Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385

Dominion

APR 30 2002

Docket Nos. 50-245
50-336
50-423
B18650

RE: 10 CFR 50.36a

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

Millstone Nuclear Power Station, Unit Nos. 1, 2 and 3
2001 Radioactive Effluent Release Report

This letter transmits the annual Radioactive Effluent Release Report, in accordance with the requirements of 10 CFR 50.36a and Sections 6.9.1.6b and 6.9.1.4 of the Millstone Unit Nos. 2 and 3 Technical Specifications, respectively. This report also satisfies the requirements of Section 5.7.3 of the Unit No. 1 Permanently Defueled Technical Specifications. This report covers the period of January 2001 through December 2001.

Enclosure 1 transmits Volumes I and II of the 2001 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 doses from airborne and liquid radioactive effluents. Volume II contains the revisions made to the Radioactive Effluent Monitoring and Off-site Dose Calculation Manual (REMODCM) throughout the year 2001.

Enclosure 2 transmits a complete copy of the REMODCM as of December 31, 2001, in accordance with Sections 5.6.1c of the Millstone Unit No. 1 Defueled Technical Specifications, and with Sections 6.15c and 6.9.13c of the Millstone Unit Nos. 2 and 3 Technical Specifications, respectively.

There are no regulatory commitments contained within this submittal.

IE48
A009

If you have any questions concerning this submittal, please contact Mr. David A. Smith at (860) 437-5840.

Very truly yours,

DOMINION NUCLEAR CONNECTICUT, INC.

J. Alan Price
Site Vice President - Millstone

Enclosures (2)

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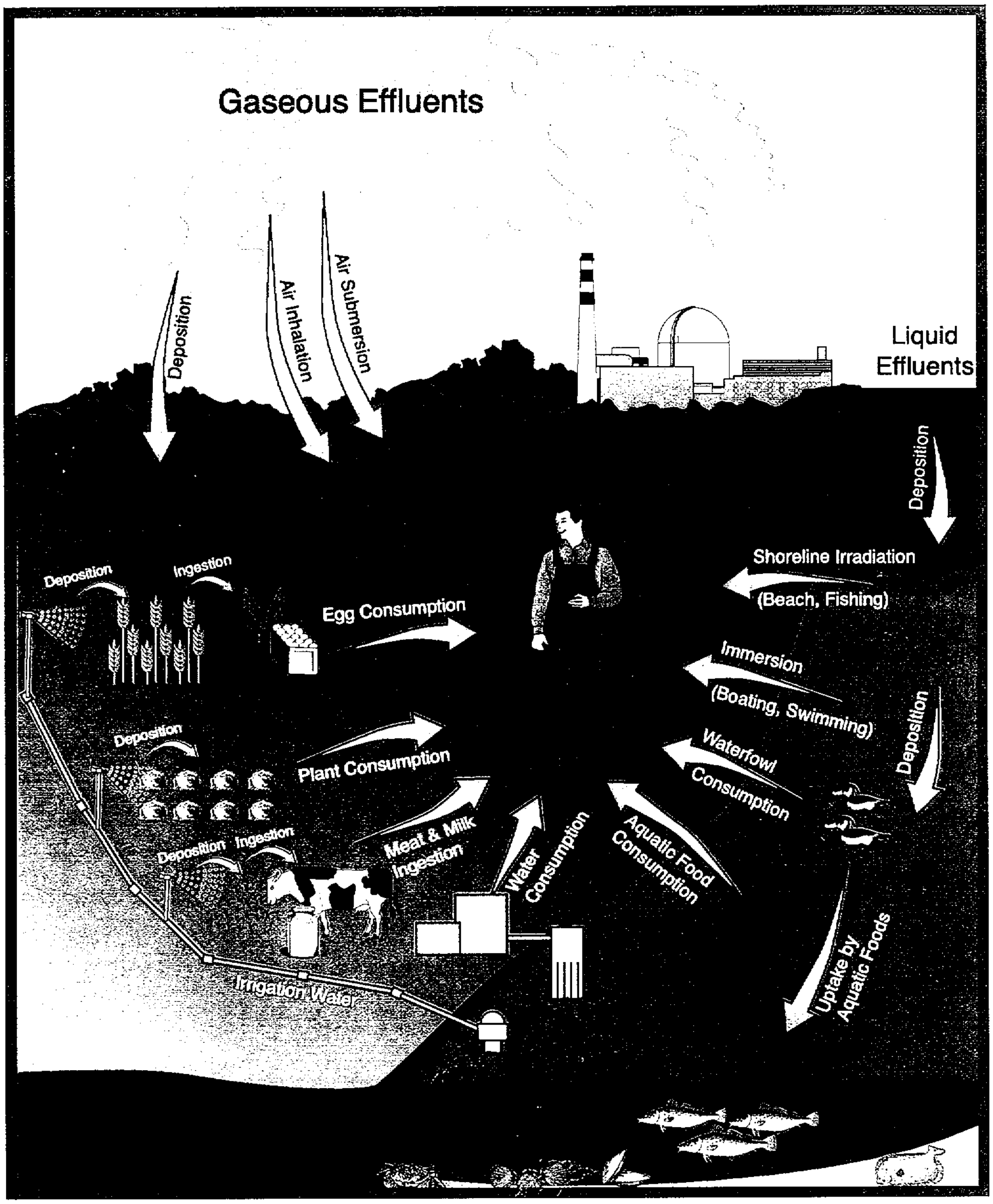
Millstone Power Station

2001 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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References

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

2. 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. MPWS-02-005, Solid Waste and Irradiated Component Shipments , March 13, 2002.

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 2001, 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 being submitted for all three units because they share some common effluent facilities.

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 any 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.

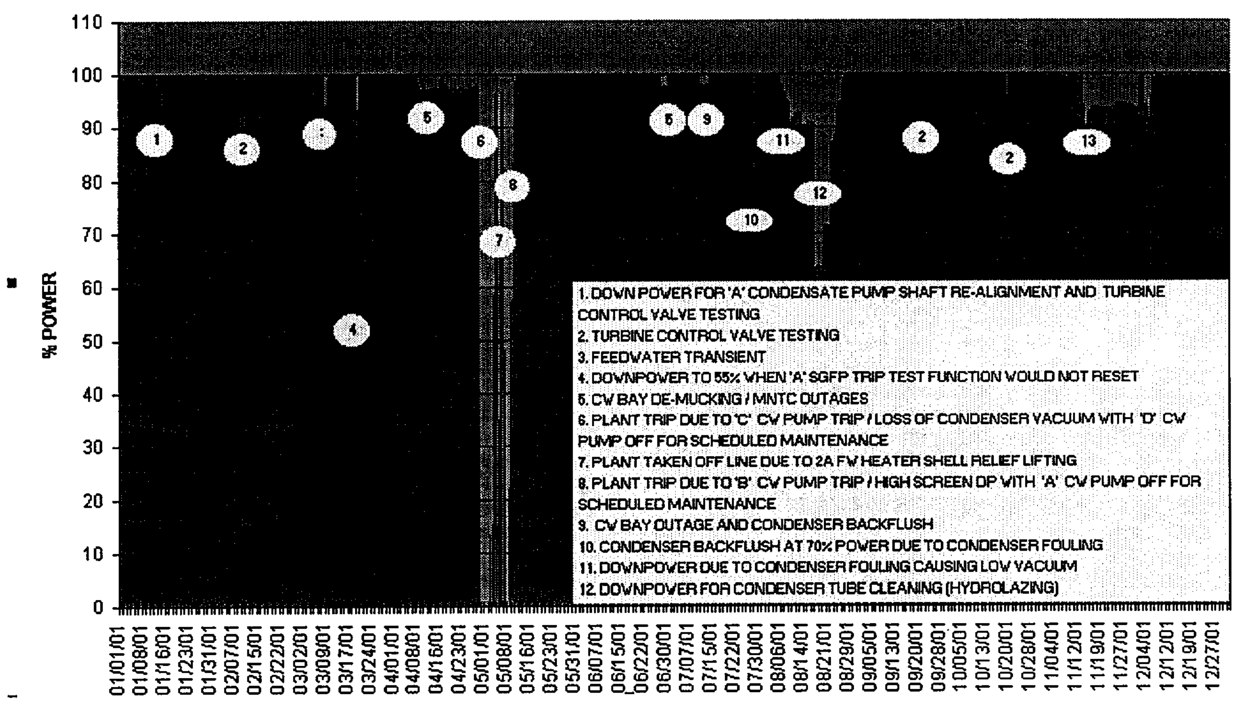
The operating history of the Millstone Units during this reporting period was as follows:

The annual capacity factor for Unit 1 was 0.0%. Unit 1 was shutdown November 11,1995 with a cessation of operation declared in July 1998.

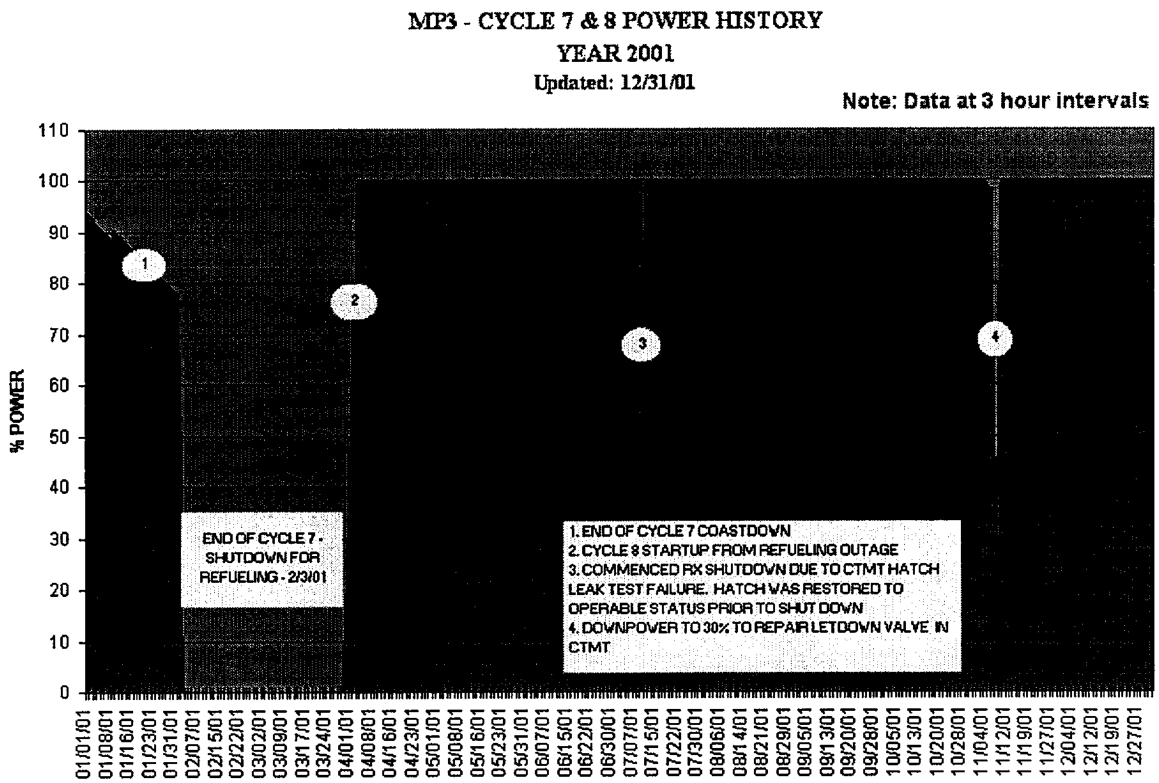
The annual capacity factor for Unit 2 was 95.3%. Unit 2 was temporarily shutdown in May due to circulating water pump trips.

MP2 - CYCLE 14 POWER HISTORY
YEAR 2001
Updated: 12/31/01

Note: Data at 3 hour intervals



The annual capacity factor for Unit 3 was 80.8%. Unit 3 was shutdown and offline in early February, 2001 for refueling (3R7) and restarted at the end of March 2001.



1.0 Doses

This report provides a summary of the 2001 off-site radiation doses for releases of radioactive materials in airborne and liquid effluents from Millstone Unit 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 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 dose computer models DOSAIR and DOSLIQ were developed by Millstone. Input parameters for DOSAIR are those used in GASPAR II (Reference 12) and NRC Regulatory Guide 1.109 (Reference 3). 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.

1.1.1 Maximum Individual Dose

The 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 due to inhalation and ingestion, taking into account radioactive decay and biological elimination of the radioactive materials.

Maximum Individual dose is defined as the dose to the individual within the 50 mile population 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 these three types of input: radioactive source term, site specific data, and generic factors. The radioactive source terms (Curies) are characterized in the Radioactivity section of this report. The site specific data includes: meteorological data (e.g. wind speed, direction, stability, etc.) to calculate the transport and dispersion of airborne effluents, dilution factors for liquid effluents, the population distribution and demographic profile surrounding the site by compass sector. Other site specific data include the average annual production of milk, meat, vegetation, fish, and shellfish. 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.

1.1.1.1 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, however, the doses were conservatively calculated using mixed mode 142 ft meteorology since DOSAIR may underestimate the plume exposure for elevated releases from the Millstone Stack prior to touchdown. All three units 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 and DOSAIR was used to calculate doses using 33 ft meteorology. Continuous ventilation of the spent fuel pool island and evaporation from the spent fuel pool water. In addition to continuous ventilation from unit 1 buildings, releases from the reactor building evaporator are discharged to the BOP Vent.

Unit 2 Vent (159 ft) releases are considered mixed mode (partially elevated and partially ground) releases; and, Pasquill stability classes are determined based upon the temperature gradient between the 33 ft and 142 ft meteorological tower levels. DOSAIR was used to calculate doses for Unit 2 mixed mode continuous releases (Auxiliary Building Ventilation and the Steam Generator Blowdown Tank flashed gases) and mixed mode batch releases (Containment Purge) through the Unit 2 Vent, and elevated batch releases (Waste Gas Decay Tanks and Containment Vents) through the Unit 1 Stack. The doses for these elevated batches were conservatively calculated using mixed mode 142 ft meteorology. These doses were summed to determine the total Unit 2 airborne effluent dose.

Unit 3 (142.5 ft) Vent releases are considered mixed mode (partially elevated and partially ground) releases; and, Pasquill stability classes are determined based upon the temperature gradient between the 33 ft and 142 ft meteorological tower levels. DOSAIR was used to calculate doses for Unit 3 mixed mode continuous releases through the Unit 3 Vent (Auxiliary Building Ventilation), mixed mode batch releases (Containment Purge) through the Unit 3 Vent, and "initial" Containment Drawdown through the roof of the Auxiliary Building. In addition, the Engineered Safety Features Building (ESF) Vent releases are considered as ground level and doses are calculated using 33 ft meteorology. These doses were summed to determine the total Unit 3 airborne effluent dose.

1.1.1.2 Liquid Effluents

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

1.1.2 Gamma and Beta Air Doses

Maximum gamma and beta air doses from the release of noble gases are calculated using DOSAIR.

1.2 Dose Results

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 the plume and from ground deposition, inhalation, and ingestion of vegetation, cow and 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 except for the case when only tritium is released in which the maximum individual dose is calculated at the vegetable garden with the highest χ/Q.

For the meat, cow's milk, and goat's milk pathways, the calculated dose is included for the maximum individual's dose only at locations and times where these pathways actually exist. Doses were calculated at the cow farm and goat farm of maximum deposition.

To determine compliance with 10CFR50, Appendix I (Reference 7), the maximum individual whole body and organ doses includes all applicable external pathways (i.e. plume and ground exposure) as well as the internal pathways (inhalation and ingestion).

The air dose includes only the dose from noble gases in the plume.

The off-site dose from airborne effluents are presented in Table 1-1. These doses are the maximum doses calculated.

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 max organ (GI-LLI, bone, liver, kidney, and lung).

The off-site dose from liquid effluents are presented in Table 1-2. These doses are the maximum doses calculated.

1.2.3 Analysis of Results

The quarterly doses presented in Tables 1-1 and 1-2 are well below the permissible levels in REMODCM and the applicable sections of 10CFR50 and are small in comparison to the dose received from natural background radiation.

Table 1-3 provides a quantitative dose comparison with limits specified in the REMODCM and also indicates that the total dose to an average member of the public from the Millstone Station and all sources of the fuel cycle is well within the limits of 40CFR190 (Reference 8).

The dose due to airborne and liquid effluents was added to the estimated maximum dose from on-site radioactive waste storage to show compliance with 40CFR190. All on-site radwaste storage during this year was within storage criteria and the maximum dose to a member of the public is approximately 0.056 mrem/yr.

Table 1-4 provides a Offsite Dose Comparison of the maximum individual within a 50 mile radius of Millstone with the average Connecticut resident

Table 1-1
2001 Off-Site Dose Commitments from Airborne Effluents
Millstone Units 1, 2, 3

Unit 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Max Air	(mrad)	(mrad)	(mrad)	(mrad)
Beta	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
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	0.00E+00	4.23E-04	9.41E-04	4.15E-04
Skin	0.00E+00	4.30E-04	9.41E-04	4.62E-04
Thyroid	0.00E+00	3.97E-04	9.41E-04	4.14E-04
Max organ+	0.00E+00	5.72E-04	9.41E-04	4.17E-04

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Max Air	(mrad)	(mrad)	(mrad)	(mrad)
Beta	1.19E-03	5.95E-03	7.40E-04	5.53E-03
Gamma	4.42E-04	1.42E-03	2.22E-04	2.41E-03
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	4.37E-03	1.05E-03	2.95E-04	1.54E-03
Skin	5.48E-03	5.03E-03	6.12E-04	4.02E-03
Thyroid	4.69E-03	3.45E-02	7.71E-03	7.90E-03
Max organ+	4.38E-03	1.21E-03	3.21E-04	1.59E-03

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Max Air	(mrad)	(mrad)	(mrad)	(mrad)
Beta	3.54E-05	4.55E-07	0.00E+00	2.70E-05
Gamma	3.66E-05	1.29E-06	0.00E+00	2.73E-05
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	5.71E-03	2.96E-03	1.39E-03	1.05E-03
Skin	6.35E-03	2.96E-03	1.39E-03	1.08E-03
Thyroid	5.76E-03	2.96E-03	1.39E-03	1.05E-03
Max organ+	5.82E-03	2.97E-03	1.48E-03	1.05E-03

Table 1-2
2001 Off-Site Dose Commitments from Liquid Effluents
Millstone Units 1, 2, 3

Unit 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	1.40E-05	0.00E+00	0.00E+00	0.00E+00
Thyroid	5.85E-06	0.00E+00	0.00E+00	0.00E+00
Max Organ	3.60E-05	0.00E+00	0.00E+00	0.00E+00

Unit 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	5.07E-05	1.06E-04	1.65E-04	1.67E-04
Thyroid	3.02E-05	7.75E-05	1.32E-04	1.28E-04
Max Organ	7.56E-04	1.14E-03	7.74E-04	1.04E-03

Unit 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	1.21E-03	9.14E-04	2.84E-04	1.55E-04
Thyroid	1.40E-04	6.04E-05	2.78E-05	9.16E-05
Max Organ	6.50E-03	6.54E-03	1.58E-03	6.19E-04

Table 1-3
2001 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)*
REMODCM Limits	***5 ****	***15***	***15***	***15 ****	***20***	***10***
Unit 1	1.78E-03	1.75E-03	1.93E-03	1.83E-03	0.00E+00	0.00E+00
Unit 2	7.25E-03	5.48E-02	7.49E-03	1.51E-02	1.34E-02	4.49E-03
Unit 3	1.11E-02	1.12E-02	1.13E-02	1.18E-02	6.28E-05	6.52E-05
Millstone Station	**2.01E-02**	**6.77E-02**	**2.08E-02**	**2.88E-02**	**1.35E-02**	**4.56E-03**

* 10CFR50, Appendix I Guidelines

Liquid Effluents

Max Individual Dose vs REMODCM Limits

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ *(mrem)*
REMODCM Limits	***3 ****	***10 ****	***10 ****
Unit 1	1.40E-05	5.85E-06	3.60E-05
Unit 2	4.89E-04	3.68E-04	3.71E-03
Unit 3	2.56E-03	3.20E-04	1.52E-02
Millstone Station	**3.07E-03**	**6.94E-04**	**1.90E-02**

* 10CFR50, Appendix I Guidelines

Millstone Station

Max Individual Dose vs 40CFR190 Limits

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ + *(mrem)*
40CFR190 Limit	***25***	***75***	***25***
Airborne Effluents	2.01E-02	6.77E-02	2.08E-02
Liquid Effluents	3.07E-03	6.94E-04	1.90E-02
Radwaste Storage	5.60E-02	5.60E-02	5.60E-02
Millstone Station	**0.079**	**0.124**	**0.10**

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

Table 1-4
2001 Dose Comparison
Millstone Units 1, 2, 3

Whole Body Dose from Millstone Station vs Natural Background Radiation

Average Resident	**Whole Body Dose**
Sources of Background Radiation:	
Cosmic	~ 27
Cosmogenic	~ 1
Terrestial (Atlantic and Gulf Coastal Plain)	~ 16
Inhaled	~ 200
In the Body	~ 40
Total Estimated Whole Body Dose from Natural Background (NCRP 94)	**~ 284 mrem**

Maximum Individual (within 50 mile radius)	
Maximum Estimated Whole Body Dose from Millstone Station	**0.079 mrem**

2.0 Radioactivity

2.1 Airborne Effluents

2.1.1 Measurement of Radioactivity

2.1.1.1 Millstone Stack

Stack monitors, MP2 WRGM and MP3 SLCRS continuously record the effluent activity concentration and flow rate. Monthly gaseous grab samples are taken and analyzed for isotopic content. The isotopic concentrations at the release point are multiplied by the total flow to the stack to obtain the total activity released for each isotope.

Tritium collection is accomplished by the gas washing bottle method. The sample is counted on a liquid scintillation detector. Concentration is multiplied by volume to get the total activity released.

Charcoal cartridges and particulate filters are used to collect iodines and particulates, respectively. These filters are then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Sr-89, Sr-90 and gross alpha. Isotopic concentrations are multiplied by the release flow rate and sampling time to determine the total amount of activity released.

2.1.1.2 Unit 1 Spent Fuel Pool Island (SFPI) Vent

The SFPI monitor continuously record the effluent activity concentration and flow rate. Monthly gaseous grab samples are taken and analyzed for isotopic content. The isotopic concentrations at the release point are multiplied by the total flow to the stack to obtain the total activity released for each isotope.

Tritium collection is accomplished by the gas washing bottle method. The sample is counted on a liquid scintillation detector. Concentration is multiplied by volume to get the total activity released.

Particulate filters are used to collect particulates. These filters are then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Sr-90 and gross alpha. Isotopic concentrations are multiplied by the release flow rate and sampling time to determine the total amount of activity released.

2.1.1.3 Unit 1 Balance of Plant (BOP) Vent

The BOP monitor continuously records the effluent activity concentration and flow rate. Monthly gaseous grab samples are taken and analyzed for isotopic content.

The isotopic concentrations at the release point are multiplied by the total flow to the stack to obtain the total activity released for each isotope.

Tritium collection is accomplished by the gas washing bottle method. 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.

Particulate filters are used to collect particulates. These filters are then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Sr-90 and gross alpha. Isotopic concentrations are multiplied by the release flow rate and sampling time to determine the total amount of activity released.

2.1.1.4 Unit 2 Vent

Total monthly effluent volume from the Unit 2 vent is multiplied by the isotopic concentrations as measured by gamma spectrometer HPGe analysis for gases and liquid scintillation analysis for tritium to obtain the total activity released from the vent. Tritium collection is accomplished by the gas washing bottle method.

Since a major source of tritium is evaporation of water from the spent fuel pool, tritium releases were also estimated based upon amount of water lost and measured concentrations of the pool water. This amount was added to the amount measured by the grab sample technique.

Charcoal cartridges and particulate filters are used to collect iodines and particulates, respectively. These filters are then analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Sr-89, Sr-90 and gross alpha. Isotopic concentrations are multiplied by the release flow rate and sampling time to determine the total amount of activity released.

2.1.1.5 Unit 2 Containment Purges / Vents

Gaseous grab samples (Noble Gas & Tritium) are taken and are analyzed on a HPGe gamma spectrometer and liquid scintillation detector for tritium. Computed concentrations are then multiplied by the calculated purge volume to obtain the total activity released. Tritium collection is accomplished by the gas washing bottle method.

A purge is the process of discharging air from containment to maintain temperature, humidity, pressure, concentration, etc., where air is replaced. Purges are considered batch releases and are filtered by HEPA and normally released through the Unit 2 vent.

A vent is the process of discharging air from containment usually once per week to maintain temperature, humidity, pressure, concentration without supplying replacement air.

2.1.1.6 Unit 2 Waste Gas Decay Tanks

Waste Gases from the 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 from the analysis of grab samples to determine the total activity released.

2.1.1.7 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.

2.1.1.8 Unit 3 Vent and ESF Building Vent

The Unit 3 ventilation vent collects gas streams from the auxiliary, fuel, waste disposal, and service building exhausts, and containment purge. Since a major source of tritium is evaporation of water from the spent fuel pool, tritium releases were also estimated based upon amount of water lost and measured concentrations of the pool water. This amount was added to the amount measured by the grab sample technique.

The Unit 3 Engineered Safety Features (ESF) building vent collects gas streams from the ESF building ventilation system.

Total effluent volume is multiplied by isotopic concentrations from the analysis of grab samples and composites to obtain the total activity released. These samples are obtained monthly for fission gas, weekly composites of filters for iodines and particulates, monthly composites of particulate filters for gross alpha and strontium.

2.1.1.9 Unit 3 Containment Drawdown and Purge

Unit 3 containment is initially drawn down and purged typically during outages. The initial drawdown is accomplished by using the containment vacuum steam jet ejector and releases through an unmonitored vent on the roof of the auxiliary building. The containment vacuum pump discharge, which maintains subatmospheric pressure following initial drawdown, is released through the Unit 1 stack. The purge is the process of discharging air from containment to maintain temperature, humidity, pressure, concentration, etc., where air is replaced. Purges are normally released through the Unit 3. Purges and drawdowns are intermittent and are therefore considered batch releases. For initial drawdowns and purges, the calculated volume discharged is multiplied by isotopic concentrations from the analysis of grab samples to obtain total activity released.

A release of radioactivity may occur from the containment building through the open equipment hatch Air samples obtained from the equipment hatch boundary were analyzed and found to contain low levels of radioactivity. As a result of these positive samples it was assumed that the potential existed for a release to the environment. It was concluded that the radioactivity potentially released during the period of time when the equipment hatch was open and the resultant dose were insignificant.

2.1.1.10 Unit 3 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.

2.1.2 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

2.1.3 Batch Releases - Airborne Effluents

Unit 1 - None

Unit 2 - None

Unit 3	Ctmt Purge	Initial Ctmt Drawdown	Summary
Number of Batches	1	1	2
Total Time (min)	61	78	139
Maximum Time (min)	61	78	78
Average Time (min)	61	78	70
Minimum Time (min)	61	78	61

2.1.4 Abnormal Airborne Releases

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

2.1.4.1 Unit 1 - None

2.1.4.2 Unit 2 - None

2.1.4.2 Unit 3 - None

2.2 Liquid Effluents

2.2.1 Measurement of Radioactivity

2.2.1.1 Liquid Tanks/Sumps

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

Unit 1 None (All liquid processed by the Reactor Building Evaporator)

Unit 2 Clean Waste Monitor Tanks (2)
Aerated Waste Monitor Tank
CPF Waste Neutralization Sump
Turbine Building Sump

Unit 3 High Level Waste Test Tanks (2)
Low Level Waste Drain Tanks (2)
Boron Test Tanks
CPF Waste Neutralization Sump
Turbine Building Sump

Prior to release, a tank/sump is recirculated for two equivalent tank volumes, a sample is drawn and then analyzed on the HPGe gamma spectrometer and liquid scintillation detector 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 Steam Generator Blowdown

Steam generator blowdown water grab samples are taken and analyzed on the HPGe gamma spectrometer and liquid scintillation detector if required by the conditional action requirements of the REMODCM. Total volume of blowdown is multiplied by the isotopic concentrations (if any) to determine the total activity released via blowdown. 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. Tritium is determined through liquid scintillation counting.

2.2.1.3 Unit 2 and Unit 3 Continuous Liquid Releases

Grab samples are are taken for continuous liquid release pathways and analyzed on the HPGe gamma spectrometer and liquid scintillation detector. 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. Tritium is determined through liquid scintillation counting. 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 Batch Releases - Liquid Effluents

	Unit 1	Unit 2	Unit 3
Number of Batches	0	58	399
Total Time (min)	0	5727	41410
Maximum Time (min)	0	351	209
Average Time (min)	0	99	104
Minimum Time (min)	0	10	2
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 or airborne material to the environment which was unplanned or uncontrolled.

In 2001, 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

Table 2.1-1

Millstone Unit No. 1
Airborne Effluents - Release Summary

	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	N/D	N/D	N/D	N/D	N/D
		No Activity Detected				
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
B. Iodine-131						
1. Total Activity Released	Ci	N/D	N/D	N/D	N/D	N/D
		No Activity Detected				
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
C. Total Activity	Ci					
1. Total Activity Released	Ci	N/D	2.93E-06	3.00E-08	4.90E-06	7.86E-06
2. Average Period Release Rate	uCi/sec	-	3.72E-07	3.77E-09	6.16E-07	2.49E-07
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D	N/D	N/D
		No Activity Detected				
E. Tritium						
1. Total Activity Released	Ci	N/D	1.70E-01	4.07E-01	2.50E-01	8.27E-01
2. Average Period Release Rate	uCi/sec	-	2.16E-02	5.12E-02	3.14E-02	2.62E-02

N/D = Not Detected

Table 2.1-2

Millstone Unit No. 1
Airborne Effluents - Elevated Continuous

<< No Activity Detected >>

Nuclides Released	Units	2001 1st Qtr	2001 2nd Qtr	2001 3rd Qtr	2001 4th Qtr	2001 Total
A. Fission & Activation Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
C. Particulates						
	Ci	-				-
Total Activity	Ci	-				N/D
D. Gross Alpha						
Gross Alpha	Ci	-				N/D
E. Tritium						
H-3	Ci	-				N/D

N/D = Not Detected

Note: MP1 ventilation releases were seperated from elevated Millstone stack after 1st Quarter 2001

Table 2.1-3

Millstone Unit No. 1

Airborne Effluents - Ground Continuous -Balance of Plant Vent (BOP) and Spent Fuel Pool Island Vent (SFPI)

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
C. Particulates						
Be-7	Ci	-	-	2.58E-08	-	2.58E-08
Cs-137	Ci	-	2.93E-06	4.19E-09	4.90E-06	7.83E-06
Total Activity	Ci	-	2.93E-06	3.00E-08	4.90E-06	7.86E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	-	1.70E-01	4.07E-01	2.50E-01	8.27E-01

N/D = Not Detected

Table 2.1-4

Millstone Unit No. 1
Liquid Effluents - Release Summary
(Release Point - Quarry)

	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	1.01E-03	N/D	N/D	N/D	1.01E-03
2. Average Period Diluted Activity	uCi/ml	2.05E-10	-	-	-	2.05E-10
B. Tritium						
1. Total Activity Released	Ci	4.19E-01	N/D	N/D	N/D	4.19E-01
2. Average Period Diluted Activity	uCi/ml	8.45E-08	-	-	-	8.45E-08
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	N/D	N/D	N/D No Activity Detected	N/D	N/D
2. Average Period Diluted Activity	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D No Activity Detected	N/D	N/D
E. Volume						
1. Released Waste Volume	Liters	1.50E+06	0.00E+00	0.00E+00	0.00E+00	1.50E+06
2. Dilution Volume During Releases	Liters	8.91E+07	0.00E+00	0.00E+00	0.00E+00	8.91E+07
3. Dilution Volume During Period	Liters	4.96E+09	0.00E+00	0.00E+00	0.00E+00	4.96E+09

N/D = Not Detected

Table 2.1-5
Millstone Unit No. 1
Liquid Effluents - Batch

Nuclides Released	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Ag-110m	Ci	-	-	-	-	-
Co-58	Ci	-	-	-	-	-
Co-60	Ci	5.02E-04	-	-	-	5.02E-04
Cs-137	Ci	2.48E-04	-	-	-	2.48E-04
Fe-55	Ci	2.44E-04	-	-	-	2.44E-04
Mn-54	Ci	2.08E-05	-	-	-	2.08E-05
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Zn-65	Ci	-	-	-	-	-
Total Activity	Ci	1.01E-03	-	-	-	1.01E-03
B. Tritium						
H-3	Ci	4.19E-01	-	-	-	4.19E-01
C. Dissolved & Entrained Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.2-1
Millstone Unit No. 2
Airborne Effluents - Release Summary

	Units	2001 1st Qtr	2001 2nd Qtr	2001 3rd Qtr	2001 4th Qtr	2001 Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	6.64E+00	8.97E+00	1.99E+00	2.12E+01	3.88E+01
2. Average Period Release Rate	uCi/sec	8.54E-01	1.14E+00	2.50E-01	2.66E+00	1.23E+00
B. Iodine-131						
1. Total Activity Released	Ci	7.68E-05	5.34E-04	7.63E-05	9.94E-05	7.87E-04
2. Average Period Release Rate	uCi/sec	9.88E-06	6.80E-05	9.60E-06	1.25E-05	2.49E-05
C. Particulates						
1. Total Activity Released	Ci	1.13E-04	9.94E-06	N/D	3.63E-08	1.23E-04
2. Average Period Release Rate	uCi/sec	1.45E-05	1.26E-06	-	4.57E-09	3.90E-06
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D No Activity Detected	N/D	N/D
E. Tritium						
1. Total Activity Released	Ci	5.48E-01	4.04E-01	4.04E-01	3.37E-01	1.69E+00
2. Average Period Release Rate	uCi/sec	7.05E-02	5.14E-02	5.08E-02	4.24E-02	5.37E-02

N/D = Not Detected

Table 2.2-2
Millstone Unit No. 2
Airborne Effluents - Mixed Continuous - Aux Bldg Vent & SGBD Tank Vent & Spent Fuel Pool Evaporation

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	-	-	1.85E-01	1.85E-01
Kr-85	Ci	-	8.87E-02	-	-	8.87E-02
Xe-131m	Ci	-	3.95E-03	-	-	3.95E-03
Xe-133	Ci	6.20E+00	6.64E+00	8.42E-02	1.73E+01	3.02E+01
Xe-133m	Ci	-	4.05E-05	-	-	4.05E-05
Xe-135	Ci	-	1.48E-01	-	1.04E+00	1.18E+00
Xe-137	Ci	-	6.22E-01	-	-	6.22E-01
Total Activity	Ci	6.20E+00	7.50E+00	8.42E-02	1.85E+01	3.23E+01
B. Iodines						
I-131	Ci	7.68E-05	5.34E-04	7.63E-05	9.94E-05	7.87E-04
I-132	Ci	-	3.66E-04	-	5.53E-05	4.21E-04
I-133	Ci	1.95E-04	6.04E-04	2.32E-04	3.08E-04	1.34E-03
I-135	Ci	2.96E-05	5.35E-04	3.17E-05	3.62E-05	6.33E-04
Total Activity	Ci	3.02E-04	2.04E-03	3.40E-04	4.99E-04	3.18E-03
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	-	-	-	-	-
Co-60	Ci	-	-	-	-	-
Mn-54	Ci	-	-	-	-	-
Ba-140	Ci	-	9.79E-06	-	-	9.79E-06
Cs-137	Ci	-	1.53E-07	-	-	1.53E-07
Total Activity	Ci	-	9.94E-06	-	-	9.94E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	2.69E-01	1.47E-01	2.65E-01	2.37E-01	9.18E-01

N/D = Not Detected

Table 2.2-3

Millstone Unit No. 2

Airborne Effluents - Mixed Batch - Containment Purges

<< No Activity Detected >>

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-131m	Ci	-				-
Xe-133m	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
C. Particulates						
I-131	Ci	-	-	-	-	-
Br-82	Ci	-	-	-	-	-
Cs-137	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.2-4

Millstone Unit No. 2

Airborne Effluents - Elevated Batch - WGDT

<< No Activity Detected >>

Nuclides Released	Units	2001 1st Qtr	2001 2nd Qtr	2001 3rd Qtr	2001 4th Qtr	2001 Total
A. Fission & Activation Gases						
Ar-41	Ci	-	-	-	-	-
Kr-85	Ci	-	-	-	-	-
Kr-85m	Ci	-	-	-	-	-
Kr-87	Ci	-	-	-	-	-
Kr-88	Ci	-	-	-	-	-
Xe-131m	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-133m	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Xe-135m	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	-	-	-	-	-
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
C. Particulates						
I-131	Ci	-	-	-	-	-
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.2-5

Millstone Unit No. 2

Airborne Effluents - Elevated Batch - Containment Vents

Nuclides Released	Units	2001 1st Qtr	2001 2nd Qtr	2001 3rd Qtr	2001 4th Qtr	2001 Total
A. Fission & Activation Gases						
Ar-41	Ci	2.91E-02	3.24E-02	2.85E-02	3.26E-02	1.23E-01
Kr-85	Ci	-	5.81E-01	5.25E-01	6.96E-01	1.80E+00
Kr-85m	Ci	-	7.72E-05	6.50E-04	4.84E-04	1.21E-03
Xe-131m	Ci	7.82E-03	2.66E-02	2.68E-02	3.64E-02	9.75E-02
Xe-133	Ci	4.01E-01	8.20E-01	1.30E+00	1.87E+00	4.39E+00
Xe-133m	Ci	3.27E-03	5.41E-03	1.35E-02	1.75E-02	3.64E-02
Xe-135	Ci	1.73E-03	4.96E-03	1.21E-02	1.12E-02	3.00E-02
Total Activity	Ci	4.42E-01	1.47E+00	1.91E+00	2.67E+00	6.48E+00
B. Iodines *						
I-131	Ci	-	-	-	-	-
I-133	Ci	1.42E-07	-	-	-	1.42E-07
Total Activity	Ci	1.42E-07	-	-	-	1.42E-07
C. Particulates						
I-131	Ci	-	-	-	-	-
Br-82	Ci	9.08E-06	-	-	-	9.08E-06
Cs-137	Ci	1.04E-04	-	-	3.63E-08	1.04E-04
Total Activity	Ci	1.13E-04	-	-	3.63E-08	1.13E-04
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	2.79E-01	2.57E-01	1.39E-01	9.98E-02	7.75E-01

N/D = Not Detected

* Prior to charcoal filtration

Table 2.2-6

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

	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	4.09E-03	7.67E-03	7.36E-03	8.95E-03	2.81E-02
2. Average Period Diluted Activity	uCi/ml	1.46E-11	2.93E-11	2.64E-11	3.29E-11	2.57E-11
B. Tritium						
1. Total Activity Released	Ci	2.17E+01	1.58E+02	3.25E+02	2.50E+02	7.55E+02
2. Average Period Diluted Activity	uCi/ml	7.72E-08	6.05E-07	1.17E-06	9.19E-07	6.91E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	1.17E-04	4.13E-02	7.48E-02	2.55E-01	3.72E-01
2. Average Period Diluted Activity	uCi/ml	4.16E-13	1.57E-10	2.68E-10	9.39E-10	3.40E-10
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D	N/D	N/D
		No Activity Detected				
E. Volume						
1. Released Waste Volume	Liters	1.75E+05	3.07E+05	5.26E+05	6.53E+05	1.66E+06
2. Dilution Volume During Releases	Liters	1.44E+09	1.71E+09	2.77E+09	2.24E+09	8.16E+09
3. Dilution Volume During Period	Liters	2.81E+11	2.62E+11	2.79E+11	2.72E+11	1.09E+12

N/D = Not Detected

Table 2.2-7

Millstone Unit No. 2
Liquid Effluents - Continuous - SGBD

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Tritium						
H-3	Ci	1.39E-01	5.82E-02	-	-	1.97E-01
C. Dissolved & Entrained Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.2-8A

Millstone Unit No. 2
Liquid Effluents - Batch

Nuclides Released	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Be-7	Ci	9.46E-06	-	-	-	9.46E-06
Ag-110m	Ci	1.57E-04	2.12E-04	1.51E-04	2.24E-04	7.44E-04
Cr-51	Ci	-	1.93E-04	-	-	1.93E-04
Co-57	Ci	5.40E-06	-	-	-	5.40E-06
Co-58	Ci	1.01E-03	1.50E-03	5.61E-04	3.07E-04	3.37E-03
Co-60	Ci	2.01E-03	4.04E-03	5.18E-03	6.85E-03	1.81E-02
Cs-134	Ci	-	-	-	1.73E-04	1.73E-04
Cs-137	Ci	3.14E-05	2.31E-05	1.50E-04	2.05E-04	4.09E-04
Cs-138	Ci	-	-	-	-	-
Fe-55	Ci	7.78E-04	1.12E-03	1.07E-03	6.70E-04	3.63E-03
Fe-59	Ci	-	-	-	-	-
I-131	Ci	1.67E-05	6.82E-06	-	-	6.82E-06
I-132	Ci	-	-	-	-	-
I-133	Ci	-	-	-	2.11E-06	2.11E-06
I-135	Ci	-	-	-	-	-
La-140	Ci	2.42E-06	-	-	-	2.42E-06
Mn-54	Ci	6.94E-05	1.64E-04	1.69E-04	2.12E-04	6.14E-04
Mo-99	Ci	7.22E-07	2.79E-06	-	2.41E-06	5.92E-06
Tc-99m	Ci	7.76E-07	2.99E-06	-	2.58E-06	6.35E-06
Nb-95	Ci	-	1.63E-04	-	-	1.63E-04
Tc-101	Ci	-	4.67E-06	-	6.83E-06	1.15E-05
Sb-124	Ci	-	5.18E-06	-	-	5.18E-06
Sb-125	Ci	-	2.42E-04	7.63E-05	2.78E-04	5.96E-04
Sn-113	Ci	-	-	-	-	-
Sr-89	Ci	-	-	8.15E-06	6.35E-06	1.45E-05
Sr-90	Ci	-	-	-	-	-
Zr-97	Ci	-	-	-	6.50E-06	6.50E-06
Total Activity	Ci	4.09E-03	7.67E-03	7.36E-03	8.95E-03	2.81E-02
B. Tritium						
H-3	Ci	2.16E+01	1.58E+02	3.25E+02	2.50E+02	7.55E+02
C. Dissolved & Entrained Gases						
Kr-85	Ci	-	9.19E-03	5.87E-02	1.29E-01	1.97E-01
Xe-131m	Ci	-	1.70E-03	8.08E-04	4.43E-03	6.94E-03
Xe-133	Ci	1.13E-04	3.04E-02	1.54E-02	1.21E-01	1.67E-01
Xe-133m	Ci	-	-	-	1.53E-04	1.53E-04
Xe-135	Ci	4.41E-06	1.25E-05	4.90E-06	1.59E-04	1.81E-04
Total Activity	Ci	1.17E-04	4.13E-02	7.48E-02	2.55E-01	3.72E-01
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.2-8B

Millstone Unit No. 2

Liquid Effluents -Continuous-Turbine Building Sump

(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Tritium						
H-3	Ci	2.45E-03	1.36E-03	-	1.29E-02	1.67E-02
Average Period Diluted Activity	uCi/ml	9.99E-08	5.48E-08	0.00E+00	5.14E-07	1.68E-07
C. Dissolved & Entrained Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Volume						
Released Waste Volume	Liters	5.39E+05	3.13E+05	0.00E+00	1.11E+06	1.96E+06
Dilution Volume During Period *	Liters	2.40E+07	2.45E+07	2.51E+07	2.40E+07	9.75E+07

* from Yard Drains

N/D = Not Detected

Table 2.3-1

Millstone Unit No. 3

Airborne Effluents - Release Summary

	Units	2001 1st Qtr	2001 2nd Qtr	2001 3rd Qtr	2001 4th Qtr	2001 Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	1.67E-01	6.54E-04	N/D	6.06E-02	2.29E-01
2. Average Period Release Rate	uCi/sec	2.15E-02	8.32E-05	-	7.62E-03	7.25E-03
B. Iodine-131						
1. Total Activity Released	Ci	2.43E-05	N/D	N/D	1.75E-07	2.45E-05
2. Average Period Release Rate	uCi/sec	3.13E-06	-	-	2.20E-08	7.77E-07
C. Particulates						
1. Total Activity Released	Ci	8.91E-04	3.18E-06	3.45E-06	2.23E-08	8.97E-04
2. Average Period Release Rate	uCi/sec	1.15E-04	4.04E-07	4.34E-07	2.81E-09	2.85E-05
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D (No Activity Detected)	N/D	N/D
E. Tritium						
1. Total Activity Released	Ci	2.83E+01	1.04E+01	4.49E+00	9.69E+00	5.29E+01
2. Average Period Release Rate	uCi/sec	3.64E+00	1.32E+00	5.64E-01	1.22E+00	1.68E+00

N/D = Not Detected

Table 2.3-2

Millstone Unit No. 3

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

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-131m	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	1.42E-05	-	-	-	1.42E-05
I-133	Ci	-	-	-	-	-
Total Activity	Ci	1.42E-05	-	-	-	1.42E-05
C. Particulates						
I-131	Ci	-	-	-	-	-
Cr-51	Ci	2.97E-04	-	-	-	2.97E-04
Mn-54	Ci	4.04E-05	-	-	-	4.04E-05
Co-58	Ci	4.34E-04	-	2.24E-06	-	4.36E-04
Co-60	Ci	3.08E-05	-	-	-	3.08E-05
Nb-95	Ci	4.54E-05	-	-	-	4.54E-05
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Ru-106	Ci	-	-	-	-	-
Total Activity	Ci	8.48E-04	-	2.24E-06	-	8.50E-04
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	2.75E+01	1.03E+01	4.37E+00	8.96E+00	5.11E+01

N/D = Not Detected

Table 2.3-3
Millstone Unit No. 3
Airborne Effluents - Ground Continuous - ESF Building Ventilation

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-131m	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	2.81E-08	-	-	-	2.81E-08
I-133	Ci	-	2.78E-06	-	-	2.78E-06
Total Activity	Ci	2.81E-08	2.78E-06	-	-	2.81E-06
C. Particulates						
I-131	Ci	-	-	-	-	-
Co-58	Ci	6.14E-07	-	-	-	6.14E-07
Mn-54	Ci	3.10E-08	-	-	-	3.10E-08
Ru-106	Ci	3.67E-07	-	-	-	3.67E-07
Cr-51	Ci	3.90E-07	-	-	-	3.90E-07
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Total Activity	Ci	1.40E-06	-	-	-	1.40E-06
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.3-4

Millstone Unit No. 3

Airborne Effluents - Mixed Batch - Containment Drawdowns

Nuclides Released	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Iodines						
I-131	Ci	-	-	-	-	-
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
C. Particulates						
I-131	Ci	-	-	-	-	-
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	1.71E-03	-	-	-	1.71E-03

N/D = Not Detected

Table 2.3-5

Millstone Unit No. 3

Airborne Effluents - Mixed Batch - Containment Purges

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	1.10E-02	-	-	-	1.10E-02
Xe-135	Ci	5.86E-03	-	-	-	5.86E-03
Total Activity	Ci	1.69E-02	-	-	-	1.69E-02
B. Iodines						
I-131	Ci	-	-	-	-	-
I-133	Ci	7.85E-07	-	-	-	7.85E-07
Total Activity	Ci	7.85E-07	-	-	-	7.85E-07
C. Particulates						
I-131	Ci	-	-	-	-	-
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	1.30E-01	-	-	-	1.30E-01

N/D = Not Detected

Table 2.3-6

Millstone Unit No. 3

Airborne Effluents - Elevated Continuous - Gaseous Waste System

Nuclides Released	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	6.54E-04	-	1.02E-02	1.09E-02
Kr-85m	Ci	-	-	-	3.17E-03	3.17E-03
Kr-87	Ci	-	-	-	7.72E-03	7.72E-03
Xe-133	Ci	-	-	-	2.34E-02	2.34E-02
Xe-135	Ci	1.21E-01	-	-	1.61E-02	1.37E-01
Xe-135m	Ci	2.94E-02	-	-	-	2.94E-02
Total Activity	Ci	1.50E-01	6.54E-04	-	6.06E-02	2.12E-01
B. Iodines						
I-131	Ci	1.01E-05	-	-	1.75E-07	1.03E-05
I-133	Ci	3.49E-05	-	-	-	3.49E-05
Total Activity	Ci	4.50E-05	-	-	1.75E-07	4.52E-05
C. Particulates						
I-131	Ci	-	-	-	-	-
Cr-51	Ci	9.44E-06	3.56E-07	-	-	9.80E-06
Mn-54	Ci	1.17E-06	5.06E-08	-	-	1.22E-06
Co-58	Ci	2.82E-05	2.07E-06	-	-	3.03E-05
Co-60	Ci	1.51E-06	3.52E-07	-	-	1.86E-06
Nb-95	Ci	9.87E-07	3.47E-07	-	-	1.33E-06
Ru-106	Ci	-	-	3.60E-07	-	3.60E-07
Cs-137	Ci	-	-		2.23E-08	2.23E-08
Br-82	Ci	-	-	8.48E-07	-	8.48E-07
Zr-95	Ci	2.66E-07	-	-	-	2.66E-07
Total Activity	Ci	4.16E-05	3.18E-06	1.21E-06	2.23E-08	4.60E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Tritium						
H-3	Ci	6.90E-01	1.05E-01	1.16E-01	7.27E-01	1.64E+00

N/D = Not Detected

Table 2.3-7

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

	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	1.10E-01	1.06E-01	2.74E-02	1.53E-02	2.58E-01
2. Average Period Diluted Activity	uCi/ml	4.12E-10	2.28E-10	5.84E-11	3.30E-11	1.55E-10
B. Tritium						
1. Total Activity Released	Ci	1.80E+02	7.37E+01	4.09E+01	2.23E+02	5.18E+02
2. Average Period Diluted Activity	uCi/ml	6.76E-07	1.58E-07	8.72E-08	4.83E-07	3.11E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	5.01E-04	N/D	N/D	4.40E-05	5.45E-04
2. Average Period Diluted Activity	uCi/ml	1.88E-12	-	-	9.52E-14	3.28E-13
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D	N/D	N/D
E. Volume						
1. Released Waste Volume	Liters	3.04E+06	4.81E+06	4.45E+06	5.23E+06	1.75E+07
2. Dilution Volume During Releases	Liters	1.69E+10	4.64E+10	4.01E+10	4.23E+10	1.46E+11
3. Dilution Volume During Period	Liters	2.66E+11	4.65E+11	4.69E+11	4.62E+11	1.66E+12

N/D = Not Detected

Table 2.3-8

Millstone Unit No. 3

Liquid Effluents - Continuous - SGBD & SW

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Tritium						
H-3	Ci	1.99E-02	4.12E-02	1.70E-01	2.00E-01	4.31E-01
C. Dissolved & Entrained Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.3-9

Millstone Unit No. 3

Liquid Effluents - Batch - LWS

Nuclides Released	Units	2001 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Ag-110m	Ci	-	-	-	-	-
Co-57	Ci	-	8.67E-06	2.62E-06	3.05E-06	1.43E-05
Co-58	Ci	1.16E-02	1.67E-02	1.59E-03	8.99E-04	3.07E-02
Co-60	Ci	4.92E-03	3.94E-03	8.54E-04	1.43E-03	1.11E-02
Cr-51	Ci	6.36E-03	6.29E-03	-	-	1.26E-02
Cs-134	Ci	-	-	-	-	-
Cs-137	Ci	1.00E-03	-	-	1.84E-04	1.19E-03
Fe-55	Ci	6.49E-02	6.52E-02	2.09E-02	6.22E-03	1.57E-01
Fe-59	Ci	5.60E-05	1.42E-04	-	-	1.98E-04
I-131	Ci	4.45E-06	-	-	-	4.45E-06
I-133	Ci	1.26E-05	-	-	-	1.26E-05
Mn-54	Ci	4.56E-03	2.47E-03	7.15E-04	5.61E-04	8.31E-03
Mo-99	Ci	6.33E-06	-	-	-	6.33E-06
Na-24	Ci	3.95E-06	-	-	-	3.95E-06
Nb-95	Ci	8.82E-04	2.88E-03	3.94E-04	1.95E-04	4.35E-03
Nb-97	Ci	1.50E-06	9.86E-06	-	-	1.14E-05
Rb-88	Ci	-	-	8.20E-05	-	8.20E-05
Ru-105	Ci	4.22E-05	4.47E-05	3.71E-06	1.55E-05	1.06E-04
Sb-124	Ci	2.43E-04	-	-	-	2.43E-04
Sb-125	Ci	1.46E-02	6.84E-03	2.68E-03	5.72E-03	2.98E-02
Sr-89	Ci	6.38E-06	-	-	-	6.38E-06
Sn-117m	Ci	-	6.09E-06	-	-	6.09E-06
Tc-99m	Ci	6.89E-06	-	-	-	6.89E-06
Tc-101	Ci	-	-	3.07E-05	-	3.07E-05
Zr-95	Ci	3.60E-04	1.37E-03	1.32E-04	3.05E-05	4.92E-04
W-187	Ci	1.14E-05	-	-	-	1.14E-05
Y-91m	Ci	-	-	-	1.77E-06	1.77E-06
Total Activity	Ci	1.10E-01	1.06E-01	2.74E-02	1.53E-02	2.57E-01
B. Tritium						
H-3	Ci	1.80E+02	7.36E+01	4.07E+01	2.23E+02	5.17E+02
C. Dissolved & Entrained Gases						
Xe-133	Ci	3.35E-04	-	-	2.43E-05	3.59E-04
Xe-133m	Ci	-	-	-	-	-
Xe-135	Ci	1.66E-04	-	-	1.97E-05	1.86E-04
Total Activity	Ci	5.01E-04	-	-	4.40E-05	5.45E-04
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.3-10A

Millstone Unit No. 3

Liquid Effluents - Batch - CPF Waste Neutralization Sumps & Hotwell Discharge

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Tritium						
H-3	Ci	6.59E-03	1.24E-02	2.75E-02	3.35E-02	8.00E-02
C. Dissolved & Entrained Gases						
Xe-131m	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D

N/D = Not Detected

Table 2.3-10B

Millstone Unit No. 3
Liquid Effluents - Continuous - Turbine Building Sump
(Release Point - Yard Drain - DSN 006)

Nuclides Released	Units	2001				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
B. Tritium						
H-3	Ci	3.58E-04	6.48E-03	2.91E-02	3.74E-02	7.33E-02
Average Period Diluted Activity	uCi/ml	1.46E-08	2.61E-07	1.16E-06	1.49E-06	7.37E-07
C. Dissolved & Entrained Gases						
	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	N/D
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	N/D
E. Volume						
Released Waste Volume	Liters	9.77E+05	1.07E+06	1.28E+06	1.25E+06	4.58E+06
Dilution Volume During Period *	Liters	2.35E+07	2.37E+07	2.38E+07	2.38E+07	9.49E+07

* from Yard Drains

N/D = Not Detected

2.3 Solid Waste

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

Table 2.1-6	Unit 1 Solid Waste and Irradiated Component Shipments
Table 2.2-9	Unit 2 Solid Waste and Irradiated Component Shipments
Table 2.3-11	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 2001

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

13 March 2002 MPWS-02-005

The attached document, identified below, has been prepared, reviewed and approved to meet quality standards and is hereby submitted for inclusion in the Annual Radioactive Effluent Report (ARER).

Solid Waste and Irradiated Component Shipments
January 1, 2001 through December 31, 2001

Table 2.1-6:	Millstone Unit 1;	11 pages
Table 2.2-9:	Millstone Unit 2;	10 pages
Table 2.3-11:	Millstone Unit 3;	11 pages

Prepared by: Danny L. Gorby (signature) Date: 3-13-2002
Danny L. Gorby

Reviewed by: Paul Tulba (signature) Date: 3/14/02
Paul M. Tulba

Approved by: J. E. Laine (signature) Date: 3/14/02
J. Eric Laine

Table 2.1-6
Solid Waste and Irradiated Component Shipments
Millstone Unit 1

January 1, 2001 through December 31, 2001

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	m^3	4.22E+01	
Chem-Nuclear Services Inc., Barnwell, SC for Burial	Ci	1.01E+02	25%
From Millstone Nuclear Power Station to Duratek,	m^3	1.75E+01	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	2.80E+00	25%

b. Dry compressible waste, contaminated equipment, etc.

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	7.44E+02	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	2.87E+00	25%

c. Irradiated components, control rods, etc.

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	2.83E-01	
Oak Ridge, TN for Metal Melt, Super-Compaction, etc.	Ci	2.13E+00	25%

d. Other - (Mixed Waste)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Diversified	m^3	4.16E-01	
Scientific Services, Inc., Oak Ridge, TN for Incineration, Fuel Blending	Ci	4.01E-04	25%
From Millstone Nuclear Power Station to Perma-Fix Environmental	m^3	7.20E+00	
Services, Gainesville FL for Stabilization, Fuel Blending, etc.	Ci	2.12E-02	25%

d. Other - (Water)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to	m^3	4.68E+01	
Duratek, Oak Ridge, TN for Incineration	Ci	2.31E+00	25%

d. Other - (Grease, oil, oily waste)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	3.15E+00	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	4.96E-04	25%

d. Other - (Calibration and check sources)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	1.98E-01	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	8.28E-02	25%

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

a. Spent resins, filter sludges, evaporator bottoms, etc.

From Millstone Nuclear Power Station to Chem-Nuclear Services Inc., Barnwell, SC for Burial

Radionuclide	% of Total	Curies
H-3	<0.01	3.37E-03
C-14	0.05	4.63E-02
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.17	1.74E-01
Fe-55	1.18	1.19E+00
Fe-59		
Co-57		
Co-58		
Co-60	20.34	2.05E+01
Ni-59		
Ni-63	2.37	2.38E+00
Zn-65	1.28	1.28E+00
Sr-85		
Y-88		
Sr-89		
Sr-90	0.10	9.94E-02
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	<0.01	2.29E-03
I-129		
Ba-133		
I-131		
Cs-134	0.07	6.63E-02
Cs-137	74.39	7.49E+01
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238	<0.01	1.63E-03
Pu-239	<0.01	1.32E-03
Pu-241	0.03	3.39E-02
Am-241	<0.01	6.35E-03
Pu-242		
Cm-242	<0.01	1.02E-06
Cm-244	<0.01	3.14E-03
TOTALS		1.01E+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, Oak Ridge, TN for Super-Compaction, Incineration, etc.

Radionuclide	% of Total	Curies
H-3	0.07	1.87E-03
C-14	27.97	7.82E-01
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.57	1.58E-02
Fe-55	63.06	1.76E+00
Fe-59		
Co-57		
Co-58		
Co-60	4.40	1.23E-01
Ni-59		
Ni-63	0.30	8.36E-03
Zn-65	0.97	2.72E-02
Sr-85		
Y-88		
Sr-89	<0.01	1.79E-04
Sr-90	0.05	1.49E-03
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134	0.04	1.10E-03
Cs-137	2.56	7.16E-02
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238	<0.01	7.82E-06
Pu-239	<0.01	4.02E-06
Pu-241	<0.01	1.71E-04
Am-241	<0.01	1.48E-05
Pu-242		
Cm-242		
Cm-244	<0.01	9.29E-06
TOTALS		2.80E+00

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

b. Dry compressible waste, contaminated equipment, etc.

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

Radionuclide	% of Total	Curies
H-3	0.17	5.00E-03
C-14	0.15	4.23E-03
Na-22		
Na-24		
Cl-36		
Cr-51	0.37	1.06E-02
Mn-54	0.02	4.39E-04
Fe-55	32.49	9.34E-01
Fe-59		
Co-57		
Co-58	5.19	1.49E-01
Co-60	26.70	7.67E-01
Ni-59	<0.01	2.34E-05
Ni-63	5.65	1.62E-01
Zn-65		
Sr-85		
Y-88		
Sr-89	0.01	2.93E-04
Sr-90		
Nb-94		
Nb-95	0.26	7.45E-03
Zr-95	0.17	4.91E-03
Tc-99		
Cd-109		
Ag-110m	<0.01	4.22E-06
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	28.79	8.27E-01
Ce-139		
Ce-141		
Ce-144		
Eu-152	<0.01	4.09E-06
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238	<0.01	3.82E-05
Pu-239	<0.01	3.20E-05
Pu-241	0.03	9.46E-04
Am-241	<0.01	9.94E-05
Pu-242		
Cm-242		
Cm-244	<0.01	4.90E-05
TOTALS		2.87E+00

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

c. Irradiated components, control rods, etc.

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

Radionuclide	% of Total	Curies
H-3		
C-14	0.01	2.92E-04
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	1.46	3.11E-02
Fe-55	53.95	1.15E+00
Fe-59	<0.01	3.94E-06
Co-57		
Co-58	0.02	3.47E-04
Co-60	35.79	7.63E-01
Ni-59	0.05	1.00E-03
Ni-63	8.73	1.86E-01
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94	<0.01	4.51E-06
Nb-95		
Zr-95		
Tc-99	<0.01	7.39E-07
Cd-109		
Ag-110m		
Sn-113		
Sb-125	<0.01	6.46E-06
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137		
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		2.13E+00

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

d. Other - (Mixed Waste)

From Millstone Nuclear Power Station to Diversified Scientific Services, Inc., Oak Ridge, TN for Incineration, Fuel Blending

Radionuclide	% of Total	Curies
H-3	7.57	3.04E-05
C-14	0.83	3.34E-06
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54		
Fe-55	3.88	1.56E-05
Fe-59		
Co-57		
Co-58	<0.01	6.95E-09
Co-60	61.55	2.47E-04
Ni-59		
Ni-63	8.14	3.27E-05
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99	<0.01	6.27E-09
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	18.03	7.24E-05
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		4.01E-04

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

d. Other - (Mixed Waste)

From Millstone Nuclear Power Station to Perma-Fix Environmental Services, Gainesville FL for Stabilization, Fuel Blending, etc.

Radionuclide	% of Total	Curies
H-3	1.83	3.88E-04
C-14	1.12	2.37E-04
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.04	8.24E-06
Fe-55	44.33	9.42E-03
Fe-59		
Co-57	<0.01	3.21E-07
Co-58	3.20	6.79E-04
Co-60	18.04	3.83E-03
Ni-59		
Ni-63	13.65	2.90E-03
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	0.01	2.25E-06
I-129		
Ba-133		
I-131		
Cs-134	0.09	1.86E-05
Cs-137	17.65	3.75E-03
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241	0.05	1.11E-05
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		2.12E-02

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

d. Other - (Water)

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

Radionuclide	% of Total	Curies
H-3	99.63	2.30E+00
C-14	<0.01	1.39E-04
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	<0.01	4.27E-05
Fe-55	0.11	2.59E-03
Fe-59		
Co-57	<0.01	8.51E-06
Co-58	0.01	2.51E-04
Co-60	0.03	7.31E-04
Ni-59		
Ni-63	0.03	7.89E-04
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95	<0.01	8.51E-06
Zr-95		
Tc-99	<0.01	8.33E-08
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129	<0.01	1.56E-07
Ba-133		
I-131	<0.01	8.43E-06
Cs-134	0.10	2.24E-03
Cs-137	0.08	1.81E-03
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		2.31E+00

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

d. Other - (Grease, oil, oily waste)

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

Radionuclide	% of Total	Curies
H-3	0.89	4.42E-06
C-14	0.05	2.40E-07
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	<0.01	4.66E-08
Fe-55	40.94	2.03E-04
Fe-59		
Co-57		
Co-58	<0.01	2.16E-08
Co-60	28.88	1.43E-04
Ni-59		
Ni-63	4.03	2.00E-05
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95	<0.01	1.14E-09
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	<0.01	4.45E-08
I-129		
Ba-133		
I-131		
Cs-134	<0.01	1.38E-08
Cs-137	25.19	1.25E-04
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		4.96E-04

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

d. Other - (Calibration and check sources)

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

Radionuclide	% of Total	Curies
H-3		
C-14		
Na-22	<0.01	3.33E-07
Na-24	<0.01	3.63E-07
Cl-36	0.02	1.47E-05
Cr-51	0.03	2.14E-05
Mn-54	<0.01	4.47E-06
Fe-55		
Fe-59	<0.01	8.00E-08
Co-57	<0.01	4.35E-06
Co-58	<0.01	1.31E-06
Co-60	0.38	3.11E-04
Ni-59		
Ni-63		
Zn-65	<0.01	2.77E-06
Sr-85	<0.01	2.46E-06
Y-88	0.02	1.46E-05
Sr-89		
Sr-90	4.83	4.00E-03
Nb-94		
Nb-95		
Zr-95		
Tc-99	<0.01	2.63E-06
Cd-109	0.10	8.19E-05
Ag-110m		
Sn-113	<0.01	5.69E-06
Sb-125		
I-129		
Ba-133	<0.01	4.11E-06
I-131	<0.01	1.65E-06
Cs-134	<0.01	3.45E-08
Cs-137	94.56	7.83E-02
Ce-139	<0.01	3.26E-06
Ce-141	<0.01	6.27E-06
Ce-144	<0.01	2.38E-08
Eu-152	<0.01	7.67E-07
Hg-203	<0.01	6.25E-06
Ra-226	<0.01	2.08E-06
Th-230	<0.01	3.28E-08
U-233	<0.01	2.20E-11
U-234	<0.01	2.20E-08
U-238	<0.01	2.20E-08
Pu-238		
Pu-239	<0.01	5.90E-07
Pu-241		
Am-241	<0.01	6.68E-06
Pu-242		
Cm-242		
Cm-244		
TOTALS		8.28E-02

3. Solid Waste Disposition (Shipments from Millstone)

Number of Shipments	Mode of Transportation	Destination
9	Truck (Sole Use Vehicle)	Chem-Nuclear Services Inc., Barnwell, SC
1	Truck (Sole Use Vehicle)	Diversified Scientific Services, Inc. - Oak Ridge, TN
32	Truck (Sole Use Vehicle)	Duratek - Oak Ridge, TN
4	Truck (Sole Use Vehicle)	Perma-Fix Environmental Services - Gainesville FL

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
No Shipments in 2001	N/A	N/A

Table 2.2-9
Solid Waste and Irradiated Component Shipments
Millstone Unit 2

January 1, 2001 through December 31, 2001

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,	m^3	5.20E+00	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	1.74E-03	25%
From Millstone Nuclear Power Station to Studsvik	m^3	1.02E+01	
Processing Facility for Thermal Destruction	Ci	1.16E+02	25%

b. Dry compressible waste, contaminated equipment, etc.

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	7.45E+01	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	9.05E-01	25%

c. Irradiated components, control rods, etc.

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	1.34E-01	
Oak Ridge, TN for Metal Melt, Super-Compaction, etc.	Ci	3.84E+00	25%

d. Other - (Mixed Waste)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Diversified	m^3	4.16E-01	
Scientific Services, Inc., Oak Ridge, TN for Incineration, Fuel Blending	Ci	4.01E-04	25%
From Millstone Nuclear Power Station to Perma-Fix Environmental	m^3	7.20E+00	
Services, Gainesville FL for Stabilization, Fuel Blending, etc.	Ci	2.12E-02	25%

d. Other - (Grease, oil, oily waste)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	2.09E+00	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	3.29E-04	25%

d. Other - (Calibration and check sources)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	1.98E-01	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	8.28E-02	25%

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, Oak Ridge, TN for Super-Compaction, Incineration, etc.

Radionuclide	% of Total	Curies
H-3	2.13	3.71E-05
C-14	1.00	1.74E-05
Na-22		
Na-24		
Cl-36		
Cr-51	3.39	5.91E-05
Mn-54		
Fe-55	18.46	3.22E-04
Fe-59		
Co-57		
Co-58	47.98	8.37E-04
Co-60	5.21	9.08E-05
Ni-59		
Ni-63	5.65	9.86E-05
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95	2.40	4.18E-05
Zr-95	1.58	2.76E-05
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	12.21	2.13E-04
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		1.74E-03

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 for Thermal Destruction

Radionuclide	% of Total	Curies
H-3	0.18	2.09E-01
C-14	1.77	2.06E+00
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	1.36	1.58E+00
Fe-55	16.13	1.88E+01
Fe-59		
Co-57	0.16	1.91E-01
Co-58	10.73	1.25E+01
Co-60	14.67	1.71E+01
Ni-59		
Ni-63	43.53	5.07E+01
Zn-65		
Sr-85		
Y-88		
Sr-89	<0.01	9.68E-03
Sr-90	0.18	2.08E-01
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	0.57	6.62E-01
I-129	<0.01	5.99E-03
Ba-133		
I-131		
Cs-134	2.00	2.33E+00
Cs-137	8.68	1.01E+01
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238	<0.01	3.95E-04
Pu-238	<0.01	7.10E-04
Pu-239	<0.01	6.50E-04
Pu-241	0.03	3.45E-02
Am-241	<0.01	8.51E-04
Pu-242	<0.01	6.61E-06
Cm-242	<0.01	1.06E-03
Cm-244	<0.01	1.63E-03
TOTALS		1.16E+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, Oak Ridge, TN for Super-Compaction, Incineration, etc.

Radionuclide	% of Total	Curies
H-3	0.08	7.02E-04
C-14	0.25	2.30E-03
Na-22		
Na-24		
Cl-36		
Cr-51	0.75	6.78E-03
Mn-54	0.01	1.02E-04
Fe-55	29.05	2.63E-01
Fe-59		
Co-57		
Co-58	10.60	9.59E-02
Co-60	23.62	2.14E-01
Ni-59		
Ni-63	6.04	5.46E-02
Zn-65		
Sr-85		
Y-88		
Sr-89	0.01	1.11E-04
Sr-90		
Nb-94		
Nb-95	0.53	4.79E-03
Zr-95	0.35	3.16E-03
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	28.66	2.59E-01
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238	<0.01	1.44E-05
Pu-239	<0.01	1.21E-05
Pu-241	0.04	3.56E-04
Am-241	<0.01	3.74E-05
Pu-242		
Cm-242		
Cm-244	<0.01	1.85E-05
TOTALS		9.05E-01

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

c. Irradiated components, control rods, etc.

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

Radionuclide	% of Total	Curies
H-3	0.09	3.56E-03
C-14	0.15	5.60E-03
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.06	2.26E-03
Fe-55	23.55	9.04E-01
Fe-59		
Co-57		
Co-58		
Co-60	48.21	1.85E+00
Ni-59	0.23	8.90E-03
Ni-63	27.70	1.06E+00
Zn-65	<0.01	3.09E-05
Sr-85		
Y-88		
Sr-89		
Sr-90	<0.01	8.41E-06
Nb-94	<0.01	1.34E-04
Nb-95		
Zr-95		
Tc-99	<0.01	6.23E-06
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134	<0.01	1.99E-05
Cs-137	<0.01	1.21E-04
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241	<0.01	3.86E-05
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		3.84E+00

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

d. Other - (Mixed Waste)

From Millstone Nuclear Power Station to Diversified Scientific Services, Inc., Oak Ridge, TN for Incineration, Fuel Blending

Radionuclide	% of Total	Curies
H-3	7.57	3.04E-05
C-14	0.83	3.34E-06
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54		
Fe-55	3.88	1.56E-05
Fe-59		
Co-57		
Co-58	<0.01	6.95E-09
Co-60	61.55	2.47E-04
Ni-59		
Ni-63	8.14	3.27E-05
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99	<0.01	6.27E-09
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	18.03	7.24E-05
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		4.01E-04

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

d. Other - (Mixed Waste)

From Millstone Nuclear Power Station to Perma-Fix Environmental Services, Gainesville FL for Stabilization, Fuel Blending, etc.

Radionuclide	% of Total	Curies
H-3	1.83	3.88E-04
C-14	1.12	2.37E-04
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.04	8.24E-06
Fe-55	44.33	9.42E-03
Fe-59		
Co-57	<0.01	3.21E-07
Co-58	3.20	6.79E-04
Co-60	18.04	3.83E-03
Ni-59		
Ni-63	13.65	2.90E-03
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	0.01	2.25E-06
I-129		
Ba-133		
I-131		
Cs-134	0.09	1.86E-05
Cs-137	17.65	3.75E-03
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241	0.05	1.11E-05
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		2.12E-02

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

d. Other - (Grease, oil, oily waste)

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

Radionuclide	% of Total	Curies
H-3	0.89	2.94E-06
C-14	0.05	1.63E-07
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.02	7.80E-08
Fe-55	41.08	1.35E-04
Fe-59		
Co-57		
Co-58	0.01	3.91E-08
Co-60	28.98	9.54E-05
Ni-59		
Ni-63	4.04	1.33E-05
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95	<0.01	2.21E-09
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	<0.01	2.97E-08
I-129		
Ba-133		
I-131		
Cs-134	<0.01	9.18E-09
Cs-137	24.90	8.19E-05
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		3.29E-04

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

d. Other - (Calibration and check sources)

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

Radionuclide	% of Total	Curies
H-3		
C-14		
Na-22	<0.01	3.33E-07
Na-24	<0.01	3.63E-07
Cl-36	0.02	1.47E-05
Cr-51	0.03	2.14E-05
Mn-54	<0.01	4.47E-06
Fe-55		
Fe-59	<0.01	8.00E-08
Co-57	<0.01	4.35E-06
Co-58	<0.01	1.31E-06
Co-60	0.38	3.11E-04
Ni-59		
Ni-63		
Zn-65	<0.01	2.77E-06
Sr-85	<0.01	2.46E-06
Y-88	0.02	1.46E-05
Sr-89		
Sr-90	4.83	4.00E-03
Nb-94		
Nb-95		
Zr-95		
Tc-99	<0.01	2.63E-06
Cd-109	0.10	8.19E-05
Ag-110m		
Sn-113	<0.01	5.69E-06
Sb-125		
I-129		
Ba-133	<0.01	4.11E-06
I-131	<0.01	1.65E-06
Cs-134	<0.01	3.45E-08
Cs-137	94.56	7.83E-02
Ce-139	<0.01	3.26E-06
Ce-141	<0.01	6.27E-06
Ce-144	<0.01	2.38E-08
Eu-152	<0.01	7.67E-07
Hg-203	<0.01	6.25E-06
Ra-226	<0.01	2.08E-06
Th-230	<0.01	3.28E-08
U-233	<0.01	2.20E-11
U-234	<0.01	2.20E-08
U-238	<0.01	2.20E-08
Pu-238		
Pu-239	<0.01	5.90E-07
Pu-241		
Am-241	<0.01	6.68E-06
Pu-242		
Cm-242		
Cm-244		
TOTALS		8.28E-02

3. Solid Waste Disposition (Shipments from Millstone)

Number of Shipments	Mode of Transportation	Destination
1	Truck (Sole Use Vehicle)	Diversified Scientific Services, Inc. - Oak Ridge, TN
12	Truck (Sole Use Vehicle)	Duratek - Oak Ridge, TN
4	Truck (Sole Use Vehicle)	Perma-Fix Environmental Services - Gainesville FL
3	Truck (Sole Use Vehicle)	Studsvik Processing Facility, LLC - Erwin, TN

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
No Shipments in 2001	N/A	N/A

Table 2.3-11
Solid Waste and Irradiated Component Shipments
Millstone Unit 3

January 1, 2001 through December 31, 2001

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,	m^3	2.60E+00	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	1.57E-03	25%
From Millstone Nuclear Power Station to Studsvik	m^3	1.78E+01	
Processing Facility for Thermal Destruction	Ci	2.63E+02	25%

b. Dry compressible waste, contaminated equipment, etc.

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	2.35E+02	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	4.10E+00	25%

c. Irradiated components, control rods, etc.

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	3.00E-03	
Oak Ridge, TN for Metal Melt, Super-Compaction, etc.	Ci	1.64E-01	25%

d. Other - (Mixed Waste)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Diversified	m^3	4.16E-01	
Scientific Services, Inc., Oak Ridge, TN for Incineration, Fuel Blending	Ci	4.01E-04	25%
From Millstone Nuclear Power Station to Perma-Fix Environmental	m^3	7.20E+00	
Services, Gainesville FL for Stabilization, Fuel Blending, etc.	Ci	2.12E-02	25%

d. Other - (Water)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	3.13E+01	
Oak Ridge, TN for Incineration	Ci	9.89E-01	25%

d. Other - (Grease, oil, oily waste)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	1.26E+00	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	1.20E-04	25%

d. Other - (Calibration and check sources)

Disposition	Units	Annual Totals	Est. Total Error %
From Millstone Nuclear Power Station to Duratek,	m^3	1.98E-01	
Oak Ridge, TN for Super-Compaction, Incineration, etc.	Ci	8.28E-02	25%

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, Oak Ridge, TN for Super-Compaction, Incineration, etc.

Radionuclide	% of Total	Curies
H-3	0.09	1.49E-06
C-14	0.09	1.37E-06
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	1.64	2.57E-05
Fe-55	64.98	1.02E-03
Fe-59		
Co-57		
Co-58	1.08	1.70E-05
Co-60	15.67	2.46E-04
Ni-59		
Ni-63	14.72	2.31E-04
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	1.73	2.71E-05
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		1.57E-03

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 for Thermal Destruction

Radionuclide	% of Total	Curies
H-3	0.12	3.17E-01
C-14	0.07	1.81E-01
Na-22		
Na-24		
Cl-36		
Cr-51	0.04	1.04E-01
Mn-54	5.23	1.38E+01
Fe-55	35.22	9.26E+01
Fe-59	0.02	6.25E-02
Co-57	0.07	1.79E-01
Co-58	3.78	9.94E+00
Co-60	16.43	4.32E+01
Ni-59		
Ni-63	33.49	8.80E+01
Zn-65		
Sr-85		
Y-88		
Sr-89	<0.01	8.18E-03
Sr-90	0.07	1.76E-01
Nb-94		
Nb-95	0.06	1.66E-01
Zr-95	0.08	2.05E-01
Tc-99	<0.01	1.03E-04
Cd-109		
Ag-110m		
Sn-113	0.03	6.68E-02
Sb-125	0.41	1.08E+00
I-129	<0.01	8.49E-04
Ba-133		
I-131		
Cs-134	0.35	9.19E-01
Cs-137	4.52	1.19E+01
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238	<0.01	1.16E-03
Pu-239	<0.01	3.97E-04
Pu-241	0.01	3.13E-02
Am-241	<0.01	6.20E-04
Pu-242		
Cm-242	<0.01	1.04E-03
Cm-244	<0.01	1.26E-03
TOTALS		2.63E+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, Oak Ridge, TN for Super-Compaction, Incineration, etc.

Radionuclide	% of Total	Curies
H-3	<0.01	1.67E-04
C-14	0.05	2.19E-03
Na-22		
Na-24		
Cl-36		
Cr-51	0.02	7.65E-04
Mn-54	2.60	1.07E-01
Fe-55	60.45	2.48E+00
Fe-59		
Co-57		
Co-58	1.17	4.80E-02
Co-60	20.44	8.38E-01
Ni-59		
Ni-63	12.89	5.28E-01
Zn-65		
Sr-85		
Y-88		
Sr-89	<0.01	2.13E-05
Sr-90		
Nb-94		
Nb-95	0.01	5.40E-04
Zr-95	<0.01	3.56E-04
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	0.47	1.92E-02
I-129	<0.01	1.61E-04
Ba-133		
I-131		
Cs-134		
Cs-137	1.88	7.69E-02
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238	<0.01	2.77E-06
Pu-239	<0.01	2.32E-06
Pu-241	<0.01	6.85E-05
Am-241	<0.01	7.20E-06
Pu-242		
Cm-242		
Cm-244	<0.01	3.55E-06
TOTALS		4.10E+00

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

c. Irradiated components, control rods, etc.

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

Radionuclide	% of Total	Curies
H-3		
C-14		
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.33	5.48E-04
Fe-55	44.88	7.36E-02
Fe-59		
Co-57		
Co-58		
Co-60	49.02	8.04E-02
Ni-59		
Ni-63	5.76	9.45E-03
Zn-65	<0.01	6.56E-06
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137		
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		1.64E-01

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

d. Other - (Mixed Waste)

From Millstone Nuclear Power Station to Diversified Scientific Services, Inc., Oak Ridge, TN for Incineration, Fuel Blending

Radionuclide	% of Total	Curies
H-3	7.57	3.04E-05
C-14	0.83	3.34E-06
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54		
Fe-55	3.88	1.56E-05
Fe-59		
Co-57		
Co-58	<0.01	6.95E-09
Co-60	61.55	2.47E-04
Ni-59		
Ni-63	8.14	3.27E-05
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99	<0.01	6.27E-09
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129		
Ba-133		
I-131		
Cs-134		
Cs-137	18.03	7.24E-05
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		4.01E-04

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

d. Other - (Mixed Waste)

From Millstone Nuclear Power Station to Perma-Fix Environmental Services, Gainesville FL for Stabilization, Fuel Blending, etc.

Radionuclide	% of Total	Curies
H-3	1.83	3.88E-04
C-14	1.12	2.37E-04
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.04	8.24E-06
Fe-55	44.33	9.42E-03
Fe-59		
Co-57	<0.01	3.21E-07
Co-58	3.20	6.79E-04
Co-60	18.04	3.83E-03
Ni-59		
Ni-63	13.65	2.90E-03
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95		
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	0.01	2.25E-06
I-129		
Ba-133		
I-131		
Cs-134	0.09	1.86E-05
Cs-137	17.65	3.75E-03
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241	0.05	1.11E-05
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		2.12E-02

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

d. Other - (Water)

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

Radionuclide	% of Total	Curies
H-3	99.58	9.85E-01
C-14	<0.01	6.00E-05
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	<0.01	1.83E-05
Fe-55	0.14	1.39E-03
Fe-59		
Co-57	<0.01	3.65E-06
Co-58	0.02	1.95E-04
Co-60	0.04	3.81E-04
Ni-59		
Ni-63	0.04	4.02E-04
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95	<0.01	3.65E-06
Zr-95		
Tc-99	<0.01	3.57E-08
Cd-109		
Ag-110m		
Sn-113		
Sb-125		
I-129	<0.01	6.69E-08
Ba-133		
I-131	<0.01	3.61E-06
Cs-134	0.10	9.60E-04
Cs-137	0.08	7.76E-04
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		9.89E-01

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

d. Other - (Grease, oil, oily waste)

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

Radionuclide	% of Total	Curies
H-3	0.89	1.07E-06
C-14	0.05	6.24E-08
Na-22		
Na-24		
Cl-36		
Cr-51		
Mn-54	0.07	8.01E-08
Fe-55	41.10	4.92E-05
Fe-59		
Co-57		
Co-58	0.03	4.15E-08
Co-60	29.00	3.47E-05
Ni-59		
Ni-63	4.07	4.87E-06
Zn-65		
Sr-85		
Y-88		
Sr-89		
Sr-90		
Nb-94		
Nb-95	<0.01	2.41E-09
Zr-95		
Tc-99		
Cd-109		
Ag-110m		
Sn-113		
Sb-125	<0.01	1.08E-08
I-129		
Ba-133		
I-131		
Cs-134	<0.01	3.34E-09
Cs-137	24.77	2.96E-05
Ce-139		
Ce-141		
Ce-144		
Eu-152		
Hg-203		
Ra-226		
Th-230		
U-233		
U-234		
U-238		
Pu-238		
Pu-239		
Pu-241		
Am-241		
Pu-242		
Cm-242		
Cm-244		
TOTALS		1.20E-04

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

d. Other - (Calibration and check sources)

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

Radionuclide	% of Total	Curies
H-3		
C-14		
Na-22	<0.01	3.33E-07
Na-24	<0.01	3.63E-07
Cl-36	0.02	1.47E-05
Cr-51	0.03	2.14E-05
Mn-54	<0.01	4.47E-06
Fe-55		
Fe-59	<0.01	8.00E-08
Co-57	<0.01	4.35E-06
Co-58	<0.01	1.31E-06
Co-60	0.38	3.11E-04
Ni-59		
Ni-63		
Zn-65	<0.01	2.77E-06
Sr-85	<0.01	2.46E-06
Y-88	0.02	1.46E-05
Sr-89		
Sr-90	4.83	4.00E-03
Nb-94		
Nb-95		
Zr-95		
Tc-99	<0.01	2.63E-06
Cd-109	0.10	8.19E-05
Ag-110m		
Sn-113	<0.01	5.69E-06
Sb-125		
I-129		
Ba-133	<0.01	4.11E-06
I-131	<0.01	1.65E-06
Cs-134	<0.01	3.45E-08
Cs-137	94.56	7.83E-02
Ce-139	<0.01	3.26E-06
Ce-141	<0.01	6.27E-06
Ce-144	<0.01	2.38E-08
Eu-152	<0.01	7.67E-07
Hg-203	<0.01	6.25E-06
Ra-226	<0.01	2.08E-06
Th-230	<0.01	3.28E-08
U-233	<0.01	2.20E-11
U-234	<0.01	2.20E-08
U-238	<0.01	2.20E-08
Pu-238		
Pu-239	<0.01	5.90E-07
Pu-241		
Am-241	<0.01	6.68E-06
Pu-242		
Cm-242		
Cm-244		
TOTALS		8.28E-02

3. Solid Waste Disposition (Shipments from Millstone)

Number of Shipments	Mode of Transportation	Destination
1	Truck (Sole Use Vehicle)	Diversified Scientific Services, Inc. - Oak Ridge, TN
24	Truck (Sole Use Vehicle)	Duratek - Oak Ridge, TN
4	Truck (Sole Use Vehicle)	Perma-Fix Environmental Services - Gainesville FL
5	Truck (Sole Use Vehicle)	Studsvik Processing Facility, LLC - Erwin, TN

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
No Shipments in 2001	N/A	N/A

3.0 REMODCM Changes

In 2001, the following changes were made to the Millstone REMODCM:

Change #	Rev	Effective Date
00-02	20	January 25, 2001
01-01	21	January 26, 2001
01-02	22	October 01, 2001

The description and the bases of the change(s) for each REMODCM revision are included in Volume I of this report. In addition, a complete copy of each of the REMODCM revisions for the calendar year 2001 is provided to the Nuclear Regulatory Commission as Volume II of this report.

REMODCM

Rev 20

Description of Changes

Radiological Environmental Review

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet
(Sheet 1 of 3)

Check: ☒ REMM ☒ ODCM ☐ Unit 1 Effluent Controls ☒ Unit 2 Effluent Controls ☒ Unit 3 Effluent Controls

Change Request #: REMODCM-00-02

I. Originator name (Print): Claude Flory
Markups of all changed pages are included.

Sect	Section Title	Page	Description of change and reason
I.B I.C.1 I.D.1 I.E I.F II.A II.B II.C II.D II.E II.F App. II.A	Responsibilities Liquid Effluent Sampling and Analysis Program Gaseous Effluent Sampling and Analysis Program Radiological Environmental Monitoring Report Content Introduction Responsibilities Liquid Dose Calculations Gaseous Dose Calculations Liquid Monitor Setpoints Gaseous Monitor Setpoints REMODCM Methodology Cross-References	I.B-1 I.C-1,12 I.D-1,9,10 I.E-2 I.F-2 II.A-1 II.B-1 II.C-1,2 II.D-1,3,4,5,15 II.E-1,3,6,7 II.F-2,3,4 App. II.A-1,2,3	Where reference is made to technical specifications it is changed to refer to, as applicable, to administrative technical specifications or to corresponding Radiological Effluent Control requirements. Because the Radiological Effluent Technical Specifications are being moved to the REMODCM, there will no longer be any technical specification outside of the administrative specifications applicable to the REMODCM.
IV (new)	Millstone Unit 2 Radiological Effluent Controls	IV-i,ii IV.A-1 IV.B-1 to 2 IV.C-1 to 2 IV.D-1to 11 IV.E-1 to 6 IV.F-1 IV.G-1 to 4	Moved Unit 2 Radiological Effluent Technical Specifications (RETS) verbatim, except for minor format changes, from Safety Technical Specifications (STS) to new Section IV of REMODCM in accordance with TSCR 2-2-00. The RETS moved includes: 1. T.S. 3/4.3.3.9 (with Tables 3.3-12 and 4.3-12) into Section IV.C 2. T.S. 3/4.3.3.10 (with Tables 3.3-13 and 4.3-13) into Section IV.C 3. T.S. 3/4.11.1 into Section IV.D 4. T.S. 3/4.11.2 into Section IV.D 5. T.S. 3/4.11.3 into Section IV.E 6. Associated bases into Section IV.F Applicable definitions from STS are being added in Section IV.B
V (new)	Millstone Unit 3 Radiological Effluent Controls	V-i,ii V.A-1 V.B-1 to 2 V.C-1 to 2 V.D-1to 10 V.E-1 to 6 V.F-1 V.G-1 to 3	Moved Unit 3 Radiological Effluent Technical Specifications (RETS) verbatim, except for minor format changes, from Safety Technical Specifications (STS) to new Section V of REMODCM in accordance with TSCR 3-1-00. The RETS moved includes: 1. T.S. 3/4.3.3.9 (with Tables 3.3-12 and 4.3-12) into Section V.C 2. T.S. 3/4.3.3.10 (with Tables 3.3-13 and 4.3-13) into Section V.C 3. T.S. 3/4.11.1 into Section V.D 4. T.S. 3/4.11.2 into Section V.D 5. T.S. 3/4.11.3 into Section V.E 6. Associated bases into Section V.F Applicable definitions from STS are being added in Section IV.B

RADIOLOGICAL ENVIRONMENTAL REVIEW

RER-00-014

Revision 0

for

REMODCM Rev 20 - Units 2 and 3 RETS Incorporation

December 4, 2000

Total Number of Pages: 3

Claude Flory	[signature] Preparer	12/5/00 Date
William Eakin	[signature] Supervisor	12/5/00 Date

DESCRIPTION OF CHANGE

REMODCM Revision 20 will incorporate the Radiological Effluent Technical Specifications (RETS) from Millstone Units 2 and 3. RETS includes the following Safety Technical Specifications (STS) from each unit:

- 3/4.3.3.9 - Radioactive Liquid Effluent Monitoring Instrumentation
- 3/4.3.3.10 - Radioactive Gaseous Effluent Monitoring Instrumentation
- 3/4.11.1 - Liquid Effluents Concentrations and Dose
- 3/4.11.2 - Gaseous Effluents Dose Rate, Noble Gas Dose, and Other Doses
- 3/4.11.3 - Total Dose

Also, STS definitions applicable to the RETS and the figures delineating the site boundary for liquid and gaseous effluents will be incorporated into the REMODCM. A new section, "Controls and Surveillance Requirements Applicability", is being added to the REMODCM. This section is similar to the STS 3/4.0, "Limiting Conditions for Operation and Surveillance Requirements." References to RETS in Sections I and II of the REMODCM are being revised to referenced new Sections IV and V which will contain the RETS.

References:

1. NUREG-1432, "Standard Technical Specifications, Combustion Engineering Plants," Rev 1, dated April 1995.
2. NUREG-1431, "Standard Technical Specifications, Westinghouse Plants," Rev 1, dated April 1995.
3. NRC Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program," dated January 31, 1989.
4. Letter B17959 to NRC, "Millstone Nuclear Power Station, Unit Nos. 2 and 3 Proposed Revision to Technical Specifications - Radiological Effluent Technical Specifications," dated February 22, 2000.

DISCUSSION

The movement of RETS into the REMODCM is a change initiated by the Regulatory Affairs Department as part of the effort to revise STS to NRC's standard format (Refs. 1 and 2) and follows the NRC guidance in Generic Letter 89-01 (Ref. 3). This proposed change was submitted to the NRC on February 22, 2000 (Ref. 4). RETS are being moved verbatim into the REMODCM except for minor format changes involving labeling of sections and tables. New definitions in the REMODCM are identical to the definitions used in STS for the same terms. Maps of site boundaries are identical to the maps used in Units 2 and 3 STSs.

Because the RETS are being re-located with no change to the requirements, there will be no affect on the Millstone radiological effluent control program. Procedures which presently implement the RETS will be revised only to change references from RETS to the REMODCM. Training will be provided to users, primarily Operations, to familarized them with the REMODCM.

CONCLUSION

The incorporation of Millstone Units 2 and 3 RETS in Revision 20 of the REMODCM would not cause an increase in release of radioactivity to the environment or of dose to the public and they do not deviate from any of the design bases for an effluent control program in the FSAR for Millstone Units 2 and 3 or in the DSAR for Millstone Unit 1. The changes will not affect the level of radioactive effluent control required by each unit's Technical Specifications and FSAR, 10CFR20, 40CFR190, 10CFR50.36a, 10CFR50 GDCs 60 and 64, and Appendix I of 10CFR50 and will not adversely impact the accuracy or reliability of effluent, dose or setpoint calculations. The change does not cause an Unreviewed Radiological Environmental Impact (UREI).

REMODCM

Rev 21

Description of Changes

Radiological Environmental Review

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1a of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
I.A	Introduction	I.A-1	Changed word "released" to "in the environment." This clarifies that the radioactive material is measured in the environment, not at the point of release.
I.C.1	Liquid Effluent Sampling and Analysis Program Table I.C-1	I.C-2 I.C-4	1. Changed wording in column headings for clarity. 2. Specified "Grab Sample" as sample type for each liquid batch release to clarify the acceptable type of sample. 3. Added "Release" after "Prior to Each Batch" for liquid batch release samples for clarification. 4. Deleted requirements for Service Water system sampling and analyses. With the Unit 1 RBCCW system drained there is no longer any potential source of contamination into the service water system. Footnotes D and F, which were only applicable to the Service Water sampling and analyses, are deleted.
I.C.1	Liquid Effluent Sampling and Analysis Program Table I.C-2	I.C-5	1. Changes in wording for column headings for clarity. 2. Specify "Grab Sample" as sample type for each liquid batch release to clarify the acceptable type of sample. 3. Added "Release" after "Prior to Each Batch" for liquid batch release samples for clarification.
I.C.1	Liquid Effluent Sampling and Analysis Program Table I.C-3	I.C-8	1. Changes in wording for column headings for clarity. 2. Specify "Grab Sample" as sample type for each liquid batch release to clarify the acceptable type of sample. 3. Added "Release" after "Prior to Each Batch" for liquid batch release samples for clarification. 4. Added "Effluent" to "Service Water" in the listing of continuous release sources for clarification.
I.C.2	Liquid Radioactive Waste Treatment	I.C-11	Added "OR Equivalent ion exchanger" and "OR Equivalent demineralizer" as alternate processing equipment for the Unit 2 clean liquid. This allows flexibility of operation if required equipment is inoperable when needed.
I.D.1	Gaseous Effluent Sampling and Analysis Program Table I.D-1	I.D-2 I.D-3	1.Changes in wording for column headings for clarity. 2.Deleted reference to Table I.D-2 for Site Stack sampling requirements. This change is needed to support the Unit 1 separation from the Millstone Stack. Unit 1 will continue to discharge to the Millstone Stack for a short period of time after implementation of this REMODCM revision. However, Unit 2 will continue to sample the Millstone Stack for any releases from Unit 1 as currently required by Table I.D-2. This temporary requirement is clarified with a note added before the sampling requirements in this table.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet
(Sheet 1b of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
I.D.1 (Cont)	Gaseous Effluent Sampling and Analysis Program Table I.D-1	I.D-2 I.D-3	3. Added sampling and analyses requirements for SFPI vent. The sampling and analyses are needed to monitor for potential releases of Kr-85, tritium (H-3) and radioactive particulates including Sr-89, Sr-90, and alpha radioactivity from the Unit 1 spent fuel pool. These requirements are needed to maintain compliance with Defueled Tech Spec 5.6.4 and with GDC 64 of 10 CFR Part 50. The SFPI vent and associated radiation monitors are new design changes. Because there may be periods of time after implementation of this revision of the REMODCM when the SFPI vent will not be a release point, a note was added to make the requirements applicable when the SFPI vent monitor becomes operable. 4. Added requirements for Balance of Plant (BOP) vent sample and analysis. The sampling and analysis are needed to monitor for potential releases of radioactive particulates including Sr-89, Sr-90, and alpha radioactivity from the Unit 1 BOP vent. This vent exhausts potentially radioactive particulates from the turbine building and the reactor building except for the SFPI. These requirements are needed to maintain compliance with Defueled Tech Spec 5.6.4 and with GDC 64 of 10 CFR Part 50. Requirements will become effective when the BOP vent sampler becomes operable. The BOP vent and associated sampler are new design changes. Because there may be periods of time after implementation of this revision of the REMODCM when the BOP vent will not be a release point, a note was added to make the requirements applicable when the BOP vent sampler becomes operable.
I.D.1	Gaseous Effluent Sampling and Analysis Program Table I.D-2	I.D-4 I.D-5 I.D-6	1. Changes in wording for column headings for clarity. 2. Specify "Gaseous Grab" as sample type for waste gas discharge to clarify type of sample. 3. Added "Waste Gas" before "Tank" for batch release gas sample type to clarify where the sample is to be taken. 4. Added "and Containment Purge" in batch release sample type and analysis frequency to clarify where the sample is to be taken and to distinguish it from the waste gas tank sample. 5. Moved "Containment Venting" from a continuous release to a batch release because the mode of release and required sampling makes the release a batch type release. 6. Change "Site Stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 7. Added a note that sampling will be from the Unit 2 Wide Range Gas Monitor (WRGM) to satisfy requirements for Millstone Stack samples for Unit 2 releases to the Millstone Stack. The WRGM is a new design change. Because there may be a period of time after implementation of this revision of the REMODCM when the WRGM is not yet operable, a note was added to make the requirements applicable when the WRGM becomes operable as the effluent monitor for Unit 2 releases to the Millstone Stack. For purposes of effluent monitoring this will not occur until Unit 1 terminates discharges to the Millstone Stack. Therefore the note also clarifies this condition. Use of the WRGM as the effluent monitor for Unit 2 releases to the stack may not occur until after the WRGM is physically operational.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1c of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
I.D.1 (Cont)	Gaseous Effluent Sampling and Analysis Program Table I.D-2	I.D-4 I.D-5 I.D-6	8. For gaseous samples specified sample type by moving words "Charcoal Sample", "Particulate Sample", and "Noble Gas" from the Analysis Frequency column to the Sample Type and Frequency column. Also specified that the noble gas monitor is a continuous monitor in the analysis frequency column. These changes clarify the requirements. 9. Deleted Footnote E which required when and how to determine an I-133 to I-131 rations and what to use the ratio for. This requirement is no longer needed because new gamma spectroscopy instrumentation and software allow for more accurate determination of the ratio.
I.D.1	Gaseous Effluent Sampling and Analysis Program Table I.D-3	I.D-7 I.D-8	1. Changes in wording for column headings for clarity. 2. Added "Hogger" to specify containment drawdown to distinguish it from the automatic drawdowns by the containment vacuum system. 3. Specified "Gaseous Grab" as sample type for drawdown and purge discharges to clarify type of sample. 4. Specified that SLCRS is the sampling point for Unit 3 releases to the Millstone Stack. Added a note that the SLCRS radiation monitor will be the monitoring point when that monitor becomes operational as the stack effluent monitor because there may be a period of time after implementation of this revision of the REMODCM when the SLCRS monitor will not yet be operable as an effluent monitor. 5. Deleted requirement for sampling from Containment Vacuum System and Gaseous Radwaste because the SLCRS radiation monitor will be monitoring releases from these sources. For any period of time when the SLCRS monitor is not yet operable (see #5 above), the Millstone Stack monitor will be the effluent monitor for Unit 3. This change, in affect, eliminates the condition of Footnote I for any such period of time. 6. For gaseous samples specified sample type by moving words "Charcoal Sample", "Particulate Sample", and "Noble Gas" from the Analysis Frequency column to the Sample Type and Frequency column. Also specified that the noble gas monitor is a continuous monitor in the analysis frequency column. These changes clarify the requirements. 7. In Footnote C changed "gaseous radwaste monitor" to "SLCRS noble gas monitor" because the SLCRS monitor, not the gaseous radwaste monitor is the effluent monitor. 8. Deleted Footnote E which required when and how to determine an I-133 to I-131 rations and what to use the ratio for. This requirement is no longer needed because new gamma spectroscopy instrumentation and software allow for more accurate determination of the ratio. 9. Deleted Footnote H on using HP containment air sample during a medical emergency. This contingency is no longer needed.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1d of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
Fig. I.D-2	Simplified Airborne Effluent Flow Diagram - U2	I.D-12	1.Change "Unit 1 Stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 2.Changed Stack Rad Monitor (1705-18A/B) to WRGM (RM-8169) because Unit 2 now monitors it's own releases to the Millstone Stack using the WRGM. 3.Corrected flow path for primary release from air ejector to Millstone stack with an alternate release to the Unit 2 vent instead of just a release to the vent.
Fig. I.D-3	Simplified Airborne Effluent Flow Diagram - U3	I.D-13	1.Change "Unit 1 Stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 2.Changed Stack Rad Monitor (1705-18A/B) to SLCRS (HVR-19B because Unit 3 now monitors it's own releases to the Millstone Stack using the SLCRS radiation monitor. 3.Changed containment drawdown/ILRT release to hogger drawdown release to specify which drawdown release is applicable in accordance with Table I.D-3. 4.Added containment vacuum system releases to the Millstone Stack to show an effluent type release not previously diagrammed.
I.E	Radiological Environmental Monitoring Program Table I.E-1	I.E-3	1.Added five more environmental TLDs and converted 14 of 18 accident TLDs to environmental TLDs for a total of 36 environmental TLDs (4 accident TLDs deleted from requirement) to be consistent with regulatory guidance in NUREG-1301. [NOTE: Redesignating these TLDs from accident to environmental does not remove them from use as accident TLDs as specified in the Millstone Emergency Plan. All environmental TLDs can service both the environmental monitoring program and the Emergency Plan. See Change #4 for Table I.E-2 below.] 2.Changed frequency of collection and analysis of TLDs from monthly to quarterly. This change is consistent with regulatory guidance in NUREG-1301 and with industry practice. It was needed to adapt to the TLD processing schedule of a new vendor provider. 3.Changed milk sample frequency from monthly to semi-monthly when animals are on pasture to be consistent with regulatory guidance in NUREG-1301. 4.Changed sea water collection frequency at the indicator location from quarterly to monthly to be consistent with regulatory guidance in NUREG-1301. 5.Specified number of TLDs or TLD elements at each locations to be consistent with regulatory guidance in NUREG-1301.
I.E	Radiological Environmental Monitoring Program Table I.E-2	I.E-4 I.E-5	1.Change "MP1 stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 2.Added list of TLDs which were redesignated from accident to environmental TLDs (see change #1 for Table I.E-1 above). 3.Added a note to indicate that the environmental TLDs can also function as emergency TLDs during an accident.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1e of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory

Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
I.E.4	Radiological Environmental Monitoring Program Bases	I.E-13	Clarified wording concerning the intermediate media of pasture grass versus vegetation and concerning LLDs for Ba-140 and La-140.
II.C.5	Liquid Dose Calculations - Monthly Dose Projections	II.C-4	The factor "R_2", ratio of primary coolant activity in present month to that in previous month, was deleted because it is no longer applicable at Unit 1.
II.D.1	Gaseous Dose Calculations - Site Release Rate Limits	II.D-1 II.D-2	1.Three operational conditions were added each with a separate method for determining the noble gas instantaneous release rate limit. They are: • with Unit 1 discharging to Millstone stack without SFPI vent, • with Unit 1 discharging to Millstone stack with SFPI vent, and • with Unit 1 not discharging to Millstone stack. Three operational conditions are needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001 when this revision of the REMODCM will be implemented. 2.Subscript designators for noble gas release rates were added to differentiate between Millstone Stack and unit vent releases. This change was needed because Units 2 and 3 will be accounting for separate releases via the stack and via their respective vents and then summing the release for the respective unit. 3.New release point from the Unit 1 Spent Fuel Pool Island (SFPI) was added and the stack release point was divided between Units 2 and 3. This change was needed because of the creation of the SFPI vent and, with Unit 1 separation, Units 2 and 3 became responsible for their own releases to the Millstone Stack. 4.New unit-specific dose factors were determined for the Unit 2 and Unit 3 releases to the stack and for the new Unit 1 SFPI vent. New factors were needed for stack releases because the change in stack flows with loss of Unit 1 exhaust flow caused new meteorological parameters which affect offsite doses. 5.In Section II.D.1.b(1), sources of releases of radioactive iodines and tritium were redistributed in the thyroid dose rate formulae (DR_{thy}). Releases of iodines and tritium from Unit 1 to the Millstone Stack are deleted and releases of tritium from the SFPI vent was added. Radioactive iodines, because of their short half-lives, no longer remain at Unit 1. Unit 1 will not be releasing to the Millstone Stack and the SFPI vent will be Unit 1's only significant release path for tritium. Units 2 and 3 will be measuring their own releases of iodines and tritium to the Millstone Stack, Unit 2 via the new WRGM monitor and Unit 3 via SLCRS rad monitor. Therefore these sources were added to thyroid dose rate formulae for Units 2 and 3.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1f of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
II.D.1 (Cont)	Gaseous Dose Calculations - Site Release Rate Limits	II.D-1 II.D-2	6.In Section II.D.1.b(2), sources of releases of radioactive particulates and tritium were redistributed in the maximum organ dose rate formulae (Dr_{org}). Releases of particulates and tritium from Unit 1 to the Millstone Stack are deleted because Unit 1 will not be releasing to the Millstone Stack. The SFPI vent will be Unit 1's only significant release path for tritium. Unit 1 will release radioactive particulates from the new SFPI and BOP vents; therefore these sources were added. Units 2 and 3 will be measuring their own releases of particulates and tritium to the Millstone Stack, Unit 2 via the new WRGM monitor and Unit 3 via SLCRS rad monitor. Therefore these sources were added to thyroid dose rate formulae for Units 2 and 3. Add a note that the contributions from the BOP vent will not required until the sampler becomes operational because there will be a period of time after implementation of this revision of the REMODCM when the BOP vent will not yet be operable. 7.Change "MP1 stack" to "Millstone Stack" to maintain consistency with designation in design documentation.
II.D.2	Gaseous Dose Calculations 10CFR50 Appendix I Noble Gas Limits	II.D-3 II.D-4	1.Three operational conditions were added each with a separate method for determining the noble gas instantaneous release rate limit. They are: • with Unit 1 discharging to Millstone stack without SFPI vent, • with Unit 1 discharging to Millstone stack with SFPI vent, and • with Unit 1 not discharging to Millstone stack. Three operational conditions are needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001 when this revision of the REMODCM will be implemented. 2.Release point for Unit 1 noble gases is changed from the Millstone Stack to the SFPI vent and new dose conversion factors for gamma air dose (D_{G1}) and for beta air dose (D_{B1}) are added. Change is needed because Unit 1 no longer will release to the stack and the SFPI vent has release parameters different from the stack. 3.Subscript designators for noble gas release rates were added to differentiate between Millstone Stack and unit vent releases. This change was needed because Units 2 and 3 will be accounting for separate releases via the stack and via their respective vents and then summing the release for the respective unit. 4.Dose contributions from release of Units 2 and 3 noble gases to the Millstone Stack were added to the gamma air dose (D_{G2} and D_{G3}) and the beta air dose (D_{B2} and D_{B3}). Dose factors for these releases are the old factors for releases fromt the Millstone Stack modified for new flow characteristic of the stack. This change is needed because, after Unit 1 flow to the stack is terminated, Units 2 and 3 will be measuring their own releases to the stack. Other wording changes associated with this change clarifies releases to Units 2 and 3 vents from releases from Units 2 and 3 to the Millstone Stack. 5.The footnote requiring a Special Assessment was deleted. This provision is no longer needed because all three units will be responsible for their own releases in dose calculations. 6.Change "site stack" to "Millstone Stack" to maintain consistency with designation in design documentation.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1g of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
II.D.3	Gaseous Dose Calculations 10CFR50 Appendix I Iodine and Particulate Doses	II.D-5 II.D-6 II.D-7 II.D-8 II.D-9	1.Exception to not include Unit 1 tritium when less than 500 curies was deleted. Tritium was a negligible contributor to offsite doses when Unit 1 was operational. Although dose due to tritium is still small, it is now a relatively significant portion of the dose contributor from Unit 1. 2.Three operational conditions were added each with a separate method for determining the noble gas instantaneous release rate limit. They are: • with Unit 1 discharging to Millstone stack without SFPI vent, • with Unit 1 discharging to Millstone stack with SFPI vent, and • with Unit 1 not discharging to Millstone stack. Three operational conditions are needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001 when this revision of the REMODCM will be implemented. 3.Subscript designators for noble gas release rates were added to differentiate between Millstone Stack and unit vent releases. This change was needed because Units 2 and 3 will be accounting for separate releases via the stack and via their respective vents and then summing the release for the respective unit. 4.Release point for Unit 1 particulates and tritium was changed from the Millstone Stack to the SFPI and BOP vents. New dose conversion factors for gamma air dose (D_{G1}) and for beta air dose (D_{B1}) were added. Change is needed because Unit 1 no longer will release to the stack and the SFPI and BOP vents have release parameters different from the stack. Add a note that the contributions from the BOP vent will not required until the sampler becomes operational because there will be a period of time after implementation of this revision of the REMODCM when the BOP vent will not yet be operable. 5.Change "site stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 6.Units 2 and 3 separate contributions of iodines, particulates, and tritium were added to critical organ dose calculation. Changes were made to distinguish Units 2 and 3 releases to their respective vents versus releases to the Millstone Stack. Changes were also made to require Units 2 and 3 to add doses due to releases from their vents to doses due to releases from each unit to the Millstone Stack. These changes are needed because Units 2 and 3 will be measuring their own releases to the stack after Unit 1 separates from the Millstone Stack. 7.On page II.D-5, the footnote requiring a Special Assessment was deleted. This provision is no longer needed because all three units will be responsible for their own releases in dose calculations. 8.Methods 1b and 1c were deleted. This change was made to simply the process for Chemistry's screening of offsite doses. Now a single step screening methodology will be used. If the screening dose criteria is exceeded, Nuclear Engineering will perform dose modeling in accordance with the requirements of Sections 2 and 3 (old Sections 4 and 5) which comprise Methods 2a and 2b for determining offsite doses. 9.On page II.D-9, the footnote about adding Unit 2 and 3 releases to stack calculations and the need for a Special Assessment was deleted. This footnote is no longer needed because all three units will be responsible for their own releases in dose calculations. 10.In II.D.3.b, Method 2c for Unit 3 releases was combined into Method 2b and Method 2b was changed to be applicable to both units for convenience.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1h of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
II.D.4	Gaseous Effluent Monthly Dose Projections	II.D-12 II.D-13	1.Added new dose factors for Units 2 and 3 gaseous radwaste discharges to the Millstone Stack applicable after Unit 1 stops discharging to the stack. 2.Change "site stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 3.Revised discussion in Section b(1) for conservativeness of factor used in projecting doses due to releases from Unit 2 waste gas discharges. The original basis is still valid but the discussion can no longer use Unit 1 mix as a comparison.
II.D.7	Bases for Gaseous Pathway Dose Projections	II.D-16	Change "site stack" to "Millstone Stack" to maintain consistency with designation in design documentation.
II.F.1	Gaseous Monitor Setpoints - Unit 1 Spent Fuel Pool Island Monitor	II.F-1	A new requirement is being added for setpoint for the SFPI radiation monitor. The monitor was added to maintain compliance with Defueled Tech Spec 5.6.4 and with GDC 64 of 10 CFR Part 50. This setpoint is the maximum allowable setpoint for this radiation monitor and is set to ensure that the site instantaneous noble gas release rate limit is not exceeded. Basis for the setpoint is contained in Calculation MPODCM-01034RG.
II.F.2	Gaseous Monitor Setpoints - Unit 2 Wide Range Gas Monitor	II.F-1	A new requirement is being added for setpoint for the WRGM radiation monitor. The monitor, which monitors Unit 2 releases to the Millstone Stack, was added to maintain compliance with Defueled Tech Spec 5.6.4 and with GDC 64 of 10 CFR Part 50. This setpoint is the maximum allowable setpoint for this radiation monitor and is set to ensure that the site instantaneous noble gas release rate limit is not exceeded. Basis for the setpoint is contained in Calculation MPODCM-01034RG.
II.F.3	Site Stack Noble Gas Monitor	II.F-2	1.Change "site stack" to "Millstone Stack" to maintain consistency with designation in design documentation. 2.Added note that setpoint not required after Unit 1 terminates flow to stack to support stack separation.
II.F.4	Site Stack Sampler Flow Rate Monitor	II.F-2	Requirement for site stack sampler flow rate monitor is being deleted because the stack radiation monitor is being removed.
II.F.4	Gaseous Monitor Setpoints - Unit 3 SLCRS	II.F-2	A new requirement is being added for setpoint for the SLCRS radiation monitor. The monitor, which monitors Unit 3 releases to the Millstone Stack, assures compliance with Defueled Tech Spec 5.6.4 and with GDC 64 of 10 CFR Part 50. This setpoint is the maximum allowable setpoint for this radiation monitor and is set to ensure that the site instantaneous noble gas release rate limit is not exceeded. Basis for the setpoint is contained in Calculation MPODCM-01034RG.
II.F.6	Gaseous Monitor Setpoints - Unit 2 Waste Gas Decay Tank	II.F-3	Revised setpoint based on new site instantaneous release rate limit. A new limit was needed because of changes in Millstone Stack release characteristics with loss of Unit 1 exhaust flow. Basis for the setpoint is contained in Calculation MPODCM-01034RG.
III.C.1 Tables III.C-1 and III.C-2	Radioactive Liquid Effluent Monitoring Instrumentation	III.C-2 III.C-4	1.Added a note that service water effluent line monitor will not be required when the RBCCW system is removed from service. The requirements will not be needed when the RBCCW system, which is the only potential source of service water contamination, is removed from service and drained. 2.Changed instrument calibration frequency from every 18 months to every 2 years.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1i of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory

Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
III.C.2 Table III.C-3	Radioactive Gaseous Effluent Monitoring Instrumentation	III.C-7 III.C-8	1.Split table into two operational conditions - when Unit 1 is discharging to the Millstone Stack and when Unit 1 is not discharging to the stack. This change is needed to support the transitional period during the first quarter of 2001 when Unit 1 will be separated from the stack but the actual effective date cannot be firmly established. Condition one, with Unit 1 discharging to the stack, will have the present stack instrumentation requirements plus new Spent Fuel Pool Island (SFPI) instrumentation. Because there may be some intermittent SFPI operation for testing purposes and then an indeterminate date for permanent start of the SFPI vent, a note was added that SFPI instrumentation requirements are only applicable when the SFPI vent is operational. Condition two, with Unit 1 not discharging to the stack, has SFPI and BOP vent instruments for monitoring gaseous effluents. Iodine sampling will not be required at the SFPI vent because all radioactive iodines, except for I-129, have decayed away since Unit 1 permanently shut down. The I-129 source term, being very small in the spent fuel, does not need to be monitored. Monitoring for Kr-85 by the noble gas monitor will be sufficient for detection of releases from the spent fuel. BOP vent will only be sampled for radioactive particulates. Except for the SFPI which vents completely to the SFPI vent, there are no sources of radioactive gases remaining in Unit 1. A note is added that BOP operability requirement will become effective when the BOP vent sampler becomes operational. 2.Action A is added to require, when the SFPI gaseous monitor is inoperable, compensatory sampling of gaseous releases three times per week or daily when moving fuel. The compensatory action will be sufficient for the present source term and mode of operations at Unit 1. 3.Action B is added to require, when the SFPI or BOP particulate sampler is inoperable, compensatory sampling consisting of a 24 hour sample collected once every 7 days and analyzed within 24 hours. During sampler inoperability, Action B compensatory sampling will be required any time significant generation of airborne radioactivity is expected. The compensatory sampling will be sufficient for the present source term and mode of operations at Unit 1. Particulate releases from the SFPI will be minimal. Particulate releases from the BOP could change suddenly, particularly during any decommissioning work.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1j of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
III.C.2 Table III.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements	III.C-9 III.C-10	1.Made surveillance of Millstone Stack instrumentation conditional on Unit 1 releasing to the stack. This supports the schedule to separate Unit 1 from the stack during the first quarter of 2001. 2.Added surveillance requirements for SFPI and BOP vent instruments for monitoring gaseous effluents. See Discussion #1 for Table III.C-3 above. 3.Deleted condition #3 in Notation 7. This condition is not needed because it was uniquely applicable to the stack instrumentation which is being removed as part of the Unit 1 separation.
III.C.5	High Range Stack Noble Gas Monitor	III.C-13	Requirements have been deleted because the stack high range radiation monitor is being removed as part of the Unit 1 separation project.
III.D.2	Radioactive Gaseous Effluents Dose Rate	III.D-3	I-131 and I-133 are deleted from Control B because these radioisotopes have decayed away since Unit 1 was permanently shut down.
III.F	Bases	III.F-1	Discussion in bases for Section III.C.2 was deleted because it was applicable to Unit 1 Stack radiation monitors which have been removed from service. Discussion revised to say that the SFPI vent is the only Unit 1 release point requiring gaseous monitoring.
IV.C.1 Table IV.C-2	Radioactive Liquid Effluent Monitoring Instrumentation	IV.C-6	"NBS" in Notation 1 changed to "NIST." The National Bureau of Standards (NBS) has changed it's name to the National Institute of Standards and Technology" (NIST).
IV.C.2 Tables IV.C-3 & IV.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation	IV.C-8 IV.C-9 IV.C-10	1.Changed "MP2 Stack" to "MP2 Vent" and "MP1 Main Stack" and "Unit 1 Stack" to "Millstone Stack" to be consistent with design documentation. ~~2.Revised Action E and changed Action B to new Action F consistent with the changes to the stack instrumentation requirements in Section III (see changes to Table III.C-3 above).~~ CRF 1/16/01
IV.C.2 Table IV.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation	IV.C-11	"NBS" in Notation 1 changed to "NIST." The National Bureau of Standards (NBS) has changed it's name to the National Institute of Standards and Technology" (NIST).
IV.F	Bases	IV.F-1	Changed "MP2 Stack" to "MP2 Vent" and "MP1 Main Stack" to "Millstone Stack" to be consistent with design documentation.
V.C.1	Radioactive Liquid Effluent Monitoring Instrumentation	V.C-2	Added clarification in Footnote ## of Table V.C-1 for monitor operability and for applicability to MODE 6. This incorporates a portion of Unit 3 TRM for Tech Spec 3.3.3.9 which was moved into Revision 20 of the REMODCM.
V.C.1 Table V.C-2	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements	V.C-5	"National Bureau of Standards (NBS)" in Notation 2 changed to "National Institute of Standards and Technology (NIST)." The National Bureau of Standards (NBS) has changed it's name to the National Institute of Standards and Technology" (NIST).

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

(Sheet 1k of 3)

Check: ☑ REMM ☑ ODCM ☑ Unit 1 Effluent Controls ☑ Unit 2 Effluent Controls ☑ Unit 3 Effluent Controls

Change Request #: REMODCM-01-01 Revision 21

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
V.C.2 Tables V.C-3 & V.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements	V.C-7 V.C-8 V.C-9 V.C-10	1.Changed "Millstone Unit 3 Ventilation Vent Stack" to "Millstone Unit 3 Ventilation Vent" and "Millstone Unit 1 Main Stack" and "Unit 1 Stack" to "Millstone Stack" to be consistent with design documentation. 2.~~Revised Action D and changed Action B to new Action E consistent with the changes to the stack instrumentation requirements in Section III (see changes to Table III.C-3 above).~~ CJF 1/16/01 3.Changed "stack" for instrument 1.d to "vent" to be consistent with design documentation. 4.Changed "stack" for instrument 2.d to "process" to specify that the flow being measured. 5.Deleted reference to Unit 1 Stack Monitor in Notation 2 of Table V.C-4 because the stack monitors are being removed as part of Unit 1 separation. 6."National Bureau of Standards (NBS)" in Notation 2 changed to "National Institute of Standards and Technology (NIST)." The National Bureau of Standards (NBS) has changed it's name to the National Institute of Standards and Technology" (NIST).
V.F	Bases	V.F-1	In Bases for Section V.C.1, incorporated a portion of Unit 3 TRM for Tech Spec 3.3.3.9 which was moved into Revision 20 of the REMODCM.
V.F	Bases	V.F-1	Add a paragraph in bases for Section V.C.2 to explain that SLCRS normal range radiation monitor, HVR*19B, is the effluent monitor and that the high range monitor, HVR*19A, has no applicable REMODCM requirements. This explanation is transferred from the Unit 3 TRM. It was no longer needed in the TRM because of the movement of effluent tech specs to the REMODCM.

RADIOLOGICAL ENVIRONMENTAL REVIEW

RER-01-001

Revision 0

for

REMODCM Rev 21 - Unit 1 Separation and Other Changes

January 12, 2001

Total Number of Pages: 9

Claude Flory	Claude Flory Preparer	1/12/01 Date
William Eakin	W J Eakin Supervisor	1/14/01 Date

1.0 DESCRIPTION OF CHANGE

Revision 21 of the REMODCM will have changes to support Unit 1 decommissioning, including separation of Unit 1 from the Millstone Stack. There will also be a number of changes to effluent sampling and analysis requirements; to the environmental monitoring program; and for corrections, clarifications, and enhancements.

List of changes for REMODCM Revision 21:

A. Changes to Support Unit 1 Separation

1. Add requirements for SFPI vent, effective upon operation of the vent, including:
   - Sampling requirements in Table I.D-1 (p. I.D-2)
   - Rad monitor setpoint requirements in Section II.F.1 (p. II.F-1)
   - Rad monitor operability requirements in Table III.C-3 (p. III.C-7)
   - Rad monitor surveillance requirements in Table III.C-4 (p. III.C-9)
2. Add requirements for Balance of Plant (BOP) vent, effective upon operation of the vent, including:
   - Sampling requirements in Table I.D-1 (p. I.D-2)
   - Sampler operability requirements in Table III.C-3 (p. III.C-7)
   - Sampler surveillance requirements in Table III.C-4 (p. III.C-8)
3. Make provisions to deactivate requirements for Unit 1 main stack normal range radiation monitor when Unit 1 terminates discharges to the Millstone Stack including:
   - Reference in Table I.D-1 (p. I.D-2)
   - Noble gas setpoint requirements in Section II.F.3 (p. II.F-2)
   - Sampler flow requirements in Section II.F.4 (p. II.F-2)
   - Operability requirements in Table III.C-3 (p. III.C-7)
   - Surveillance requirements in Table III.C-4 (p. III.C-9)
4. Add requirements Unit 2 WRGM radiation monitor, contingent on termination of Unit 1 flow to the Millstone Stack, including:
   - Replace Stack Rad Monitor with WRGM in Diagram I.D-2 (p. I.D-12).
   - Noble gas setpoint requirements in Section II.F.2 (p. II.F-1)

   [NOTE: WRGM becomes the source for Millstone Stack sampling requirements in Table I.D-2 and operability and surveillance requirements in Tables IV.C-3 and IV.C-4 without any need to rephrase any of the requirements in these tables.]
5. In Section II.F.6, revise Unit 2 Waste Gas Decay Tank radiation monitor setpoint based on new site release rate limits (p. II.F-3).
6. Add requirements for Unit 3 SLCRS radiation monitor, contingent on termination of Unit 1 flow to the Millstone Stack, including:
   - Millstone Stack sampling requirements in Table I.D-3 (p. I.D-7)
   - Replace Stack Rad Monitor with SLCRS Rad Monitor in Diagram I.D-3 (p. I.D-13).
   - Noble gas setpoint requirements in Section II.F.4 (p. II.F-2).
7. Deleted requirements for Millstone Stack high range radiation monitor in Section III.C.5
8. Changes to gaseous dose calculation methodologies in Section II.D based on dose from each unit's release rather than a common stack dose including:
   - Provision for phasing in of requirements depending on dates of termination of Unit 1 flow to the Millstone Stack and operation of the SFPI vent.
   - Releases of iodines and tritium from Unit 1 to the Millstone Stack were deleted.
   - New release points from the Unit 1 Spent Fuel Pool Island (SFPI) and Balance of Plant (BOP) were added.

- Units 2 and 3 will be responsible for measuring their own releases of noble gases, iodines, particulates, and tritium to the Millstone Stack.
- New factors were determined for each unit's share of instantaneous release rate limits for noble gases, iodines, tritium, and particulates.
- A new factor for instantaneous release rate limit was determined for the SFPI vent based on skin dose limit rather than whole body dose limit.
- New unit-specific dose conversion factors were determined for iodines, particulates, and tritium for the Unit 2 and Unit 3 releases to the stack and for the new Unit 1 SFPI vent.
- Exception to not include Unit 1 tritium when less than 500 curies in 10CFR50 critical organ doses was deleted.
- A new section was added for Unit 1 critical organ doses which accounts for releases from the new Unit 1 SFPI and BOP vents. A note is included that releases from the BOP vent are not applicable until the BOP sampler is operational.
- On page II.D-5, the footnote requiring a Special Assessment was deleted.
- On page II.D-9, the footnote about adding Unit 2 and 3 releases to stack calculations and the need for a Special Assessment was deleted.

9. Revised bases discussion for Unit 1 gaseous radiation monitors in Section III.F (p. III.F-1).

B. Changes to Support Unit 1 Decommissioning

1. Add note that Service Water system requirements not applicable after RBCCW is taken out of service including:
   - Sample requirements in Table I.C-1 (p. I.C-2)
   - Radiation monitor setpoint in Section II.E.2a
   - Limitation on Unit 1 service water discharge radioactivity concentrations in Section II.E.2b
   - Operability and surveillance requirements in Section III.C.1
2. Delete reference to Emergency Service Water in Section II.E.1 (p. II.E-1).
3. Deleted I-131 and I-133 in Control B of Section III.D.2 (p. III.D-3).
4. In Section II.C.5 deleted a factor which was applicable only for operating reactors.

C. Other changes to Liquid and Gaseous Effluent Sampling and Analysis (Sections I.C and I.D)

1. Changes for clarification including:
   - Changes in wording for column headings in Tables I.C-1,2,3 (pgs. I.C-2,5,8) and Tables I.D-1,2,3 (pgs. I.D-2,4,7).
   - Specify "Grab Sample" as sample type for each liquid batch release.
   - Added "Release" after "Prior to Each Batch" for liquid batch release samples.
   - In Table I.C-3, added "Effluent" to further describe Service Water.
   - Specify "Gaseous Grab" as sample type for each containment purge, Unit 3 hogger drawdown, and Unit 2 waste gas discharge.
   - In Table I.D-2, added "Waste Gas" before "Tank" for Unit 2 gas sample type.
   - In Table I.D-2, added "and Containment Purge" in Unit 2 analysis frequency for batch releases.
   - For gaseous samples specify sample type by moving words "Charcoal Sample", "Particulate Sample", and "Noble Gas" from the Analysis Frequency column to the Sample Type and Frequency column.

- In Table I.D-3, specify 'hogger' drawdown for Unit 3 to distinguish from the vacuum system drawdown.

2. Added option of equivalent ion exchanger or demineralizer for Unit 2 Clean Liquid processing equipment.
3. In Table I.D-2, moved Unit 2 "Containment Venting" from a continuous release to a batch release.
4. In Table I.D-3, deleted Unit 3 "Containment Vacuum System and Gaseous Radwaste" as a continuous release. With this change Footnote I and the reference to Footnote I in Footnote C are deleted.
5. In Table I.D-3, Footnote C, changed "gaseous radwaste monitor" to "SLCRS monitor."
6. Deleted specification on I-133 analysis (Footnote E of Tables I.D-2 and I.D-3) (pgs. I.D-4&5, I.D-7&8).
7. Deleted Footnote H of Table I.D-3 (pgs. I.D-7,8) on using HP containment air sample during a medical emergency.

D. Changes to REMP (Section I.E) - All changes are to Tables I.E-1 and I.E-2 (ps.I.E-3,4)

1. Added five more environmental TLDs and converted 14 of 18 accident TLDs to environmental TLDs for a total of 36 environmental TLDs (4 accident TLDs deleted from requirement).
2. Specified two or more TLDs or TLD with two or more elements per location.
3. Changed frequency of collection and analysis of TLDs from monthly to quarterly.
4. Changed milk sample frequency from monthly to semimonthly when animals are on pasture. Requirement remains monthly for animals not on pasture.
5. Changed sea water collection frequency at the indicator location from quarterly to monthly.

E. Other Corrections, Clarifications, and Enhancements

1. Clarified wording in Section I.A (p. I.A-1) for radioactive material in the environment.
2. Change "Site Stack" to "Millstone Stack" to maintain consistency with designation in design documentation. Change made in following places:
   - Table I.D-2 on pgs. I.D-4 and I.D-6
   - Figure I.D-2 on p. I.D-12
   - Figure I.D-3 on p. I.D-13
   - Table I.E-2 on pgs. I.E-4 and I.E-5
   - Sections II.D.2.b, II.D.3.a (new b)
3. Added a note in Table I.D-2 that sampling will be from the Unit 2 Wide Range Gas Monitor (WRGM) to satisfy requirements for Millstone Stack samples. This note is added to clarify that samples of Unit 2 releases to the stack during the first quarter of 2001 will be split between compensatory sampling during installation of the WRGM and the WRGM (p. I.D-4).
4. Corrected Figure I.D-2 (p. I.D-12) to show air ejector release pathway to the Unit One Stack with alternate release pathway to Unit 2 vent.
5. Corrected Figure I.D-3 (p. I.D-13) to show containment vacuum system release pathway to the Unit One Stack and to specify drawdown as the hogger drawdown.
6. Clarified wording in the bases section (Section I.E.4, p. I.E-12) concerning the intermediate media of pasture grass versus vegetation and concerning LLDs for Ba-140 and La-140.

7. In Section II.D, simplified dose methodology for gaseous releases by eliminating Methods 1b and 1c and, for organ doses, combining Methods 2b and 2c.
8. In Section II.D.4.b(1) revised the wording in explanation of more conservative dose factor being applied to Unit 2 waste gas discharges (p. II.D-13).
9. In Units 2 and 3 Radiological Controls (Sections IV and V) changed "National Bureau of Standards (NBS)" to "National Institute of Standards and Technology (NIST)."
10. In Units 2 and 3 Radiological Controls (Sections IV and V) changed references to Unit 2 or 3 "stack vent" or "stack" to just "vent" and MP1 Main Stack" or "Unit 1 Stack" to "Millstone Stack."
11. Added a sentence to Table V.C-1 footnote and paragraphs to Section V.C.1 bases (page V.F-1) to incorporate TRM contents for old Tech Spec 3.3.3.9.
12. Added a paragraph in Unit 3 Radiological Controls Bases (Section V.G) explaining that SLCRS normal range radiation monitor is HVR*19B and that the SLCRS high range monitor, HVR*19A, has no applicable REMODCM requirements. This incorporates TRM contents for old Tech Spec 3.3.3.10.

References:

1. Millstone Unit 1 Design Change Package DCP No. M1-99012, "Spent Fuel Pool Island."
2. Regulatory Guide 1.21, Revision 1, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants."
3. Radiological Environmental Review RER-00-002, "Millstone Unit 1 Spent Fuel Pool Island Conceptual Design."
4. Unit 1 Design Change Notice DCN No. DM1-00-0201-00, "Unit 1 Cold & Dark Heating & Ventilation Requirements."
5. Radiological Environmental Review RER-00-012, "Millstone Unit 1 Decommissioning Balance of Plant (BOP) Ventilation."
6. Design Change DCR M2-00-010, "Unit 2 Wide Range Gas Monitor."
7. Calculation NUC-202, "Long Term Atmospheric Dispersion Factors Due to Release Point Separation," Duke Engineering & Services, January 10, 2001.
8. Calculation MPODCM-01034RG, "Stack and Vent Rad Monitor Setpoints," January 10, 2001.
9. NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors," April, 1991.

2.0 DISCUSSION

Changes to Support Unit 1 Separation

All the changes to support Unit 1 separation as listed in Description of Change above result from the cessation of gaseous releases from Unit 1 to the Millstone Stack and creation of two new Unit 1 gaseous release points. Prior to the separation, the Millstone Stack was referred to as the Unit 1 Stack. The two new release points from Unit 1 are the Spent Fuel Pool Island (SFPI) vent and the Balance of Plant (BOP) vent.

To provide for safe, long-term storage of spent fuel, the SFPI envelope was designed (Ref. 1). The SFPI envelope, which includes the upper portion of the Reactor Building, has it's own independent ventilation and radiation monitoring systems. SFPI ventilation and the associated effluent radiation monitor provides all the functions for measuring and monitoring releases of radioactive material in gaseous effluents from the SFPI envelope to ensure compliance with GDCs 60 and 64 in Appendix A of 10 CFR Part 50 and with Regulatory Guide 1.21 (Ref. 2). This finding is documented in Reference 3. Requirements added to the REMODCM for sampling from and setpoint, operability, and surveillance of the SFPI vent monitor are necessary components of an effective effluent control program for the Unit 1 SFPI.

The second new Unit 1 release point, BOP vent, is the exhaust for the remainder of Unit 1 indoor areas which constitutes a potential source for release of radioactive material to the environment (Ref. 4). This includes all the turbine building and the portion of the reactor building which is not part of the SFPI envelope. Because the only potential source is radioactive particulates this vent has only a particulate sampler. Requirements added to the REMODCM for sampling from and operability, and surveillance of the BOP vent sampler are necessary components of an effective effluent control program for Unit 1, in compliance with GDCs 60 and 64 and Regulatory Guide 1.21. This finding is documented in Reference 5.

Monitoring of releases from all three Millstone units to the Millstone Stack has been done by a common radiation monitor. Unit 1 has been responsible for stack monitor operability and surveillance and for accounting for radioactivity releases from the stack with subsequent offsite doses. Because Unit 1 is decommissioned, Millstone Units 2 and 3 will be assuming responsibility for determining their own releases to the stack with respective subsequent offsite doses. Use of the original stack radiation monitor for Units 2 and 3 could not be justified because of age and the need to realign power and signal cables from/to Units 2 and/or 3 control room(s). Therefore a decision was made to purchase a new effluent radiation monitor for Unit 2 releases to the stack and to utilize the Unit 3 SLCRS radiation monitor for that unit's releases to the stack. The new Unit 2 monitor will be the Wide Range Gas Monitor (WRGM - RM8169). Design and configuration changes needed to make the WRGM and the SLCRS radiation monitors the effluent monitors for releases to the Millstone Stack are documented in Reference 6. These two monitors will provide the same level of gaseous effluent measuring and monitoring for releases from the Millstone Stack from Units 2 and 3 as was provided by the original stack radiation monitor. They will help ensure compliance with GDCs 60 and 64 in Appendix A of 10 CFR Part 50 and with Regulatory Guide 1.21 (Ref. 2). Requirements added to the REMODCM for sampling from and setpoint, operability, and surveillance of the WRGM and SLCRS radiation monitors are necessary components of an effective effluent control program for the Units 2 and 3.

Along with the stack normal range radiation monitor, the stack high range monitor will be removed to accommodate installation of the Unit 2 WRGM. Operability and surveillance requirements for the high range monitor were place in the REMODCM when the Unit 1 RETS were moved to the manual. However, accident range monitoring is outside the scope of the REMODCM. Therefore these requirements are being deleted from the REMODCM. Deletion of these requirements has no impacts on normal range monitoring which is needed for the radiological effluent control program. Accident monitoring is not in the scope of GDCs 60 and 64 in Appendix A of 10 CFR Part 50 and of Regulatory Guide 1.21 (Ref. 2).

With Unit 1 separation from the Millstone Stack, new instantaneous release rate limits are needed. Instantaneous release rate limits are based on dose rates at the site boundary. They are applicable to the whole site; that is, dose rate at the site boundary must be summed for releases from all three Millstone units. The limits have been based on the three major gaseous release points - Millstone Stack, Unit 2 Vent, and Unit 3 Vent. With the two new Unit 1 release points, SFPI and BOP vents, the site instantaneous release rate limit had to be recalculated. Dose rate at the site boundary due to release from a particular release point is highly dependent on characteristics of the release point, especially on the release point flow rate. Loss of Unit 1 flow to the Millstone Stack caused a drastic reduction of flow from approximately 160,000 cfm to approximately 1,400 cfm. Calculation of release characteristics of the stack with reduced flow and of the new Unit 1 release points (Ref. 7) were used to calculate new instantaneous release rate limits (Ref. 8). These calculations are the bases for the new factors used in Section II.D.1.

Unit 1 separation from the Millstone Stack also requires new methods for determining offsite doses. The new Unit 1 release points have different release characteristics due to lower flow rates, lower release elevation, and different release location. New dose conversion factors were calculated for these release points (Ref. 8). Prior to Unit 1 separation, releases from the stack were treated as a common release for the purposes of calculating offsite doses. Units 2 and 3 will now track their own releases to the Millstone Stack and calculate their own offsite doses. Just as the change in stack release characteristics caused a change in the instantaneous release rate limits, so new dose factors are needed for releases from the stack. These factors were calculated in Reference 8. REMODCM dose methodology was revised to use the new dose conversion factors for releases from the stack and to account for separate accounting of Units 2 and 3 offsite doses. This includes a summing of doses due to stack releases with doses due to vent releases. Unlike the instantaneous release rate limits, offsite dose limits are applicable to each Millstone Unit. However, Units 2 and 3 releases to the stack were used to calculate Unit 1 offsite doses. To ensure that a unit dose limit was not exceeded, the REMODCM required a more exacting dose analysis when the dose for any one unit reached one-third of the limit. Doses are required to be calculated every 31 days when determining compliance with quarterly and annual dose limits. The new dose methodology will be unit-specific for dose accounting. However, the more exacting dose analysis will still be required at one-third of the limit. This provides a margin of safety for offsite dose determinations.

Changes to Support Unit 1 Decommissioning

Sampling and monitoring of Unit 1 service water required in Table I.C-1 and Sections II.E.2 and III.C.1 is needed because of potential leakage of radioactivity from the RBCCW System into the Service Water System. Presently, the only source of radioactivity into the RBCCW System is the Spent Fuel Pool. A design modification currently being installed is to provide closed loop cooling of spent fuel pool water. Once this modification is complete, the only source of the contamination into service water, via RBCCW water, will be eliminated. Requirements for sampling and monitoring of service water will then no longer be needed. Therefore Revision 21 of the REMODCM will have a conditional statement that these requirements will not be applicable when the RBCCW System is removed from service.

The Emergency Service Water System has already been removed from service. Therefore the reference to this system in Section II.E.1 as a potential source of dilution water during radwaste discharges will be removed.

In Section III.D.2, the two radioactive iodine nuclides of I-131 and I-133 were deleted from radionuclide types which have to be included in dose rate determination for radioactive materials in particulate form. Because Unit 1 has been permanently shut down for five years these short half life radionuclides have decayed away and do not need to be included.

In Section II.C.5 there is a value used in Unit 1 monthly dose projections which is the ratio of estimated primary coolant activity for the present month to that for the previous month. Unit 1 is permanently shutdown and there is no primary reactor coolant. Therefore this ratio is being deleted from the formula for monthly dose projection.

<u>Other changes to Liquid and Gaseous Effluent Sampling and Analysis</u>

In Section I.C.2 provisions are being added to allow use of an equivalent ion exchanger or demineralizer for Unit 2 liquid radwaste processing equipment including the purification ion exchanger T10A or T10B, the primary demineralizer T22A or T22B, and the secondary demineralizer T23. This will allow flexibility for Unit 2 radwaste processing in case any of the designated equipment are not available when needed. As long as the replacement equipment provides equivalent processing of liquid radwaste, there will be no reduction in the effectiveness of the effluent control program.

Containment venting in Table I.D-2 (Unit 2) is being redesignated from a continuous to a batch release. This change is meant to more accurately designate the type of release. There is no reduction in sampling or analysis requirements for this source of gaseous effluent release.

Containment vacuum system and gaseous radwaste are being deleted as sources of gaseous effluents in Table I.D-3 (Unit 3). Footnote I (and the reference to Footnote I in Footnote C) excepted sampling and analyses of this source when doses were less than 20% of the limit. Although these sources will no longer be specifically listed in the table, any radioactive gases from these sources will be continuously monitored and periodically sampled and analyzed with the addition of the Unit 3 SLCRS normal range radiation monitor as the new effluent monitor and pathway from Unit 3 to the Millstone Stack. For this same reason the reference to the gaseous radwaste monitor in Footnote C is being changed to the SLCRS monitor.

Footnote E in Tables I.D-2 and I.D-3 is being deleted. This footnote provided relief from having to calculate I-133 in every weekly charcoal sample. Because of recent advances in gamma spectroscopy, there is no longer any difficulty in determining I-133 in every charcoal sample. Requiring I-133 analysis on every sample will increase the accuracy of I-133 determination without increasing work effort.

Footnote H in Table I.D-3 which allowed use of a Health Physics containment air sample during a medical emergency. The basis for this footnote was never documented and is not presently needed. It has been decided that any containment air sample could be used to satisfy the requirement in Table I.D-3 without a specific footnote allowance.

A number of other changes for clarification of requirements were made to Tables I.C-1, I.C-2, I.C-3, I.D-1, I.D-2, and I.D-3. None of these changes affected the technical merits of the table requirements.

Changes to REMP

The number of required environmental TLDs are being increased from 17 to 36 and sample frequency is changing from monthly to quarterly. Increase of number of required TLDs, done to make the requirement consistent with NRC guidance in NUREG-1301 (Ref. 9), will be an enhancement to the REMP. A change in TLD sample frequency to quarterly was needed to match the readout cycle used by a new environmental TLD vendor. Quarterly readouts of environmental TLDs is a standard in the industry and does not conflict with NRC guidance in NUREG-1301. A change to specify number of TLDs or TLD elements per location is also being added to maintain consistency with NUREG-1301.

Milk sample frequency is being changed from monthly to semi-monthly when animals are on pasture. Sea water sample frequency at the quarry discharge is being changed from quarterly to monthly. Both of these changes to sample frequency are being made to maintain consistency with NUREG-1301 (Ref. 9). The REMP will be enhanced because of increase requirements for sample frequency.

Other Corrections, Clarifications, and Enhancements

Minor changes for corrections, clarifications, and enhancements all serve to improve the REMODCM. The only changes in this category which may be considered more than a minor change is the incorporation of language from the Unit 3 TRM for requirements which were formerly Unit 3 Tech Specs 3.3.3.9 and 3.3.3.10. Language from the Unit 3 TRM was added verbatim in Footnote ## of Table V.C-1 and in the bases for Sections V.C.1 (page V.F-1) and V.C.2 (page V.F-2).

3.0 CONCLUSION

The changes in Revision 21 to the REMODCM would not cause an increase in release of radioactivity to the environment or of dose to the public and they do not deviate from any of the design bases for an effluent control program in the FSAR for Millstone Units 2 and 3 or in the DSAR for Millstone Unit 1. The changes will not affect the level of radioactive effluent control required by each unit's Technical Specifications and FSAR, 10CFR20, 40CFR190, 10CFR50.36a, 10CFR50 GDCs 60 and 64, and Appendix I of 10CFR50 and will not adversely impact the accuracy or reliability of effluent, dose or setpoint calculations. The changes do not cause an Unreviewed Radiological Environmental Impact (UREI).

REMODCM

Rev 22

Description of Changes

Radiological Environmental Review

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

Check: ☐ REMM ☐ ODCM ☐ Unit 1 Effluent Controls ☐ Unit 2 Effluent Controls ☐ Unit 3 Effluent Controls

Change Request #: 01-02

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
I.B.1	Responsibilities	I.B-1	Changed title "Senior Vice President and CNO" to "Vice President and Senior Nuclear Officer" because of a change in organizational title.
I.C.1	Liquid Effluent Sampling and Analysis Program	I.C-1	Corrected references to Sections IV.E.1.a and V.E.1.a to Sections IV.D.1.a and V.D.1.a.
I.C.1	Liquid Effluent Sampling and Analysis Program Table I.C-1	I.C-2 to I.C-4	All sampling and analyses requirements for liquid releases from waste sample tanks, floor drain sample tank, decontamination solution tank, and service water have been removed because Unit 1 currently does not release any liquid effluents from these systems. Unit 1 has been permanently shutdown and was placed in a "cold and dark" configuration which does not include any release of liquids containing radioactivity. Potential sources of radioactivity in liquids are processed to a solid waste form and shipped offsite as solid radwaste. This includes spent fuel pool cleanup and reactor building sump water.
I.C.1	Liquid Effluent Sampling and Analysis Program Tables I.C-2 & I.C-3	I.C-5, I.C-7, I.C-8, and I.C-10	1.In Table I.C-2, corrected name "Coolant Waste Monitor Tank" to "Clean Waste Monitor Tank." 2.Changed frequency of gross alpha analyses from monthly to quarterly. Monthly analyses for gross alpha is not cost beneficial. Any increase in gross alpha would indicate fuel integrity problems; but, weekly analyses of gamma emitters (including I-131 and Ce-144) on continuous release samples and prior to release for batch release samples are sufficient for detecting fuel integrity problems. 3.Moved footnote designators D*,J*, and L* from 4th column to 1st column to make the tables easier to read. 4.In Table I.C-2, added a batch release sample "RBCCW Sump." Added new Footnote M that sampling is not required when the sump is directed to radwaste treatment or is not aligned to Long Island Sound. Sampling of this point is needed because sump water is discharged to the Millstone Quarry and may contain radioactivity from system leakage in the Auxiliary Building. 5.Rearranged the requirements in Footnotes D, E, H, L, and M (old) so that each footnote is applicable to only one source release point. This was done to facilitate reading of the requirements. 6.In Footnote E, changed exception for all analyses except tritium when steam generator gross gamma is low to an exception for analyses of gross alpha, strontiums, and Fe-55 when the grab sample prior to release is low. This is a more restrictive requirement but is consistent with the treatment for batch releases. 7.In Footnote H, deleted reference to Table 4.7.2 of Tech Spec. Reference was not needed and deleting it avoids impact on the REMODCM if the Tech Spec is revised.
I.C.2	Liquid Radioactive Waste Treatment	I.C-11	1.Deleted all waste streams and processing equipment from the Unit 1 table. See discussion for Section I.C.1, "Liquid Effluent Sampling and Analysis Program Table I.C-1" above. 2.Added a Secondary Demineralizer T23B and redesignated Secondary Demineralizer T23 to T23A in processing equipment for Unit 2 Clean Liquid Radwaste System. This is newly installed equipment; see DCR M2-01009. 3.

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Change Request #: 01-02

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
I.C.3	Basis for Liquid Sampling, Analysis, and Radioactive Treatment System Use	I.C-12	Added three sentences to explain compliance with Reg Guide 1.21 for monitoring of all major release points and Millstone Effluent Control Program disposition of minor release points. This completes AR #01000909-02 which addresses a concern with treatment of minor release points.
I.D.1	Gaseous Effluent Sampling and Analysis Program	I.D-1	Corrected references from "IV.E.2.a" and "V.E.2.a" to "IV.D.2.a" and "V.D.2.a."
I.D.1	Gaseous Effluent Sampling and Analysis Program Table I.D-1	I.D-2	1.Deleted notes regarding Unit 1 releases to the Millstone Stack and regarding operability of the Spent Fuel Pool Island (SFPI) and Balance of Plant (BOP) vents. These notes were needed for the transition period when Unit 1 was being separated from Units 2 and 3. With permanent separation of Unit 1 they are no longer needed. 2.Added Footnote E for continuous monitoring and sampling at the SFPI and BOP vents which specifies that monitoring or sampling only required when the exhaust fans are operating. With exhaust fans off there will not be any effluents from these release points. 3.Changed frequency of particulate sample from "Every two weeks" to "Twice per month." This requirement will accommodate scheduling; and only reduces total annual samples from 26 to 24. Given the low particulate releases from Unit 1, this is an acceptable reduction. 4.Deleted requirement to analyze for Sr-89 in quarterly composite samples. Sr-89, with a half-life less than 51 days, is decayed away and will not be seen in Unit 1 air samples. 5.In Footnote D, increased the factor for monitor reading increase when an additional sample is required from two to ten. Also, added the requirement for an additional sample if the monitor reads 8.8E-5 uCi/cc. The monitor normally reads very low, barely above it's detectability threshold. A factor of two increase in reading could have been caused by extraneous electronic noise, or by natural radioactivity such as radon. Not requiring an additional sample until there is a factor of ten increase is acceptable because the monitor will still be reading very low. However, a requirement for an additional sample at a reading of 8.8E-5 uCi/cc is added because this is the Alert setpoint for this monitor. This reading may correspond to a release of 1500 uCi/sec which is reportable to the State of Connecticut. 6.Added a tritium sample from the Reactor Building evaporator staging tank to the Balance of Plant vent. Sample is needed because the evaporator vents directly to the BOP vent which does not have a requirement for tritium sampling.

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Change Request #: 01-02

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Sect	Section Title	Page	Description of change and reason
I.D.1	Gaseous Effluent Sampling and Analysis Program Table I.D-2	I.D-4 I.D-6	1.Created new release source type in Column 1 called "Containment Releases" because sampling requirements for containment releases are different from those for batch release. 2.Added requirement for particulate and iodine (charcoal) grab samples and analyses for containment purges and vents. This is an area of improvement identified in CR M3-98-4756 and AR#98020045-02. 3.Deleted note on RM-8169 becoming operational and sampling of Unit 1 releases to stack. This note is no longer needed now that Unit 1 is permanently separated from the Millstone Stack. 4.Add vent and stack monitor designators, RM8132B and RM8169-1, to the continuous release points to identify points of sampling. 5.Changed frequency of gross alpha analyses from monthly to quarterly. Monthly analyses for gross alpha is not cost beneficial. Any increase in gross alpha would indicate fuel integrity problems; but, weekly analyses of gamma emitters and I-131 and I-133 are sufficient for detecting fuel integrity problems. 6.In Footnote I, the factor for requiring a new containment air sample was changed from a factor of two to 50% and added particulate channel increases by a factor of two. This is in response to an INPO Gaseous Effluent Audit recommendation. See CR M2-00-0170 (AR #00000851-03).
I.D.1	Gaseous Effluent Sampling and Analysis Program Table I.D-3	I.D-7	1.Added requirement for particulate and iodine (charcoal) grab samples and analyses for containment purges and drawdowns. This is an area of improvement identified in Self-assessment MP-SA-00-024 (see CR M3-00-03122 and AR#00010641-02) and in CR M3-98-4756 and AR#98020045-02. 2.Deleted note on SLCRS rad monitor becoming operational. This note is no longer needed now that SLCRS has become the effluent monitor for Unit 3 releases to the Millstone Stack. 3.Added vents and SLCRS monitor designators HVR-RE10B, HVQ-RE49, and HVR-RE19B to the continuous release points to identify points of sampling. 4.Changed frequency of gross alpha analyses from monthly to quarterly. Monthly analyses for gross alpha is not cost beneficial. Any increase in gross alpha would indicate fuel integrity problems; but, weekly analyses of gamma emitters and I-131 and I-133 are sufficient for detecting fuel integrity problems.
I.D.3	Basis for Gaseous Sampling, Analysis, and Radioactive Treatment System Use	I.D-10	1.Added three sentences to explain compliance with Reg Guide 1.21 for monitoring of all major release points and Millstone Effluent Control Program disposition of minor release points. This completes AR #01000909-02 which addresses a concern with treatment of minor release points. 2.Corrected wording "liquid radwaste" to "gaseous radwaste" in seven places.
I.D	Fig. I.D-1	I.D-11	Added a gaseous effluent flow diagram for Unit 1 to show new ventilation alignment at Unit 1.

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Change Request #: 01-02

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Sect	Section Title	Page	Description of change and reason
I.E	Radiological Environmental Monitoring Program	I.E-1 I.E-3 I.E-4	1.Added requirement that grass samples when used as milk substitutes be analyzed for I-131. This is not a new requirement but is done to make it consistent with the requirement in Table I.E-1 (Page I.E-3). 2.In Table I.E-1, changed number of required pasture grass locations from 4 to 3. This change should have been made during a previous revision when the number of milk sample locations was reduced from 4 to 3. Pasture grass is a milk sample substitute when milk is not available. 3.In Tables I.E-1 and I.E-2, added three soil locations with analyses for gamma isotopics. These are recommended program improvements from Self Assessment ES-SA-00-007. 4.In Table I.E-2, made the following additional changes: • Changed distance for TLD location #12 from 8.7 to 8.0 miles, • Combined two Pleasure Beach locations by moving vegetation sample at Location 18 to Location 10, and • Split the two specified directions and distances for Niantic Shoals (Location 31) by moving the 1.5 mile NNW point to new Location 30.
I.F	Radioactive Effluent Release Report	I.F-2	Added reference to REMODCM Technical Information Document (MP-13-REM-REF02) for more guidance on determination of an abnormal release.
II.B.1	Responsibilities	II.B-1	Changed title "Senior Vice President and CNO" to "Vice President and Senior Nuclear Officer" because of a change in organizational title.
II.C.1	Liquid Dose Calculations - Whole Body Dose from Liquid Effluents	II.C-1	1.Requirement for Unit 1 dose calculations were removed because Unit 1 is not currently releasing radioactivity in liquid effluents. 2.Units 2 and 3 Method 1 whole body dose conversation factor was changed from 0.02 to 0.2. This gives additional conservativeness to the dose calculation to account for non-gamma emitters such as Sr-90 and Fe-55. Basis for the factor is given in Technical Evaluation RA-EV-00-0001.
II.C.2	Liquid Dose Calculations - Max Organ Dose from Liquid Effluents	II.C-2	1.Requirements for Unit 1 dose calculations were removed because Unit 1 is not currently releasing radioactivity in liquid effluents. 2.Units 2 and 3 Method 1 maximum organ dose conversation factor was changed from 0.2 to 1.5. This gives additional conservativeness to the dose calculation to account for non-gamma emitters such as Sr-90 and Fe-55. Basis for the factor is given in Technical Evaluation RA-EV-00-0001.
II.C.3	Estimation of Annual Whole Body Dose	II.C-3	Added wording to specify that only units which release radioactivity in liquid effluents are required to estimate whole body dose. This wording is needed to allow relief from the requirement for Unit 1, which has no radioactive liquid releases.
II.C.4	Estimation of Annual Max Organ Dose	II.C-3	Added wording to specify that only units which release radioactivity in liquid effluents are required to estimate max organ dose. This wording is needed to allow relief from the requirement for Unit 1, which has no radioactive liquid releases.
II.C.5	Monthly Dose Projections	II.C-4	Requirements for Unit 1 dose projections were removed because Unit 1 is not currently releasing radioactivity in liquid effluents.

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Change Request #: 01-02

I. Originator name (Print): Claude Flory

Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
II.D.1	Gaseous Dose Calculations - Site Release Rate Limits	II.D-1 II.D-2	1.Deleted the following three operational conditions, equations, and parameters for determining the noble gas instantaneous release rate: • with Unit 1 discharging to Millstone stack without SFPI vent, • with Unit 1 discharging to Millstone stack with SFPI vent, and • with Unit 1 not discharging to Millstone stack. These conditions, equations, and parameters were needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001. With Unit 1 now permanently separated, they are no longer needed. 2.Added Balance of Plant tritium release to parameter "Q_{HIV}" to account for tritium measured in the Reactor Building evaporator processed water which is released to the BOP vent.
II.D.2	Gaseous Dose Calculations 10CFR50 Appendix I Noble Gas Limits	II.D-4 II.D-5	1.On Page II.D-4, deleted the following three operational conditions, equations, and parameters for determining the noble gas doses: • with Unit 1 discharging to Millstone stack without SFPI vent, • with Unit 1 discharging to Millstone stack with SFPI vent, and • with Unit 1 not discharging to Millstone stack. These conditions, equations, and parameters were needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001. With Unit 1 now permanently separated, they are no longer needed. 2.On Page II.D-5, deleted the requirement to use the AIREM code in Method 2 Air Dose. This code is no longer needed. Other, more user-friendly, computer programs are available for the same dose calculations. Use of these programs are now allowed because they follow the Reg Guide 1.109 method. 3.In sub-section c on Page II.D-5, the special locations X/Q and D/Q values were specified for the period 1980 to 1987 rather than just an unspecified 8 year period to clarify the basis for the values.
II.D.3	Gaseous Dose Calculations 10CFR50 Appendix I Iodine and Particulate Doses	II.D-6 II.D-7 II.D-8	1.On Pages II.D-6 and II.D-7, deleted the following three operational conditions, equations, and parameters for determining the iodine and particulate doses: • with Unit 1 discharging to Millstone stack without SFPI vent, • with Unit 1 discharging to Millstone stack with SFPI vent, and • with Unit 1 not discharging to Millstone stack. These conditions, equations, and parameters were needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001. With Unit 1 now permanently separated, they are no longer needed. 2.On Page II.D-7 under "Critical Organ Doses," corrected a reference to Section b(1) to Section a(1). 3.On Page II.D-8, corrected parameter "C_{PSV}" to "C_{PS}."
II.D.4	Gaseous Effluent Monthly Dose Projections	II.D-11 II.D-12	Deleted separate operational conditions, equations, and parameters for determining the iodine and particulate doses with and without Unit 1 discharging to Millstone stack. Unit 1 discharge to stack condition with accompanying equations and parameters were needed on a temporary basis to support the schedule for separating Unit 1 from the Millstone Stack during the first quarter of 2001. With Unit 1 now permanently separated, they are no longer needed.

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Check: ☐ REMM ☐ ODCM ☐ Unit 1 Effluent Controls ☐ Unit 2 Effluent Controls ☐ Unit 3 Effluent Controls Change Request #: 01-02			
I. Originator name (Print): Claude Flory Markups of all changed pages included.			
Sect	Section Title	Page	Description of change and reason
II.D.5	Quarterly Dose Calculations for Radioactive Effluent Release Report	II.D-14	Deleted the requirement to use the AIREM code because this code is no longer needed. Other, more user-friendly, computer programs are available for the same dose calculations. Use of these programs are now allowed because they follow the Reg Guide 1.109 method.
II.D.6	Compliance with 40CFR190	II.D-14	Deleted the word "Stored" in source item 'c.' This clarifies that the dose to be calculated for compliance with 40CFR190 should be based on all licensed sources on site rather than sources, such as radwaste waiting for shipment, which are in storage.
II.E.1	Unit 1 Liquid Radwaste Effluent Line	II.E-1	Requirement for Unit 1 liquid radwaste line monitor setpoint was removed because Unit 1 is not currently releasing radioactivity in liquid effluents.
II.E.2a	Unit 1Reactor Building Service Water Effluent Line	II.E-2	Requirement for Unit 1 service water line monitor setpoint was removed because Unit 1 is not currently releasing radioactivity in liquid effluents.
II.E.2b	Unit 1Reactor Building Service Water Effluent Concentration Limitation	II.E-2	Requirement for Unit 1 service water effluent concentration limit was removed because Unit 1 is not currently releasing radioactivity in liquid effluents.
II.E.3	Unit 2 Clean Liquid Radwaste Effluent Line	II.E-2 II.E-3	1.Included Aerated Liquid Radwaste Effluent Line which has same requirements. 2.Deleted reference to Unit 1 liquid discharge line which is no longer used. 3.Added designators for rad monitors to title line for clarification. 4.Removed allowance to increase the allowable discharge flow by up to a factor of 5. Use of such an allowance would have taken away the safety margin which ensures that liquid discharges are maintained below concentration limits in 10CFR20. Historically, this allowance has never been used.
II.E.4	Unit 2 Aerated Liquid Radwaste Effluent Line and CPF Waste Neut Sump Effluent Line	II.E-4	1.Moved Aerated Liquid Radwaste Effluent Line requirements to Section II.E.3. 2.For clarity, revised wording for when a setpoint based on background may be used for the CPF Neut Sump Effluent Line.
II.E.5	Unit 2 Steam Generator Blowdown	II.E-4	Added designator for rad monitor to title line for clarification.
II.E.6	Unit 2 Condenser Air Ejector	II.E-5	Added designator for rad monitor to title line for clarification.

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Sect	Section Title	Page	Description of change and reason
II.E.7a	Unit 2 Reactor Bldg Closed Cooling Water	II.E-5	Added designator for rad monitor to title line for clarification.
II.E.8	Unit 3 Liquid Waste Monitor	II.E-6	1.Added designator for rad monitor to title line for clarification. 2.Deleted reference to Unit 1 liquid discharge line which is no longer used. 3.Removed allowance to increase the allowable discharge flow by up to a factor of 5. Use of such an allowance would have taken away the safety margin which ensures that liquid discharges are maintained below concentration limits in 10CFR20. Historically, this allowance has never been used.
II.E.9	Unit 3 Regenerant Evaporator Effluent Line	II.E-7	Added designator for rad monitor to title line for clarification.
II.E.10	Unit 3 Waste Neut Sump Effluent Line	II.E-7	Added designator for rad monitor to title line for clarification.
II.E.11a	Unit 3 Steam Generator Blowdown	II.E-8	Added designator for rad monitor to title line for clarification.
II.E.12a	Unit 3 Turbine Bldg Floor Drains Effluent Line	II.E-9	Added designator for rad monitor to title line for clarification.
II.F.1	Unit 1 Spent Fuel Pool Island Monitor	II.F-1	1.Added designator for rad monitor to title line for clarification. 2.Corrected the value of 33% used to determine the setpoint based on skin dose limit of 3000 mrem per year. Setpoint is actually based on 7% of the dose limit.
II.F.2	Unit 2 Wide Range Gas Monitor	II.F-1	1.Added designator for rad monitor to title line for clarification. 2.Corrected the value of 26.4% used to determine the setpoint based on site limit. Setpoint is actually based on 13% of the site limit.
II.F.3	Site Stack Noble Gas Monitor	II.F-2	Requirement for Millstone Stack noble gas monitor setpoint was removed. This monitor was removed and replaced by separate monitors for discharges from Units 2 and 3 to the Millstone Stack.
II.F.4	Unit 3 SLCRS	II.F-2	1.Added designator for rad monitor to title line for clarification. 2.Corrected the value of 26.4% used to determine the setpoint based on site limit. Setpoint is actually based on 13% of the site limit.
II.F.5	Unit 2 Vent - Noble Gas Monitor	II.F-2	Added designator for rad monitor to title line for clarification.
II.F.6	Unit 2 Waste Gas Decay Tank Monitor	II.F-3	Added designator for rad monitor to title line for clarification.

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Sect	Section Title	Page	Description of change and reason
II.F.7	Unit 3 Vent Noble Gas Monitor	II.F-3	Added designator for rad monitor to title line for clarification.
II.F.8	Unit 3 ESF Vent Monitor	II.F-3	Added designator for rad monitor to title line for clarification.
App. II.A	REMODCM Methodology Cross-References	II.A-1 to II.A-2	Made minor corrections which included changing references to multiple tables to references to a single table, deleting reference to Unit 1, and correcting references to wrong REMODCM sections.
III.C.1 Tables III.C-1 and III.C-2	Radioactive Liquid Effluent Monitoring Instrumentation	III.C-1 to III.C-5	Operability and surveillance requirements for Unit 1 radioactive liquid effluent monitoring instrumentation were removed because Unit 1 is not currently releasing radioactivity in liquid effluents.
III.C.2	Radioactive Gaseous Effluent Monitoring Instrumentation	III.C-6	"Alarm/trip" was changed to "alarm" for describing gaseous effluent monitor setpoints because the SFPI vent monitor does not have a trip function.
III.C.2 Table III.C-3	Radioactive Gaseous Effluent Monitoring Instrumentation Operability Requirements	III.C-7 to III.C-8	1.Operability requirements for Millstone Stack instrumentation were removed. This monitor was removed and replaced by separate monitors for discharges from Units 2 and 3 to the Millstone Stack. Separate operability and surveillance requirements for the Unit 2 monitor (WRGM) and the Unit 3 monitor (SLCRS) are contained in REMODCM Sections IV.C.2 and V.C.2. 2.Operational conditions of discharging or not discharging to the Millstone Stack have been removed because Unit 1 is now configured to discharge to the SFPI or BOP vent. Discharges to the Millstone Stack have permanently ceased. 3.Notes for requirements being applicable upon instrument operational status (old Actions C & D) were deleted because the SFPI and BOP vent monitors have been permanently placed into service. 4.New Actions C & D were added for inop actions for SFPI vent flow rate and sampler flow rate monitors. Actions are same as previous actions except that, for the vent flow rate, a default flow rate of 36,000 cfm is used instead of estimating flow every 4 hours and, for the sampler flow rate, flow rate is estimated once during Chemistry compensatory sampling instead of every 4 hours. This reduces operator burden and is commensurate with the reduced source potential at Unit 1. 5.Frequency of operability is changed from "At all times" to when exhaust fans are operating. There will be no effluent releases via these release points when the exhaust fans are not operating. 6.In Action A the number of required grab samples when the SFPI Noble Gas Activity Monitor is inop is reduced from three per week to once per week. This reduces Chemistry burden and is commensurate with the reduced source potential at Unit 1.

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Sect	Section Title	Page	Description of change and reason
III.C.2 Table III.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements	III.C-9	1.Surveillance requirements for Millstone Stack instrumentation were removed. This monitor was removed and replaced by separate monitors for discharges from Units 2 and 3 to the Millstone Stack. Separate operability and surveillance requirements for the Unit 2 monitor (WRGM) and the Unit 3 monitor (SLCRS) are contained in REMODCM Sections IV.C.2 and V.C.2. 2.Removed condition that SFPI vent instrumentation requirements were effective when the SFPI vent became operational because this vent is now in use as a release point. 3.Instrument check frequency for the SFPI and BOP particulate samplers were changed from every two weeks to twice per month. This requirement will accommodate scheduling; and only reduces total annual checks from 26 to 24. Given the low particulate releases from Unit 1, this is an acceptable reduction.
III.D.1	Radioactive Liquid Effluents	III.D-1 to III.D-2	Limitations on Unit 1 radioactive liquid effluent concentrations and doses were removed because Unit 1 is not currently releasing radioactivity in liquid effluents.
III.D.2.a	Radioactive Gaseous Effluents Dose Rate	III.D-3	Changed "instantaneous" to "at any time" to make the requirement consistent with the bases wording in Section III.F and with NUREG-1301.
III.E	Total Radiological Dose from Station Operations	III.E-1	Frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement.
III.F	Bases	III.F-1 to III.F.2	1.Bases for Sections III.C.1, III.D.1.a, and III.D.1.b on radioactive liquid effluent controls were revised because Unit 1 is not currently releasing radioactivity in liquid effluents. 2."Radio-iodines" was deleted from basis for Section III.D.2.c because radio-iodine no longer yield any significant dose at Unit 1
IV.B	Definitions	IV.B-2	Added a definition for MODE which cross references Tech Spec definition for Modes of Operations. This definition is needed because it is used in Table IV.C-1.
IV.C.1 Table IV.C-1	Radioactive Liquid Effluent Monitoring Instrumentation	IV.C-2 to IV.C-4	1.Changed applicability for Aerated Liquid Radwaste Effluent Line from all times to whenever the pathway is being used. Change is needed to avoid unnecessary use of the sample pump when there is no ongoing discharge. See CR M2-00-3110 (AR # 00010813-05). 2.Changed applicability for CPF Waste Neut Sump from "Modes 1-6 when pathway is being used" to "Whenever the pathway is being used." Change is needed because it is possible for Unit 2 to operate in a state other than that defined by Modes 1-6. 3.Changed action statement for CPF Waste Neut Sump monitor to eliminate requirement for independent verification of release rate calculations and discharge valving if the grab sample activity is less than 5E-7 uCi/ml. The level of radioactivity in this source does not warrant this level of effort when the radiation monitor is inoperable. Two independent samples of CPF Waste Neutralization Sump water before discharge will be sufficient to prevent exceedance of limits.

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Sect	Section Title	Page	Description of change and reason
IV.C.2 Tables IV.C-3 & IV.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation	IV.C-10	1.In Table IV.C-3, deleted the words "when it becomes operational" in header line for Millstone Stack because the WRGM is now operational. 2.In Table IV.C-3, allowed auxiliary sampling equipment outage of up to 12 hours in Action B. This makes the action consistent with the similar action at Unit 3 in Table V.C-3 (see Unit 3 change below). 3.In Table IV.C-4, added "P = Prior to discharge" in list of frequency abbreviations at bottom of table. This abbreviation definition was inadvertently omitted during a previous revision.
IV.E	Total Radiological Dose from Station Operations	IV.E-1	Frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement.
V.B	Definitions	V.B-2	Added a definition for MODE which cross references Tech Spec definition for Modes of Operations. This definition is needed because it is used in Table V.C-1.
V.C.1 Table V.C-1	Radioactive Liquid Effluent Monitoring Instrumentation Operability Requirements	V.C-3	1.In Action A on Page V.C-3, corrected reference from Specification V.C.1.a to Specification V.D.1.a. 2.In Action C on Page V.C-3, changed requirement to estimate flow rate from "once per 4 hours" to "at least once per 4 hours." This clarifies that the action does not have to be done exactly every 4 hours. The original words "at least" were inadvertently dropped when Tech Specs were transferred to the REMODCM. 3.Changed action statement for CPF Waste Neut Sump monitor to eliminate requirement for independent verification of release rate calculations and discharge valving if the grab sample activity is less than 5E-7 uCi/ml. The level of radioactivity in this source does not warrant this level of effort when the radiation monitor is inoperable. Two independent samples of CPF Waste Neutralization Sump water before discharge will be sufficient to prevent exceedance of limits.
V.C.2 Table V.C-3	Radioactive Gaseous Effluent Monitoring Instrumentation Operability Requirements	V.C-7 & V.C-8	1.Added designators for the vent monitor (HVR-RE10B), SLCRS monitor (HVR-RE19B), and the ESF vent monitor (HVQ-RE49). This was done for user friendliness; and it distinguishes the normal range instruments (10B, 19B) from the high range instruments (10A, 19A) which monitor the same pathway. It also incorporates part of the OPS Form 3273-3/4.3.3.3.10 from the TRM which was removed when Tech Spec 3.3.3.10 was moved to the REMODCM. 2.Statement that operability requirements for SLCRS instrumentation is conditional on operational status for monitoring releases to Millstone Stack was removed. SLCRS instrumentation is now needed to monitor releases to the stack. 3.Allowed auxiliary sampling equipment outage of up to 12 hours was added to Action B. This is a partial incorporation of the OPS Form 3273-3/4.3.3.3.10 and is consistent with the Table V.C-3 single asterisk note.

Attachment 3
REMM/ODCM Change Request - Routing and Cover Sheet

Check: ☐ REMM ☐ ODCM ☐ Unit 1 Effluent Controls ☐ Unit 2 Effluent Controls ☐ Unit 3 Effluent Controls

Change Request #: 01-02

I. Originator name (Print): Claude Flory
Markups of all changed pages included.

Sect	Section Title	Page	Description of change and reason
V.C.2 Table V.C-4	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements	V.C-9	1.At top of last column changed "Modes for which" to "When." This avoids use of the defined word "MODE" where it is not needed. 2.Added designators for the vent monitor (HVR-RE10B), SLCRS monitor (HVR-RE19B), and the ESF vent monitor (HVQ-RE49). This was done for user friendliness; and it distinguishes the normal range instruments (10B, 19B) from the high range instruments (10A, 19A) which monitor the same pathway. It also incorporates part of the OPS Form 3273-3/4.3.3.3.10 from the TRM which was removed when Tech Spec 3.3.3.10 was moved to the REMODCM.
V.E	Total Radiological Dose from Station Operations	V.E-1	Frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement.
V.F	Bases	V.F-2	1.The last sentence in the first paragraph of the basis for Section V.C.1 was deleted. This sentence gave the basis for tank level indicating devices which have no requirements in the REMODCM. 2.A paragraph was added to the basis for Section V.C.2 to explain that the vent normal range monitor, HVR*10B, satisfies the requirements for effluent monitoring from the vent and that the high range monitor, HVR*10A, is not needed to satisfy the requirements. This incorporates part of the OPS Form 3273-3/4.3.3.3.10 from the TRM which was removed when Tech Spec 3.3.3.10 was moved to the REMODCM.

RADIOLOGICAL ENVIRONMENTAL REVIEW

RER-01-007

Revision 0

for

REMODCM Rev 22

June 14, 2001

Total Number of Pages: 11

Claude Flory	Claude Flory Preparer	6/14/01 Date
William Eakin	W Eakin Supervisor	6/19/01 Date

1.0 DESCRIPTION OF CHANGE

List of changes for REMODCM Revision 22:

A. Changes to Support Unit 1 Cold and Dark

1. In Table I.C-1, all sampling and analyses requirements for liquid releases from waste sample tanks, floor drain sample tank, decontamination solution tank, and service water have been deleted.
2. In Section I.C.2, deleted all waste streams and processing equipment from the Unit 1 table. This removes requirements for operability of certain liquid radwaste processing equipment when off-site doses are projected to exceed certain criteria.
3. In Table I.D-1, deleted notes regarding Unit 1 releases to the Millstone Stack and regarding operability of the Spent Fuel Pool Island (SFPI) and Balance of Plant (BOP) vents.
4. In Table I.D-1, added a tritium sample from the Reactor Building evaporator staging tank to the Balance of Plant vent.
5. In Table I.D-2, deleted note on RM-8169 becoming operational and sampling of Unit 1 releases to stack.
6. In Table I.D-3, deleted note on SLCRS rad monitor becoming operational.
7. Added a gaseous effluent flow diagram (Figure I.D-1) for Unit 1 to show new ventilation alignment at Unit 1.
8. In Sections II.C.1.a and II.C.2.a, requirement for Unit 1 liquid whole body and maximum organ dose calculations were deleted.
9. In Sections II.C.3 and II.C.4, added wording to specify that only Millstone units which release radioactivity in liquid effluents are required to estimate whole body dose.
10. In Section II.C.5, requirements for Unit 1 dose projections were deleted.
11. In Section II.D, deleted the following three operational conditions, equations, and parameters for determining the noble gas instantaneous release rate and noble gas, particulate, and iodine doses:
    - with Unit 1 discharging to Millstone stack without SFPI vent,
    - with Unit 1 discharging to Millstone stack with SFPI vent, and
    - with Unit 1 not discharging to Millstone stack.
12. In Section II.D.2, added tritium from Reactor Building evaporator to parameter "Q_{H1V}."
13. In Section II.D.4, deleted separate operational conditions, equations, and parameters for projecting iodine and particulate doses, due to releases from Units 2 and 3 gaseous radwaste system, with and without Unit 1 discharging to Millstone stack.
14. Requirements for Unit 1 liquid radwaste line and service water monitor setpoints and limitation on service water radioactivity concentration in Sections II.E.1 and II.E.2 were deleted.
15. In Section II.E.3, Unit 2 Clean Liquid Radwaste Effluent Line setpoint, deleted reference to Unit 1 liquid discharge line.
16. Section II.F.3 requirement for Millstone Stack noble gas monitor setpoint was deleted.
17. In Section III.C.1, operability and surveillance requirements for Unit 1 radioactive liquid effluent monitoring instrumentation were deleted.
18. In Section III.C.2, the following changes were made:
    - Operability and surveillance requirements for Millstone Stack instrumentation were deleted.
    - Operational conditions of discharging or not discharging to the Millstone Stack have been deleted.
    - Notes for requirements being applicable upon instrument operational status (old Actions C & D) were deleted.

19. In Section III.D, limitations on Unit 1 radioactive liquid effluent concentrations and doses were deleted.
20. In Table III.D-4, removed condition that SFPI vent instrumentation requirements were effective when the SFPI vent became operational because this vent is now in use as a release point.
21. In Section III.F, bases for Sections III.C.1, III.D.1.a, and III.D.1.b on radioactive liquid effluent controls were revised.
22. In Section III.F, "Radio-iodines" was deleted from basis for Section III.D.2.c because radio-iodine no longer yield any significant dose at Unit 1.
23. In Table IV.C-3, deleted the words "when it becomes operational" in header line for Millstone Stack because the WRGM is now operational.
24. In Table V.C-3, statement that operability requirements for Unit 3 SLCRS instrumentation is conditional on operational status for monitoring releases to Millstone Stack was deleted.

B. Other Changes to Liquid and Gaseous Effluent Sampling and Analysis and Radwaste Processing Equipment (Sections I.C and I.D)
   1. Changes for correction and clarification including:
      - On Pages I.C-1 and I.D-1, corrected references to Sections IV.E.1.a, V.E.1.a, IV.E.2.a, and V.E.2.a to Sections IV.D.1.a, V.D.1.a, IV.D.2.a, and V.D.2.a, respectively.
      - In Table I.C-2, corrected name "Coolant Waste Monitor Tank" to "Clean Waste Monitor Tank."
      - In bases sections (I.C.3 and I.D.3), added three sentences to explain compliance with Reg Guide 1.21 (Ref 4) for monitoring of all major release points and Millstone Effluent Control Program disposition of minor release points. This completes AR#01000909-02 which addresses a concern with treatment of minor release points.
      - In Table I.D-2, created new release source type in Column 1 called "Containment Releases" because sampling requirements for containment releases are different from those for batch release.
      - In Table I.D-2, added vent and stack monitor designators, RM8132B and RM8169-1, to the continuous release points to identify points of sampling.
      - In Table I.D-3, added vents and SLCRS monitor designators HVR-RE10B, HVQ-RE49, and HVR-RE19B to the continuous release points to identify points of sampling.
      - In Section I.D.3, corrected wording "liquid radwaste" to "gaseous radwaste" in seven places.
   2. In Tables I.C-2, I.C-3, I.D-2, and I.D-3 changed frequency of gross alpha analyses from monthly to quarterly.
   3. In Table I.C-2, added a batch release sample "RBCCW Sump." Added new Footnote M that sampling is not required when the sump is directed to radwaste treatment or is not aligned to Long Island Sound and that analyses for alpha, strontiums, and Fe-55 are not required when there is low gamma activity.
   4. In Section I.C.2, added Secondary Demineralizer T23B and redesignated Secondary Demineralizer T23 to T23A in processing equipment for Unit 2 Clean Liquid Radwaste System.
   5. In Table I.D-1, added Footnote E for continuous monitoring and sampling at the SFPI and BOP vents which specifies that monitoring or sampling only required when the exhaust fans are operating.
   6. In Table I.D-1, deleted requirement to analyze for Sr-89 in quarterly composite samples.

7. In Table I.D-1, changed frequency of particulate sample from "Every two weeks" to "Twice per month."
8. In Table I.D-1 Footnote D, increased the factor for monitor reading increase when an additional sample is required from two to ten. Also, added the requirement for an additional sample if the monitor reads 8.8E-5 uCi/cc.
9. In Tables I.D-2 and I.D-3, added requirement for particulate and iodine (charcoal) grab samples and analyses for containment purges, drawdowns, and vents.
10. In Table I.D-2 Footnote I, the factor for requiring a new containment air sample was changed from a factor of two to 50% based on radiation monitor gas channel or a factor of two based on radiation monitor particulate channel.

C. Changes to REMP (Section I.E)
 1. Changes for correction and clarification including:
    - On Page I.E-1, added requirement that grass samples when used as milk substitutes be analyzed for I-131. This is not a new requirement but is done to make it consistent with the requirement in Table I.E-1 (Page I.E-3).
    - In Table I.E-1, changed number of required pasture grass locations from 4 to 3. This change should have been made during a previous revision when the number of milk sample locations was reduced from 4 to 3. Pasture grass is a milk sample substitute when milk is not available.
    - In Table I.E-2, combined two Pleasure Beach locations by moving vegetation sample at Location 18 to Location 10.
    - In Table I.E-2, split the two specified directions and distances for Niantic Shoals (Location 31) by moving the 1.5 mile NNW point to new Location 30.
 2. In Table I.E-2, changed distance for TLD location #12 from 8.7 to 8.0 miles.
 3. In Tables I.E-1 and I.E-2, added three new soil locations with analyses for gamma isotopics. This is a recommended program improvements from Self Assessment ES-SA-00-007.

D. Changes to Liquid and Gaseous Dose Calculations (Sections II.C and II.D)
 1. Changes for correction and clarification including:
    - In Section II.D.2b, clarified that the special location X/Q and D/Q values were derived from the eight year period from 1980 to 1987 instead of just stating that they were derived from an unspecified 8 year period.
    - On Page II.D-7 under "Critical Organ Doses," corrected a reference to Section b(1) to Section a(1).
    - On Page II.D-8, corrected parameter "C_{PSV}" to "C_{PS}."
    - In Section II.D.6, deleted the word "Stored" in source item 'c.' This clarifies that the dose to be calculated for compliance with 40CFR190 should be based on all licensed sources on site rather than sources, such as radwaste waiting for shipment, which are in storage.
 2. In Section II.C.1.a, Units 2 and 3 Method 1 liquid whole body dose conversation factor was changed from 0.02 to 0.2.
 3. In Section II.C.2.a, Units 2 and 3 Method 1 liquid maximum organ dose conversation factor was changed from 0.2 to 0.15.
 4. In Section II.D.2.b, deleted the requirement to use the AIREM code in Method 2 Air Dose.

E. Changes to Liquid and Gaseous Monitor Setpoint Calculations (Sections II.E and II.F)
   1. Changes for correction and clarification including:
      - Added designators for radiation monitors in title lines for each sub-section.
   2. In Section II.E.3, Unit 2 Clean Liquid Radwaste Effluent Line, and Section II.E.8, Unit 3 Liquid Waste Monitor setpoint calculations, removed allowance to increase the allowable discharge flow by up to a factor of 5.

F. Other Changes to Unit 1 Radiological Effluent Controls (Section III)
   1. Changes for correction and clarification including:
      - In Section III.C.2 requirements for Unit 1 gaseous effluent monitoring instrumentation, "Alarm/trip" was changed to "alarm" for describing gaseous effluent monitor setpoints because the SFPI vent monitor does not have a trip function.
      - In Section III.D.2.a, changed Unit 1 requirement to read like Units 2 and 3 requirement by changing the word "instantaneous" to "at any time." This makes the wording of the requirement consistent with the wording in Section III.F and in NUREG-1301.
   2. In Section III.C.2, the following changes were made:
      - New Actions C & D were added for inop actions for SFPI vent flow rate and sampler flow rate monitors. Actions are same as previous actions except that, for the vent flow rate, a default flow rate of 36,000 cfm is used instead of estimating flow every 4 hours and, for the sampler flow rate, flow rate is estimated once during Chemistry compensatory sampling instead of every 4 hours.
      - Frequency of operability is changed from "At all times" to when exhaust fans are operating.
      - In Action A the number of required grab samples when the SFPI Noble Gas Activity Monitor is inop is reduced from three per week to once per week.
      - Instrument check frequency for the SFPI and BOP particulate samplers were changed from every two weeks to twice per month.
   3. In Section III.E, frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual."

G. Changes to Unit 2 Radiological Effluent Controls (Section IV)
   1. Changes for correction and clarification including:
      - In Section IV.B, added a definition for MODE which cross references Tech Spec definition for Modes of Operations. This definition is needed because it is used in Table IV.C-1.
      - In Table IV.C-4 in Section IV.C.2, added "P = Prior to discharge" in list of frequency abbreviations at bottom of table. This abbreviation definition was inadvertently omitted during a previous revision.
   2. In Section IV.C.1 (Table IV.C-1) made following changes:
      - Changed applicability for Aerated Liquid Radwaste Effluent Line from all times to MODES 1-6 when the pathway is being used. Change is needed to avoid unnecessary use of the sample pump when there is no ongoing discharge. See CR M2-00-3110 (AR # 00010813-05).
      - Changed applicability for CPF Waste Neut Sump from "Modes 1-6 when pathway is being used" to "Whenever the pathway is being used." Change is needed because it is possible for Unit 2 to operate in a state other than that defined by Modes 1-6.
      - Changed action statement for CPF Waste Neut Sump monitor to require independent verification of release rate calculations and discharge valving only if there is significant gamma activity in the batch sample.

3. In Section IV.C.2 (Table IV.C-3), allowed auxiliary sampling equipment outage of up to 12 hours in Action B. This makes the action consistent with the similar action at Unit 3 in Table V.C-3 (see Unit 3 change below).
4. In Section IV.E, frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement.

H. Changes to Unit 3 Radiological Effluent Controls (Section V)
1. Changes for correction and clarification including:
    - In Section V.B, added a definition for MODE which cross references Tech Spec definition for Modes of Operations. This definition is needed because it is used in Table V.C-1.
    - In Action A on Page V.C-3, corrected reference from Specification V.C.1.a to Specification V.D.1.a.
    - In Table V.C-3, added designators for the vent monitor (HVR-RE10B), SLCRS monitor (HVR-RE19B), and the ESF vent monitor (HVQ-RE49) for user friendliness.
    - In Table V.C-4, at top of last column, changed "Modes for which" to "When." This avoids use of the defined word "MODE" where it is not needed.
    - In Section V.F, the last sentence in the first paragraph of the basis for Section V.C.1 was deleted. This sentence gave the basis for tank level indicating devices which have no requirements in the REMODCM.
2. In Table V.C-1 Action C in Section V.C.1, changed requirement to estimate flow rate from "once per 4 hours" to "at least once per 4 hours."
3. Made the following changes to incorporate OPS Form 3273-3/4.3.3.3.10 from the TRM which was removed when Tech Spec 3.3.3.10 was moved to the REMODCM:
    - In Tables V.C-3 and V.C-4, added designators for the vent monitor (HVR-RE10B) and SLCRS monitor (HVR-RE19B).
    - Allowed auxiliary sampling equipment outage of up to 12 hours in Table V.C-3 Action B.
    - In Section V.F, a paragraph was added to the basis for Section V.C.2 to explain that the vent normal range monitor, HVR*10B, satisfies the requirements for effluent monitoring from the vent and that the high range monitor, HVR*10A, is not needed to satisfy the requirements.
4. In Section V.E, frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual."

I. Other Corrections, Clarifications, and Enhancements
1. In Section I.B.1 and II.B.1, changed title "Senior Vice President and CNO" to "Vice President and Senior Nuclear Officer" because of a change in organizational title.
2. In Section I.F.2, added reference to REMODCM Technical Information Document (MP-13-REM-REF02) for more guidance on determination of an abnormal release.
3. Made minor corrections to Appendix II.A including changing references to multiple tables to references to a single table, deleting reference to Unit 1, and correcting references to wrong REMODCM sections.

References:

1. Radiological Environmental Review RER-01-001, "REMODCM Rev 21 - Unit 1 Separation and Other Changes."
2. DCR M2-01009, "Installation of Additional Liquid Radwaste Secondary Demineralizer T-23B (EWR M2-99108)."
3. Technical Evaluation RA-EV-00-0001, "Bases for Method I Whole Body and Maximum Organ Dose Conversion Factors (DCF) in Millstone REMODCM Sections II.C.1 and II.C.2."
4. Regulatory Guide 1.21, Revision 1, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants."
5. NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors," April, 1991.

2.0 DISCUSSION

Changes to Support Unit 1 Cold and Dark

Unit 1 has been permanently shutdown and placed in a cold and dark condition awaiting final decommissioning. Design modifications for the cold and dark condition involved some major changes to both gaseous and liquid effluent release configurations.

Releases of gaseous effluents from Unit 1 to the Millstone Stack have ceased and two new Unit 1 gaseous release points have been created. The two new release points from Unit 1 are the Spent Fuel Pool Island (SFPI) vent and the Balance of Plant (BOP) vent. All gaseous effluents from the SFPI envelope in the upper portions of the Reactor Building are released out the SFPI vent and all gaseous effluents from other Unit 1 indoor spaces are released out the BOP vent. This includes the lower portions of the Reactor Building, the Turbine Building, and the Liquid Radwaste Building. Revision 21 to the REMODCM added many effluent control requirements for these new release points (see Ref 1). That revision also included special provisions for the transition period while all three Millstone units were still releasing to the Millstone Stack. These special provisions are no longer needed now that Unit 1 is not discharging to the Millstone Stack. Millstone Units 2 and 3 will now be responsible for determining their own releases to the stack and offsite doses from the releases.

Unit 1 in the cold and dark condition does not release liquid effluents to the environment. The only potential sources of radioactivity in water within Unit 1 is from release of radioactivity from spent fuel in the fuel pool and from residual radioactivity in Reactor Building sump water. Cooling of spent fuel pool water is provided by a closed loop utilizing air cooling eliminating this source of radioactivity in liquid effluents. An evaporator was added to process Reactor Building sump water, with removal of residual radioactivity in solid form for eventual land burial. With these design provisions, all REMODCM requirements for radiological liquid effluent control at Unit 1 can be deleted.

Other changes were made because of Unit 1's cold and dark condition. The justification for these changes are evident in the list of changes description.

Other Changes to Liquid and Gaseous Effluent Sampling and Analysis

In Tables I.C-2, I.C-3, I.D-2, and I.D-3, changed frequency of gross alpha analyses from monthly to quarterly. Monthly analyses for gross alpha is not cost beneficial. Any increase in gross alpha would indicate fuel integrity problems; but, weekly analyses of gamma emitters (including I-131 and Ce-144) on continuous release liquid samples and prior to release for batch liquid release samples and weekly analyses of gamma emitters and radioiodines on continuous gaseous releases samples are sufficient for detecting fuel integrity problems.

In Table I.C-2, added a batch release sample "RBCCW Sump." Added new Footnote M that sampling is not required when the sump is directed to radwaste treatment or is not aligned to Long Island Sound (via the Millstone Quarry) and that analyses for alpha, strontiums, and Fe-55 are not required when there is low gamma activity. Sampling of this point is needed because sump water, which may contain radioactivity, needs to be monitored when not directed through the normal effluent control pathway of liquid radwaste processing. Concerns about unmonitored releases of RBCCW sump water were documented in CR M2-00-3110. This is an enhancement to the Millstone Radiological Effluent Control Program.

In Section I.C.2, added Secondary Demineralizer T23B and redesignated Secondary Demineralizer T23 to T23A in processing equipment for Unit 2 Clean Liquid Radwaste System. This is newly installed equipment (Ref 2) which adds redundancy to processing equipment required for operation when projected liquid doses exceed criteria. This is an enhancement to the Millstone Radiological Effluent Control Program.

In Table I.D-1, added Footnote E for continuous monitoring and sampling at the SFPI and BOP vents which specifies that monitoring or sampling only required when the exhaust fans are operating. With exhaust fans off there will not be any effluents from these release points.

In Table I.D-1, deleted requirement to analyze for Sr-89 in quarterly composite samples. Sr-89, with a half-life less than 51 days, is decayed away and will not be seen in Unit 1 air samples.

In Table I.D-1, changed frequency of particulate sample from "Every two weeks" to "Twice per month." This requirement will accommodate scheduling; and only reduces total annual samples from 26 to 24. Given the low particulate releases from Unit 1, this is an acceptable reduction.

In Table I.D-1 Footnote D, increased the factor for monitor reading increase when an additional sample is required from two to ten. Also, added the requirement for an additional sample if the monitor reads 8.8E-5 uCi/cc. The monitor normally reads very low, barely above it's detectability threshold. A factor of two increase in reading could have been caused by extraneous electronic noise, or by natural radioactivity such as radon. Not requiring an additional sample until there is a factor of ten increase is acceptable because the monitor will still be reading very low. However, a requirement for an additional sample at a reading of 8.8E-5 uCi/cc is added because this is the Alert setpoint for this monitor. This reading may correspond to a release of 1500 uCi/sec which is reportable to the State of Connecticut.

In Table I.D-2, added requirement for particulate and iodine (charcoal) grab samples and analyses for containment purges and vents. This is an area of improvement identified in CR M3-98-4756 and AR#98020045-02 and is an enhancement to the Millstone Radiological Effluent Control Program.

In Table I.D-2 Footnote I, the factor for requiring a new containment air sample was changed from a factor of two to 50% for gas channels only and added the particulate channels at the factor of two criteria. This is in response to an INPO Gaseous Effluent Audit recommendation (see CR M2-00-0170 and AR #00000851-03) and is an enhancement to the Millstone Radiological Effluent Control Program.

In Table I.D-3, added requirement for particulate and iodine (charcoal) grab samples and analyses for containment purges and drawdowns. This is an area of improvement identified in Self-assessment MP-SA-00-024 (see CR M3-00-03122 and AR#00010641-02) and in CR M3-98-4756 and AR#98020045-02. This is an enhancement to the Millstone Radiological Effluent Control Program.

Changes to REMP

Changed distance for TLD location #12 from 8.7 to 8.0 miles. Location had to be moved when the air sampling station at eight miles, in which the TLD had been co-located, was shutdown. This change in distance will not affect the status of the TLD as a control location; it is still far enough awhile to not be influenced by plant radiation.

Added three new soil locations with analyses for gamma isotopics. This is a recommended program improvement from Self Assessment ES-SA-00-007. REMP soil samples are not part of a suggested NRC monitoring program in Reference 5.

Changes to Liquid and Gaseous Dose Calculations

Method 1 liquid whole body dose conversation factor was changed from 0.02 to 0.2 and Method 1 liquid maximum organ dose conversation factor was changed from 0.2 to 0.15. This gives additional conservativeness to the dose calculation to account for non-gamma emitters such as Sr-90 and Fe-55. Derivation of these factors is given in Reference 3.

Deleted the requirement to use the AIREM code in Method 2 Air Dose. This code is no longer needed. With lower flow in the Millstone Stack, the GASPAR code can be used instead. Other, more user-friendly, computer programs are also available for the same dose calculations. Use of these programs are now allowed because they follow the Reg Guide 1.109 method.

Changes to Liquid and Gaseous Monitor Setpoint Calculations

In Section II.E.3, Unit 2 Clean Liquid Radwaste Effluent Line, and Section II.E.8, Unit 3 Liquid Waste Monitor setpoint calculations, the allowance to increase the allowable discharge flow by up to a factor of 5 was removed. Use of such an allowance would have taken away the safety margin which ensures that liquid discharges are maintained below concentration limits in 10CFR20. Historically, this allowance has never been used.

Changes to Unit 1 Radiological Effluent Controls

Several operability and surveillance requirements for gaseous effluent instrumentation in Tables III.C-3 and III.C-4 were reduced in scope. These include:

- Action C in Table III.C-3 for an inoperable SFPI vent flow rate monitor was revised to allow use of a default flow rate of 36,000 cfm instead of estimating flow every 4 hours.
- Action D in Table III.C-4 for an inoperable SFPI sampler flow rate monitor was revised to allow flow rate estimation once during Chemistry compensatory sampling instead of every 4 hours.
- Operability applicability in Table III.C-3 was changed from "At all times" to when exhaust fans are operating.
- Action A in Table III.C-3 for an inoperable SFPI Noble Gas Activity Monitor is revised to reduce the number of required grab samples from three per week to once per week.
- Instrument check frequency for the SFPI and BOP particulate samplers in Table III.C-4 was changed from every two weeks to twice per month.

These reductions in scope reflect the change of Unit 1 from an operating reactor to a permanently shutdown reactor with a spent fuel inventory. The source term presented by the spent fuel and residual plant radioactivity is substantially less than that from an operating reactor. These reductions will reduce Operator and Chemistry burden and are commensurate with the reduced source potential.

In Section III.E, frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement. The 12 consecutive month schedule for satisfying the regulatory requirement was an unnecessary administrative burden.

Changes to Unit 2 Radiological Effluent Controls

In Table IV.C-1 the operability applicability for Aerated Liquid Radwaste Effluent Line was changed from "At all times" to "MODES 1-6 when the pathway is being used." Change is needed to avoid use of the sample pump during RBCCW sump discharges which use the same discharge piping. The saline sump water causes corrosive damage to the radiation monitor and associated piping. See CR M2-00-3110 (AR # 00010813-05). This change is consistent with FSAR statement that the aerated liquid radwaste system is operating on a batch basis and effluent instrumentation monitors releases. Dual isolation valves and administrative controls are adequate to prevent inadvertent discharges between batch releases.

In Table IV.C-1, changed action statement for CPF Waste Neut Sump monitor to eliminate requirement for independent verification of release rate calculations and discharge valving when gamma activity in the batch sample is sufficiently low. The level of radioactivity in this source does not warrant this level of effort when the radiation monitor is inoperable. Two independent samples of CPF Waste Neutralization Sump water before discharge will be sufficient to prevent exceedance of limits.

In Section IV.E, frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement. The 12 consecutive month schedule for satisfying the regulatory requirement was an unnecessary administrative burden.

Changes to Unit 3 Radiological Effluent Controls

Table V.C-1 Action C was revised to change requirement to estimate flow rate from "once per 4 hours" to "at least once per 4 hours." This clarifies that the action does not have to be done exactly every 4 hours. The original words "at least" were inadvertently dropped when Tech Specs were transferred to the REMODCM. This avoids an unnecessarily restrictive literal interpretation of the requirement to estimate flow at exactly every 4 hours. The new language is actually requires estimation more often than once every 4 hours.

Made the following changes to incorporate OPS Form 3273-3/4.3.3.3.10 from the TRM which was removed when Tech Spec 3.3.3.10 was moved to the REMODCM:

- In Tables V.C-3 and V.C-4, added designators for the vent monitor (HVR-RE10B) and SLCRS monitor (HVR-RE19B) to distinguish the normal range instruments (10B, 19B) from the high range instruments (10A, 19A) which monitor the same pathway.
- Allowed auxiliary sampling equipment outage of up to 12 hours in Table V.C-3 Action B. This is the same allowance given for the normal gaseous effluent sampling instrumentation. It allows for equipment contingencies.
- In Section V.F, a paragraph was added to the basis for Section V.C.2 to explain that the vent normal range monitor, HVR*10B, satisfies the requirements for effluent monitoring from the vent and that the high range monitor, HVR*10A, is not needed to satisfy the requirements.

In Section V.E, frequency of total dose limitation was changed from "over a period of 12 consecutive months" to "annual." This change is consistent with the Federal regulatory requirement in 40 CFR Part 190 which this REMODCM requirement is intended to implement. The 12 consecutive month schedule for satisfying the regulatory requirement was an unnecessary administrative burden.

3.0 CONCLUSION

The changes in Revision 22 to the REMODCM would not cause an increase in release of radioactivity to the environment or of dose to the public and they do not deviate from any of the design bases for an effluent control program in the FSAR for Millstone Units 2 and 3 or in the DSAR for Millstone Unit 1. The changes will not affect the level of radioactive effluent control required by each unit's Technical Specifications and FSAR, 10CFR20, 40CFR190, 10CFR50.36a, and Appendix I of 10CFR50 and will not adversely impact the accuracy or reliability of effluent, dose or setpoint calculations. The changes do not cause an Unreviewed Radiological Environmental Impact (UREI).

4.0 Inoperable Effluent Monitors

During the period January 1 through December 31, 2001, the following effluent monitors were inoperable for more than 30 consecutive days:

4.1 Unit 1

4.1.1 Millstone Stack monitor

The Millstone Unit 1 Main Stack radioactive gaseous effluent monitoring instrumentation, except for the stack flow rate monitor, were inoperable from December 27, 2000 to March 2, 2001. This includes the noble gas activity monitor, the iodine sampler, the particulate sampler, and the sampler flow rate monitor. Inoperability of these instruments during this time period was due to work to separate Unit 1 from the Main Stack and to provide independent monitoring by Units 2 and 3 for their releases to the Main Stack. Modifications to effect this separation included removal of the existing Main Stack gaseous effluent monitoring instrumentation from the Main Stack Sample Room. This removal had to be done to allow for the installation of a new, dedicated Unit 2 Wide Range Gas Monitor (WRGM). At the same time, other modifications at Unit 1 were adding instrumentation for monitoring gaseous releases at two new release points, the Spent Fuel Pool Island (SFPI) and the Balance of Plant (BOP) vents. When the independent gaseous monitoring instrumentation at Units 2 and 3 and the instrumentation for the two new Unit 1 release points became operable, all by March 2, the requirements for the Unit 1 Main Stack gaseous effluent monitoring instrumentation were deleted and the instrumentation was abandoned. The length of the Main Stack instruments' inoperability was due to the extensive work needed for installation of the Unit 2 instrumentation at the Main Stack and post-installation testing. Best efforts were made while installing the new instrumentation to minimize the time of inoperability. This including extensive design and work planning for DCR MP2-00-010 and much overtime work during the installation of new instrumentation. During this time the inoperability actions required in Table III.C-3 of the REMODCM were implemented. In addition, an alternate method for monitoring noble gas effluents at the Main Stack was performed, besides the action required for the inoperable noble gas activity monitor.

4.2 Unit 2 - None

4.3 Unit 3

4.3.1 Steam generator blowdown monitor (SSR-08)

The Unit 3 steam generator blowdown monitor (SSR-08) was declared inoperable from 2-3-01 to 3-30-01 for a total of 48 days due to inadequate design. The monitor requires steam generator pressure to maintain adequate sample flow. In a portion of mode 4 and in modes 5 & 6, steam generator pressure is insufficient to provide adequate sample flow. Unit 3 was in a refueling outage during this time. Best efforts were made to complete the outage and return to power operation but was not completed within thirty days. During the inoperable period, grab samples were collected and analyzed for gross radioactivity at least once every 24 hours when the pathway was in service as required by the REMODCM.

5.0 Errata

An typographical error was found in Section 2.2.4 of the 2000 Radioactive Effluent Release Report. The maximum organ dose for the Millstone Unit 2 abnormal liquid effluent release from the turbine building sump was incorrectly labeled as skin dose. The corrections are boldfaced in the following pages.

Table 2.1-4 Liquid Effluents Release Summary for the 2000 Radioactive Effluent Release Report had incorrect values for the E.3. Dilution Volume During the Period. The corrected values and values derived from these values are boldfaced in the following pages.

2.2.4 Abnormal Liquid Releases

An abnormal release of radioactivity is the unintentional discharge of a volume of liquid or airborne material to the environment which was unplanned and/or uncontrolled.

In 2000, the following abnormal liquid releases occurred:

2.2.4.1 Unit 1 - None

2.2.4.2 Unit 2 - Turbine Building Sump to Storm Drain (DSN 006)

In November - December, an unplanned release of radioactivity occurred when the Auxiliary Steam Heat Exchanger interface in the RWST resulted in radioactivity entering the Turbine Building Sump which discharges to the Storm Drain Release Point (DSN 006) into the Long Island Sound.

The following radioactivity was unintentionally released :

H3 2.00 E-02 Curies

The dose consequence resulting from this release

[illegible]	Maximum Individual (mrem)
Total Body	2.48 E-06 mrem
Thyroid	2.48 E-06 mrem
Max Organ	2.48 E-06 mrem

2.2.4.1 Unit 3 - None

Table 2.1-4

Millstone Unit No. 1

Liquid Effluents - Release Summary

	Units	2000 1st Qtr	2000 2nd Qtr	2000 3rd Qtr	2000 4th Qtr	2000 Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	1.39E-03	1.56E-03	1.17E-03	1.21E-03	5.32E-03
2. Average Period Diluted Activity	uCi/ml	**2.34E-10**	**2.62E-10**	**1.95E-10**	**2.01E-10**	**2.23E-10**
B. Tritium						
1. Total Activity Released	Ci	2.09E-01	2.42E+00	5.68E-01	1.68E+00	4.88E+00
2. Average Period Diluted Activity	uCi/ml	**3.52E-08**	**4.07E-07**	**9.45E-08**	**2.79E-07**	**2.04E-07**
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	N/D	N/D	N/D No Activity Detected	N/D	N/D
2. Average Period Diluted Activity	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	N/D	N/D	N/D No Activity Detected	N/D	N/D
E. Volume						
1. Released Waste Volume	Liters	7.72E+05	2.01E+06	7.60E+05	1.26E+06	4.80E+06
2. Dilution Volume During Releases	Liters	4.41E+08	9.07E+07	4.65E+07	5.74E+07	6.36E+08
3. Dilution Volume During Period	Liters	**5.94E+09**	**5.94E+09**	**6.01E+09**	**6.01E+09**	**2.39E+10**

N/D = Not Detected

Docket Nos. 50-245
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B18650

Enclosure 1

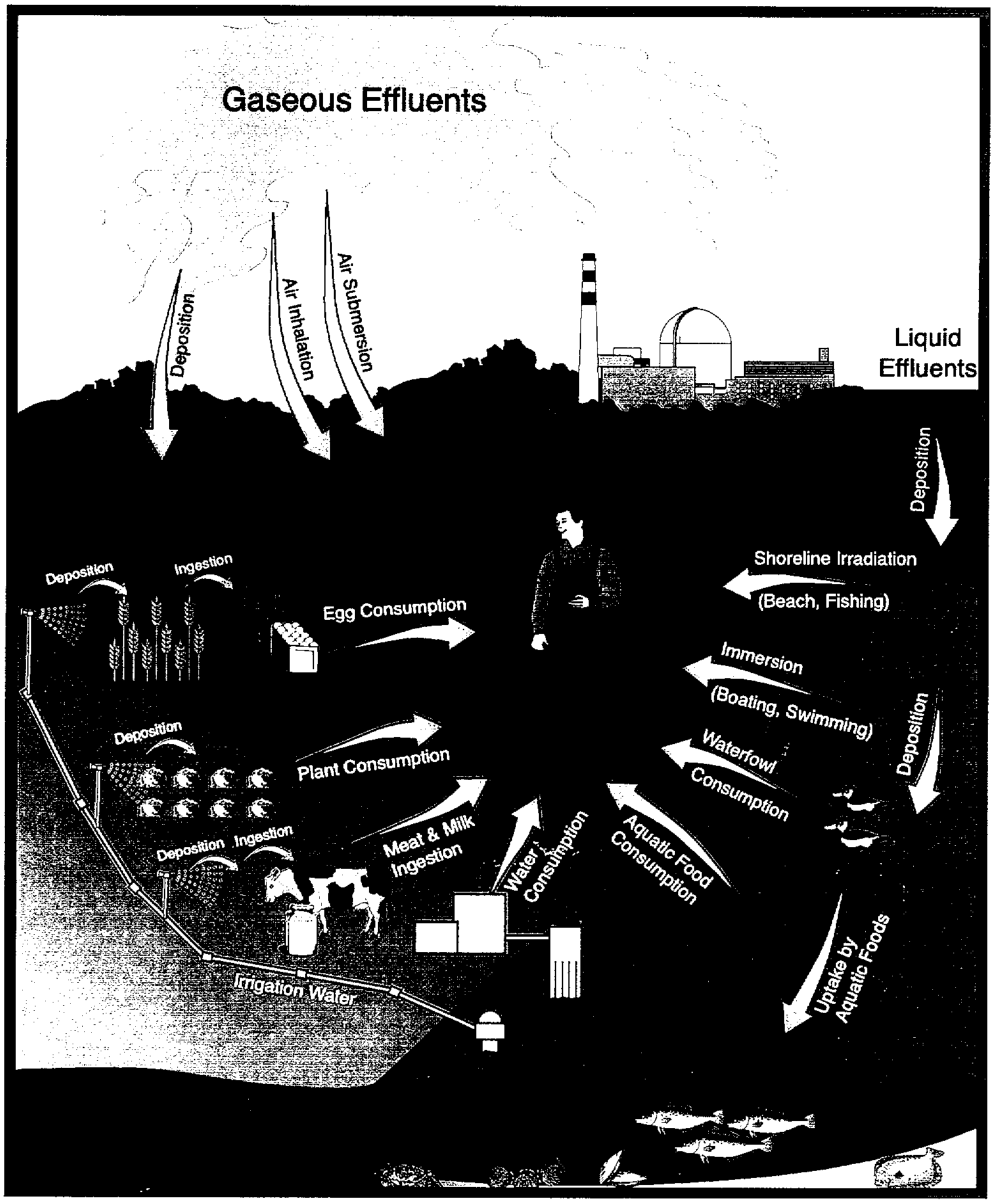
Millstone Nuclear Power Station, Unit Nos. 1, 2 and 3

2001 Radioactive Effluent Release Report, Volumes I and II

Millstone Power Station

2001 Radioactive Effluent Release Report

Volume II



Dominion

Dominion Nuclear Connecticut, Inc.

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

Millstone Power Station

2001
Radioactive Effluent Release Report

Volume II

Dominion Nuclear Connecticut, Inc.

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Millstone

REMODCM

Revision 20

SECTION I

RADIOLOGICAL EFFLUENT

MONITORING MANUAL (REMM)

FOR THE
MILLSTONE NUCLEAR POWER STATION
UNIT NOs. 1, 2, & 3

DOCKET NOs. 50-245, 50-336, 50-423

Revision 20
January 25, 2001

MILLSTONE STATION
RADIOLOGICAL EFFLUENT MONITORING AND OFF-SITE DOSE CALCULATION MANUAL
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MILLSTONE STATION
RADIOLOGICAL EFFLUENT MONITORING AND OFFSITE DOSE CALCULATION MANUAL (REMODCM)

SECTION I: RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

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MILLSTONE STATION
RADIOLOGICAL EFFLUENT MONITORING AND OFFSITE DOSE CALCULATION MANUAL (REMODCM)

SECTION I: RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

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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 released 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.*

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 Senior Vice President and CNO - 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 *Millstone Radiological Effluent Program Reference Manual (MP-13-REM-REF01).*

I.C. LIQUID EFFLUENTS

1. Liquid Effluent Sampling and Analysis Program

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

Table I.C-1

MILLSTONE UNIT 1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
A. Batch Release[B] Waste Sample Tanks, Floor Drain Sample Tank and Decontamination Solution Tank	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[C]	5×10^{-7}
			Ce-144	5×10^{-6}
		Monthly Composite[E]	H-3	1×10^{-5}
			Gross alpha	1×10^{-7}
		Quarterly Composite[E]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Release Reactor Building Service Water	Weekly Grab Sample[D]*	Weekly Composite[E]	Principal Gamma Emitters[C]	5×10^{-7}
			Ce-144	5×10^{-6}
	Weekly Grab or Composite[E]	Monthly Composite[E]	H-3	1×10^{-5}
			Gross alpha[F]	1×10^{-7}
	Weekly Composite[E,F]*	Quarterly Composite[E,F]*	Sr-89[F], Sr-90[F]	5×10^{-8}
			Fe-55[F]*	1×10^{-6}

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

TABLE I.C-1 (Cont'd.)

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.

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, and Cs-137. Ce-144 shall 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*.

TABLE I.C-1 (Cont'd.)

E. 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.

CONDITIONAL ACTION REQUIREMENTS:

D. **IF** a weekly sample identifies the presence of gamma activity greater than or equal to 5×10^{-7} µCi/ml, **THEN** the sample frequency shall be increased to daily until the gamma activity is less than 5×10^{-7} µCi/ml. Daily grab samples shall be taken at least five times per week.

F. **IF** a weekly gamma analysis does not indicate a gamma activity greater than 5×10^{-7} µCi/ml, **THEN** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

Table I.C-2
MILLSTONE UNIT 2
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
A. Batch Release[B] 1. Coolant Waste Monitor Tank, Aerated Waste Monitor Tank and Steam Generator Bulk 2. Condensate Polishing Facility - Waste Neutralization Sump[E]*	Prior to Each Batch	Prior to Each Batch	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}
		Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[D]*	1×10^{-7}
		Quarterly Composite[F,G]	Sr-89[D]*, Sr-90[D]*	5×10^{-8}
			Fe-55[D]*	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 3. Turbine Building Sumps[H]*,[M]*	Monthly Grab Sample	Monthly	Dissolved and Entrained Gases[K]	1×10^{-5}
	Weekly Grab or Composite	Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[J,L]*	1×10^{-7}
	Weekly Composite	Quarterly Composite[F,G]	Sr-89[J]*, Sr-90[J]*	5×10^{-8}
			Fe-55[J]*	1×10^{-6}

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

TABLE I.C-2 (Cont'd.)

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*.

TABLE I.C-2 (Cont'd.)

TABLE NOTATIONS

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*.

CONDITIONAL ACTION REQUIREMENTS

I. For the Condensate Polishing Facility (CPF) waste neutralization sump and steam generator bulk:
IF the applicable batch gamma activity is not greater than 5×10^{-7} μCi/ml, **THEN** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

II. For the Condensate Polishing Facility (CPF) waste neutralization sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analyses are not required.

IF the steam generator gross gamma activity (sampled and analyzed three times per week per *Table 4.7-2* of the *Technical Specifications*) does not exceed 1×10^{-5} μCi/ml, **THEN** the sampling and analysis schedule for all principal gamma emitters, I-131, Ce-144, noble gases, gross alpha, Sr-89, Sr-90 and Fe-55 are not required.

H. For the Steam Generator Blowdown and the Turbine Building Sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analysis of the Turbine Building Sump is not required.

IF the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7-2* of the *Safety Technical Specifications*) 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** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

L. For the Turbine Building Sump: **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. **IF** the Turbine Building Sump is directed to radwaste treatment, **THEN** sampling is not required.

Table I.C-3
MILLSTONE UNIT 3
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
A. Batch Release[B]				
1. Condensate Polishing Facility - Waste Neutralization Sump[E*]	Prior to Each Batch	Prior to Each Batch	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 Drain Tank, Boron Test Tanks and Steam Generator Bulk		Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[D*]	1×10^{-7}
		Quarterly Composite[F,G]	Sr-89[D*], Sr-90[D*]	5×10^{-8}
			Fe-55[D*]	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	Monthly Grab Sample	Monthly	Dissolved and Entrained Gases[K]	1×10^{-5}
3. Turbine Building Sumps[H*,M*]	Weekly Grab or Composite	Monthly Composite[F,G]	H-3	1×10^{-5}
			Gross alpha[J*,L*]	1×10^{-7}
	Weekly Composite	Quarterly Composite[F,G]	Sr-89[J*], Sr-90[J*]	5×10^{-8}
			Fe-55[J*]	1×10^{-6}

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

TABLE I.C-3 (Cont'd.)

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.*

TABLE I.C-3 (Cont'd.)

TABLE NOTATIONS

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.*

CONDITIONAL ACTION REQUIREMENTS

D. For the Condensate Polishing Facility (CPF) waste neutralization sump and steam generator bulk:
IF the applicable batch gamma activity is not greater than 5×10^{-7} µCi/ml, **THEN** these analyses (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 analysis is not required.

IF the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7*-1 of the *Safety Technical Specifications*) does not exceed 1×10^{-5} µCi/ml, **THEN** the sampling and analysis schedule for all principal gamma emitters, I-131, Ce-144, noble gases, gross alpha, Sr-89, Sr-90 and Fe-55 are not required.

H. For the Steam Generator Blowdown and the Turbine Building Sump:
IF there is no detectable tritium in the steam generators, **THEN** tritium sampling and analysis of the Turbine Building Sump is not required.

IF the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7*-1 of the *Safety Technical* Specifications) 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** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

L. **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.

M. **IF** the Turbine Building Sump is directed to radwaste treatment, **THEN** sampling is not required.

I.C. LIQUID EFFLUENTS (Cont'd)

2. Liquid Radioactive Waste Treatment

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

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

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

2. Millstone Unit No. 2

Waste Stream	Processing Equipment
Clean liquid	Deborating ion exchanger (T11) OR Purification ion exchanger (T10A or T10B)
	Primary demineralizer (T22 A or B)
	Secondary demineralizer (T23)
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.

I.C.2 <u>Liquid Radioactive Waste Treatment</u> (Cont'd)

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 inoperable equipment or subsystems, and the reason for the inoperability,
- Action(s) taken to restore the inoperable equipment to OPERABLE status, and
- Summary description of action(s) taken to prevent a recurrence.

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

Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid effluents during the past 12 months of plant operation. The indicated liquid surveillance programs (as directed by surveillance requirements for Radiological Effluent Controls in Sections III.D.1.a, IV.D.1.a, and V.D.1.a) provides the means to quantify and report on liquid discharges from all major and potential significant release pathways. 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 RESERVED

FIGURE I.C-1

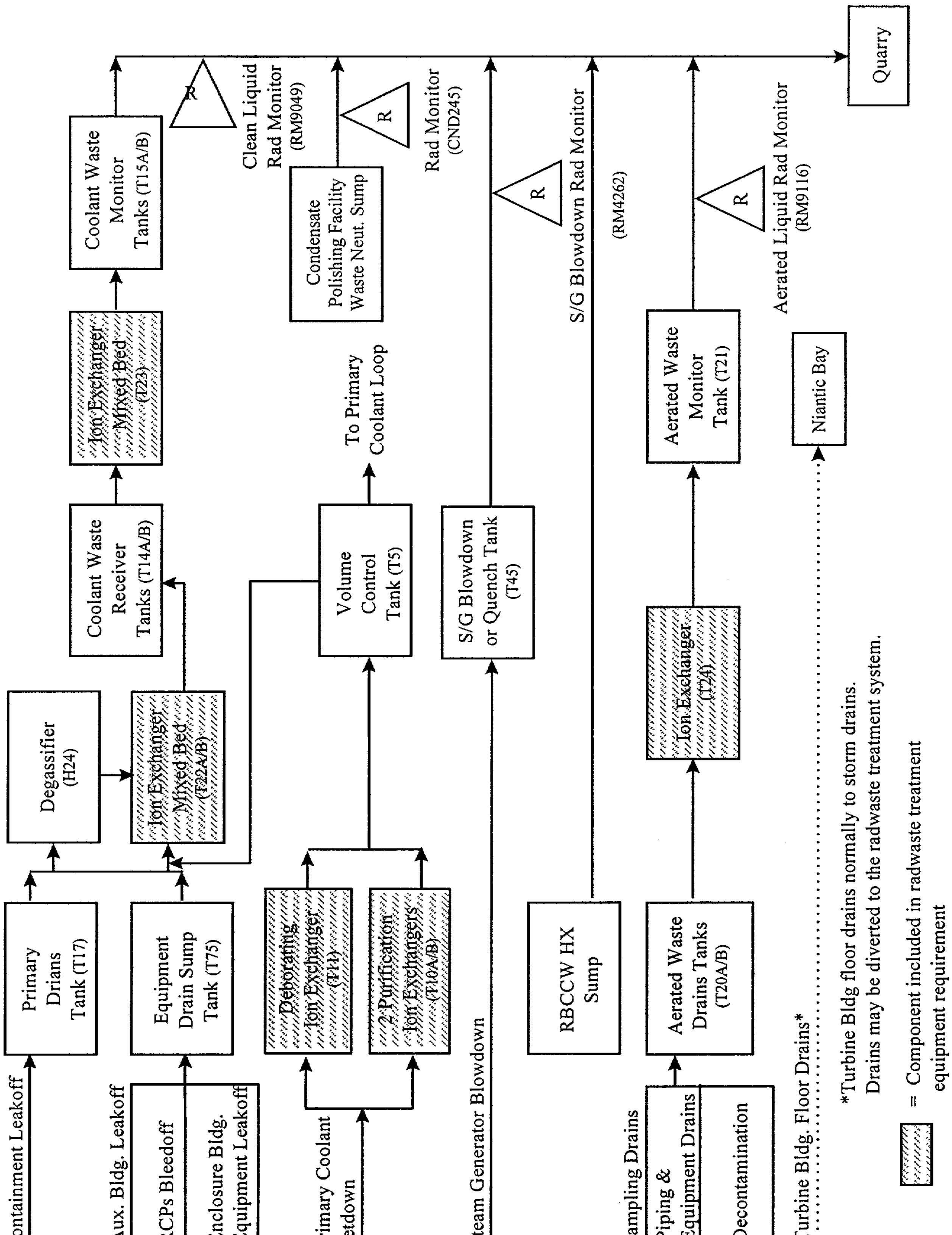

FIGURE I.C-2
SIMPLIFIED LIQUID EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT TWO

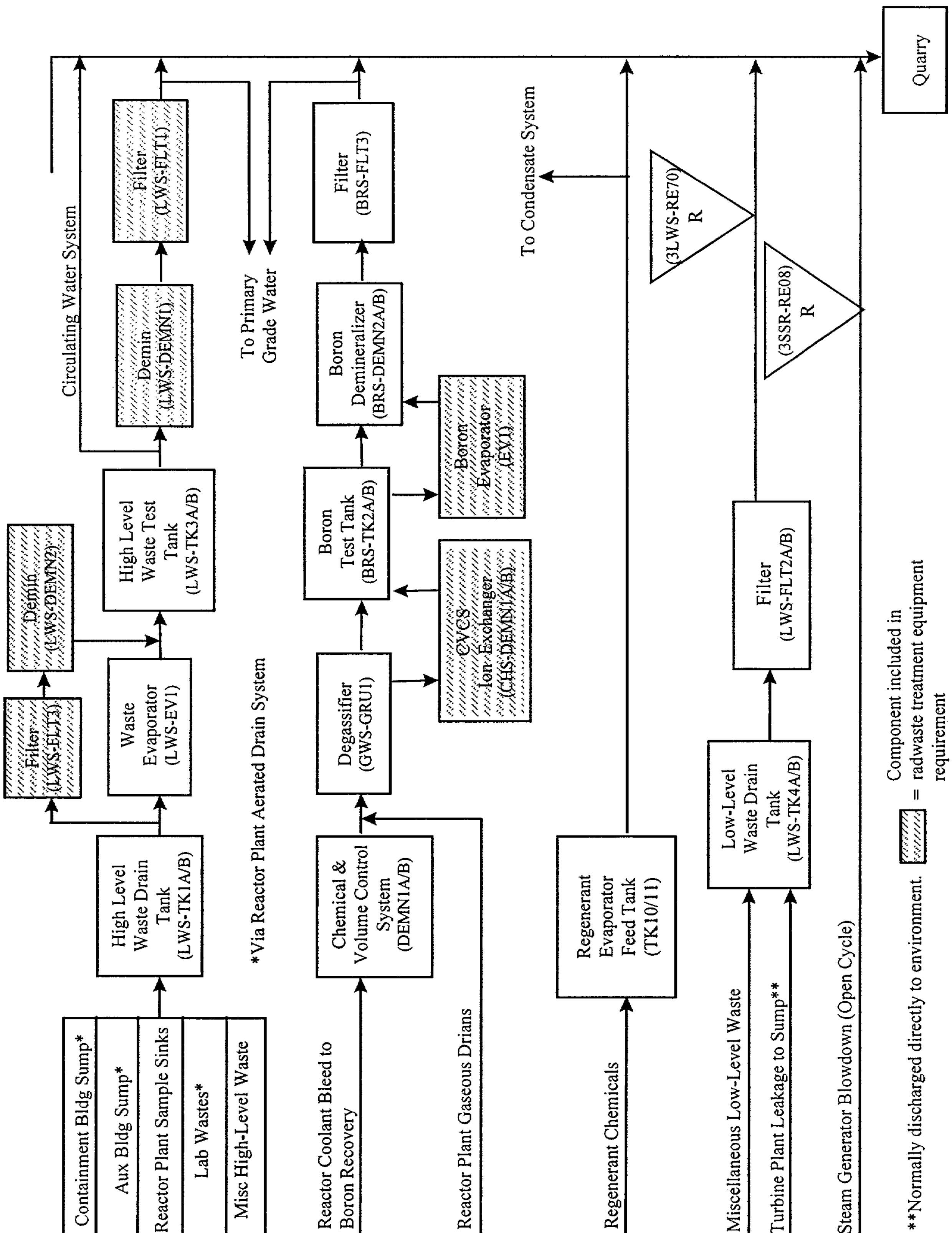

FIGURE I.C-3
SIMPLIFIED LIQUID EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT THREE

I.D. GASEOUS EFFLUENTS

1. Gaseous Effluent Sampling and Analysis Program

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

Table I.D-1

MILLSTONE UNIT 1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/cc)
B. Main Site Stack Refer to Table I.D-2				

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Table I.D-2

MILLSTONE UNIT 2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling 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] 2. Containment Purge	Prior to Each Tank Discharge	Each Tank Discharge	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}
B. Continuous Release 1. Vent 2. Site Stack	Monthly - Gaseous Grab Sample[C]*	Monthly[C]*	Principal Gamma Emitters[B]	1×10^{-4}
			H-3[G]*	1×10^{-6}
	Continuous[D]	Weekly Charcoal Sample[F]*	I-131	1×10^{-12}
			I-133[E]	1×10^{-10}
	Continuous[D]	Weekly Particulate Sample[F]*	Principal Particulate Gamma Emitters[B] - (I-131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous[D]	Monthly Composite Particulate Sample	Gross alpha	1×10^{-11}
	Continuous[D]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[D]	Noble Gas Monitor	Noble Gases - Gross Activity	1×10^{-6}
3. Containment Venting	Weekly Grab, if venting[I]*	Weekly	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}

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

TABLE I.D-2 (Cont'd.)

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. Analyses for I-133 will not be performed on each charcoal sample. Instead, at least once per month, the ratio of I-133 to I-131 will be determined from a charcoal sample changed after 24 hours of sampling. This ratio, along with the routine I-131 activity determination will be used to determine the release rate of I-133.

H. Waste Gas Storage Tanks are normally released on a batch basis. However, for the purpose of tank maintenance, inspection, or reduction of oxygen concentration, a waste gas tank may be continuously purged with nitrogen provided the following conditions are met:

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

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

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

(4) After pressurizing the tank with nitrogen, a sample of the gas in the tank will be taken and analyzed for any residual gamma emitters and tritium prior to initiation of the nitrogen purge. The measured activity will be used to calculate the amount of activity released during the purge.

TABLE I.D-2 (Cont'd.)

TABLE NOTATIONS

CONDITIONAL ACTION REQUIREMENTS:

C. **IF** there is an unexplained increase of the Site Stack or Unit 2 Vent noble gas monitor of greater than 50%, after factoring out increases due to changes in THERMAL POWER levels, containment purges, or other explainable increases, **THEN** sampling and analysis shall also be performed within 24 hours.

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:
IF reactor coolant Dose Equivalent I-131 samples, which are taken two to six hours following a THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour, show an increase of greater than a factor of 5, **THEN** special sampling and analysis of iodine and particulate filters shall also be performed. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant Dose Equivalent I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.

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 Site Stack or vent where the containment ventilation is being discharged at the time of sampling.

I. **IF** the containment air radioactivity increases or decreases by a factor of two compared to the radioactivity at the time of the weekly air sample based on a trend of Radiation Monitors RM8123 and RM8262 gas channels, **THEN** a new containment air sample shall be taken.

Table I.D-3

MILLSTONE UNIT 3

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (µCi/cc)
A. Batch Release 1. Containment Drawdown 2. Containment Purge	Prior to Each Purge or Drawdown[H]	Each Purge or Drawdown	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}
B. Continuous Release	Monthly - Gaseous Grab[C]*	Monthly[C]*	Principal Gamma Emitters[B]	1×10^{-4}
			H-3[G]*	1×10^{-6}
1. Unit 3 Ventilation Vent 2. Engineered Safeguards Building 3. Containment Vacuum System and Gaseous Radwaste[I]*	Continuous[D]	Weekly Charcoal Sample[F]*	I-131	1×10^{-12}
			I-133[E]	1×10^{-10}
	Continuous[D]	Weekly Particulate Sample[F]*	Principal Particulate Gamma Emitters[B] - (I-131, others with half lives greater than 8 days)	1×10^{-11}
	Continuous[D]	Monthly Composite Particulate Sample	Gross alpha	1×10^{-11}
	Continuous[D]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[D]	Noble Gas Monitor	Noble Gases - Gross Activity	1×10^{-6}

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

TABLE I.D-3 (Cont'd.)

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

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

E. Analyses for I-133 will not be performed on each charcoal sample. Instead, at least once per month, the ratio of I-133 to I-131 will be determined from a charcoal sample changed after 24 hours of sampling. This ratio, along with the routine I-131 activity determination will be used to determine the release rate of I-133.

H. Subsequent to medical emergencies, for initial determination of isotopic content of the containment air, a Health Physics sample may be used in place of the normal chemistry sample.

CONDITIONAL ACTION REQUIREMENTS

C. **IF** there is an unexplained increase of the Unit 3 ventilation vent noble gas monitor or gaseous radioactive waste monitor of greater than 50%, after factoring out increases due to changes in THERMAL POWER levels, containment purges, or other explainable increases, **THEN** appropriate sampling and analysis shall also be performed within 24 hours. (Only applicable to gaseous radioactive waste monitor when gaseous dose exceeds 20% of limit - see Footnote I.)

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

IF reactor coolant Dose Equivalent I-131 samples (which are taken two to six hours following a THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour per *Table 4.4-4* of the *Safety Technical Specifications)* show an increase of greater than a factor of 5, **THEN** special sampling and analysis of iodine and particulate filters shall also be performed. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant Dose Equivalent I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing the filters. The LLDs may be increased by a factor of 10 for these samples.

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.

I. **IF** Unit 1 and 3 gaseous doses do not exceed 20% of their limits, **THEN** sampling and analysis of containment vacuum system and gaseous radwaste are not required.

I.D GASEOUS EFFLUENTS (Cont'd)

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 inoperable 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 continuously 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 inoperable equipment or subsystems, and the reason for the inoperability,
- Action(s) taken to restore the inoperable equipment to OPERABLE status, and
- Summary description of action(s) taken to prevent a recurrence.

I.D GASEOUS EFFLUENTS (Cont'd)

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 from all major and potential significant release pathways. 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 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 in NUREG-1301.

FIGURE RESERVED

FIGURE I.D-1

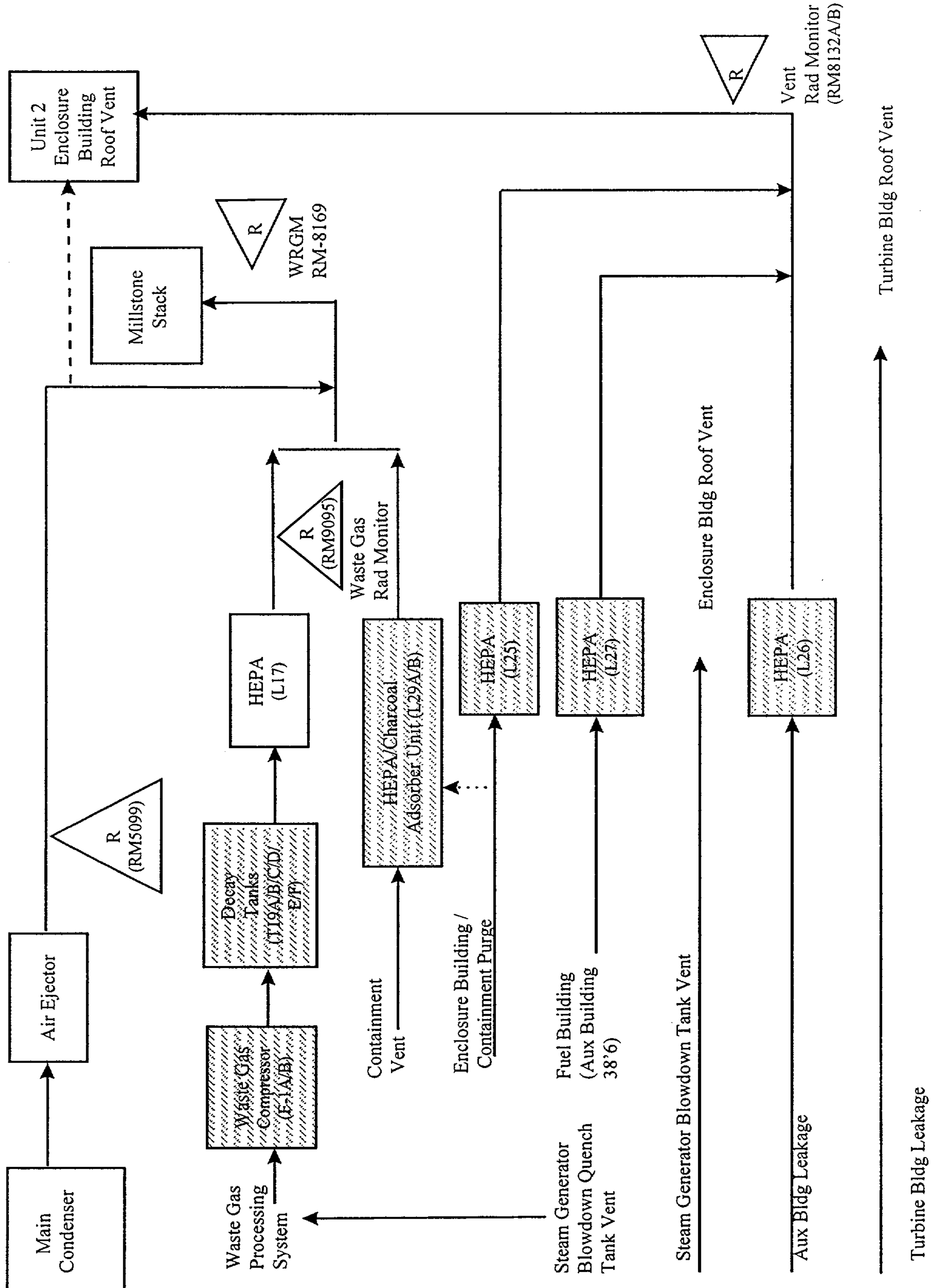

FIGURE I.D-2
SIMPLIFIED AIRBORNE EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT TWO

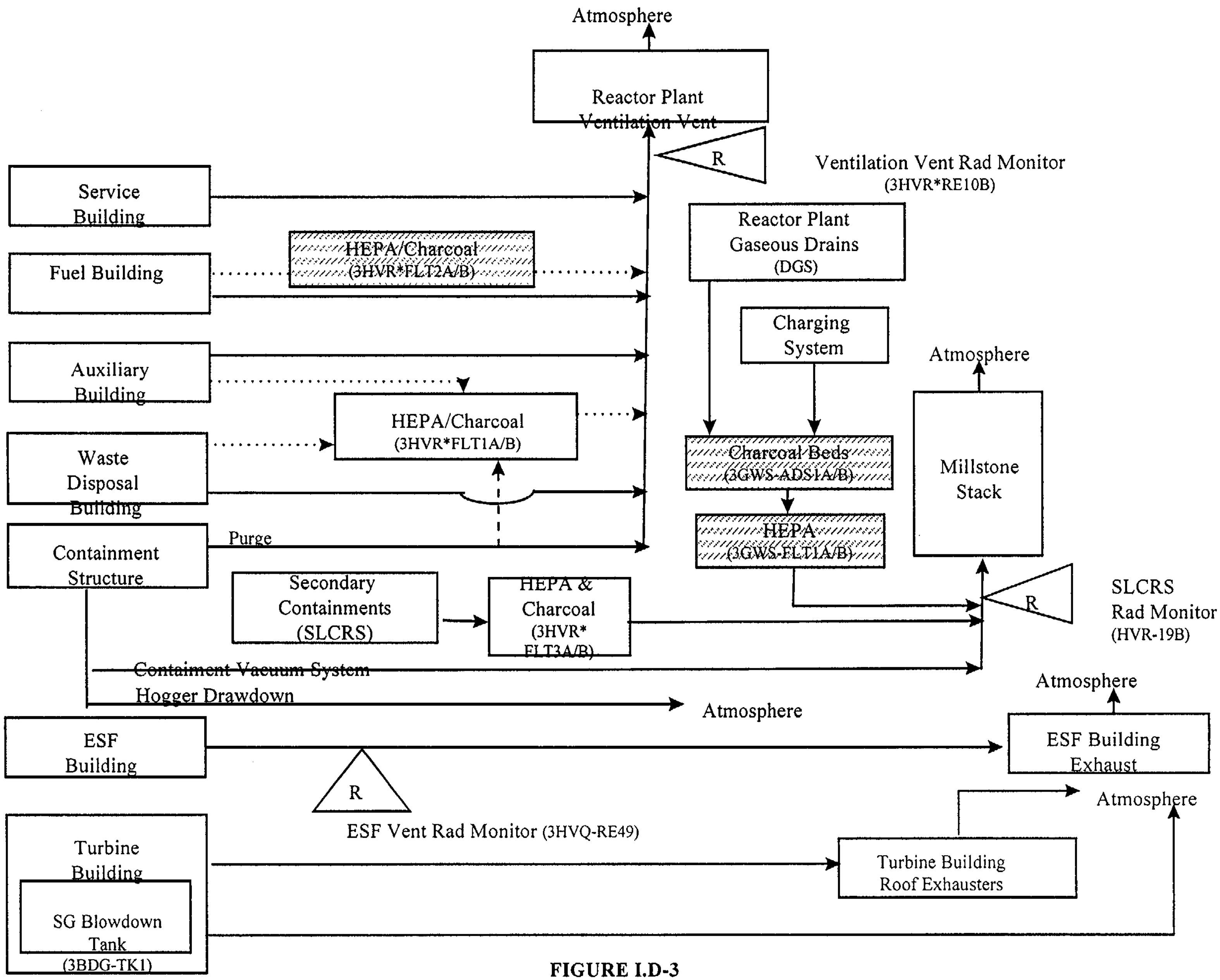

FIGURE I.D-3
SIMPLIFIED AIRBORNE EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT THREE

I.E. RADIOLOGICAL ENVIRONMENTAL MONITORING

1. Sampling and Analysis

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

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

All deviations from the sampling schedule shall be documented in the *Annual Radiological Environmental Operating Report* pursuant to *Section I.F.1.* It is recognized that, at times, it may not be possible or practicable to 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 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:

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

I.E. RADIOLOGICAL ENVIRONMENTAL MONITORING (Cont'd)

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 (Section III.D.1.b, III. D.2.b, or III.D.2.c for Unit 1; Section IV.E.1.b, IV.E.2.b, or IV.E.2.c for Unit 3; and Section V.E.1.b, V.E.2.b, or V.E.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	Number of Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1a. Gamma Dose - Environmental TLD	17	Monthly	Gamma Dose - Monthly
1b. Gamma Dose - Accident TLD	18	Quarterly[a]	N/A[a]
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	Monthly	Gamma Isotopic and I-131 on each sample; Sr-89 and Sr-90 on Quarterly Composite
5a. Pasture Grass	4	Sample as necessary to substitute for unavailable milk	Gamma Isotopic and I-131
6. Sea Water	2	Continuous sampler with a quarterly collection at indicator location. Quarterly at control location - Composite of 6 weekly grab samples	Gamma Isotopic and Tritium on each sample.
7. Bottom Sediment	5	Semiannual	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) Accident monitoring TLDs to be dedosed at least quarterly.

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			
Number*	Name	Direction & Distance from Release Point**	Sample Types
1-I	On-Site - Old Millstone Road	0.6 Mi, NNW	TLD, Air Particulate, Iodine, Vegetation
2-I	On-Site - Weather Shack	0.3 Mi, S	TLD, Air Particulate, Iodine
3-I	On-Site - Bird Sanctuary	0.3 Mi, NE	TLD, Air Particulate, Iodine
4-I	On-Site - Albacore Drive	1.0 Mi, N	TLD, Air Particulate, Iodine
5-I	MP3 Discharge	0.1 Mi, SSE	TLD
6-I	Quarry Discharge	0.3 Mi, SSE	TLD
7-I	Environmental Lab Dock	0.3 Mi, SE	TLD
8-I	Environmental Lab	0.3 Mi, SE	TLD
9-I	Bay Point Beach	0.4 Mi, W	TLD
10-I	Pleasure Beach	1.2 Mi, E	TLD, Air Particulate, Iodine
11-I	New London Country Club	1.6 Mi, ENE	TLD, Air Particulate, Iodine
12-C	Fisher's Island, NY	8.7 Mi, ESE	TLD
13-C	Mystic, CT	11.5 Mi, ENE	TLD
14-C	Ledyard, CT	12.0 Mi, NE	TLD
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
18-I	Pleasure Beach	1.2 Mi, E	Vegetation
21-I	Goat Location No. 1	2.0 Mi., N	Milk
22-I	Goat Location No. 2	5.2 Mi, NNE	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
29-I	West Jordan Cove	0.4 Mi, NNE	Clams
31-I	Niantic Shoals	1.8 Mi, NW 1.5 Mi, NNW	Bottom Sediment, Oysters Mussels
32-I	Vicinity of Discharge		Bottom Sediment, Oysters, Lobster, Fish, 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
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

* I = Indicator; C = Control.

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

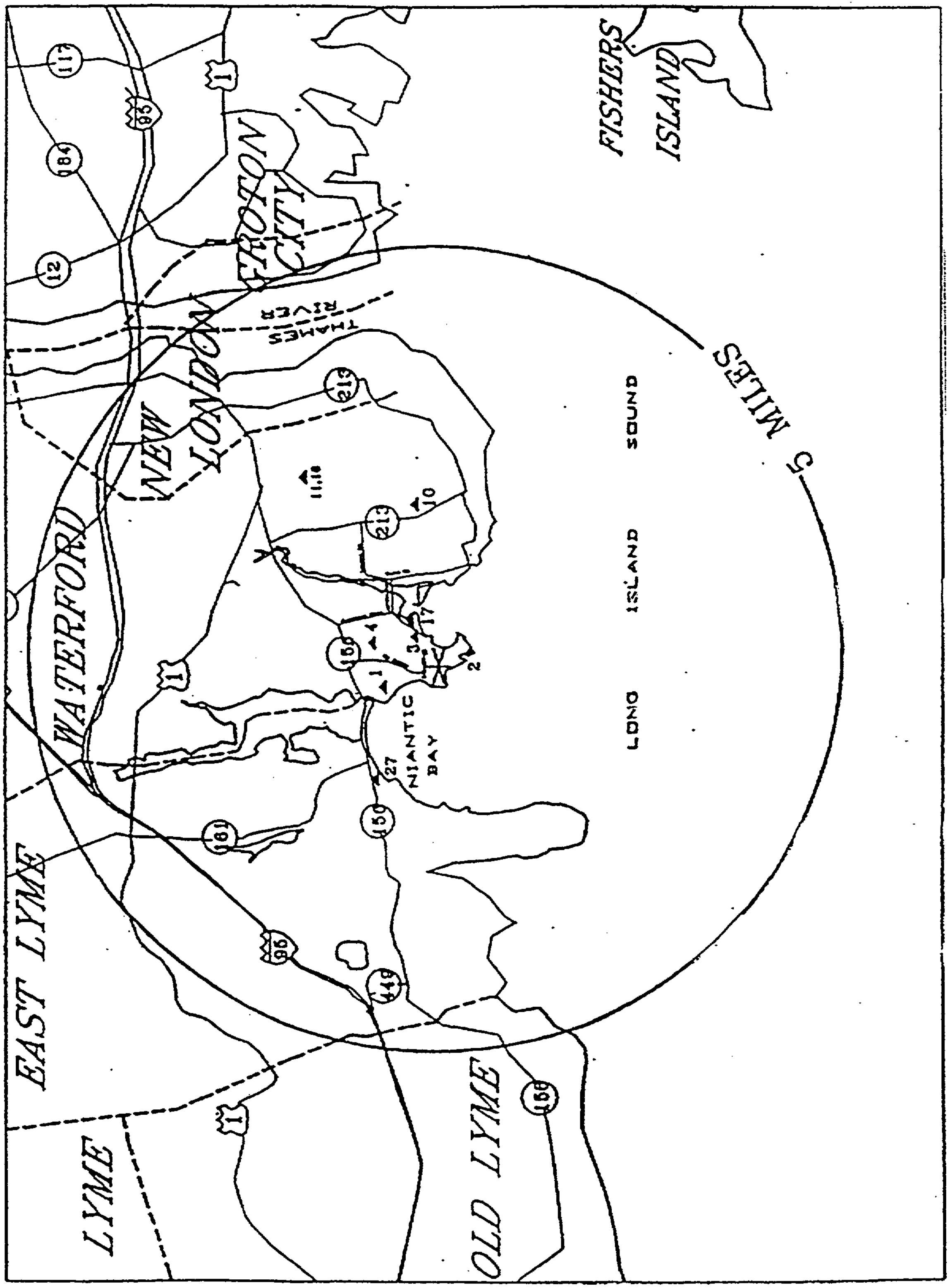

FIGURE I.E-1

INNER AIR PARTICULATE AND VEGETATION MONITORING STATIONS

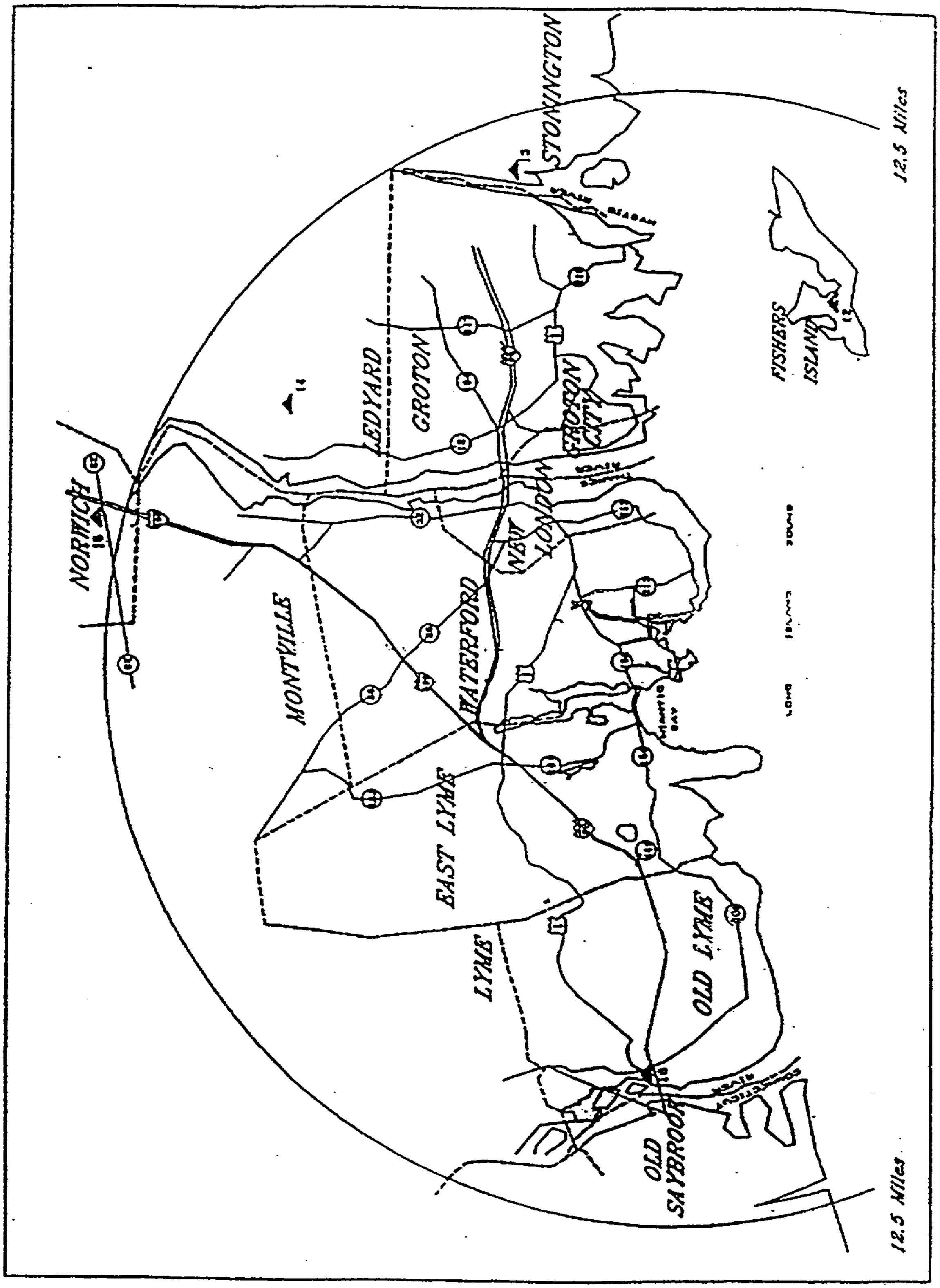

FIGURE I.E-2

OUTER TERRESTIAL MONITORING STATIONS

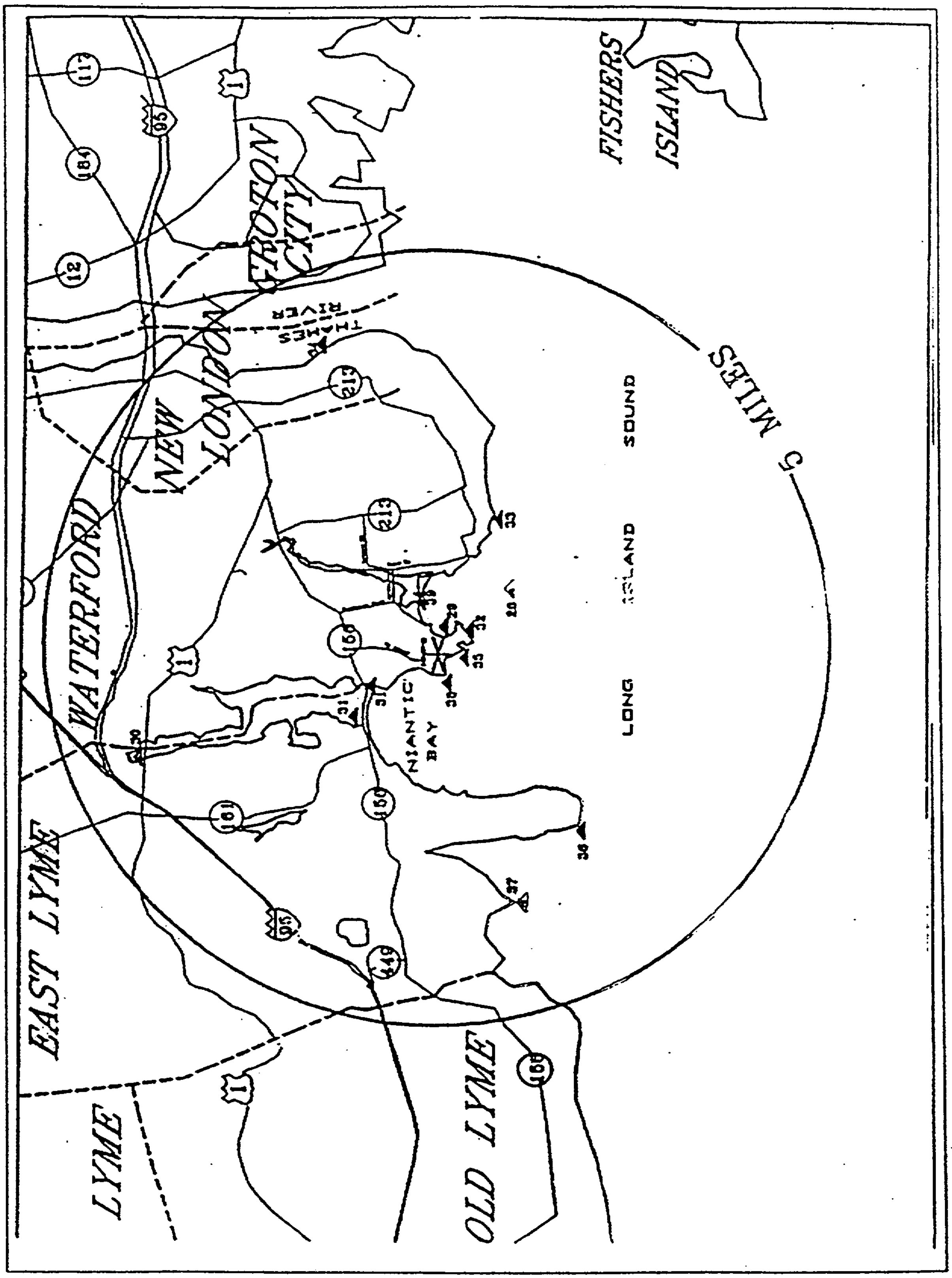

FIGURE I.E-3

AQUATIC SAMPLING 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/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
gross beta		1×10^{-2}				
H-3	2000[d]					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	15[c]	7×10^{-2}		1	60[b]	
Cs-134	15	5×10^{-2}	130	15	60	150
Cs-137	18	6×10^{-2}	150	18	80	180
Ba-140	60[c]			70		
La-140	15[c]			25		

TABLE I.E-4 (Cont'd)

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 is the lower limit of detection as defined above (as pCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 is the number of transformations per minute per picocurie

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 (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.

I.E. RADIOLOGICAL ENVIRONMENTAL MONITORING (Cont'd)

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.

I.E. RADIOLOGICAL ENVIRONMENTAL MONITORING (Cont'd)

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 pasture grass 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). The required LLDs are from NUREGs-1301 and 1302.

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.F. REPORT CONTENT

1. Annual Radiological Environmental Operating Report

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

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

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

F.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 time 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 the following information for 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:

- 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
UNIT NOs. 1, 2, & 3

DOCKET NOs. 50-245, 50-336, 50-423

Revision 20
January 25, 2001

MILLSTONE STATION
RADIOLOGICAL EFFLUENT MONITORING AND OFFSITE DOSE CALCULATION MANUAL (REMODCM)

SECTION II: OFFSITE DOSE CALCULATION MANUAL (ODCM)

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APPENDICES

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 Reference Manual *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 Senior Vice President and CNO - 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 Millstone Radiological Effluent Program Reference Manual (MP-13-REM-REF01).

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)

For Unit 1:

$$D_W = 2.5\ C_F + 5.6 \times 10^{-7}\ C_H$$

For Units 2 and 3:

$$D_W = 2 \times 10^{-2}\ C_F + 5.6 \times 10^{-7}\ C_H$$

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.

II.C. LIQUID DOSE CALCULATIONS (Cont'd)

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 the REMODCM Technical Information Manual (MP-13-REM-REF02).

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)**

For Unit 1:

$$D_O = 2.1\ C_F$$

For Units 2 and 3:

$$D_O = 0.2\ C_F$$

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 the REMODCM Technical Information Manual (MP-13-REM-REF02).

II.C. LIQUID DOSE CALCULATIONS (Cont'd)

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. 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. 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.

II.C. LIQUID DOSE CALCULATIONS (Cont'd)

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)

The projected monthly whole body dose (Unit 1) is determine from:

$$D^E_{MW} = D'_{MW} * R_1 * R_2 * F$$

The projected monthly maximum organ dose is determine from:

$$D^E_{MO} = D'_{MO} * R_1 * R_2 * F$$

Where:

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

D'_{MO} = the maximum organ dose from the last typical (see notes) 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 primary coolant activity for the present month to that for the past month.

F = 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-0016 or past experience shall be used to determine the effect of each form of treatment which will vary. F = 1 if there are no expected differences.

Notes:

1. The last typical month should be one without significant operational differences from the projected month.
2. 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.
3. If the last typical month's doses were calculated using LADTAP II (or similar methodology), also multiply the LADTAP doses by R_5 where R_5 = total dilution flow from LADTAP run divided by estimated total dilution flow.

II.C. LIQUID DOSE CALCULATIONS (Cont'd)

b. Whole Body and Maximum Organ (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.*

***Note:** See notes in Section II.C.5.a.

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 the REMODCM Technical Information Manual (MP-13-REM-REF02).

II.C. LIQUID DOSE CALCULATIONS (Cont'd)

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 *Reference Manual, "REMODCM Technical Information Document (MP-13-REM-REF02).* 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 nobles 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:

$$\frac{Q_1}{1{,}100{,}000}+\frac{Q_2}{290{,}000}+\frac{Q_3}{290{,}000}\leq 1$$

Where:

Q_1 = Noble gas release rate from Site Stack (μCi/sec)
Q_2 = Noble gas release rate from MP2 Vent (μCi/sec)
Q_3 = 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.

b. Method 1 for Release Rate Limit - I-131, I-133, H-3 and Particulates With 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:

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

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

Where the contribution from each Unit is calculated from:

Unit 1: $DR_{thy1} = 5.5 \times 10^{-4}\ {}_{131}Q_{I1} + 1.33 \times 10^{-4}\ {}_{133}Q_{I1} + 4.4 \times 10^{-8}\ Q_{H1}$
Unit 2: $DR_{thy2} = 5.1 \times 10^{-2}\ {}_{131}Q_{I2} + 1.25 \times 10^{-2}\ {}_{133}Q_{I2} + 4.2 \times 10^{-6}\ Q_{H2}$
Unit 3: $DR_{thy3} = 5.1 \times 10^{-2}\ {}_{131}Q_{I3} + 1.25 \times 10^{-2}\ {}_{133}Q_{I3} + 4.2 \times 10^{-6}\ Q_{H3}$

(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: $DR_{org1} = 5.5 \times 10^{-4}\ Q_{P1} + 4.4 \times 10^{-8}\ Q_{H1}$
Unit 2: $DR_{org2} = 5.1 \times 10^{-2}\ Q_{P2} + 4.2 \times 10^{-6}\ Q_{H2}$
Unit 3: $DR_{org3} = 5.1 \times 10^{-2}\ Q_{P3} + 4.2 \times 10^{-6}\ Q_{H3}$

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

${}_{131}Q_{I1}$ = Release rate of I-131 from the Site Stack (μCi/sec)
${}_{133}Q_{I1}$ = Release rate of I-133 from the Site Stack (μCi/sec)
${}_{131}Q_{I2}$ = Release rate of I-131 from MP2 Vent (μCi/sec)*
${}_{133}Q_{I2}$ = Release rate of I-133 from MP2 Vent (μCi/sec)*
${}_{131}Q_{I3}$ = Release rate of I-131 from MP3 Vent (μCi/sec)*
${}_{133}Q_{I3}$ = Release rate of I-133 from MP3 Vent (μCi/sec)*
Q_{H1} = Release rate of tritium from the Site Stack (μCi/sec)
Q_{H2} = Release rate of tritium from MP2 Vent (μCi/sec)*
Q_{H3} = Release rate of tritium from MP3 Vent (μCi/sec)*
Q_{P1} = Release rate of total particulates with half-lives greater than 8 days from the Site Stack (μCi/sec)
Q_{P2} = Release rate of total particulates with half-lives greater than 8 days from the MP2 Vent (μCi/sec)
Q_{P3} = Release rate of total particulates with half-lives greater than 8 days from the MP3 Vent (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 REMODCM Technical Information Manual (MP-13-REM-REF02).

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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:

$$D_{G1} = 9.3 \times 10^{-5}\ C_{N1}{**}$$
$$D_{B1} < 9.3 \times 10^{-7}\ C_{N1}{**}$$

For Unit 2:

$$D_{G2} = 6.3 \times 10^{-4}\ C_{N2}{**}$$
$$D_{B2} = 1.7 \times 10^{-3}\ C_{N2}{**}$$

For Unit 3:

$$D_{G3} = 6.3 \times 10^{-4}\ C_{N3}{**}$$
$$D_{B3} = 1.7 \times 10^{-3}\ C_{N3}{**}$$

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_{N1} = The total curies of noble gas released from Site Stack* during the period of interest.
C_{N2} = The total curies of noble gas released from Unit 2 during the period of interest. Include all sources - Unit 2 Vent, containment purges and waste gas decay tanks.
C_{N3} = The total curies of noble gas released from Unit 3 during the period of interest. Include all sources - Unit 3 Vent, ESF Building Vent, and containment purges and drawdowns.

* Includes contributions from all three units. If 10% of the airborne dose limits are exceeded, a Special Assessment will be performed to determine the dose attributable to each unit individually. The intent is to prevent double accounting of normal routine releases. Special sampling for batch releases is not required at the Site Stack.

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

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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

Site Stack For dose calculations for releases from the Site Stack, use the AIREM computer code to determine the critical location air doses.

The 3rd quarter 1980 joint frequency data shall be used as input for the AIREM code. The reason for this is given in the *REMODCM Technical Information Document (MP-12-REF02), Section 4.2.*

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

Units 2 and 3 releases For dose calculations for releases from Units 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:

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

(See the *REMODCM Technical Information Document (MP-12-REM-REF02), Attachment 5*)

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

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

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

3. 10 CFR50 Appendix I - Iodine 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.

Doses from tritium (for Methods 1a-2a only) for Unit 1 may be neglected if the total tritium curies from the quarter are less than 500.

a. Critical Organ Doses (Applicable to Site Stack releases)

(1) Method 1a - Site Stack

The maximum organ dose is the greater of D_T or D_O:

$$D_T = 1.22 \times 10^{2}\,{}_{131}C_I + 1.13\,{}_{133}C_I + 2.0 \times 10^{-5} C_H$$
$$D_O = 42.3 C_P + 2.0 \times 10^{-5} C_H$$

If either dose is greater than 2.5 mrem within a calendar quarter go to Method 1b below.

Where:

D_T = The thyroid dose for the period of release of gaseous effluents.
D_O = The dose to the maximum organ other than the thyroid for the period of gaseous effluent release.
${}_{131}C_I$ = The total curies of I-131 released in gaseous effluents from Site Stack* during the period of interest.
${}_{133}C_I$ = The total curies of I-133 released in gaseous effluents from Site Stack* during the period of interest.
C_P = The total curies of particulates with half-lives greater than 8 days released in gaseous effluents from Site Stack* during the period of interest.
C_H = The total curies of tritium released in gaseous effluents from Site Stack* during period of interest.

***Note:** Site Stack samples include releases from all units. If 10% of any airborne limits are exceeded, a Special Assessment will be required to determine the dose attributable to each unit individually. The intent is to prevent double accounting of normal routine releases. Special sampling for batch releases is not required at the Site Stack.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

(2) **Method 1b - Site Stack**

Doses from vegetation consumption can be neglected during the 1st and 4th quarters and doses from milk consumption can be neglected during the 1st quarter. These time frames can be extended for short term releases (batch releases and weekly continuous, if necessary) if it can be verified that the milk animals were not on pasture and/or vegetation is not available for harvest. Therefore, calculate doses to the thyroid and maximum organ for pathways that actually exist. Sum pathways if necessary.

With the same determination of radioactivity released in Method 1a above, calculate the pathway related dose as follows:

i. **Inhalation Pathway**

$$D_T = 3.2 \times 10^{-2}\,{}_{131}C_I + 7.8 \times 10^{-3}\,{}_{133}C_I + 2.6 \times 10^{-6} C_H$$
$$D_O = 3.2 \times 10^{-2} C_P + 2.6 \times 10^{-6} C_H$$

ii. **Vegetation Pathway**

$$D_T = 4.1\,{}_{131}C_I + 7.48 \times 10^{-2}\,{}_{133}C_I + 8.0 \times 10^{-6} C_H$$
$$D_O = 4.9\, C_P + 8.0 \times 10^{-6} C_H$$

iii. **Milk Pathway**

$$D_T = 118\,{}_{131}C_I + 1.05\,{}_{133}C_I + 9.8 \times 10^{-6} C_H$$
$$D_O = 38\, C_P + 9.8 \times 10^{-6} C_H$$

Sum above pathways, as appropriate (Note: sum of all three pathways is *Method 1a).*

The maximum organ dose is the greater D_T or D_O. If it is greater than 2.5 mrem within a calendar quarter go to Method 1c.

(3) **Method 1c - Site Stack**

After reviewing the existing cow and goat farms, if it can be determined that the 1983 -1987 D/Q data is acceptable (Note: If not, see guidance in the *REMODCM Technical Information Document (MP-12-REM-REF02) Section 4.2,* then follow *Method 1b* above, except for *iii.* where milk pathway dose is:

$$D_T = 28\,{}_{131}C_I + 0.249\,{}_{133}C_I + 9.8 \times 10^{-6} C_H$$
$$D_O = 8.9\, C_P + 9.8 \times 10^{-6} C_H$$

Note: During the 2nd and 3rd quarters also add (to the above) the Inhalation and Vegetation Pathways from *Method1b;* during the 4th quarter add Inhalation and Milk (above) only.

(4) **Method 2a - Site Stack**

Use the GASPAR code, or a code which uses the methodology given in Regulatory Guide 1.109, to determine the maximum organ dose. For the Special Location, enter the following worst case quarterly average meteorology as taken from the *REMODCM Technical Information Document (MP-12-REM-REF02), Attachment 5:*

II.D. <u>GASEOUS DOSE CALCULATIONS</u> (Cont'd)

$X/Q = 6.1 \times 10^{-8}$ sec/ m^3
$D/Q = 5.9 \times 10^{-9}\ m^{-2}$ (Milk and Vegetation) and/or
$D/Q = 1.4 \times 10^{-9}\ m^{-2}$ (If 1983-1987 D/Q data is acceptable for existing milk locations. If not, see guidance in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.)*

Use the Inhalation, Milk and Vegetation pathways (if applicable) in totaling the dose. If the maximum organ dose is greater than 3.8 mrem within a calendar quarter go to *Method 2b*.

(5) **Method 2b - Site Stack**

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.

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

(1) **Method 1a - Unit 2 and Unit 3 releases**

The maximum organ dose is the greater of D_T or D_O.

$$D_T = 3.1 \times 10^3\ {}_{131}C_I + 29.53\ {}_{133}C_I + 2.6 \times 10^{-3}\ C_H$$
$$D_O = 1.1 \times 10^3\ C_P + 2.6 \times 10^{-3}\ C_H$$

If either dose is greater than 2.5 mrem within a calendar quarter go to Method 1b for Units 2 and 3 below.

Where:

D_T = The thyroid dose for the period of gaseous effluents releases.
D_O = The dose to the maximum organ other than the thyroid for the period of gaseous effluent releases.
${}_{131}C_I$ = The total curies of I-131 in gaseous effluents from Unit 2 (Unit 2 Vent and Steam Generator Blowdown Tank Vent*) or Unit 3 (Unit 3 Vent, ESF Building Vent, Steam Generator Blowdown Tank Vent*, and Containment Drawdown**) during the period of interest.***
${}_{133}C_I$ = The total curies of I-133 in gaseous effluents from Unit 2 (Unit 2 Vent and Steam Generator Blowdown Tank Vent*) or Unit 3 (Unit 3 Vent, ESF Building Vent, Steam Generator Blowdown Tank Vent*, and Containment Drawdown**) during the period of interest.***
C_P = The total curies of particulates with half-lives greater than eight days released in gaseous effluents from the Unit 2 Vent or Unit 3 (Unit 3 Vent, ESF Building Vent, and Containment Drawdown**) during the period of interest.***
C_H = The total curies of tritium released in gaseous effluents from the Unit 2 Vent or Unit 3 (Unit 3 Vent, ESF Building Vent and Containment Drawdown**) during the period of interest.***

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

* Results from SAI studies in 1982 and 1983 and guidance provided in the R. A. Crandall / E. R. Brezinski memo to E. J. Mroczka, Millstone Unit 2 Steam Generator Blowdown Tank Releases, NE-83-RA-879, June 15, 1983, indicate that the steam generator blowdown tank vent releases can be estimated by use of a factor of 1/6,000 (a DF of 2001 and a partitioning factor of 1/3). Although Unit 3 normally recycles blowdown, periodically blowdown is released for short periods of time. These releases should be similar to Unit 2 and until studies can be performed at Unit 3 the same calculation should be performed. Based upon the above, the formula to be used is:

S/G blowdown concentration x S/G blowdown flow rate x 1/6000 x time = integrated activity

** This pathway does not have a effluent monitor.

*** Unit 2 and 3 also have releases via the Site Stack. This activity will be included in the Site Stack calculations unless 10% of any airborne limit is exceeded and/or a Special Evaluation is performed.

(2) **Method 1b - Unit 2 and Unit 3 releases**

Doses from vegetation consumption can be neglected during the 1st and 4th quarters and doses from milk consumption can be neglected during the 1st quarter. These time frames can be extended for short term releases (batch releases and weekly continuous, if necessary) if it can be verified that the milk animals were not on pasture and/or vegetation was not available for harvest. Therefore, calculate doses to the thyroid and maximum organ for pathways that actually exist. Sum pathways, if necessary.

With the same determination of radioactivity released in Method 1a above, calculate the pathway-related doses as follows:

i. **Inhalation Pathway** (1st, 2nd, 3rd and 4th Quarters)

$$D_T = 4.1\ {}_{131}C_I + 1.0\ {}_{133}C_I + 3.3 \times 10^{-4}\ C_H$$
$$D_O = 4.1\ C_P + 3.3 \times 10^{-4}\ C_H$$

ii. **Vegetation Pathway** (2nd and 3rd Quarters)

$$D_T = 105\ {}_{131}C_I + 1.9\ {}_{133}C_I + 1.0 \times 10^{-3}\ C_H$$
$$D_O = 124\ C_P + 1.0 \times 10^{-3}\ C_H$$

iii. **Milk Pathway** (2nd, 3rd and 4th Quarters)

$$D_T = 3000\ {}_{131}C_I + 26.6\ {}_{133}C_I + 1.3 \times 10^{-3}\ C_H$$
$$D_O = 951\ C_P + 1.3 \times 10^{-3}\ C_H$$

Sum above pathways, as appropriate (Note: sum of all three pathways is *Method 1a).*

The maximum organ dose is the greater of D_T or D_O. If it is greater than 2.5 mrem within a calendar quarter, go to the Method 1c.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

(3) **Method 1c - Unit 2 and Unit 3 releases**

After reviewing the existing cow and goat farms, if it can be determined that the 1983-1987 D/Q data is acceptable (Note: If not, see guidance in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2)* then follow *Method1b*, above, except for *iii* where the milk pathway dose is:

$D_T = 122\,{}_{131}C_I + 1.08\,{}_{133}C_I + 1.3 \times 10^{-3}\, C_H$
$D_O = 40\, C_P + 1.3 \times 10^{-3}\, C_H$

Note: During the 2nd and 3rd quarters also add (to the above) the Inhalation and Vegetation Pathways from *Method1b above;* during the 4th quarter add Inhalation and Milk (above) only.

(4) **Method 2a - Unit 2 and Unit 3releases**

Use the GASPAR code, or a code which uses the methodology given in Regulatory Guide 1.109, to determine the maximum organ dose. For the Special Location, enter the following worst case quarterly average meteorology as taken from the *REMODCM Technical Information Document (MP-12-REM-REF02), Attachment 5:*

$X/Q = 8.1 \times 10^{-6}$ sec/ m^3
$D/Q = 1.5 \times 10^{-7}\ m^{-2}$ (Milk and Vegetation) and/or
$D/Q = 6.1 \times 10^{-9}\ m^{-2}$
(If 1983-1987 D/Q data is acceptable for existing milk locations. If not, see guidance in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.)*

As shown in the *REMODCM Technical Information Document (MP-12-REM-REF02), Attachments 4 and 5,* the same meteorology can be used for both continuous and batch releases. Therefore, the program need only be run once using the total curies from all releases from Unit 2 or 3 releases.

Use the Inhalation, Milk and Vegetation pathways (if applicable) in totaling the dose.

If the maximum organ dose is greater than 3.8 mrem, go to *Methods 2b and 2c.*

(5) **Method 2b - Unit 2**

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. The code shall be run separately for steam generator blowdown tank vents and ventilation releases, containment purges and waste gas tank releases.

(6) **Method 2c - Unit 3**

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 these locations. The code shall be run separately for ventilation, process gas, containment vacuum system, aerated ventilation and containment purges.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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} (mrad) = $9.3 \times 10^{-5}\ C^{E}_{N}$
D^{E}_{MB} (mrad) = $9.3 \times 10^{-7}\ C^{E}_{N}$
D^{E}_{MB} = the estimated monthly beta air dose.

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.

(The dose conversion factor is from the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2,* for the Site Stack releases since the Unit 2 waste gas tanks are discharged via the Site Stack. This factor should be conservative as the isotopic mix would only be the longer-lived noble gases which would have lower dose conversion factors than the typical mix from Unit 1.)

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

i. Method 1

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

$$D^{E}_{MO} = 1/3\ R_1 \times D_T$$

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

Where:

R_1 = the expected ratio of secondary coolant iodine level for the coming month as compared with the average level during the quarter used in 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.*

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

(3) **Due to Ventilation Releases (Unit 2)****

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

i. **Method 1**

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

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

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

R_1 = the expected reduction factor for the HEPA filter. Typically this should be 100 *(see NUREG-0016 or 0017 for additional guidance).*
R_2 = the fraction of the time which the equipment was inoperable during the last quarter.
R_3 = the fraction of the time which the equipment is expected to be inoperable during the next month.

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.

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:

$$D^E_{MG}\ (\text{mrad}) = 9.3 \times 10^{-5}\ C^E_N$$
$$D^E_{MB}\ (\text{mrad}) = 9.3 \times 10^{-7}\ C^E_N$$

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 *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2,* for the Site Stack releases since the Unit 3 reactor plant gaseous vents are discharged via the Site Stack.)

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

(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.

$$D^E_{MO} = 1/3\ R_1 \times D_T$$

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

Where:

R_1 = 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.

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

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

Where:

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

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

R_3 = the fraction of the time which the equipment is 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.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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 codes GASPAR and AIREM, or codes 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 Stored 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.F (Unit 2) and V.F (Unit 3) contain specific requirementsfor 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 (RER's) where total off-site doses from all sources are considered to ensure compliance with 40CFR190.

II.D. GASEOUS DOSE CALCULATIONS (Cont'd)

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 (pre-1991) 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 Site 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 the Station Reference Manual, "*REMODCM Technical Information Document (MP-13-REM-REF02)*. 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 MONITOR SETPOINTS

1. Unit 1 Liquid Radwaste Effluent Line

The trip/alarm setting on the Unit 1 liquid radwaste discharge line depends 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:

Determine the allowable discharge flow (F) from:

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

Where:

R = Required Reduction Factor = $\dfrac{1}{\Sigma \{\mu Ci/ml \text{ of nuclide } i \, / \, MPC \text{ of nuclide } i\}}$.

Based on the tank isotopic analysis and the MPC values for each identified nuclide (including noble gases*) determine to be in the liquid radwaste effluent.

D = The existing dilution flow * (Note: D = # service water pumps x 8,000 gpm + # emergency service water pumps x 2,500 gpm

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:

$$S = 2 \times AC \times Ca$$

Where:

S = The setpoint of the monitor (cps).
AC = The total measured radwaste effluent concentration (µCi/ml) in the waste tank.
Ca = The current calibration factor for the radwaste effluent line monitor.
2 = The multiple of expected count rate on the monitor based on the radioactivity concentration in the tank.

This value or that corresponding to 2.1×10^{-5} µCi/ml**, whichever is greater, plus background is the trip setpoint. For the latter setpoint, independent valve verification shall be performed and a minimum dilution flow of 2,500 gpm shall be verified and if necessary, appropriately adjusted.

The allowable discharge flow rate (F) calculated above may be increased by up to a factor of 5 with appropriate administrative controls (e.g., ensure other release points may not cause MPC's to be exceeded).

* If necessary, credit for other unit dilution flow can be taken as long as administrative controls are in place to assure MPC's are not exceeded. When using other unit dilution flow, at least one circulating water pump from the other unit shall be operating and the setpoint shall be equal to 8.5×10^{-4} uCi/ml. The value of 8.5×10^{-4} is based on a maximum discharge flow of 350 gpm, a minimum dilution flow of 100,000 gpm, and an effective maximum permissible concentration of 3×10^{-6}. The concentration assumes that Sr-90 is present at 10% of total activity.

** The value of 2.1×10^{-5} is based on the same parameters as the previous note except minimum dilution flow is 2,500 gpm.

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

2a. Unit 1 Reactor Building Service Water Effluent Line

The MP1 Reactor Building Service Water Monitor is approximately two times the ambient background reading on the monitor in counts per second.

2b. Unit 1 Reactor Building Service Water Effluent Concentration Limitation

Results of analysis of service water sample taken in accordance with Table I.C-1 of Section I of the REMODCM shall be used to limit radioactivity concentrations in the service water to less than the limits in 10CFR20, Appendix B (version prior to January 1, 1994).

3. Unit 2 Clean Liquid Radwaste Effluent Line

Similar to the Unit 1 liquid discharge line, the setpoint on the Unit 2 clean liquid waste effluent line 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:

From the tank isotopic analysis and the MPC values for each identified nuclide (including noble gases*) determine the required reduction factor, i.e.:

For Nuclides Other Than Noble Gases:

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

For Noble Gases*:

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

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

* In lieu of determining the required reduction factor for noble gases, conservatism is allowed. For example, calculate the maximum concentration of noble gases that can be discharged from any tank.

Assuming:

Maximum discharge rate = 350 gpm

Normal Minimum dilution flow = 200,000 gpm (2 *circulating pumps, less than rated due to biotic fouling)*)

$$\text{Maximum Noble Gas Concentration} \times \frac{350\ \text{gpm}}{200{,}000\ \text{gpm}} = 2\ \text{x}10^{-4}\ \mu\text{Ci / ml}$$

Therefore,

Maximum concentration = 0.11 μCi/ml

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

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 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.

The allowable discharge flow rate (F) may be increased by up to a factor of 5 with appropriate administrative controls to ensure other releases concurrent with releases from this pathway would not cause MPC's to be exceeded.

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

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

Where:

R_{set} = The setpoint of the monitor (cps).
AC = The total radwaste effluent concentration (μCi/ml) in the tank.
Ca = The current calibration factor for the effluent line monitor.
2 = The multiple of expected count rate on the monitor based on the radioactivity concentration in the tank.

This value or that corresponding to 1.7×10^{-4} 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), normal minimum dilution water flow (200,000 gpm for MP2) and an assumed worst case mix of nuclides (3×10^{-7} - I-131 MPC). 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.

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

4. Unit 2 Aerated Liquid Radwaste Effluent Line and Condensate Polishing Facility Waste Neutralization Sump Effluent Line

Same as II.E.3 for Clean Liquid Monitor and the Condensate Polishing Facility (CPF) Waste Neutralization Sump monitor except the CPF monitor has the capability to readout in CPM or µCi/ml. For the CPF Waste Neutralization Sump monitor, use a default setpoint if no chemistry grab samples are required. This default shall be the lower of: two times background or the value as specified in II.E.3.

5a. Unit 2 Steam Generator Blowdown

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 10% of the *10CFR Part 20* limit for I-131 ($0.1 \times 3 \times 10^{-7}$ µCi/ml = 3×10^{-8} µCi/ml)*

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:

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

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

<u>**Note**</u>: 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 the I-131 MPC value, the identified MPC values for unrestricted area may be used.

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

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

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 the concentration limits in 10CFR20, Appendix B (version prior to January 1, 1994).

6. Unit 2 Condenser Air Ejector

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

7a. Unit 2 Reactor Building Closed Cooling Water

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 allowable limits 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 10CFR20 limits 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 Turbine Building Sump Effluent Concentration Limitation

Results of analyses of service water 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 and turbine building sump effluents to less than the limits in 10CFR20, Appendix B (version prior to January 1, 1994).

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

8. Unit 3 Liquid Waste Monitor

Similar to the Unit 1 liquid discharge line, 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:

From the tank isotopic analysis and the MPC values for each identified nuclide (including noble gases*) determine the required reduction factor, i.e.:

For Nuclides Other Than Noble Gases*:

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

For Noble Gases:*

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

$$= 2\text{x}10^{-4} / \Sigma\ \mu\text{Ci/ml of noble gases}$$

$$R \ = \text{the smaller of } R_1 \text{ or } R_2$$

* In lieu of determining the required reduction factor for noble gases, conservatism is allowed. For example, calculate the maximum concentration of noble gases that can be discharged from any tank.

Assuming:

Maximum discharge rate = 150 gpm

Normal Minimum dilution flow = 300,000 gpm (2 *circulating pumps)*

$$\text{Maximum "Allowable" Concentration x } \frac{150 \text{ gpm}}{300{,}000 \text{ gpm}} = 2 \text{ x}10^{-4}\ \mu\text{Ci/ml}$$

Therefore,

Maximum "allowable" concentration = 0.4 μCi/ml

Determine the allowable discharge flow (F)

F = 0.1 x R x D

Where:

D = The existing dilution flow (D): (Note: D = # circulating water pumps x 150,000 gpm + # service water pumps x 15,000 gpm

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.

The allowable discharge flow rate (F) may be increased by up to a factor of 5 with appropriate administrative controls to ensure other releases concurrent with release from this release pathway would not cause MPC's to be exceeded.

II.E. **LIQUID MONITOR SETPOINTS (Cont'd)**

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

R_{set} = 2 x AC x Ca (see Note 1)

Where:

R_{set} = The setpoint of the monitor (cps).
AC = The total radwaste effluent concentration (µCi/ml) in the tank.
Ca = The current calibration factor for the effluent line monitor.
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 x 10^{-4} 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.

Note 2: This value is based upon worst case conditions, assuming maximum discharge flow (150 gpm), minimum dilution water flow (2 circulating pumps = 300,000 gpm), and an assumed mix of nuclides as specified for an unidentified liquid release in *10CFR20* (1 x 10^{-7} µCi/ml). 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**

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**

Same as *Section II.E.8*. Note that for this monitor, even though grab samples may not be required, setpoints still have to be utilized. In such cases, the default shall be the lower of: two times background or the value as specified in II.E.8.

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

11a. Unit 3 Steam Generator Blowdown

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 10% of the *10CFR Part* 20 limit (0.1 times the I-131 MPC* for unrestricted areas which equals $0.1 \times 3 \times 10^{-7}$ μCi/ml).

c. Minimum possible circulating and service water dilution flow during periods of blowdown = 300,000 gpm (2 circulating water pumps) + 30,000 gpm (2 service water pumps) = 330,000 gpm.

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

Therefore, the alarm setpoint corresponds to a concentration of:

$$\text{Alarm } (\mu\text{Ci/ml}) = \frac{330{,}000}{400} \times 3 \times 10^{-8} + \text{background} = 2.47 \times 10^{-5}\ \mu\text{Ci/ml} + \text{background}$$

This setpoint may be increased through proper administrative controls if the steam generator blowdown rate is maintained less than 400 gpm and/or more than 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:

$$\text{Alarm } (\mu\text{Ci/ml}) = 2.47 \times 10^{-5}\ \mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{330{,}000} \times \frac{400}{\text{S/G blowdown (gpm)}} +$$

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

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

* In lieu of using the I-131 MPC value, the identified MPC values for unrestricted area 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 the concentration limits in 10CFR20, Appendix B (version prior to January 1, 1994).

II.E. LIQUID MONITOR SETPOINTS (Cont'd)

12a. Unit 3 Turbine Building Floor Drains Effluent Line

The alarm setpoint for this monitor assumes:

a. Drinking water is not a real pathway at this site. Therefore, the NRC code, LADTAP or other Regulatory Guide 1.109 code, is used to calculate the dose to the maximum individual.

b. The average annual discharge flow is 1.11×10^{-2} ft^3/sec (process flow during sump pump operation is 50 gpm and pump normally operates less than 10% of the time for a conservative average flow of 5 gpm). There is no continuous additional dilution, therefore, there is no dilution prior to discharge.

c. Near field dilution factor = 13,000.
Far field dilution factor = 32,000.
(Reference: Millstone 3 FSAR, Section 2.4.13)

d. Isotopic concentrations were taken from the *Millstone 3 FSAR, Table 11.2-4 (See column under Turbine Building).*

e. Each concentration above was multiplied by the total annual flow (9.95×10^9 cm^3, conservatively assuming 5 gpm continuous as discussed in item b).

f. The maximum individual organ dose is set equal to 1% of 75 mrem (40CFR190 limit). The limiting individual is the child; maximum organ is the thyroid. This value is approximately one quarter of the value

The setpoint corresponding to 0.75 mrem to the child's thyroid is 3.8×10^{-5} µCi/ml.

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

Results of analyses of service water and turbine building sump samples taken in accordance with Table I.C-3 of Section I of the REMODCM shall be used to limit radioactivity concentrations in the service water and turbine building sump effluents to less than the limits in 10CFR20, Appendix B (version prior to January 1, 1994).

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 the limits of 10 CFR Part 20 (Appendix B, Table II, 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 MPC limit for the mix. The setpoint is then selected to be only 2 times the expected concentration, or 20% of the MPC 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. Section reserved

2. Section reserved

II.F. GASEOUS MONITOR SETPOINTS (Cont'd)

3. Site Stack Noble Gas Monitor

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 V.C.2.*

The alarm setpoint shall be set at or below the "cps" corresponding to 363,000 μCi/sec from the Site Stack noble gas monitor calibration curve. The calibration curve (given as μCi/sec per cps) is determined by assuming a maximum ventilation flow of 180,000 CFM.

The release rate value of 363,000 μCi/sec assumes that 33% of the site limit is assigned to the Site Stack. If effluent conditions from the Site Stack approach the alarm setpoint, it may be increased if the MP2 or MP3 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.*

4. Site Stack Sampler Flow Rate Monitor

The Site Stack sampler flow control alarms on low pressure indicating loss of flow, or on high pressure indicating restricted flow.

The alarm will occur with either (per GEK-27681A):

a. Pressure Switch #1 less than 2" Hg (Low Flow, i.e., damaged filter, filter inadvertently left out)

or

b. Pressure Switch #1 greater than 18" Hg (Restricted Flow, i.e., plugged filter)

or

c. Pressure Switch #2 less than 20" Hg (Restricted Flow, i.e., pump abnormalities)

5. Unit 2 Vent - Noble Gas Monitor

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 approach the alarm setpoint, it may be increased if the Site Stack or MP3 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.*

II.F. GASEOUS MONITOR SETPOINTS (Cont'd)

6. Unit 2 Waste Gas Decay Tank Monitor

Administratively all waste gas decay tank releases are via the Site Stack which has a release rate limit typically set at 363,000 μCi/sec (see the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2* for bases). Assuming 33% of the limit is from the Site Stack, the release rate limit for the Site Stack is 363,000 μCi/sec.

Releases from waste gas decay tanks are much lower than this limit and are based upon a dilution factor of 1000 (dilution less than 1% of the worst case quarter X/Q; 210,000 ft^3/min x 6.3 x 10^{-8} sec/m^3 x 0.028317 m^3/ft^3 x 1/60 min/sec = 1/160,000, which is equivalent to 0.6245% of a dilution factor of 1000) and release rates to maintain offsite concentration below MPC values.

The MP2 waste gas decay tank monitor (given μCi/cc per cpm) calibration curve is used to assure that the concentration of gaseous activity being released from a waste gas decay tank is not greater than the concentration used in discharge permit calculations.

7. Unit 3 Vent Noble Gas Monitor

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 9.5 x 10^{-4} μCi/cc for the MP3 vent.

The release rate value of 9.5 x 10^{-4} μCi/cc assumes that 33% of the site limit is assigned to the MP3 vent. This value corresponds to a release rate of 95,000 μCi/sec and a maximum ventilation flow rate of 210,000 CFM (per memo from G. C. Knight to R. A. Crandall, MP-3-1885, July 19, 1989). If effluent conditions from the MP3 vent approach the alarm setpoint, it may be increased if the Site Stack or MP2 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2*.

8. Unit 3 Engineering Safeguards Building Monitor

Assuming releases less than 10% of the MP3 FSAR design releases of noble gases *(Table 11.3-11,* 1.4 x 10^4 Ci/year which is equal to 450 μCi/sec) assures that less than 1% of the above instantaneous release rate is added by this intermittent pathway (450/290,000 = 0.16%). Assuming a flow rate of 6,500 CFM (3.05 x 10^6 cc/sec) for this pathway translates this limit to:

$$0.1 \times 450/3.05 \times 10^6 = 1.5 \times 10^{-5}\ \mu Ci/cc$$

The Alarm setpoint shall be set at or below this value.

II.F. GASEOUS MONITOR SETPOINTS (Cont'd)

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 *Radiological Effluent Controls (Sections III, IV, 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 (the version prior to January 1, 1994) 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-1 provides a cross-reference guide between liquid and gaseous effluent release limits and those sections of the REMODCM which are used to determine compliance. It also shows the administrative Technical Specifications which reference the REMODCM for operation of radioactive waste processing equipment. The table also provide 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

EFFLUENT REQUIREMENTS AND METHODOLOGY CROSS REFERENCE

Radiological Effluent Controls and Technical Specfications	REMODCM Methodology Section	Applicable Limit or Objective	Exposure Period	Required Action
III.D.1.a IV/V.E.1.a Liquid Effluent Concentration	Tables I.C-1, I.C-2, and I.C-3	10CFR20, App. B, Table II, Column 2, and $2x10^{-4}$ μCi/mL for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 minutes.
III.D.1.b IV/V.E.1.b Dose-Liquids	II.C.1 II.C.2 II.C.3 II.C.4	≤1.5 mrem T.B. ≤5 mrem Organ ≤3 mrem T.B. ≤10 mrem Organ	Calendar Quarter** Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the REMP in Section I.
T.S. 5.6.4 (Unit 1) 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.E.2.a Gaseous Effluents Dose Rate	Tables I.D-1, I.D-2, and I.D-3 II.D.1.a II.D.1.b	≤500 mrem/yr T.B. from noble gases* ≤3000 mrem/yr skin from noble gases* ≤1500 mrem/yr organ from particulates with T½ > 8d., I-131, I-133 and tritium*	Instantaneous	Restore release rates to within specifications within 15 minutes.
III.D.2.b IV/V.E.2.b Dose Noble Gases	II.D.2	≤5 mrad gamma air ≤10 mrad beta air ≤10 mrad gamma air ≤20 mrad beta air	Calendar Quarter** Calendar Year	30-day report if exceeded.
III.D.2.c IV/V.E.2.c Dose I-131, I-133, Particulates, H-3	II.D.3	≤7.5 mrem organ ≤15 mrem organ	Calendar Quarter** Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the REMP in Section I.
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.
III.E IV/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.