04/24/2020

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Dominion Energy

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.	20-147
MPS Lic/LD	R0
Docket Nos.	50-245
	50-336
	50-423
License Nos.	DPR-21
	DPR-65
	NPF-49

DOMINION ENERGY NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 1, 2, AND 3
2019 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

In accordance with 10 CFR 50.36a, this letter transmits the annual Radioactive Effluent Release Report (RERR) for the period January 2019 through December 2019. This report meets the provisions of Section 5.7.3 of the Millstone Power Station Unit 1 Permanently Defueled Technical Specifications (PDTS), and Sections 6.9.1.6b and 6.9.1.4 of the Millstone Power Station Units 2 and 3 Technical Specifications, respectively.

Attachment 1 transmits Volume 1 of the 2019 RERR, in accordance with Regulatory Guide 1.21. The RERR contains information regarding airborne, liquid, and solid radioactivity released from Millstone Power Station, including the off-site dose from airborne and liquid effluents.

Attachment 2 transmits Volume 2 of the report, which consists of a complete copy of the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual (REMODCM) as of December 31, 2019. This satisfies the requirements of Sections 5.6.1c of the Millstone Power Station Unit 1 PDTS, and Sections 6.15c and 6.9.13c of the Millstone Power Station Units 2 and 3 Technical Specifications, respectively.

Should you have any questions, please contact Mr. Jeffry A. Langan at (860) 444-5544.

Sincerely,

L. J. Armstrong
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Attachments: 2

Commitments made in this letter:

1. None.

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Serial No. 20-147
Docket Nos. 50-245
50-336
50-423
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DPR-65
NPF-49

ATTACHMENT 1

2019 RADIOACTIVE EFFLUENTS RELEASE REPORT
VOLUME 1

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

Millstone Power Station
2019
Radioactive Effluents Release Report
Volume One

Dominion Energy Nuclear Connecticut, Inc.

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1	DPR-21	50-245
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Dominion Energy

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List of Acronyms

ABD-TK2 – Auxiliary Boiler Drains Tank 2
ADV – Atmospheric Dump Valve
ALPS – Advanced Liquid Processing System
BOP – Balance of plant
CFR – Code of Federal Regulations
CPF – Condensate polishing facility
DENC – Dominion Energy Nuclear Connecticut
DOT – Department of Transportation
DSN – Discharge serial number
EBFS – Enclosure building filtration system
EDAN – Environmental Data Acquisition Network
EDST – Equipment Drain Sump Tank
ESF – Engineering safeguards facility
GI – Gastrointestinal
GWPP – Groundwater protection program
HPGe – High purity germanium
ISFSI – Independent spent fuel storage installation
MPS – Millstone Power Station
MPS1 – Millstone Power Station Unit 1
MPS2 – Millstone Power Station Unit 2
MPS3 – Millstone Power Station Unit 3
MDA – Minimum Detectable Activity
NCRP- National Council on Radiation Protection and Measurements
NEI – Nuclear Energy Institute
NIST – National Institute of Standards and Technology
NPP – Nuclear power plant
NRC – Nuclear Regulatory Commission
RBCCW – Reactor building closed cooling water
REMODCM - Radiological Effluent Monitoring and Offsite Dose Calculation Manual
RWST – Reactor water storage tank
SFPI – Spent Fuel Pool Island
SG – Steam generator
SGBD – Steam generator blowdown
SLCRS – Secondary Leakage Collection and Recovery System
SW – Service water
TB – Turbine building
WGDT – Waste gas decay tank
WRGM – Wide range gas monitor
WTT – Waste test tank

Introduction

This report, for the period of January through December of 2019, is being submitted by DENC, Inc. for MPS1, 2, and 3, in accordance with 10 CFR 50.36a, the Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM), the MPS1 Permanently Defueled Technical Specifications, and the MPS2 and 3 Technical Specifications. This report contains radiological and volumetric information on gaseous and liquid effluents, doses to the public from these effluents, shipments of solid waste & irradiated components, onsite well water results, information on effluent instrumentation which was nonfunctional for more than 30 consecutive days and operating history.

Radioactive materials may be disposed of in solid waste shipments sent to licensed disposal sites or released in liquid or gas form in effluents to the local environment. The two basic characteristics used to describe radioactive effluents are radioactivity and radiation dose. The radioactivity of any given radionuclide increases in direct proportion to the amount of the radionuclide present. This report lists the amounts of various radionuclides present in radioactive effluents. For this report, activity can be thought of as the amount of radioactive material present in radioactive effluents. Section 2.0 of this report gives the activity released from MPS in 2019.

Although radioactivity is an important, inherent characteristic that helps to describe radioactive effluents, it is not—by itself—a good indicator of the potential health effects from exposure to radiation. Health effects are dependent on many factors, such as the radionuclide, the type of radiation emitted by the radionuclide, the energy of the radiation, the uptake of the radionuclide into the human body, and the metabolism of the radionuclide by the human body. To properly describe the potential health effects from exposure to radioactive materials, a measure that accounts for all of these differences is needed. Dose is a measure of how much radiation energy is absorbed by organs or tissues of the body. Dose is a good indicator of the potential health effects from exposure to radiation. Section 1.0 of this report gives the dose from activity released from MPS in 2019.

1.0 Off-Site Doses

This report provides a summary of the 2019 off-site radiation doses from releases of radioactive materials in gaseous and liquid effluents and from direct radiation from MPS1, 2 and 3. This includes the annual maximum dose in millirem (mrem) to any real member of the public as well the maximum gamma and beta air doses. To provide perspective, these doses are compared to the regulatory limits (in Table 1-3) and to the annual average dose that a member of the public could receive from natural background and other sources (in Table 1-4). The doses from radioactive effluents were much less than the doses from other sources of natural radiation that are commonly considered safe. This indicates radioactive effluents from MPS in 2019 had no significant impact on the health and safety of the public or the environment.

1.1 Dose Calculations

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

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

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

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

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

1.1.1 Gaseous Effluents

The following release points are considered ground level:

- MPS1 SFPI Vent (73 foot)
- MPS1 BOP Vent (80 foot)
- MPS2 and 3 Refueling Water Storage Tank (RWST) Vents
- MPS3 Engineered Safety Features Building (ESF) Ventilation
- Auxiliary Boiler Drains Tank 2 (ABD TK-2) Vent
- MPS2 & 3 Containment Equipment Hatch
- MPS3 Containment Drawdowns

Doses for releases from these points were calculated using the 33 foot meteorology. For each unit, doses from their respective release points were summed to determine the total unit gaseous effluent ground level dose.

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

- MPS2 Auxiliary Building Ventilation (159 foot elevation)
- MPS3 Auxiliary Building Ventilation (133 foot elevation)
- MPS2 No. 1&2 Atmospheric Dump Valves

The doses for mixed mode releases are calculated using 142 foot meteorology for which the Pasquill stability classes are determined based upon the temperature gradient between the 33 foot and 142 foot meteorological tower levels.

The MPS Stack release point at 374 foot elevation is considered an elevated release. Doses for elevated releases are calculated using Pasquill stability classes determined based upon the temperature gradient between the 33 foot and 374 foot meteorological tower levels. Only MPS2 and MPS3 discharge to the MPS Stack. In March 2001, MPS1 was separated from the stack and two new release points were added to MPS1, the Spent Fuel Pool Island (SFPI) Vent and the Balance of Plant (BOP) Vent. The following are sources of radioactivity for releases from the stack:

- MPS2 Waste Gas Decay Tanks batch releases
- MPS2 Containment Vents batch releases
- MPS2 Containment Purge batch releases
- MPS3 Containment Vents batch releases
- MPS3 Gaseous Waste System continuous releases
- MPS3 Containment Purge batch releases (only during outage in second quarter)

1.1.2 Liquid Effluents

MPS discharges radioactivity in water through two release pathways – thru the MPS Quarry to the Long Island Sound and thru Discharge Point DSN-006 to Niantic Bay. Discharges to the MPS Quarry are from primary side water, primarily from liquid waste processing systems. Discharges to DSN-006 are from secondary side water, primarily turbine building sumps. MPS1 discharges only to the MPS Quarry from sumps and leakage collection systems. Discharges to both release pathways are considered either continuous or batch discharges. Sources of continuous and batch discharges are listed in Sections 2.2.1.1 and 2.2.1.2. Water containing radioactivity being discharged to the MPS Quarry is diluted mainly by circulating water and, to a minor extent, by service water. Water containing radioactivity being discharged to DSN-006 is diluted by storm drains runoff.

1.2 Dose Results

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

1.2.1 Gaseous Effluents

For the dose to the maximum individual, OpenEMS calculates the dose to the whole body, gastrointestinal (GI), bone, liver, kidney, thyroid, lung, and skin from each of the following pathways: direct exposure from submersion in noble gases in the plume, direct exposure from ground deposition of radioactivity, inhalation, and ingestion of vegetation, produce, cow or goat milk, and meat. A cloud shine dose component for releases of noble gas radioactivity from the elevated MPS Stack is calculated using Reference 13. This cloud shine pathway accounts for dose to the maximum individual from the plume at the site boundary while the plume is still elevated. The values presented are a total from all pathways. Only the whole body, skin, thyroid and maximum organ (other than thyroid) doses are presented.

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

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

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

1.2.2 Liquid Effluents

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

1.2.3 Analysis of Results

Table 1-3 provides a quantitative dose comparison with the limits specified in the REMODCM. Gaseous and liquid effluent doses are compared to limits required by technical specifications and contained in Appendix I of 10 CFR 50. Total offsite doses are compared to limits in 40 CFR 190 (Reference 8). The data indicates that the total whole body and organ doses to the maximum offsite individual from MPS including all sources of the fuel cycle are well within the limits. On-site radioactive waste and spent fuel storage during this year was within storage criteria and the maximum dose to a member of the public from these sources was approximately 0.13 mrem. The doses from gaseous and liquid effluents were added to the estimated dose from on-site radioactive waste storage to show compliance compared to 40 CFR 190.

The Offsite Dose Comparison, Table 1-4, provides a perspective on the maximum offsite individual dose received from MPS with the natural background radiation dose received by the average Connecticut resident (Reference 4). The total dose to the maximum individual received from MPS is < 0.3% in comparison to the dose received from lowest natural background radiation areas of 100 mrem/year.

Table 1-1
2019 Off-Site Dose Commitments from Gaseous Effluents
MPS1, 2, 3

MPS1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	8.99E-06	1.38E-05	2.16E-05	1.04E-05	5.48E-05
Skin	8.99E-06	6.58E-06	1.02E-05	8.32E-06	3.41E-05
Thyroid	8.99E-06	1.38E-05	2.16E-05	1.04E-05	5.48E-05
Max organ[1]	8.99E-06	1.38E-05	2.16E-05	1.04E-05	5.48E-05

MPS2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	2.96E-06	1.74E-07	1.77E-06	3.34E-06	7.40E-06
Gamma	5.91E-06	3.97E-07	4.11E-06	7.73E-06	1.62E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	3.71E-03	1.84E-02	1.32E-02	7.42E-03	4.27E-02
Skin	1.53E-03	5.15E-04	6.75E-04	3.80E-04	3.10E-03
Thyroid	3.78E-03	1.91E-02	1.37E-02	7.57E-03	4.41E-02
Max organ[1]	1.27E-02	1.09E-01	7.86E-02	3.60E-02	2.36E-01

MPS3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.26E-05	3.78E-07	5.36E-06	1.07E-05	2.66E-05
Gamma	2.16E-06	7.44E-08	1.58E-06	2.30E-06	5.43E-06
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	3.59E-03	2.50E-02	2.11E-02	1.04E-02	6.02E-02
Skin	1.01E-03	6.53E-03	1.79E-03	2.24E-03	1.16E-02
Thyroid	3.59E-03	2.49E-02	2.11E-02	1.04E-02	6.01E-02
Max organ[1]	1.44E-02	8.80E-02	1.12E-01	4.13E-02	2.56E-01

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

Table 1-2
2019 Off-Site Dose Commitments from Liquid Effluents
MPS1, 2, 3

MPS1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	6.41E-06	9.72E-06	0.00E+00	1.47E-05	3.09E-05
Thyroid	1.07E-06	2.68E-06	0.00E+00	4.23E-06	7.98E-06
Max Organ	2.80E-05	1.55E-05	0.00E+00	1.85E-05	6.20E-05

MPS2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	3.69E-05	6.87E-05	3.39E-05	5.13E-05	1.82E-04
Thyroid	3.55E-06	6.74E-05	3.37E-05	5.13E-05	1.56E-04
Max Organ	2.10E-04	5.01E-05	6.86E-06	0.00E+00*	2.67E-04

MPS3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Total
Max Individual	(mrem)	(mrem)	(mrem)	(mrem)	(mrem)
Whole Body	2.82E-04	4.16E-04	5.30E-05	8.23E-05	8.33E-04
Thyroid	2.59E-04	4.08E-04	4.88E-05	8.18E-05	7.98E-04
Max Organ	2.91E-04	4.65E-04	5.97E-05	8.49E-05	9.00E-04

* Highest organ dose for 2019 was from bone and the fission and activation products were less than MDA in the 4th quarter of 2019.

Table 1- 3
2019 Off-Site Dose Comparison to Limits MPS1, 2, 3

Gaseous Effluents Dose

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*	Skin *(mrem)*	Beta Air *(mrad)*	Gamma Air *(mrad)*
MPS1	5.48E-05	5.48E-05	5.48E-05	3.41E-05	0.00E+00	0.00E+00
MPS2	4.27E-02	4.41E-02	2.36E-01	3.10E-03	7.40E-06	1.62E-05
MPS3	6.02E-02	6.01E-02	2.56E-01	1.16E-02	2.66E-05	5.43E-06
MPS	**1.03E-01**	**1.04E-01**	**4.92E-01**	**1.47E-02**	**3.40E-05**	**2.16E-05**
Limits	***5***	***15***	***15***	***15***	***20***	***10***

Liquid Effluents Dose

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*
MPS1	3.09E-05	7.98E-06	6.20E-05
MPS2	1.82E-04	1.56E-04	2.67E-04
MPS3	8.33E-04	7.98E-04	9.00E-04
MPS	1.05E-03	9.62E-04	1.23E-03
Limits	***3***	***10***	***10***

Total Off-Site Dose from MPS

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*
Gaseous	1.03E-01	1.04E-01	4.92E-01
Liquid	1.05E-03	9.62E-04	1.23E-03
Direct Shine**	1.30E-01	1.30E-01	1.30E-01
MPS	2.34E-01	2.35E-01	6.23E-01
Limits	***25***	***75***	***25***

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

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

Table 1- 4
2019 Off-Site Dose Comparison
Natural Background vs MPS

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

Courtesy UNSCEAR Report 2000

Maximum Off-Site Individual	**MPS Whole Body Dose**	
Gaseous Effluents	0.103	mrem
Liquid Effluents	0.001	mrem
Direct Shine	0.130	mrem
	0.234	mrem

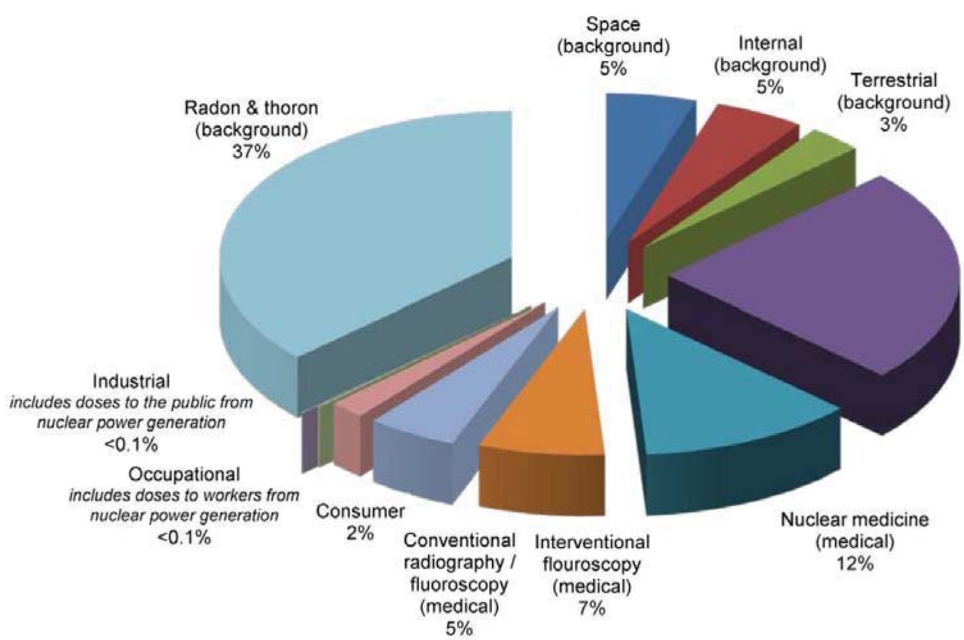
1.3 Other Sources of Radiation Dose to the Public (from Ref. 12)

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

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

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

Sources of Radiation Exposure to the U.S. Population



2.0 Effluent Radioactivity

2.1 Gaseous Effluents

2.1.1 Measurement of Radioactivity in Gaseous Effluents

2.1.1.1 Continuous Releases

The following pathways have continuous radiation monitors which monitor gaseous radioactivity and collect radioactive particulates on filters and radioactive halogens (iodine's, etc.) on charcoal cartridges except where noted on the list.

MPS1 SFPI Island (no charcoal cartridge)
MPS1 BOP Vent (no charcoal cartridge)
MPS2 Ventilation Vent
MPS2 Wide Range Gas Monitor (WRGM) to Site Stack
MPS2 Equipment Hatch Opening (no gaseous monitoring)
MPS3 Ventilation Vent
MPS3 SLCRS to Site Stack
MPS3 ESF Building Vent
MPS3 Containment Equipment Hatch Openings (no gaseous monitoring)
MPS2 & MPS3 Secondary Side Systems

Most releases are based on results of sample analyses. Charcoal cartridges and particulate filters are replaced weekly (except every two weeks for MPS1) and analyzed for isotopic content using a gamma spectrometer. Particulate filters are also analyzed for Strontium-89 (Sr-89) (except for MPS1), Strontium-90 (Sr-90) and gross alpha. At least monthly, gaseous grab samples are taken and analyzed for noble gasses and H-3. The gas washing bottle (bubbler) method is utilized for H-3 collection. This sample is counted on a liquid scintillation detector. Isotopic concentrations at the release point are multiplied by the total flow to obtain the total activity released for each isotope.

Some releases are based on calculation. These include tritium from spent fuel pools, Carbon 14 (C-14), Equipment Hatch, and RWST vent releases.

Spent fuel pool tritium release is calculated using concentrations of tritium in the water and evaporation determined by change in pool levels. Grab samples from the MPS1 SFPI Vent and the MPS2 and MPS3 Vents are compared to the measured evaporation and both of these results are included in the amount of tritium released.

C-14 releases are calculated using the methodology in Reference 11. Based on Reference 2, it was conservatively assumed that 30% of the C-14 exists as carbon dioxide (CO_2), which may be deposited on surfaces. Thus only 30% of C-14 released yielded dose via ingestion pathways of milk, meat, produce and vegetation. Since the overall quantity of other radioactive releases has steadily decreased due to improvements in power plant operations and improved fuel integrity, C-14 now qualifies as a principle radionuclide. For MPS2 and MPS3, it is assumed that the C-14 will be dispersed equally through the MPS Site Stack and each unit's main ventilation vent.

When water is transferred to the RWST there is a potential for a release of radioactivity through the tank vent. In 2017 MP-CHEM-17-07, "Reporting of Radioactivity Released from RWST Vents" was written to establish a maximum dose threshold of 0.075 mrem/quarter for creating release permits. The organ dose threshold value of 0.075 mrem/quarter is 1% of the quarterly organ dose limit of 7.5 mrem for H-3 and particulate releases. Nuclides that do not have a partitioning or evaporation factor such as iodines and noble gases are assumed to have been released and are reported in the MPS2 & MPS3 ground release tables. Both the MPS2&3 RWSTs are sampled on a monthly basis during normal operations and prior to transfer when transferring water during outages.

The secondary side system on both MPS2 & MPS3 has valves and steam traps have visible leakage in the form of a steam plume. The secondary side plant water is analyzed for both tritium and gamma activity. All secondary side system releases for 2019 were greater than MDA for tritium, but less than MDA gamma activity. The total amount of secondary plant leakage releases rates are estimated off of the amount of secondary side system leakage.

Any releases from the spent fuel pool area in the reactor building at MPS1 are released through the SFPI Vent. Releases from other parts of the MPS1 reactor building and other buildings are continuously discharged to the BOP Vent.

2.1.1.2 Batch Releases

The following sources of radioactivity releases are considered batch releases:

MPS2 Waste Gas Decay Tanks (WGDT) (via MPS2 WRGM to MPS Stack)
MPS3 Containment Purge (via MPS3 Main Exhaust Vent)
MPS2 and MPS3 Containment Vents (via EBFS to MPS Stack for MPS2 and via SLCRS to MPS Stack for MPS3)
MPS3 Containment Drawdown (via MPS3 Vent System)
MPS3 Volume control tank sampling and purging operations
MPS3 Process gas system maintenance

Waste Gases from the MPS2 Gaseous Waste Processing System are held for decay in waste gas decay tanks prior to discharge through the MPS Site Stack. Each gas decay tank is analyzed prior to discharge for noble gas and H-3. Calculated volume discharged is multiplied by the isotopic concentrations (noble gas and H-3) from the analysis of grab samples to determine the total activity released.

Containment air is sampled prior to each purge for gamma and H-3 to determine the activity released from containment purging. Similar to containment venting, the measured concentrations are multiplied by the containment purge volume to obtain the total activity released. Any iodines and particulates discharged would be detected by the continuous monitoring discussed in section 2.1.1.1. There was only one containment purges conducted in 2019 one in the beginning of MPS3 refueling outage 3R19.

Containment air is sampled periodically for gamma and H-3 to determine the activity released from containment venting. The measured concentrations are multiplied by the containment vent volume to obtain the total activity released. MPS2 typically performs this process of discharging air from containment to maintain pressure approximately once per week and MPS3 vents containment about 16 times per month. Any iodines and particulates discharged would be detected by the continuous monitoring discussed in Section 2.1.1.1.

Unit 3 containment is initially drawn down to approximately 13.8 PSIA prior to startup. Grab samples are performed prior to drawdown to document the amount of radioactivity released during these evolutions. The grab sample results determine an alignment to minimize the amount of Curies released and dose to the public. The activity results were below activity limits for the MPS3 Ventilation vent, so this pathway was used coming out of 3R19.

Periodically the MPS3 volume control tank needs to be purged for chemistry control of the reactor coolant system. Normally reactor coolant system gases are maintained and processed by the degasifier, but extensive maintenance required the degasifier to be tagged out of service. While the degasifier was removed from service periodic sampling was required to ensure the reactor chemistry parameters were within specification. These periodic samples would cause deflection on SLCRS gaseous low range radiation monitor HVR-19B and gaseous grab samples of the volume control tank and radiation monitor activity concentration were used to quantify VCT sampling releases. During the 2019 the MPS3 VCT did not need to be purged but was sampled periodically to monitor parameters while the degasifier was out of service.

The MPS3 process gas water separator skid experienced a dryer problem and was required to be drained before the unit could be placed back into service. While this draining was occurring there is potential for reactor coolant system gases to be releases to both SLCRS and MPS3 Ventilation Vent. The most recent RCS noble gas sample and responses on "Ventilation Vent Noble Gas Effluent monitor" HVR-10B and "SLCRS gaseous low range radiation monitor" HVR-19B were used to quantify these releases.

Atmospheric dump valves are used to control reactor coolant system temperature and pressure during plant start-ups and shutdowns. These secondary side system atmospheric dump releases occur over a period of a 12 hour shift, while plant is being maneuvered. For 2019 these releases were greater than MDA for tritium and less than MDA for gamma activity. The tritium released from atmospheric dump valves account less than 1% total tritium releases for the applicable month.

2.1.2 Estimate of Errors

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

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

2.1.3 Gaseous Batch Release Statistics

MPS1 – None

MPS2	CTMT Vents	WGDT
Number of Batches	47	4
Total Time (min)	6595	771
Maximum Time (min)	193	197
Average Time (min)	140	193
Minimum Time (min)	44	184

MPS3	CTMT Vents	VCT Sample	CTMT Purge	CTMT Drawdown
Number of Batches	206	2	1	1
Total Time (min)	49671	28	1000	1124
Maximum Time (min)	392	17	1000	1124
Average Time (min)	241	14	1000	1124
Minimum Time (min)	91	11	1000	1124

2.1.4 Abnormal Gaseous Releases

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

2.1.4.1 MPS1 – None

2.1.4.2 MPS2 – None

2.1.4.3 MPS3 – None

2.1.5 Gaseous Release Tables

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

Table 2.1-A1

MPS1

Gaseous Effluents - Release Summary

	Units	2019 1st Qtr	2019 2nd Qtr	2019 3rd Qtr	2019 4th Qtr	2019 Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
B. Iodines / Halogens						
1. Total Activity Released	Ci	na	na	na	Na	na
2. Average Period Release Rate	uCi/sec	na	na	na	Na	na
C. Particulates						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Release Rate	uCi/sec	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	1.19E-02	1.09E-02	1.27E-02	1.10E-02	4.65E-02
2. Average Period Release Rate	uCi/sec	1.53E-03	1.38E-03	1.60E-03	1.39E-03	1.48E-03

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

Table 2.1-A2
MPS1
Gaseous Effluents - Ground Continuous - BOP Vent & SFPI Vent

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
I-131	Ci	na	na	na	Na	na
I-133	Ci	na	na	na	Na	na
Other γ Emitters	Ci	na	na	na	Na	na
Total Activity	Ci	na	na	na	Na	na
C. Particulates						
Be-7	Ci	-	-	-	-	-
Cs-137	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	1.19E-02	1.09E-02	1.27E-02	1.10E-02	4.65E-02

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

Table 2.2-A1
MPS2
Gaseous Effluents - Release Summary

	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	5.44E-02	5.09E-02	4.78E-02	5.17E-02	2.05E-01
2. Average Period Release Rate	uCi/sec	6.99E-03	6.48E-03	6.02E-03	6.51E-03	6.50E-03
B. Iodines / Halogens						
1. Total Activity Released	Ci	7.55E-05	6.25E-05	1.71E-05	3.13E-05	1.86E-04
2. Average Period Release Rate	uCi/sec	9.71E-06	7.95E-06	2.16E-06	3.94E-06	5.91E-06
C. Particulates						
1. Total Activity Released	Ci	-	9.69E-07	-	-	9.69E-07
2. Average Period Release Rate	uCi/sec	-	1.23E-07	-	-	3.07E-08
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	7.95E+00	1.84E+00	2.05E+00	1.66E+00	1.35E+01
2. Average Period Release Rate	uCi/sec	1.02E+00	2.35E-01	2.58E-01	2.09E-01	4.28E-01
F. C-14						
1. Total Activity Released**	Ci	2.46E+00	2.34E+00	2.34E+00	2.40E+00	9.54E+00
2. Average Period Release Rate	uCi/sec	3.16E-01	2.98E-01	2.94E-01	3.02E-01	3.03E-01

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

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

Table 2.2-A2
MPS2
Gaseous Effluents - Ground Level Release - Batch Mode
Release Point - No Releases

Nuclides Released	Units	2019 1st Qtr	2019 2nd Qtr	2019 3rd Qtr	2019 4th Qtr	2019 Total
A. Fission & Activation Gases						
Total Activity	Ci	*	*	*	*	*
B. Iodines / Halogens						
Total Activity	Ci	*	*	*	*	*
C. Particulates						
Total Activity	Ci	*	*	*	*	*
D. Gross Alpha						
Gross Alpha	Ci	*	*	*	*	*
E. Tritium						
H-3	Ci	*	*	*	*	*

* No activity released

Table 2.2-A3

MPS2

Gaseous Effluents - Ground Level Release - Continuous Mode

Release Point - Refuel Water Storage Tank Vent, Equipment Hatch

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Xe-133	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines/Halogens						
I-131	Ci	-	-	-	-	-
I-132	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Cr-51	Ci	-	-	-	-	-
Mn-54	Ci	-	-	-	-	-
Co-57	Ci	-	-	-	-	-
Co-58	Ci	-	-	-	-	-
Fe-59	Ci	-	-	-	-	-
Zn-65	Ci	-	-	-	-	-
Nb-95	Ci	-	-	-	-	-
Zr-95	Ci	-	-	-	-	-
Ru-103	Ci	-	-	-	-	-
Ag-110m	Ci	-	-	-	-	-
Sn-113	Ci	-	-	-	-	-
Sn-117m	Ci	-	-	-	-	-
Sb-124	Ci	-	-	-	-	-
Sb-125	Ci	-	-	-	-	-
Sb-126	Ci	-	-	-	-	-
Cs-137	Ci	-	-	-	-	-
Ce-141	Ci	-	-	-	-	-
Ce-144	Ci	-	-	-	-	-
Hf-181	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	Na	na
E. Tritium						
H-3	Ci	-	-	-	-	-

"na" denotes Not Required to be Analyzed

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

Table 2.2-A4

MPS2

Gaseous Effluents - Elevated Release - Batch Mode

Release Point – MPS Stack

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	2.11E-02	2.76E-02	2.63E-02	2.58E-02	1.04E-01
Kr-85	Ci	-	8.55E-04	-	-	8.55E-04
Xe-133	Ci	3.29E-02	2.24E-02	2.15E-02	2.31E-02	9.99E-02
Xe-135	Ci	3.64E-04	1.34E-04	-	1.09E-04	6.07E-04
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	5.44E-02	5.09E-02	4.78E-02	5.17E-02	2.05E-01
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Co-60	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	4.18E-02	1.15E-01	1.13E-01	6.71E-02	3.43E-01

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

Table 2.2-A5
MPS2
Gaseous Effluents - Elevated Release - Continuous Mode
Release Point - MPS Stack

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Gases

Ar-41	Ci	-	-	-	-	-
Kr-85	Ci	-	-	-	-	-
Kr-85m	Ci	-	-	-	-	-
Kr-87	Ci	-	-	-	-	-
Kr-88	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-133m	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Xe-135m	Ci	-	-	-	-	-
Xe-138	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-

B. Iodines / Halogens

Br-82	Ci	-	-	-	-	-
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-

C. Particulates

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

D. Gross Alpha

Gross Alpha	Ci	-	-	-	-	-

E. Tritium

H-3	Ci	-	-	-	-	-

F. C-14

C-14	Ci	1.23E+00	1.17E+00	1.17E+00	1.20E+00	4.77E+00

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

Table 2.2-A6
MPS2
Gaseous Effluents - Mixed Mode Release - Batch Mode
Release Point – MPS2 Main Exhaust Vent, CTMT Purge

Nuclides		2019				
Released	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	-	-	-	-
Kr-85	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
Br-82	Ci	-	-	-	-	-
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Co-60	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	-	-	-	-	-

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

Table 2.2-A7

MPS2

Gaseous Effluents - Mixed Mode Release - Continuous Mode

Release Point - MPS 2 Main Exhaust Vent

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Kr-85	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
Br-82	Ci	-	-	-	-	-
I-131	Ci	1.16E-05	1.11E-05	5.51E-06	6.96E-06	3.52E-05
I-133	Ci	6.39E-05	5.14E-05	1.16E-05	2.43E-05	1.51E-04
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	7.55E-05	6.25E-05	1.71E-05	3.13E-05	1.86E-04
C. Particulates						
Co-58	Ci	-	-	-	-	-
Co-60	Ci	-	9.96E-07	-	-	9.96E-07
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Cs-137	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	9.69E-07	-	-	9.96E-07
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	7.91E+00	1.73E+00	1.94E+00	1.59E+00	1.32E+01
F. C-14						
C-14	Ci	1.23E+00	1.17E+00	1.17E+00	1.20E+00	4.77E+00

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

Table 2.3-A1
MPS3
Gaseous Effluents - Release Summary

	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
1. Total Activity Released	Ci	2.23E-01	1.25E-01	1.62E-01	1.87E-01	6.79E-01
2. Average Period Release Rate	uCi/sec	2.87E-02	1.60E-02	2.03E-02	2.35E-02	2.21E-02
B. Iodines / Halogens						
1. Total Activity Released	Ci	3.99E-06	3.38E-06	1.19E-05	2.15E-05	4.07E-05
2. Average Period Release Rate	uCi/sec	5.13E-07	4.30E-07	1.49E-06	2.70E-06	1.29E-06
C. Particulates						
1. Total Activity Released	Ci	-	1.39E-04	3.47E-07	8.05E-6	1.47E-04
2. Average Period Release Rate	uCi/sec	-	1.77E-05	4.37E-08	1.01E-06	4.67E-06
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Tritium						
1. Total Activity Released	Ci	5.54E+00	2.34E+01	9.83E+00	1.19E+01	5.06E+01
2. Average Period Release Rate	uCi/sec	7.13E-01	2.98E+00	1.24E+00	1.49E+00	1.61E+00
F. C-14						
1. Total Activity Released**	Ci	2.82E+00	2.82E+00	2.82E+00	2.76E+00	1.12E+01
2. Average Period Release Rate	uCi/sec	3.63E-01	3.59E-01	3.55E-01	3.47E-01	3.56E-01

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

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

Table 2.3-A2

MPS3

Gaseous Effluents - Ground Level Release - Batch Mode

Release Point -ESF Building Rooftop, Secondary Side Releases

Nuclides Released	Units	2019				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Other γ Emitters	Ci	*	-	*	-	-
Total Activity	Ci	*	-	*	-	-
B. Iodines / Halogens						
I-131	Ci	*	-	*	-	-
I-133	Ci	*	-	*	-	-
Other γ Emitters	Ci	*	-	*	-	-
Total Activity	Ci	*	-	*	-	-
C. Particulates						
Other γ Emitters	Ci	*	-	*	-	-
Total Activity	Ci	*	-	*	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	*	1.17E-03	*	3.24E-03	4.41E-03

* No activity released

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

"na" denotes Not Required to be Analyzed

Table 2.3-A3
MPS3
Gaseous Effluents - Ground Level Release - Continuous Mode
Release Point - ESF Building Vent, Containment Equipment Hatch, RWST Vent, Auxiliary Boiler Vents, Secondary Side Systems

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
I-131	Ci	-	1.67E-07	-	-	1.67E-07
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	1.67E-07	-	-	1.67E-07
C. Particulates						
Be-7	Ci	-	-	3.47E-07	-	3.47E-07
Cr-51	Ci	-	4.36E-05	-	-	4.36E-05
Mn-54	Ci	-	2.74E-06	-	-	2.74E-06
Co-57	Ci	-	-	-	-	-
Co-58	Ci	-	1.45E-05	-	-	1.45E-05
Fe-59	Ci	-	-	-	-	-
Co-60	Ci	-	1.12E-05	-	-	1.12E-05
Zn-65	Ci	-	-	-	-	-
Nb-95	Ci	-	3.29E-06	-	-	3.29E-06
Zr-95	Ci	-	5.66E-06	-	-	5.66E-06
Ag-110m	Ci	-	-	-	-	-
Sn-113	Ci	-	-	-	-	-
Sb-124	Ci	-	-	-	-	-
Sb-125	Ci	-	-	-	-	-
Sb-126	Ci	-	-	-	-	-
Cs-137	Ci	-	-	-	-	-
Ce-141	Ci	-	-	-	-	-
Ce-144	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	8.23E-05	-	-	8.23E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	4.16E-02	4.13E+00	5.38E-02	1.25E-01	4.35E+00

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

Table 2.3-A4
MPS3
Gaseous Effluents - Elevated Release - Batch Mode
Release Point - MPS Stack

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	7.79E-03	3.85E-03	9.59E-03	6.77E-03	2.80E-02
Kr-85		-	2.44E-04	-	1.94E-04	4.38E-04
Kr-85m	Ci	-	7.45E-05	1.26E-04	2.94E-05	2.30E-04
Kr-87	Ci	-	1.65E-05	2.48E-04	7.46E-05	3.39E-04
Kr-88	Ci	-	3.85E-04	1.54E-05	1.45E-04	5.45E-04
Xe-131m		-	-	1.49E-04	-	1.49E-04
Xe-133	Ci	4.31E-05	2.98E-05	7.36E-04	-	8.09E-04
Xe-133m		-	-	2.12E-04	-	2.12E-04
Xe-135	Ci	2.65E-05	3.00E-03	4.99E-04	2.22E-04	3.75E-03
Xe-135m	Ci	-	-	9.13E-05	-	9.13E-05
Xe-138	Ci	-	-	-	1.33E-03	1.33E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	7.86E-03	7.60E-03	1.17E-02	8.77E-03	3.59E-02
B. Iodines / Halogens						
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
C. Particulates						
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	na	na	na	na	na
E. Tritium						
H-3	Ci	8.60E-02	2.96E-01	3.69E-01	3.10E-01	1.06E+00

"-" denotes less than Minimum Detectable Activity (MDA)
"na" denotes Not Required to be Analyzed

Table 2.3-A5
MPS3
Gaseous Effluents - Elevated Release - Continuous Mode
Release Point - MPS Stack

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Ar-41	Ci	-	-	-	-	-
Kr-83m	Ci	-	-	-	-	-
Kr-85	Ci	2.15E-01	1.18E-01	1.50E-01	1.78E-01	6.61E-01
Kr-85m	Ci	-	-	-	-	-
Kr-87	Ci	-	-	-	-	-
Kr-88	Ci	-	-	-	-	-
Xe-133	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Xe-135m	Ci	-	-	-	-	-
Xe-138	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.15E-01	1.18E-01	1.50E-01	1.78E-01	6.61E-01
B. Iodines / Halogens						
Br-82	Ci	3.99E-06	2.87E-06	3.02E-06	2.64E-06	1.25E-05
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	3.99E-06	2.87E-06	3.02E-06	2.64E-06	1.25E-05
C. Particulates						
Co-58	Ci	-	7.25E-07	-	-	7.25E-07
Co-60	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	7.25E-07	-	-	7.25E-07
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	3.66E-01	8.49E-01	2.99E-01	1.50E-01	1.66E+00
F. C-14						
C-14	Ci	1.41E+00	1.41E+00	1.41E+00	1.38E+00	5.61E+00

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

Table 2.3-A6

MPS3

Gaseous Effluents - Mixed Mode Release - Batch Mode

Release Point - MPS3 Unit 3 Ventilation Vent

Nuclides Released	Units	2019				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total

A. Fission & Activation Gases

Kr-85	Ci	-	-	-	-	-
Kr-85m	Ci	-	-	-	-	-
Kr-87	Ci	-	-	-	-	-
Kr-88	Ci	-	-	-	-	-
Xe-135	Ci	-	-	-	-	-
Xe-135m	Ci	-	-	-	-	-
Xe-138	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-

B. Iodines / Halogens

Other γ Emitters	Ci	-	3.24E-07	-	-	3.24E-07
Total Activity	Ci	-	3.24E-07	-	-	3.24E-07

C. Particulates

Co-58	Ci	-	6.83E-09	-	-	6.83E-09
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	6.83E-09	-	-	6.83E-09

D. Gross Alpha

Gross Alpha	Ci	na	na	na	na	Na

E. Tritium

H-3	Ci	-	2.13E-01	-	-	2.13E-01

* No activity released

"-" denotes less than Minimum Detectable Activity (MDA)
"na" denotes Not Required to be Analyzed

Table 2.3-A7

MPS3

Gaseous Effluents - Mixed Mode Release - Continuous Mode

Release Point - MPS3 Ventilation Vent

Nuclides Released	Units	2019				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Gases						
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Iodines / Halogens						
Br-82	Ci	-	-	8.84E-06	1.88E-05	2.77E-05
I-131	Ci	-	-	-	-	-
I-133	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	8.84E-06	1.88E-05	2.77E-05
C. Particulates						
Be-7	Ci	-	-	-	8.05E-06	8.05E-06
Cr-51	Ci	-	2.75E-05	-	-	2.75E-05
Co-58	Ci	-	2.19E-05	-	-	2.19E-05
Co-60	Ci	-	3.28E-06	-	-	3.28E-06
Nb-95	Ci	-	3.26E-06	-	-	3.26E-06
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	5.60E-05	-	8.05E-06	6.40E-05
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-
E. Tritium						
H-3	Ci	5.05E+00	1.77E+01	9.10E+00	1.13E+01	4.32E+01
F. C-14						
C-14	Ci	1.41E+00	1.41E+00	1.41E+00	1.38E+00	5.61E+00

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

2.2 Liquid Effluents

2.2.1 Measurement of Radioactivity in Liquid Effluents

2.2.1.1 Continuous Liquid Releases

Water containing radioactivity is continuously released through one of two pathways – the MPS Quarry or DSN006. DSN006 is next to the MPS3 intake structure (DSN is acronym for Discharge Serial Number.) Grab samples are taken for continuous liquid release pathways and analyzed on the gamma spectrometer and liquid scintillation detector (for H-3) if required by the conditional action requirements of the REMODCM. Total estimated volume is multiplied by the isotopic concentrations (if any) to determine the total activity released. A proportional aliquot of each discharge is retained for composite analysis for Sr-89, Sr-90, Fe-55 and gross alpha if required by the conditional action requirements of the REMODCM. Sources for continuous liquid effluent releases via the MPS Quarry include Steam Generator Blowdown for MPS2 & MPS3, Service Water Effluent for MPS2 & MPS3 and Reactor Building Closed Cooling Water (RBCCW) Sump for MPS2. Sources for continuous liquid effluent releases via DSN006 include Turbine Building Sump discharge from MPS2 & MPS3, CPF TK2 from MPS3 and SRW Sump 3 from MPS3.

2.2.1.2 Batch Liquid Releases from Tanks and Sumps

Batch liquid releases are made via both the MPS Quarry and DSN006. There are numerous sources from which batches of liquids containing radioactivity are discharged to the environs. Except for two sources from MPS3 to DSN006 they are discharged via the MPS Quarry. The sources are:

MPS1 Radwaste Processing System – Includes sources from:
1. Reactor Building Sumps
2. Underground Ventilation Duct
3. Site Stack Sump

MPS2 Radwaste Processing System:
1. Clean Waste Monitor Tanks (2)
2. Aerated Waste Monitor Tanks

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

MPS3 Radwaste Processing
1. Waste Test Tanks (2)
2. Low Level Waste Test Tanks (2)
3. Boron Test Tanks (2)

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

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

2.2.2 Estimate of Errors

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

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

2.2.3 Liquid Batch Release Statistics

	MPS1	MPS2	MPS3
Radwaste Processing System:			
Number of Batches	11	13	68
Total Time (min)	481	2744	7556
Maximum Time (min)	50	245	111
Average Time (min)	44	211	177
Minimum Time (min)	40	170	83

	MPS1	MPS2	MPS3
Other Radwaste Sources:			
Number of Batches	NA	30	95
Total Time (min)	NA	7647	17989
Maximum Time (min)	NA	2575	1195
Average Time (min)	NA	255	189
Minimum Time (min)	NA	5	13

2.2.4 Dilution Flow Reduction

The spring refueling outage, 3R19 included a plant configuration that shut down the circulating water pumps at MPS3. MPS2 circulating water system was operating with reduced flow for fish impingement reduction season during the second quarter 2019. The combination of reduced circulating water flow at MPS2 and no circulating water flow a MPS3 resulted in REMP sample location 32 recording the second highest tritium result ever recorded 2234 pCi/l for second quarter 2019. One outage related activity underwater peening, increased the amount of liquid waste water that needed to be discharged during 3R19. The increased risk from minimal dilution flow was evaluated with a Radiological Environmental Review and although there was an increase dose from less dilution flow at the quarry, the underwater peening project increased the integrity of the RCS fission product barrier.

To assess the radiological impact of the reduced circulating water flow during MPS3 refueling outages, quarters were selected where MPS3 was in a refueling outage and the reduced flow period for reducing fish impingement. During MPS3 refueling outages 3R17 and 3R19 MPS3 circulating water pumps were secured for 3 to 4 week period and the next available quarter where MPS3 met the selection conditions was the second quarter 2013, 3R15.

Quarters	Tritium discharged to quarry (Ci)	Whole Body Dose (mrem)	Organ Dose (mrem)
2nd Quarter 2013 (3R15)	2.32E+02	5.70E-04	4.68E-03
2nd Quarter 2016 (3R17)	7.08E+02	5.54E-04	7.93E-04
2nd Quarter 2019 (3R19)	6.61E+02	4.88E-04	5.31E-04

Comparisons with previous outages show an overall downward trend in both whole body and organ doses, which is directly related to the source term reduction impact of the Advance Liquid Processing System (ALPS). During the second quarter 2019, 6.61E+02 Ci of tritium were released to MPS quarry where REMP station 32 sample is drawn. The second quarter 2019 the MPS quarry whole body dose of 4.88E-04 mrem is below the NRC whole body liquid effluent dose limit of 1.5 mrem per quarter. The second quarter organ dose of 5.31E-04 mrem is below the NRC quarterly organ dose limit of 5 mrem. The risk from elevated tritium results in the quarry during the second quarter when MPS3 is in a refueling outage are balanced with minimizing fish impingement and outage activities that increase plant safety and reliability.

2.2.5 Abnormal Liquid Releases

An abnormal release of radioactivity is the discharge of a volume of liquid radioactive material to the environment that was unplanned or uncontrolled. In 2019, the following abnormal liquid releases occurred:

2.2.4.1 MPS1 - None
2.2.4.2 MPS2 - None
2.2.4.3 MPS3 - None

2.2.6 Liquid Release Tables

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

Table 2.1-L1
MPS1
Liquid Effluents - Release Summary

	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	5.28E-04	7.08E-04	*	1.15E-03	2.39E-03
2. Average Period Diluted Activity+	uCi/ml	2.19E-12	3.00E-12	*	4.15E-12	2.29E-12
B. Tritium						
1. Total Activity Released	Ci	8.42E-03	1.79E-02	*	3.71E-03	3.00E-02
2. Average Period Diluted Activity+	uCi/ml	3.49E-11	7.58E-11	*	1.34E-11	2.89E-11
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	*	-	-
2. Average Period Diluted Activity+	uCi/ml	-	-	*	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	*	-	-
E. Volume						
1. Released Waste Volume	Liters	9.99E+04	1.70E+05	0.00E+00	1.02E+05	3.72E+05
2. Dilution Volume During Releases	Liters	6.31E+08	1.02E+09	0.00E+00	6.60E+08	2.31E+09
3. Dilution Volume During Period++	Liters	2.41E+11	2.36E+11	2.86E+11	2.77E+11	1.04E+12

* No activity released
"-" denotes less than Minimum Detectable Activity (MDA)
+ "Total Activity Released" ÷ ("Released Waste Volume" + "Dilution Volume During Period")
++ MPS2 Dilution Volume During Period used because there is no MPS1 dilution

Table 2.1-L2

MPS1

Liquid Effluents - Batch

Release to Quarry: Liquid Radwaste Processing System

Nuclides Released	Units	2019				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Fe-55	Ci	2.62E-04	4.02E-05	*	-	3.02E-04
Sr-89	Ci	-	-	*	-	-
Sr-90	Ci	1.61E-06	1.08E-06	*	4.75E-06	7.44E-06
Cs-137	Ci	2.65E-04	6.61E-04	*	1.15E-03	2.07E-03
Ce-143	Ci	-	5.32E-06	*	-	5.32E-06
Other γ Emitters	Ci	-	-	*	-	-
Total Activity	Ci	5.28E-04	7.08E-04	*	1.15E-03	2.39E-03
B. Tritium						
H-3	Ci	8.42E-03	1.79E-02	*	3.71E-03	3.00E-02
C. Dissolved & Entrained Gases						
Kr-85	Ci	-	-	*	-	-
Other γ Emitters	Ci	-	-	*	-	-
Total Activity	Ci	-	-	*	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	*	-	-

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

Table 2.2-L1

MPS2

Liquid Effluents - Release Summary

	Units	2019 1st Qtr	2019 2nd Qtr	2019 3rd Qtr	2019 4th Qtr	2019 Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	2.08E-03	3.08E-04	8.74E-05	-	2.48E-03
2. Average Period Diluted Activity *	uCi/ml	8.63E-12	1.30E-12	3.06E-13	-	2.38E-12
B. Tritium						
1. Total Activity Released	Ci	6.74E+00	1.02E+02	1.04E+02	1.54E+02	3.67E+02
2. Average Period Diluted Activity *	uCi/ml	2.08E-08	4.32E-07	3.64E-07	5.56E-07	3.53E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	2.85E-04	-	1.22E-03	1.51E-03
2. Average Period Diluted Activity *	uCi/ml	-	1.21E-12	-	4.42E-12	1.45E-12
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.81E+05	4.95E+05	2.94E+05	2.98E+05	1.27E+06
Secondary	Liters	1.91E+06	1.65E+04	1.57E+05	1.73E+06	3.82E+06
2. Dilution Volume During Releases						
Primary	Liters	1.61E+09	3.25E+09	3.12E+09	3.08E+09	1.11E+10
Secondary (DSN006)	Liters	4.60E+07	4.07E+03	0.00E+00	3.98E+07	8.57E+07
Secondary (Quarry)	Liters	1.37E+10	1.07E+09	1.24E+10	3.77E+09	3.10E+10
3. Dilution Volume During Period						
Quarry	Liters	2.41E+11	2.36E+11	2.86E+11	2.77E+11	1.04E+12
DSN006	Liters	5.84E+07	5.06E+07	5.37E+07	6.47E+07	2.27E+08

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

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

Table 2.2-L2

MPS2

Liquid Effluents - Continuous

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

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Ni-63	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	4.45E-03	2.69E-04	4.71E-05	9.23E-03	1.40E-02
C. Dissolved & Entrained Gases						
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.2-L3
MPS2
Liquid Effluents - Batch
Release to Quarry: Liquid Radwaste Processing System

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Mn-54	Ci	-	-	-	-	-
Fe-55	Ci	2.03E-03	-	-	-	2.03E-03
Co-58	Ci	3.12E-05	9.72E-06	-	-	4.09E-05
Co-60	Ci	1.89E-05	-	-	-	1.89E-05
Ni-63	Ci	-	2.98E-04	8.74E-05	-	3.85E-04
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Nb-97	Ci	-	-	-	-	-
Ag-110m	Ci	-	-	-	-	-
Sb-125	Ci	-	-	-	-	-
I-131	Ci	-	-	-	-	-
Cs-137	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.08E-03	3.08E-04	8.74E-05	-	2.47E-03
B. Tritium						
H-3	Ci	6.74E+00	1.02E+02	1.04E+02	1.54E+02	3.67E+02
C. Dissolved & Entrained Gases						
Xe-133	Ci	-	2.85E-04	-	1.14E-03	1.43E-03
Xe-135	Ci	-	-	-	8.47E-05	8.47E-05
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	2.85E-04	-	1.22E-03	1.51E-03
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L1

MPS3

Liquid Effluents - Release Summary

	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission and Activation Products						
1. Total Activity Released	Ci	2.26E-03	1.41E-03	5.29E-04	4.50E-04	4.66E-03
2. Average Period Diluted Activity *	uCi/ml	5.68E-12	4.96E-12	1.12E-12	9.70E-13	2.88E-12
B. Tritium						
1. Total Activity Released	Ci	4.99E+02	5.59E+02	1.34E+02	2.14E+02	1.40E+03
2. Average Period Diluted Activity *	uCi/ml	1.25E-06	1.97E-06	2.83E-07	4.62E-07	8.65E-07
C. Dissolved and Entrained Gases						
1. Total Activity Released	Ci	-	-	-	-	-
2. Average Period Diluted Activity *	uCi/ml	-	-	-	-	-
D. Gross Alpha						
1. Total Activity Released	Ci	-	-	-	-	-
E. Volume						
1. Released Waste Volume						
Primary	Liters	1.16E+06	1.28E+06	7.80E+05	8.05E+05	4.03E+06
Secondary	Liters	1.30E+07	5.93E+06	2.43E+07	1.36E+07	5.68E+07
2. Dilution Volume During Releases						
Primary	Liters	9.35E+09	8.11E+09	7.37E+09	7.36E+09	3.22E+10
Secondary (DSN006)	Liters	4.58E+07	5.73E+07	1.07E+08	1.28E+08	3.38E+08
Secondary (Quarry)	Liters	8.73E+11	4.10E+11	9.01E+11	7.62E+11	2.95E+12
3. Dilution Volume During Period						
Quarry	Liters	3.98E+11	2.84E+11	4.74E+11	4.64E+11	1.62E+12
DSN006	Liters	5.84E+07	5.06E+07	5.37E+07	6.47E+07	2.27E+08

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

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

Table 2.3-L2

MPS3

Liquid Effluents - Continuous

1. Release to Quarry: Steam Generator Blowdown, Service Water, ABD TK-2

2. Release to DSN006: Turbine Building Sump and SRW Sump 3

Nuclides Released	Units	2019 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Fe-55	Ci	-	-	-	-	-
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
B. Tritium						
H-3	Ci	4.13E-01	3.72E-02	9.69E-01	4.18E-01	1.84E+00
C. Dissolved & Entrained Gases						
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

Table 2.3-L3

MPS3

Liquid Effluents - Batch

1. Release to Quarry: Liquid Radwaste Processing System, CPF Waste Neutralization Sumps, Hotwell and Steam Generator Bulk, ABD TK-2

2. Release to DSN006: Waste Test Tank Berm

Nuclides Released	Units	2019				
		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
A. Fission & Activation Products						
Mn-54	Ci	-	-	-	6.47E-06	6.47E-06
Fe-55	Ci	1.16E-03	-	4.34E-04	-	1.60E-03
Co-58	Ci	-	1.12E-03	5.39E-05	1.88E-05	1.19E-03
Co-60	Ci	-	8.96E-05	-	3.71E-05	1.27E-04
Ni-63	Ci	-	-	-	1.26E-04	1.26E-04
Sr-89	Ci	-	-	-	-	-
Sr-90	Ci	-	-	-	-	-
Zr-95	Ci	-	-	-	-	-
Sb-125	Ci	1.28E-04	1.05E-04	4.14E-05	2.62E-04	5.35E-04
Cs-134	Ci	3.00E-05	-	-	-	3.00E-05
Cs-137	Ci	9.42E-04	1.04E-04	-	-	1.05E-03
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	2.26E-03	1.41E-03	5.29E-04	4.50E-04	4.66E-03
B. Tritium						
H-3	Ci	4.99E+02	5.59E+02	1.33E+02	2.14E+02	1.40E+03
C. Dissolved & Entrained Gases						
Other γ Emitters	Ci	-	-	-	-	-
Total Activity	Ci	-	-	-	-	-
D. Gross Alpha						
Gross Alpha	Ci	-	-	-	-	-

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

2.3 Solid Waste

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

Table 2.1-S MPS1 Solid Waste and Irradiated Component Shipments
Table 2.2-S MPS2 Solid Waste and Irradiated Component Shipments
Table 2.3-S MPS3 Solid Waste and Irradiated Component Shipments

The principal radionuclides in these tables were from shipping manifests.

Solidification Agent(s): No solidification on site

Containers routinely used for radioactive waste shipment include:

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

* United States Department of Transportation

Table 2.1-S
Solid Waste and Irradiated Component Shipments
MPS1

January 1, 2019 through December 31, 2019

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

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

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0.00E+00

Table 2.1-S (continued)
Solid Waste and Irradiated Component Shipments
MPS1

January 1, 2019 through December 31, 2019

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

Dry Active Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.80E+02	5.10E+00	2.09E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.80E+02**	**5.10E+00**	**2.09E-09**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
C-14	0.02 %	4.68E-07
Fe-55	0.15 %	3.11E-06
Co-60	5.30 %	1.11E-04
Ni-63	2.47 %	5.17E-05
Sr-90	0.42 %	8.80E-06
Cs-137	91.52 %	1.92E-03
Pu-238	< 0.01 %	2.08E-07
Pu-239	< 0.01 %	1.95E-07
Pu-241	0.05 %	1.05E-06
Am-241	0.03 %	7.14E-07
Cm-242	< 0.01 %	2.57E-11
Cm-244	0.01 %	2.65E-07
CURIES (TOTAL)		**2.09E-03**

Table 2.1-S (continued)
Solid Waste and Irradiated Component Shipments
MPS1

January 1, 2019 through December 31, 2019

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

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

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

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

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Table 2.1-S (continued)
Solid Waste and Irradiated Component Shipments
MPS1

January 1, 2019 through December 31, 2019

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

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.80E+02	5.10E+00	2.09E-03
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	1.80E+02	5.10E+00	2.09E-03

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
C-14	0.02 %	4.68E-07
Fe-55	0.15 %	3.11E-06
Co-60	5.30 %	1.11E-04
Ni-63	2.47 %	5.17E-05
Sr-90	0.42 %	8.80E-06
Cs-137	91.52 %	1.92E-03
Pu-238	< 0.01 %	2.08E-07
Pu-239	< 0.01 %	1.95E-07
Pu-241	0.05 %	1.05E-06
Am-241	0.03 %	7.14E-07
Cm-242	< 0.01 %	2.57E-11
Cm-244	0.01 %	2.65E-07
CURIES (TOTAL)		**2.09E-03**

Table 2.2-S
Solid Waste and Irradiated Component Shipments
MPS2

January 1, 2019 through December 31, 2019

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

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	N/A	N/A	N/A
B	8.76E+01	2.48E+00	1.39E+01
C	N/A	N/A	N/A
ALL	**8.76E+01**	**2.48E+00**	**1.39E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.03 %	3.82E-03
C-14	1.45 %	2.02E-01
Mn-54	4.81 %	6.71E-01
Fe-55	20.59 %	2.87E+00
Co-57	0.06 %	8.99E-03
Co-58	0.10 %	1.37E-02
Co-60	28.77 %	4.01E+00
Ni-59	0.33 %	4.61E-02
Ni-63	27.98 %	3.90E+00
Sr-89	< 0.01%	3.81E-04
Sr-90	0.15%	2.13E-02
Tc-99	0.03%	4.59E-03
Ag-110m	0.44%	6.19E-02
Sn-113	0.07%	1.02E-02
Sb-125	3.23%	4.50E-01
Cs-134	0.29%	4.08E-02
Cs-137	11.48%	1.60E+00
Pu-238	< 0.01%	2.38E-04
Pu-239	< 0.01%	7.18E-05
Pu-241	0.17%	2.42E-02
Am-241	< 0.01%	7.18E-05
Cm-242	< 0.01%	9.81E-06
Cm-244	< 0.01%	1.03E-04
CURIES (TOTAL)		**1.39E+01**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS2

January 1, 2019 through December 31, 2019

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

Dry Active Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	4.69E+03	1.33E+02	7.25E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**4.69E+03**	**1.33E+02**	**7.25E-01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.60%	4.32E-03
C-14	< 0.01%	8.12E-06
Cr-51	< 0.01%	9.80E-06
Mn-54	0.21%	1.49E-03
Fe-55	6.29%	4.56E-02
Fe-59	< 0.01%	7.45E-07
Co-57	< 0.01%	6.00E-06
Co-58	0.17%	1.27E-03
Co-60	35.12%	2.55E-01
Ni-59	0.56%	4.09E-03
Ni-63	50.72%	3.68E-01
Sr-89	< 0.01%	9.30E-10
Sr-90	< 0.01%	2.82E-06
Zr-95	0.15%	1.07E-03
Nb-94	< 0.01%	6.12E-05
Nb-95	0.34%	2.43E-03
Tc-99	0.16%	1.19E-03
Ag-110m	0.45%	3.27E-03
Sn-113	< 0.01%	1.09E-05
Sb-125	2.27%	1.65E-02
Cs-137	2.81%	2.04E-02
Ce-144	< 0.01%	7.67E-07
Pu-238	< 0.01%	4.19E-05
Pu-239	< 0.01%	1.19E-05
Pu-241	0.12%	8.67E-04
Am-241	< 0.01%	3.62E-05
Cm-242	< 0.01%	7.73E-06
Cm-244	< 0.01%	2.14E-05
CURIES (TOTAL)		**7.25E-01**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS2

January 1, 2019 through December 31, 2019

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

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

Nuclides for the Above Table:

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

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS2

January 1, 2019 through December 31, 2019

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

Other Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.04E+03	2.96E+01	4.40E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.04E+03**	**2.96E+01**	**4.40E-02**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	98.98%	4.35E-02
C-14	0.13%	5.89E-05
Cr-51	0.04%	1.84E-05
Mn-54	0.03%	1.24E-05
Fe-55	0.10%	4.54E-05
Fe-59	< 0.01%	8.15E-07
Co-57	< 0.01%	1.10E-07
Co-58	0.14%	6.26E-05
Co-60	0.18%	7.75E-05
Ni-59	< 0.01%	2.81E-07
Ni-63	0.11%	4.78E-05
Sr-90	< 0.01%	2.86E-08
Zr-95	0.01%	5.43E-06
Nb-94	< 0.01%	1.93E-07
Nb-95	0.02%	1.02E-05
Tc-99	0.02%	7.28E-06
Ag-110m	0.02%	9.30E-06
Sn-113	< 0.01%	1.94E-07
Sb-124	< 0.01%	1.62E-06
Sb-125	0.08%	3.54E-05
Cs-137	0.12%	5.44E-05
Th-230	< 0.01%	9.35E-08
U (nat)	< 0.01%	9.40E-08
Np-237	< 0.01%	7.10E-08
Pu-238	< 0.01%	4.42E-09
Pu-239	< 0.01%	1.21E-09
Pu-241	< 0.01%	8.11E-08
Am-241	< 0.01%	3.96E-09
Cm-242	< 0.01%	1.51E-09
Cm-244	< 0.01%	2.89E-09
CURIES (TOTAL)		**4.40E-02**

Table 2.2-S (continued)
Solid Waste and Irradiated Component Shipments
MPS2

January 1, 2019 through December 31, 2019

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

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	5.73E+03	1.62E+02	7.69E-01
B	8.76E+01	2.48E+00	1.39E+01
C	N/A	N/A	N/A
ALL	**5.82E+03**	**1.65E+02**	**1.47E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.35%	5.17E-02
C-14	1.37%	2.02E-01
Cr-51	< 0.01%	2.82E-05
Mn-54	4.57%	6.73E-01
Fe-55	19.82%	2.92E+00
Fe-59	< 0.01%	1.56E-06
Co-57	0.06%	9.00E-03
Co-58	0.10%	1.50E-02
Co-60	29.00%	4.26E+00
Ni-59	0.34%	5.02E-02
Ni-63	29.02%	4.27E+00
Sr-89	< 0.01%	3.81E-04
Sr-90	0.14%	2.13E-02
Zr-95	< 0.01%	1.07E-03
Nb-94	< 0.01%	6.14E-05
Nb-95	0.02%	2.44E-03
Tc-99	0.04%	5.79E-03
Ag-110m	0.44%	6.52E-02
Sn-113	0.07%	1.02E-02
Sb-124	< 0.01%	1.62E-06
Sb-125	3.17%	4.66E-01
Cs-134	0.28%	4.08E-02
Cs-137	11.02%	1.62E+00
Ce-144	< 0.01%	7.67E-07
Th-230	< 0.01%	9.35E-08
U (nat)	< 0.01%	9.40E-08
Np-237	< 0.01%	7.10E-08
Pu-238	< 0.01%	2.80E-04
Pu-239	< 0.01%	8.37E-05
Pu-241	0.17%	2.51E-02
Am-241	< 0.01%	1.08E-04
Cm-242	< 0.01%	1.75E-05
Cm-244	< 0.01%	1.24E-04
CURIES (TOTAL)		**1.47E+01**

Table 2.3-S
Solid Waste and Irradiated Component Shipments
MPS3

January 1, 2019 through December 31, 2019

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

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	5.52E+02	1.56E+01	4.20E+01
B	8.28E+01	2.34E+00	1.99E+01
C	2.24E+01	6.34E-01	4.16E+00
ALL	**6.57E+02**	**1.86E+01**	**6.61E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	3.15%	2.08E+00
C-14	0.20%	1.33E-01
Cr-51	0.03%	1.70E-02
Mn-54	7.28%	4.81E+00
Fe-55	13.75%	9.09E+00
Fe-59	< 0.01%	1.88E-03
Co-57	0.16%	1.07E-01
Co-58	1.64%	1.08E+00
Co-60	12.87%	8.50E+00
Ni-59	0.96%	6.36E-01
Ni-63	56.38%	3.73E+01
Zn-65	0.02%	1.53E-02
Sr-89	< 0.01%	1.12E-03
Sr-90	0.02%	1.07E-02
Zr-95	0.02%	1.39E-02
Nb-94	0.03%	1.87E-02
Nb-95	0.04%	2.93E-02
Tc-99	< 0.01%	9.07E-04
Ag-110m	< 0.01%	3.18E-03
Sn-113	0.02%	1.03E-02
Sb-124	< 0.01%	4.49E-05
Sb-125	1.90%	1.25E+00
Cs-134	0.09%	5.93E-02
Cs-137	1.41%	9.35E-01
Pu-238	< 0.01%	7.72E-05
Pu-239	< 0.01%	1.33E-05
Pu-241	0.03%	1.84E-02
Am-241	< 0.01%	1.40E-04
Cm-242	< 0.01%	1.43E-05
Cm-244	< 0.01%	1.01E-04
CURIES (TOTAL)		**6.61E+01**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS3

January 1, 2019 through December 31, 2019

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

Dry Active Waste	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.04E+04	2.95E+02	2.79E-01
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.04E+04**	**2.95E+02**	**2.79E-01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	0.30%	8.50E-04
Cr-51	5.23%	1.46E-02
Mn-54	3.16%	8.81E-03
Fe-55	15.12%	4.22E-02
Fe-59	0.29%	8.09E-04
Co-57	0.08%	2.15E-04
Co-58	15.24%	4.25E-02
Co-60	39.24%	1.09E-01
Ni-59	0.05%	1.51E-04
Ni-63	5.19%	1.45E-02
Sr-90	< 0.01%	5.37E-06
Zr-95	4.65%	1.30E-02
Nb-94	0.14%	3.82E-04
Nb-95	8.84%	2.46E-02
Tc-99	< 0.01%	1.14E-07
Ag-110m	0.28%	7.93E-04
Sn-113	0.18%	4.97E-04
Sb-125	1.11%	3.11E-03
Cs-137	0.89%	2.47E-03
Pu-238	< 0.01%	3.98E-09
Pu-239	< 0.01%	1.09E-09
Pu-241	< 0.01%	7.25E-08
Am-241	< 0.01%	8.99E-08
Cm-242	< 0.01%	5.61E-08
Cm-244	< 0.01%	1.03E-07
CURIES (TOTAL)		**2.79E-01**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS3

January 1, 2019 through December 31, 2019

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

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

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
CURIES (TOTAL)		0

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS3

January 1, 2019 through December 31, 2019

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

Other Waste	Volume		Curies Shipped
Waste Class	ft^3	m^3	Curies
A	1.51E+03	4.28E+01	4.13E-02
B	N/A	N/A	N/A
C	N/A	N/A	N/A
ALL	**1.51E+03**	**4.28E+01**	**4.13E-02**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	99.01%	4.09E-02
C-14	0.14%	5.81E-05
Cr-51	0.04%	1.84E-05
Mn-54	0.03%	1.24E-05
Fe-55	0.11%	4.36E-05
Fe-59	< 0.01%	8.15E-07
Co-57	< 0.01%	1.10E-07
Co-58	0.11%	4.63E-05
Co-60	0.17%	7.07E-05
Ni-59	< 0.01%	2.81E-07
Ni-63	0.11%	4.51E-05
Sr-90	< 0.01%	2.26E-08
Zr-95	0.01%	5.43E-06
Nb-94	< 0.01%	1.93E-07
Nb-95	0.02%	1.02E-05
Tc-99	0.02%	7.13E-06
Ag-110m	0.02%	8.45E-06
Sn-113	< 0.01%	1.94E-07
Sb-124	< 0.01%	9.51E-07
Sb-125	0.07%	2.92E-05
Cs-137	0.12%	5.15E-05
Th-230	< 0.01%	9.35E-08
U (nat)	< 0.01%	9.40E-08
Np-237	< 0.01%	7.10E-08
Pu-238	< 0.01%	3.91E-09
Pu-239	< 0.01%	1.07E-09
Pu-241	< 0.01%	7.17E-08
Am-241	< 0.01%	3.55E-09
Cm-242	< 0.01%	1.37E-09
Cm-244	< 0.01%	2.64E-09
CURIES (TOTAL)		**4.13E-02**

Table 2.3-S (continued)
Solid Waste and Irradiated Component Shipments
MPS3

January 1, 2019 through December 31, 2019

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

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	**ft^3**	**m^3**	**Curies**
A	1.25E+04	3.54E+02	4.23E+01
B	8.28E+01	2.34E+00	1.99E+01
C	2.24E+01	6.34E-01	4.16E+00
ALL	**1.26E+04**	**3.57E+02**	**6.64E+01**

Nuclides for the Above Table:

Radionuclide	% of Total	Curies
H-3	3.19%	2.12E+00
C-14	0.20%	1.33E-01
Cr-51	0.05%	3.16E-02
Mn-54	7.26%	4.82E+00
Fe-55	13.75%	9.13E+00
Fe-59	< 0.01%	2.69E-03
Co-57	0.16%	1.07E-01
Co-58	1.69%	1.12E+00
Co-60	12.97%	8.61E+00
Ni-59	0.96%	6.36E-01
Ni-63	56.13%	3.73E+01
Zn-65	0.02%	1.53E-02
Sr-89	< 0.01%	1.12E-03
Sr-90	0.02%	1.08E-02
Zr-95	0.04%	2.69E-02
Nb-94	0.03%	1.91E-02
Nb-95	0.08%	5.40E-02
Tc-99	< 0.01%	9.14E-04
Ag-110m	< 0.01%	3.98E-03
Sn-113	0.02%	1.08E-02
Sb-124	< 0.01%	4.59E-05
Sb-125	1.89%	1.26E+00
Cs-134	0.09%	5.93E-02
Cs-137	1.41%	9.37E-01
Th-230	< 0.01%	9.35E-08
U(nat)	< 0.01%	9.40E-08
Np-237	< 0.01%	7.10E-08
Pu-238	< 0.01%	7.72E-05
Pu-239	< 0.01%	1.33E-05
Pu-241	0.03%	1.84E-02
Am-241	< 0.01%	1.40E-04
Cm-242	< 0.01%	1.43E-05
Cm-244	< 0.01%	1.01E-04
CURIES (TOTAL)		**6.64E+01**

2.4 Groundwater Monitoring

The Groundwater Protection Program (GWPP) at MPS implements the actions cited in the Nuclear Energy's Institute's (NEI) Groundwater Protection Initiative, NEI 07-07 (Reference 10). The purpose of the GWPP is to establish a program to assure timely and effective management of situations involving potential releases of radioactive material to ground. A key element in the GWPP is on-site groundwater monitoring. The results of the GWPP are documented in Table 2.4-GW.

Another key element in the GWPP is site hydrological characterization. The general trend of groundwater flow at the station is toward the Long Island Sound. The underdrain system effectively captures groundwater in the area around MPS3 and channels this water via the storm drain system to Long Island Sound

On 07/31/2018, during a planned underground pipe inspection of the Unit 3 condensate surge tank, a water leak was identified from one of the return lines to the tank. The leak was stopped and leaked standing water was captured. Following the event, local and state government stakeholders and the NRC were notified.

The level of tritium in the groundwater wells inside the Plant Protected Area does not present an exposure pathway to onsite personnel or members of the public, as there are no drinking water wells onsite. In addition to ground water samples taken within the Protected Area, ground water samples were also taken outside the Protected Area on owner-controlled property. The absence of tritium in wells outside the Protected Area indicates that tritium is confined to the specified locations identified in Table 2.4.

Table 2.4 GW (p. 1 of 2) Well Sample Results

Name	Date	H-3[1,2] (pCi/L)	Name	Date	H-3[1,2] (pCi/L)
MW-7C[3]	01/17/2019	3080	MW-7D[3]	01/17/2019	2480
	02/05/2019	3410		02/05/2019	2720
	02/26/2019	2320		02/26/2019	1840
	03/27/2019	3970		03/28/2019	1970
	04/25/2019	5650		04/25/2019	3170
	05/06/2019	3450		05/06/2019	1700
	05/29/2019	4960		05/29/2019	2210
	07/05/2019	3890		07/05/2019	<mda
	07/19/2019	3300		07/19/2019	<mda
	08/01/2019	3430		08/01/2019	<mda
	09/06/2019	2840		09/06/2019	<mda
	09/24/2019	1720		09/24/2019	<mda
	10/21/2019	2060		10/21/2019	<mda
	11/11/2019	3730		11/11/2019	<mda

Notes:

1. There was no gamma radioactivity detected in all samples.
2. MDA is approximately 1,730 pCi/L.
3. MW-7C/7D have been subject to tritium from atmospheric deposition as well as residual water leakage of the buried condensate piping that was replaced in 2018. Also, these wells are located near the Unit 3 RWST which is downwind direction from the Unit 3 Ventilation Vent. Tritium detected is attributed from releases out of the RWST vent and Ventilation Vent. Gaseous releases from the Ventilation Vent are reported in Table 2.3-A7 and from the RWST vent in Table 2.3-A3. Any releases from RWST vent or Ventilation Vent which reach the groundwater are captured in sumps and underground vaults, and periodically monitored before release to the environment and reported in Table 2.3-L2. There has been no hydraulic communication with offsite groundwater.

Table 2.4 GW (p. 2 of 2)
Well Sample Results

Name	Date	H-3[1,2] (pCi/L)	Name	Date	H-3[1,2] (pCi/L)
DP-102[3]	03/28/2019	3,280	MW-GPI-10	03/27/2019	<mda
	05/04/2019	10,800		06/19/2019	<mda
	09/26/2019	Dry		09/26/2019	<mda
	10/24/2019	2,950		11/16/2019	<mda
ME-2	11/19/2019	<mda	MW-GPI-11[4]	03/27/2019	<mda
ME-5	11/19/2019	<mda		06/27/2019	<mda
MW-6A	03/28/2019	<mda		09/26/2019	3,400
	04/29/2019	<mda		09/27/2019	2,410
	09/26/2019	<mda		10/07/2019	2,250
	10/07/2019	<mda		10/25/2019	<mda
	10/26/2019	<mda		11/15/2019	2,740
MW-6B	02/06/2019	<mda		01/03/2020	<mda
	04/29/2019	<mda		01/28/2020	<mda
	07/19/2019	<mda		02/20/2020	<mda
	10/26/2019	<mda			
MW-GPI-02	03/27/2019	<mda	S11-MW-1	09/24/2019	<mda
	06/19/2019	<mda	S12-MW-1	03/27/2019	<mda
	09/26/2019	<mda		06/27/2019	<mda
	11/06/2019	<mda		07/09/2019	<mda
MW-GPI-03	11/19/2019	<mda		11/16/2019	<mda
MW-GPI-04	12/13/2019	<mda	S12-MW-3	03/27/2019	<mda
MW-GPI-06	03/28/2019	<mda		06/27/2019	<mda
	05/06/2019	<mda		09/26/2019	<mda
	09/27/2019	<mda		11/06/2019	<mda
	10/24/2019	<mda	T1-MW-3	11/16/2019	<mda
MW-GPI-08	03/28/2019	<mda	S13-MW-1	04/29/2019	<mda
	06/19/2019	<mda	S1-MW-1	07/31/2019	<mda
	09/26/2019	<mda	S3-MW-2	05/22/2019	<mda
	11/16/2019	<mda		11/05/2019	
MW-GPI-09	03/27/2019	<mda	T10-MW-5E	11/16/2019	<mda
	06/19/2019	<mda	T10-MW-6A	11/15/2019	<mda
	09/26/2019	<mda	T10-MW-6B	11/16/2019	<mda
	11/16/2019	<mda			

Notes:

1. There was no gamma radioactivity detected in these samples.
2. MDA is approximately 1,730 pCi/L.
3. DP-102 is a shallow groundwater monitoring well located inside the Unit 3 RCA yard, 3 feet from the base of the Unit 3 RWST, which is also in the downwind direction of the Unit 3 Ventilation Vent. Tritium in this well is related to atmospheric deposition of tritiated water vapor from the MP3 RWST Vent and is not indicative of a leak. Atmospheric deposition from RWST Vent and Unit 3 Ventilation Vent that reach groundwater are captured, by design, in Sump 3. Water in Sump 3 is released through the monitored discharged pathway, DSN-006, as reported in Table 2.3-L2. There has been no hydraulic communication between Well DP-102 and offsite groundwater.
4. MW-GPI-11 has been subject to tritium from atmospheric deposition due to gas effluent discharges as well as potential seep through water from Manhole-22A. Visual inspection of Manhole 22A and its associated piping is scheduled for 2020. Maximum tritium concentration detected in MW-GPI-11 during the 3rd and 4th quarters of 2019 was 2,740 pCi/L. The activity concentration in the well for the month of January and February of 2020 was less than MDA. Monitoring of systems, manholes, and wells in the area will continue more frequently until inspection is complete.

3.0 Non-Functional Effluent Monitors

During the period January 1 through December 31, 2019, the following effluent instrumentation were NONFUNCTIONAL for more than 30 consecutive days:

3.1. **MPS1 -** None

3.2. **MPS2** - None

3.3. **MPS3 -** None

4.0 Operating History

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

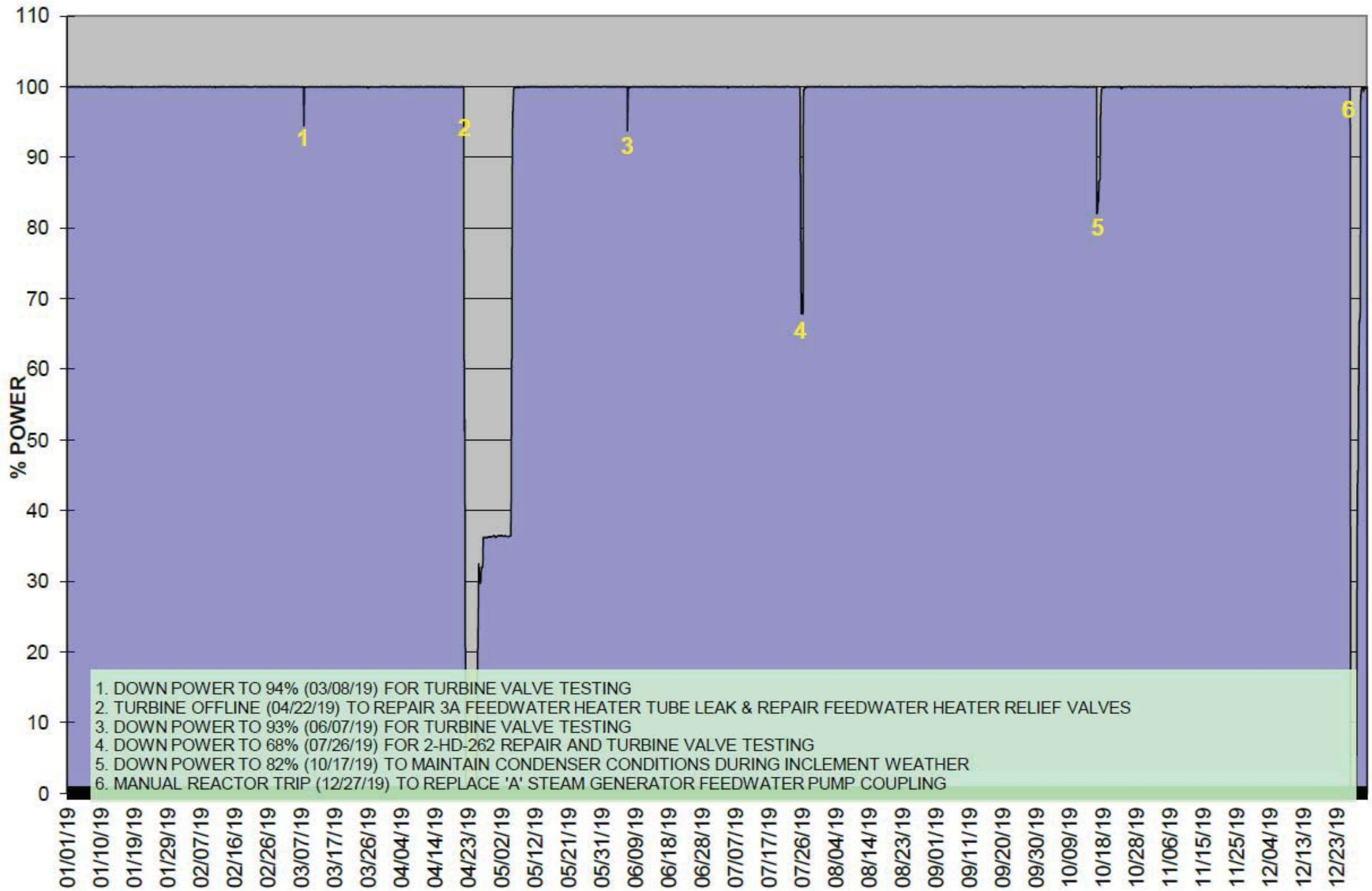
MPS1 was shut down November 11, 1995 with a cessation of operation declared in July 1998.

MPS2 operated with a capacity factor of **95.04%**

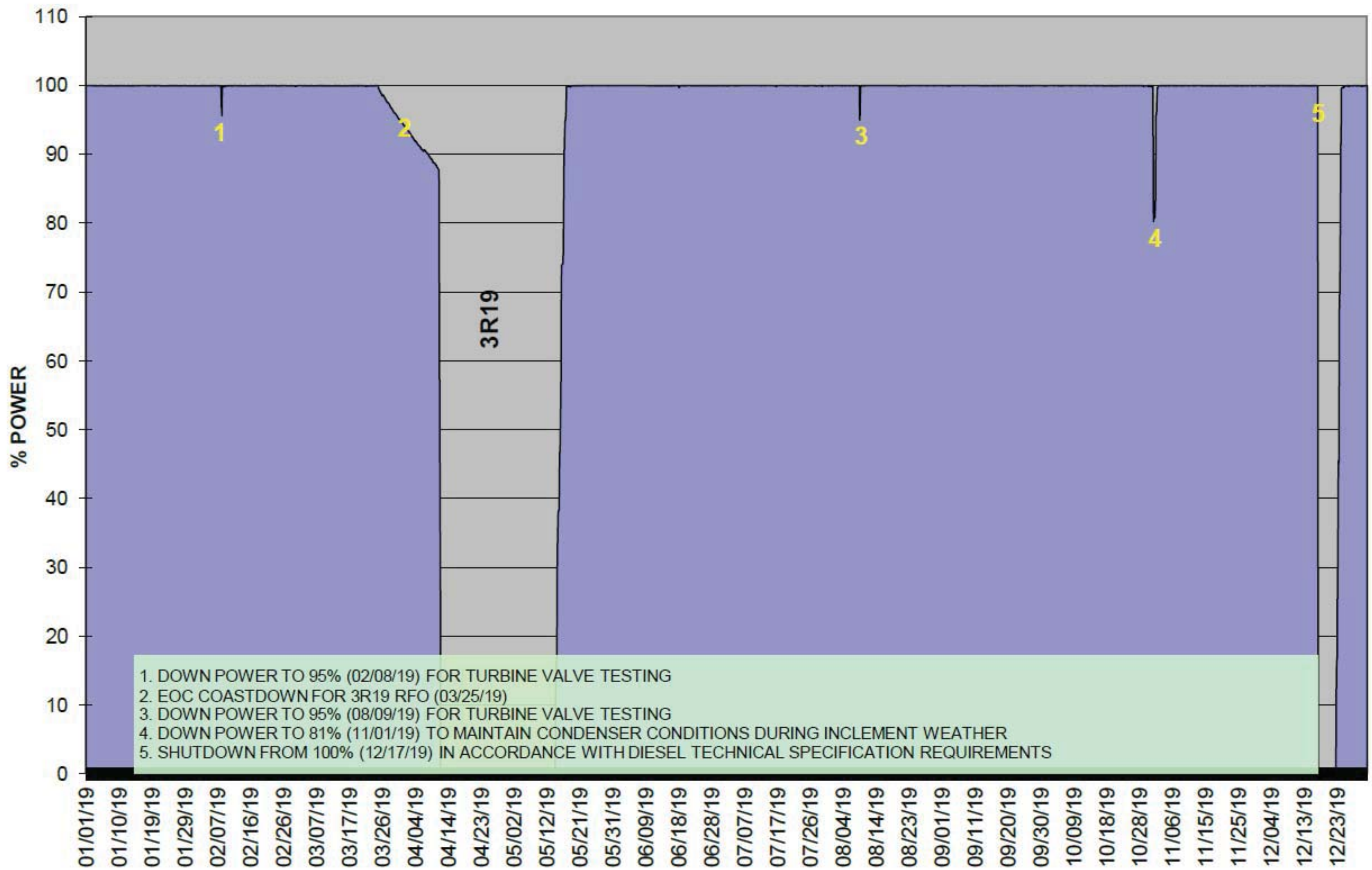
MPS3 operated with a capacity factor of **89.58%**

The power histograms for 2019 are on the following pages.

MP2 - POWER HISTORY
12 Months
Updated through: December 31, 2019



MP3 - POWER HISTORY
12 Months
Updated through: December 31, 2019



5.0 Errata

Offsite Dose Commitments from Gaseous Effluents Millstone Units 1, 2, 3 "Max Air" beta and gamma doses were revised for the 2018 RERR. The link to update the MPS2 beta and gamma air doses was not updated correctly and values from the previous year were populated. MPS3 total beta and gamma air doses were updated to account for the rounding difference between the OpenEMS software and excel. This did not change maximum whole body dose for offsite individual of 0.2 mrem for 2018 and the revised values are highlighted in the tables below.

Table 1-1
2018 Off-Site Dose Commitments from Gaseous Effluents
MPS1, 2, 3

MPS1	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	1.18E-05	2.86E-05	2.19E-05	2.01E-06	6.43E-05
Skin	1.05E-05	1.36E-05	1.02E-05	2.01E-06	3.63E-05
Thyroid	1.05E-05	2.86E-05	2.19E-05	2.01E-06	6.30E-05
Max organ[1]	1.33E-05	2.86E-05	2.19E-05	2.01E-06	6.58E-05

MPS2	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	3.82E-06	1.44E-07	2.22E-05	4.43E-06	2.75E-05
Gamma	1.03E-05	3.85E-07	1.33E-05	1.71E-06	1.82E-05
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	2.49E-03	1.65E-02	1.73E-02	1.24E-03	3.76E-02
Skin	4.73E-04	3.84E-04	7.13E-04	3.14E-04	1.88E-03
Thyroid	2.60E-03	1.75E-02	1.79E-02	1.25E-03	3.93E-02
Max organ[1]	1.11E-02	9.89E-02	1.02E-01	5.39E-03	2.18E-01

MPS3	*1st Quarter*	*2nd Quarter*	*3rd Quarter*	*4th Quarter*	*Annual Total*
Max Air	mrad	mrad	mrad	mrad	mrad
Beta	1.25E-05	5.27E-07	1.87E-06	1.68E-04	1.72E-04
Gamma	1.72E-06	6.16E-08	1.35E-06	2.93E-04	2.94E-04
Max Individual	mrem	mrem	mrem	mrem	mrem
Whole Body	4.46E-03	1.74E-02	1.75E-02	2.46E-03	4.18E-02
Skin	1.60E-03	9.84E-04	5.42E-04	1.41E-03	4.53E-03
Thyroid	4.46E-03	1.74E-02	1.75E-02	2.46E-03	4.18E-02
Max organ[1]	1.63E-02	9.94E-02	1.02E-01	7.99E-03	2.26E-01

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

Table 1- 3
2018 Off-Site Dose Comparison to Limits MPS1, 2, 3

Gaseous Effluents Dose

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*	Skin *(mrem)*	Beta Air *(mrad)*	Gamma Air *(mrad)*
MPS1	6.43E-05	6.30E-05	6.58E-05	3.63E-05	0.00E+00	0.00E+00
MPS2	3.76E-02	3.93E-02	2.18E-01	1.88E-03	2.75E-05	1.82E-05
MPS3	4.18E-02	4.18E-02	2.26E-01	4.53E-03	1.72E-04	2.94E-04
MPS	**7.95E-02**	**8.12E-02**	**4.44E-01**	**6.45E-03**	**2.00E-04**	**3.12E-04**
Limits	***5***	***15***	***15***	***15***	***20***	***10***

Liquid Effluents Dose

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*
MPS1	3.53E-05	1.02E-05	4.98E-05
MPS2	2.36E-04	2.33E-04	8.56E-04
MPS3	4.73E-04	3.23E-04	1.32E-03
MPS	**7.43E-04**	**5.65E-04**	**2.23E-03**
Limits	***3***	***10***	***10***

Total Off-Site Dose from MPS

	Whole Body *(mrem)*	Thyroid *(mrem)*	Max Organ* *(mrem)*
Gaseous	7.95E-02	8.12E-02	4.44E-01
Liquid	7.43E-04	5.65E-04	2.23E-03
Direct Shine**	1.20E-01	1.20E-01	1.20E-01
MPS	**2.00E-01**	**2.02E-01**	**5.66E-01**
Limits	***25***	***75***	***25***

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

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

6.0 REMODCM Changes

The description and the bases of the change(s) for REMODCM Revision 31 (effective November 15, 2019) are included here in Volume II of the Radioactive Effluent Release Report. In addition, a complete copy of the REMODCM revision is provided to the Nuclear Regulatory Commission as Volume 2 of the Radioactive Effluent Release Report.

6.1 Summary of Changes

The changes in revision 31 involve:

1. Removing sampling location number 80-I from the Radiological Environmental Monitoring Program and adding it to the Groundwater Protection Program. The basis of the change is the previous leakage investigation of the MP3 condensate surge tank and its associated underground piping as it requires frequent monitoring and sampling. Sampling obtained for Groundwater Protection Program is performed at more frequent sampling basis than sampling under the Radiological Environmental Monitoring program.

2. Adding a new sampling location number 83-I to the Radiological Environmental Monitoring Program. Location number 83-I would indicate any potential leakage from the MP3 Boron Recover Tanks.

REMODCM Summary of Changes in Revision 31	
Table I.E.I “Sampling and Analysis” Table I.E.-2 Pg. 40	“Environmental Monitoring Program Sampling Locations” Sample location No* 80-I is to be replaced with sampling location No* 83-I. The change is initiated to align the Radiological Monitoring Program sampling locations listed in REMODCM, MP-22-REC-BAP01, Table I.E.-2 with current sample schedule.

7.0 References

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

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

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

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

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

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

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

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

9. OpenEMS Software Documentation, SQA-OpenEMS-20140130, SQA Level 3

10. NEI 07-07, Nuclear Energy Institute, Industry Ground Water Protection Initiative – Final Guidance Document, Revision 1 March 2019.

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

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

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

14. Radiation Protection Calculation #16-18, "Isotopic Cloud Shine Doses for MPS Releases," Jan. 24, 2017.

15. MP-CHEM-17-07, "Reporting of Radioactivity Released from RWST Vents," May 26, 2016.

Serial No. 20-147
Docket Nos. 50-245
50-336
50-423
License Nos. DPR-21
DPR-65
NPF-49

ATTACHMENT 2

2019 RADIOACTIVE EFFLUENT RELEASE REPORT
VOLUME 2

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

MILLSTONE POWER STATION
STATION PROCEDURE

STOP THINK ACT REVIEW

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

MP−22−REC−BAP01

Rev. 031

Approval Date: 11/06/19

Effective Date: 11/15/19

Radiological Effluent Monitoring and Offsite Dose Calculation Manual (REMODCM)

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TABLES AND FIGURES

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SECTION I.

Radiological Effluent Monitoring Manual (REMM)

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

Docket Nos. 50−245, 50−336, 50−423

SECTION I. RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

I.A. Introduction

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

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

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

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

I.B. Responsibilities

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

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

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

I.C. Liquid Effluents

1. Liquid Effluent Sampling and Analysis Program

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

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

Table I.C.–1
TABLE NOTATIONS

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

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

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

Where:

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

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

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

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

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

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

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

TABLE I.C.−2
TABLE NOTATIONS

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

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

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

Where:

- **LLD** is the lower limit of detection as defined above (as μCi per unit mass or volume)
- $\mathbf{S_b}$ 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)
- $\mathbf{2.22 \times 10^6}$ is the number of transformations per minute per μCi
- **Y** is the fractional radiochemical yield (when applicable)
- $\boldsymbol{\lambda}$ is the radioactive decay constant for the particular radionuclide
- $\boldsymbol{\Delta t}$ is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

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

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

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

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

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

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

H. For the Steam Generator Blowdown:
IF the steam generator gross gamma radioactivity does not exceed 5×10^{-7} μCi/ml, **THEN** the sampling and analysis schedule for all principal gamma, I−131, Ce−144, noble gases, gross alpha, Sr−89, Sr−90 and Fe−55 are not required. For the purposes of this footnote, if steam generator samples are not available, condensate water gamma radioactivity may be used during times of blowdown.

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. For steam generator blowdown, condensate may be sampled during blowdown if steam generator sample is not available.

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

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

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

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

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

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

Liquid Release Source	Sample Type and Frequency	Minimum Analysis Frequency	Type of Radioactivity Analysis	Lower Limit of Detection (LLD)[A] (µCi/ml)
A. Batch Release[B.]				
1. Condensate Polishing Facility Waste Neutralization Sump[E.] 2. Waste Test Tanks 3. Low Level Waste Tank 4. Boron Test Tanks 5. Steam Generator Bulk [D.]	Grab sample prior to each batch release	Prior to each batch release	Principal Gamma Emitters[C.]	5×10^{-7}
			I–131	1×10^{-6}
			Ce–144	5×10^{-6}
			Dissolved & Entrained Gases[K.]	1×10^{-5}
			H–3	1×10^{-5}
		Quarterly Composite[F.,G.]	Gross alpha	1×10^{-7}
			Sr–89, Sr–90	5×10^{-8}
			Fe–55	1×10^{-6}
B. Continuous Release				
1. Steam Generator Blowdown[H.] 2. Service Water Effluent[J.] 3. Turbine Building Sumps[L.]	Daily Grab Sample[I.]	Weekly Composite[F.,G.]	Principal Gamma Emitters[C.]	5×10^{-7}
			I–131	1×10^{-6}
			Ce–144	5×10^{-6}
	Monthly Grab Sample	Monthly	Dissolved & Entrained Gases[K.]	1×10^{-5}
	Weekly Grab or Composite	Monthly Composite[F.,G.]	H–3[M.]	1×10^{-5}
	Weekly Composite	Quarterly Composite[F.,G.]	Gross alpha	1×10^{-7}
			Sr–89, Sr–90	5×10^{-8}
			Fe–55	1×10^{-6}

TABLE I.C.–3
TABLE NOTATIONS

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

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

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

Where:

- **LLD** is the lower limit of detection as defined above (as μCi per unit mass or volume)
- $\mathbf{S_b}$ 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)
- $\mathbf{2.22 \times 10^6}$ is the number of transformations per minute per μCi
- **Y** is the fractional radiochemical yield (when applicable)
- **λ** is the radioactive decay constant for the particular radionuclide
- **Δt** is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2. Liquid Radioactive Waste Treatment

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

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

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

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

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

b. Required Equipment for Each Millstone Unit

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

1. Millstone Unit No. 1	
Waste Stream	**Processing Equipment**
Spent Fuel Pool water	One filter and one demineralizer
2. Millstone Unit No. 2	
Waste Stream	**Processing Equipment**
Clean liquid	Deborating ion exchanger (T11) **OR** Purification ion exchanger (T10A or T10B) **OR** Equivalent ion exchanger
	Primary demineralizer (T22 A or B) **OR** Equivalent demineralizer
	ALPS/AIM processing **OR** Secondary demineralizer (T23 A or B) **OR** Equivalent demineralizer
Aerated liquid	ALPS/AIM processing **OR** Demineralizer (T24) **OR** Equivalent demineralizer
3. Millstone Unit No. 3	
Waste Stream	**Processing Equipment or Radioactivity Concentration**
High level	ALPS processing (3LWS−SKD1) **OR** Demineralizer (3LWS−DEMN2) and Demineralizer filter (3LWS−FLT3) **OR** Demineralizer (LWS−DEMN1) and Demineralizer filter (LWS−FLT1)
Boron recovery	Cesium ion exchanger (3BRS−DEMN1A or B)
	Boron evaporator (3BRS−EV1)
Low level	High level processing equipment
Steam generator blowdown	Blowdown recovery when total gamma radioactivity exceeds 5E−7 μCi/ml or tritium exceeds 0.02 μCi/ml.

NOTE: The qualifier **OR** indicates that any of the equipment listed within the block would satisfy the processing requirement if functional.

c. Report Requirement For All Three Millstone Units

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

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

Figure I.C.−1, “Reserved

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

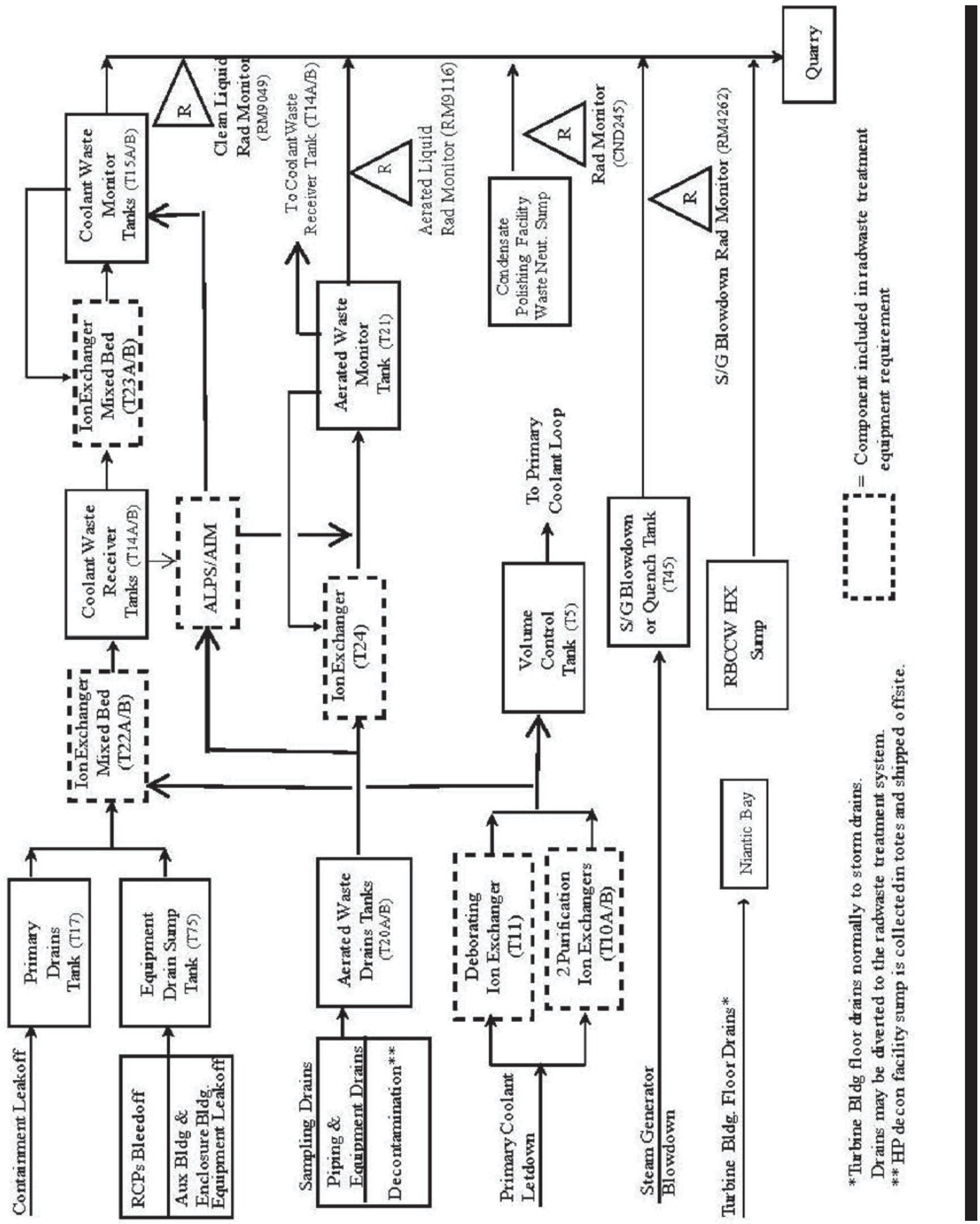
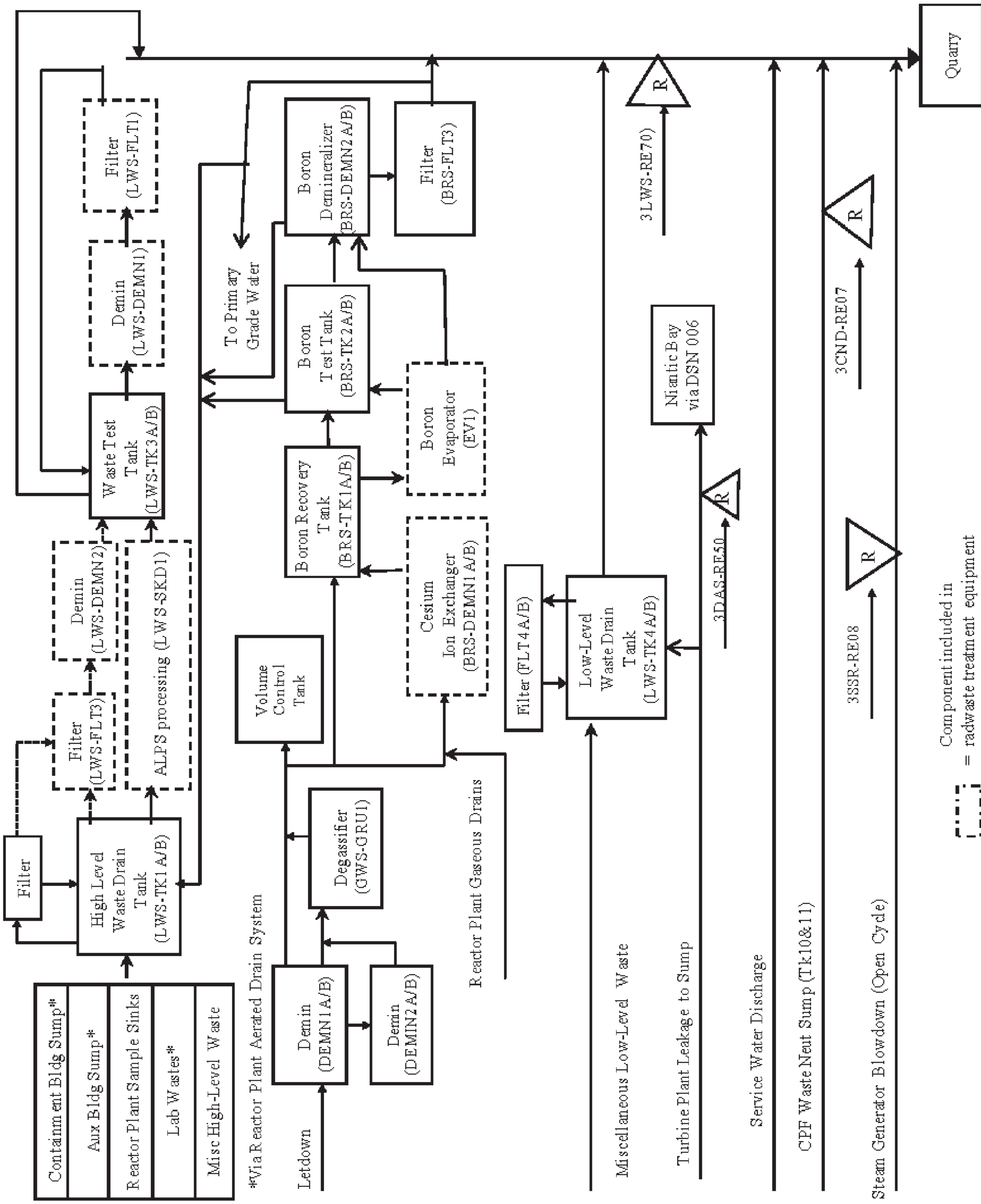


Figure I.C.−3, "Simplified Liquid Effluent Flow Diagram Millstone Unit 3"



STOP THINK ACT REVIEW

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 doses are maintained within the limits of Radiological Effluent Controls (Section III.D.2. for Millstone Unit No. 1, Section IV.D.2. for Millstone Unit No. 2, and Section V.D.2. for Millstone Unit No. 3).

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

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

Table I.D.−1
TABLE NOTATIONS

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

B. Samples not required when Release Point is not in use.

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

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

E. Continuous when exhaust fans are in operation.

F. When Spent Fuel Pool Island ventilation is shutdown and ventilation of Spent Fuel Pool Island is exhausted to Balance of Plant Vent, the monthly gaseous grab sample shall be obtained from the Balance of Plant Vent.

G. Tritium analysis of vent grab sample may be replaced by a calculation of tritium released from the spent fuel pool.

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

TABLE I.D.−2
TABLE NOTATIONS

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

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

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

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

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

E. RESERVED

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

For Unit 2 vent only

The sampling frequency shall be increased to daily following each reactor shutdown, reactor criticality after shutdown, or thermal power change exceeding 15% of rated thermal power as defined in Technical Specification within a one hour period, if one or both of the following has occurred:

1) The Dose Equivalent I−131 concentration in the reactor coolant has increased by more than a factor of three above the concentration that existed during steady state, full power operation prior to the power transient.

2) The noble gas monitor, RM8132B, has increased more than a factor of three relative to the radiation monitor reading that existed during steady state, full power operation prior to the power transient.

Analyses shall be completed within 48 hours of changing. For daily samples, the LLDs may be increased by a factor of 10.

Daily sampling shall be maintained for seven days or until such time when both conditions (1) and (2) are not satisfied, whichever is shorter.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TABLE I.D.−3
TABLE NOTATIONS

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

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

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

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

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

E. RESERVED

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

   For Unit 3 Vent only:

   The sampling frequency shall be increased to daily following each reactor shutdown, reactor criticality after shutdown, or thermal power change exceeding 15% of rated thermal power as defined in Technical Specification within a one hour period, if one or both of the following has occurred:

   1) The Dose Equivalent I−131 concentration in the reactor coolant has increased by more than a factor of three above the concentration that existed during steady state, full power operation prior to the power transient.

   2) The noble gas monitor, HVR−RE10B, has increased more than a factor of three relative to the radiation monitor reading that existed during steady state, full power operation prior to the power transient.

   Analyses shall be completed within 48 hours of changing. For daily samples, the LLDs may be increased by a factor of 10.

   Daily sampling shall be maintained for seven days or until such time when both conditions (1) and (2) are not satisfied, whichever is shorter.

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

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

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

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

2. Gaseous Radioactive Waste Treatment

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

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

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

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

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

b. Required Equipment for Each Millstone Unit

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

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

c. Report Requirement For All Three Millstone Units

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

- Explanation of why gaseous radwaste was being discharged without treatment, identification of any equipment out of service, and the reason for being out of service,
- Actions taken to restore the nonfunctional equipment to service, and
- Summary description of actions taken to prevent a recurrence.

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

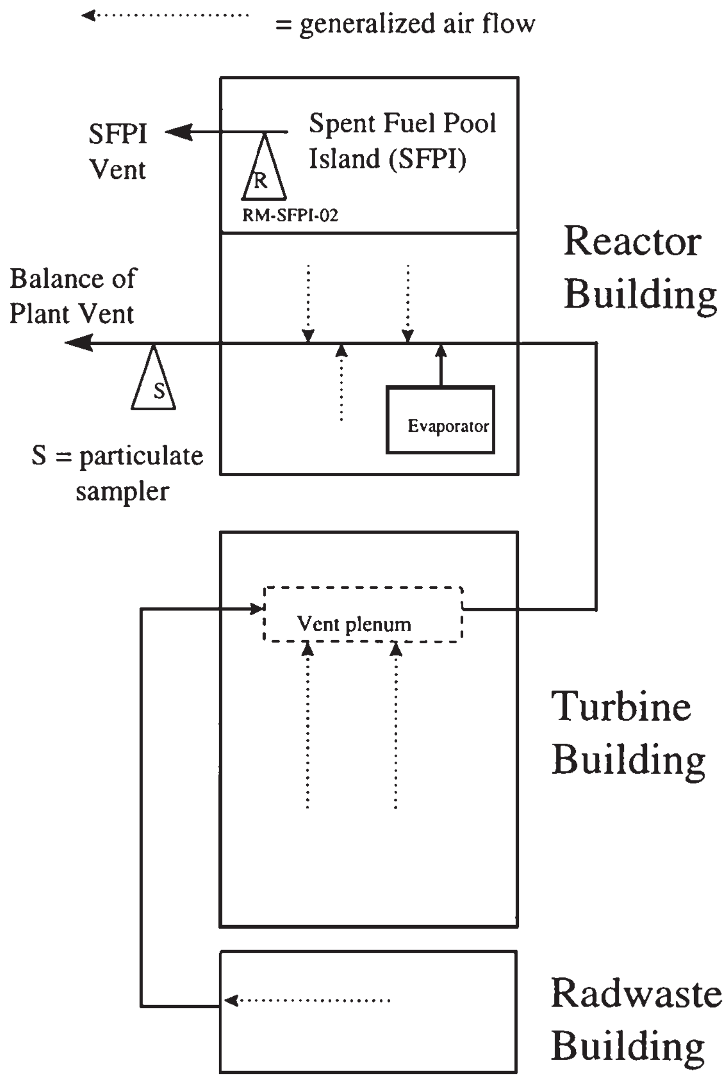
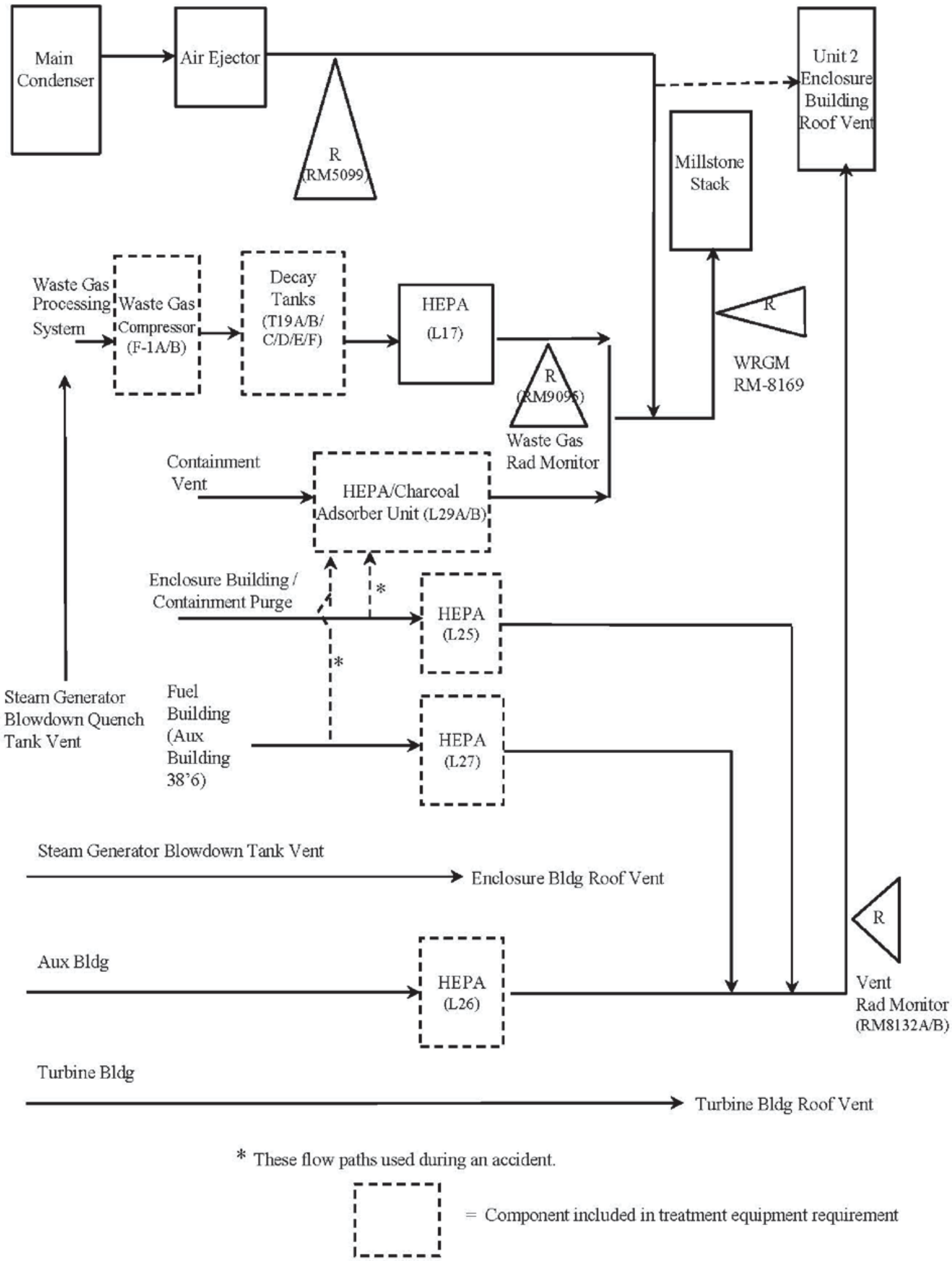
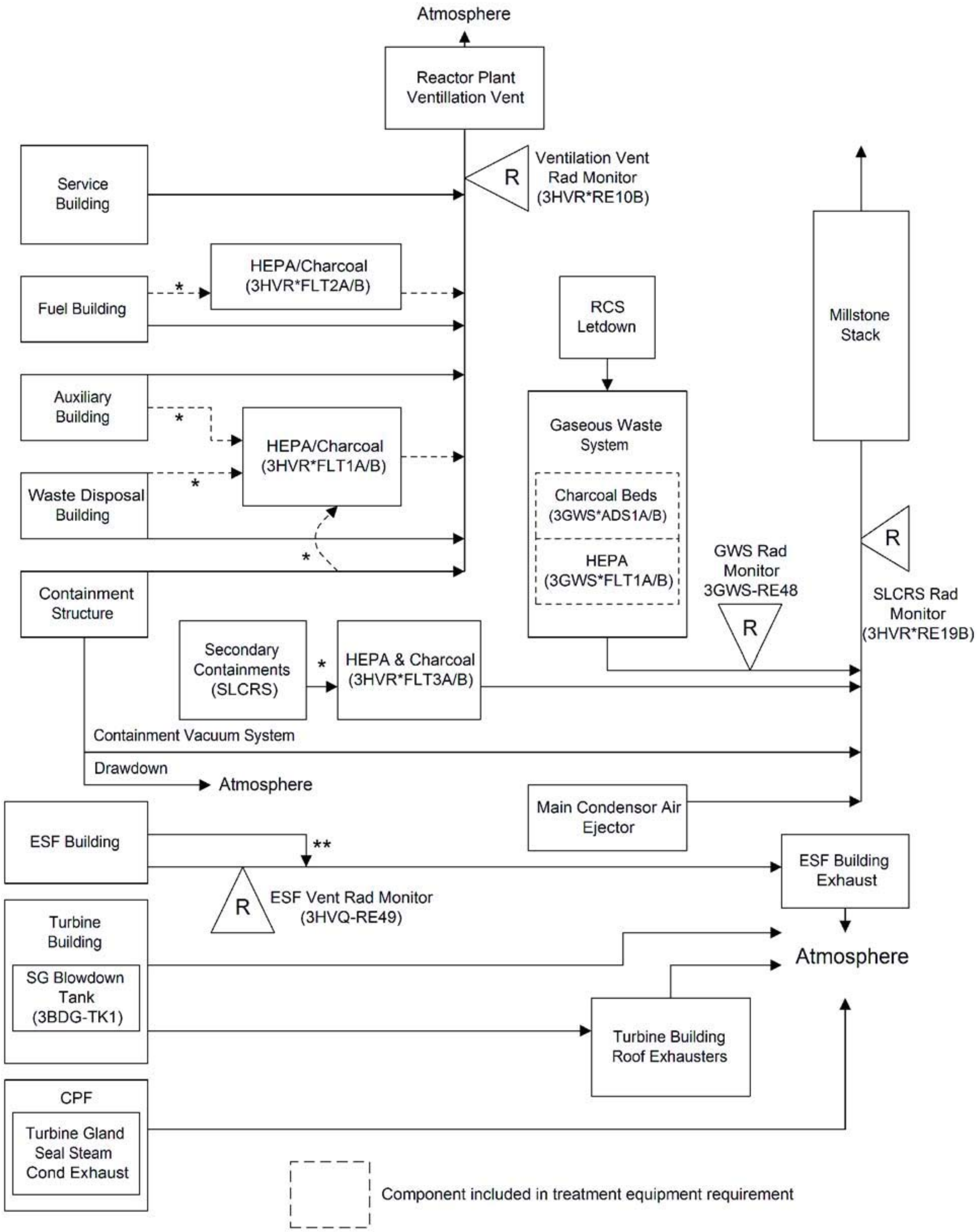


Figure I.D.–2, "Simplified Gaseous Effluent Flow Diagram Millstone Unit Two"



STOP THINK ACT REVIEW

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



* These flow paths used during an accident

** Releases from Mechanical Rooms A-D not monitored

I.E. **Radiological Environmental Monitoring**

1. Sampling and Analysis

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

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

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

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

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

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

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

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

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

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

(b) Not required during 1^{st} quarter.

Table I.E.–2 **Environmental Monitoring Program Sampling Locations**			
The following lists the environmental sampling locations and the types of samples obtained at each location. Sampling locations are also shown on Figures I.E.–1 and I.E.–2:			
Location		Direction & Distance from Release Point**	Sample Types
No*	**Name**		
1–I	Onsite – NAP Parking Lot North	0.6 Mi, NNW	TLD, Air Particulate, Iodine, Vegetation
2–I	Onsite – Weather Shack	0.3 Mi, S	TLD, Air Particulate, Iodine
3–I	Onsite – Bird Sanctuary	0.3 Mi, NE	TLD, Air Particulate, Iodine, Soil
4–I	Onsite – Albacore Drive	1.0 Mi, N	TLD, Air Particulate, Iodine, Soil
5–I	Onsite – Quarry East	0.1 Mi, SSE	TLD
6–I	Onsite – Quarry Discharge	0.3 Mi, SSE	TLD
7–I	Onsite – Environmental Lab Dock	0.3 Mi, SE	TLD
8–I	Onsite – Environmental Lab	0.3 Mi, SE	TLD
9–I	Onsite – Bay Point Beach	0.4 Mi, W	TLD
10–I	Waterford–Goshen Fire Dept.	1.2 Mi, E	TLD, Air Particulate, Iodine, Vegetation
11–I	Great Neck Country Club	1.6 Mi, ENE	TLD, Air Particulate, Iodine
13–C	Mystic, CT	11.5 Mi, ENE	TLD
14–C	Ledyard, CT	12.0 Mi, NE	TLD, Soil
15–C	Norwich, CT	14.0 Mi, N	TLD, Air Particulate, Iodine
16–C	Old Lyme, Halls Rd.	8.8 Mi, W	TLD
17–I	Site Boundary	0.5 Mi, NE	Vegetation
25–I	Fruits & Vegetables	Within 10 Miles	Vegetation
26–C	Fruits & Vegetables	Beyond 10 Mi	Vegetation
27–I	East Lyme – Police Station	1.7 Mi, WNW	TLD, Air Particulate, Iodine
28–I	Two Tree Island	0.8 Mi, SSE	Fish[1]
29–I	West Jordan Cove	≤ 0.5 Mi, ENE to ESE	Clams, Fish[1], Aquatic Flora
31–I	Niantic Shoals	1.8 Mi, NW	Bottom Sediment, Clams
32–I	Vicinity of Discharge[2]		Bottom Sediment, Fish[1], Seawater, Aquatic Flora
33–I	Seaside Point	1.8 Mi, ESE	Bottom Sediment
34–I	Thames River Yacht Club	4.0 Mi, ENE	Bottom Sediment
35–I	Niantic Bay	≤ 0.5 Mi, SSW to W	Lobster, Fish, Aquatic Flora
36–C	Black Point	2.7 Mi, SW	Aquatic Flora
37–C	Giant's Neck	3.5 Mi, WSW	Bottom Sediment, Seawater
41–I	Waterford – Myrock Avenue	3.2 Mi, ENE	TLD
42–I	East Lyme – Billow Road	2.4 Mi, WSW	TLD

Table I.E.−2, Cont.			
Location		Direction & Distance from Release Point**	Sample Types
No*	**Name**		
43−I	East Lyme − Old Black Point Rd.	2.6 Mi, SW	TLD
44−I	Onsite − Schoolhouse	0.1 Mi, NNE	TLD
45−I	Onsite Access Road #1	0.5 Mi, NNW	TLD
46−I	Old Lyme − Hillcrest Rd.	4.6 Mi, WSW	TLD
47−I	East Lyme − W. Main St.	4.5 Mi, W	TLD
48−I	East Lyme − Corey & Roxbury Rd.	3.4 Mi, WNW	TLD
49−I	East Lyme − Society Rd.	3.6 Mi, NW	TLD
50−I	East Lyme − Manwaring Rd & Terrace Ave.	2.1 Mi, W	TLD
51−I	East Lyme − Smith Ave.	1.5 Mi, NW	TLD
52−I	Waterford − River Rd.	1.1 Mi, NNW	TLD
53−I	Waterford − Gardiners Wood Rd.	1.4 Mi, NNE	TLD
55−I	Waterford − Magonk Point	1.8 Mi, ESE	TLD
56−I	New London − Ocean & Mott Ave.	3.7 Mi, E	TLD
57−I	New London − Ocean Ave.	3.6 Mi, ENE	TLD
59−I	Waterford −Miner Ave.	3.4 Mi, NNE	TLD
60−I	Waterford − Parkway South & Cross Rd.	4.0 Mi, N	TLD
61−I	Waterford − Oil Mill & Boston Post Rd.	4.3 Mi, NNW	TLD
62−I	East Lyme − Columbus Ave.	1.9 Mi, WNW	TLD
63−I	Waterford − Gradiners Wood & Jordon Cove Rd.	0.8 Mi, NE	TLD
64−I	Waterford − Shore Rd.	1.1 Mi, ENE	TLD
65−I	Waterford − Boston Post Rd.	3.2 Mi, NE	TLD
71−I	Onsite well	Onsite	Well water
72−I	Onsite well	Onsite	Well water
79−I	Onsite well	Onsite	Well water
81−I	Onsite well	Onsite	Well water
82−I	Onsite well	Onsite	Well water
83−I	Onsite well	Onsite	Well water
89−C	Aquatic Background	Beyond 4 Mi. Of discharge	Lobster

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

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

* I = Indicator; C = Control.

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

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

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

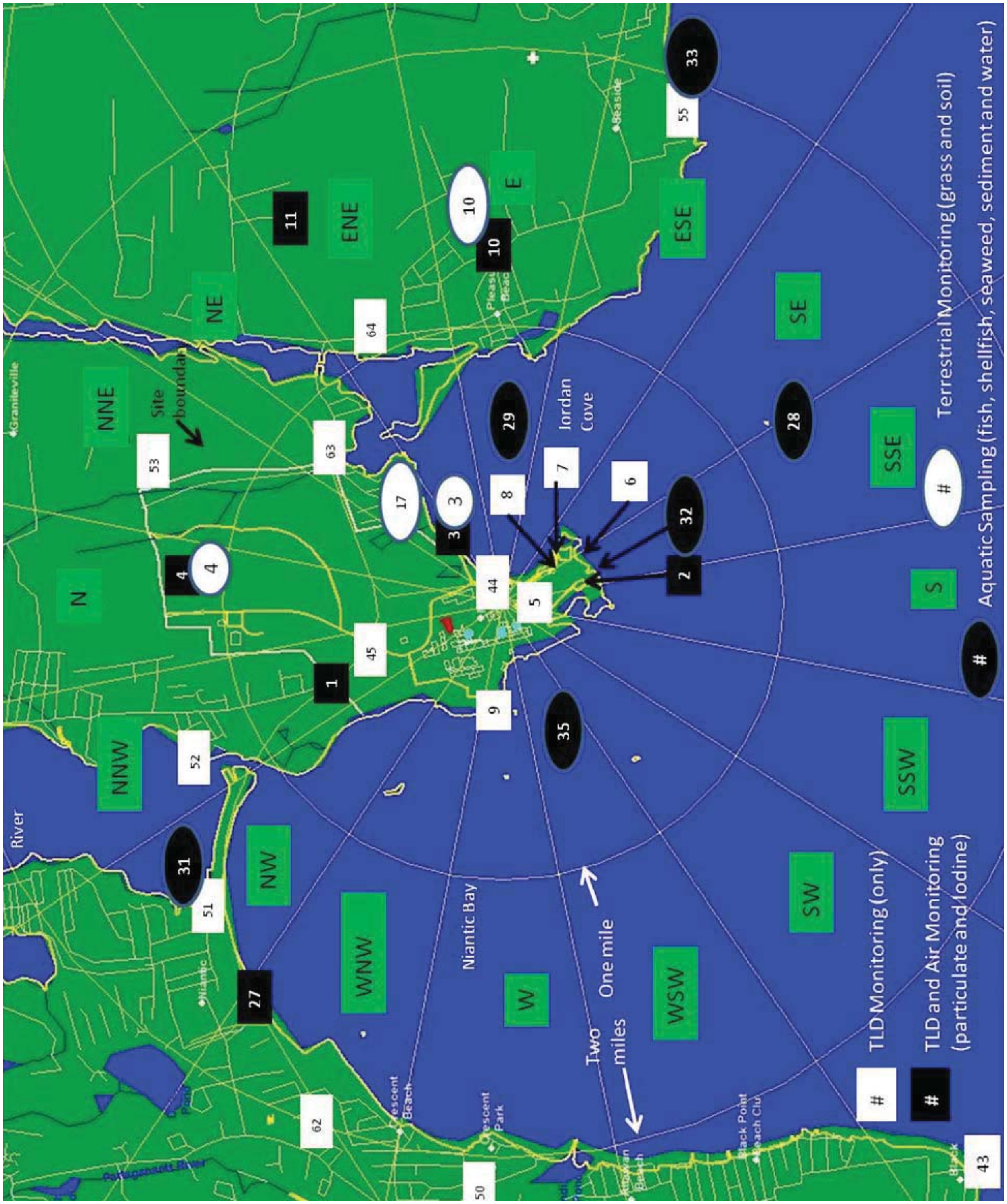


Figure I.E.−2, “Outer TLD and Aquatic Locations”

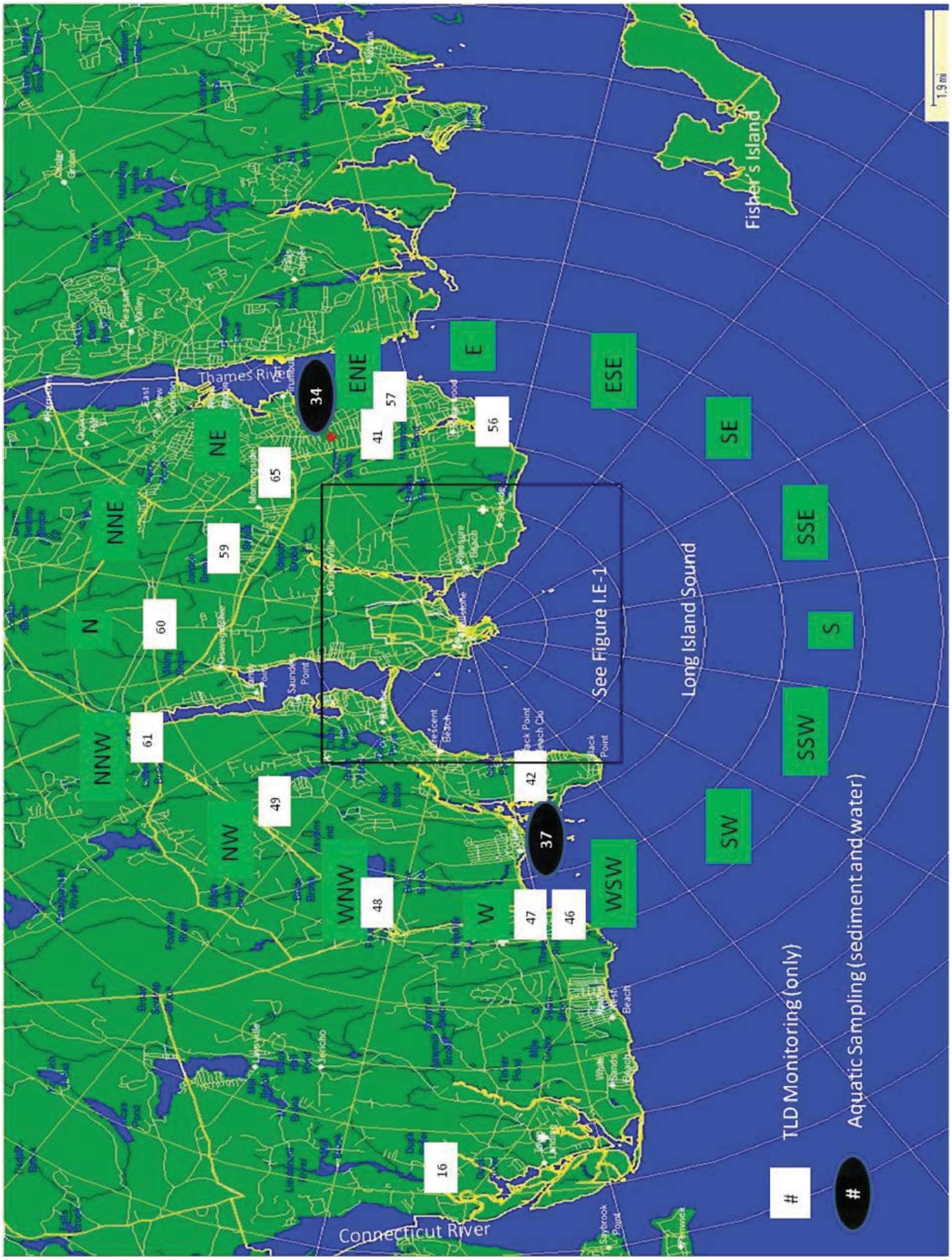


Table I.E.–3 Reporting Levels For Radioactivity Concentrations In Environmental Samples						
Analysis	**Water (pCi/l)**	**Airborne Particulate or Gases (pCi/m^3)**	**Fish (pCi/g, wet)**	**Shellfish[C.] (pCi/g, wet)**	**Milk (pCi/l)**	**Vegetables (pCi/g, wet)**
H–3	20,000[A.]					
Mn–54	1,000		30	140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

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

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

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

Table I.E.−4 Maximum Values For Lower Limits Of Detection (LLD)[A.]						
Analysis	**Water (pCi/l)**	**Airborne Particulate or Gases (pCi/m^3)**	**Fish Shellfish (pCi/g, wet)**	**Milk (pCi/l)**	**Food Products and Vegeta-tion (pCi/g, wet)**	**Sediment and Soil (pCi/g, dry)**
gross beta		1×10^{-2}				
H−3	2000[D.]					
Mn−54	15		0.130			
Fe−59	30		0.260			
Co−58, 60	15		0.130			
Zn−65	30		0.260			
Zr−95	30					
Nb−95	15					
I−131	15[C.]	7×10^{-2}	0.093	1	0.06[B.]	
Cs−134	15	5×10^{-2}	0.130	15	0.060	0.150
Cs−137	18	6×10^{-2}	0.150	18	0.080	0.180
Ba−140	60[C.]			70		
La−140	15[C.]			25		

TABLE NOTATIONS
Table I.E.−4

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

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

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

Where:

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

- **Y** is the fractional radiochemical yield (when applicable)
- **λ** is the radioactive decay constant for the particular radionuclide
- **Δt** is the elapsed time between midpoint of sample collection and midpoint of counting time (or end of the sample collection period) and time of counting.

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

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

B. LLD for leafy vegetables.

C. From end of sample period.

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

2. Land Use Census

A land use census shall be conducted annually during the growing season to identify; (1) changes in the use of unrestricted areas, (2) receptor locations, and (3) new exposure pathways to permit modifications in monitoring programs for evaluating doses to individuals from principal pathways of exposure. The land use census shall identify the location of the nearest resident, nearest garden, and any other land–based food sources in each of the meteorological land sectors within a distance of five miles. Sectors SE, SSE, S, and SSW, are not land sectors because they are over water.

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

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

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

3. Interlaboratory Comparison Program

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

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

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

I.F. **Report Content**

1. Annual Radiological Environmental Operating Report

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

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

1) Total number of analyses performed at indicator locations.

2) Total number of analyses performed at control locations.

3) Lower limit of detection (LLD).

4) Mean and range of all indicator locations together.

5) Mean and range of all control locations together.

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

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

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

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

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

2. Radioactive Effluent Release Report

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

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

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

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

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

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

SECTION II.

Offsite Dose Calculation Manual (ODCM)

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

Docket Nos. 50−245, 50−336, 50−423

SECTION II. OFFSITE DOSE CALCULATION MANUAL (ODCM)

II.A. Introduction

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

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

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

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

II.B. Responsibilities

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

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

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

II.C. **Liquid Dose Calculations**

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

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

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

2. Monthly Dose Projections

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

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

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

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

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

Where:

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

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

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

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

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

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

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

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

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

II.D. **Gaseous Dose Calculations**

1. Site Release Rate Limits (“Instantaneous”)

   Radiological Effluent Controls (Sections III.D.2.a, IV.D.2.a, and V.D.2.a) for each unit require that the instantaneous off−site dose rates from noble gases released to the atmosphere be limited such that they do not exceed 500 mrem/year at any time to the whole body or 3000 mrem/year to the skin at any time. For iodine−131, 133, tritium, and particulates (half−lives >8 days), the dose rate from all units shall not exceed 1500 mrem/year at any time to any organ. 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.

   a. Method 1 for Noble Gas Release Rate Limits

      Instantaneous noble gas release rate for the site:

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

      Where:

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

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

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

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

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

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

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

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

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

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

Where the contribution from each Unit is calculated from:

Unit 1: $DR_{thy1} = 2.78E{-}5\ Q_{H1V}$

Unit 2: $DR_{thy2} = 8.80E{-}2\ {}_{131}Q_{I2V} + 9.67E{-}3\ {}_{131}Q_{I2S} + 2.08E{-}2\ {}_{133}Q_{I2V} + 2.29E{-}3\ {}_{133}Q_{I2S} + 6.87E{-}6\ Q_{H2V} + 7.53E{-}7\ Q_{H2S}$

Unit 3: $DR_{thy3} = 8.80E{-}2\ {}_{131}Q_{I3V} + 9.67E{-}3\ {}_{131}Q_{I3S} + 2.08E{-}2\ {}_{133}Q_{I3V} + 2.29E{-}3\ {}_{133}Q_{I3S} + 6.87E{-}6\ Q_{H3V} + 7.53E{-}7\ Q_{H3S}$

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

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

Where the contribution from each Unit is calculated from:

Unit 1: $DR_{org1} = 3.52E{-}1\ [Q_{P1V} + Q_{P1B}] + 2.78E{-}5\ Q_{H1V}$

Unit 2: $DR_{org2} = 9.53E{-}3\ Q_{P2S} + 8.67E{-}2\ Q_{P2V} + 7.53E{-}7\ Q_{H2S} + 6.87E{-}6\ Q_{H2V}$

Unit 3: $DR_{org3} = 9.53E{-}3\ Q_{P3S} + 8.67E{-}2\ Q_{P3V} + 7.53E{-}7\ Q_{H3S} + 6.87E{-}6\ Q_{H3V}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

* includes releases via the steam generator blowdown tank vent.

c. Method 2

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

2. 10 CFR50 Appendix I − Noble Gas Limits

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

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

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

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

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

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

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

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

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

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

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

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

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

4. Gaseous Effluent Monthly Dose Projections

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

a. Unit 1 Projection Method

None required.

b. Unit 2 Projection Method

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

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

$$D^E_{MG} \text{ (mrad)} = 5E-4\ C^E_N$$

$$D^E_{MB} \text{ (mrad)} = 3E-4\ C^E_N$$

$$D^E_{MO} \text{ (mrem)} = 3E-4\ C^E_N$$

Where:

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

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

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

D^E_{MO} = the estimated monthly organ dose.

2) (Reserved)

3) Due to Ventilation Releases (Unit 2)

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

i. Method 1

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

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

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

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

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

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

D_O = maximum organ dose from the previous month.

ii. Method 2

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

c. Unit 3 Projection Method

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

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

D^E_{MG} (mrad) $= 5E-4\ C^E_N$

D^E_{MB} (mrad) $= 3E-4\ C^E_N$

D^E_{MO} (mrem) $= 3E-4\ C^E_N$

Where:

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

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

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

D^E_{MO} = the estimated monthly organ dose.

5. Compliance with 40CFR190

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

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

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

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

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

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

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

II.E. **Liquid Discharge Flow Rates And Monitor Setpoints**

1. Unit 1 Liquid Waste Effluent Discharge (RE−M6−110)

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

   STEP 1:

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

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

   STEP 2:

   Determine the allowable discharge flow (F)

   F = 0.1 x R x D

   Where:

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

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

   STEP 3:

   Calculate the monitor setpoint as follows:

   Rset = 2 x AC x RCF + Background

   Where:

   Rset = The setpoint of the monitor.

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

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

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

Option setpoint:

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

2. Reserved

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

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

STEP 1:

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

For Nuclides Other Than Noble Gases:

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

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

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

R = the smaller of R_1 or R_2

STEP 2:

Determine the allowable discharge flow (F) in gpm:

F = 0.1 x R x D

Where:

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

NOTE

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

5a. Unit 2 Steam Generator Blowdown − RM4262

Alarm ≤ 800 CPM + background

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

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

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

5b. Unit 2 Steam Generator Blowdown Effluent Concentration Limitation

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

6. Unit 2 Condenser Air Ejector − RM5099

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

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

7a. Unit 2 Reactor Building Closed Cooling Water RM6038

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

SETPOINT DURING POWER OPERATIONS:

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

SETPOINT DURING SHUTDOWN:

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

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

PROVISIONS FOR ALTERNATE DILUTION FLOWS:

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

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

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

8. Unit 3 Liquid Waste Monitor – LWS–RE70

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

<u>Step 1:</u>

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

For Nuclides Other Than Noble Gases:

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

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

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

R = the smaller of R1 or R2

<u>Step 2:</u>

Determine the allowable discharge flow (F)

F = 0.1 x R x D

Where:

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

NOTE

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

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

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

Where:

Rset= The setpoint of the monitor.

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

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

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

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

NOTE

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

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

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

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

   Same as Section II.E.8.

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

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

   The alarm setpoint for this monitor assumes:

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

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

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

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

Therefore, the alarm setpoint corresponds to a concentration of:

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

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

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

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

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

NOTE

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

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

11b. Unit 3 Steam Generator Blowdown Effluent Concentration Limitation

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

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

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

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

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

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

II.F. **Gaseous Monitor Setpoints**

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

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

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

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

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

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

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

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

3. Reserved

4. Unit 3 SLCRS – HVR–RE19B

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

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

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

5. Unit 2 Vent – Noble Gas Monitor – RM8132B

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

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

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

6. Unit 2 Waste Gas Decay Tank Monitor RM9095

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

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

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

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

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

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

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

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

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

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

APPENDIX II.A
REMODCM METHODOLOGY CROSS−REFERENCES

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

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

Table II.A.–1
Millstone Effluent Requirements and Methodology Cross Reference

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

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

SECTION III.

Millstone Unit 1

Radiological Effluent Controls

Docket Nos. 50−245

SECTION III. **REMODCM UNIT ONE CONTROLS**

III.A. **Introduction**

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

a. the effluent radiation monitor controls and surveillance requirements,

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

c. the bases for the controls and surveillance requirements.

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

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

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

III.B.1 − Definitions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Radioactive Liquid Effluent Monitoring Instrumentation

CONTROLS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE III.C.–1 **Radioactive Liquid Effluent Monitoring Instrumentation**		
Instrument	Action when not functional	Notes
1. Liquid Waste Effluent Monitor (RE–M6–110)	A	1, 2

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

2. Alarm setpoint required.

Action A

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

(1) At least two independent samples are analyzed for gamma radioactivity as specified in Table I.C–1 and;

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

TABLE III.C.–2 Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1. Liquid Waste Effluent Monitor (RE–M6–110)	D*	P	T(1)	Q

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

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

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

2. Radioactive Gaseous Effluent Monitoring Instrumentation

CONTROLS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENT

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

TABLE III.C.–3 **Radioactive Gaseous Effluent Monitoring Instrumentation**		
Instrument	Action when not functional	Notes
1.Spent Fuel Pool Island Vent		
(a) Noble Gas Radioactivity Monitor	A	1, 2
(b) Particulate Sampler	B	1
(c) Vent Flow Rate Monitor	C	1
(d) Sampler Flow Rate Monitor	D	1, 2
2.Balance of Plant Vent		
(a) Particulate Sampler	B	1
(b) Sampler Flow Monitor	D	1

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

ACTION STATEMENTS

Action A

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

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum number FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that a 24 hour duration sample is collected with auxiliary sampling equipment once every seven (7) days, or anytime significant generation of airborne radioactivity is expected, and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours.

Action C

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

Action D

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

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

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

Table III.C.−4
TABLE NOTATION

(1) RESERVED

(2) RESERVED

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

(4) RESERVED

(5) RESERVED

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

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

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

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

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATIONS

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENT

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

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATIONS

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

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

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

APPLICABILITY: At all times

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

CONTROLS

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

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENT

1) The release rate, at any time, corresponding to the above dose rates shall be determined in accordance with the methodology of Section II.

2) The release rate, at any time shall be monitored in accordance with the requirements of Section III.C.2.

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

b. Radioactive Gaseous Effluents Noble Gas Dose

CONTROLS

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

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

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

CONTROLS

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

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

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

APPLICABILITY: At all times.

ACTION:

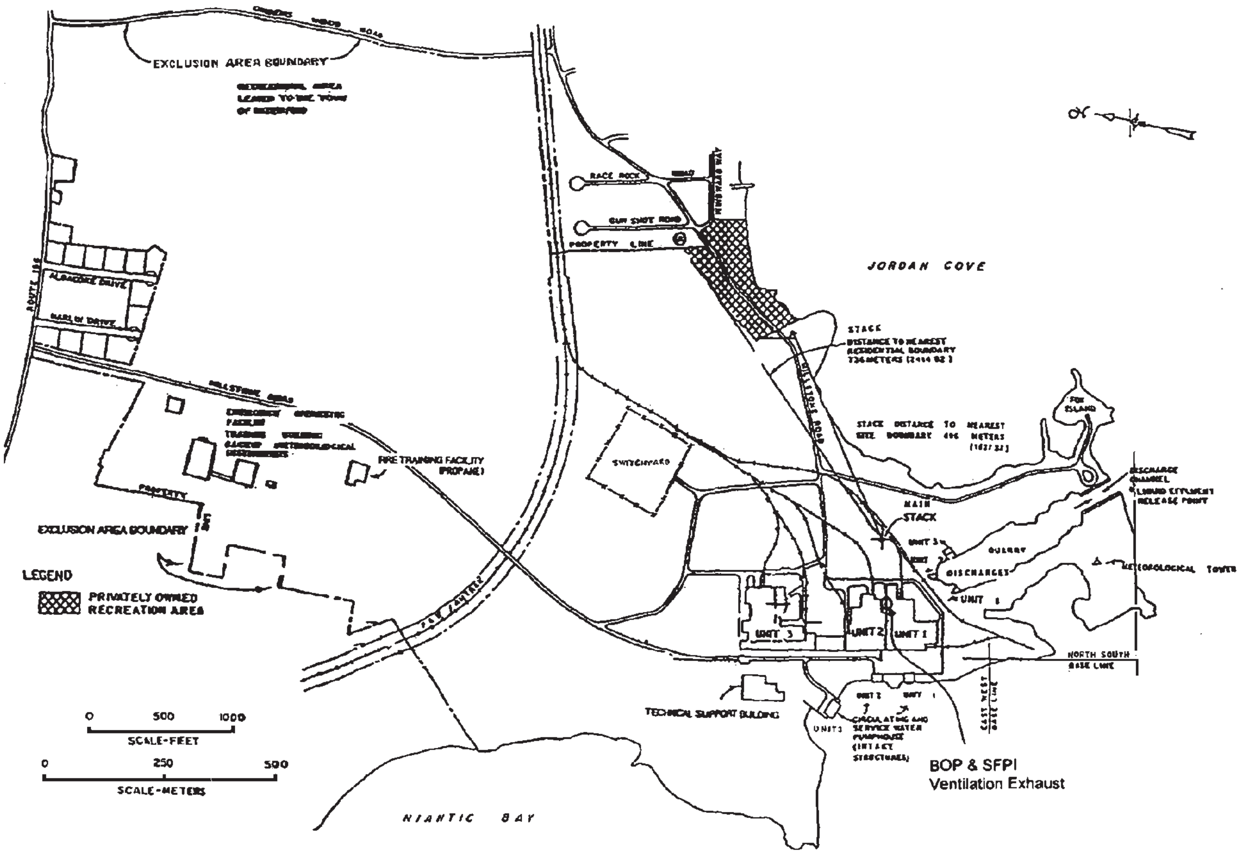
With the calculated dose from the release of Tritium and radioactive materials in particulate form exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken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

SURVEILLANCE REQUIREMENTS

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

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

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



III.E. **Total Radiological Dose From Station Operations Controls**

CONTROLS

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

APPLICABILITY: At all times.

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

SECTION IV.

Millstone Unit 2

Radiological Effluent Controls

Docket Nos. 50–336

SECTION IV. REMODCM UNIT TWO CONTROLS

IV.A. Introduction

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

a. the effluent radiation monitor controls and surveillance requirements,

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

c. the bases for the controls and surveillance requirements.

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

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

IV.B. Definitions, Applicability and Surveillance Requirements

IV.B.1 − Definitions

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

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

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

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

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

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

6. SOURCE CHECK – A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to radiation.

7. MEMBER(S) OF THE PUBLIC – MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or its vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

   The term "REAL MEMBER OF THE PUBLIC" means an individual who is exposed to existing dose pathways at one particular location.

8. MODE – Refers to Mode of Operation as defined in Safety Technical Specifications.

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

10. UNRESTRICTED AREA – Any area at or beyond the site boundary to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the site boundary used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

11. DOSE EQUIVALENT I−131 − DOSE EQUIVALENT I−131 shall be that concentration of I−131 (μCi/gram) which alone would produce the same CDE−thyroid dose as the quantity and isotopic mixture of I−131, I−132, I−133, I−134, and I−135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed under Inhalation in Federal Guidance Report No. 11 (FGR 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion."

IV.B.2 − Applicability

IV.B.2a − LIMITING CONDITIONS FOR OPERATION

1. Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

2. Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and associated ACTION requirements are not met within the specified time intervals, except as provided in Condition IV.B.2.a(6). If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3. NOT USED.

4. NOT USED.

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

6. Equipment removed from service or declared nonfunctional to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its FUNCTIONALITY or the FUNCTIONALITY of other equipment. This is an exception to Condition IV.B.2.a(2) for the system returned to service under administrative control to perform the testing required to demonstrate FUNCTIONALITY.

IV.B2.b – SURVEILLANCE REQUIREMENTS

1. Surveillance Requirements shall be applicable during any condition specified for individual Limiting Conditions for Operation unless otherwise stated in an individual Surveillance Requirement.

2. Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance time interval.

3. Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Condition IV.B2.b(2), shall constitute a failure to meet the FUNCTIONALITY requirements for a Limiting Condition for Operation. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on nonfunctional equipment.

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

IV.C. **Radioactive Effluent Monitoring Instrumentation**

1. Radioactive Liquid Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATIONS

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

APPLICABILITY: As shown in Table IV.C.−1

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE IV.C.−1 Radioactive Liquid Effluent Monitoring Instrumentation		
Instrument	Action when not functional	Notes
1.Gross Radioactivity Monitors Providing Alarm and Automatic Termination Of Release		
(a) Clean Liquid Radwaste Effluent Line	A	1
(b) Aerated Liquid Radwaste Effluent Line	A	2
(c) Steam Generator Blowdown Monitor	B	2
(d) Condensate Polishing Facility Waste Neut Sump	E	2
2.Gross Radioactivity Monitors Providing Alarm and Not Providing Automatic Termination Of Release		
(a) Reactor Building Closed Cooling Water Monitor	C	1
3.Flow Rate Measurements − No Alarm Setpoint Requirements		
(a) Clean Liquid Radwaste Effluent Line	D	1
(b) Aerated Liquid Radwaste Effluent Line	D	1
(c) Condensate Polishing Facility	D	1

1. Required to be functional at all times − which means that channels shall be FUNCTIONAL and in service on a continuous, uninterrupted basis, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

2. Required to be functional whenever the discharge pathway is being used except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

ACTION STATEMENTS

Action A

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

(1) At least two independent samples are analyzed for gamma radioactivity as specified in Table I.C.−2, and;

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

Action B

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, either:

(1) Suspend all effluent releases via this pathway, or

(2) Make best efforts to repair the instrument and obtain grab samples and analyze for gamma radioactivity as specified in Table I.C.−2;

a) Once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 μCi/gm DOSE EQUIVALENT I−131.

b) Once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 μCi/gm DOSE EQUIVALENT I−131.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that once per 12 hours grab samples of the service water effluent are collected and analyzed for gamma radioactivity at LLD as specified in Table I.C.−2;

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

Action E

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

(1) At least two independent samples are analyzed for gamma radioactivity as specified in Table I.C.−2, and;

(2) If one of the samples has gamma radioactivity greater than any of the LLDs in Table I.C.−2, the original release rate calculations and discharge valving are independently verified by a second individual.

TABLE IV.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Gross Radioactivity Monitors Providing Alarm and Automatic Termination Of Release				
a. Clean Liquid Radwaste Effluent Line	D*	P	R(1)	Q(2)
b. Aerated Liquid Radwaste Effluent Line	D*	P	R(1)	Q(2)
c. Steam Generator Blowdown Monitor	D*	M	R(1)	Q(2)
d.Condensate Polishing Facility Waste Neut Sump	D*	P	R(1)	Q(2)
2.Gross Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination Of Release				
a. Reactor Building Closed Cooling Water Monitor	D*	M	R(1)	Q(2)
3.Flow Rate Measurements				
a. Clean Liquid Radwaste Effluent Line	D*	N/A	R	Q
b. Aerated Liquid Radwaste Effluent Line	D*	N/A	R	Q
c. Condensate Polishing Facility Waste Neut Sump	D*	N/A	R	Q

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

TABLE IV.C.–2
TABLE NOTATION

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

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

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

a) Instrument indicates measured levels above the alarm/trip setpoint.

b) Instrument indicates a downscale or circuit failure.
– Automatic isolation of the discharge stream shall also be demonstrated for this case for each monitor except the reactor building closed cooling water monitor.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATIONS

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

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

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE IV.C.−3 Radioactive Gaseous Effluent Monitoring Instrumentation		
Instrument	Action when not functional	Notes
1.MP2 Vent (normal range, RM−8132 only; high range monitor, RM−8168, requirements are in the TS)		
a. Noble Gas Radioactivity Monitor	A	1, 3
b. Iodine Sampler	B	1
c. Particulate Sampler	B	1
d. Vent Flow Rate Monitor	C	1
e. Sampler Flow Rate Monitor	C	1
2.Millstone Stack − applicable to the WRGM (RM−8169, normal range, channel 1, only; mid range channel 2 and high range channel 3 requirements are contained in TRM LCO 3.3.3.8)		
a. Noble Gas Radioactivity Monitor	E	1, 3
b. Iodine Sampler	B	1
c. Particulate Sampler	B	1
d. Stack Flow Rate Monitor	C	1
e. Sampler Flow Rate Monitor	C	1
3.Waste Gas Holdup System		
a. Noble Gas Monitor Providing Automatic Termination of Release	D	2, 4

1 Required to be functional at all times when air is being released to the environment by the pathway being monitored. The channel shall be FUNCTIONAL and in service on a continuous, uninterrupted basis. Outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

2 Required to be functional during waste gas holdup system discharge.

3 Alarm setpoint with required. Automatic isolation feature is not required.

4 Alarm setpoint required. Automatic isolation feature is required.

ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours. If the monitor flow and readout are not adversely affected by the loss of functionality, the daily CHANNEL CHECK may be performed in lieu of the grab sample.

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum number FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that effluent is continuously sampled with auxiliary sampling equipment and collected at least once per seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Auxiliary sampling must be initiated within 12 hours of initiation of this action statement. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 5 hours. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement:

Releases from the Millstone Unit 2 waste gas system may continue provided that best efforts are made to repair the instrument and that prior to initiating the release:

a) At least two independent samples of the tank's contents are analyzed; and

b) The original release rate calculations and discharge valve lineups are independently verified by a second individual. Otherwise, suspend releases from the waste gas holdup system.

Action E

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, Millstone Unit 2 releases via the Millstone Stack may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours. If the monitor flow and readout are not adversely affected by the loss of functionality, the daily CHANNEL CHECK may be performed in lieu of the grab sample.

TABLE IV.C.−4 **Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.MP2 Vent (normal range, RM−8132 only; high range monitor, RM−8168, requirements are in the TS)				
a. Noble Gas Radioactivity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Vent Flow Rate Monitor	D	NA	R	Q
e. Sampler Flow Rate Monitor	D	NA	R	NA
2.Millstone Stack − applicable to the WRGM (RM−8169, normal range, channel 1, only; mid range channel 2 and high range channel 3 requirements are contained in TRM LCO 3.3.3.8)				
a. Noble Gas Radioactivity Monitor	D	M	R(1)	Q(2)
b. Iodine Sampler	W	NA	NA	NA
c. Particulate Sampler	W	NA	NA	NA
d. Stack Flow Rate Monitor	D	NA	R	Q
e. Sampler Flow Rate Monitor	D	NA	R	NA
3.Waste Gas Holdup System				
a. Noble Gas Monitor	D*	P	R(1)	Q(2)

*During releases via this pathway and when the monitor is required FUNCTIONAL per Table IV.C.−3. The CHANNEL CHECK should be performed when the discharge is in progress.

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

TABLE IV.C.−4
TABLE NOTATION

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

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

a) Instrument indicates measured levels above the alarm/trip setpoint.

b) Instrument indicates a downscale failure.

* − Also demonstrate automatic isolation for the waste gas system noble gas monitor.

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

1. Radioactive Liquid Effluents

   a. Radioactive Liquid Effluents Concentrations

      LIMITING CONDITIONS OF OPERATIONS

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

      APPLICABILITY: At all times.

      ACTION:

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

      SURVEILLANCE REQUIREMENTS

      1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

      2) The results of the radioactive analysis shall be used in accordance with the methods of Section II.E to assure that the concentrations at the point of release are maintained within the limits of Specification IV.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATIONS

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 2 released from the site (see Figure IV.D.−1) shall be limited:

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATIONS

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

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

3) The release rate of Iodine−131, Iodine−133, tritium and for all radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATIONS

The air dose offsite (see Figure IV.D.−1) due to noble gases released in gaseous effluents from Unit 2 shall be limited to the following:

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

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

LIMITING CONDITIONS OF OPERATIONS

The dose to any REAL MEMBER OF THE PUBLIC from Iodine–131, Iodine–133, Tritium, C–14, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 2 (see Figure IV.D.–1) shall be limited to the following:

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

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

APPLICABILITY: At all times.

ACTION:

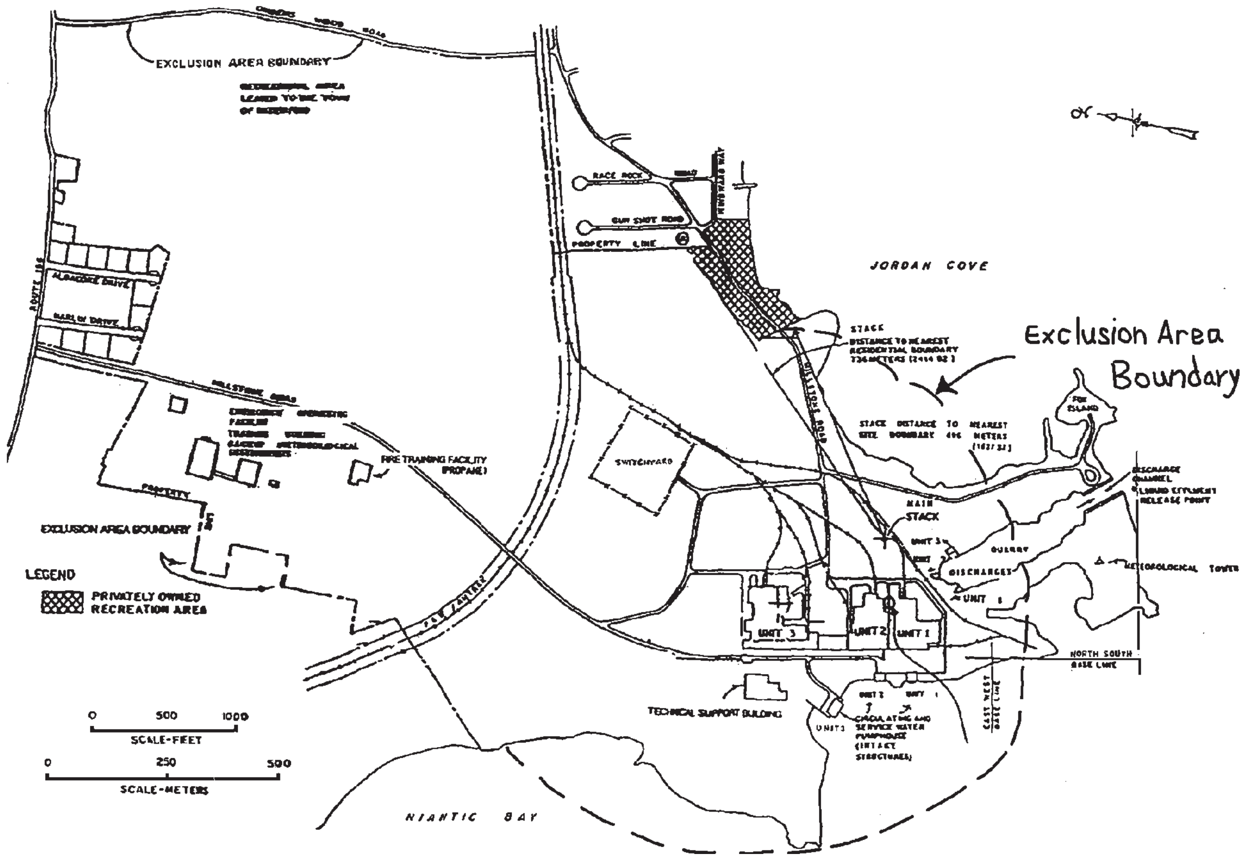
a. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for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

SURVEILLANCE REQUIREMENTS

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

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

Figure IV.D.−1, "Site Boundary for Liquid and Gaseous Effluents"



IV.E. **Total Radiological Dose From Station Operation**

CONTROLS

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

APPLICABILITY: At all times.

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

SECTION V.

Millstone Unit 3

Radiological Effluent Controls

Docket Nos. 50–423

SECTION V. **REMODCM UNIT THREE CONTROLS**

V.A. **Introduction**

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

a. the effluent radiation monitor controls and surveillance requirements,

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

c. the bases for the controls and surveillance requirements.

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

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

V.B. **Definitions and Applicability and Surveillance Requirements**

V.B.1 − Definitions

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

1. ACTION − ACTION shall be that part of the control which prescribes remedial measures required under designated conditions.

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

   The CHANNEL FUNCTIONAL TEST shall include adjustments, as necessary, of the alarm, interlock and/or trip setpoints such that the setpoints are within the required range and accuracy.

3. CHANNEL CALIBRATION – A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock and/or trip functions and may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

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

5. DOSE EQUIVALENT I–131 – DOSE EQUIVALENT I–131 shall be that concentration of I–131 (μCi/gram) which alone would produce the same CDE–thyroid dose as the quantity and isotopic mixture of I–131, I–132, I–133, I–134, and I–135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed under Inhalation in Federal Guidance Report No. 11 (FGR 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion."

6. MEMBER(S) OF THE PUBLIC – MEMBER(S) OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the licensee, its contractors or its vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

   The term "REAL MEMBER OF THE PUBLIC" means an individual who is exposed to existing dose pathways at one particular location.

7. MODE – Refers to Mode of Operation as defined in Safety Technical Specifications.

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

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

10. SOURCE CHECK – A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to radiation.

11. UNRESTRICTED AREA – Any area at or beyond the SITE BOUNDARY to which access is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials or any area within the SITE BOUNDARY used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

V.B.2 – Applicability

V.B.2.a – LIMITING CONDITIONS FOR OPERATION

1. Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

2. Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and associated ACTION requirements are not met within the specified time intervals. If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

V.B.2.b – SURVEILLANCE REQUIREMENTS

1. Surveillance Requirements shall be applicable during any condition specified for individual Limiting Conditions for Operation unless otherwise stated in an individual Surveillance Requirement.

2. Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance time interval.

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

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

V.C. Radioactive Effluent Monitoring Instrumentation

1. Radioactive Liquid Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

The radioactive liquid effluent monitoring instrumentation channels shown in Table V.C.−1 shall be FUNCTIONAL with their Alarm/Trip setpoints set to ensure that the limits of Specification V.D.1.a are not exceeded. The alarm/trip setpoints shall be determined in accordance with methodology and parameters as described in Section II.

APPLICABILITY: As shown in Table V.C.−1

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE V.C.–1 **Radioactive Liquid Effluent Monitoring Instrumentation**		
Instrument	Action when not functional	Notes
1.Radioactivity Monitors Providing Alarm and Automatic Termination Of Release		
a. Waste Neutralization Sump Monitor Condensate Polishing Facility	D	2
b. Turbine Building Floor Drains	B	1
c. Liquid Waste Monitor	A	1
d. RESERVED		
e. Steam Generator Blowdown Monitor	B	3
2.Flow Rate Measurement Devices – No Alarm Setpoint Requirements		
a. Waste Neutralization Sump Effluents	C	1
b. RESERVED		
c. Liquid Waste Effluent Line	C	1
d. RESERVED		
e. Steam Generator Blowdown Effluent Line	C	3

1 Required to be functional at all times – which means that channels shall be FUNCTIONAL and in service on a continuous, uninterrupted basis, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument.

2 Required to be functional in MODEs 1–5, and MODE 6 when discharge pathway is being used, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument. The monitor must be on-line with no unexpected alarms.

3 Required to be functional whenever the discharge pathway is being used, except that outages are permitted, for a maximum of 12 hours, for the purpose of maintenance and performance of required test, checks, calibrations, or sampling associated with the instrument or any system or component which affects functioning of the instrument. The monitor must be on-line with no unexpected alarms.

TABLE V.C.–1
ACTION STATEMENTS

Action A

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

1. At least two independent samples are analyzed for gamma radioactivity as specified in Table I.C–3, and;
2. The original release rate calculations and discharge line valving are independently verified by a second individual.

Action B

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided best efforts are made to repair the instrument and that grab samples are analyzed for gamma radioactivity specified in Table I.C.–3:

1. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 µCi/gram DOSE EQUIVALENT I–131, or
2. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 µCi/gram DOSE EQUIVALENT I–131.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

Action D

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

1. At least two independent samples are analyzed for gamma radioactivity as specified in Table I.C–3, and;
2. If one of the samples has gamma radioactivity greater than any of the lower limits of detection specified in Table I.C.–3, the original release rate calculations and discharge valving are independently verified by a second individual.

TABLE V.C.–2 **Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements**				
Instrument	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1.Radioactivity Monitors Providing Alarm and Automatic Termination Of Release				
a. Waste Neutralization Sump Monitor Condensate Polishing Facility	D	P	R[2]	Q[1]
b. Turbine Building Floor Drains	D	M	R[2]	Q[1]
c. Liquid Waste Monitor	D	P	R[2]	Q[1]
d. Deleted				
e. Steam Generator Blowdown Monitor	D	M	R[2]	Q[1]
2.Flow Rate Measurements				
a. Waste Neutralization Sump Effluents	D[3]	NA	R	Q
b. RESERVED				
c. Liquid Waste Effluent Line	D[3]	N/A	R	Q
d. Deleted				
e. Steam Generator Blowdown Effluent Line	D[3]	N/A	R	Q

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

TABLE V.C.–2
TABLE NOTATION

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur if any of the following conditions exists:

a) Instrument indicates measured levels above the alarm/trip setpoint, or

b) Circuit failure (Alarm only), or Instrument indicates a downscale failure (Alarm only).

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities of NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(3) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

2. Radioactive Gaseous Effluent Monitoring Instrumentation

LIMITING CONDITIONS OF OPERATION

The radioactive gaseous effluent monitoring instrumentation channels shown in Table V.C.−3 shall be FUNCTIONAL with their Alarm Setpoints set to ensure that the limits of Specification V.D.2.a. are not exceeded. The Alarm Setpoints of these channels shall be determined in accordance with the methodology and parameters in Section II.

APPLICABILITY: As shown in Table V.C.−3.

ACTION:

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

b. With the number of FUNCTIONAL radioactive gaseous effluent monitoring instrumentation channels less than the Minimum Channels FUNCTIONAL, take the ACTION shown in Table V.C.−3. Exert best efforts to restore the nonfunctional instrumentation to FUNCTIONAL status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report why the nonfunctionality was not corrected in a timely manner. Release need not be terminated after 30 days provided the specified actions are continued.

SURVEILLANCE REQUIREMENT

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

TABLE V.C.–3 Radioactive Gaseous Effluent Monitoring Instrumentation		
Instrument	Action when not functional	Notes
1.Millstone Unit 3 Ventilation Vent (Turbine Building – HVR–RE10B, normal range only; high range monitor, HVR–RE10A, requirements are in the TRM)		
a. Noble Gas Radioactivity Monitor Providing Alarm	A	1, 2
b. Iodine Sampler	B	1, 2
c. Particulate Sampler	B	1, 2
d. Vent Flow Rate Monitor	C	1, 2
e. Sampler Flow Rate Monitor	C	1
2.Millstone Stack – applicable to SLCRS (HVR–RE19B, normal range only; high range monitor, HVR–RE19A, requirements are in the TRM)		
a. Noble Gas Radioactivity Monitor Providing Alarm	A	1, 2
b. Iodine Sampler	B	1, 2
c. Particulate Sampler	B	1, 2
d. Process Flow Rate Monitor	C	1, 2
e. Sampler Flow Rate Monitor	C	1
3.Engineered Safeguards Building Monitor (HVQ–RE49)		
a. Noble Gas Radioactivity Monitor	D	1
b. Iodine Sampler	B	1
c. Particulate Sampler	B	1
d. Discharge Flow Rate Monitor	E	1
e. Sampler Flow Rate Monitor	C	1

TABLE V.C.–3
Table Notations

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

2 When the Ventilation Vent Flow Rate Monitor or Millstone Stack Process Flow Rate Monitor is nonfunctional because of degraded flow indication, the Noble Gas Monitor and Iodine and Particulate Samplers for the affected pathway (Ventilation Vent or Millstone Stack) remain functional as long as there is a minimum indicated process flow.

TABLE V.C.–3
ACTION STATEMENTS

Action A

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that

a) best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours, OR

b) if the cause of the nonfunctionality is solely due to a loss of annunciation in the control room and the Remote Indicating Controller (RIC) remains FUNCTIONAL, perform a channel check at the RIC at least once per twelve hours and verify the indication has not alarmed.

Action B

With the number of samplers FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that effluent is continuously sampled with auxiliary sampling equipment at least once per seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period. Auxiliary sampling must be initiated within 12 hours after initiation of this ACTION statement. Operation of the auxiliary sampling equipment shall be verified every twelve (12) hours. Auxiliary sampling outages are permitted for a maximum of 12 hours for the purpose of maintenance and performance of required tests, checks, calibrations, or sampling.

Action C

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated at least once per 5 hours. Sample flow rate need not be estimated if the auxiliary sampling equipment of Action B is in use.

Action D

With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken at least once per 12 hours and these samples are analyzed for gamma radioactivity within 24 hours.

Action E

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

TABLE V.C.–4 **Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements**					
Instrument	Channel Check	Source-Check	Channel Calibra-tion	Channel Functional Check	When Surveil-lance is Required
1.Millstone Unit 3 Ventilation Vent (Turbine Building – HVR–RE10B, normal range only; high range monitor, HVR–RE10A, requirements are in the TRM)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Vent Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*
2.Millstone Stack – applicable to SLCRS (HVR–RE19B, normal range only; high range monitor, HVR–RE19A, requirements are in the TRM)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Process Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*
3.Engineered Safeguards Building Monitor (HVQ–RE49)					
a. Noble Gas Radioactivity Monitor Providing Alarm	D	M	R(1)	Q(2)	*
b. Iodine Sampler	W	NA	NA	NA	*
c. Particulate Sampler	W	NA	NA	NA	*
d. Discharge Flow Rate Monitor	D	NA	R	Q	*
e. Sampler Flow Rate Monitor	D	NA	R	Q	*

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

D = Daily
W = Weekly
M = Monthly

R = Once every 18 months
Q = Once every 3 months
N/A= Not Applicable

STOP THINK ACT REVIEW

TABLE V.C.−4
Table Notations

(1) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities of NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

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

a) Instrument indicates measured levels above the Alarm Setpoint, or

b) Circuit failure, or

c) Instrument indicates a downscale failure.

(3) The CHANNEL CALIBRATION shall include the use of a known source whose strength is determined by a detector which has been calibrated to an NIST source. These sources shall be in know, reproducible geometry.

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

1. Radioactive Liquid Effluents

a. Radioactive Liquid Effluents Concentrations

LIMITING CONDITIONS OF OPERATION

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

1) Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

2) The results of the radioactive analysis shall be used in accordance with the methods of Section II.E to assure that the concentrations at the point of release are maintained within the limits of Specification V.D.1.a.

b. Radioactive Liquid Effluents Doses

LIMITING CONDITIONS OF OPERATION

The dose or dose commitment to any REAL MEMBER OF THE PUBLIC from radioactive materials in liquid effluents from Unit 3 released from the site (see Figure V.D.−1) shall be limited:

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

LIMITING CONDITIONS OF OPERATION

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

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

3) The release rate of Iodine−131, Iodine−133, tritium, and for all radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents shall be determined by obtaining representative samples and performing analyses in accordance with the sampling and analysis program, specified in Section I. The corresponding dose rate shall be determined using the methodology given in Section II.

b. Radioactive Gaseous Effluents Noble Gas Dose

LIMITING CONDITIONS OF OPERATION

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

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

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

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

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

LIMITING CONDITIONS OF OPERATION

The dose to any REAL MEMBER OF THE PUBLIC from Iodine–131, Iodine–133, Tritium, C–14, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 3 released offsite (see Figure V.D.–1) shall be limited to the following:

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

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

APPLICABILITY: At all times.

ACTION:

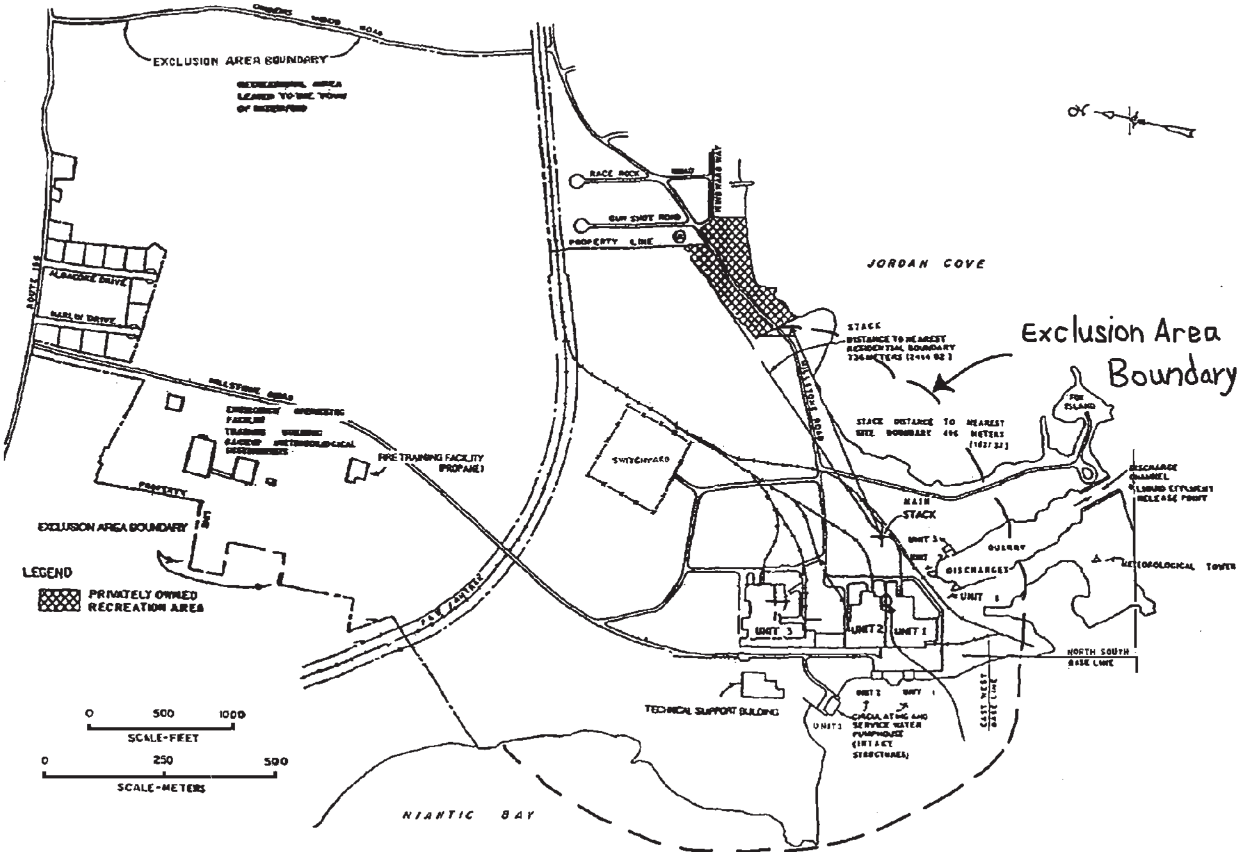
c. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for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

SURVEILLANCE REQUIREMENTS

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

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

Figure V.D.−1, "Site Boundary for Liquid and Gaseous Effluents"



V.E. **Total Radiological Dose From Station Operations**

CONTROLS

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

APPLICABILITY: At all times.

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

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