two. Any increase of containment gaseous activity within a factor of two does not lead to a significant increase of unmonitored release of radioactivity to the environment. Normal sampling is required every week and the amount of containment air vented during one week is not significant. 8) Gaseous grab sampling of containment is decreased from weekly to every two weeks with a condition for weekly sampling if containment noble gas activity exceeds 1E-6 uCi/cc. Analyses of containment air activity reveals that sampling every two weeks is sufficient if the activity does not exceed 1E-6 uCi/cc.
Table I.D-3/ Pgs.30-32	1) Added requirements for sampling and monitoring from fuel building rollup doors during fuel movement. Continuous sampling for iodines with weekly analysis and daily gaseous grab sample will be required. These requirements are being added to provide compensatory monitoring in support of Alternate Source Term (AST) licensing actions. 2) Added daily gaseous grab sample for equipment hatch. This requirement is being added to provide compensatory monitoring in support of Alternate Source Term (AST) licensing actions. 3) Divided Footnote C into two footnotes (C+J) in order to make the requirements easier to understand. 4) Gaseous grab sampling of containment is decreased from weekly to every two weeks with a condition for weekly sampling if containment noble gas activity exceeds 1E-6 uCi/cc. Analyses of containment air activity reveals that sampling every two weeks is sufficient if the activity does not exceed 1E-6 uCi/cc.
Continued on next page	

Last page? Yes ☐ No ☒

REMODCM Change Request – Continuation Sheet

Change Request #: 04-01 **Page 3 of 8**

Section/Page	Section Title and Description of Change with Basis
Table I.D-3/ Pgs.30-32 (continued)	5) In Footnote C specified that the change in power exceeding 15% of maximum power would occur within one hour. This helps in implementation of the requirement and is consistent with the guidance in NUREG-1301 and with the similar requirement in Footnote F. 6) Made Footnote C applicable only to the Vent and SLCRS release points, removing the ESF vent as a release point which needs additional sampling with a change in reactor power. Any changes in effluent release based on change in reactor power are expected to be seen in the Vent and SLCRS (to Millstone Stack) release points and not via the ESF Vent. 7) Revised the wording of Footnote F. Criteria for additional samples will now be based on reactor operation with exceptions based on coolant iodine radioactivity <u>and</u> on radiation monitor reading. Previous wording criteria was based on coolant iodine radioactivity <u>or</u> radiation monitor reading with no exceptions. Requirement is now based on collecting the iodine charcoal sample prior to the normal weekly collection only when there is a possible change involving short half-life iodine isotopes. This revision removes some of the ambiguity present in the previous wording and is identical to guidance in NUREG-1301. 8) In Footnote I the criteria for requiring an additional sample is changed from a gas channel increase of 50% to a gas channel increase of a factor of two. Any increase of containment gaseous activity within a factor of two does not lead to a significant increase of unmonitored release of radioactivity to the environment. Normal sampling is required every week and the amount of containment air vented during one week is not significant.
Fig. I.D-2/ Pg. 37	1) Replaced Reactor Plant Gaseous Drains and Charging System with RCS Letdown as input to Gaseous Waste System to further simplify the diagram. 2) Added Main Condenser Air Ejector.
Fig. I.D-3/ Pg. 38	A line is added to show the alternate discharge path from the fuel pool in the aux building to the Millstone Stack with HEPA/charcoal filtration.
Table I.E-1 Pg. 41	1) Changed frequency of well water sample from quarterly to semiannually. Plant related radioactivity has not been seen in ground water and if radioactivity were to get into ground water it would change very slowly in time. Semiannually sampling would be sufficient to track such long term trends and could be increased if plant related radioactivity were to be detected. 2) Changed frequency of soil sample from quarterly to annually. Soil sampling can be reduced because it is redundant to airborne and vegetation sampling. NRC guidance in NUREG-1301 does not include soil sampling.

Last page? Yes ☐ No ☒

REMODCM Change Request – Continuation Sheet

Change Request #: 04-01 **Page 4 of 8.**

Section/Page	Section Title and Description of Change with Basis
Table I.E-2 Pgs. 42-43	1) Changed direction and distance for goat location #2 from 5.2 miles, NNE to 2.7 miles, NE because there are no longer any milking goats at the 5.2 mile location. Milking goats have been located at the 2.7 mile site and arrangements have been made to collect routine samples from that location. 2) Added fish as sample types at Locations #27 and #28 and added Footnotes 1 and 2. The intent of these changes is to define the sampling area which would be part of the "Vicinity of Discharge" Location #32. Because of their mobility, fish in Jordan Cove and out to Two Tree Island can be considered vicinity of discharge. 3) Locations #70, Background Well, is deleted. No radioactivity has been seen in groundwater. Instead of a background well for comparison, a historical trend can be used if radioactivity in groundwater is detected in the future.
Figures I.E-1 to I.E-3 Pgs. 44-46	These three figures are updated to provide more to provide better clarity. The third figure is deleted because all the information is in the two new figures.
Table I.E-4 Pg. 48	Units for fish, shellfish, food products, and sediment are changed from pCi/kg to pCi/g and values adjusted accordingly to make the units consistent with Table I.E-3.
II.D.3a/ Pgs. 69-70	Dose conversion factors for releases from Units 2 and 3 to Millstone Stack are changed from 947 to 30 for I-131 releases, from 8.77 to 0.29 for I-133 releases, from 1.58E-4 to 4.66E-5 for tritium releases, and from 328 to 10.2 for particulate releases. New conversion factors are based on new meteorological parameters calculated in Calculation NUC-202, Rev. 0. These new meteorological parameters were used with the methodology described in MP-22-REC-REF03, "REMODCM Technical Information Document" to calculate the new conversion factor. With lower conversion factors, Method 2a is not needed and has been deleted. Method 2b becomes Method 2a.
II.D.3b/ Pgs. 71-73	Method 1 dose conversion factor is changed from 3100 to 230 for I-131 and from 29.53 to 4.0 for I-133. Method 2a is deleted and Method 2b is renamed to Method 2. The affect of this change is that the methodology of Method 2a becomes the methodology of Method 1. The only difference between Methods 1 and 2a was the assumed location of milk animals. Method 1 used the conservative assumption that the closest milk animal was located at the closest residence. Based on land use censes since plant startup, the closest milk animal can be assumed to be the locations observed during the years 1983 through 1987. Thus the new Method 1 iodine factors (the old Method 2a factors) are based on the highest quarterly deposition parameter (D/Q) observed from 1983 to 1987.

Last page? Yes ☐ No ☒

REMODCM Change Request – Continuation Sheet

Change Request #: 04-01 **Page 5 of 8.**

Section/Page	Section Title and Description of Change with Basis
II.E.1/ Pgs. 79-80	Revised the Unit 1 Reactor Cavity Water Discharge Line radiation monitor setpoint requirements to make them applicable to a generic monitor for Unit 1 liquid radwaste discharges. Cavity water has been discharged and this monitor is no longer needed. The generic requirements are equivalent to those for Units 2 and 3 monitors.
II.E.3/ Pgs.80-81	1. Added a condition that if noble gas activity is less than 0.011 uCi/ml that the noble gas reduction factor need not be determined. This should have been included in the last revision of the REMODCM when a footnote which established the same condition was removed. The intent at that time was to retain the condition, just in a different format. This condition is equivalent to the condition for the Unit 3 liquid radwaste monitor in Section II.E.8. 2. Changed radiation monitor readout units from cps to cpm to correspond to the actual monitor units. This appears to have been a typographical error. 3. The default setpoint of 5.7E-5 uCi/ml and it's basis in Note 2 was changed to 2.8E-5 uCi/ml. This change is needed because future plant operations may limit the circulating water usage to one pump during outages.
II.E.8/ Pgs. 85-86	1) Revised the noble gas activity from 0.26 to 0.026 uCi/ml at which the noble gas reduction factor need not be determined. Reducing the value by 10 maintains the factor of 10 safety factor which is utilized in the formula for allowable discharge flow (F = 0.1 x R x D). 4. The default setpoint of 1.3E-4 uCi/ml and it's basis in Note 2 was changed to 6.6E-5 uCi/ml. This change is needed because future plant operations may limit the circulating water usage to one pump during outages.
II.E.12a/ P.87	Change maximum allowable setpoint for the Unit 3 turbine building floor drains rad monitor from 3E-6 to 1.4E-5 uCi/ml based on results of Calc RERM-04101-R3.
II.F.4,7,8/ Pgs.89-90	Revised setpoints for Unit 3 gaseous effluent monitors - Vent HVR-10B, SLCRS HVR-19B, and ESF HVQ-49. Setpoints were changed with revision of basis calculation RERM-01946R3 because corrections for pressure in the counting chamber were applied to the monitors' conversion factors rather than to the setpoints. Reference to the calculation was added and basis information which is contained in the calculation was deleted from the REMODCM.

Last page? Yes ☐ No ☒

REMODCM Change Request – Continuation Sheet

Change Request #: 04-01 **Page 6 of 8.**

Section/Page	Section Title and Description of Change with Basis
Sect. III.C.1 Pgs. 97-98	Requirements for radioactive effluent monitoring instrumentation are revised to change cavity water radwaste monitor to a general monitor requirement for liquid releases and to delete flow rate measurement instrumentation. Unit 1 has completed discharge of reactor cavity water. This change will cover any future possible discharge of radioactivity in liquid effluents. Deleting flow measurement instrumentation requirement allows the option of not installing such a device if it is not economically feasible. If needed, flows can be controlled and discharge volumes can be estimated with the required accuracy based on calculations.
Table III.C-3 Pg. 100	Delete requirement for a weekly gaseous grab sample when the Spent Fuel Pool Island gas activity monitor is inoperable. Significant release of radioactive gas from the Unit 1 fuel is not expected unless there is fuel damage which could occur during fuel movement. The compensatory action of daily gas grab sample during fuel movement will remain with the addition of any evolution or event which would threaten fuel integrity.
Fig. III.D-1 Pg. 106	The figure is being revised for clarity and to label the Unit 1 gaseous release point at the BOP and SFPI vents. The new figure is identical to Figure 2.1-3 of the DSAR.
III.F Bases Pg. 108	In the bases for Section III.D.1.a the word "ten times" is being added to specify that liquid effluent concentrations are now limited to ten times the 10 CFR 20 values. This is a Tech Spec limit which became effective in 2001.
Tables IV.C-3/C-4 Pgs. 121	1. In both tables, reference to rad monitor for the vent is changed from RM-8132B to RM-8132 because the requirements apply to both the gaseous channel (B) and the particulate channel (A). 2. In Table IV.C-4 "TRM" is revised to "Tech Specs" in line for MP2 Vent to correct an wrong reference. 3. In Action Statement C the time to estimate flow rate for inoperable flow rate monitors is increased from 4 to 5 hours. This change is being made to facilitate scheduling of the estimate during 8 and 12 hours shifts.
Fig. IV.D-1 Pg. 127	The figure is being revised for clarity. The new figure is identical to Figure 1.2-1 of the FSAR.

Last page? Yes ☐ No ☒

REMODCM Change Request – Continuation Sheet

Change Request #: **Page 7 of 8 .**

Section/Page	Section Title and Description of Change with Basis
IV.F Bases Pg. 129	1) In the bases for Section IV.D.1.a the word "ten times" is being added to specify that liquid effluent concentrations are now limited to ten times the 10 CFR 20 values. This is a Tech Spec limit which became effective in 2001. 2) Other changes are being made to conform to the terminology of the current version of 10 CFR 20.
Tables V.C-1 & V.C-2/ Pgs. 136, 138	Turbine Building Floor Drains flow rate measurement device is deleted. There is no instrumentation that measures turbine building drains flow. Flow is determined as needed to quantify any release of radioactivity.
Table V.C-3/ Pgs.140-141	1) New Footnote E is added to delete the requirement to estimate ESF vent flow every four hours when the discharge flow rate monitor (table item #3.d) is inoperable. The requirement remains to estimate flow every four hours when the flow monitor for Unit 3 vent and Millstone Stack (via SLCRS) releases are inoperable. Relative to these two release points the ESF vent flow is smaller and less variable. The only need for this flow is to estimate radioactivity release. Chemistry, in SP3867-001, assumes a ESF flow of 6,500 cfm. Thus, there is no need to estimate flow rate. (See Extent of Condition in CR-03-03161 investigation.) 2) Requirement for monitoring and sampling at Warehouse No. 5 vent is deleted. This requirement was originally placed in the REMODCM when it was anticipated that higher levels of radioactivity would be present in waste processed in the CPF. Actual need to implement the requirement was conditioned on a level of 1E-4 uCi/ml in regenerated waste. This level has never been seen in regenerated waste and it is no longer expected. Any change in plant operations which could generate such levels in the CPF would receive a Radiological Environment Review in accordance with MP-22-REC-FAP01.3 and, if needed, appropriate monitoring and sampling would be performed. 3) In Action Statement C the time to estimate flow rate for inoperable flow rate monitors is increased from 4 to 5 hours. This change is being made to facilitate scheduling of the estimate during 8 and 12 hours shifts.
Fig. V.D-1 Pg. 148	The figure is being revised for clarity. The new figure is identical to Figure 2.1-3 of the FSAR.
V.F Bases Pg. 152	1. In the bases for Section IV.D.1.a the word "ten times" is being added to specify that liquid effluent concentrations are now limited to ten times the 10 CFR 20 values. This is a Tech Spec limit which became effective in 2001. 2. Other changes are being made to conform to the terminology of the current version of 10 CFR 20.

Last page? Yes ☒ No ☐

REMODCM Change Request - Routing and Cover Sheet

Change Request Number #: 04-01 Page 8 of 8.

II. Technical Reviews:

Approve ☑ Disapprove ☐

Manager, - Radiological Protection and Chemistry Date 12/20/04

Approve ☑ Disapprove ☐

Supervisor - Radiological Engineering Date 1/7/05

III. SORC Review: **Meeting No.** MP-05-011

Unreviewed Radiological Environmental Impact (Bases Attached) Yes ☐ No ☒

Approve ☒ Disapprove ☐

SORC Chairman Date 1/28/05

IV. Management Approval:

Approve ☑ Disapprove ☐

Site Vice President Date 1-28-05

V. Implementation: Verify that the affected document changes have been

Effective date of REMODCM revision: 4/8/05

Supervisor - Radiological Engineering Section (NFE) Date 9/29/05

VI. Distribution: Change sent to Document Control for distribution

Supervisor - Radiological Engineering Section (NFE) Date 4/8/05

VII. Documentation: In Annual Effluent Report (or separate submittal to NRC)

Supervisor - Radiological Engineering Section (NFE) Date 4/13/06

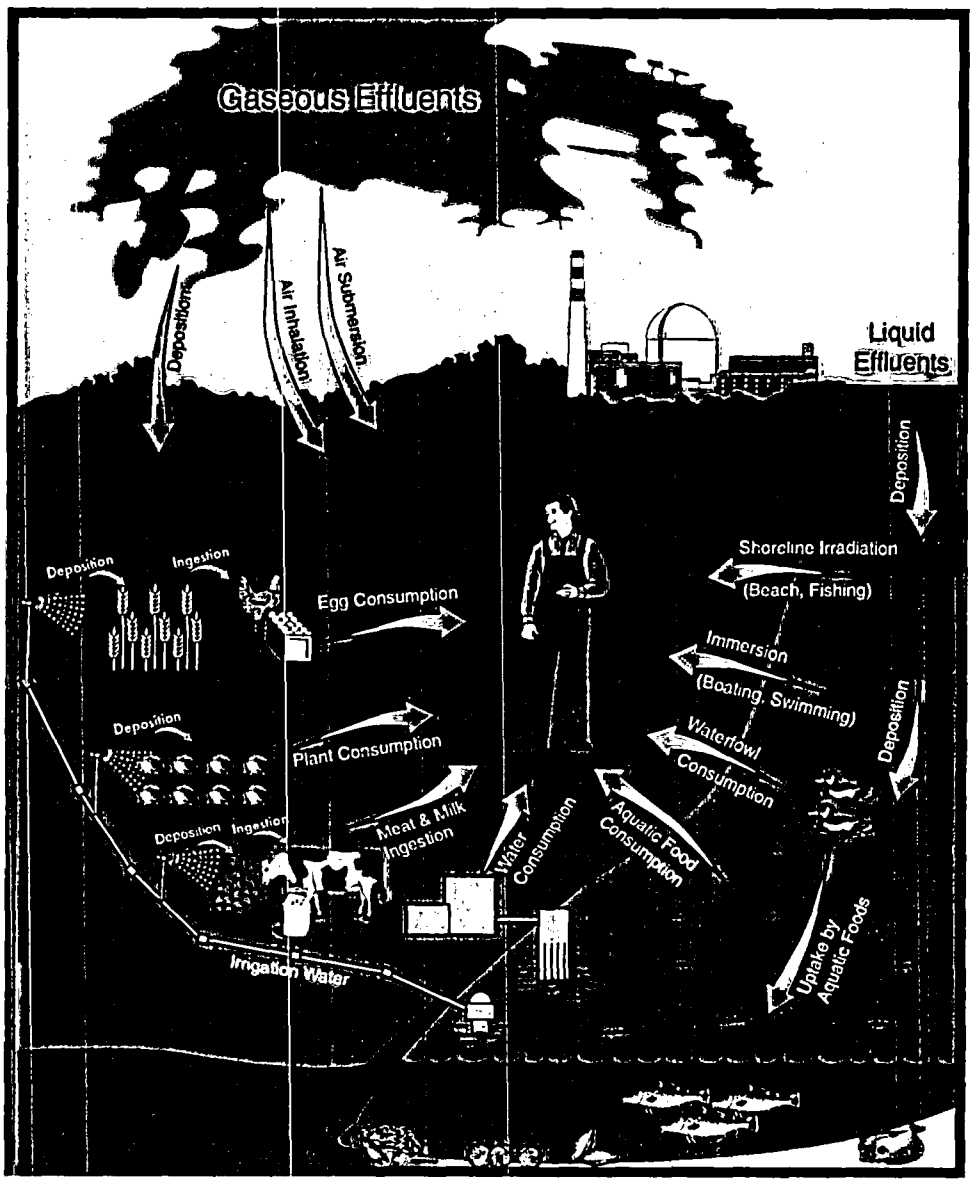
Serial No. 06-333
Docket Nos. 50-245
50-336
50-423
License Nos. DPR-21
DPR-65
NPF-49

Attachment 2

2005 Radioactive Effluent Release Report
Volume II

Millstone Power Station Units 1, 2, and 3
Dominion Nuclear Connecticut, Inc. (DNC)

Millstone Power Station
2005 Radioactive Effluent Release Report
Volume II



Dominion

Dominion Nuclear Connecticut, Inc.

MILLSTONE UNIT	LICENSE	DOCKET
1	DPR-21	50-245
2	DPR-65	50-336
3	NPF-49	50-423

Manual

Millstone Station

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

MP-22-REM-BAP01

Rev. 025

Approval Date: _____

Effective Date: _____

Radiological Effluent Monitoring & Offsite Dose Calculation Manual
REMODCM

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Section I

Radiological Effluent Monitoring Manual (REMM)

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

Docket Nos. 50-245, 50-336, 50-423

SECTION 1. 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-13-REM-REF02, "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 Site Operations 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-13-REM-REF01, "Millstone Radiological Effluent Program Reference Manual."

I.C. Liquid Effluents

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 Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
Any Batch Release from any source	Grab sample prior to each batch release[B]	Prior to each batch release	Principal Gamma Emitters	5×10^{-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 any one source and quarterly thereafter	Gross alpha	1×10^{-7}
			Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

Table I.C-1
TABLE NOTATIONS

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

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

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

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 microcurie
- **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.

Table I.C-2
Millstone Unit 2 Radioactive Liquid Waste Sampling and Analysis Program

Liquid Release Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
A. Batch Release				
1. Clean Waste Monitor Tank[B], Aerated Waste Monitor Tank[B] and Steam Generator Bulk[B,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 and Entrained Gases[K]	1×10^{-5}
2. Condensate Polishing Facility - Waste Neutralization Sump[B,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*]	Daily Grab Sample[I] and prior to aligning to Long Island Sound for RBCCW sump	Weekly Composite[F,G]	Principal Gamma Emitters[C]	5×10^{-7}
2. Service Water Effluent[J*]			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
3. Turbine Sumps[L*]	Monthly Grab Sample	Monthly	Dissolved and 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}

* There is a Conditional Action Requirement associated with this notation

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):

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

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 microcurie
- **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, samples 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.*

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.

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.

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.*

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

CONDITIONAL ACTION REQUIREMENTS

D. For the Steam Generator Bulk:
IF the applicable batch gamma activity 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.

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

H. For the Steam Generator Blowdown:
IF the steam generator gross gamma activity 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.

J. For the Service Water:
IF a weekly gamma analysis does not indicate a gamma activity 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.

L. For the Turbine Building Sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analyses is not required.
IF the steam generator gross gamma activity does not exceed 5×10^{-7} 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 activity 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.

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

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

* There is a Conditional Action Requirement associated with this notation.

TABLE I.C-3
TABLE NOTATIONS

INFORMATIONAL NOTES:

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):

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

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 microcurie
- **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, samples 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.*

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.

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.

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*.

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

CONDITIONAL ACTION REQUIREMENTS

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

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

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

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

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

L. For the Turbine Building Sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analyses is not required.
IF the steam generator gross gamma activity does not exceed 5×10^{-7} 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 Turbine Building sump release 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.

Liquid Radioactive Waste Treatment

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

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

1) **IF** the radioactivity concentration criteria for the Unit 3 steam generator blowdown is exceeded with blowdown recovery not available to maintain releases to as low as reasonably achievable; or,
IF any of the other radioactive waste processing equipment listed in Section b are not routinely operating, **THEN** doses due to liquid effluents from the applicable waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section II.C.5.

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

3) **IF** an actual dose due to liquid effluents exceeds 0.06 mrem to the total body or 0.2 mrem to any organ **AND** the dose from the waste stream with processing equipment not operating exceeds 10% of one of these limits, **THEN** prepare and submit to the Commission a Special Report within 30 days as specified in Section 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
Reactor cavity 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	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 activity exceeds 5E-7 μCi/ml or tritium activity exceeds 0.02 μCi/ml.

c. Report Requirement For All Three Millstone Units

If required by Section 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.

Basis for Liquid Sampling, Analysis and Radioactive Treatment System Use

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

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

If not already in use, the requirement that the appropriate portions of the liquid radioactive waste treatment system for each Unit be returned to service when the specified effluent doses are exceeded provides assurance that the release of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This condition of equipment usage implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR 50, and the design objective given in Section II.D of Appendix I to 10 CFR Part 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-2, "Reserved"

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

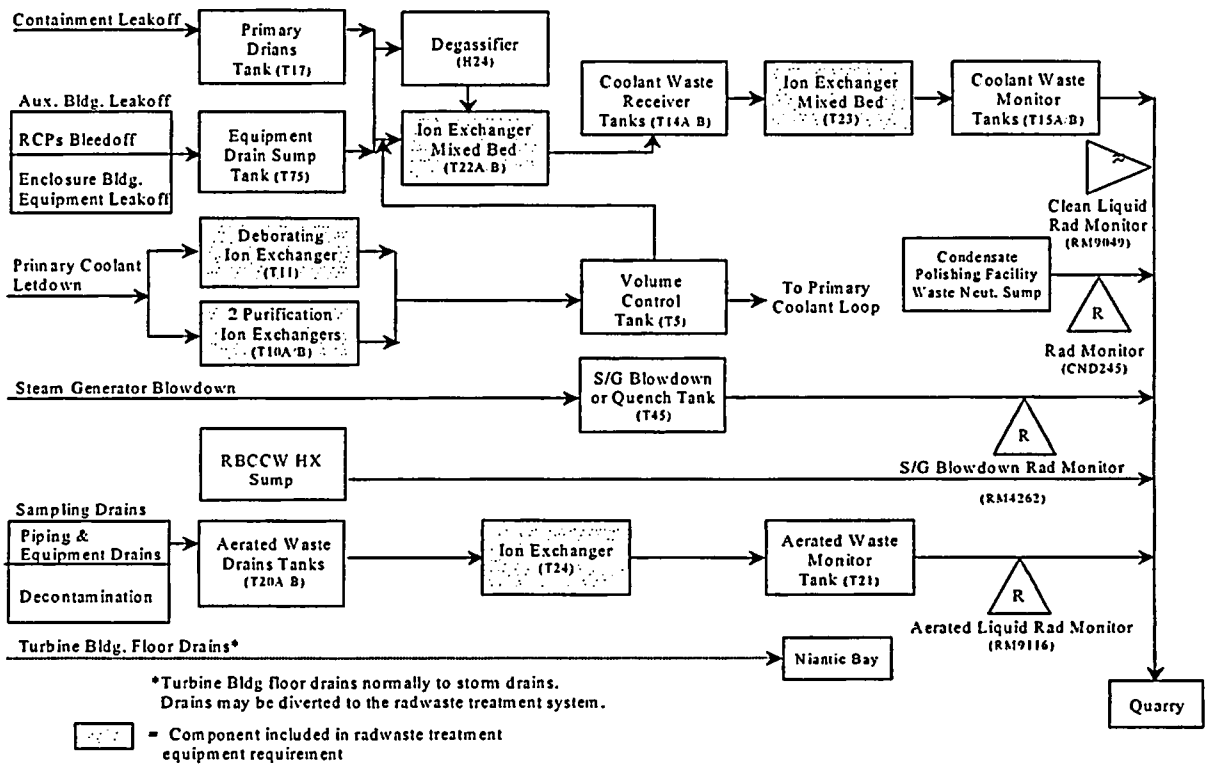
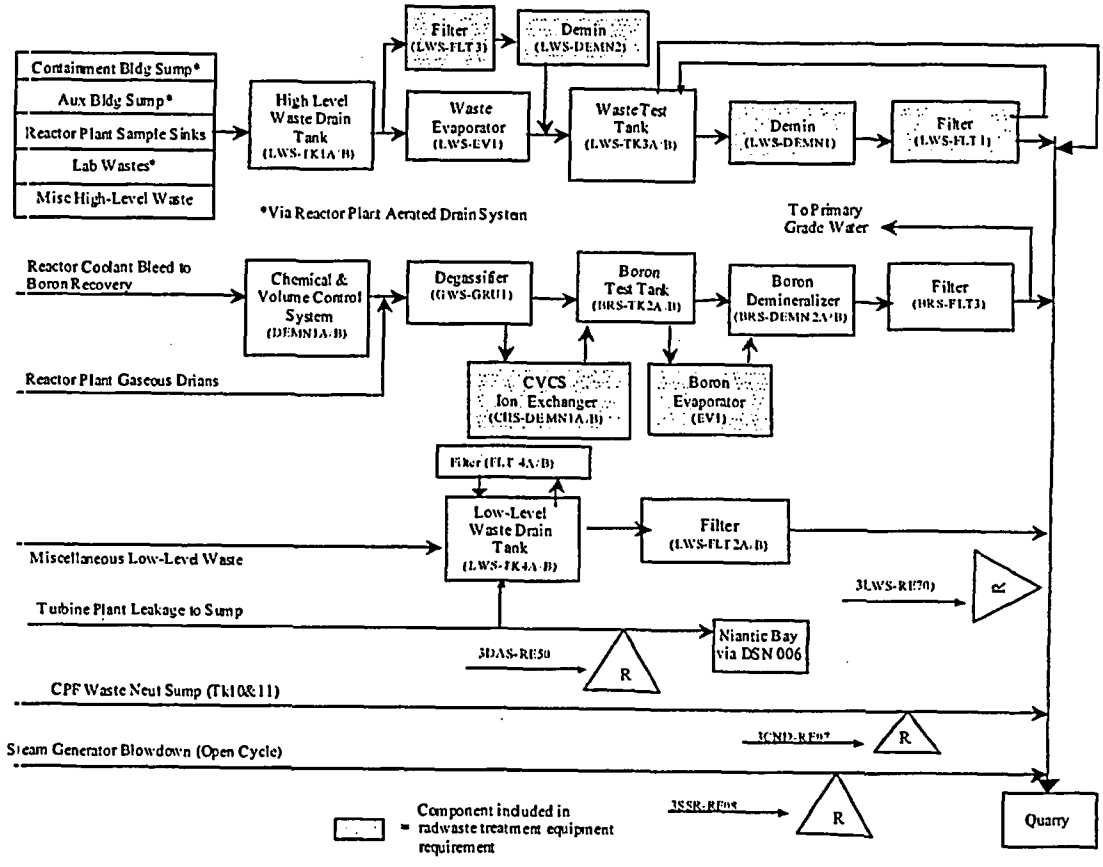


Figure I.C-3, "Simplified Liquid Effluent Flow Diagram Millstone Unit 3"



Gaseous Effluents

Gaseous Effluent Sampling and Analysis Program

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

Table I.D-1
Millstone Unit 1
Radioactive Gaseous Waste Sampling And Analysis Program

Gaseous Release Point or Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/cc)
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 Particulate 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 Particulate 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}

*There is a Conditional Action Requirement associated with this notation.

Table I.D-1
TABLE NOTATIONS

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

CONDITIONAL ACTION REQUIREMENTS:

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 uCi/cc or greater, **THEN** sampling and analysis shall also be performed within 24 hours.

E. Continuous when exhaust fans are in operation.

Table I.D-2
Millstone Unit 2 Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Point or Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/cc)
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 Purge 2. Containment Venting	Gaseous Grab of purges and vents 1. Prior to Each Purge[J*] 2. Every two weeks for Venting[I*]	1. Prior to purge 2. Weekly for venting and prior to venting for Footnote I samples	Principal Gamma Emitters[B]	1×10^{-4}
3. Open Equipment Hatch during Outages		Monthly	H-3	1×10^{-6}
4. Spent Fuel Pool	Continuous Particulate for Open Equipment Hatch during Outage	Weekly	Particulate Gamma emitters for 1/2 hour count (I-131, others with half-life greater than 8 days	NA
	Continuous Charcoal for Open Equipment Hatch during Outage and Aux Bldg Rollup Door[L]	Weekly	I-131 and I-133 for one hour count	NA
	Gaseous Grab at Equipment Hatch and Aux Bldg Rollup Door[L]	Dailey	Noble Gases – Gross Activity	1×10^{-4}
C. Continuous Release 1.Vent (RM8132B)	Monthly - Gaseous Grab Sample[C*, K]	Monthly[C*, K]	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 Particulate Gamma Emitters[B] - (I-131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous Particulate [illegible]	Quarterly Composite	Sr-89, Sr-90 [illegible]	1×10^{-11} [illegible]
	Continuous Noble Gas[D]	Continuous Monitor	Noble Gases - Gross Activity	1×10^{-6}

*There is a Conditional Action Requirement associated with this notation.

TABLE I.D-2
TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

E. RESERVED

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 conditons are met:

(1) The previous batch of radioactive waste gas has been discharged to a final tank pressure of less than 5 PSIG.

(2) No radioactive gases have been added to the tank since the previous discharge.

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

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

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

b) the sum of Kr-85 and Xe-133 is less than 0.01 Ci and the sum 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.

CONDITIONAL ACTION REQUIREMENTS:

C. Sampling and analysis shall also be performed 24 to 72 hours after:

(1) reactor shutdown or startup, or

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

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 within a 1-hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the Dose Equivalent I-131 concentration in the reactor coolant has not increased more than a factor of three; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of three.

G. **IF** the refueling cavity is flooded and there is fuel in the cavity, **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.

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

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

K. **IF** there is an increase of the Millstone Stack or Unit 2 Vent noble gas monitor of greater than 50%, **THEN** sampling and analysis shall also be performed within 24 hours, except for the following conditions:

(1) the increase is already accounted for, or

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

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

L. Continuous charcoal sample at Aux Bldg Rollup Door and daily gas sample at Equipment Hatch and Aux Bldg Rollup Door are only required when moving fuel. Sampling at the Equipment Hatch is not required if the Enclosure Building is intact. Sampling at the Aux Bldg Rollup Door is not required if the rollup door is closed.

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

Gaseous Release Source or Point	Sample Type and Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/cc)
A. Containment and Fuel Building Release				
1. Containment Hogger Drawdown 2. Containment Purge 3. Containment Vent 4. Open Equipment Hatch during Outages 5. Fuel Building	Gaseous, Particulate and Charcoal Grab Prior to Each Drawdown Gaseous Grab prior to each purge[H*] Gaseous Grab every two weeks for venting[I*]	Prior to Each Purge or Drawdown; Weekly for venting and prior to venting for Footnote I sample	Principal Gamma Emitters[B]	1×10^{-4}
		Prior to Each Drawdown	I-131 I-133	1×10^{-12} 1×10^{-10}
			Principal Particulate Gamma Emitters[B] - (I-131, others with half lives greater than 8 days)	1×10^{-11}
		Monthly for all release sources except Equipment Hatch	H-3	1×10^{-6}
	Continuous Particulate at Open Equipment Hatch	Weekly	Particulate Gamma emitters for ½ hour count (I-131, others with half-life greater than 8 days)	NA
	Continuous Charcoal at Equipment Hatch and Fuel Building Rollup Doors[K]	Weekly	I-131 and I-133 for one hour count	NA
	Gaseous Grab at Equipment Hatch and Fuel Building Rollup Doors[K]	Daily	Noble Gases – Gross Activity	1×10^{-4}
B. Continuous Release				
1. Unit 3 Ventilation Vent (HVR-RE10B)	Monthly - Gaseous Grab[C*,J*]	Monthly[C*,J*]	Principal Gamma Emitters[B]	1×10^{-4}
			H-3[G*]	1×10^{-6}
2. Engineered Safeguards Building (HVQ-RE49)	Continuous Charcoal Sample[D,F*]	Weekly	I-131 I-133	1×10^{-12} 1×10^{-10}
3. Millstone Stack via SLCRS (HVR-RE19B)	Continuous Particulate Sample[D,F*]	Weekly	Principal Particulate 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 Activity	1×10^{-6}

* There is a Conditional Action Requirement associated with this notation.

TABLE I.D-3
TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

E. RESERVED

CONDITIONAL ACTION REQUIREMENTS

C. For the ventilation vent and SLCRS, sampling and analysis shall also be performed 24 to 72 hours after:

(1) reactor shutdown or startup, or

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

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 within a 1-hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the Dose Equivalent I-131 concentration in the reactor coolant has not increased more than a factor of three; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of three.

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

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

I. **IF,** compared to the radioactivity at the time of the air sample, Radiation Monitor CMS22 gas channel or particulate channel increases by a factor of two, **THEN** a new containment air sample shall be taken.
IF, containment noble gas activity exceeds 1E-6 uCi/cc as indicated by the last grab sample, THEN sampling frequency shall be increased to weekly until such time that the activity is less than 1E-6 uCi/cc.

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

(1) the increase is already accounted for, or

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

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

K. Continuous charcoal sample at any open Fuel Bldg Rollup Door and daily gas sample at Equipment Hatch and at any open Fuel Bldg Rollup Door are only required when moving fuel. Sampling at a Fuel Bldg Rollup Door is not required if the rollup door is closed.

2. Gaseous Radioactive Waste Treatment

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

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

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

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

3) **IF** actual doses exceed 0.2 mrad for gamma radiation, 0.4 mrad for beta radiation or 0.3 mrem to any organ **AND** the dose from a waste stream with equipment not operating exceed 10% any of these limits, **THEN** prepare and submit to the Commission a report as specified in Section 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
Gaseous Radwaste Treatment System	Charcoal bed adsorbers
	One HEPA filter
Building Ventilation	Fuel building ventilation filter

c. Report Requirement For All Three Millstone Units

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

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

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

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

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

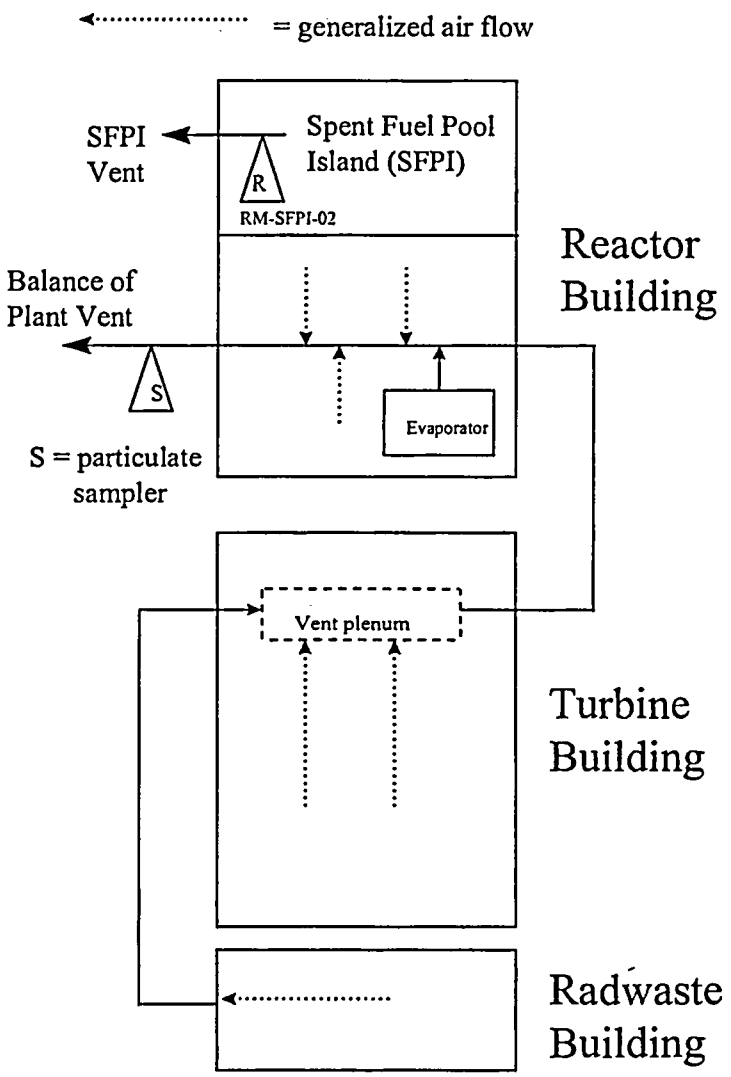


FIGURE I.D-1
Simplified Gaseous Effluent Flow Diagram Millstone Unit One

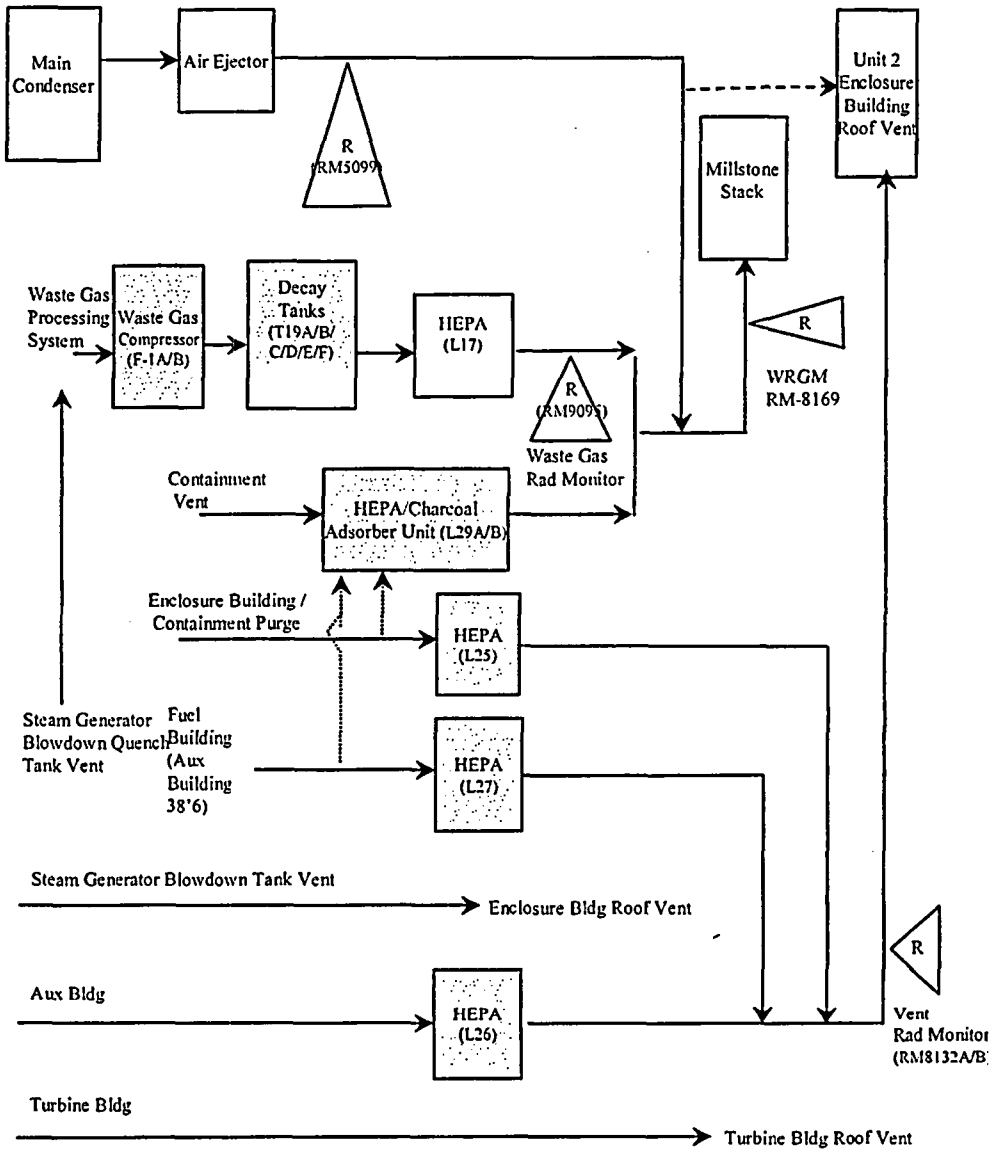


FIGURE I.D-2
Simplified Gaseous Effluent Flow Diagram Millstone Unit Two

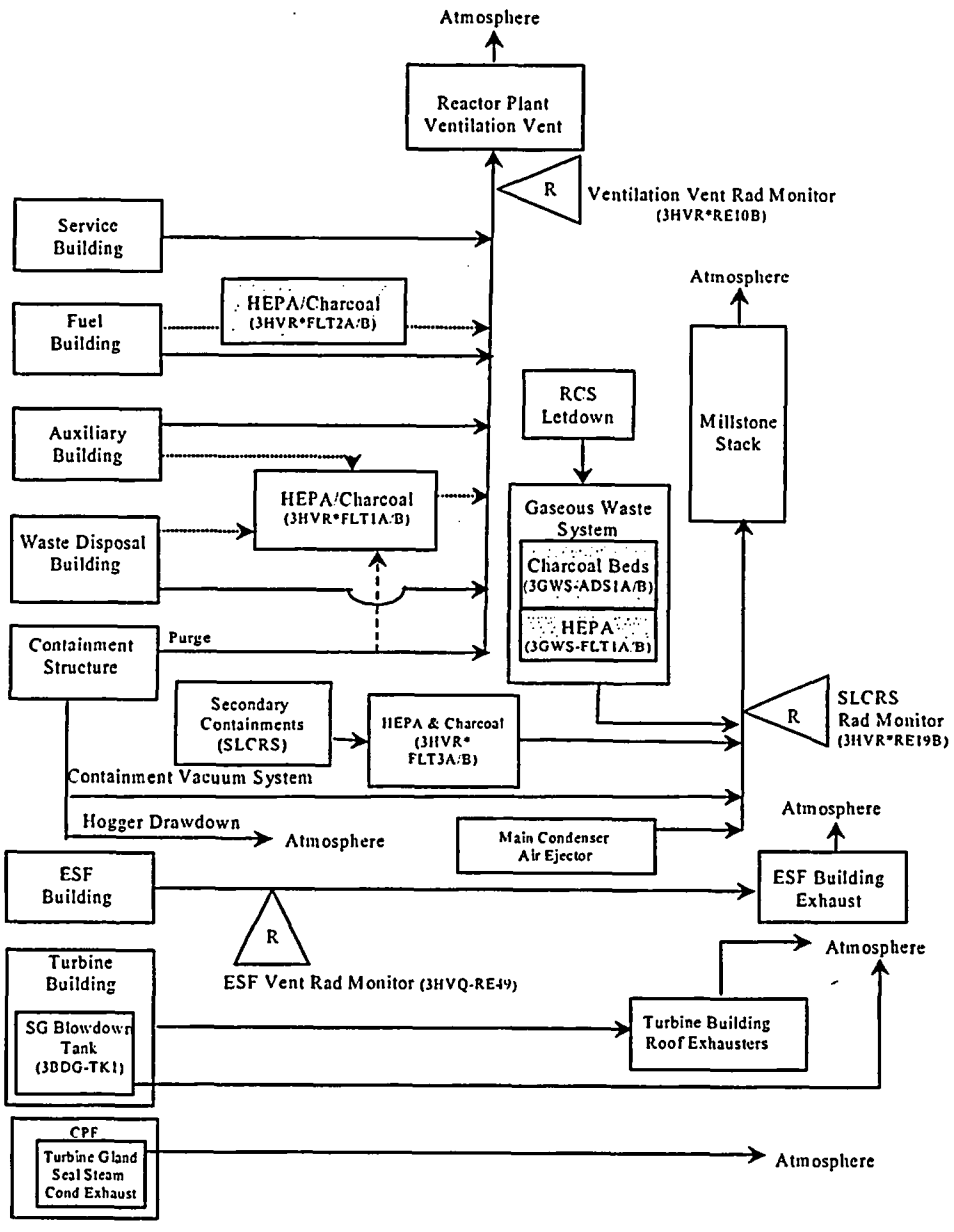


Figure I.D-3
Simplified Gaseous Effluent Flow Diagram Millstone Unit Three

I.D. Radiological Environmental Monitoring

1. Sampling and Analysis

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

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

All deviations from the sampling schedule shall be documented in the *Annual Radiological Environmental Operating Report* pursuant to *Section I.F.1.* It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice (excluding milk) at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathways in questions and appropriate substitutions made within 30 days in the radiological environmental monitoring program.

If milk samples are temporarily unavailable from any one or more of the milk sample locations required by Table I.E-2, a grass sample shall be substituted during the growing season (Apr. - Dec.) and analyzed for gamma isotopes and I-131 until milk is again available. Upon notification that milk samples will be unavailable for a prolonged period (>9 months) from any one or more of the milk sample locations required by Table I.E-2, a suitable replacement milk location shall be evaluated and appropriate changes made in the radiological environmental monitoring program. Reasonable attempts shall be made to sample the replacement milk location prior to the end of the next sampling period. Any of the above occurrences shall be documented in the Annual Radiological Environmental Operating Report which is submitted to the U. S. Nuclear Regulatory Commission prior to May 1 of each year.

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

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 the end of the affected calendar quarter, 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.1b, 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	40[a]	Quarterly	Gamma Dose - Quarterly
2. Airborne Particulate	8	Continuous sampler - weekly filter change	Gross Beta - Weekly Gamma Spectrum - Quarterly on composite (by location), and on individual sample if gross beta is greater than 10 times the mean of the weekly control station's gross beta results
3. Airborne Iodine	8	Continuous sampler - weekly canister change	I-131 - Weekly
4. Vegetation	5	One sample near middle and one near end of growing season	Gamma Isotopic on each sample
5. Milk	3	Semimonthly when animals are on pasture; monthly at other times.	Gamma Isotopic and I-131 on each sample; Sr-89 and Sr-90 on Quarterly Composite
5a. Pasture Grass	3	Sample as necessary to substitute for unavailable milk	Gamma Isotopic and I-131
6. Sea Water	2	Continuous sampler with a monthly collection at indicator location. Quarterly at control location - Composite of 6 weekly grab samples	Gamma Isotopic and Tritium on each sample.
6a. Well Water	3	Semiannually	Gamma Isotopic and Tritium on each sample.
7. Bottom Sediment	5	Semiannual	Gamma Isotopic on each sample
7a. Soil	3	Annually	Gamma Isotopic on each sample
8. Fin Fish-Flounder and one other type of edible fin fish (edible portion)	2	Quarterly	Gamma Isotopic on each sample
9. Mussels (edible portion)	2	Quarterly	Gamma Isotopic on each sample
10. Oysters (edible portion)	4	Quarterly	Gamma Isotopic on each sample
11. Clams (edible portion)	2	Quarterly	Gamma Isotopic on each sample
12. Lobsters (edible portion)	2	Quarterly	Gamma Isotopic on each sample

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

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, I.E-2, and I.E-3:

Location		Direction & Distance from Release Point**	Sample Types
Number*	Name		
1-I	Onsite - Old Millstone Road	0.6 Mi, NNW	TLD, Air Particulate, Iodine, Vegetation
2-I	Onsite - Weather Shack	0.3 Mi, S	TLD, Air Particulate, Iodine
3-I	Onsite - Bird Sanctuary	0.3 Mi, NE	TLD, Air Particulate, Iodine, Soil
4-I	Onsite - Albacore Drive	1.0 Mi, N	TLD, Air Particulate, Iodine, Soil
5-I	Onsite - MP3 Discharge	0.1 Mi, SSE	TLD
6-I	Onsite - Quarry Discharge	0.3 Mi, SSE	TLD
7-I	Onsite - Environmental Lab Dock	0.3 Mi, SE	TLD
8-I	Onsite - Environmental Lab	0.3 Mi, SE	TLD
9-I	Onsite - Bay Point Beach	0.4 Mi, W	TLD
10-I	Pleasure Beach	1.2 Mi, E	TLD, Air Particulate, Iodine, Vegetation
11-I	New London Country Club	1.6 Mi, ENE	TLD, Air Particulate, Iodine
12-C	Fisher's Island, NY	8.0 Mi, ESE	TLD
13-C	Mystic, CT	11.5 Mi, ENE	TLD
14-C	Ledyard, CT	12.0 Mi, NE	TLD, Soil
15-C	Norwich, CT	14.0 Mi, N	TLD, Air Particulate, Iodine
16-C	Old Lyme, CT	8.8 Mi, W	TLD
17-I	Site Boundary	0.5 Mi, NE	Vegetation
21-I	Goat Location No. 1	2.0 Mi., N	Milk
22-I	Goat Location No. 2	2.7 Mi, NE	Milk
24-C	Goat Location No. 3	29 Mi, NNW	Milk
25-I	Fruits & Vegetables	Within 10 Miles	Vegetation
26-C	Fruits & Vegetables	Beyond 10 Miles	Vegetation
27-I	Niantic	1.7 Mi, WNW	TLD, Air Particulate, Iodine
28-I	Two Tree Island	0.8 Mi, SSE	Mussels, Fish[1]
29-I	West Jordan Cove	0.4 Mi, NNE	Clams, Fish[1]
30-I	Niantic Shoals	1.5 Mi, NNW	Mussels
31-I	Niantic Shoals	Mi, NW	Bottom Sediment, Oysters
32-I	Vicinity of Discharge[2]		Bottom Sediment, Oysters, Lobster, Fish[1], Seawater
33-I	Seaside Point	1.8 Mi, ESE	Bottom Sediment
34-I	Thames River Yacht Club	4.0 Mi, ENE	Bottom Sediment
35-I	Niantic Bay	0.3 Mi, WNW	Lobster, Fish

[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.

Location		Direction & Distance from Release Point**	Sample Types
Number*	Name		
36-I	Black Point	3.0 Mi, WSW	Oysters
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
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	Background well	Onsite	Well water

* I = Indicator; C = Control.
** = The release points are the Millstone Stack for terrestrial locations and the end of the quarry for aquatic location.
NOTE: Environmental TLDs also function as accident TLDs in support of the Millstone Emergency Plan.

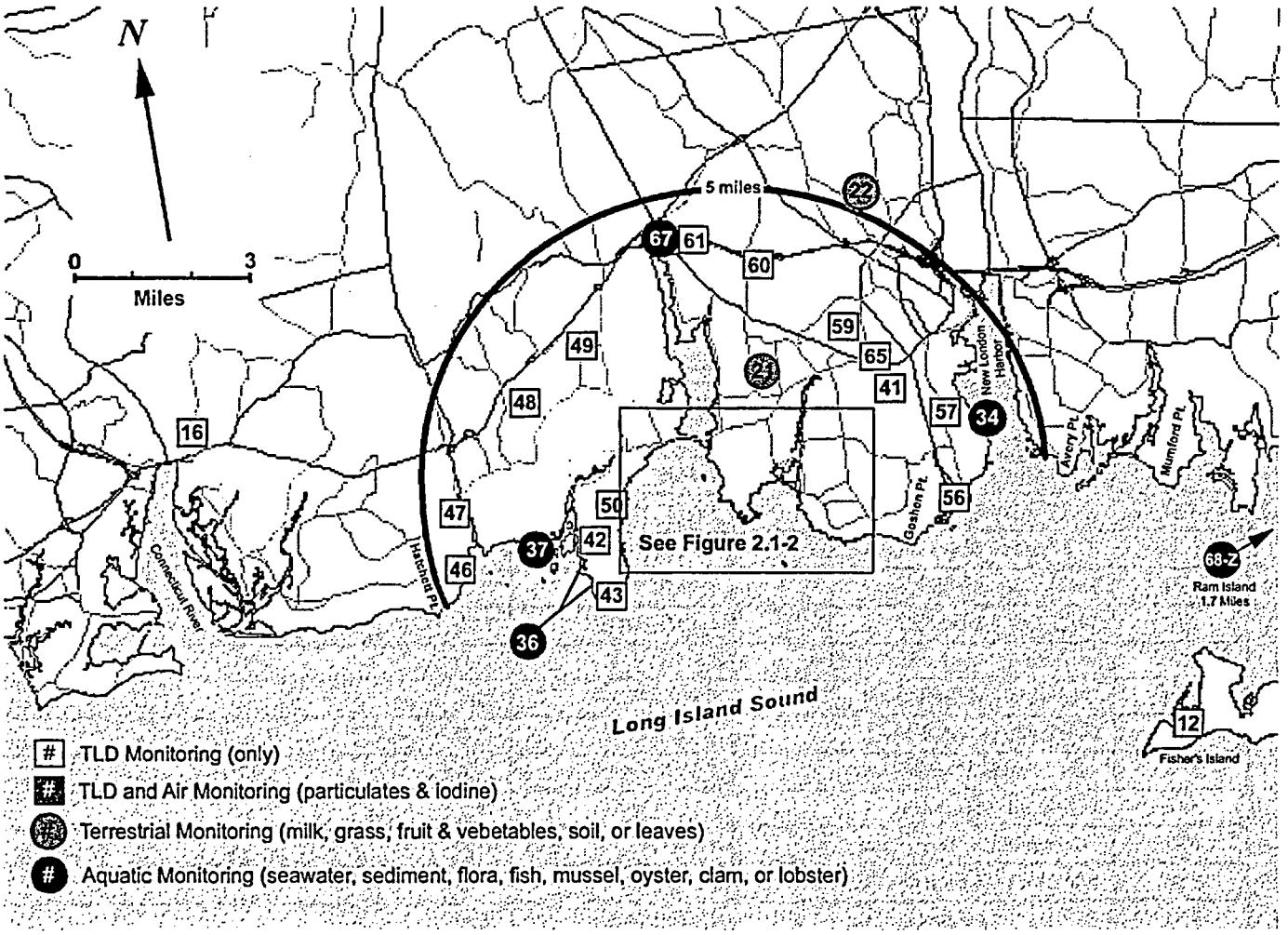


FIGURE I.E-1
Inner Air Particulate And Vegetation Monitoring Stations

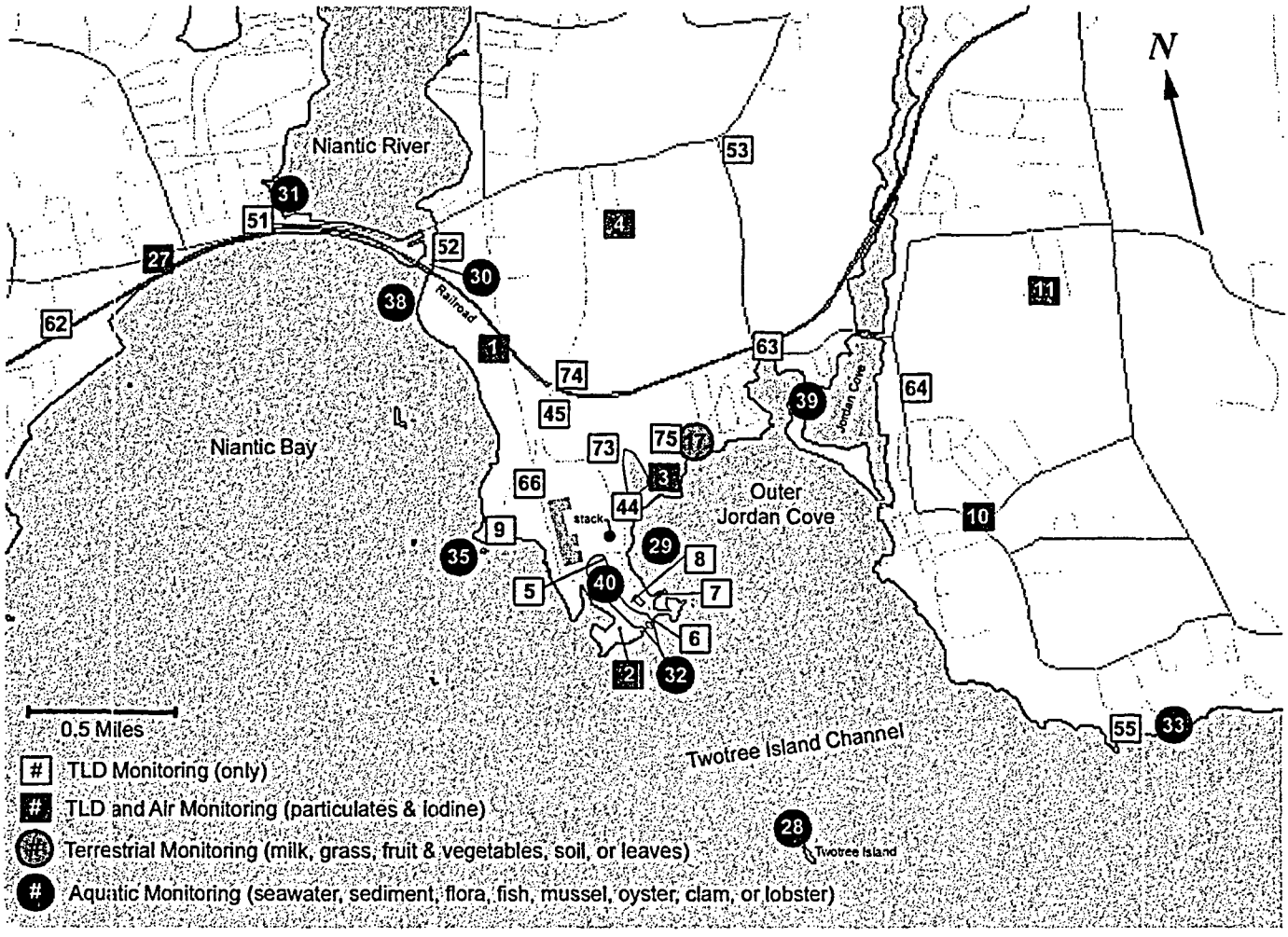


FIGURE I.E-2
Outer Terrestrial Monitoring Stations

TABLE I.E-3
Reporting Levels For Radioactivity Concentrations In Environmental Samples

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/g, wet)	Shellfish[c] (pCi/g, wet)	Milk (pCi/l)	Vegetables (pCi/g, wet)
H-3	20,000[a]					
Mn-54	1,000		30	140		
Fe-59	400		10	60		
Co-58	1,000		30	130		
Co-60	300		10	50		
Zn-65	300		20	80		
Zr-95	400					
Nb-95	400					
Ag-110m			8	30		
I-131	20[b]	0.9	0.2	1	3	0.1
Cs-134	30	10	1	5	60	1
Cs-137	50	20	2	8	70	2
Ba-140	200				300	
La-140	200				300	

(a) 20,000 pCi/l for drinking water samples. (This is 40 CFR Part 141 value.) For non-drinking water pathways (i.e., seawater), 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 Gas (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		0.13			
Fe-59	30		0.26			
Co-58, 60	15		0.13			
Zn-65	30		0.26			
Zr-95	30					
Nb-95	15					
I-131	15[c]	7×10^{-2}		1	0.06[b]	
Cs-134	15	5×10^{-2}	0.13	15	0.06	0.15
Cs-137	18	6×10^{-2}	0.15	18	0.08	0.18
Ba-140	60[c]			70		
La-140	15[c]			25		

TABLE I.E-4
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):

$$LLD = \frac{4.66\ S_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda\ \Delta t)}$$

where:

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

- Δt = the elapsed time between midpoint of sample collection (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 Part 50.* The land use census shall be maintained and shall identify the location of the nearest resident, nearest garden*, and milk animals in each of the 16 meteorological sectors within a distance of five miles.

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

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

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

(1) If the D/Q is at least 20% greater than the previously highest D/Q, replace one of the present sample locations with the new one within 30 days if milk is available.

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

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

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

3. Interlaboratory Comparison Program

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

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

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

4. Bases for the Radiological Environmental Monitoring Program

Federal regulations (10 CFR Parts 20 and 50) require that radiological environmental monitoring programs be established to provide data on measurable levels of radiation and radioactive materials in the site environs. In addition, Appendix I to 10 CFR Part 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 Part 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.E. Report Content

1. Annual Radiological Environmental Operating Report

The *Annual Radiological Environmental Operating Report* shall include summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The report shall also include the results of the land use census required by *Section I.E.2* of this manual. If levels of radioactivity are detected that result in calculated doses greater than 10CFR50 Appendix I Guidelines, the report shall provide an analysis of the cause and a planned course of action to alleviate the cause.

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

1. Total number of analyses performed at indicator locations.
2. Total number of analyses performed at control locations.
3. Lower limit of detection (LLD).
4. Mean and range of all indicator locations together.
5. Mean and range of all control locations together.
6. Name, distance and direction from discharge, mean and range for the location with the highest annual mean (indicator or control).
7. Number of nonroutine reported measurements as defined in these specifications.

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

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

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

2. Radioactive Effluent Release Report

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

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

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

The RERR shall include a list of all abnormal releases of radioactive gaseous and liquid effluents (i.e., all unplanned or uncontrolled radioactivity releases, including reportable quantities) from the site to unrestricted areas. See the REMODCM Technical Information Document (MP13-REM-REF02) 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 *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 2. OFFSITE DOSE CALCULATION MANUAL (ODCM)

II.A. Introduction

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

The bases for selected site-specific factors used in the dose calculation methodology are provided in MP-13-REM-REF02, "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.E.2.a, and V.E.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 and App.A-2 provide a cross-reference of effluent requirements and applicable methodologies contained in the REMODCM.

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

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

II.B. Responsibilities

All changes to the Off-Site Dose Calculation Manual (ODCM) shall be reviewed and approved by the Site Operations 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 Vice President and Senior Nuclear Executive - 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-13-REM-REF01, "Millstone Radiological Effluent Program Reference Manual."

II.C. Liquid Dose Calculations

The determination of potential doses from liquid effluents to the maximum exposed member of the public is divided into two methods. Method 1 is a simplified calculation approach that is used as an operational tool to ensure that effluent releases as they occur are not likely to cause quarterly and annual offsite dose limits to be exceeded. Effluent doses are calculated at least once every 31 days. Method 2 is a more detailed computational calculation using accepted computer models to demonstrate actual regulatory dose compliance. Method 2 is used whenever the Method 1 estimation begins to approach a regulatory limit, and for preparation of the *Radioactive Effluent Release Report* which includes the quarterly and annual dose impacts for all effluents recorded discharged to the environment during the year of record.

1. Whole Body Dose from Liquid Effluents

Radiological Effluent Controls (Sections III, IV, and V) limit the whole body dose to an individual member of the public to 1.5 mrem per calendar quarter and 3 mrem per year from liquid effluents released from each unit. (See Appendix A, Tables App.A-1 and App.A-2 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 whole body dose over 31 days from applicable waste streams exceeds 0.006 mrem. This part of the REMODCM provides the calculation methodology for determining the whole body dose from radioactive materials released into liquid pathways of exposure associated with routine discharges. This includes the liquid pathways which contribute to the 25 mrem annual total dose limit (40 CFR190) to any real individual member of the public from all effluent sources (liquids, gases, and direct).

a. Method 1 (Applicable to Units 1, 2, and 3)

<u>For Unit 1</u>: No Method 1, use Method 2 (Section II.C.1.b)

<u>For Units 2 and 3</u>:

$D_W = 0.2\ C_F + 5.6 \times 10^{-7}\ C_H$

Where:

D_W =The estimated whole body dose to a potentially maximum exposed individual (in mrem) due to fission and activation products released in liquid effluents during a specified time period.

C_F = total gross curies of fission and activation products, excluding tritium and dissolved noble gases, released during the period of interest.

C_H = total curies of tritium released during the period of interest.

If D_W, within a calendar quarter is greater than 0.5 mrem, go to Method 2.

b. Method 2 (Applicable to Units 1, 2, and 3)

If the calculated dose using Method 1 is greater than 0.5 mrem within a calendar quarter, or if a more accurate determination is desired, use the NRC computer code LADTAP II, or a code which uses the methodology given in Regulatory Guide 1.109, to calculate the liquid whole body doses. Method 2 (LADTAP II) is also used in the performance of dose calculations for the *Radioactive Effluent Release Report.* The use of this code is given in Engineering Procedure RAB B-11, *Liquid Dose Calculations - LADTAPII.* Additional information on LADTAPII is contained in MP-13-REM-REF02, "REMODCM Technical Information Manual."

2. Maximum Organ Dose from Liquid Effluents

Radiological Effluent Controls (Sections III, IV, and V) limit the maximum organ dose to an individual member of the public to 5 mrem per calendar quarter and 10 mrem per year from liquid effluents released from each unit. (See Appendix A, Tables App.A-1 and App.A-2 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 maximum organ dose over 31 days from applicable waste streams exceeds 0.02 mrem. This part of the REMODCM provides the calculation methodology for determining the maximum organ dose from radioactive materials released into liquid pathways of exposure associated with routine discharges. This includes the liquid pathways which contribute to the 25 mrem annual organ (except 75 mrem thyroid) dose limit (40 CFR190) to any real individual member of the public from all effluent sources (liquids, gases, and direct).

a. Method 1 (Applicable to Units 1, 2, and 3)

<u>For Unit 1</u>: No Method 1, use Method 2 (Section II.C.2.b)

<u>For Units 2 and 3</u>:

$D_O = 1.5\ C_F$

Where: D_O =The estimated maximum organ dose to the potentially maximum exposed individual (in mrem) due to fission and activation products released in liquid effluents during a specified time period.

C_F =total gross curies of fission and activation products, excluding tritium and dissolved noble gases, released during the period of interest - same as *Section II.C.1.a.*

If D_O, within a calendar quarter is greater than 2 mrem, go to *Method 2.*

b. Method 2 (Applicable to Units 1, 2, and 3)

If the calculated dose using Method 1 is greater than 2 mrem, or if a more accurate determination is desired, use the NRC computer code LADTAP II, or a code which uses the methodology given in Regulatory Guide 1.109, to calculate the liquid maximum organ doses. Method 2 (LADTAP II) is also used in the performance of dose calculations for the Radioactive Effluent Release Report. The use of this code and the input parameters are given in Engineering Procedure *RAB B-11, Liquid Dose Calculations - LADTAP II.* Additional information on LADTAPII is contained in MP-13-REM-REF02, "REMODCM Technical Information Manual."

3. Estimation of Annual Whole Body Dose (Applicable to All Units)

An estimation of annual (year-to-date) whole body dose (D_{YW}) from liquid effluents shall be made every month to determine compliance with the annual dose limits for each Unit which releases any radioactivity in liquid effluents. Annual doses will be determined as follows:

$$D_{YW} = \Sigma D_W$$

where the sum of the doses include the whole body dose contribution from all effluent releases for each Unit recorded to-date. For estimation of the Total Dose requirements of 40CFR190, the effluent releases from all three Units combined are used.

The following shall be used as D_W:

(1) If the detailed quarterly dose calculations required per *Section II.C.6* for the *Radioactive Effluent Release Report* are completed for any calendar quarter, use that result.

(2) If the detailed calculations are not complete for a particular quarter, use the results as determined in *Section II.C.1.*

(3) If the annual dose estimate, D_{YW}, is greater than 3 mrem and any D_W determined as in *Section II.C.1* was not calculated using *Method 2* (i.e., LADTAP II computer code or a Regulatory Guide 1.109 code), recalculate D_w using Method 2 if this could reduce D_{YW} to less than 3 mrem.

4. Estimation of Annual Maximum Organ Dose (Applicable to All Units)

An estimation of annual (year-to-date) maximum organ dose (D_{YO}) from liquid effluents shall be made every month to determine compliance with the annual dose limits for each Unit which releases any radioactivity in liquid effluents. Annual doses will be determined as follows:

$$D_{YO} = \Sigma D_O$$

where the sum of the doses include the maximum organ dose contribution from all effluent releases for each Unit recorded to-date. For estimation of the Total Dose requirements of 40CFR190, the effluent releases from all three Units combined are used.

The following guidelines shall be used:

(1) If the detailed quarterly dose calculations required per *Section II.C.6* for the *Radioactive Effluent Release Report* are completed for any calendar quarter, use that result.

(2) If the detailed calculations are not complete for a particular quarter, use the results as determined in *Section II.C.2*.

(3) If different organs are the maximum for different quarters, they may be summed together and D_{YO} can be recorded as a less than value as long as the value is less than 10 mrem.

(4) If D_{YO} is greater than 10 mrem and any value used in its determination was calculated as in *Section II.C.2*, but not with *Method 2* (i.e., LADTAP II computer code or a Regulatory Guide 1.109 code), recalculate that value using *Method 2* if this could reduce D_{YO} to less than 10 mrem.

5. 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 (Applicable to Unit 1 Only)

In the dose code DOSLIQ use concentrations of radionuclides in reactor cavity water and estimates of projected volumes and discharge rates for the following 31 days to estimate dose from liquid discharge of reactor cavity water in the following 31 days.

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

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

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

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

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

Where:

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

D'_{MO} = the maximum organ dose from the last typical* previously completed month as calculated per the methods in *Section II.C.2.*

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

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

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

Notes:

1. 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.
2. If the last typical month's doses were calculated using LADTAP II (or similar methodology), also multiply the LADTAP (or similar methodology) doses by R_5 where R_5 = total dilution flow from LADTAP run divided by estimated total dilution flow.

c. Whole Body and Maximum Organ when Steam Generator Total Gamma Activity Exceeds 5E-7 uCi/ml or Steam Generator Tritium Exceeds 0.02 uCi/ml (Applicable to Units 2 and 3)

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

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

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

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

Where:

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

D'_{MO} = the maximum organ dose from the last typical* previously completed month as calculated per the methods in *Section II.C.2*.

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 activity for the present month to that for the past month.

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

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

6. Quarterly Dose Calculations for Radioactive Effluent Release Report

Detailed quarterly dose calculations required for the *Radioactive Effluent Release Report* shall be done using the NRC computer code LADTAP II, or a code which uses the methodology given in Regulatory Guide 1.109. The use of this code, and the input parameters are given in *Engineering Procedure, RAB B-11, Liquid Dose Calculations - LADTAP II.* Additional information on LADTAPII is contained in MP-13-REM-REF02, " REMODCM Technical Information Manual"

7. 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 estimations calculated by both Method 1 and Method 2 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". These equations are implemented via the use of the NRC sponsored computer code LADTAP II. Input parameter values typically used in the dose models are listed in MP-13-REM-REF02, "REMODCM Technical Information Document." This same methodology is used in the determination of compliance with the 40CFR190 total dose standard for the liquid pathways.

The conversion constants in the Method 1 equations are based on the maximum observed comparison of historical effluent releases for each unit and corresponding whole body or critical organ doses to a maximum individual. The dose conversion factors are calculated based on the ratio of the observed highest dose (whole body and organ) and the curies of fission and activation products released during the period. This ratio results in the Method 1 equation conversion factor in mrem/Ci released. This same approach was repeated separately for tritium (as a different radionuclide class) discharged in liquids wastes. Reference Manual MP-13-REM-REF02 describes the derivation of the Method 1 constants and list the historical whole body and maximum organ doses calculated for each unit operation.

II.D. Gaseous Dose Calculations

The determination of potential release rates and doses from radioactive gaseous effluents to the maximum off-site receptor are divided into two methods. Method 1 provides simplified operational tools to ensure that effluent releases are not likely to cause quarterly and annual off-site dose or dose rate limits to be exceeded. Effluent doses are calculated at least once every 31 days. Method 2 provides for a more detailed computational calculation using accepted computer models to demonstrate actual regulatory compliance. Method 2 is used whenever the Method 1 estimation approaches a regulatory limit, and for preparation of the Radioactive Effluent Release Report which includes the quarterly and annual dose impacts for all effluents recorded discharged to the atmosphere during the year of record.

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

The instantaneous noble gas release rate limit from the site shall be:

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

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_{3S} = Noble gas release rate from MP3 to Millstone Stack (μCi/sec)
Q_{3V} = Noble gas release rate from MP3 Vent (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) The site release rate limit of I-131, I-133, and tritium (where the thyroid is the critical organ for these radionuclides) shall be:

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

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) The site release rate limit 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) shall be:

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

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: $DR_{org2} = 2.38 \times 10^{-3} Q_{P2S} + 5.1 \times 10^{-2} Q_{P2V} + 1.9 \times 10^{-7} Q_{H2S} + 4.2 \times 10^{-6} Q_{H2V}$

Unit 3: $DR_{org3} = 2.38 \times 10^{-3} Q_{P3S} + 5.1 \times 10^{-2} Q_{P3V} + 1.9 \times 10^{-7} Q_{H3S} + 4.2 \times 10^{-6} Q_{H3V}$

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 the 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, utilize the GASPAR, or a code which uses the methodology given in Regulatory Guide 1.109, code to estimate the dose rate from either noble gases or iodines, tritium, and particulates with half-lives greater than 8 days. The use of the code is described in Engineering Procedure *RAB-B12, Gaseous Dose Calculations - GASPAR.* Additional information on GASPAR is contained in the MP-13-REM-REF02, "REMODCM Technical Information Manual."

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 (10 and 20 mrad gamma and beta, respectively, per calendar year). Effluent dose calculations are 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 and App.A-2 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.

a. Method 1 Air Dose* (Applicable to Units 1, 2, and 3)

For Unit 1: $D_{G1} = 3.3 \times 10^{-6}\ C_{N1V}*$

$D_{B1} = 1.49 \times 10^{-3}\ C_{N1V}*$

For Unit 2: $D_{G2} = 6.3 \times 10^{-4}\ C_{N2V} + 1.81 \times 10^{-4}\ C_{N2S}*$

$D_{B2} = 1.7 \times 10^{-3}\ C_{N2V} + 1.81 \times 10^{-6}\ C_{N2S}*$

For Unit 3: $D_{G3} = 6.3 \times 10^{-4}\ C_{N3V} + 1.81 \times 10^{-4}\ C_{N3S}*$

$D_{B3} = 1.7 \times 10^{-3}\ C_{N3V} + 1.81 \times 10^{-6}\ C_{N3S}*$

If D_{G1}, D_{G2}, or D_{G3} are greater than 1.6 mrad or D_{B1}, D_{B2}, or D_{B3} are greater than 3.3 mrad within a calendar quarter, go to Method 2 below.

Where:

D_{G1} = the gamma air dose from Unit 1 for the period of interest (mrad).

D_{B1} = the beta air dose from Unit 1for the period of interest (mrad).

D_{G2} = the gamma air dose from Unit 2 for the period of interest (mrad).

D_{B2} = the beta air dose from Unit 2 for the period of interest (mrad).

D_{G3} = the gamma air dose from Unit 3 for the period of interest (mrad).

D_{B3} = the beta air dose from Unit 3 for the period of interest (mrad).

C_{N1V} = the total curies of noble gas released from Spent Fuel Pool Island Vent during the period of interest.

C_{N2V} = the total curies of noble gas released from Unit 2 Vent during the period of interest. Include containment releases to Unit 2 Vent

C_{N2S} = the total curies of noble gas released from Unit 2 to Millstone Stack during the period of interest.

C_{N3V} = the total curies of noble gas released from Unit 3 vents during the period of interest. Include containment releases to Unit 3 Vent and ESF Building Vent.

C_{N3S} = the total curies of noble gas released from Unit 3 to Millstone Stack during the period of interest.

* See MP-13-REM-REF02, "REMODCM Technical Information Document," Section 4.2, for the derivation of air dose Method 1 factors.

b. Method 2 Air Dose (Applicable to Units 1, 2, and 3)

Use the GASPAR computer code, or a code which uses the methodology given in Regulatory Guide 1.109, to determine the critical site boundary air doses.

For the Special Location, enter the following worst case quarterly average meteorology based on the Unit 2 vent eight-year history for 1980 to 1987:

$X/Q = 8.1 \times 10^{-6}$ sec/m^3

$D/Q = 1.5 \times 10^{-7}$ m^{-2}

(See the MP-13-REM-REF02 (Att5) "REMODCM Technical Information Document.")

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

c. Estimation of Annual Air Dose Limit Due to Noble Gases (Applicable to Units 1, 2, and 3)

An estimation of annual (year-to-date) beta and gamma air doses (D_{YB} and D_{YG}, respectively) from noble gases released from Units 1, 2 and 3 shall be made every month to determine compliance with the annual dose limits for each Unit. Annual air doses will be determined as follows:

Unit 1	Unit 2	Unit 3
$D_{YG1} = \Sigma D_{G1}$	$D_{YG2} = \Sigma D_{G2}$	$D_{YG3} = \Sigma D_{G3}$
$D_{YB1} = \Sigma D_{B1}$	$D_{YB2} = \Sigma D_{B2}$	$D_{YB3} = \Sigma D_{B3}$

Where the sums are over the first quarter (i.e., summation of the all release periods within the quarter) through the present calendar quarter doses.

Where: D_{YG1}, D_{YG2}, D_{YG3}, D_{YB1}, D_{YB2} and D_{YB3} = gamma air dose and beta air dose for the calendar year for Unit 1, 2, or 3.

The following shall be used as the quarterly doses:

(1) If the detailed quarterly dose calculations required per *Section II.D.5* for the *Radioactive Effluent Release Report* are complete for any calendar quarter, use those results.

(2) If the detailed calculations are not complete for a particular quarter, use the results as determined above in *Sections II.D.2.a or II.D.2.b.*

If $D_{YG1, YG2 \text{ or } YG3}$ are greater than 10 mrad or $D_{YB1, YB2 \text{ or } YB3}$ are greater than 20 mrad and any corresponding quarterly dose was not calculated using Method 2 (*Section II. D.2.b)*, recalculate the quarterly dose using meteorology concurrent with quarter of release.

3. 10 CFR50 Appendix I - Iodine, Tritium and Particulate Doses

Radiological Effluent Controls (Section III, IV, and V) limit the off-site dose to a critical organ from radioiodines, tritium, and particulates with half-lives greater than 8 days released in gaseous effluents to 7.5 mrem for a calendar quarter (15 mrem per calendar year). Effluent dose calculations are performed at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.03 mrem. (See Appendix A, Tables App.A-1 and App.A-2 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.

a. Critical Organ Doses (Applicable to Millstone Stack and Unit 1 releases)

1) Method 1 - Millstone Stack and Unit 1 Releases

Calculate organ doses for D_{TS} and D_{OS}:

For Unit 2 or 3: $D_{TS} = 30_{131}C_{IS} + 0.29_{133}C_{IS} + 4.66 \times 10^{-5} C_{HS}$

$D_{OS} = 10.2C_{PS} + 4.66 \times 10^{-5} C_{HS}$

Sum critical organ doses from stack with critical organ doses from vent in Section b(1) below:

If either dose is greater than 2.5 mrem within a calendar quarter go to Method 2a below

For Unit 1: $D_{TS} = 1.97 \times 10^{-3} C_{HV}$

$D_{OS} = 94.8[C_{PV} + C_{PB}] + 1.97 \times 10^{-3} C_{HV}$

If either dose is greater than 2.5 mrem within a calendar quarter go to Method 2a below

Where:

D_{TS} = the thyroid dose for the period of release of gaseous effluents.

D_{OS} = the dose to the maximum organ other than the thyroid for the period of gaseous effluent release.

${}_{131}C_{IS}$ =The total curies of I-131 released in gaseous effluents from Unit 2 or 3 to Millstone Stack during the period of interest.

${}_{133}C_{IS}$ =The total curies of I-133 released in gaseous effluents from Unit 2 or 3 to Millstone Stack during the period of interest.

C_{PS} = the total curies of particulates with half-lives greater than 8 days released in gaseous effluents from Millstone Stack during the period of interest.

C_{PV} = the total curies of particulates with half-lives greater than 8 days released in gaseous effluents from the SFPI vent during the period of interest.

C_{PB} = the total curies of particulates with half-lives greater than 8 days released in gaseous effluents from the BOP vent during the period of interest.

C_{HS} = the total curies of tritium released in gaseous effluents from Millstone Stack during period of interest.

C_{HV} = the total curies of tritium released in gaseous effluents from the SFPI and BOP vents during period of interest.

2) Method 2b - Millstone Stack and Unit 1 Releases

Use the GASPAR code, or a code which uses the methodology given in Regulatory Guide 1.109, with actual locations, real-time meteorology and the pathways which actually exist at the time at those locations. Sum critical organ doses from stack with critical organ doses from vent in Section b(3) below.

b. Critical Organ Doses (Applicable to Units 2 and 3 vent releases)

1) Method 1 - Unit 2 and Unit 3 releases

For Unit 2 and Unit3, separately, calculate organ doses D_T and D_O:

$$D_{TV} = 230\ {}_{131}C_{IV} + 4.0\ {}_{133}C_{IV} + 2.6 \times 10^{-3}\ C_{HV}$$

$$D_{OV} = 1.1 \times 10^{3}\ C_{PV} + 2.6 \times 10^{-3}\ C_{HV}$$

Sum with organ doses for releases from the stack from Section a(1):

$$D_T = D_{TS} + D_{TV}$$

$$D_O = D_{OS} + D_{OV}$$

If either dose is greater than 2.5 mrem within a calendar quarter go to Section a(2) and recalculate any organ dose greater than 2.5 mrem for releases from the stack and go to Section b(2) below and recalculate any organ dose greater than 2.5 mrem for releases from the vent, where:

D_T = the total thyroid dose for the period of gaseous effluents releases.

D_O = the total dose to the maximum organ other than the thyroid for the period of gaseous effluent releases.

D_{TV} =the thyroid dose for the period of gaseous effluents releases from the vent.

D_{OV}=the dose to the maximum organ other than the thyroid for the period of gaseous effluent releases from the vent.

${}_{131}C_{IV}$=The total curies of I-131 in gaseous effluents from Unit 2 other than to the Millstone Stack (Unit 2 Vent, containment releases to vent, and Steam Generator Blowdown Tank Vent) or from Unit 3 other than to the Millstone Stack (Unit 3 Vent, ESF Building Vent, containment releases to vent, Steam Generator Blowdown Tank Vent, and Containment Drawdown using the hogger) during the period of interest.

${}_{133}C_{IV}$ =The total curies of I-133 in gaseous effluents from Unit 2 other than to the Millstone Stack (Unit 2 Vent, containment releases to vent, and Steam Generator Blowdown Tank Vent) or from Unit 3 other than to the Millstone Stack (Unit 3 Vent, ESF Building Vent, containment releases to vent, Steam Generator Blowdown Tank Vent, and Containment Drawdown using the hogger) during the period of interest.

C_{PS}=The total curies of particulates with half-lives greater than eight days released in gaseous effluents from Unit 2 other than to the Millstone Stack (Unit 2 Vent and containment releases to vent) or from Unit 3 other than to the Millstone Stack (Unit 3 Vent, ESF Building Vent, containment releases to vent, and Containment Drawdown using the hogger) during the period of interest.

C_{HV}=The total curies of tritium released in gaseous effluents from Unit 2 other than to the Millstone Stack (Unit 2 Vent, Steam Generator Blowdown Tank Vent and containment releases to vent) or from Unit 3 other than to the Millstone Stack (Unit 3 Vent, ESF Building Vent, Steam Generator Blowdown Tank Vent containment releases to vent, and Containment Drawdown using the hogger) during the period of interest.

2) Method 2b - Unit 2 and Unit 3 releases

Use the GASPAR code, or a code which uses the methodology given in Regulatory Guide 1.109, with the actual locations, real-time meteorology and the pathways which actually exist at the time at these locations. For Unit 2, the code shall be run separately for steam generator blowdown tank vents and ventilation releases, containment purges and waste gas tank releases. For Unit 3, the code shall be run separately for ventilation, process gas, containment vacuum system, ESF ventilation and containment purges.

c. Estimation of Annual Critical Organ Doses Due to Iodines, Tritium and Particulates (Applicable to Units 1, 2, and 3)

An estimation of annual (year-to-date) critical organ doses (D_{YT} and D_{YO} for thyroid and maximum organ other than thyroid, respectively) from radioiodine, tritium and particulates with half-lives greater than 8 days released from Units 1, 2 and 3 shall be made every month to determine compliance with the annual dose limits for each Unit. Annual critical organ doses will be determined as follows:

Unit 1	Unit 2	Unit 3
$D_{YT1} = \Sigma D_{T1}$	$D_{YT2} = \Sigma D_{T2}$	$D_{YT3} = \Sigma D_{T3}$
$D_{YO1} = \Sigma D_{O1}$	$D_{YO2} = \Sigma D_{O2}$	$D_{YO3} = \Sigma D_{O3}$

Where the sums are over the first quarter (i.e., summation of the all release periods within the quarter) through the present calendar quarter doses.

Where:

D_{YT1}, D_{YT2}, D_{YT3}, D_{YO1}, D_{YO2} and D_{YO3} = thyroid (T) dose and maximum organ (O) dose (other than the thyroid) for the calendar year for Unit 1, 2, or 3.

The following guidelines shall be used for D_T and D_O:

(1) If the detailed quarterly dose calculations required per *Section II.D.5* for the *Radioactive Effluent Release Report* are complete for any calendar quarter, use those results.

(2) If the detailed calculations are not complete for a particular quarter, use the results as determined above in *Section II.D.3.a* or II.*D.3.b.*

(3) If D_{YT} and/or D_{YO} are greater than 15 mrem and quarterly dose was not calculated using *Method 1c* of *Section II.D.3.a* or II.*D.3.b*, recalculate the quarterly dose using *Method 1c.*

(4) If different organs are the maximum organ for different quarters, they can be summed together and D_{YO} recorded as a less-than value as long as the value is less than 15 mrem. If it is not, the sum for each organ involved shall be determined.

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-13-REM-REF02, "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 DO as determined per Section II.D.3-b.

R1 = the expected reduction factor for the HEPA filter. Typically this should be 100 (see NUREG-0016 or 0017 for additional guidance).

R2 = the fraction of the time which the equipment was inoperable during the last quarter.

R3 = the fraction of the time which the equipment is expected to be inoperable during the next 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.b.*

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:

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

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

Where:

C^E_N = the number of curies of noble gas estimated to be released from the reactor plant gaseous vents (the activity from this pathway increases when the process waste gas system is out of service.) 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 the *MP-13-REM-REF02, "REMODCM Technical Information Document," Section 4.2,* for the Millstone Stack releases since the Unit 3 reactor plant gaseous vents are discharged via the Millstone Stack.)

2) Due to Steam Generator Blowdown Tank Vent (Unit 3)

i. Method 1

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

$D^E_{MO} = 1/3\ R_I \times D_T$

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

Where:

R_I = the expected ratio of secondary coolant iodine level for the coming month as compared with the average level during the quarter used in the determining D_T above.

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.b.*

3) Due to Ventilation Releases (Unit 3)**

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.

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

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

Where:

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

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

R_3 = the fraction of the time which the equipment is estimated to be inoperable during the next 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.b.*

**Since dose projections are only required if the treatment specified in Section I.D of the Radiological Effluent Monitoring Manual are not operating, the monthly gamma and beta air dose projections are not required for ventilation releases.

5. Quarterly Dose Calculations for Radioactive Effluent Release Report

Detailed quarterly gaseous dose calculations required for the *Radioactive Effluent Release Report* shall be done using the computer code GASPAR, or a code which use the methodology given in Regulatory Guide 1.109.

6. Compliance with 40CFR190

The following sources shall be considered in determining the total dose to a real individual 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. Since all other uranium fuel cycle sources are greater than 5 miles away, they need not be considered.

The Radiological Effluent Controls in Sections III.E (Unit 1), IV.E (Unit 2), and V.E (Unit 3) contain specific requirements for ensuring compliance with 40CFR190 based on gaseous and liquid doses (sources a and b).

Doses to source c are controlled by design and operations to ensure the off-site dose from each radwaste storage facility is less than one mrem per year. Potential doses from each facility are evaluated in Radiological Environmental Reviews (RERs) where total off-site doses from all sources are considered to ensure compliance with 40CFR190.

7. Bases for Gaseous Pathway Dose Calculations

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

The equivalent instantaneous release rate limits for Millstone Stack were determined using the EPA AIREM code. For Units 2 & 3, these doses were calculated using the NRC GASPAR code. 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. 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-13-REM-REF02, "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 (assumed to be nearest residence) and cow and goat farms with maximum D/Qs. The conversion constants in the Method 1 equations for maximum air doses, organ and whole body doses, and dose rates are based on the maximum observed comparison of historical effluent releases and corresponding calculated maximum doses. The dose conversion factors are calculated based on the ratio of the observed highest dose and the curies of fission and activation products released during the period. This ratio results in the Method 1 equation conversion factor in mrem/Ci released. Reference Manual MP-13-REM-REF02 describes the derivation of the Method 1 constants and list the historical maximum doses calculated for the maximum organ.

II.E. Liquid Discharge Flow Rates And Monitor Setpoints

1. Unit 1 Reactor Cavity Water Discharge Line

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

Step 1:
From the isotopic analysis and the Effluent Concentration (EC) values for each identified nuclide determine the required reduction factor, i.e.:

$$R = \text{Re}quired\ \text{Re}duction\ Factor = 1/\Sigma \frac{\mu Ci/ml\ of\ nuclide\ i}{10xEC\ of\ nuclide\ i}$$

Step 2:
Determine the allowable discharge flow (F)

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

Where:

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

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

Step 3:
Calculate the monitor setpoint as follows:

$$R_{set} = 2 \times AC \times RCF$$

Where:

R_{set} = The setpoint of the monitor.

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

RCF = The response correction factor for the effleunt line monitor using the current calibration factor or isotopic-specific reponses.

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} uCi/ml which is lower than any 10CFR20 EC limit except for transuranics. This will assure that low level releases are not terminated due to small fluctuations in activity. When using this option setpoint independent verification of discharge lineup shall be performed. The optional setpoint may be adjusted (increased or decreased) by factors to account for the actual discharge flow and actual dilution flow; however, controls shall be established to ensure that the allowable discharge flow is not exceeded and the dilution flow is maintained.

2. Reserved

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

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

STEP 1:

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

For Nuclides Other Than Noble Gases:

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

For Noble Gases: If the noble gas concentration is less than 0.011 uCi/ml, the reduction factor need not be determined

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

$$= 2 \times 10^{-4}\ \text{uCi/ml} / \Sigma\ (\mu\text{Ci/ml})\ \text{noble gases}$$

R = the smaller of R_1 or R_2

STEP 2:

Determine the allowable discharge flow (F) in gpm:

$F = 0.1 \times R \times D$

Where: D = the existing dilution flow (D)
(Note: D = # circulating water pumps x 100,000 gpm + # service water pumps x 4,000 gpm

NOTE

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

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

R_{set} = 2 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 2.8 x 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 worst case conditions, assuming maximum discharge flow (350 gpm), dilution water flow (100,000 gpm) and a limit of 1 x 10^{-7} which is lower than any Technical Specification limit (ten times 10CFR20 EC values) except for transuranics. This will assure that low level releases are not terminated due to small fluctuations in 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.

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

When the grab sample prior to release required by Table I.C-2 is greater than 5×10^{-7} uCi/ml, the setpoint shall be determined as for the Clean and Aerated Liquid Monitors in Section II.E.3 except the CPF monitor has the capability to readout in CPM or µCi/ml. If the grab sample is less than 5×10^{-7} uCi/ml, use a setpoint of the lower of ten times background or the value as specified in II.E.3. A setpoint based on ten times background shall not exceed a reading corresponding to 1.7×10^{-4} uCi/ml, which is approximately 38,000 CPM based on recent calibration data.

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

5a. Unit 2 Steam Generator Blowdown - RM4262

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

a. Total S.G. blowdown flow rate = 700 gpm.

b. Normal minimum possible circulating water dilution flow during periods of blowdown = 200,000 gpm (2 circulating water pumps) = 200,000 gpm.

c. The release rate limit is conservatively set at 3×10^{-8} µCi/ml which is lower than any 10CFR20 Effluent Concentration (EC) limit except for some transuranics *

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

Therefore, the alarm setpoint corresponds to a concentration of:

$$\text{Alarm } (\mu\text{Ci/ml}) = \frac{200{,}000}{700} \times 3 \times 10^{-8} + \text{background}^{**} = 8.5 \times 10^{-6}\ \mu\text{Ci/ml} + \text{background}$$

The latest monitor calibration curve shall be used to determine the alarm setpoint in cpm corresponding to 8.5×10^{-6} µCi/ml.

This setpoint may be adjusted (increased or decreased) through proper administrative controls if the steam generator blowdown rate is maintained other than 700 gpm and/or other than 2 circulating water pumps are available. The adjustment would correspond to the ratio of flows to those assumed above or:

$$Alarm\ (\mu Ci/ml) = 8.5 \times 10^{-6}\ \mu Ci/ml \times \frac{circulating\ \&\ service\ water\ flow\ (gpm)}{200{,}000} \times \frac{700}{S/G\ blowdown\ (gpm)} +$$

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

NOTE

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

*In lieu of using 3×10^{-8} μCi/ml, the identified EC limits from 10CFR20 may be used.

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

5b. Unit 2 Steam Generator Blowdown Effluent Concentration Limitation

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

6. Unit 2 Condenser Air Ejector - RM5099

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

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

7a. Unit 2 Reactor Building Closed Cooling Water RM6038

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

$$R_1 = \text{Required Reduction Factor} = \frac{1}{\Sigma \{\mu\text{Ci/ml of nuclide i} / 10\text{xEC of nuclide i}\}}$$

For Noble Gases: If the noble gas concentration is less than 0.026 uCi/ml, the reduction factor need not be determined

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

$= 2 \times 10^{-4}$ uCi/ml/ Σ (μCi/ml) noble gases

R = the smaller of R_1 or R_2

Step 2:
Determine the allowable discharge flow (F)

$F = 0.1 \times R \times D$

Where:

D = The existing dilution flow (D): (Note: D = # circulating water pumps x 100,000 gpm + # service water pumps x 15,000 gpm

NOTE

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

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

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

Where:

R_{set}= 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 worst case conditions, assuming maximum discharge flow (150 gpm), dilution water flow of 100,000 gpm), and a limit of 1×10^{-7} µCi/ml which is lower than any Technical Specification limit (ten times 10CFR20 EC values) except for transuranics. This will assure that low level releases are not terminated due to small fluctuations in 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.

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

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

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

Same as Section II.E.8

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

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

The alarm setpoint for this monitor assumes:

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

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

c. Minimum possible circulating and service water dilution flow during periods of blowdown = 200,000 gpm (2 circulating water pumps) + 30,000 gpm (2 service water pumps) = 230,000 gpm.

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

Therefore, the alarm setpoint corresponds to a concentration of:

$$Alarm(\mu Ci/ml) = \frac{230{,}000}{400} x 3 x 10^{-8} + background = 1.7 x 10^{-5}\ \mu Ci/ml + background$$

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 2 circulating and 2 service water pumps are available. The amount of the increase would correspond to the ratio of flows to those assumed above or:

$$\text{Alarm } (\mu Ci/ml) = 1.7 \times 10^{-5}\ \mu Ci/ml \ x \frac{circulatin\ g\&service\ \ water\ \ flow\ (gpm)}{230{,}000} x \frac{400}{S/G\ blowdown\ \ (gpm)} + Background$$

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

NOTE

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

* In lieu of using 3 x 10^{-8} uCi/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 1.4E-5 uCi/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 Part 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 10 CFR Part 50 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 Radiological Effluent Controls III.C.2 and III.D.2.1.

The alarm setpoint shall be set at or below the monitor reading in µCi/cc corresponding to 29,000 µCi/sec assuming a maximum ventilation flow of 36,000 CFM. The corresponding monitor reading is 1.71E-3 uCi/cc. NOTE: This setpoint is the basis for emergency classification in Unit 1 EAL Table (OA-1). A change to this setpoint would require a concurrent change to the EAL.

The release rate value of 29,000 µCi/sec 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 29,000 uCi/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-13-REM-REF02, "REMODCM Technical Information Document," in making this determination.

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.2.1.

The alarm setpoint shall be set at or below the monitor reading in uCi/cc corresponding to 74,000 μCi/sec assuming a maximum ventilation flow of 12,000 CFM. The corresponding monitor reading is 1.31E-2 uCi/cc.

The release rate value of 74,000 μCi/sec assumes that 13% of the site limit is assigned to Unit 2 releases to the Millstone Stack. If effluent conditions from Unit 2 to the Millstone Stack reach 74,000 uCi/sec, releases from Units 1, 2 and 3 vents and from Unit 3 to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in *MP-13-REM-REF02, "REMODCM Technical Information Document," Section 4.2.*

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.2.1.

The alarm setpoint shall be set at or below the monitor reading in uCi/cc corresponding to 74,000 μCi/sec assuming a maximum ventilation flow of 12,000 CFM. The corresponding monitor reading is 1.16E-2 uCi/cc in accordance with Calculation RERM-01946R3, Rev.1.

If effluent conditions from Unit 3 to the Millstone Stack reach 74,000 uCi/sec, releases from Units 1, 2 and 3 vents and from Unit 2 to the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in *MP-13-REM-REF02, "REMODCM Technical Information Document," Section 4.2.*

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 Radiological Effluent Controls in Sections IV.C.2 and IV.D.2.a.

The alarm setpoint shall be set at or below the "cpm" corresponding to 95,000 μCi/sec from the MP2 vent noble gas monitor calibration curve. The calibration curve (given as μCi/sec per cpm) is determined by assuming the maximum possible ventilation flow for various fan combinations. Curves for three different fan combinations are normally given.

The release rate value of 95,000 μCi/sec assumes that 33% of the site limit is assigned to the MP2 vent. If effluent conditions from the MP2 vent reach the alarm setpoint, releases from Units 1 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 exceed the site limit as dictated in Section II.D.1.a, and described in *MP-13-REM-REF02, "REMODCM Technical Information Document," Section 4.2.*

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 74,000 μCi/sec (see the *MP-13-REM-REF02, "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 7,400 uCi/sec.

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 activity being released from a waste gas decay tank does not cause the setpoint of 7,400 uCi/sec to be exceeded.

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

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

The alarm setpoint shall be set at or below a value of 8.4E-4 μCi/cc in accordance with Calculation RERM-01946R3, Rev.1.

If effluent conditions from the MP3 vent reach the alarm setpoint, releases from Units 1 and 2 vents and from the Millstone Stack shall be determined to ensure that the sum of the individual noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in *MP-13-REM-REF02, "REMODCM Technical Information Document," Section 4.2.*

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

The Alarm setpoint shall be set at or below the value of 5.9E-4 uCi/cc in accordance with Calculation RERM-01946-R3, Rev. 0.

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 (as discussed above for each monitor 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 Part 20 in Unrestricted Areas. Since the Radiological Effluent Controls are constructed such that the numerical values of the annual dose limits of 10 CFR Part 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-1provides 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 App. II.A-1
Millstone Effluent Requirements and Methodology Cross Reference

Radiological Effluent Controls and 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 10CFR20, App. B, Table 2, Column 2, and $2x10^{-4}$ µCi/mL for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 minutes.
IV/V.E.1.b Dose-Liquids	II.C.1 II.C.2	≤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.3 II.C.4	≤3 mrem T.B. ≤10 mrem Organ	Calendar Year	
T.S. 6.16 (Unit 2) T.S. 6.14 (Unit 3) Liquid Radwaste Treatment	I.C.2 II.C.5	≤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 Gaseous Effluents Dose Rate	Tables I.D-1, I.D-2, and 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,		
III.D.2.b IV/V.D.2.b Dose Noble Gases	II.D.2	≤5 mrad gamma air ≤10 mrad beta air	Calendar Quarter**	30-day report if exceeded.
		≤10 mrad gamma air ≤20 mrad beta air	Calendar Year	
III.D.2.c IV/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 6.16 (Unit 3) Gaseous Radwaste Treatment	I.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.6	≤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 3. 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 OPERABLE, 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. INSTRUMENT CHECK - the qualitative determination of operability by observation of behavior during operation. This determination shall include, where possible, comparison of the instrument with other independent instruments measuring the same variable.

5. OPERABLE - An instrument shall be OPERABLE 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 inoperable 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

Radioactive Liquid Effluent Monitoring Instrumentation

CONTROLS

The radioactive liquid effluent monitoring instrumentation channels shown in Table III.C-1 shall be OPERABLE 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 inoperable, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels OPERABLE requirement, take the action shown in Table III.C-1. Exert best efforts to restore the inoperable monitor to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the inoperability 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 OPERABLE 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 # Operable	Alarm Setpoints Required	Applicability	Action
1. 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 OPERABLE less than required by the Minimum Channels OPERABLE 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. Radioactivity Monitors 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 OPERABLE 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.

Radioactive Gaseous Effluent Monitoring Instrumentation

CONTROLS

The radioactive gaseous effluent monitoring instrumentation channels shown in Table III.C-3 shall be OPERABLE 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 SectionII.F.1.

Applicability: As shown in Table III.C-3.

Action:

c. 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 inoperable, or change the setpoint so it is acceptably conservative.

d. With the number of channels less than the minimum channels operable requirements, take the action shown in Table III.C-3. Exert best efforts to restore the inoperable monitor to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radiological Effluent Release Report why the inoperability 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 OPERABLE 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 # Operable	Alarm Setpoints	Applicability	Action
1. Spent Fuel Pool Island Vent				
(a) Noble Gas Activity Monitor	1	Yes	*	A
(b) Particulate Sampler	1	No	*	B
(c) Vent Flow Rate Monitor	1	No	*	C
(d) Sampler Flow Rate Monitor	1	Yes	*	D
2. Balance of Plant Vent				
(a) Particulate Sampler	1	No	*	B
(b) Sampler Flow Monitor	1	Yes	*	D

* Channels are OPERABLE 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 OPERABLE less than required by the Minimum Channels OPERABLE 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 week, or daily when fuel is being moved or during any evolution or event which would threaten fuel integrity, and these samples are analyzed for gross activity within 24 hours.

Action B

With the number of samplers OPERABLE less than required by the Minimum number OPERABLE 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.

Action C

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 OPERABLE less than required by the Minimum Channels OPERABLE 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.

Table III.C-4
Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	Instrument Check	Instrument Calibration	Functional Test	Source Check
1. Spent Fuel Pool Island Vent				
(a) Noble Gas Activity Monitor	D(3)	T(6)	Q(7)	M
(b) Particulate Sampler	TM	N/A	NA	NA
(c) Vent Flow Rate Monitor	D	T	NA	NA
(d) Sampler Flow Rate Monitor	D	T	NA	NA
2. Balance of Plant Vent				
(a) Particulate Sampler	TM	NA	NA	NA
(b) Sampler Flow Monitor	D	T	NA	NA

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

Table III.C-4
TABLE NOTATION

(1) RESERVED

(2) RESERVED

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

(4) RESERVED

(5) RESERVED

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

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

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

III.D. Radioactive Effluents Concentrations And Dose Limitations

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 activity.

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENT

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 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 during the remainder of the current calendar quarter and the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 3 mrem to the total body and 10 mrem to any organ.

SURVEILANCE REQUIREMENTS

1) Dose Calculations. Cumulative dose contributions from liquid effluents shall be determined in accordance with Section II.

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

c. 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 REQUIREMENTS

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 during the remainder of the current calendar quarter and the calendar year so that the cumulative dose during the calendar year is within 10 mrad for gamma radiation and 20 mrad for beta radiation.

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 during the remainder of the current calendar quarter and during the remainder of the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 15 mrem to any organ.

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.

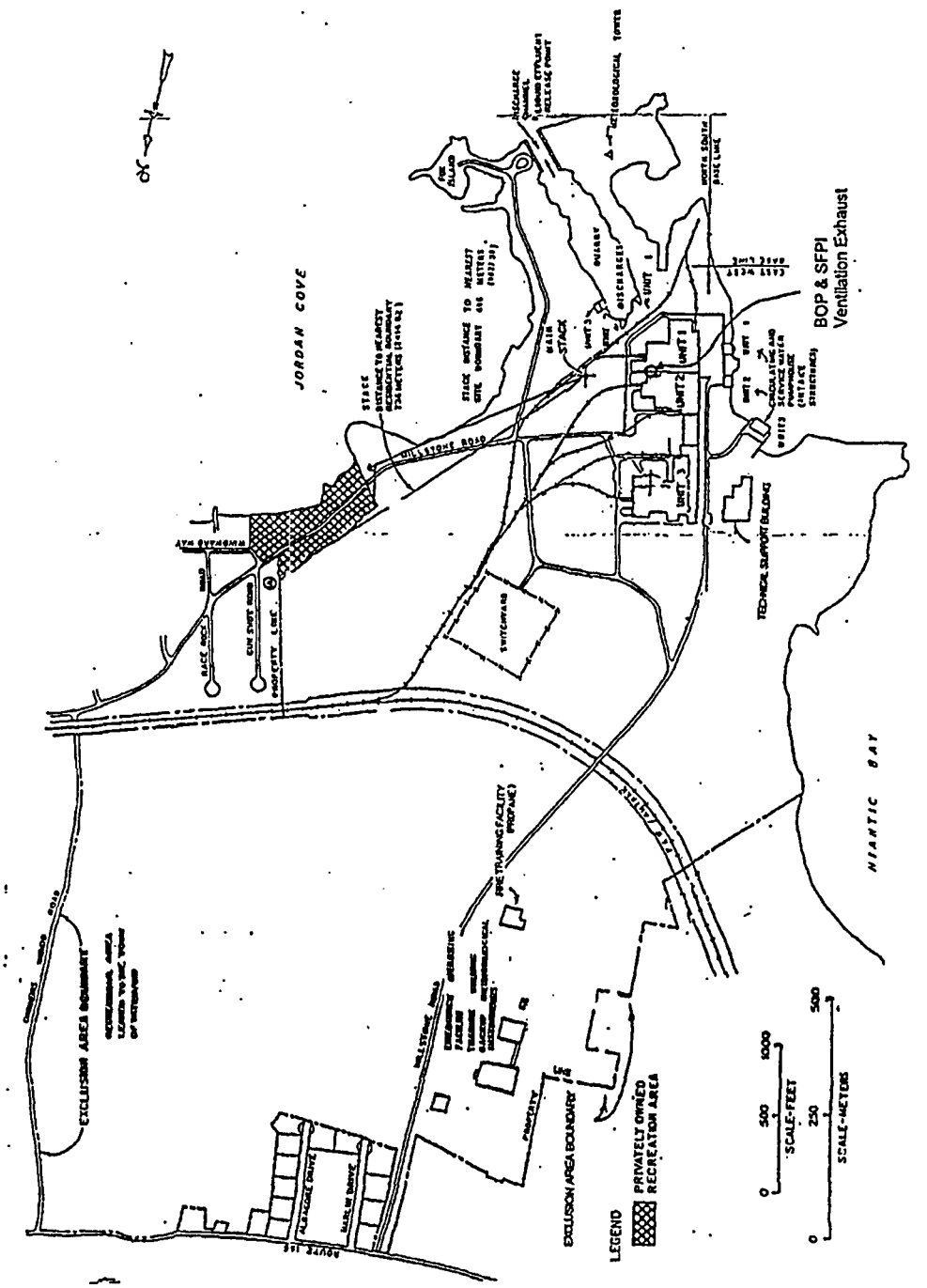


Figure III.D-1
Site Boundary for Liquid and Gaseous Effluents

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 Part 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 Part 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 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 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 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 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 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 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 Part 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 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 Part 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 Part 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 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 ODCM equations provided for determining the air doses at the site boundary were based upon utilizing successively more realistic dose calculational methodologies. More realistic dose calculational methods are used whenever simplified calculations indicate a dose approaching a substantial portion of the regulatory limits. The methods used are, in order, previously determined air dose per released activity ratio, historical meteorological data and actual radionuclide mix released, or real time meteorology and actual radionuclides released.

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

These controls is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 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 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. 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 Part 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 4. 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. OPERABLE / OPERABILITY - An instrument shall be OPERABLE or have OPERABILITY 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(s) are also capable of performing their related support function(s).

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 OPERABILITY including alarm and/or trip functions. For digital instruments, the computer database may be manipulated, in lieu of a signal injection, to verify operability 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 (microCurie/gram) which alone would produce the same 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 in Regulatory Guide 1.109 Rev. 1, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluent for the Purpose of Evaluating Compliance with 10 CFR Part 50 Appendix I.

IV.B.2. - **Applicability**

IV.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, 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 inoperable solely because its emergency power source is inoperable, or solely because its normal power source is inoperable, it may be considered OPERABLE for the purpose of satisfying the requirements of its applicable Limiting Condition for Operation, provided: (1) its corresponding normal or emergency power source is OPERABLE; and (2) all of its redundant system(s), subsystem(s), train(s), component(s) and device(s) are OPERABLE, or likewise satisfy the requirements of this specification.

6) Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY 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 OPERABILITY.

IV.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 IV.B.2.b(2), shall constitute a failure to meet the OPERABILITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on inoperable equipment.

4) Entry into any specified condition shall not be made unless the Surveillance Requirement(s) associated with the Limiting Condition for Operation have been performed within the stated surveillance interval or as otherwise specified.

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 OPERABLE 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 inoperable, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels OPERABLE requirement, take the action shown in Table IV.C-1. Exert best efforts to restore the inoperable monitor to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the inoperability 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 OPERABLE 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 # Operable	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 OPERABLE 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 OPERABLE less than required by the Minimum Channels OPERABLE requirements, effluent releases may continue provided that best efforts are made to repair the instrument and that prior to initiating a release:

1. At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification IV.D.1.a and;
2. The original release rate calculations and discharge valving are independently verified by a second individual.

Action B

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 uCi/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 uCi/gm DOSE EQUIVALENT I-131.

Action C

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 lower limits of detection as specified in Table I.C-2.

Action D

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

1. At least two independent samples are analyzed in accordance with the first Surveillance Requirement of Specification IV.D.1.a, and;
2. If one of the samples has gamma radioactivity greater than any of the lower limits of detection 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				
a. Reactor Building Closed Cooling Water	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 Line	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
NA = Not Applicable

TABLE IV.C-2
TABLE NOTATION

* During releases via this pathway and when the monitor is required OPERABLE 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 OPERABLE with applicable alarm/trip 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/trip 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 inoperable, or change the setpoint so it is acceptably conservative.

b. With the number of channels less than the minimum channels OPERABLE requirement, take the action shown in Table IV.C-3. Exert best efforts to restore the inoperable monitor to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the inoperability 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 OPERABLE 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 Operable	Alarm Setpoints Required	Applicability	Action
1. MP2 Vent (normal range, RM-8132 only; high range monitor, RM-8168, requirements are in the Tech Specs)				
a. Noble Gas Activity Monitor	1	Yes***	**	A
b. Iodine Sampler	1	No	**	B
c. Particulate Sampler	1	No	**	B
d. Vent Flow Rate Monitor	1	No	**	C
e. Sampler Flow Rate Monitor	1	No	**	C
2. Millstone Stack - applicable to the WRGM (RM-8169, normal range, channel 1, only; high range channels 2 and 3 requirements are in the TRM)				
a. Noble Gas Activity Monitor	1	Yes***	**	E
b. Iodine Sampler	1	No	**	B
c. Particulate Sampler	1	No	**	B
d. Stack Flow Rate Monitor	1	No	**	C
e. Sampler Flow Rate Monitor	1	No	**	C
3. Waste Gas Holdup System				
a. Noble Gas Monitor Providing Automatic Termination of Release	1	Yes	*	D

* During waste gas holdup system discharge.

** At all times when air is being released to the environment by the pathway being monitored. which means that channels be OPERABLE 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 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 OPERABLE less than required by the Minimum Channels OPERABLE 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 gross activity within 24 hours.

Action B

With the number of samplers OPERABLE less than required by the Minimum number OPERABLE requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that samples are continuously collected with auxiliary sampling equipment for periods of 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. 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 OPERABLE less than required by the Minimum Channels OPERABLE 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.

Action D

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 analyzéd; 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 OPERABLE less than required by the Minimum Channels OPERABLE 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 gross activity within 24 hours

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-8132B only; high range monitor, RM-8168, requirements are in the Tech Specs)				
a. Noble Gas Activity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Vent Flow Rate Monitor	D	NA	R	Q
e. Sampler Flow Rate Monitor	D	NA	R	NA
2. Millstone Stack - applicable to the WRGM (RM-8169, normal range, channel 1, only; high range channels 2 and 3 requirements are in the TRM)				
a. Noble Gas Activity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Stack Flow Rate Monitor	D	NA	R	Q(2)
e. Sampler Flow Rate Monitor	D	NA	R	NA
3. Waste Gas System Noble Gas Monitor	D*	P	R(1)	Q(2)

* During releases via this pathway and when the monitor is required OPERABLE 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 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 activity.

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENT

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 during the remainder of the current calendar quarter and the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 3 mrem to the total body and 10 mrem to any organ.

SURVEILANCE 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 during the remainder of the current calendar quarter and the calendar year so that the cumulative dose during the calendar year is within 10 mrad for gamma radiation and 20 mrad for beta radiation.

SURVEILLANCE REQUIREMENTS

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

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

c. Gaseous Effluents - Doses from Radionuclides Other than Noble Gas

LIMITING CONDITIONS OF OPERATIONS

The dose to any REAL MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, Tritium, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 2 (see Figure IV.D-1) shall be limited to the following:

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

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

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases during the remainder of the current calendar quarter and during the remainder of the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 15 mrem to any organ.

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.

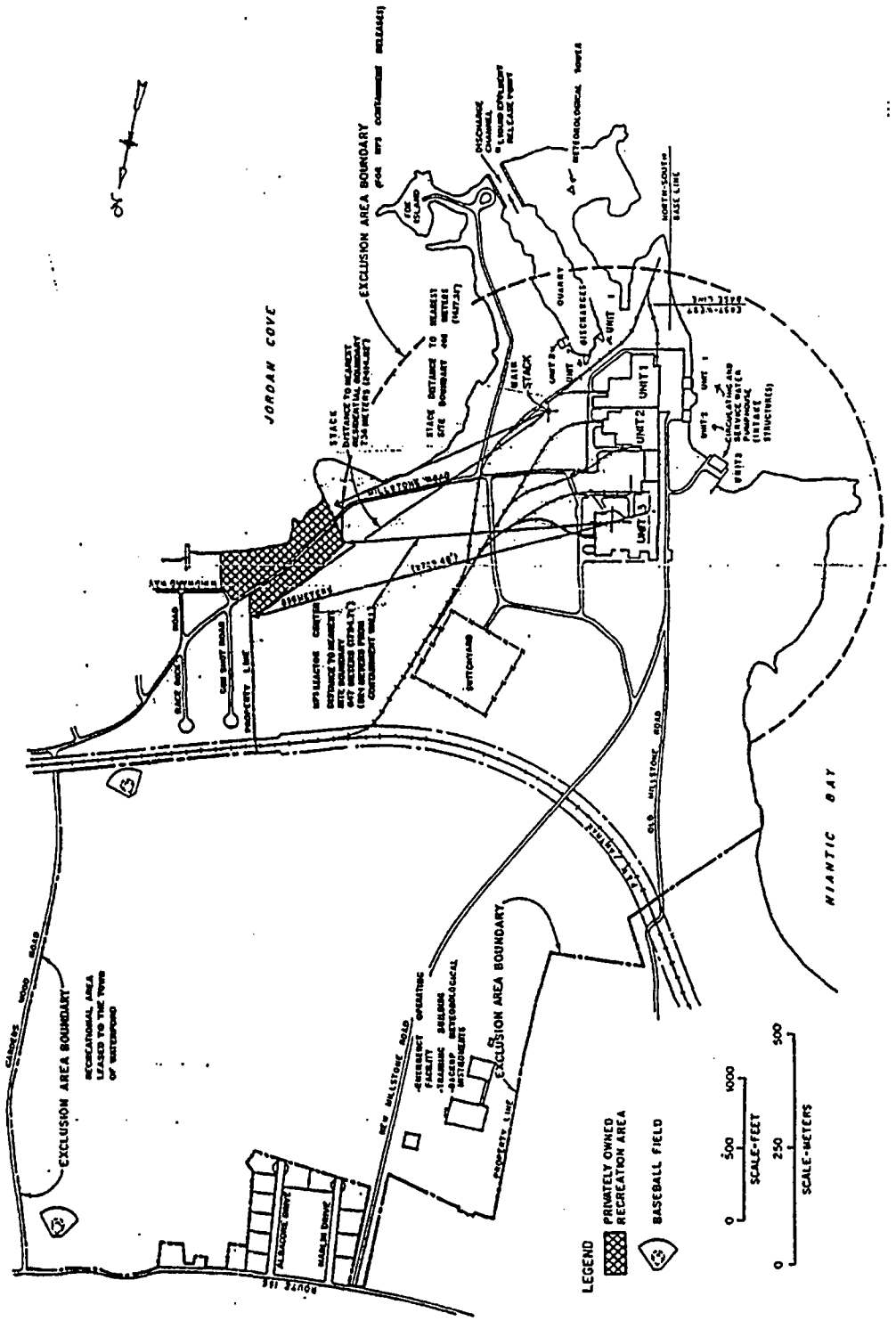


Figure IV.D-1
Site Boundary for Liquid and Gaseous Effluents

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.1.b, IV.D.2.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 Part 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 Part 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 Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 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/trip setpoints for these instruments shall be calculated in accordance with the approved methods in the REMODCM to ensure that the alarm/trip will occur prior to exceeding the dose rate limits, at any time, as specified in Section IV.D.2.a. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

Two types of radioactive gaseous effluent monitoring instrumentation, monitors and samplers, are being used at MP2 vent and Millstone Stack. Monitors have alarm/trip setpoints and are demonstrated operable 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 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 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 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 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 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 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 Part 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 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 Part 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 5. 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 OPERATIONAL TEST - A CHANNEL OPERATIONAL TEST shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY of alarm, interlock and/or trip functions. 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 CHANNEL OPERATIONAL 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 (microCurie/gram) which alone would produce the same 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 in Regulatory Guide 1.109 Rev. 1, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluent for the Purpose of Evaluating Compliance with 10 CFR Part 50 Appendix I.

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. OPERABLE – OPERABILITY - An instrument shall be OPERABLE or have OPERABILITY 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 OPERABILITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on inoperable equipment.

4) Entry into any specified condition shall not be made unless the Surveillance Requirement(s) associated with the Limiting Condition for Operation have been performed within the stated surveillance interval or as otherwise specified.

V.C. Radioactive Effluent Monitoring Instrumentation

1. Radioactive Liquid Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

The radioactive liquid effluent monitoring instrumentation channels shown in Table V.C-1 shall be OPERABLE 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 inoperable, or change the setpoint so it is acceptably conservative.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the action shown in Table V.C-1. Exert best efforts to restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the inoperability 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 OPERABLE 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 # Operable	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} uCi/ml, or the sump is being directed to radwaste.

\# At all times - which means that channels shall be OPERABLE 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 1-5, 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 OPERABLE less than required by the Minimum Channels OPERABLE 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 OPERABLE less than required by the Minimum Channels OPERABLE 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 microCurie/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 microCurie/gram DOSE EQUIVALENT I-131.

Action C

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 OPERABLE less than required by the Minimum Channels OPERABLE 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 Operational 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 Measurement Devices				
a. Waste Neutralization Sump Effluents	D(3)	NA	R	Q
b. Reserved				
c. Liquid Waste Effluent Line	D(3)	NA	R	Q
d. Deleted				
e. Steam Generator Blowdown Effluent Line	D(3)	NA	R	Q

D = Daily
M = Monthly
P = Prior to each batch release
R = Once every 18 months
Q = Once every 3 months
NA = Not Applicable

TABLE V.C-2
TABLE NOTATION

(1) The CHANNEL OPERATIONAL 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 OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Specification V.D.2.a are not exceeded. The Alarm/Trip 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/Trip 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 inoperable, or change the setpoint so it is acceptably conservative.

b. With the number of OPERABLE radioactive gaseous effluent monitoring instrumentation channels less than the Minimum Channels OPERABLE, take the ACTION shown in Table V.C-3. Exert best efforts to restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the inoperability 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 OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL OPERATIONAL TEST at the frequencies shown in Table V.C-4.

TABLE V.C-3
Radioactive Gaseous Effluent Monitoring Instrumentation

Instrument	Minimum Channels Operable	Applicability	Action
1. Millstone Unit 3 Ventilation Vent (Turbine Building - HVR-RE10B, normal range only; high range monitor, HVR-RE10A, requirements are in the TRM)			
(a) Noble Gas Activity Monitor Providing Alarm	1	*	A
(b) Iodine Sampler	1	*	B
(c) Particulate Sampler	1	*	B
(d) Vent Flow Rate Monitor	1	*	C
(e) Sampler Flow Rate Monitor	1	*	C
2. Millstone Stack - applicable to SLCRS (HVR-RE19B, normal range only; high range monitor, HVR-RE19A, requirements are in the TRM)			
(a) Noble Gas Activity Monitor Providing Alarm	1	*	A
(b) Iodine Sampler	1	*	B
(c) Particulate Sampler	1	*	B
(d) Process Flow Rate Monitor	1	*	C
(e) Sampler Flow Rate Monitor	1	*	C
3. Engineered Safeguards Building Monitor (HVQ-RE49)			
(a) Noble Gas Activity Monitor	1	*	D
(b) Iodine Sampler	1	*	B
(c) Particulate Sampler	1	*	B
(d) Discharge Flow Rate Monitor	1	*	C
(e) Sampler Flow Rate Monitor	1	*	C

TABLE V.C-3
Table Notations

* Whenever the release path is in service. Outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

** When the gross activity of the regenerated waste is greater than 1×10^{-4} microCurie/ml.

TABLE V.C-3
ACTION STATEMENTS

Action A
With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 radioactivity within 24 hours, OR

b) if the cause of the inoperability is solely due to a loss of annunciation in the control room and the Remote Indicating Controller (RIC) remains OPERABLE, 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 OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that samples are continuously collected with auxiliary sampling equipment for periods of 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. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performancé of required tests, checks, calibrations, or sampling.

Action C
With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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.

Action D
With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 radioactivity within 24 hours.

Action E
With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE 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 Instrumentation Surveillance Requirements

Instrument	Check	Source Check	Channel Calibration	Channel Operational Test	When Surveillance is Required
1. Millstone Unit 3 Ventilation Vent (Turbine Building - HVR-RE10B, normal range only; high range monitor, HVR-RE10A, requirements are in the TRM)					
(a) Noble Gas Activity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
(b) Iodine Sampler	W	NA	NA	NA	*
(c) Particulate Sampler	W	NA	NA	NA	*
(d) Vent Flow Rate Monitor	D	NA	R	Q	*
(e) Sampler Flow Rate Monitor	D	NA	R	Q	*
2. Millstone Stack - applicable to SLCRS (HVR-RE19B, normal range only; high range monitor, HVR-RE19A, requirements are in the TRM)					
(a) Noble Gas Activity Monitor Providing Alarm	D	M	R(3)	Q(2)	*
(b) Iodine Sampler	W	NA	NA	NA	*
(c) Particulate Sampler	W	NA	NA	NA	*
(d) Process Flow Rate Monitor	D	NA	R	Q	*
(e) Sampler Flow Rate Monitor	D	NA	R	Q	*
3. Engineered Safeguards Building Monitor (HVQ-RE49)					
(a) Noble Gas Activity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
(b) Iodine Sampler	W	NA	NA	NA	*
(c) Particulate Sampler	W	NA	NA	NA	*
(d) Discharge Flow Rate Monitor	D	NA	R	Q	*
(e) Sampler Flow Rate Monitor	D	NA	R	Q	*

* At all times except when the vent path is isolated.

D = Daily	R = Once every 18 months
W = Weekly	Q = Once every 3 months
M = Monthly	NA = Not Applicable

Table V.C-4
TABLE NOTATION

(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 OPERATIONAL 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 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 activity.

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENT

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 during the remainder of the current calendar quarter and the remainder of the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 3 mrem to the whole body and 10 mrem to any organ.

SURVEILANCE REQUIREMENTS

1) Dose Calculations. Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in Section II at least once per 31 days.

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

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATION

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

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

b. The dose rate limit due to inhalation for Iodine-131, Iodine-133, Tritium, and for all radioactive materials in particulate form with half lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

1. The release rate, at any time, of noble gases in gaseous effluents shall be controlled by the offsite dose rate as established in Specification V.D.2.a. The corresponding release rate shall be determined in accordance with the methodology of Section II.

2. The noble gas effluent monitors of Table V.C-3 shall be used to control release rates to limit offsite doses within the values established in Specification V.D.2.a.

3. The release rate of radioactive materials in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program, specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATION

The air dose offsite (see Figure V.D-1) due to noble gases released from Unit 3 in gaseous effluents shall be limited to the following:

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

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

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive noble gases in gaseous effluents during the remainder of the current calendar quarter and during the remainder of the calendar year so that the cumulative dose during the calendar year is within 10 mrad for gamma radiation and 20 mrad for beta radiation.

SURVEILLANCE REQUIREMENTS

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

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

c. Gaseous Effluents - Doses from Radionuclides Other than Noble Gas

LIMITING CONDITIONS OF OPERATION

The dose to any REAL MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, Tritium, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 3 released offsite (see Figure V.D-1) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,

b. During any calendar year: Less than or equal to 15 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

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 during the remainder of the current calendar quarter and during the remainder of the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 15 mrem to any organ.

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.

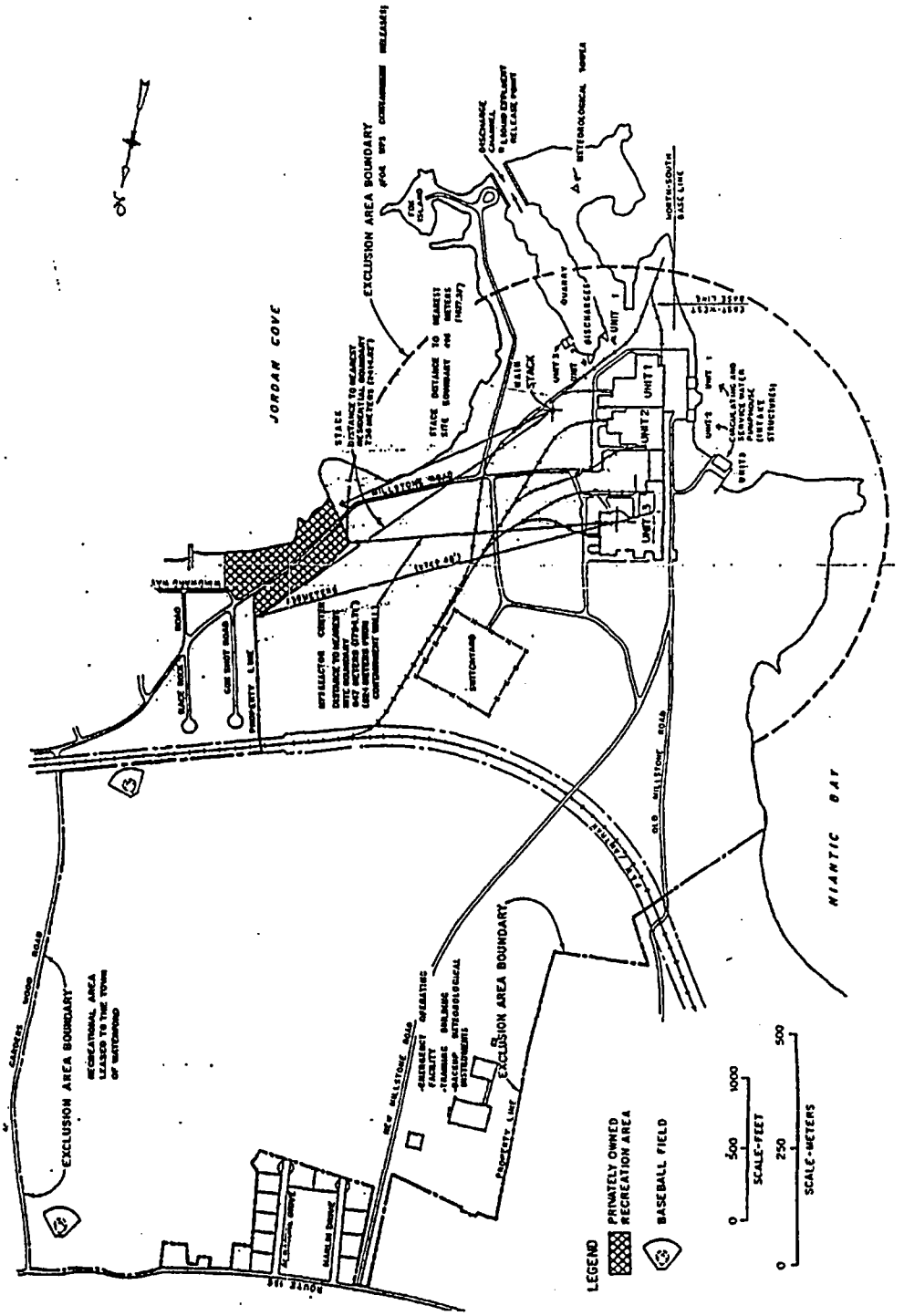


Figure V.D-1
Site Boundary for Liquid and Gaseous Effluents

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. 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 Part 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 Part 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 Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

OPERABILITY 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 OPERABLE 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 OPERABILITY. 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 OPERABLE 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" to Table V.C-1 (then Tech Spec Table 3.3-12). The applicability 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 12 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 inoperability of monitoring instrumentation for up to 12 hours for the purpose of maintenance and performance of required test, check, calibration or sampling
- a requirement to initiate auxiliary sampling within 12 hours after inoperability of certain gaseous effluent monitors
- allowance for inoperability of certain effluent monitoring instrumentation, during MODE 6 (refueling) when the effluent pathway is not being used.

Section V.C.2 - Radioactive Gaseous Effluent Monitoring Instrumentation

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section II to ensure that the alarm/trip will occur prior to exceeding the limits of Section V.D.2.a. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

The sensitivity of any noble gas activity monitors used to show compliance with the gaseous effluent release requirements of Specification V.C.2.a shall be such that concentrations as low as 1×10^{-6} uCi/cc are measurable.

The vent normal range radiation monitor, HVR*10B, satisfies the requirements of Section V.C.2 for Unit 3 releases to the vent which is located on the turbine building. There are no requirements in the REMODCM associated with the vent high range radiation monitor, HVR*10A.

The SLCRS normal range radiation monitor, HVR*19B, satisfies the requirements of Section V.C.2 for Unit 3 releases to the Millstone Stack. There are no requirements in the REMODCM associated with the SLCRS high range radiation monitor, HVR*19A.

Section V.D.1.a - Radioactive Liquid Effluents Concentrations

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than ten times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR 20.1301 to the population. The concentration limit for noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its concentrations in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Section V.D.1.b - Radioactive Liquid Effluents Doses

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

Section V.D.2.a - Radioactive Gaseous Effluents Dose Rate

This specification will ensure that the dose from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for all areas offsite. The annual dose limits specified in this section are the dose limits from the version of 10 CFR Part 20 prior to 1994. Annual dose limit in the current version of 10CFR20 were reduced from 500 to 100 mrem. But REMODCM restrictions will not allow the current annual dose limit to be exceeded because the REMODCM requires termination, within fifteen minutes, of any release which exceed the setpoint and much lower annual dose limits from 10CFR50, Appendix I are implemented. For individuals who may, at times, be within the SITE BOUNDARY, the occupancy of that individual will be usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid or any other organ dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

Section V.D.2.b - Radioactive Gaseous Effluents Noble Gas Dose

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

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

Section V.D.2.c - Radioactive Gaseous Effluents for Radionuclides Other Than Noble Gas

These specifications are provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The specifications are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The Section II calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides for Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The Section II calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculating of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision I, July 1977. The release rate specifications for radioiodines, radioactive material in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man. The pathways that are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy

vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

Section V.E - Total Radiological Dose from Station Operations

This specification is provided to meet the dose limitations of 40 CFR Part 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.