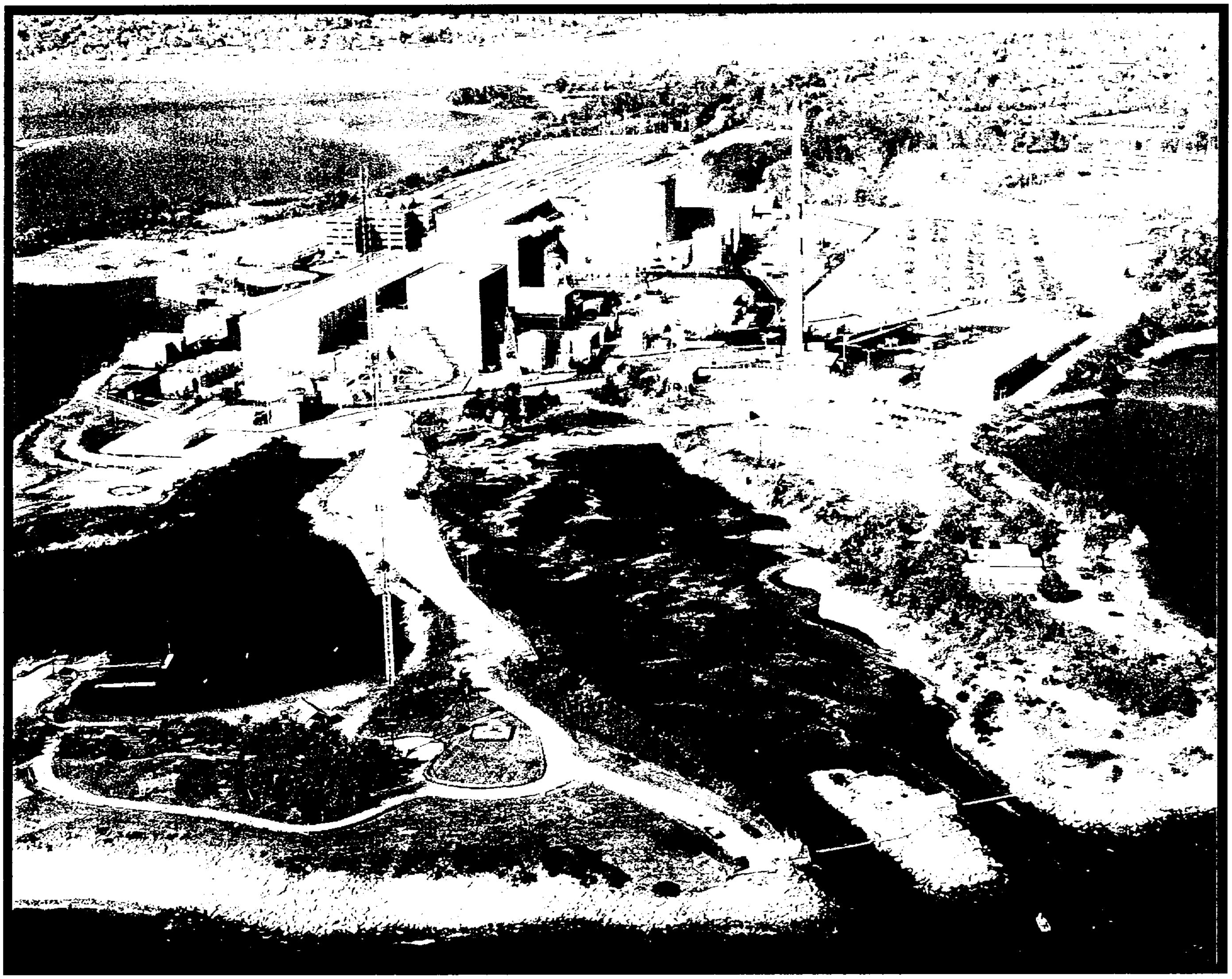
Millstone Power Station

2000 Radioactive Effluent Release Report

Volume II



Dominion

Dominion Nuclear Connecticut, Inc.

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

MAJOR

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

SECTION I: RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

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

SECTION I: RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

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I.A. INTRODUCTION

Section I.A

Section II

The purpose of this manual is to provide the sampling and analysis programs which provide input to ~~the ODCM~~ 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).

12/15/99 GH

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

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

I.B. RESPONSIBILITIES

All changes to ~~this manual~~ the Radiological Effluent Monitoring Manual (REMM) shall be reviewed and approved by the Site Operations Review Committee prior to implementation.

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

It shall be the responsibility of the Senior Vice President and CNO - Millstone to ensure that this manual is used in performance of the surveillance requirements and administrative controls of the *Technical Specifications* ~~*for Millstone Units 2 and 3*~~. The delegation of implementation responsibilities is delineated in the *Millstone Radiological Effluent Program Reference Manual (MP-13-REM-REF01).*

I.C. LIQUID EFFLUENTS

1. Liquid Effluent Sampling and Analysis Program

Section II

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 ~~the ODCM~~ to assure that the concentrations at the point of release are maintained within the limits of *Radiological Effluent Control (Section III D.1.1)* for Millstone Unit No. 1 and within *Technical Specification 3.11.1* for Millstone Unit Nos. 2 and 3. 12/15/94 CAK

Table I.C-1

MILLSTONE UNIT 1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
A. Batch Release[B] Waste Sample Tanks, Floor Drain Sample Tank and Decontamination Solution Tank	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[C]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
		Monthly Composite[E]	H-3	1×10^{-5}
			Gross alpha	1×10^{-7}
		Quarterly Composite[E]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Release Reactor Building Service Water	Weekly Grab Sample[D]*	Weekly Composite[F]	Principal Gamma Emitters[C]	5×10^{-7}
			I-131	1×10^{-6}
			Ce-144	5×10^{-6}
	Weekly Grab or Composite[F]	Monthly Composite[F]	H-3	1×10^{-5}
			Gross alpha[F]	1×10^{-7}
	Weekly Composite[E,F]*	Quarterly Composite[E,F]*	Sr-89[F], Sr-90[F]	5×10^{-8}
			Fe-55[F]*	1×10^{-6}

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midoint of sample collection and midpoint of counting time

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

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

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided.

C. The LLD will be 5×10^{-7} µCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall be measured, but with an LLD of 5×10^{-6} uCi/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 *Annual Radioactive Effluent Report*.

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

E. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

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

~~G. 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 *Annual Radioactive Effluent Report*.~~

CONDITIONAL ACTION REQUIREMENTS:

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

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

Table I.C-2

MILLSTONE UNIT 2

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

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

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

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

C. The LLD will be 5×10^{-7} µCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall also be measured, but with an LLD of 5×10^{-6} uCi/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 *Annual Radioactive Effluent Report*.

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

TABLE NOTATIONS

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

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

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

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

CONDITIONAL ACTION REQUIREMENTS

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

E. For the Condensate Polishing Facility (CPF) - ~~W~~waste ~~N~~neutralization ~~S~~sump: **IF** ~~tritium sampling and analyses is only required if~~ there is no detectable tritium in the steam generators, **THEN** tritium sampling and analyses are not required.

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

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

~~Remaining sampling and analysis is required when~~ **IF** the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7-2* of the *Safety Technical Specifications*) does not exceeds 5×10^{-7} μCi/ml, **THEN** the sampling and analysis schedule for all principal gamma , I-131, Ce-144, noble gases, gross alpha, Sr-89, Sr-90 and Fe-55 are not required.~~.~~

J. For the Service Water:~~,~~ ~~these analyses are only required if~~**IF** -a weekly gamma analysis does not indicates a gamma activity greater than 5×10^{-7} μCi/ml, **THEN** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

L. ~~When~~ For the Turbine Building ~~s~~Sump: **IF** the release pathway is directed to yard drains, **THEN** the LLD for I-131 shall be 1.5×10^{-7} uCi/ml and for gross alpha 1×10^{-8} uCi/ml.

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

Table LC-3

MILLSTONE UNIT 3

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

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

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal. For a particular measurement system (which may include radiochemical separation):

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

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

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

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

TABLE NOTATIONS

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

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

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

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

CONDITIONAL ACTION REQUIREMENTS

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

E. For the Condensate Polishing Facility (CPF) ~~-W~~waste ~~N~~neutralization ~~S~~sump: ~~tritium sampling and analyses is only required if~~**IF** there is no detectable tritium in the steam generators, **THEN** tritium sampling and analysis is not required.

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

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

~~Remaining sampling and analysis is required when~~**IF** the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7-1* of the *Safety Technical* Specifications) does not exceeds 5×10^{-7} μCi/ml, **THEN** the sampling and analysis for all principal gamma , I-131, Ce-144, noble gases, gross alpha, Sr-89, Sr-90 and Fe-55 are not required.

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

J. For ~~the~~ Service Water:~~,~~ ~~these analyses are only required if~~**IF** a weekly gamma analysis does not indicates a gamma activity greater than 5×10^{-7} μCi/ml, **THEN** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

L. ~~When~~**IF** the Turbine Building sump release is directed to yard drains, **THEN** the LLD for I-131 shall be 1.5×10^{-7} uCi/ml and for gross alpha 1×10^{-8} uCi/ml.

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

I.C. LIQUID EFFLUENTS (Cont'd)

2. Liquid Radioactive Waste Treatment

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

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

1. **IF** the radioactivity concentration criteria for the Unit 3 steam generator blowdown is exceeded with blowdown recovery not available to maintain releases to as low as reasonably achievable; or,
   IF any of the other radioactive waste processing equipment listed in Section b are not routinely operating,
   THEN doses due to liquid effluents from the applicable waste stream to unrestricted areas shall be II projected at least once per 31 days in accordance with the methodology and parameters in Section C.5 ~~of the ODCM~~. 12/15/94
2. **IF** any of these dose projections exceeds 0.006 mrem to the total body or 0.02 mrem to any organ,
   THEN best efforts shall be made to return the inoperable equipment to service, or to limit discharges via the applicable waste stream.
3. **IF** an actual dose due to liquid effluents exceeds 0.06 mrem to the total body or 0.2 mrem to any organ,
   AND the dose from the applicable waste stream exceeds 10% of one of these limits,
   THEN prepare and submit to the Commission a Special Report within 30 days as specified in Section c.

b. Required Equipment for Each Millstone Unit

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

1. Millstone Unit No. 1

Waste Stream	Processing Equipment
Waste collector	Filtration
	Waste demineralizer A or B
Floor drains	Filtration/ion exchanger OR Waste collector equipment (filtration and demineralizer)

2. Millstone Unit No. 2

Waste Stream	Processing Equipment
Clean liquid	Deborating ion exchanger (T11) OR Purification ion exchanger (T10A or T10B)
	Primary demineralizer (T22 A or B)
	Secondary demineralizer (T23)
Aerated liquid	Demineralizer (T24) OR Equivalent demineralizer

3. Millstone Unit No. 3

Waste Stream	Processing Equipment or Radioactivity Concentration
High level	Demineralizer filter (LWS-FLT3) and Demineralizer (LWS-DEMIN2) OR Demineralizer (LWS-DEMIN1) and Demineralizer filter (LWS-FLT1)
Boron recovery	Cesium ion exchanger (DEMIN A or B)
	Boron evaporator (EV-1)
Low level	High level processing equipment
Steam generator blowdown	Blowdown recovery when total gamma activity exceeds 5E-7 uCi/ml or tritium activity exceeds 0.02 uCi/ml.

I.C.2 Liquid Radioactive Waste Treatment (Cont'd)

c. Report Requirement For All Three Millstone Units

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

- Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,
- Action(s) taken to restore the inoperable equipment to OPERABLE status, and
- Summary description of action(s) taken to prevent a recurrence.

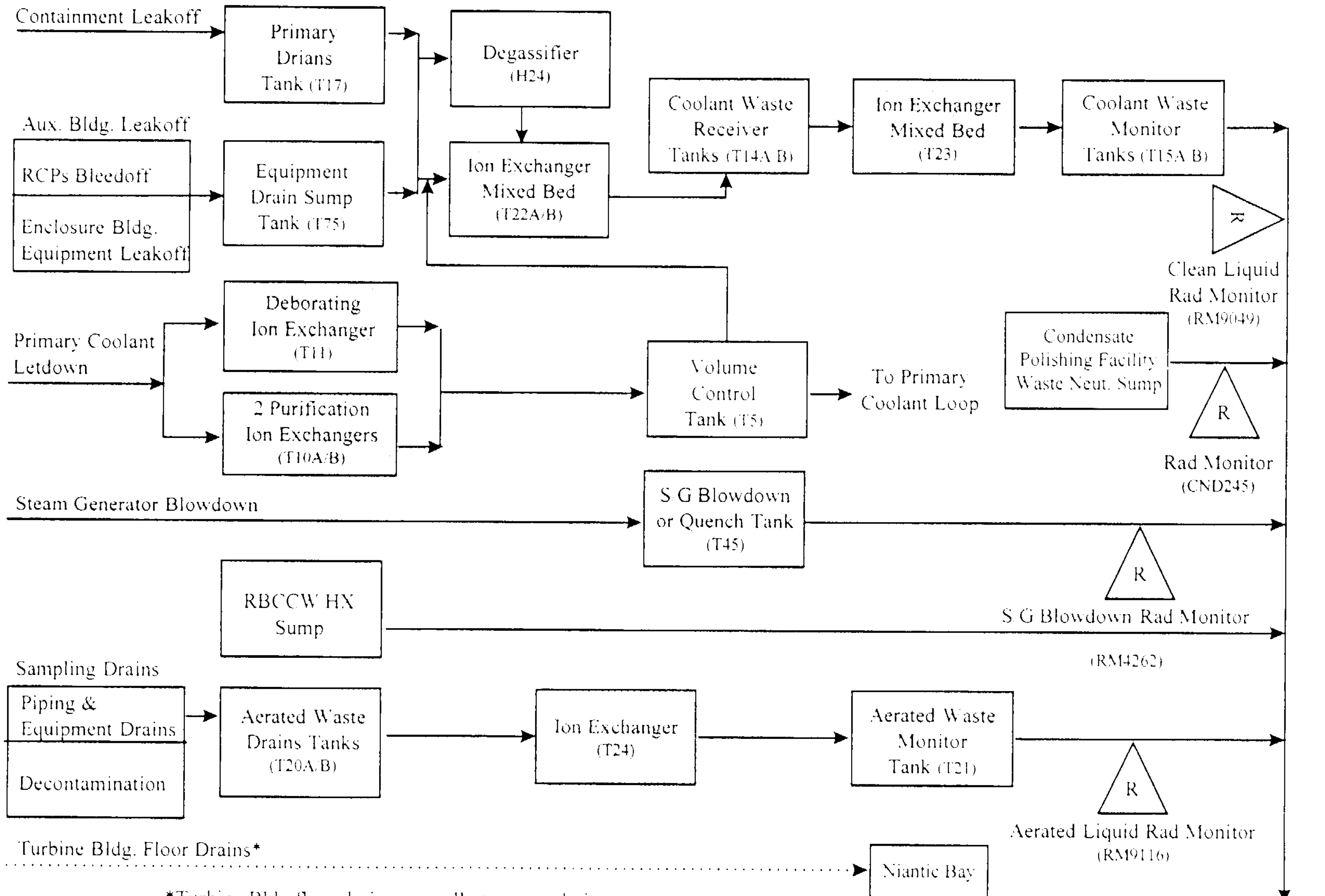
3. Basis for Liquid Sampling, Analysis and Radioactive Treatment System Use

Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid effluents during the past 12 months of plant operation. The indicated liquid surveillance programs (as directed by Unit 1 Radiological Effluent Control III.D.1.1, Surveillance Requirement 1; and Units 2 and 3 Technical Specification Surveillance Requirement 4.11.1.1.1) provides the means to quantify and report on liquid discharges from all major and potential significant release pathways. This information also provides for the assessment of effluent concentrations and environmental dose impacts for the purpose of demonstration compliance with the effluent limits of 10 CFR 20, and dose objectives of 10 CFR 50, Appendix I. The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of Lower Limits of Detection (LLDs) and are selected such that the detection of radioactivity in effluent releases will occur at levels below which effluent concentration limits and off-site dose objectives would be exceeded. The LLDs are listed in Table 4.11-1 of NUREG-1301 except for the LLD for Ce-144 which is contained in Footnote 4.11-1 of NUREG-1301 12/15/99 CH The indicated liquid radwaste treatment equipment for each Unit have been determined to be capable to minimize radioactive liquid effluents such that the dose objectives of Appendix I can be met for expected routine (and anticipated operational occurrence) effluent releases. This equipment is maintained and routinely operated to treat appropriate liquid waste streams without regards to projected environmental doses.

If not already in use, the requirement that the appropriate portions of the liquid radioactive waste treatment system for each Unit be returned to service when the specified effluent doses are exceeded provides assurance that the release of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This condition of equipment usage implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR 50, and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified dose limits governing the required use of appropriate portions of the liquid radwaste treatment system were selected as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR 50 for liquid effluents. following the guidance given in NUREG-1301 12/15/99 CH

FIGURE RESERVED

FIGURE I.C-1



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

[ ] = Component included in radwaste treatment equipment requirement

FIGURE LC-2
SIMPLIFIED LIQUID EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT TWO

NEW

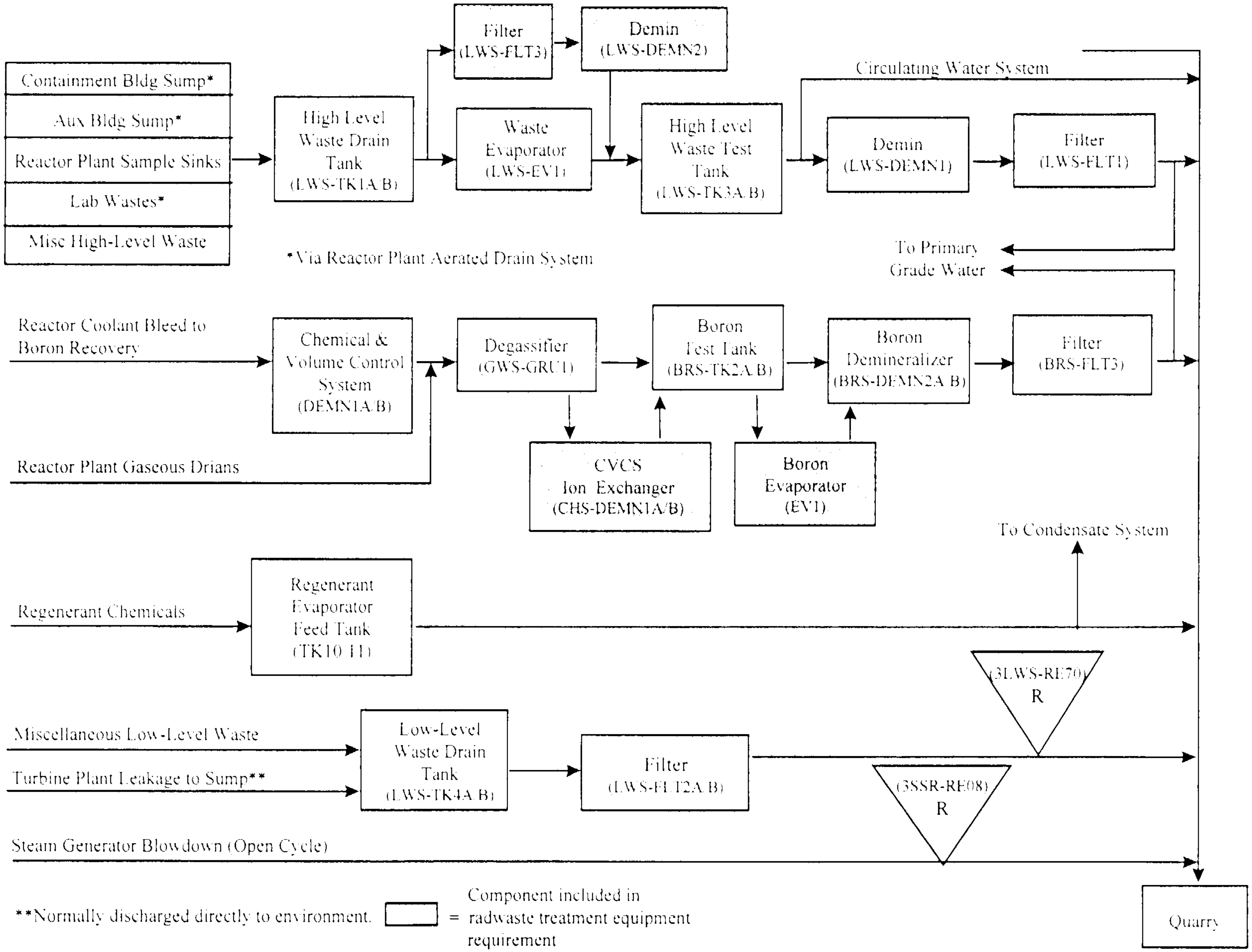


FIGURE LC-3
SIMPLIFIED LIQUID EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT THREE

NEW

I.D. GASEOUS EFFLUENTS

1. Gaseous Effluent Sampling and Analysis Program

Section II

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 ~~the ODCM~~ to assure that offsite dose rates are maintained within the limits of *Radiological Effluent Control III.D.2.1* for Millstone Unit No. 1 and within *Technical Specification 3.11.2.1* for Millstone Unit Nos. 2 and 3. 12/15/99 CAF

Table I.D-1

MILLSTONE UNIT 1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/cc)
A. Steam Jet Air Ejector Discharge	Monthly - Gaseous Grab Sample[C] *	Monthly	Principal Gamma Emitters[B]	1×10^{-4}
B. Main Stack	Monthly - Gaseous Grab Sample	Monthly	Principal Gamma Emitters[B]	1×10^{-4}
			H-3	1×10^{-6}
	Continuous[D]	Weekly Charcoal Sample[F] *	I-131	1×10^{-12}
			I-133[E]	1×10^{-10}
	Continuous[D]	Weekly Particulate Sample[F] *	Principal Particulate Gamma Emitters[B] - (I-131, Others with half lives greater than 8 Days)	1×10^{-11}
	Continuous[D]	Monthly Composite Particulate Sample	Gross alpha	1×10^{-11}
	Continuous[D]	Quarterly Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[D]	Noble Gas Monitor	Noble Gases - Gross Activity	1×10^{-6}

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES

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

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

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

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

CONDITIONAL ACTION REQUIREMENTS:

C. ~~Sampling and analysis shall also be performed within 24 hours following~~ **IF** there is an increase~~, as indicated by~~of the steam jet air ejector off-gas monitor~~,~~ of greater than 50%, after factoring out increases due to changes in THERMAL POWER level, **THEN** sampling and analysis shall also be performed within 24 hours.

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

~~Special sampling and analysis of iodine and particulate filters shall also be performed whenever subsequent~~**IF** reactor coolant I-131 samples show an increase of greater than a factor of 5 after factoring out increases due to changes in thermal power level, **THEN** special sampling and analysis of iodine and particulate filters shall also be performed. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.

Table I.D-2

MILLSTONE UNIT 2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

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

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

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

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

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

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

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

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

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

TABLE NOTATIONS

CONDITIONAL ACTION REQUIREMENTS:

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

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

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

G. ~~Grab samples for tritium shall be taken weekly whenever~~**IF** the refueling cavity is flooded and there is fuel in the cavity, **THEN** grab samples for tritium shall be taken weekly. The grab sample shall be taken from the stack (Units 1 and 2) where the containment ventilation is being discharged at the time of sampling.

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

Table I.D-3

MILLSTONE UNIT 3

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

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

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

B. For gaseous samples, the LLD will be 1 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 *Annual Radioactive Effluent Report.*

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

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

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

CONDITIONAL ACTION REQUIREMENTS

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

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

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

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

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

I.D GASEOUS EFFLUENTS (Cont'd)

2. Gaseous Radioactive Waste Treatment

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

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

1. **IF** any of the radioactive waste processing equipment listed in Section b are not routinely operating, **THEN** doses due to gaseous effluents from the untreated waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section II.D.4 of the REMODCM. For each waste stream, only those doses specified in Section II.D.4 of the REMODCM need to be determined for compliance with this section.
2. **IF** any of these dose projections exceed 0.02 mrad for gamma radiation, 0.04 mrad for beta radiation or 0.03 mrem to any organ due to gaseous effluents, **THEN** best efforts shall be made to return the inoperable equipment to service.
3. **IF** actual doses exceed 0.2 mrad for gamma radiation, 0.4 mrad for beta radiation or 0.3 mrem to any organ **AND** the dose from a waste stream with equipment not continuously operating exceed 10% any of these limits, **THEN** prepare and submit to the Commission a report as specified in Section 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 dose limits are not exceeded.

1. Millstone Unit No. 1

Waste Stream	Processing Equipment
Radwaste Vent Exhaust	Radwaste ventilation HEPA filters

2. Millstone Unit No. 2

Waste Stream	Processing Equipment
Gaseous Radwaste Treatment System	Five (5) gas decay tanks
	One waste gas compressor
Ventilation Exhaust Treatment System	Auxiliary building ventilation HEPA filter (L26 or L27)
	Containment purge HEPA filter (L25)
	Containment vent HEPA/charcoal filter (L29 A or B)

3. Millstone Unit No. 3

Waste Stream	Processing Equipment
Gaseous Radwaste Treatment System	Charcoal bed adsorbers
	One HEPA filter
Building Ventilation	Fuel building ventilation filter

c. Report Requirement For All Three Millstone Units

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

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

I.D GASEOUS EFFLUENTS (Cont'd)

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

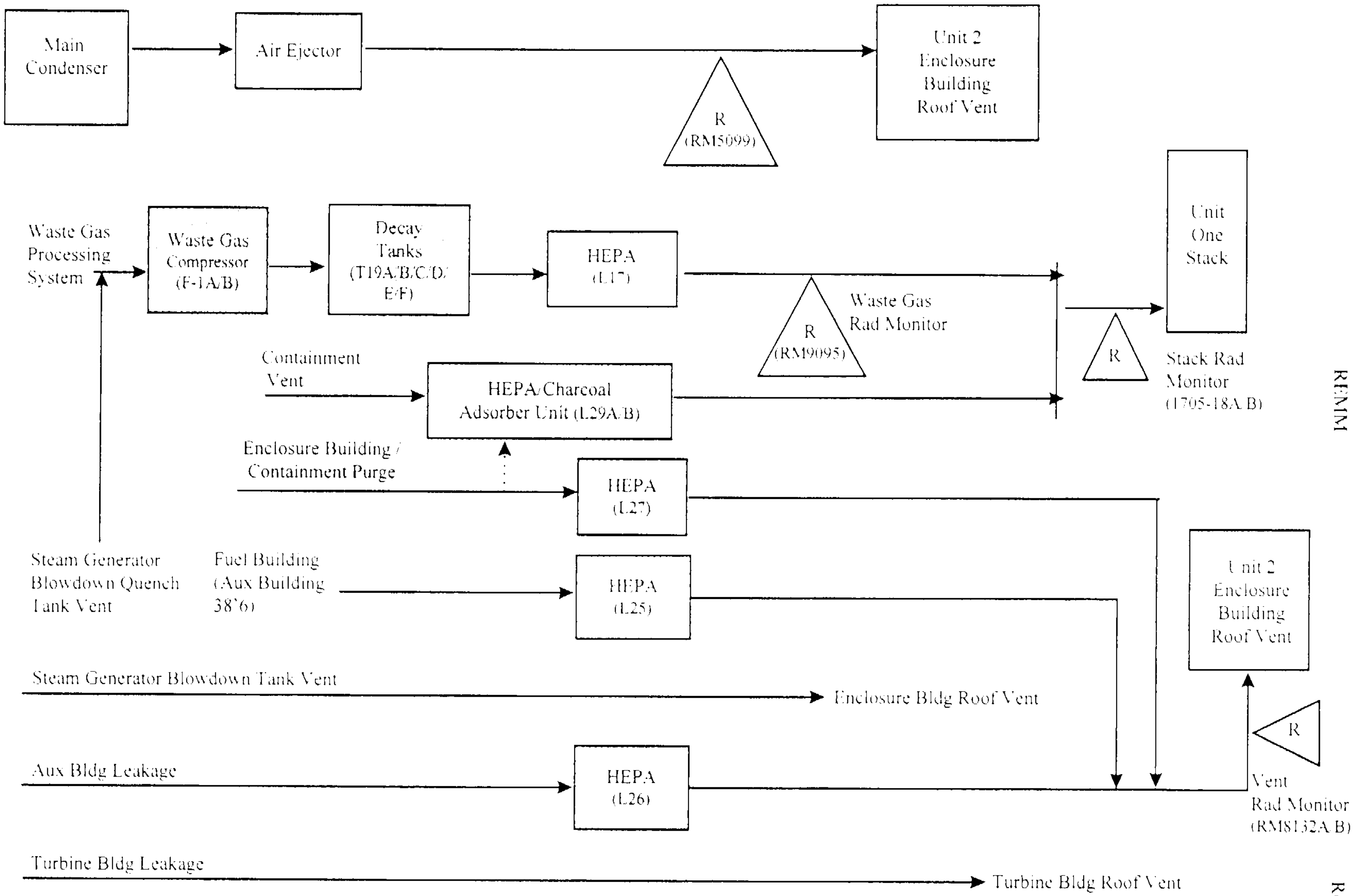
Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in gaseous effluents during the past 12 months of plant operation. The indicated gaseous surveillance programs (as directed by Unit 1 Radiological Effluent Control III.D.2.1, Surveillance Requirement 3; and Units 2 and 3 Technical Specification Surveillance Requirement 4.11.2.1.3) provides the means to quantify and report on radioactive materials released to the atmosphere from all major and potential significant release pathways. This information also provides for the assessment of effluent dose rates and environmental dose impacts for the purpose of demonstration compliance with the effluent limits of 10 CFR 20, and dose objectives of 10 CFR 50, Appendix I. The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of lower limits of detection (LLDs) and are selected such that the detection of radioactivity in releases will occur at levels below which effluent offsite dose objectives would be exceeded. The indicated liquid radwaste treatment equipment for each Unit have been determined to be capable to minimize radioactive liquid effluents such that the dose objectives of Appendix I can be met for expected routine (and anticipated operational occurrence) effluent releases. This equipment is maintained and routinely operated to treat appropriate liquid waste streams without regards to projected environmental doses.

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

FIGURE RESERVED

FIGURE I.D-1

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



New

NEW

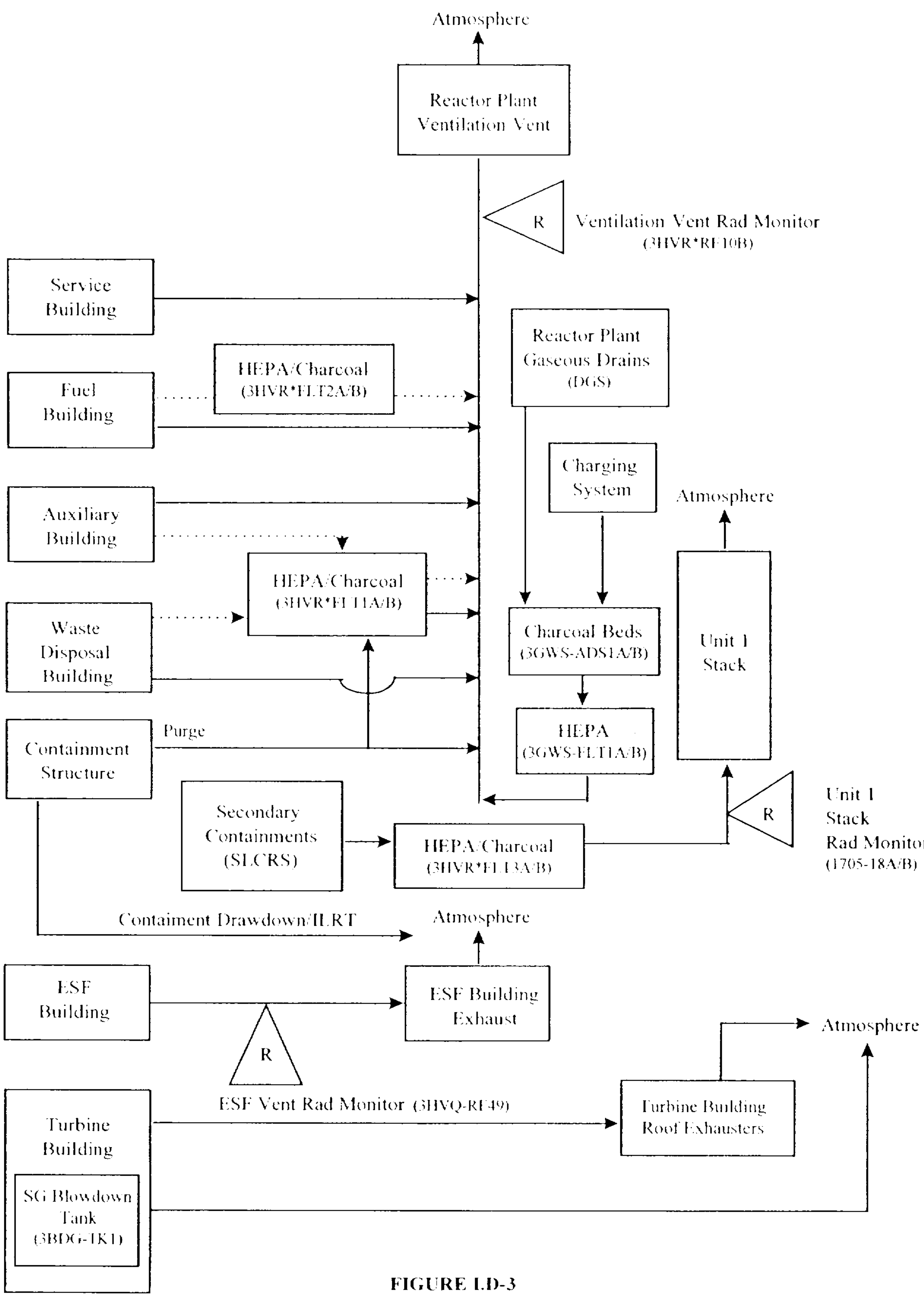


FIGURE I.D-3
SIMPLIFIED AIRBORNE EFFLUENT FLOW DIAGRAM
MILLSTONE UNIT THREE

I.E. RADIOLOGICAL ENVIRONMENTAL MONITORING

1 Sampling and Analysis

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

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

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

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

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

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

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

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

When radionuclides other than those in *Table I.E-3* are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to an individual is equal to or greater than the appropriate calendar year limit of the *Radiological Effluent Controls (Section III) D.1.1, D.2.2, or D.2.3* for Millstone Unit No. 1 or *Technical Specifications 3.11.1.2, 3.11.2.2 or 3.11.2.3* for Millstone Unit Nos. 2 and 3. This report is not required if the measured level of radioactivity was not the result of plant effluents, however, in such an event, the condition shall be reported and described in the *Annual Radiological Environmental Operating Report*.

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

TABLE I.E-1

MILLSTONE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1a. Gamma Dose - Environmental TLD	17	Monthly	Gamma Dose - Monthly
1b. Gamma Dose - Accident TLD	18	Quarterly[(a)]	N/A[(a)]
2. Airborne Particulate	8	Continuous sampler - weekly filter change	Gross Beta - Weekly Gamma Spectrum - Quarterly on composite (by location), and on individual sample if gross beta is greater than 10 times the mean of the weekly control station's gross beta results
3. Airborne Iodine	8	Continuous sampler - weekly canister change	I-131 - Weekly
4. Vegetation	5	One sample near middle and one near end of growing season	Gamma Isotopic on each sample
5. Milk	3	Monthly	Gamma Isotopic and I-131 on each sample; Sr-89 and Sr-90 on Quarterly Composite
5a. Pasture Grass	4	Sample as necessary to substitute for unavailable milk	Gamma Isotopic and I-131
6. Sea Water	2	Continuous sampler with a quarterly collection at indicator location. Quarterly at control location - Composite of 6 weekly grab samples	Gamma Isotopic and Tritium on each sample.
7. Bottom Sediment	5	Semiannual	Gamma Isotopic on each sample
8. Fin Fish-Flounder and one other type of edible fin fish (edible portion)	2	Quarterly	Gamma Isotopic on each sample
9. Mussels (edible portion)	2	Quarterly	Gamma Isotopic on each sample
10. Oysters (edible portion)	4	Quarterly	Gamma Isotopic on each sample
11. Clams (edible portion)	2	Quarterly	Gamma Isotopic on each sample
12. Lobsters (edible portion)	2	Quarterly	Gamma Isotopic on each sample

(a) Accident monitoring TLDs to be dedosed at least quarterly.

TABLE I.E-2
ENVIRONMENTAL MONITORING PROGRAM

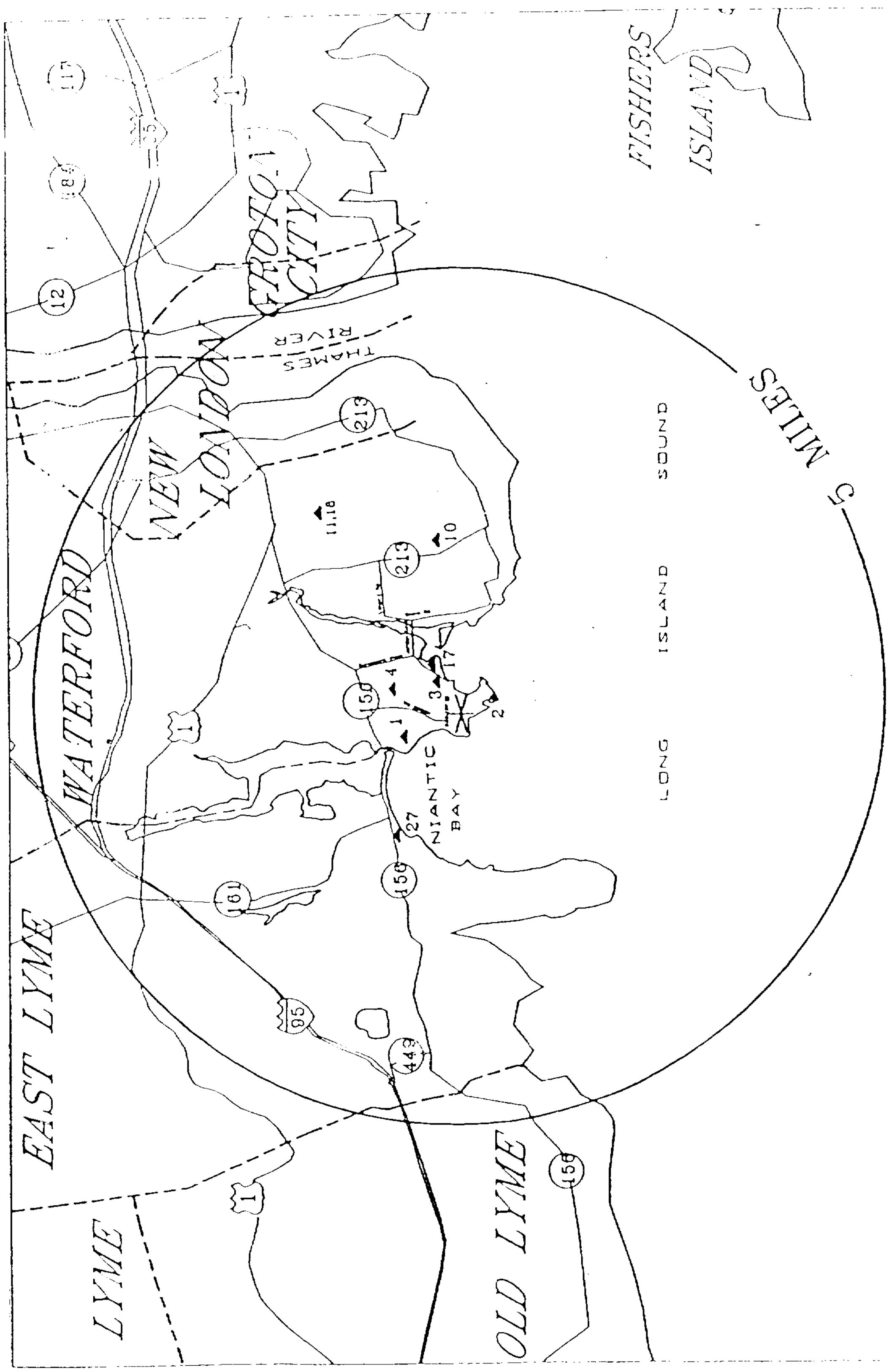
Sampling Locations

The following lists the environmental sampling locations and the types of samples obtained at each location. Sampling locations are also shown on Figures I.E-1, I.E-2, and I.E-3:

Location			
Number*	**Name**	**Direction & Distance from Release Point****	**Sample Types**
1-I	On-Site - Old Millstone Road	0.6 Mi, NNW	TLD, Air Particulate, Iodine, Vegetation
2-I	On-Site - Weather Shack	0.3 Mi, S	TLD, Air Particulate, Iodine
3-I	On-Site - Bird Sanctuary	0.3 Mi, NE	TLD, Air Particulate, Iodine
4-I	On-Site - Albacore Drive	1.0 Mi, N	TLD, Air Particulate, Iodine
5-I	MP3 Discharge	0.1 Mi, SSE	TLD
6-I	Quarry Discharge	0.3 Mi, SSE	TLD
7-I	Environmental Lab Dock	0.3 Mi, SE	TLD
8-I	Environmental Lab	0.3 Mi, SE	TLD
9-I	Bay Point Beach	0.4 Mi, W	TLD
10-I	Pleasure Beach	1.2 Mi, E	TLD, Air Particulate, Iodine
11-I	New London Country Club	1.6 Mi, ENE	TLD, Air Particulate, Iodine
12-C	Fisher's Island, NY	8.7 Mi, ESE	TLD
13-C	Mystic, CT	11.5 Mi, ENE	TLD
14-C	Ledyard, CT	12.0 Mi, NE	TLD
15-C	Norwich, CT	14.0 Mi, N	TLD, Air Particulate, Iodine
16-C	Old Lyme, CT	8.8 Mi, W	TLD
17-I	Site Boundary	0.5 Mi, NE	Vegetation
18-I	Pleasure Beach	1.2 Mi, E	Vegetation
21-I	Goat Location No. 1	2.0 Mi., N	Milk
22-I	Goat Location No. 2	5.2 Mi, NNE	Milk
~~23~~	~~Location number not in use~~		
24-C	Goat Location No. 43	29 Mi, NNW	Milk
25-I	Fruits & Vegetables	Within 10 Miles	Vegetation
26-C	Fruits & Vegetables	Beyond 10 Miles	Vegetation
27-I	Niantic	1.7 Mi, WNW	TLD, Air Particulate, Iodine
28-I	Two Tree Island	0.8 Mi, SSE	Mussels
29-I	West Jordan Cove	0.4 Mi, NNE	Clams
~~30-C~~	~~Golden Spur~~	~~4.7 Mi, NNW~~	-
31-I	Niantic Shoals	1.8 Mi, NW 1.5 Mi, NNW	Bottom Sediment, Oysters Mussels
32-I	Vicinity of Discharge		Bottom Sediment, Oysters, Lobster, Fish, Seawater
33-I	Seaside Point	1.8 Mi, ESE	Bottom Sediment
34-I	Thames River Yacht Club	4.0 Mi, ENE	Bottom Sediment
35-I	Niantic Bay	0.3 Mi, WNW	Lobster, Fish
36-I	Black Point	3.0 Mi, WSW	Oysters
37-C	Giant's Neck	3.5 Mi, WSW	Bottom Sediment, Oysters, Seawater
38-I	Waterford Shellfish Bed No. 1	1.0 Mi, NW	Clams

* I Indicator; C Control.

** – The release points are the MP1 stack for terrestrial locations and the end of the quarry for aquatic location.



INNER AIR PARTICULATE AND VEGETATION MONITORING STATIONS

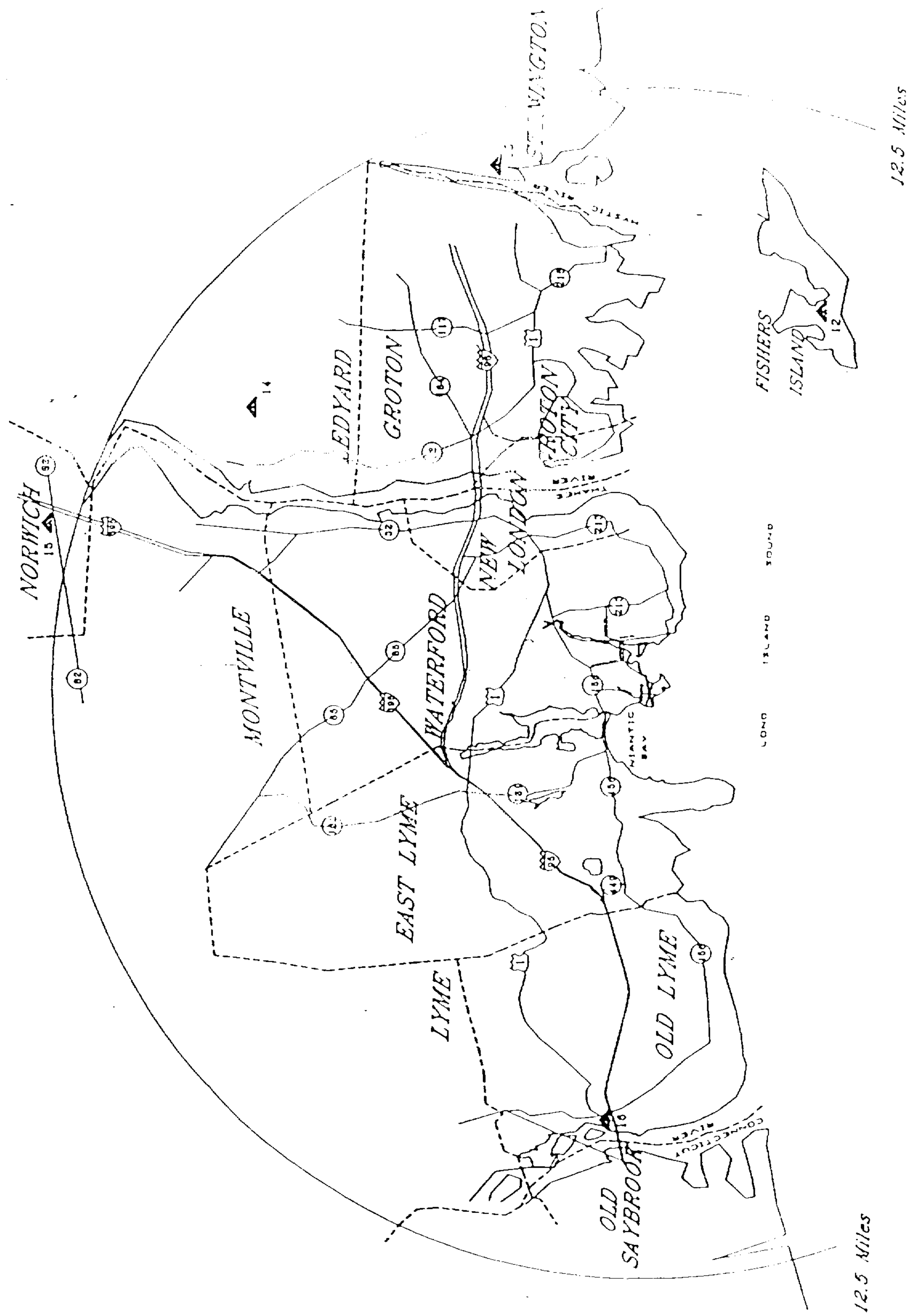


Figure I.E-2

OUTER TERRESTRIAL MONITORING STATIONS

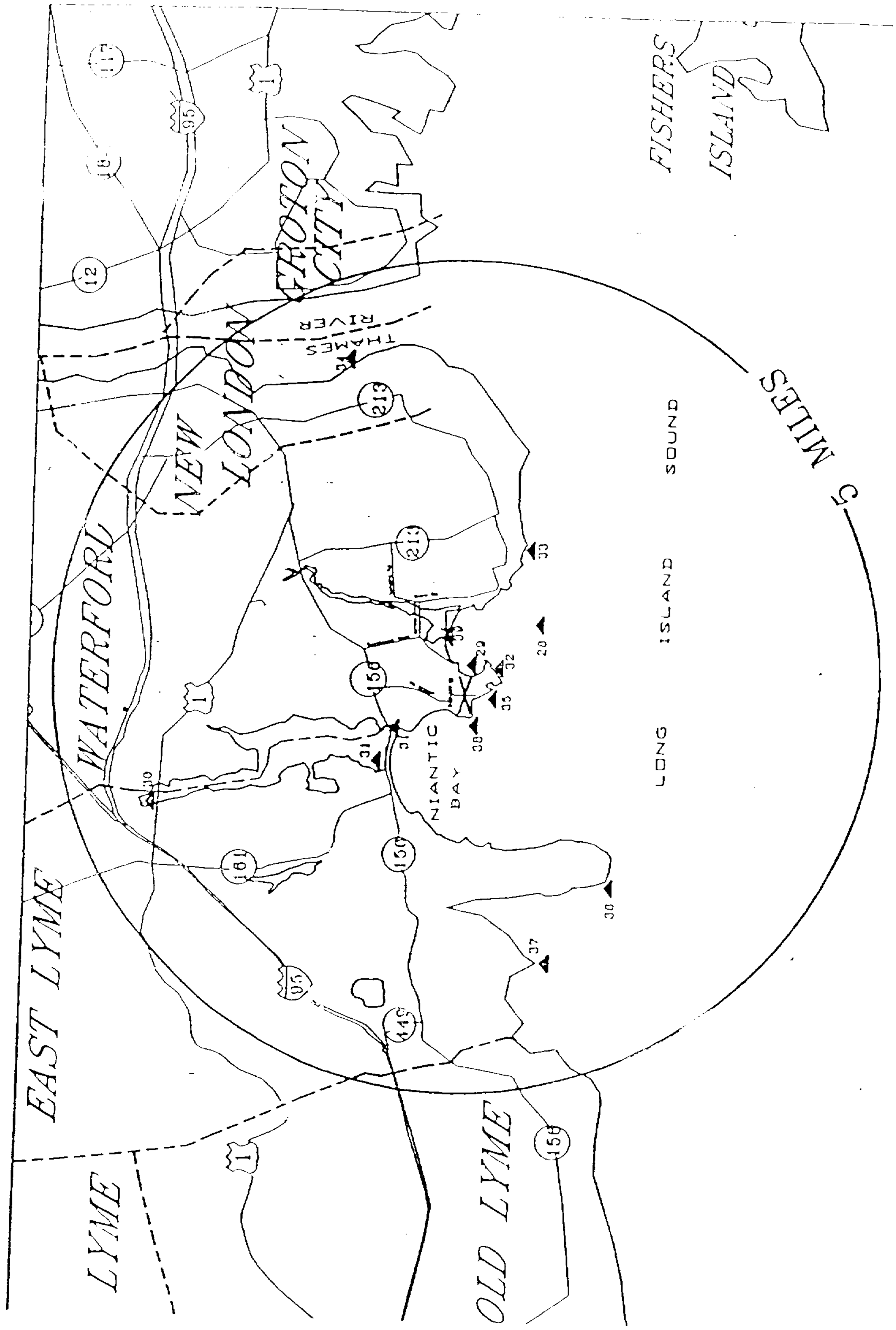


FIGURE I.E-3

AQUATIC SAMPLING STATIONS

TABLE I.E-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m³)	Fish (pCi/g, wet)	Shellfish[c] (pCi/g, wet)	Milk (pCi/l)	Vegetables (pCi/g, wet)
H-3	20,000[a]					
Mn-54	1,000		30	140		
Fe-59	400		10	60		
Co-58	1,000		30	130		
Co-60	300		10	50		
Zn-65	300		20	80		
Zr-95	400					
Nb-95	400					
Ag-110m			8	30		
I-131	20[b]	0.9	0.2	1	3	0.1
Cs-134	30	10	1	5	60	1
Cs-137	50	20	2	8	70	2
Ba-140	200				300	
La-140	200				300	

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

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

(c) For on-site samples, these values can be multiplied by 3 to account for the near field dilution factor.

TABLE I.E-4

MAXIMUM VALUES FOR LOWER LIMITS OF DETECTION (LLD)[a]

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

TABLE I.E-4 (Cont'd)

TABLE NOTATIONS

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

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

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22 is the number of transformations per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection (or end of the sample collection period) and time of counting.

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

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

b. LLD for leafy vegetables.

c. From end of sample period.

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

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

2. Land Use Census

The land use census ensures that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of *Section IV.B.3* of *Appendix I* to *10 CFR Part 50*. The land use census shall be maintained and shall identify the location of the nearest resident, nearest garden*, and milk animals in each of the 16 meteorological sectors within a distance of five miles.

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

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

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

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

(2) If the D/Q is not 20% greater than the previously highest D/Q, consider direction, distance, availability of milk, and D/Q in deciding whether to replace one of the existing sample locations. If applicable, replacement ~~should~~ be within 30 days. If no replacement is made, sufficient justification ~~should~~ be given in the annual report. shall 12/15/98 CAF

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

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

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

3. Interlaboratory Comparison Program

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

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

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

4. Bases for the Radiological Environmental Monitoring Program

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

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

The required detection capabilities for environmental sample analyses are tabulated in terms of lower limits of detection (LLDs). The required LLDs are considered optimum for routine environmental measurements in commercial laboratories.

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

I.F. REPORT CONTENT

1. Annual Radiological Environmental Operating Report

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

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

1. Total number of analyses performed at indicator locations.

2. Total number of analyses performed at control locations.

3. Lower limit of detection (LLD).

4. Mean and range of all indicator locations together.

5. Mean and range of all control locations together.

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

7. Number of nonroutine reported measurements as defined in these specifications.

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

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

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

F.2 Annual Radioactive Effluent ~~Operating~~ Report

The *Annual Radioactive Effluent Report (ARER)* 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 Technical Specifications*. An annual assessment of the radiation doses from the site to the most likely exposed REAL MEMBER OF THE PUBLIC shall be included to demonstrate conformance with 40 CFR 190. Gaseous pathway doses shall use meteorological conditions concurrent with the time of radioactive gaseous effluent releases. Doses shall be calculated in accordance with the *Offsite Dose Calculation Manual*. The licensee shall maintain an annual summary of the hourly meteorological data (i.e., wind speed, wind direction and atmospheric stability) either in the form of an hour-by-hour listing on a magnetic medium or in the form of a joint frequency distribution. The licensee has the option of submitting this annual meteorological summary with the ARER or retaining it and providing it to the NRC upon request. The ARER shall be submitted by May 1 of each year for the period covering the previous calendar year.

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

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

The ARER shall include the following information for all abnormal releases of radioactive gaseous and liquid effluents (i.e., all unplanned or uncontrolled radioactivity releases, including reportable quantities) from the site to unrestricted areas:

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

Changes to the *RADIOLOGICAL EFFLUENT MONITORING* and *OFFSITE DOSE CALCULATION MANUAL (REMODCM)* shall be submitted to the NRC as appropriate, as a part of or concurrent with the ARER for the period in which the changes were made.

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APPENDICES

II.A. INTRODUCTION

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

The bases for selected site-specific factors used in the dose calculation methodology are provided in Reference Manual *MP-13-REM-REF02, REMODCM Technical Information.*

Another section of this manual discusses the methods to be used in determining effluent monitor alarm/trip setpoints to be used to ensure compliance with the instantaneous release rate limits in the *Technical Specifications*.

~~The basis for some of the factors in this manual are included as appendices to this manual. Supplemental information on environmental sample locations is provided in an additional appendix.~~

This manual does not include the surveillance procedures and forms required to document compliance with the surveillance requirements in the *Technical Specifications (Units 2 and 3)* or *Radiological Effluent Controls in REMODCM Section III for Unit 1*. All that is included here are the methods to be used in performance of the surveillance requirements. Appendix A, Tables App.A-1 and App.A-2 provide a cross-reference of effluent requirements and applicable methodologies contained in the REMODCM.

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

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

II.B. RESPONSIBILITIES

All changes to ~~this manual~~ the Off-Site Dose Calculation Manual (ODCM) shall be reviewed and approved by the Site Operations Review Committee prior to implementation.

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

It shall be the responsibility of the Senior Vice President and CNO - Millstone to ensure that this manual is used in performance of the surveillance requirements and administrative controls of the *Technical Specifications.* The delegation of implementation responsibilities is delineated in the Millstone Radiological Effluent Program Reference Manual (MP-13-REM-REF01).

MAJOR

II.C. LIQUID DOSE CALCULATIONS

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

1. Whole Body Dose from Liquid Effluents

Millstone Units 2 and 3 Technical Specifications and Unit 1 Radiological Effluent Controls (Section III) limit the whole body dose to an individual member of the public to 1.5 mrem per calendar quarter and 3 mrem per year from liquid effluents released from each unit. (See Appendix A, Tables App.A-1 and App.A-2 for cross-reference effluent control requirements and applicable sections in the REMODCM which are used to determine compliance). In addition, installed portions of liquid radwaste treatment system are required to be operated to reduce radioactive materials in liquid effluents when the projected whole body dose over 31 days from the applicable waste stream exceeds 0.006 mrem. This part of the REM ODCM provides the calculation methodology for determining the whole body dose from radioactive materials released into liquid pathways of exposure associated with routine discharges. This includes the liquid pathways which contribute to the 25 mrem annual total dose limit (40 CFR190) to any real individual member of the public from all effluent sources (liquids, gases, and direct).

12/17/99 CAF

12/15/99 CAF

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

For Unit 1:

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

For Units 2 and 3:

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

Where:

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

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

C_H = total curies of tritium released during the period of interest. ~~(such as last 31 days, calendar quarter, year-to-date).~~ 12/17/99 CAF

> **Note:** Calculation Requirements (Method 1):
>
> If D_W, ~~during~~ within a calendar quarter or shorter time period, is greater than 0.5 mrem, go to Method 2.

12/17/99 CAF

MAJOR

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

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

within a calendar quarter

12/17/99 CAF

If the calculated dose using Method 1 is greater than 0.5 mrem, or if a more accurate determination is desired, use the NRC computer code LADTAP II to calculate the liquid whole body doses. Method 2 (LADTAP II) is also used in the performance of dose calculations for the *Annual Radioactive Effluent Report*. The use of this code is given in Engineering Procedure RAB B-11, *Liquid Dose Calculations - LADTAP II*. Additional information on LADTAP II is contained in the REMODCM Technical Information Manual (TIP-13-REM-REF02) 12/17/99 CAF

2. Maximum Organ Dose from Liquid Effluents

Technical Specifications limit the maximum organ dose to an individual member of the public to 5 mrem per calendar quarter and 10 mrem per year from liquid effluents released from each unit. (See Appendix A, Tables App.A-1 and App.A-2 for cross–reference effluent control requirements and applicable sections in the REMODCM which are used to determine compliance). In addition, installed portions of liquid radwaste treatment system are required to be operated to reduce radioactive ~~materials in~~ liquid effluents when the projected maximum organ dose over 31 days exceeds 0.02 mrem. This part of the REM ODCM provides the calculation methodology for determining the maximum organ dose from radioactive materials released into liquid pathways of exposure associated with routine discharges. This includes the liquid pathways which contribute to the 25 mrem annual organ (except 75 mrem thyroid) dose limit (40 CFR190) to any real individual member of the public from all effluent sources (liquids, gases, and direct). 12/15/99 CAF

from applicable waste streams

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

For Unit 1:

$$D_O = 2.1\ C_F$$

For Units 2 and 3:

$$D_O = 0.2\ C_F$$

Where:

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

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

> **Note:** Calculation Requirements (Method 1)
> If D_O, within ~~during a~~ calendar quarter ~~or shorter time period,~~ is greater than 2 mrem, go to *Method 2*.

12/17/99 CAF

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

If the calculated dose using Method 1 is greater than 2 mrem, or if a more accurate determination is desired, use the NRC computer code LADTAP II to calculate the liquid maximum organ doses. Method 2 (LADTAP II) is also used in the performance of dose calculations for the Annual Radioactive Effluent Report. The use of this code and the input parameters are given in Engineering Procedure *RAB B-11, Liquid Dose Calculations - LADTAP II*. Additional information on LADTAP II is contained in the REMODCM Technical Information Manual (TIP-13-REM-REF02) 12/17/99 CAF

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

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

An estimation of annual (year-to-date) whole body dose (D_{YW}) from liquid effluents ~~should~~ shall be made every month to determine compliance with the annual dose limits for each Unit. Annual doses ~~can~~ will be determined as follows: 12/17/99 CAF

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

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

The following ~~should~~ shall be used as D_W: 12/17/99 CAF

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

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

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

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

An estimation of annual (year-to-date) maximum organ dose (D_{YO}) from liquid effluents ~~should~~ shall be made every month to determine compliance with the annual dose limits for each Unit. Annual doses ~~can~~ will be determined as follows: 12/17/99 CAF

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

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

The following guidelines ~~should~~ shall be used: 12/17/99 CAF

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

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

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

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

MAJOR

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

5. **Monthly Dose Projections**

Section I.C.2.a of the REMM requires that ~~certain portions of the~~ liquid radwaste treatment equipment for untreated pathways 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:

12/17/99 CJK

a. **Whole Body and Maximum Organ (Applicable to Unit 1 Only)**

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

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

The projected monthly maximum organ dose is determine from:

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

Where:

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

D'_{MO} = the maximum organ dose from the last typical (see Notes below) previously completed month as calculated per the methods in *Section II.C.2.* 12/17/99 CJK

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

R_2 = the ratio of estimated primary coolant activity for the present month to that for the past month.

F = the factor to be applied to the estimated ratio of final curies released if there are expected differences in treatment of liquid waste for the present month as opposed to the past month (e.g., bypass of filters or demineralizers). NUREG-0016 or past experience ~~should~~ shall be used to determine the effect of each form of treatment which will vary. F = 1 if there are no expected differences. 12/15/99 CJK

Notes:

1. The last typical month should be one without significant operational differences from the projected month. For example, if the plant was down for refueling the entire month of February and startup is scheduled for March 3, use the last month of operation as the base month to estimate March's dose.

2. If there were no releases during last month, do not use that month as the base month it is estimated that there will be releases for the coming month.

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

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

b. Whole Body and Maximum Organ (Applicable to Units 2 and 3)

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

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

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

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

Where:

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

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

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

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

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

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

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

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

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

F_2 = the factor to be applied to the estimated ratio of final curies released if there are expected differences in treatment of liquid waste for the present month as opposed to the past month (e.g., bypass of filters or demineralizers). NUREG-0017 or past experience ~~should~~ shall be used to determine the effect of each form of treatment which will vary. $F_2 = 1$ if there are no expected differences. 12/15/99 CAK

6. Quarterly Dose Calculations for Annual Radioactive Effluent Report

Detailed quarterly dose calculations required for the *Annual Radioactive Effluent Report* shall be done using the NRC computer code LADTAP II. The use of this code, and the input parameters are given in *Engineering Procedure, RAB B-11, Liquid Dose Calculations - LADTAP II.* Additional information on LADTAP II is contained in the REMODCM Technical Information Manual (MP-13-REM-REF02). 12/17/99 CAK

NEW

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

7. Bases for Liquid Pathway Dose Calculations

Section II of REM

R/15/ CAH

The dose calculation methodology and parameters used in the ODCM implement the requirements in Section III.A of Appendix I (10CFR50) which states that conformance with the dose objectives of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. The dose estimations calculated by both Method 1 and method 2 are based on the liquid models presented in Regulatory Guide 1.109, Rev.1; "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I". These equations are implemented via the use of the NRC sponsored computer code LADTAP II. Input parameter values typically used in the dose models are listed in *Station Reference Manual, "REMODCM Technical Information Document (MP-13-REM-REF02).* This same methodology is used in the determination of compliance with the 40CFR190 total dose standard for the liquid pathways.

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

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II.D. GASEOUS DOSE CALCULATIONS

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

1. Site Release Rate Limits ("Instantaneous")

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

a. Method 1 for Noble Gas Release Rate Limits (Applicable to Units 1, 2, and 3)

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

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

Where:

Q_1 = Noble gas release rate from MP1 Stack (μCi/sec)
Q_2 = Noble gas release rate from MP2 Vent (μCi/sec)
Q_3 = Noble gas release rate from MP3 Vent (μCi/sec)

As long as the above is less than or equal to 1, the doses will be less than or equal to 500 mrem to the total body and less than 3000 mrem to the skin.

~~Note: See the *REMODCM Technical Information Document (MP-13-REM-REF02), Section 4.2* for the derivation of the noble gas release rate limit equality.~~

b. Method 1 for Release Rate Limit - I-131, I-133, H-3 and Particulates With Half Lives Greater Than 8 Days (Applicable to Units 1, 2, and 3)

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

(1) The site release rate limit of I-131, I-133, and tritium (where the thyroid is the critical organ for these radionuclides) shall be:

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

D => symbol 'R' changed to 'DR'

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

Where the contribution from each Units is calculated from:

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

ALL 'R' Change to 'DR' 12/17/99 CAK

(2) The site release rate limit of particulates with half-lives grater than 8 days and tritium (where the critical organ is a composite of target organs for a mix of radionuclides) shall be:

$$ {}^{D}R_{org1} + {}^{D}R_{org2} + {}^{D}R_{org3} \leq 1 $$

Where the contribution from each Units is calculated from:

Unit 1: $R_{org1} = 5.5 \times 10^{-4}\ Q_{P1} + 4.4 \times 10^{-8}\ Q_{H1}$
Unit 2: $R_{org2} = 5.1 \times 10^{-2}\ Q_{P2} + 4.2 \times 10^{-6}\ Q_{H2}$
Unit 3: $R_{org3} = 5.1 \times 10^{-2}\ Q_{P3} + 4.2 \times 10^{-6}\ Q_{H3}$

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

${}_{131}Q_{I1}$ = Release rate of I-131 from MP1 Stack (μCi/sec)
${}_{133}Q_{I1}$ = Release rate of I-133 from MP1 Stack (μCi/sec)
${}_{131}Q_{I2}$ = Release rate of I-131 from MP2 Vent (μCi/sec)*
${}_{133}Q_{I2}$ = Release rate of I-133 from MP2 Vent (μCi/sec)*
${}_{131}Q_{I3}$ = Release rate of I-131 from MP3 Vent (μCi/sec)*
${}_{133}Q_{I3}$ = Release rate of I-133 from MP3 Vent (μCi/sec)*
Q_{H1} = Release rate of tritium from MP1 Stack (μCi/sec)
Q_{H2} = Release rate of tritium from MP2 Vent (μCi/sec)*
Q_{H3} = Release rate of tritium from MP3 Vent (μCi/sec)*
Q_{P1} = Release rate of total particulates with half-lives greater than 8 days from the MP1 Stack (μCi/sec)
Q_{P2} = Release rate of total particulates with half-lives greater than 8 days from the MP2 Vent (μCi/sec)
Q_{P3} = Release rate of total particulates with half-lives greater than 8 days from the MP3 Vent (μCi/sec)

* includes releases via the steam generator blowdown tank vent.

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

The above Method 1 equations assume a conservative nuclide mix. If necessary, utilize the GASPAR code to estimate the dose rate from either noble gases or iodines, tritium, and particulates with half-lives greater than 8 days. The use of the code is described in Engineering Procedure *RAB-B12, Gaseous Dose Calculations - GASPAR.* Additional information on GASPAR is contained in the REMODCM Technical Information Manual (MP-13-REM-REF02). 12/17/99 CAK

MAJOR

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

2. 10 CFR50 Appendix I - Noble Gas Limits

Technical Specifications limit the off-site air dose from noble gases released in gaseous effluents to 5 mrad gamma, and 10 mrad beta for a calendar quarter (10 and 20 mrad gamma and beta, respectively, per calendar year). Effluent dose calculations are calculated at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.02 mrad air gamma or 0.04 mrad air beta. (See Appendix A, Tables App.A-1 and App.A-2 for a cross reference of effluent control requirements and applicable sections of the REMODCM which are used to determine compliance.) This part of the REM ODCM provides the calculation methodology for determining air doses from noble gases.

12/1/99 CAK

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

For Unit 1:

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

[NO CHANGE - SAME AS CURRENT REV]

For Unit 2:

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

For Unit 3:

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

NO BOX

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

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Where:

D_{G1} = The gamma air dose from Unit 1 for the period of interest (mrad).
D_{B1} = The beta air dose from Unit 1for the period of interest (mrad).
D_{G2} = The gamma air dose from Unit 2 for the period of interest (mrad).
D_{B2} = The beta air dose from Unit 2 for the period of interest (mrad).
D_{G3} = The gamma air dose from Unit 3 for the period of interest (mrad).
D_{B3} = The beta air dose from Unit 3 for the period of interest (mrad).
C_{N1} = The total curies of noble gas released from Unit 1 Stack* during the period of interest.
C_{N2} = The total curies of noble gas released from Unit 2 during the period of interest. Include all sources - Unit 2 Vent, containment purges and waste gas decay tanks.
C_{N3} = The total curies of noble gas released from Unit 3 during the period of interest. Include all sources - Unit 3 Vent, ESF Building Vent, and containment purges and drawdowns.

* Includes contributions from Units 2 and 3. If 20% of the airborne dose limits are exceeded, a Special Assessment will be performed to determine the dose attributable to each unit individually. The intent is to prevent double accounting of normal routine releases since Unit 1 accounts for some Unit 2 and 3 releases. Special sampling for batch releases is not required at the Unit 1 Stack.

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

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

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

Unit 1 For MP1 dose calculations, use the AIREM computer code to determine the critical location air doses.

shall

The 3rd quarter 1980 joint frequency data ~~should~~ be used as input for the AIREM code. The reason for this is given in the *REMODCM Technical Information Document (MP-12-REF02), Section 4.2.* 12/15/ CAF

~~Note:~~ If the calculated air dose exceeds one half the Technical Specification limit, use meteorology concurrent with time of release.

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Units 2, 3 For MP2 and MP3 dose calculations use the GASPAR computer code to determine the critical site boundary air doses.

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

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

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

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

~~Note:~~ If the calculated air dose exceeds one half the quarterly Technical Specification limit, use meteorology concurrent with time of release.

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

An estimation of annual (year-to-date) beta and gamma air doses (D_{YB} and D_{YG}, respectively) from noble gases released from Units 1, 2 and 3 shall ~~should~~ be made every month to determine compliance with the annual dose limits for each Unit. Annual air doses ~~can~~ will be determined as follows: 12/15/99 CAF

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

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

Where:

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

The following shall ~~should~~ be used as the quarterly doses: 12/17/99 CAF

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

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

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

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MAJOR

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

3. 10 CFR50 Appendix I - Iodine and Particulate Doses

Technical Specifications limit the off-site dose to a critical organ from radioiodines, tritium, and particulates with half-lives greater than 8 days released in gaseous effluents to 7.5 mrem for a calendar quarter (15 mrem per calendar year). Effluent dose calculations are performed at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.03 mrem. (See Appendix A, Tables App.A-1 and App.A-2 for a cross reference of effluent control requirements and applicable sections of the REMODCM which are used to determine compliance.) This part of the ODCM provides the calculation methodology for determining critical organ doses from atmospheric releases of iodines, tritium and particulates. REM 12/15/99 CJK

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

a. Critical Organ Doses (Applicable to Unit 1)

(1) Method 1a - Unit 1

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

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

~~Note:~~ If either dose is greater than 2.5 mrem during a calendar quarter or shorter time period, go to Method 1b for Unit 1 below. NO BOX 12/17/99 CJK

Where:

- D_T = The thyroid dose for the period of release of gaseous effluents.
- D_O = The dose to the maximum organ other than the thyroid for the period of gaseous effluent release.
- ${}_{131}C_I$ = The total curies of I-131 released in gaseous effluents from Unit 1 Stack* during the period of interest.
- ${}_{133}C_I$ = The total curies of I-133 released in gaseous effluents from Unit 1 Stack* during the period of interest.
- C_P = The total curies of particulates with half-lives greater than 8 days released in gaseous effluents from Unit 1 Stack* during the period of interest.
- C_H = The total curies of tritium released in gaseous effluents from Unit 1 Stack* during period of interest.

***Note:** Unit 1 Stack samples include releases from Units 2 and 3. The activity from Units 2 and 3 released via the Unit 1 Stack will normally be included here. However, if 20% of any airborne limits are exceeded, a Special Assessment will be required to determine the dose attributable to each unit individually. The intent is to prevent double accounting of normal routine releases since Unit 1 accounts for some Unit 2 and 3 releases. Special sampling for batch releases is not required at the Unit 1 Stack.

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

(2) **Method 1b - Unit 1**

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

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

i. **Inhalation Pathway**

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

ii. **Vegetation Pathway**

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

iii. **Milk Pathway**

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

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

Note: The maximum organ dose is the greater D_T or D_O. If it is greater than 2.5 mrem ~~during~~ within a calendar quarter ~~or shorter time period~~, go to Method 1c.

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(3) **Method 1c - Unit 1**

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

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

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

(4) **Method 2a - Unit 1**

Use the GASPAR code to determine the maximum organ dose. For the Special Location, enter the following worst case quarterly average meteorology as taken from the *REMODCM Technical Information Document (MP-12-REM-REF02), Attachment 5:*

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

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

within

Note: Use the Inhalation, Milk and Vegetation pathways (if applicable) in totaling the dose. If the maximum organ dose is greater than 3.8 mrem ~~during~~ a calendar quarter ~~or shorter time period,~~ go to *Method 2b.*

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(5) **Method 2b - Unit 1**

Use the GASPAR code with actual locations, real-time meteorology and the pathways which actually exist at the time at those locations.

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

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

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

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

within

Note: If either dose is greater than 2.5 mrem ~~during~~ a calendar quarter ~~or shorter time period,~~ go to Method 1b for Units 2 and 3 below.

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Where:

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

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

* Results from SAI studies in 1982 and 1983 and guidance provided in the R. A. Crandall / E. R. Brezinski memo to E. J. Mroczka, Millstone Unit 2 Steam Generator Blowdown Tank Releases, NE-83-RA-879, June 15, 1983, indicate that the steam generator blowdown tank vent releases can be estimated by use of a factor of 1/6,000 (a DF of 2000 and a partitioning factor of 1/3). Although Unit 3 normally recycles blowdown, periodically blowdown is released for short periods of time. These releases should be similar to Unit 2 and until studies can be performed at Unit 3 the same calculation should be performed. Based upon the above, the formula to be used is:

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

** This pathway does not have a effluent monitor.

*** Unit 2 and 3 also have releases via the Unit 1 Stack. This activity will be included in the Unit 1 calculations unless 20% of any airborne limit is exceeded and/or a Special Evaluation is performed.

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

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

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

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

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

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

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

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

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

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

Note: The maximum organ dose is the greater of D_T or D_O. If it is greater than 2.5 mrem ~~during~~ within a calendar quarter ~~or shorter time period~~ go to the Method 1c.

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

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

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

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

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

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

Use the GASPAR code to determine the maximum organ dose. For the Special Location, enter the following worst case quarterly average meteorology as taken from the *REMODCM Technical Information Document (MP-12-REM-REF02), Attachment 5:*

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

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

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

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

Use the GASPAR code with the actual locations, real-time meteorology and the pathways which actually exist at the time at these locations. The code shall ~~should~~ be run separately for steam generator blowdown tank vents and ventilation releases, containment purges and waste gas tank releases. 12/15/99 CAH

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

Use the GASPAR code with the actual locations, real-time meteorology and the pathways which actually exist at these locations. The code shall ~~should be run~~ be run separately for ventilation, process gas, containment vacuum system, aerated ventilation and containment purges. 12/15/99 CAH

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

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

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

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

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

Where:

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

The following guidelines ~~should~~ shall be used for D_T and D_O:

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

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

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

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

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

4. Gaseous Effluent Monthly Dose Projections

for untreated pathways

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.

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a. Unit 1 Projection Method

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

If the augmented offgas system is expected to be out of service during the month, determine the noble gas air doses from the following:

$$D^{E}_{MG}\ (\text{mrad}) = 8.0 \times Q \times R \times d$$
$$D^{E}_{MB}\ (\text{mrad}) = 0.08 \times Q \times R \times d$$

[NO CHANGE - SAME AS PREVIOUS REV.] 12/17/94 CJK

Where:

Q = Estimated curies/sec at the air ejector at the expected maximum power for the month.

R = Estimated curie reduction factor from air ejector to stack via the 30 minute (actual time is approximately 55 minutes) holdup line (in decimal fraction).

d = Estimated number of days the 30 minute holdup pipe will be used.

D^{E}_{MG} = Estimated monthly gamma air dose.
= 9.3×10^{-5} mrad/Ci* x Q Ci/sec x R x d (day) x 8.6×10^{4} sec/day

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

* *See* the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2, for dose factor derivation.*

(2) Due to Ventilation System Releases (Unit 1)**

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**

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

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

Where:

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

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

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

ii. **Method 2**

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

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

b. Unit 2 Projection Method

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

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

D^{F}_{MG} (mrad) = $9.3 \times 10^{-5}\ C^{F}_{N}$ (L) [NO CHANGE - SAME AS LAST REVISION] 12/17/99 CMK

D^{F}_{MB} (mrad) = $9.3 \times 10^{-7}\ C^{F}_{N}$

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

Where:

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

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

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

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

i. Method 1

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

$$D^{E}_{MO} = 1/3\ R_{I} \times D_{T}$$

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

Where:

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

ii. Method 2

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

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

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

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

i. **Method 1**

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

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

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

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

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

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

ii. **Method 2**

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

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

c. **Unit 3 Projection Method**

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

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

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

[NO CHANGE - SAME AS LAST REVISION] 12/17/99

Where:

C^E_N = the number of curies of noble gas estimated to be released from the reactor plant gaseous vents (the activity from this pathway increases when the process waste gas system is out of service.) during the next month.

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

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

(The dose conversion factor is from the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2,* for the Unit 1 stack releases since the Unit 3 reactor plant gaseous vents are discharged via the Unit 1 stack.)

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

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

i. Method 1

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

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

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

Where:

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

ii. Method 2

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

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

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

i. Method 1

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

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

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

Where:

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

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

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

ii. Method 2

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

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

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

5. Quarterly Dose Calculations for Annual Radioactive Effluent Report

Detailed quarterly gaseous dose calculations required for the *Annual Radioactive Effluent Report* shall be done using the computer codes GASPAR and AIREM.

6. Compliance with 40CFR190

The following sources ~~should~~ shall be considered in determining the total dose to a real individual from uranium fuel cycle sources: 12/15/99 CAG

a. **Gaseous Releases** from Units 1, 2, and 3.
b. **Liquid Releases** from Units 1, 2, and 3.
c. **Direct and Scattered Radiation** from Unit 1 Turbine Shine.
d. **Direct and Scattered Radiation** from Radioactive Material Stored on Site.
e. Since all other uranium fuel cycle sources are greater than 5 miles away, they need not be considered.

The Radioactive Effluents Technical Specifications (RETS) contain specific requirements in REMODCM, Section III, Control D.3, for Unit 1and Technical Specification 3.11.3 for Units 2 & 3 for ensuring compliance with 40CFR190 based on gaseous and liquid doses (sources **a** and **b**).

Calculations and detailed surveys* were used to characterize off-site exposure from "Skyshine" (source **c**) from the Unit 1 Turbine Building. The location of maximum dose is that of the critical fisherman. Listed below are the assumptions used for the calculation of this dose:

CALCULATION OF SKYSHINE CONTRIBUTION TO CRITICAL FISHERMAN**

(1) Based upon data obtained by Don Landers (MP Env. Lab) from the State of CT Department of Environmental Protection (DEP) records on lobster catches:
Annual average of 3.5-4.5 days between trips to each lobster basket.
(2) Therefore, there are 104 trips per year.
(3) Conservatively, assuming it takes one hour in the area to check all the baskets, this results in 104 hours around the intake structures areas.
(4) Maximum dose rate in the area is normally 65 μR/hr.
(5) Average dose rate is approximately one-half of the maximum.
(6) Therefore, annual dose to critical lobsterman is approximately
104 hours/year x 65 μR/h x 1/2 = 3.4 mrem.
(7) Multiplication to account for increase due to hydrogen water chemistry (HWC).
(8) Therefore, dose/month =

$$3.4\,\frac{\text{mrem}}{\text{year}} \times \frac{\text{year}}{12\text{ months}} \times \text{Unit 1 Capacity Factor} = 0.3\,\frac{\text{mrem}}{\text{month}} \times \text{Unit 1 Capacity Factor} \times \text{HWC Factor}^{+}$$

+For operation without hydrogen injection, HWC = 1.

There are three things that could increase the Skyshine doses. First, would be an increase in the percent of N-16 in main steam. This occurs at plants implementing hydrogen water chemistry (HWC) and was observed at the Unit 1 mini test. Based on this test and data from other HWC plants an HWC factor increase in the range of 1.5 to 4 for feedwater hydrogen of 0.4 to 0.8 ppm and a factor increase from 4 to 5 for 0.8 to 2.0 ppm would be expected. Hence, any process that could increase N-16 main steam concentrations would require a detailed Radiological Environmental Review to ensure limits are met. Second, would be removal of shielding within the Unit 1 Turbine Building. This is not expected, but would definitely receive a radiological review if it occurred. Third, would be an increased occupancy time by a member of the public off site such that the combined occupancy and dose rate exceeded that assumed for the fisherman. Since the dose rate decreases rapidly with distance, this would only be expected to be an activity very near the Unit 1 intake structure. The Safety Analysis Branch (SAB)~~RAB~~ should be informed by anyone who becomes aware of any activity by a member of the public that could be expected to exceed 50 hours per year in this location.

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

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

* Memo to P. L. Tirinzoni from J. W. Doroski and C. A. Flory, Skyshine Evaluation at Millstone Unit #1, NE-87-RA-1033, December 8, 1987.

** This should be the most limiting individual since it is expected that even though fishermen may spend more time near the area, they normally fish in an area of ~1 μR/hr.

NEW

7. Bases for Gaseous Pathway Dose Calculations

Section II of the REMODCM

12/15/9 CSB

The dose calculation methodology and parameters used in ~~the ODCM~~ implement the requirements in Section III.A of Appendix I (10CFR50) which states that conformance with the ALARA dose objectives of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. Operational flexibility is provided by controlling the instantaneous release rate of noble gas (as well as iodines and particulate activity) such the maximum off-site dose rates are less than the equivalent of 500 mrem/year to the whole body, 3000 mrem/year to the skin from noble gases, or 1500 mrem/year to a critical organ from the inhalation of iodines, tritium and particulates. The dose rate limits are based on the 10CFR20 (pre-1991) annual dose limits, but applied as an instantaneous limit to assure that the actual dose over a year will be well below these numbers.

The equivalent instantaneous release rate limits for Unit 1 were determined using the EPA AIREM code. For Units 2 & 3, these doses were calculated using the NRC GASPAR code. The AIREM code calculates cloud gamma doses using dose tables from a model that considers the finite extent of the cloud in the vertical direction. Beta doses are calculated assuming semi-infinite cloud concentrations, which are based upon a standard sector averaged diffusion equation. The GASPAR code implements the models of NRC Regulatory Guide 1.109, Rev. 1, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I." Input parameter values typically used in the dose models are listed in the Station Reference Manual, "*REMODCM Technical Information Document (MP-13-REM-REF02)*. This same methodology is used in the determination of compliance with the 40CFR190 total dose standard for the gaseous pathways.

In the determination of compliance with the dose and dose rate limits, maximum individual dose calculations are performed at the nearest land site boundary with maximum decayed X/Q, and at the nearest vegetable garden (assumed to be nearest residence) and cow and goat farms with maximum D/Qs. The conversion constants in the Method 1 equations for maximum air doses, organ and whole body doses, and dose rates are based on the maximum observed comparison of historical effluent releases and corresponding calculated maximum doses. The dose conversion factors are calculated based on the ratio of the observed highest dose and the curies of fission and activation products released during the period. This ratio results in the Method 1 equation conversion factor in mrem/Ci released. Reference Manual MP-13-REM-REF02 describes the derivation of the Method 1 constants and list the historical maximum doses calculated for ~~each~~ the maximum organ.

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II.E. LIQUID MONITOR SETPOINTS

1. Unit 1 Liquid Radwaste Effluent Line

The trip/alarm setting on the Unit 1 liquid radwaste discharge line depends on dilution water flow, radwaste discharge flow, the isotopic composition of the liquid, the background count rate of the monitor and the efficiency of the monitor. Due to the variability of these parameters, an alarm/trip setpoint will be determined prior to the release of each batch. The following method will be used: MAJOR

Determine the allowable discharge flow (F) from:

$$F = 0.1 \times R_1 \times D$$

Where:

$$R_1 = \text{Required Reduction Factor} = 1 / \Sigma \frac{\mu Ci / ml \text{ of nuclide i}}{\text{MPC of nuclide i}}$$ 12/17/99 CAF

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

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

Note: That discharging at this flow rate would yield a discharge concentration corresponding to 10% of the *Technical Specification Limit* due to the safety factor of 0.1.

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

S ~~R~~ = 2 x AC x Ca

Where: 12/17/99 CAF

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

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

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

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

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

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

2a. Unit 1 Reactor Building Service Water Effluent Line

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

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

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

3. Unit 2 Clean Liquid Radwaste Effluent Line

Similar to the Unit 1 liquid discharge line, the setpoints on the Unit 2 liquid waste effluent line depend on dilution water flow, radwaste discharge flow, the isotopic composition of the liquid, the background count rate of the monitor and the efficiency of the monitor. Due to the variability of these parameters, an alarm/trip setpoint will be determined prior to the release of each batch. The following method will be used:

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

For Nuclides Other Than Noble Gases:

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

For Noble Gases: (*)

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

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

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

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

Assuming:

Maximum discharge rate = 350 gpm

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

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

Therefore,

Maximum concentration = 0.11 μCi/ml

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

Determine the allowable discharge flow (F) in gpm:

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

Where:

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

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

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

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

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

Where:

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

This value or that corresponding to 1.7×10^{-4} μCi/ml *(Note 2 below)*, whichever is greater, plus background is the trip setpoint. For the latter setpoint, independent valve verification shall be performed and minimum dilution flow in Note 2 shall be verified and if necessary, appropriately adjusted.

Note 1: If discharging at the allowable discharge rate (F) as determined in above, this setpoint would correspond ~~See Note 1 below~~ to 20% of the Technical Specification limit. 12/17/99 CAF

Note 2: This value is based upon worst case conditions, assuming maximum discharge flow (350 gpm), normal minimum dilution water flow (200,000 gpm for MP2) and an assumed worst case mix of nuclides (3×10^{-7} - I-131 MPC). This will assure that low level releases are not terminated due to small fluctuations in activity. However, to verify that the correct tank is being discharged when using this value, independent valve verification shall be performed. This value may be adjusted (increased or decreased) by factors to account for the actual discharge flow and actual dilution flow; however, controls shall be established to ensure that the allowable discharge flow is not exceeded and the dilution flow is maintained.

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

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

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

5a. Unit 2 Steam Generator Blowdown

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

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

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

c. The release rate limit is conservatively set at 10% of the *10CFR Part 20* limit for I-131 ($0.1 \times 3 \times 10^{-7}$ μCi/ml = 3×10^{-8} μCi/ml)*

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

Therefore, the alarm setpoint ~~should~~ corresponds to a concentration of: 12/15/99 CAF

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

The latest monitor calibration curve ~~should~~ shall be used to determine the alarm setpoint in cpm corresponding to 8.5×10^{-6} μCi/ml. 12/15/99 CAF

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

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

$$\text{Background} = 3\times10^{-8}\ \mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{\text{total S/G blowdown (gpm)}} + \text{Background}$$

Note: The Steam Generator Blowdown alarm criteria is in practice based on setpoints required to detect allowable levels of primary to secondary leakage. This alarm criteria is typically more restrictive than that required to meet discharge limits. This fact ~~should~~ shall be verified, however, whenever the alarm setpoint is recalculated. 12/15/99 CAF

* In lieu of using the I-131 MPC value, the identified MPC values for unrestricted area may be used.

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

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

5b. Unit 2 Steam Generator Blowdown Effluent Concentration Limitation

The results of analysis of blowdown samples required by Table I.C-2 of Section I of the REMODCM shall be used to ensure that blowdown effluent releases do not exceed the concentration limits in 10CFR20, Appendix B (version prior to January 1, 1994).

6. Unit 2 Condenser Air Ejector

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

7a. Unit 2 Reactor Building Closed Cooling Water

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

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

SETPOINT DURING SHUTDOWN:

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

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

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

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

Results of analyses of service water and turbine building sump samples taken in accordance with Table I.C-2 of Section I of the REMODCM shall be used to limit radioactivity concentrations in the service water and turbine building sump effluents to less than the limits in 10CFR20, Appendix B (version prior to January 1, 1994).

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

8. Unit 3 Liquid Waste Monitor

Similar to the Unit 1 liquid discharge line, the setpoints on the Unit 3 liquid waste monitor depend on dilution water flow, radwaste discharge flow, the isotopic composition of the liquid, the background count rate of the monitor and the efficiency of the monitor. Due to the variability of these parameters, the alert and alarm setpoints will be determined prior to the release of each batch. The following method will be used:

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

For Nuclides Other Than Noble Gases*:

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

For Noble Gases:*

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

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

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

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

Assuming:

Maximum discharge rate = 150 gpm

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

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

Therefore,

Maximum "allowable" concentration = 0.4 μCi/ml

MAJOR

Determine the allowable discharge flow (F)

$F = 0.1 \times R \times D$

Where:

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

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

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

MAJOR

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

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

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

Where:

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

This value, or that corresponding to 2×10^{-4} μCi/ml *(Note 2* below*)*, whichever is greater, plus background. 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 Technical Specification limit.

Note 2: This value is based upon worst case conditions, assuming maximum discharge flow (150 gpm), minimum dilution water flow (2 circulating pumps = 300,000 gpm), and an assumed mix of nuclides as specified for an unidentified liquid release in *10CFR20* (1×10^{-7} μCi/ml). This will assure that low level releases are not terminated due to small fluctuations in activity. However, to verify that the correct tank is being discharged when using this value, independent valve verification shall be performed. This value may be adjusted (increased or decreased) by factors to account for the actual discharge flow and actual dilution flow; however, controls shall be established to ensure that the allowable discharge flow is not exceeded and the dilution flow is maintained.

9. Unit 3 Regenerant Evaporator Effluent Line

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

10. Unit 3 Waste Neutralization Sump Effluent Line

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

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

11a. Unit 3 Steam Generator Blowdown

The alarm setpoint for this monitor assumes:

a. Steam generator blowdown rate of 400 gpm (maximum blowdown total including weekly cleaning of generators - per 3-Part Memo from MP3 Reactor Engineering).

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

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

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

Therefore, the alarm setpoint ~~should~~ corresponds to a concentration of: | 12/15/99 CAK

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

This setpoint may be increased through proper administrative controls if the steam generator blowdown rate is maintained less than 400 gpm and/or more than 2 circulating and 2 service water pumps are available. The amount of the increase would correspond to the ratio of flows to those assumed above or:

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

$$\text{Background} = 3\times10^{-8}\mu\text{Ci/ml} \times \frac{\text{circulating \& service water flow (gpm)}}{\text{total S/G blowdown (gpm)}} + \text{Background}$$

Note: The Steam Generator Blowdown alarm criteria is in practice based on setpoints required to detect allowable levels of primary to secondary leakage. This alarm criteria is typically more restrictive than that required to meet discharge limits. This fact ~~should~~ shall be verified, however, whenever the alarm setpoint is recalculated. | 12/15/99 CAK

* In lieu of using the I-131 MPC value, the identified MPC values for unrestricted area may be used.

11b. Unit 3 Steam Generator Blowdown Effluent Concentration Limitation

The results of analysis of blowdown samples required by Table I.C-3 of Section I of the REMODCM shall be used to ensure that blowdown effluent releases do not exceed the concentration limits in 10CFR20, Appendix B (version prior to January 1, 1994).

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

12a. Unit 3 Turbine Building Floor Drains Effluent Line

The alarm setpoint for this monitor assumes:

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

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

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

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

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

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

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

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

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

13. Bases for Liquid Monitor Setpoints

Liquid effluent monitors are provided on discharge pathways to control, as applicable, the release of radioactive materials in liquid effluents during actual or potential releases of liquid waste to the environment. The alarm / trip setpoints are calculated to ensure that the alarm / trip function of the monitor will occur prior to exceeding the limits of 10 CFR Part 20 (Appendix B, Table II, Column 2), which applies to the release of radioactive materials from all units on the site. This limitation also provides additional assurance that the levels of radioactive materials in bodies of water in Unrestricted Areas will result in exposures within the Section II.A design objectives of Appendix I to 10 CFR Part 50 to a member of the public.

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

II.F. GASEOUS MONITOR SETPOINTS

1. Unit 1 Hydrogen Monitor

Per *Section III.C.3* of the *Radiological Effluent Controls*, the alarm setpoint shall be less than or equal to 4% hydrogen by volume. [Note: This parameter is pertinent only during the operational period of the plant. Power operations has permanently ceased.]

2. Unit 1 Steam Jet Air Ejector Offgas Monitor

[Note: This parameter is pertinent only during the operational period of the plant. Power operations has permanently ceased.]

Radiological Effluent Control III.C.2 requires the alarm setpoint to be set up to ensure that the instantaneous noble gas release rate limits from the stack are not exceeded.

Radiological Effluent Control III.C.4 specifies the maximum allowed noble gas in-process activity to be 1.47×10^6 µCi/sec. The value of 1.47×10^6 µCi/sec is based on an assumed release of the entire inventory in the off gas treatment system with 95% worst-case meteorology. At that level, the dose would still be less than 10CFR20 limits.

Based on *Section II.F.3 (below)*, the stack instantaneous release rate limit for MP-1 (assuming 1/3 of the site limit) is 363,000 µCi/sec. Assuming an approximate two factor decay from the air ejector monitor to the stack when using the 50 minute hold-up pipe, the corresponding activity at the air ejector is 700,000 µCi/sec and, hence, is more limiting than the 1.47×10^6 µCi/sec. When using the off gas treatment system, the decay factor is greater than 40, and hence, the 1.47×10^6 µCi/sec is more limiting.

The trip setpoint should be established by Station Chemistry to ensure Technical Specification Limits are met based on latest conversion factor from mR/hr to µCi/sec. Chemistry should specify the mR/hr corresponding to the following noble gas activity rates at the air ejector monitor:

With of gas treatment system out of service:	≤ 700,000 µCi/sec
With all flow thru off gas treatment system:	≤ 1,470,000 µCi/sec

To avoid having to re-adjust the setpoint with a change in off gas treatment, it is recommended that the alarm correspond to ≤ 700,000 µCi/sec unless a higher value is necessary to continue operations.

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

3. Unit 1 Stack Noble Gas Monitor

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in ODCM Section II.D.1.a in order to satisfy *Radiological Effluent Control III.D.2.1.* 12/17/99 CAC

The alarm setpoint ~~should~~ shall be set at or below the "cps" corresponding to 363,000 μCi/sec from the MP1 stack noble gas monitor calibration curve. The calibration curve (given as μCi/sec per cps) is determined by assuming a maximum ventilation flow of 180,000 CFM. 12/15/99 CAC

Note: The release rate value of 363,000 μCi/sec assumes that 33% of the site limit is assigned to the MP1 stack. If effluent conditions from the MP1 stack approach the alarm setpoint, it may be increased if the MP2 or MP3 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in ODCM Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2*. 12/17/99 CAC

4. Unit 1 Main Stack Sampler Flow Rate Monitor

The MP1 main stack sampler flow control alarms on low pressure indicating loss of flow, or on high pressure indicating restricted flow.

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

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

or

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

or

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

5. Unit 2 Vent - Noble Gas Monitor

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in ODCM Section II.D.1.a in order to satisfy *Technical Specifications 3.3.3.10 and 3.11.2.1.* 12/17/99 CAC

The alarm setpoint ~~should~~ shall be set at or below the "cpm" corresponding to 95,000 μCi/sec from the MP2 vent noble gas monitor calibration curve. The calibration curve (given as μCi/sec per cpm) is determined by assuming the maximum possible ventilation flow for various fan combinations. Curves for three different fan combinations are normally given. 12/15/99 CAC

Note: The release rate value of 95,000 μCi/sec assumes that 33% of the site limit is assigned to the MP2 vent. If effluent conditions from the MP2 vent approach the alarm setpoint, it may be increased if the MP1 stack or MP3 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in ODCM Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.* Prior to decreasing the MP1 stack setpoint, evaluate if the MP1 steam jet air ejector setpoint needs to be changed, to comply with *Radiological Effluent Control III.C.2 (see ODCM Section II.F.2).* 12/17/99 CAC 12/17/99 CAC

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

6. Unit 2 Waste Gas Decay Tank Monitor

Administratively all waste gas decay tank releases are via the MP1 stack which has a release rate limit typically set at 363,000 μCi/sec (see the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2* for bases). Assuming 33% of the limit is from the MP1 stack, the release rate limit for MP1 is 363,000 μCi/sec.

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

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

7. Unit 3 Vent Noble Gas Monitor

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in ~~ODCM~~ Section II.D.1.a in order to satisfy *Technical Specification 3.3.3.10 and 3.11.2.1.*

The alarm setpoint ~~should~~ shall be set at or below a value of 9.5 x 10^{-4} μCi/cc for the MP3 vent. 12/15/99 CJL

[Note: The release rate value of 9.5 x 10^{-4} μCi/cc assumes that 33% of the site limit is assigned to the MP3 vent. This value corresponds to a release rate of 95,000 μCi/sec and a maximum ventilation flow rate of 210,000 CFM (per memo from G. C. Knight to R. A. Crandall, MP-3-1885, July 19, 1989). If effluent conditions from the MP3 vent approach the alarm setpoint, it may be increased if the MP1 stack or MP2 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in ~~ODCM~~ Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.*] 12/15/99 CJL

8. Unit 3 Engineering Safeguards Building Monitor

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

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

The Alarm setpoint ~~should~~ shall be set at or below this value. 12/15 CJL

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

9. Bases for Gaseous Monitor Setpoints

Gaseous effluent monitors are provided on atmospheric release pathways to control, as applicable, the release of radioactive materials in gaseous effluents to the environment. The alarm / trip setpoints are calculated to ensure that the alarm / trip function of the monitor will occur prior to exceeding the dose rate limits required by the *Technical Specifications (Units 2 and 3)* or *Radiological Effluent Controls (Unit 1)* requirements for each unit. Monitor setpoint selection is based on a conservative set of conditions for each release pathway (as discussed above for each monitor pathway) such that the dose rate at any time at and beyond the site boundary from all gaseous effluents from all units on the site will be within the numerical values of the annual dose limits of 10 CFR Part 20 (the version prior to January 1, 1994) in~~to~~ Unrestricted Areas. Since the Technical Specifications and Effluent Controls are constructed such that the numerical values of the annual dose limits of 10 CFR Part 20 be applied on an instantaneous basis (i.e., no time averaging over the year), and the integrated dose objectives of 10 CFR 50, Appendix I provide for corrective actions to reduce effluents if the ALARA dose values are exceeded, assurance is obtained that compliance with the revised annual dose limits of 10 CFR 20.1301 (100 mrem total effective dose equivalent to a member of the public) will also be met. The use of the stated instantaneous release rate values, which equate to the site dose rate limits, also provides operational flexibility to accommodate short periods of higher than normal effluent releases that may occur during plant operaitons.

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

SECTION III: MILLSTONE UNIT ONE RADIOLOGICAL EFFLUENT CONTROLS

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SECTION III: MILLSTONE UNIT ONE RADIOLOGICAL EFFLUENT CONTROLS

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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

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

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

B.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.

B.3 INSTRUMENT FUNCTIONAL TEST - the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify that the instrument is OPERABLE, including all components in the channel, such as alarms, interlocks, displays, and trip functions, required to perform the specified safety function(s). 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.

B.4 INSTRUMENT CHECK - the qualitative determination of operability by observation of behavior during operation. This determination shall include, where possible, comparison of the instrument with other independent instruments measuring the same variable.

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

B.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, ~~and~~ persons who use portions of the Millstone site for recreational, occupational, or other purposes not associated with any of the Millstone plants. (This does include) 12/15/99 CAF

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

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

B.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.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 OPERABLE with applicable alarm/trip setpoints set to ensure that the limits of Control III.D.1.a are not exceeded. The setpoints shall be determined in accordance with methods and parameters described in the ODCM (Section II).

12/17/99 CAL

APPLICABILITY
As shown in Table III.C-1

ACTION:

1. In the event of a control requirement for operation and/or associated action requirement cannot be satisfied, this shall not require unit shutdown or prevent a change in operational modes.

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

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

SURVEILLANCE REQUIREMENTS

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

TABLE III.C-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum # Operable	Alarm Setpoints Required	Applicability	Action
1. Gross Radioactivity Monitors Providing Automatic Termination Of Release				
a. Liquid Radwaste Effluent Line	1	Yes	*	A
2. Gross Radioactivity Monitors Not Providing Automatic Termination Of Release				
a. Service Water Effluent Line	1	Yes	*	B
3. Flow Rate Measurement Devices				
a. Liquid Radwaste	1	No	*	C
b. Dilution water Flow	**	No	*	NA

* At all times - which means that channels be OPERABLE and in service on a continuous, uninterrupted basis, except that outages are permitted, within the time limit of the specified ACTION statement, for the purpose of maintenance and performance of required test, checks and calibrations.

**Dilution water flow is determined by the use of condenser cooling water and service water pump status. Only those pumps actually discharging to the quarry at the time of the release are included. Pump status is only reviewed for purpose of determining flows.

NA - Not Applicable

TABLE III.C-1 (Continued)

ACTION STATEMENTS

Action A

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

1. At least two independent samples of the tank to be discharged are analyzed in accordance with Controls III.D.1.a and;

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

Action B

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, 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 are collected and analyzed for gross radioactivity (beta or gamma) at a lower limit of detection of at least 3×10^{-7} uCi/gm.

Action C

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

TABLE III.C-2

RADIOACTIVE LIQUID EFFLUENT MONITORING

INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Instrument Check	Instrument Calibration	Instrument Functional Test	Source Check
1. Gross Radioactivity Monitors Providing Alarm And Automatic Termination Of Release				
a. Liquid Radwaste Effluent Line	D(1)	R(2)	Q(3)	P
2. Gross Radioactivity Monitors Providing Alarm But Not Providing Automatic Termination Of Release				
a. Service Water Effluent Line	D(1)	R(2)	Q(3)	M
3. Flow Rate Measurement Devices				
a. Liquid Radwaste Effluent Line	D(1)	R	Q(5)	NA
b. Dilution Water Flow	D(4)	NA	NA	NA

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

TABLE III.C-2 (Continued)

TABLE NOTATION

(1) Instrument Check shall consist of verifying indication of radiation or flow readings during periods of discharge. Instrument check need only be performed daily when discharges are made from this pathway.

(2) Calibration shall include the use of a radioactive solid source, the activity of which can be traced to an NIST source. The radioactive source shall be in a known, reproducible geometry.

(3) 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 or circuit failure.

3. Instrument controls not set in operate mode.

* Automatic isolation shall also be demonstrated for the liquid radwaste effluent line.

(4) Pump status should be checked daily.

(5) The quarterly functional test for the liquid radwaste flow monitor shall consist only of a comparison of the calculated volumes discharged by using the measured flow rate versus the tank level decrease. This surveillance is not required if no waste was discharged during the quarter.

III.C. RADIOACTIVE EFFLUENT MONITORING INSTRUMENTATION (Cont'd)

2. Radioactive Gaseous Effluent Monitoring Instrumentation

CONTROLS

The radioactive gaseous effluent monitoring instrumentation channels shown in Table III.C-3 shall be OPERABLE with applicable alarm/trip setpoints set to ensure that the limits of Controls III.C.3 and III.D.2.1 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-3.

Action:

In the event of a control requirement for operation and/or associated action requirement cannot be satisfied, this shall not require unit shutdown or prevent a change in operational modes, except for Table III.C-3 action B statement for SJAE off-gas monitor.

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

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

SURVEILLANCE REQUIREMENT

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

TABLE III.C-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Instrument	Minimum # Operable	Alarm Setpoints	Applicability	Action
1. Main Condenser Augmented Offgas Treatment System Explosive Gas Monitor (For System Designed to Withstand Effects of a Hydrogen Explosion)				
(a) Hydrogen Monitor	1	Yes	**	A
2. Condenser Air Ejector Noble Gas Activity Monitor				
(a) SJAE Off-Gas Monitor	2	Yes	*	B
3. MP1 Main Stack				
(a) Noble Gas Activity Monitor	1	Yes	*	C
(b) Iodine Sampler	1	No	*	D
(c) Particulate Sampler	1	No	*	D
(d) Stack Flow Rate Monitor	1	No	*	E
(e) Sampler Flow Rate Monitor	1	Yes	*	E

* At all times - which means that channels be OPERABLE and in service on a continuous, uninterrupted basis, except that outages are permitted, within the time frame of the specified ACTION statement, for the purpose of maintenance and performance of required test, checks and calibrations.

** During augmented off-gas treatment system (recombiner) operation.

TABLE III.C-3 (Continued)

ACTION STATEMENTS

Action A

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, operations of the main condenser augment offgas treatment system may continue provided that best efforts are made to repair the instrument and that gas samples are collected once per 4 hours and analyzed for hydrogen within the ensuing 4 hours.

Action B

With one monitor inoperable, releases via this pathway may continue provided the inoperable monitor is placed in the tripped position. With both monitors inoperable, releases may continue for up to 72 hours provided the augmented gas system is not bypassed and the main stack monitor is operable, otherwise, be in at least HOT STANDBY within 12 hours.

Action C

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that grab samples are taken once per 12 hours and these samples are analyzed for gross activity within 24 hours.

Action D

With the number of samplers OPERABLE less than required by the Minimum number OPERABLE requirement, effluent releases via this pathway may continue provided that the best efforts are made to repair the instrument and that samples are continuously collected with auxiliary sampling equipment for periods of seven (7) days and analyzed for principal gamma emitters with half lives greater than 8 days within 48 hours after the end of the sampling period.

Action E

With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that best efforts are made to repair the instrument and that the flow rate is estimated once per 4 hours.

Table III.C-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING

INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Instrument	Instrument Check	Instrument Calibration	Instrument Functional Test	Source Check
1. Main Condenser Augmented Offgas Treatment System Explosive Gas Monitor				
(a) Hydrogen Monitor	D(1)	Q(2)	M	NA
2. Condenser Air Ejector Noble Gas Activity Monitor				
(a) SJAE Off-Gas Monitor	D(3)	R(4)	Q(5)	M
3. MP1 MAIN STACK				
(a) Noble Gas Activity Monitor	D(3)	R(6)	Q(7)	M
(b) Iodine Sampler	W	NA	NA	NA
(c) Particulate Sampler	W	NA	NA	NA
(d) Stack Flow Rate Monitor Monitor	D	R	NA	NA
(e) Sampler Flow Rate Monitor	D	R	NA	NA

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

Table III.C-4 (Continued)

TABLE NOTATION

(1) Instrument check daily only when the augmented off-gas treatment system is in operation.

(2) The INSTRUMENT CALIBRATION shall include the use of standard gas samples containing a nominal:

1. One volume percent hydrogen, balance nitrogen; and
2. Four volume percent hydrogen, balance nitrogen.

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

(4) Calibration shall be performed using a known source whose strength has been determined through the use of a condenser R meter traceable to the NIST. The source and detector shall be in a known reproducible geometry.

(5) The instrument functional test shall also demonstrate the following:

1. Automatic isolation of the off-gas line occurs within 15 minutes if any of the following conditions exist:
    a. Both monitors indicate measured levels above the trip setpoint.
    b. One monitor indicates measured levels above the trip setpoint, and the other indicates a downscale trip.
2. Control room alarm annunciation occurs if any of the following conditions exist:
    a. Either monitor indicates measured levels above the alarm/trip setpoint.
    b. Either monitor indicates a downscale failure.
    c. Instrument controls are not set in the operate mode.

(6) 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 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.
3. Instrument controls not set in operate mode.

* - Not applicable for stack flow rate monitor.

III.C. RADIOACTIVE EFFLUENT MONITORING INSTRUMENTATION (Cont'd)

3. Explosive Gas Instrumentation

CONTROLS

The concentration of hydrogen in the main condenser offgas treatment system, downstream of the recombiners, shall be limited to less than or equal to 4% by volume.

APPLICABILITY: At all times.

ACTION:
With the concentration of hydrogen greater than 4% but less than or equal to 8%, restore the concentration to within the limit within 48 hours. With the concentration of hydrogen greater than 8%, terminate use of the augmented off-gas system.

SURVEILLANCE REQUIREMENT

The concentration of hydrogen shall be determined to be within the above limits by monitoring the waste gases with the hydrogen monitor required by Table III.C-3 or by compliance with Action A of Table III.C-3 if the Monitor is inoperable.

III.C. RADIOACTIVE EFFLUENT MONITORING INSTRUMENTATION (Cont'd)

4. Steam Jet Air Ejector Noble Gas Activity

CONTROLS

In the main condenser off-gas system, the noble gas in-process activity rate shall not exceed 1.47 x 10^6 uCi/sec averaged over 15 minutes as measured at the off-gas monitor.

APPLICABILITY: At all times.

ACTION:
With the noble gas activity exceeding the above limit, reduce the activity rate to within the limit within 72 hours or be in at least HOT STANDBY within the next 12 hours.

SURVEILLANCE REQUIREMENT

1. The noble gas in-process activity rate shall be continuously monitored by the steam jet air ejector off-gas monitor required OPERABLE in Table III.C-3.
2. The noble gas in-process activity rate shall be determined to be within the above limit by performance of the steam jet air ejector sampling required in Section I.D.1.

III.C. RADIOACTIVE EFFLUENT MONITORING INSTRUMENTATION (Cont'd)

5. High Range Stack Noble Gas Monitor

CONTROLS

The MP1 stack high range noble gas effluent monitor shall be OPERABLE.

APPLICABILITY:
At all times which means that the monitor shall be OPERABLE on a continuous basis, except that outages are permitted, within the time frame of the specified action statement, for the purpose of maintenance and performance of required tests, check and calibrations.

ACTION:
If the stack high range noble gas monitor is not OPERABLE then initiate a preplanned alternate method of monitoring noble gas effluents within 72 hours, and either restore the inoperable monitor to OPERABLE status within 7 days or prepare and submit a special report to the Commission within 14 days following the event outlining the action taken, the cause of the inoperability and the plans and schedule for restoring the monitor to OPERABLE status.

SURVEILLANCE REQUIREMENT

The monitor shall be demonstrated OPERABLE by performance of a CHANNEL CHECK on a monthly frequency and performance of a CHANNEL CALIBRATION once per refueling cycle.

III.D. RADIOACTIVE EFFLUENTS CONCENTRATIONS AND DOSE LIMITATIONS

1. Radioactive Liquid Effluents

a. Radioactive Liquid Effluents Concentrations

CONTROLS

The concentration of radioactive material released from the site (see Figure III.D-1) shall not exceed the concentrations specified in 10 CFR Part 20, Appendix B, Table II, 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} uCi/ml total activity.

APPLICABILITY: At all times.

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

SURVEILLANCE REQUIREMENT

1. Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Section I.

2. The results of the radioactive analysis shall be used in accordance with the methods of Section II to assure that the concentrations at the point of release are maintained within the limits of Control III.D.1.a.

III.D. RADIOACTIVE EFFLUENTS CONCENTRATIONS AND DOSE LIMITATIONS (Cont'd)

1. Radioactive Liquid Effluents (Cont'd)

b. Radioactive Liquid Effluents Doses

CONTROLS

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:

With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce the releases of radioactive materials in liquid effluents during the remainder of the current calendar quarter and the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 3 mrem to the total body and 10 mrem to any organ.

SURVEILANCE REQUIREMENTS

1. Dose Calculations. Cumulative dose contributions from liquid effluents shall be determined in accordance with Section II 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 the REMM (Section II). 12/15/99 CM

III.D. RADIOACTIVE EFFLUENTS CONCENTRATIONS AND DOSE LIMITATIONS

2. Radioactive Gaseous Effluents

a. Radioactive Gaseous Effluents Dose Rate

CONTROLS

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

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

b. The dose rate limit for 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 Control III.D.2.a within 15 minutes.

SURVEILLANCE REQUIREMENTS

1. The instantaneous release rate corresponding to the above dose rate shall be determined in accordance with the methodology of ~~the ODCM~~ C (Section II) 6 12/15/99 CAF

2. The instantaneous release rate shall be monitored in accordance with the requirements of Table III.D-4.

3. Sampling and analysis shall be performed in accordance with the REMM (Section I) to assure that the limits of Control III.D.2.a are met. 12/15/99 CAF

III.D. RADIOACTIVE EFFLUENTS CONCENTRATIONS AND DOSE LIMITATIONS (Cont'd)

2. Radioactive Gaseous Effluents (Cont'd)

b. Radioactive Gaseous Effluents Noble Gas Dose

CONTROLS

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

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

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

APPLICABILITY: At all times.

ACTION:

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

SURVEILLANCE REQUIREMENTS

1. Dose Calculations - Cumulative dose contributions for the current calendar quarter and current calendar year shall be determined in accordance with the ODCM (Section III) once every 31 days. 12/15/99 CAL

2. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in the REMM (Section II) 12/15/99 CAL

III.D. RADIOACTIVE EFFLUENTS CONCENTRATIONS AND DOSE LIMITATIONS (Cont'd)

2. Radioactive Gaseous Effluents (Cont'd)

c. Gaseous Effluents - Dose, Radio-iodines, Radioactive Material In Particulate Form, and Radionuclides Other than Noble Gas

CONTROLS

The dose to any REAL MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, Tritium, and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents released offsite from Unit 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 radio-iodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding any of the above limits prepare and submit to the Commission within 30 days a Special Report which identifies the cause(s) for exceeding the limit and defines the corrective actions to be taken to reduce the releases during the remainder of the current calendar quarter and during the remainder of the calendar year so that the cumulative dose or dose commitment to any REAL MEMBER OF THE PUBLIC from such releases during the calendar year is within 15 mrem to any organ.

SURVEILLANCE REQUIREMENTS

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

2. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the Radiological Environmental Monitoring Program as detailed in the REMM (Section 6). 12/17/99 CJK

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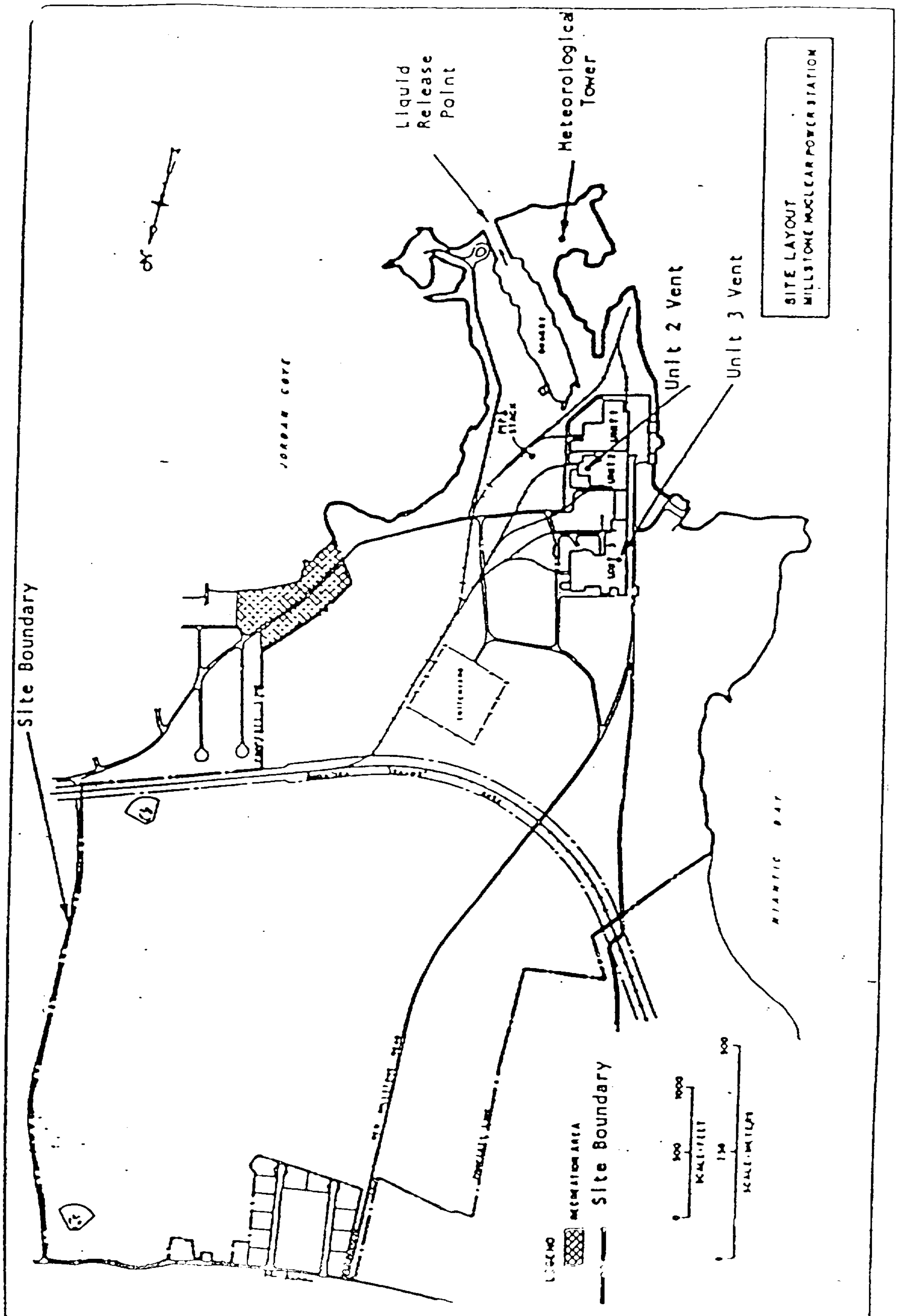

Figure III.D-1
Site Boundary for Liquid and Gaseous Effluents

III.E. TOTAL RADIOLOGICAL DOSE FROM STATION OPERATIONS

CONTROLS

The dose or dose commitment 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 the thyroid, which is limited to less than or equal to 75 mrem) over a period of 12 consecutive months.

APPLICABILITY: At all times.

ACTION:

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

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

SURVEILLANCE REQUIREMENTS

Cumulative dose contributions from liquid and gaseous effluents and direct radiation from the Millstone Site shall be determined in accordance with the ODCM (Section II) once per 31 days. 12/17/99 CAH

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III.F. BASES

Section III.C.1 - Radioactive Liquid Effluent Monitoring Instrumentation
The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the approved methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

Section III.C.2 - Radioactive Gaseous Effluent Monitoring Instrumentation
The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments shall be calculated in accordance with the approved methods in the REMODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. This instrumentation also includes provisions for monitoring (and controlling) the concentrations of potentially explosive gas mixtures in the waste gas holdup system. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

Section III.C.3 - Explosive Gas Monitoring
This specification is provided to ensure that the concentration of potentially explosive gas mixtures contained in the waste gas treatment system is maintained below the flammability limits of hydrogen and oxygen. Maintaining the concentration of hydrogen and oxygen below their flammability limits provides assurance that the releases of radioactive materials will be controlled in conformance with the requirements of General Design Criterion 60 of Appendix A to 10 CFR Part 50.

Section III.C.4 - Steam Jet Air Ejector Noble Gas Activity
Restricting the gross radioactivity rate of noble gases from the main condenser provides reasonable assurance that the total body exposure to an individual at the exclusion area boundary will not exceed a small fraction of the limits of 10 CFR Part 100 in the event this effluent is inadvertently discharged directly to the environment without treatment. This Specification implements the requirements of General Design Criteria 60 and 64 of Appendix A to 10 CFR Part 50.

Section III.C.5 - High Range Stack Noble Gas Monitor
This specification ensures the operability of the High Range Stack Noble Gas Monitor installed per NUREG-0737 to monitor post-accident noble gas releases from the Millstone Unit No. 1 stack. Since the Millstone Unit No. 1 stack represents the final release point for potential accident level releases from all 3 Millstone units, the applicability has been defined as "At all times" rather than relating it solely to Millstone Unit No. 1 operating modes. The Millstone Unit No. 1 stack noble gas effluent monitor required to be operable per Section III.C.2 - Table C.1-1 is strictly the low range (Normal Range) monitor. Hence this specification for the High Range Monitor is not redundant.

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

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II. This instantaneous limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual and (2) the limits of 10 CFR 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

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

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

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

This control is provided to ensure that the dose rate at anytime from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for all areas offsite. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual offsite to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR 20.106(b)). For individuals who may, at times, be within the site boundary, the occupancy of that individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to an infant via the cow-milk-infant pathway to less than or equal to 1500 mrem/year for the nearest cow to the plant.

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

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

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

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

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

Section III.E - Total Radiological Dose from Station Operations

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

New

APPENDIX A

REMODCM METHODOLOGY CROSS-REFERENCES

Radiological effluent controls (Section III of the REMODCM for Unit 1, and Radiological Effluent Technical Specifications for Units 2 and 3) 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.

Tables App.A-1 (Unit 1) and App.A-2 (Units 2 & 3) provide a cross-reference guide between liquid and gaseous effluent release limits and those sections of the REMODCM, which are used to determine compliance. These tables also provide a quick outline of the applicable limits or dose objectives and the required actions if those limits are exceeded. Details of the effluent control requirements and the implementing sections of the REMODCM should be reviewed directly for a full explanation of the requirements.

NJW

TABLE App.A-1

MILLSTONE UNIT 1

EFFLUENT REQUIREMENTS AND METHODOLOGY CROSS REFERENCE

Radiological Effluent Controls	REMODCM Methodology Section	Applicable Limit or Objective	Exposure Period	Required Action
III.D.1.1 Liquid Effluent Concentration	Table I.C-1	10CFR20, App. B, Table II, Column 2, and 2×10^{-4} μCi/mL for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 minutes.
III.D.1.2 Dose-Liquids	II.C.1 II.C.2 II.C.3 II.C.4	≤1.5 mrem T.B. ≤5 mrem Organ ≤3 mrem T.B. ≤10 mrem Organ	Calendar Quarter** Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the REMP in Section I.
T.S. 6.15 Liquid Radwaste Treatment	I.C.2 II.C.5	≤0.06 mrem T.B. ≤0.2 mrem Organ	Projected for 31 days (if system not in use)	Return to operation Liquid Waste Treatment System.
III.D.2.1 Gaseous Effluents Dose Rate	Table I.D-1 II.D.1.a II.D.1.b	≤500 mrem/yr T.B. from noble gases* ≤3000 mrem/yr skin from noble gases* ≤1500 mrem/yr organ from particulates with T½ > 8d., I-131, I-133 and tritium*	Instantaneous	Restore release rates to within specifications within 15 minutes.
III.D.2.2 Dose Noble Gases	II.D.2	≤5 mrad gamma air ≤10 mrad beta air ≤10 mrad gamma air ≤20 mrad beta air	Calendar Quarter** Calendar	30-day report if exceeded.
III.D.2.3 Dose I-131, I-133, Particulates, H-3	II.D.3	≤7.5 mrem organ ≤15 mrem organ	Calendar Quarter** Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of the calculations shall be confirmed by performance of the REMP in Section I.
T.S. 6.15 Gaseous Radwaste Treatment	I.D.2 II.D.4	>0.02 mrad gamma air >0.04 mrad beta air >0.03 mrem organ	Projected for 31 Days (if system not in use)	Return to operation Gaseous Radwaste Treatment System.
III.D.3 Total Dose	II.D.6	≤25 mrem T.B.* ≤25 mrem organ* ≤75 mrem thyroid*	12 Consecutive Months**	30-day report if Effluent Control III.D.1.2, III.D.2.2, or III.D.2.3 are exceeded by a factor of 2. Restore dose to public to within the applicable EPA limit(s) or obtain a variance.

* Applies to the entire site (Units 1, 2, and 3) discharges combined.
**Cumulative dose contributions calculated once per 31 days.

new

TABLE APP.A-2

MILLSTONE UNITS 2 and 3

EFFLUENT REQUIREMENTS AND METHODOLOGY CROSS REFERENCE

Technical Specification Section	REMODCM Methodology Section	Applicable Limit or Objective	Exposure Period	Required Action
3/4.11.1 Liquid Effluent Concentration	Tables I.C-2 and I.C-3	10CFR20, App. B., Table II, Column 2, and 2×10^{-4} μCi/mL for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 minutes.
3/4.11.1.2 Dose-Liquids	II.C.1 II.C.2 II.C.3 II.C.4	≤1.5 mrem T.B. ≤5 mrem organ ≤3 mrem T.B. ≤10 mrem organ	Calendar Quarter Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of calculations shall be confirmed by performance of the REMP in Section I.
6.15 Liquid Radwaste Treatment	I.C.2 II.C.5	>0.06 mrem T.B. >0.2 mrem organ	Projected for 31 days	Return to operation Liquid Waste Treatment System.
3/4.11.2 Gaseous Effluents Dose Rate	II.D.1.a II.D.1.b	≤500 mrem/yr T.B. from noble gases* ≤3000 mrem/yr skin from noble gases* ≤1500 mrem/yr organ from particulates with T½ > 8d., I-131, I-133, and tritium*	Instantaneous	Restore release rates to within specifications within 15 minutes.
3/4.11.2.2 Dose-Noble Gases	II.D.2	≤5 mrad gamma air ≤10 mrad beta air ≤10 mrad gamma air ≤20 mrad beta air	Calendar Quarter** Calendar Year	30-day report if exceeded.
3/4.11.2.3 Dose I-131, I-133, Particulates, H-3	II.D.3	≤7.5 mrem organ ≤15 mrem organ	Calendar Quarter** Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of calculations shall be confirmed by performance of the REMP in Section I.
6.15 (Unit 2) 6.13 (Unit 3) Gaseous Radwaste Treatment	I.D.2 II.D.4	>0.02 mrad gamma air >0.04 mrad beta air >0.03 mrem organ	Projected for 31 days (if system not in use)	Return to operation Gaseous Radwaste Treatment System.
3/4.11.3 Total Dose	II.D.6	≤25 mrem T.B.* ≤25 mrem organ* ≤75 mrem thyroid*	12 Consecutive Months**	30-day report if Tech Spec 3.11.1.2, 3.11.2.2, or 3.11.2.3 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.

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

SECTION I: RADIOLOGICAL EFFLUENT MONITORING MANUAL (REMM)

TABLE OF CONTENTS

I.A. INTRODUCTION

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

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

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

I.B. RESPONSIBILITIES

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

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

It shall be the responsibility of the Senior Vice President and CNO - Millstone to ensure that this manual is used in performance of the surveillance requirements and administrative controls of the *Technical Specifications* . The delegation of implementation responsibilities is delineated in the *Millstone Radiological Effluent Program Reference Manual (MP-13-REM-REF01).*

Table I.C-1

MILLSTONE UNIT 1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/ml)
A. Batch Release[B] Waste Sample Tanks, Floor Drain Sample Tank and Decontamination Solution Tank	Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters[C]	5×10^{-7}
			~~I-131~~	~~1×10^{-6}~~
			Ce-144	5×10^{-6}
		Monthly Composite[E]	H-3	1×10^{-5}
			Gross alpha	1×10^{-7}
		Quarterly Composite[E]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Release Reactor Building Service Water	Weekly Grab Sample[D]*	Weekly Composite[E]	Principal Gamma Emitters[C]	5×10^{-7}
			~~I-131~~	~~1×10^{-6}~~
			Ce-144	5×10^{-6}
	Weekly Grab or Composite[E]	Monthly Composite[F]	H-3	1×10^{-5}
			Gross alpha[F]	1×10^{-7}
	Weekly Composite[E,F]*	Quarterly Composite[E,F]*	Sr-89[F], Sr-90[F]	5×10^{-8}
			Fe-55[F]*	1×10^{-6}

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

B. A batch release is the discharge of liquid wastes of a discrete volume from the tanks listed in this table. Prior to the sampling, each batch shall be isolated and at least two tank/sump volumes shall be recirculated or equivalent mixing provided.

C. The LLD will be 5×10^{-7} µCi/ml. The principal gamma emitters for which this LLD applies are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, and Cs-137~~, and Ce-141~~. Ce-144 shall be measured, but with an LLD of 5×10^{-6} µCi/ml.

This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in a priori LLDs higher than required, the reasons shall be documented in the ~~Annual~~ *Radioactive Effluent Release Report.*

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

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

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

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

TABLE NOTATIONS

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

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

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

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

CONDITIONAL ACTION REQUIREMENTS

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

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

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

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

IF the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7-2* of the *Safety Technical Specifications*) does not exceed 5 x 10^{-7} µCi/ml, **THEN** the sampling and analysis schedule for all principal gamma , I-131, Ce-144, noble gases, gross alpha, Sr-89, Sr-90 and Fe-55 are not required.

J. For the Service Water: **IF** a weekly gamma analysis does not indicate a gamma activity greater than 5 x10^{-7} µCi/ml, **THEN** these analyses (gross alpha, Sr-89, Sr-90, Fe-55) are not required.

L. For the Turbine Building Sump: **IF** the release pathway is directed to yard drains, **THEN** the LLD for I-131 shall be 1.5 x 10^{-7} µCi/ml and for gross alpha 1 x 10^{-8} µCi/ml.

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

A. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal. For a particular measurement system (which may include radiochemical separation):

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

where:

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

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

E is the counting efficiency (as counts per transformation)

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

2.22×10^6 is the number of transformations per minute per microcurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between midpoint of sample collection and midpoint of counting time

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

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

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

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

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

TABLE NOTATIONS

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

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

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

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

CONDITIONAL ACTION REQUIREMENTS

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

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

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

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

IF the steam generator gross gamma activity (sampled and analyzed three times per week as per *Table 4.7-1* of the *Safety Technical* Specifications) does not exceed 5 x 10^{-7} µCi/ml, **THEN** the sampling and analysis for all principal gamma , I-131, Ce-144, noble gases, gross alpha, Sr-89, Sr-90 and Fe-55 are not required.

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

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

L. **IF** the Turbine Building sump release is directed to yard drains, **THEN** the LLD for I-131 shall be 1.5 x 10^{-7} µCi/ml and for gross alpha 1 x 10^{-8} µCi/ml.

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

Table I.D-1

MILLSTONE UNIT 1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[A] (μCi/cc)
~~A. Steam Jet Air Ejector Discharge~~	~~Monthly - Gaseous Grab Sample[C]~~ *	~~Monthly~~	~~Principal Gamma Emitters[B]~~	~~1×10^{-4}~~
~~B.~~ ~~Main~~Site Stack Refer to Table I.D-2	~~Monthly - Gaseous Grab Sample~~	~~Monthly~~	~~Principal Gamma Emitters[B]~~	~~1×10^{-4}~~
			~~H-3~~	~~1×10^{-6}~~
	~~Continuous[D]~~	~~Weekly Charcoal Sample[F]~~ *	~~I-131~~	~~1×10^{-12}~~
			~~I-133[E]~~	~~1×10^{-10}~~
	~~Continuous[D]~~	~~Weekly Particulate Sample[F]~~ *	~~Principal Particulate Gamma Emitters[B] - (I-131, Others with half lives greater than 8 Days)~~	~~1×10^{-11}~~
	~~Continuous[D]~~	~~Monthly Composite Particulate Sample~~	~~Gross alpha~~	~~1×10^{-11}~~
	~~Continuous[D]~~	~~Quarterly Composite Particulate Sample~~	~~Sr-89, Sr-90~~	~~1×10^{-11}~~
	~~Continuous[D]~~	~~Noble Gas Monitor~~	~~Noble Gases - Gross Activity~~	~~1×10^{-6}~~

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

~~TABLE I.D-1 (Cont'd.)~~

~~TABLE NOTATIONS~~

~~INFORMATIONAL NOTES~~

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

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

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

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

~~CONDITIONAL ACTION REQUIREMENTS:~~

~~C. **IF** there is an increase of the steam jet air ejector off-gas monitor of greater than 50%, after factoring out increases due to changes in THERMAL POWER level, **THEN** sampling and analysis shall also be performed within 24 hours.~~

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

~~**IF** reactor coolant I-131 samples show an increase of greater than a factor of 5 after factoring out increases due to changes in thermal power level, **THEN** special sampling and analysis of iodine and particulate filters shall also be performed. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.~~

Table I.D-2

MILLSTONE UNIT 2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

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

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

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

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

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

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

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

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

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

TABLE NOTATIONS

CONDITIONAL ACTION REQUIREMENTS:

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

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

For Unit 2 vent only:
IF reactor coolant Dose Equivalent I-131 samples, which are taken two to six hours following a THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour, show an increase of greater than a factor of 5, **THEN** special sampling and analysis of iodine and particulate filters shall also be performed. These filters shall be changed following such a five-fold increase in coolant activity and every 24 hours thereafter until the reactor coolant Dose Equivalent I-131 levels are less than a factor of 5 greater than the original coolant levels or until seven days have passed, whichever is shorter. Sample analyses shall be completed within 48 hours of changing. The LLDs may be increased by a factor of 10 for these samples.

G. **IF** the refueling cavity is flooded and there is fuel in the cavity, **THEN** grab samples for tritium shall be taken weekly. The grab sample shall be taken from the Site ~~s~~Stack or vent ~~(Units 1 or 2)~~ where the containment ventilation is being discharged at the time of sampling.

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

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

TABLE NOTATIONS

INFORMATIONAL NOTES:

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

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

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

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

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

CONDITIONAL ACTION REQUIREMENTS

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

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

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

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

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

I.D GASEOUS EFFLUENTS (Cont'd)

2. Gaseous Radioactive Waste Treatment

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

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

1. **IF** any of the radioactive waste processing equipment listed in Section b are not routinely operating, **THEN** doses due to gaseous effluents from the untreated waste stream to unrestricted areas shall be projected at least once per 31 days in accordance with the methodology and parameters in Section II.D.4. For each waste stream, only those doses specified in Section II.D.4 need to be determined for compliance with this section.
2. **IF** any of these dose projections exceed 0.02 mrad for gamma radiation, 0.04 mrad for beta radiation or 0.03 mrem to any organ due to gaseous effluents,
THEN best efforts shall be made to return the inoperable equipment to service.
3. **IF** actual doses exceed 0.2 mrad for gamma radiation, 0.4 mrad for beta radiation or 0.3 mrem to any organ
AND the dose from a waste stream with equipment not continuously operating exceed 10% any of these limits,
THEN prepare and submit to the Commission a report as specified in Section c.

b. Required Equipment for Each Millstone Unit

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

1. Millstone Unit No. 1

Waste Stream	Processing Equipment
~~Radwaste Vent Exhaust~~None specified	~~Radwaste ventilation HEPA filters~~None required

2. Millstone Unit No. 2

Waste Stream	Processing Equipment
Gaseous Radwaste Treatment System	Five (5) gas decay tanks
	One waste gas compressor
Ventilation Exhaust Treatment System	Auxiliary building ventilation HEPA filter (L26 or L27)
	Containment purge HEPA filter (L25)
	Containment vent HEPA/charcoal filter (L29 A or B)

3. Millstone Unit No. 3

Waste Stream	Processing Equipment
Gaseous Radwaste Treatment System	Charcoal bed adsorbers
	One HEPA filter
Building Ventilation	Fuel building ventilation filter

c. Report Requirement For All Three Millstone Units

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

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

I.D GASEOUS EFFLUENTS (Cont'd)

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

Paragraph (a)(2) of Part 50.36a provides that licensee will submit an annual report to the Commission which specifies the quantity of each of the principal radionuclides released to unrestricted areas in gaseous effluents during the past 12 months of plant operation. The indicated gaseous surveillance programs (as directed by Unit 1 Radiological Effluent Control III.D.2.~~1~~a, Surveillance Requirement 3; and Units 2 and 3 Technical Specification Surveillance Requirement 4.11.2.1.3) provides the means to quantify and report on radioactive materials released to the atmosphere from all major and potential significant release pathways. This information also provides for the assessment of effluent dose rates and environmental dose impacts for the purpose of demonstration compliance with the effluent limits of 10 CFR 20, and dose objectives of 10 CFR 50, Appendix I. The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of lower limits of detection (LLDs) and are selected, based on NUREG-1301, such that the detection of radioactivity in releases will occur at levels below which effluent offsite dose objectives would be exceeded. The indicated liquid radwaste treatment equipment for each Unit have been determined, using the GALE code, to be capable to minimize radioactive liquid effluents such that the dose objectives of Appendix I can be met for expected routine (and anticipated operational occurrence) effluent releases. This equipment is maintained and routinely operated to treat appropriate liquid waste streams without regards to projected environmental doses.

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

F.2 ~~Annual~~ Radioactive Effluent Release Report

The ~~*Annual*~~ *Radioactive Effluent Release Report (ARERR)* 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 Technical Specifications.* An annual assessment of the radiation doses from the site to the most likely exposed REAL MEMBER OF THE PUBLIC shall be included to demonstrate conformance with 40 CFR 190. Gaseous pathway doses shall use meteorological conditions concurrent with the time of radioactive gaseous effluent releases. Doses shall be calculated in accordance with the *Offsite Dose Calculation Manual.* The licensee shall maintain an annual summary of the hourly meteorological data (i.e., wind speed, wind direction and atmospheric stability) either in the form of an hour-by-hour listing on a magnetic medium or in the form of a joint frequency distribution. The licensee has the option of submitting this annual meteorological summary with the ARERR or retaining it and providing it to the NRC upon request. The ARERR shall be submitted ~~by~~prior to May 1 of each year for the period covering the previous calendar year.

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

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

The ARERR shall include the following information for all abnormal releases of radioactive gaseous and liquid effluents (i.e., all unplanned or uncontrolled radioactivity releases, including reportable quantities) from the site to unrestricted areas:

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

Changes to the *RADIOLOGICAL EFFLUENT MONITORING* and *OFFSITE DOSE CALCULATION MANUAL (REMODCM)* shall be submitted to the NRC as appropriate, as a part of or concurrent with the ARERR for the period in which the changes were made.

MARK-UP

SECTION II

OFFSITE DOSE

CALCULATION MANUAL (ODCM)

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

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

Revision 19
June 15, 2000

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

SECTION II: OFFSITE DOSE CALCULATION MANUAL (ODCM)

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APPENDICES

II.A. INTRODUCTION

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

The bases for selected site-specific factors used in the dose calculation methodology are provided in Reference Manual *MP-13-REM-REF02, REMODCM Technical Information.*

Another section of this manual discusses the methods to be used in determining effluent monitor alarm/trip setpoints to be used to ensure compliance with the instantaneous release rate limits in the *Technical Specifications.*

This manual does not include the surveillance procedures and forms required to document compliance with the surveillance requirements in the *Technical Specifications (Units 2 and 3)* or *Radiological Effluent Controls in REMODCM Section III for Unit 1.* All that is included here are the methods to be used in performance of the surveillance requirements. Appendix A, Tables App.A-1 and App.A-2 provide a cross-reference of effluent requirements and applicable methodologies contained in the REMODCM.

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

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

II.B. RESPONSIBILITIES

All changes to the Off-Site Dose Calculation Manual (ODCM) shall be reviewed and approved by the Site Operations Review Committee prior to implementation.

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

It shall be the responsibility of the Senior Vice President and CNO - Millstone to ensure that this manual is used in performance of the surveillance requirements and administrative controls of the *Technical Specifications*. The delegation of implementation responsibilities is delineated in the Millstone Radiological Effluent Program Reference Manual (MP-13-REM-REF01).

II.C. LIQUID DOSE CALCULATIONS

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

1. Whole Body Dose from Liquid Effluents

Millstone Units 2 and 3 Technical Specifications and Unit 1 Radiological Effluent Controls (Section III) limit the whole body dose to an individual member of the public to 1.5 mrem per calendar quarter and 3 mrem per year from liquid effluents released from each unit. (See Appendix A, Tables App.A-1 and App.A-2 for cross-reference effluent control requirements and applicable sections in the REMODCM which are used to determine compliance). In addition, installed portions of liquid radwaste treatment system are required to be operated to reduce radioactive materials in liquid effluents when the projected whole body dose over 31 days from applicable waste streams exceeds 0.006 mrem. This part of the REMODCM provides the calculation methodology for determining the whole body dose from radioactive materials released into liquid pathways of exposure associated with routine discharges. This includes the liquid pathways which contribute to the 25 mrem annual total dose limit (40 CFR190) to any real individual member of the public from all effluent sources (liquids, gases, and direct).

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

For Unit 1:

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

For Units 2 and 3:

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

Where:

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

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

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

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

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

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

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

2. Maximum Organ Dose from Liquid Effluents

Millstone Units 2 and 3 Technical Specifications and Unit 1 Radiological Effluent Controls (Section III) limit the maximum organ dose to an individual member of the public to 5 mrem per calendar quarter and 10 mrem per year from liquid effluents released from each unit. (See Appendix A, Tables App.A-1 and App.A-2 for cross-reference effluent control requirements and applicable sections in the REMODCM which are used to determine compliance). In addition, installed portions of liquid radwaste treatment system are required to be operated to reduce radioactive materials in liquid effluents when the projected maximum organ dose over 31 days from applicable waste streams exceeds 0.02 mrem. This part of the REMODCM provides the calculation methodology for determining the maximum organ dose from radioactive materials released into liquid pathways of exposure associated with routine discharges. This includes the liquid pathways which contribute to the 25 mrem annual organ (except 75 mrem thyroid) dose limit (40 CFR190) to any real individual member of the public from all effluent sources (liquids, gases, and direct).

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

For Unit 1:

$$D_O = 2.1\ C_F$$

For Units 2 and 3:

$$D_O = 0.2\ C_F$$

Where:

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

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

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

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

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

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

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

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

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

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

The following shall be used as D_W:

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

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

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

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

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

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

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

The following guidelines shall be used:

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

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

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

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

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

5. Monthly Dose Projections

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

a. Whole Body and Maximum Organ (Applicable to Unit 1 Only)

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

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

The projected monthly maximum organ dose is determine from:

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

Where:

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

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

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

R_2 = the ratio of estimated primary coolant activity for the present month to that for the past month.

F = the factor to be applied to the estimated ratio of final curies released if there are expected differences in treatment of liquid waste for the present month as opposed to the past month (e.g., bypass of filters or demineralizers). NUREG-0016 or past experience shall be used to determine the effect of each form of treatment which will vary. F = 1 if there are no expected differences.

Notes:

1. The last typical month should be one without significant operational differences from the projected month. ~~For example, if the plant was down for refueling the entire month of February and startup is scheduled for March 3, use the last month of operation as the base month to estimate March's dose.~~

2. If there were no releases during last month, do not use that month as the base month if it is estimated that there will be releases for the coming month.

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

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

b. Whole Body and Maximum Organ (Applicable to Units 2 and 3)

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

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

6. Quarterly Dose Calculations for ~~Annual~~ Radioactive Effluent Release Report

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

II.D. GASEOUS DOSE CALCULATIONS

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

1. Site Release Rate Limits ("Instantaneous")

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

a. Method 1 for Noble Gas Release Rate Limits ~~(Applicable to Units 1, 2, and 3)~~

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

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

Where:

Q_1 = Noble gas release rate from ~~MP1~~ Site Stack (μCi/sec)
Q_2 = Noble gas release rate from MP2 Vent (μCi/sec)
Q_3 = Noble gas release rate from MP3 Vent (μCi/sec)

As long as the above is less than or equal to 1, the doses will be less than or equal to 500 mrem to the total body and less than 3000 mrem to the skin.

b. Method 1 for Release Rate Limit - I-131, I-133, H-3 and Particulates With Half Lives Greater Than 8 Days ~~(Applicable to Units 1, 2, and 3)~~

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

(1) The site release rate limit of I-131, I-133, and tritium (where the thyroid is the critical organ for these radionuclides) shall be:

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

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

Where the contribution from each Units is calculated from:

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

(2) The site release rate limit of particulates with half-lives greater than 8 days and tritium (where the critical organ is a composite of target organs for a mix of radionuclides) shall be:

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

Where the contribution from each Units is calculated from:

Unit 1: $DR_{org1} = 5.5 \times 10^{-4}\ Q_{P1} + 4.4 \times 10^{-8}\ Q_{H1}$
Unit 2: $DR_{org2} = 5.1 \times 10^{-2}\ Q_{P2} + 4.2 \times 10^{-6}\ Q_{H2}$
Unit 3: $DR_{org3} = 5.1 \times 10^{-2}\ Q_{P3} + 4.2 \times 10^{-6}\ Q_{H3}$

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

${}_{131}Q_{I1}$ = Release rate of I-131 from ~~MP1~~the Site Stack (μCi/sec)
${}_{133}Q_{I1}$ = Release rate of I-133 from ~~MP1~~the Site Stack (μCi/sec)
${}_{131}Q_{I2}$ = Release rate of I-131 from MP2 Vent (μCi/sec)*
${}_{133}Q_{I2}$ = Release rate of I-133 from MP2 Vent (μCi/sec)*
${}_{131}Q_{I3}$ = Release rate of I-131 from MP3 Vent (μCi/sec)*
${}_{133}Q_{I3}$ = Release rate of I-133 from MP3 Vent (μCi/sec)*
Q_{H1} = Release rate of tritium from ~~MP1~~the Site Stack (μCi/sec)
Q_{H2} = Release rate of tritium from MP2 Vent (μCi/sec)*
Q_{H3} = Release rate of tritium from MP3 Vent (μCi/sec)*
Q_{P1} = Release rate of total particulates with half-lives greater than 8 days from the ~~MP1~~Site Stack (μCi/sec)
Q_{P2} = Release rate of total particulates with half-lives greater than 8 days from the MP2 Vent (μCi/sec)
Q_{P3} = Release rate of total particulates with half-lives greater than 8 days from the MP3 Vent (μCi/sec)

* includes releases via the steam generator blowdown tank vent.

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

The above Method 1 equations assume a conservative nuclide mix. If necessary, utilize the GASPAR, or a code which uses the methodology given in Regulatory Guide 1.109, code to estimate the dose rate from either noble gases or iodines, tritium, and particulates with half-lives greater than 8 days. The use of the code is described in Engineering Procedure *RAB-B12, Gaseous Dose Calculations - GASPAR*. Additional information on GASPAR is contained in the REMODCM Technical Information Manual (MP-13-REM-REF02).

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

2. 10 CFR50 Appendix I - Noble Gas Limits

Technical Specifications limit the off-site air dose from noble gases released in gaseous effluents to 5 mrad gamma and 10 mrad beta for a calendar quarter (10 and 20 mrad gamma and beta, respectively, per calendar year). Effluent dose calculations are calculated at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.02 mrad air gamma or 0.04 mrad air beta. (See Appendix A, Tables App.A-1 and App.A-2 for a cross reference of effluent control requirements and applicable sections of the REMODCM which are used to determine compliance.) This part of the REMODCM provides the calculation methodology for determining air doses from noble gases.

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

For Unit 1:

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

For Unit 2:

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

For Unit 3:

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

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

Where:

D_{G1} = The gamma air dose from Unit 1 for the period of interest (mrad).
D_{B1} = The beta air dose from Unit 1for the period of interest (mrad).
D_{G2} = The gamma air dose from Unit 2 for the period of interest (mrad).
D_{B2} = The beta air dose from Unit 2 for the period of interest (mrad).
D_{G3} = The gamma air dose from Unit 3 for the period of interest (mrad).
D_{B3} = The beta air dose from Unit 3 for the period of interest (mrad).
C_{N1} = The total curies of noble gas released from ~~Unit 1~~ Site Stack* during the period of interest.
C_{N2} = The total curies of noble gas released from Unit 2 during the period of interest. Include all sources - Unit 2 Vent, containment purges and waste gas decay tanks.
C_{N3} = The total curies of noble gas released from Unit 3 during the period of interest. Include all sources - Unit 3 Vent, ESF Building Vent, and containment purges and drawdowns.

* Includes contributions from all three ~~U~~units ~~2 and 3~~. If ~~2~~10% of the airborne dose limits are exceeded, a Special Assessment will be performed to determine the dose attributable to each unit individually. The intent is to prevent double accounting of normal routine releases ~~since Unit 1 accounts for some Unit 2 and 3 releases~~. Special sampling for batch releases is not required at the ~~Unit 1~~Site Stack.

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

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

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

~~Unit 1~~Site Stack For ~~MP1~~ dose calculations for releases from the Site Stack, use the AIREM computer code to determine the critical location air doses.

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

If the calculated air dose exceeds one half the Technical Specification limit, use meteorology concurrent with time of release.

Units 2~~,~~ and 3 releases For ~~MP2 and MP3~~ dose calculations for releases from Units 2 and 3, use the GASPAR computer code, or a code which uses the methodolgy given in Regulatory Guide 1.109, to determine the critical site boundary air doses.

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

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

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

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

If the calculated air dose exceeds one half the quarterly Technical Specification limit, use meteorology concurrent with time of release.

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

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

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

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

Where:

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

The following shall be used as the quarterly doses:

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

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

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

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

3. 10 CFR50 Appendix I - Iodine and Particulate Doses

Technical Specifications limit the off-site dose to a critical organ from radioiodines, tritium, and particulates with half-lives greater than 8 days released in gaseous effluents to 7.5 mrem for a calendar quarter (15 mrem per calendar year). Effluent dose calculations are performed at least once every 31 days. In addition, installed portions of the gaseous radwaste treatment system are required to be operated to reduce radioactive materials in gaseous effluents when the projected doses over 31 days from the applicable waste stream exceed 0.03 mrem. (See Appendix A, Tables App.A-1 and App.A-2 for a cross reference of effluent control requirements and applicable sections of the REMODCM which are used to determine compliance.) This part of the REMODCM provides the calculation methodology for determining critical organ doses from atmospheric releases of iodines, tritium and particulates.

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

a. Critical Organ Doses (Applicable to ~~Unit 1~~Site Stack releases)

(1) Method 1a - ~~Unit 1~~Site Stack

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

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

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

Where:

D_T = The thyroid dose for the period of release of gaseous effluents.

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

${}_{131}C_I$ = The total curies of I-131 released in gaseous effluents from ~~Unit 1~~Site Stack* during the period of interest.

${}_{133}C_I$ = The total curies of I-133 released in gaseous effluents from ~~Unit 1~~Site Stack* during the period of interest.

C_P = The total curies of particulates with half-lives greater than 8 days released in gaseous effluents from ~~Unit 1~~Site Stack* during the period of interest.

C_H = The total curies of tritium released in gaseous effluents from ~~Unit 1~~Site Stack* during period of interest.

***Note:** ~~Unit 1~~Site Stack samples include releases from all ~~U~~units~~-2 and 3~~. ~~The activity from Units 2 and 3 released via the Unit 1 Stack will normally be included here. However, i~~If ~~2~~10% of any airborne limits are exceeded, a Special Assessment will be required to determine the dose attributable to each unit individually. The intent is to prevent double accounting of normal routine releases~~ since Unit 1 accounts for some Unit 2 and 3 releases~~. Special sampling for batch releases is not required at the ~~Unit 1~~Site Stack.

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

(2) Method 1b - ~~Unit 1~~Site Stack

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

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

i. **Inhalation Pathway**

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

ii. **Vegetation Pathway**

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

iii. **Milk Pathway**

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

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

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

(3) Method 1c - ~~Unit 1~~Site Stack

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

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

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

(4) Method 2a - ~~Unit 1~~Site Stack

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

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

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

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

(5) **Method 2b - ~~Unit 1~~Site Stack**

Use the GASPAR code, or a code which uses the methodolgy given in Regulatory Guide 1.109, with actual locations, real-time meteorology and the pathways which actually exist at the time at those locations.

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

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

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

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

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

Where:

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

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

${}_{131}C_I$ = The total curies of I-131 in gaseous effluents from Unit 2 (Unit 2 Vent and Steam Generator Blowdown Tank Vent*) or Unit 3 (Unit 3 Vent, ESF Building Vent, Steam Generator Blowdown Tank Vent*, and Containment Drawdown**) during the period of interest.***

${}_{133}C_I$ = The total curies of I-133 in gaseous effluents from Unit 2 (Unit 2 Vent and Steam Generator Blowdown Tank Vent*) or Unit 3 (Unit 3 Vent, ESF Building Vent, Steam Generator Blowdown Tank Vent*, and Containment Drawdown**) during the period of interest.***

C_P = The total curies of particulates with half-lives greater than eight days released in gaseous effluents from the Unit 2 Vent or Unit 3 (Unit 3 Vent, ESF Building Vent, and Containment Drawdown**) during the period of interest.***

C_H = The total curies of tritium released in gaseous effluents from the Unit 2 Vent or Unit 3 (Unit 3 Vent, ESF Building Vent and Containment Drawdown**) during the period of interest.***

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

* Results from SAI studies in 1982 and 1983 and guidance provided in the R. A. Crandall / E. R. Brezinski memo to E. J. Mroczka, Millstone Unit 2 Steam Generator Blowdown Tank Releases, NE-83-RA-879, June 15, 1983, indicate that the steam generator blowdown tank vent releases can be estimated by use of a factor of 1/6,000 (a DF of 2000 and a partitioning factor of 1/3). Although Unit 3 normally recycles blowdown, periodically blowdown is released for short periods of time. These releases should be similar to Unit 2 and until studies can be performed at Unit 3 the same calculation should be performed. Based upon the above, the formula to be used is:

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

** This pathway does not have a effluent monitor.

*** Unit 2 and 3 also have releases via the ~~Unit 1~~Site Stack. This activity will be included in the ~~Unit 1~~Site Stack calculations unless ~~2~~10% of any airborne limit is exceeded and/or a Special Evaluation is performed.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Use the GASPAR code, or a code which uses the methodolgy given in Regulatory Guide 1.109, with the actual locations, real-time meteorology and the pathways which actually exist at these locations. The code shall be run separately for ventilation, process gas, containment vacuum system, aerated ventilation and containment purges.

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

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

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

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

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

Where:

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

The following guidelines shall be used for D_T and D_O:

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

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

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

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

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

4. Gaseous Effluent Monthly Dose Projections

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

a. Unit 1 Projection Method

None required.

~~(1) Due to Gaseous Radwaste Treatment System (Offgas) (Unit 1)~~

~~If the augmented offgas system is expected to be out of service during the month, determine the noble gas air doses from the following:~~

$$\cancel{D^E_{MG}\ (\text{mrad}) = 8.0 \times Q \times R \times d}$$
$$\cancel{D^E_{MB}\ (\text{mrad}) < 0.08 \times Q \times R \times d}$$

~~Where:~~

~~Q = Estimated curies/sec at the air ejector at the expected maximum power for the month.~~

~~R = Estimated curie reduction factor from air ejector to stack via the 30 minute (actual time is approximately 55 minutes) holdup line (in decimal fraction).~~

~~d = Estimated number of days the 30 minute holdup pipe will be used.~~

~~D^E_{MG} = Estimated monthly gamma air dose.~~

~~= 9.3×10^{-5} mrad/Ci* x Q Ci/sec x R x d (day) x 8.6×10^{4} sec/day~~

~~D^E_{MB} = Estimated monthly beta air dose.~~

~~* *See* the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2, for dose factor derivation.*~~

~~(2) Due to Ventilation System Releases (Unit 1)**~~

~~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~~

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

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

~~Where:~~

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

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

~~R_3 = The estimate of the fraction of the time which the equipment is expected to be inoperable during the next month.~~

~~ii. Method 2~~

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

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

b. Unit 2 Projection Method

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

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

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

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

Where:

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

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

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

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

i. Method 1

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

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

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

Where:

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

ii. Method 2

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

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

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

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

i. **Method 1**

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

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

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

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

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

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

ii. **Method 2**

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

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

c. **Unit 3 Projection Method**

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

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

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

Where:

C^E_N = the number of curies of noble gas estimated to be released from the reactor plant gaseous vents (the activity from this pathway increases when the process waste gas system is out of service.) during the next month.

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

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

(The dose conversion factor is from the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2,* for the ~~Unit 1~~Site sStack releases since the Unit 3 reactor plant gaseous vents are discharged via the ~~Unit 1~~Site sStack.)

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

5. Quarterly Dose Calculations for ~~Annual~~ Radioactive Effluent Release Report

Detailed quarterly gaseous dose calculations required for the ~~Annual~~ *Radioactive Effluent Release Report* shall be done using the computer codes GASPAR and AIREM, or codes which use the methodolgy given in Regulatory Guide 1.109,.

6. Compliance with 40CFR190

The following sources shall be considered in determining the total dose to a real individual from uranium fuel cycle sources:

a. **Gaseous Releases** from Units 1, 2, and 3.
b. **Liquid Releases** from Units 1, 2, and 3.
~~c. **Direct and Scattered Radiation** from Unit 1 Turbine Shine.~~
~~d~~c. **Direct and Scattered Radiation** from Radioactive Material Stored on Site.
~~e~~d. Since all other uranium fuel cycle sources are greater than 5 miles away, they need not be considered.

The Radioactive Effluents Technical Specifications (RETS) contain specific requirements in REMODCM, Section III, Control D.3, for Unit 1and Technical Specification 3.11.3 for Units 2 & 3 for ensuring compliance with 40CFR190 based on gaseous and liquid doses (sources **a** and **b**).

~~Calculations and detailed surveys* were used to characterize off-site exposure from "Skyshine" (source c) from the Unit 1 Turbine Building. The location of maximum dose is that of the critical fisherman. Listed below are the assumptions used for the calculation of this dose:~~

~~**CALCULATION OF SKYSHINE CONTRIBUTION TO CRITICAL FISHERMAN****~~

~~(1) Based upon data obtained by Don Landers (MP Env. Lab) from the State of CT Department of Environmental Protection (DEP) records on lobster catches:~~
~~Annual average of 3.5-4.5 days between trips to each lobster basket.~~
~~(2) Therefore, there are 104 trips per year.~~
~~(3) Conservatively, assuming it takes one hour in the area to check all the baskets, this results in 104 hours around the intake structures areas.~~
~~(4) Maximum dose rate in the area is normally 65 μR/hr.~~
~~(5) Average dose rate is approximately one-half of the maximum.~~
~~(6) Therefore, annual dose to critical lobsterman is approximately 104 hours/year x 65 μR/h x 1/2 = 3.4 mrem.~~
~~(7) Multiplication to account for increase due to hydrogen water chemistry (HWC).~~
~~(8) Therefore, dose/month =~~

$$\cancel{3.4\frac{\text{mrem}}{\text{year}} \times \frac{\text{year}}{12\text{ months}} \times \text{Unit 1 Capacity Factor} = 0.3\frac{\text{mrem}}{\text{month}} \times \text{Unit 1 Capacity Factor} \times \text{HWC Factor}^{+}}$$

~~+For operation without hydrogen injection, HWC = 1.~~

~~There are three things that could increase the Skyshine doses. First, would be an increase in the percent of N-16 in main steam. This occurs at plants implementing hydrogen water chemistry (HWC) and was observed at the Unit 1 mini test. Based on this test and data from other HWC plants an HWC factor increase in the range of 1.5 to 4 for feedwater hydrogen of 0.4 to 0.8 ppm and a factor increase from 4 to 5 for 0.8 to 2.0 ppm would be expected. Hence, any process that could increase N-16 main steam concentrations would require a detailed Radiological Environmental Review to ensure limits are met. Second, would be removal of shielding within the Unit 1 Turbine Building. This is not expected, but would definitely receive a radiological review if it occurred. Third, would be an increased occupancy time by a member of the public off site such that the combined occupancy and dose rate exceeded that assumed for the fisherman. Since the dose rate decreases rapidly with distance, this would only be expected to be an activity very near the Unit 1 intake structure. The Safety Analysis Branch (SAB) should be informed by anyone who becomes aware of any activity by a member of the public that could be expected to exceed 50 hours per year in this location.~~

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

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

~~* Memo to P. L. Tirinzoni from J. W. Doroski and C. A. Flory, Skyshine Evaluation at Millstone Unit #1, NE-87-RA-1033, December 8, 1987.~~

~~** This should be the most limiting individual since it is expected that even though fishermen may spend more time near the area, they normally fish in an area of ~1 μR/hr.~~

7. Bases for Gaseous Pathway Dose Calculations

The dose calculation methodology and parameters used in Section II of the REMODCM implement the requirements in Section III.A of Appendix I (10CFR50) which states that conformance with the ALARA dose objectives of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. Operational flexibility is provided by controlling the instantaneous release rate of noble gas (as well as iodines and particulate activity) such the maximum off-site dose rates are less than the equivalent of 500 mrem/year to the whole body, 3000 mrem/year to the skin from noble gases, or 1500 mrem/year to a critical organ from the inhalation of iodines, tritium and particulates. The dose rate limits are based on the 10CFR20 (pre-1991) annual dose limits, but applied as an instantaneous limit to assure that the actual dose over a year will be well below these numbers.

The equivalent instantaneous release rate limits for ~~Unit 1~~Site Stack were determined using the EPA AIREM code. For Units 2 & 3, these doses were calculated using the NRC GASPAR code. The AIREM code calculates cloud gamma doses using dose tables from a model that considers the finite extent of the cloud in the vertical direction. Beta doses are calculated assuming semi-infinite cloud concentrations, which are based upon a standard sector averaged diffusion equation. The GASPAR code implements the models of NRC Regulatory Guide 1.109, Rev. 1, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I." Input parameter values typically used in the dose models are listed in the Station Reference Manual, "*REMODCM Technical Information Document (MP-13-REM-REF02)*. This same methodology is used in the determination of compliance with the 40CFR190 total dose standard for the gaseous pathways.

In the determination of compliance with the dose and dose rate limits, maximum individual dose calculations are performed at the nearest land site boundary with maximum decayed X/Q, and at the nearest vegetable garden (assumed to be nearest residence) and cow and goat farms with maximum D/Qs. The conversion constants in the Method I equations for maximum air doses, organ and whole body doses, and dose rates are based on the maximum observed comparison of historical effluent releases and corresponding calculated maximum doses. The dose conversion factors are calculated based on the ratio of the observed highest dose and the curies of fission and activation products released during the period. This ratio results in the Method I equation conversion factor in mrem/Ci released. Reference Manual MP-13-REM-REF02 describes the derivation of the Method 1 constants and list the historical maximum doses calculated for the maximum organ.

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

11a. Unit 3 Steam Generator Blowdown

The alarm setpoint for this monitor assumes:

a. Steam generator blowdown rate of 400 gpm (maximum blowdown total including weekly cleaning of generators - per ~~3 Part Memo from MP3 Reactor Engineering~~ ERC 25212-ER-99-0133).

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

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

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

Therefore, the alarm setpoint corresponds to a concentration of:

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

This setpoint may be increased through proper administrative controls if the steam generator blowdown rate is maintained less than 400 gpm and/or more than 2 circulating and 2 service water pumps are available. The amount of the increase would correspond to the ratio of flows to those assumed above or:

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

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

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

* In lieu of using the I-131 MPC value, the identified MPC values for unrestricted area may be used.

11b. Unit 3 Steam Generator Blowdown Effluent Concentration Limitation

The results of analysis of blowdown samples required by Table I.C-3 of Section I of the REMODCM shall be used to ensure that blowdown effluent releases do not exceed the concentration limits in 10CFR20, Appendix B (version prior to January 1, 1994).

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

12a. Unit 3 Turbine Building Floor Drains Effluent Line

The alarm setpoint for this monitor assumes:

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

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

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

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

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

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

The setpoint corresponding to 0.75 mrem to the child's thyroid is 3.8×10^{-5} µCi/ml.

12b. Unit 3 Service Water and Turbine Building Sump Effluent Concentration Limitation

Results of analyses of service water and turbine building sump samples taken in accordance with Table I.C-3 of Section I of the REMODCM shall be used to limit radioactivity concentrations in the service water and turbine building sump effluents to less than the limits in 10CFR20, Appendix B (version prior to January 1, 1994).

13. Bases for Liquid Monitor Setpoints

Liquid effluent monitors are provided on discharge pathways to control, as applicable, the release of radioactive materials in liquid effluents during actual or potential releases of liquid waste to the environment. The alarm / trip setpoints are calculated to ensure that the alarm / trip function of the monitor will occur prior to exceeding the limits of 10 CFR Part 20 (Appendix B, Table II, Column 2), which applies to the release of radioactive materials from all units on the site. This limitation also provides additional assurance that the levels of radioactive materials in bodies of water in Unrestricted Areas will result in exposures within the Section II.A design objectives of Appendix I to 10 CFR Part 50 to a member of the public.

In application, the typical approach is to determine the expected concentration in a radioactive release path and set the allowable discharge rate past the monitor such the existing dilution flow will limit the effluent release concentration to 10% of the MPC limit for the mix. The setpoint is then selected to be only 2 times the expected concentration, or 20% of the MPC limit. As a result, considerable margin is included in the selection of the setpoint for the monitor to account for unexpected changes in the discharge concentration or the contribution from other potential release pathways occurring at the same time as the planned effluent release. For those monitors on systems that are not expected to be contaminated, the alarm point is usually selected to be two times the ambient background to give notice that normal conditions may have changed and should be evaluated.

II.F. GASEOUS MONITOR SETPOINTS

1. ~~Unit I Hydrogen Monitor~~Section reserved

~~Per *Section III.C.3* of the *Radiological Effluent Controls*, the alarm setpoint shall be less than or equal to 4% hydrogen by volume. [Note: This parameter is pertinent only during the operational period of the plant. Power operations has permanently ceased.]~~

2. ~~Unit 1 Steam Jet Air Ejector Offgas Monitor~~Section reserved

~~[Note: This parameter is pertinent only during the operational period of the plant. Power operations has permanently ceased.]~~

~~Radiological Effluent Control III.C.2 requires the alarm setpoint to be set up to ensure that the instantaneous noble gas release rate limits from the stack are not exceeded.~~

~~Radiological Effluent Control III.C.4 specifies the maximum allowed noble gas in-process activity to be 1.47 x 10⁶ μCi/sec. The value of 1.47 x 10⁶ μCi/sec is based on an assumed release of the entire inventory in the off gas treatment system with 95% worst case meteorology. At that level, the dose would still be less than 10CFR20 limits.~~

~~Based on *Section II.F.3 (below)*, the stack instantaneous release rate limit for MP-1 (assuming 1/3 of the site limit) is 363,000 μCi/sec. Assuming an approximate two factor decay from the air ejector monitor to the stack when using the 50 minute hold-up pipe, the corresponding activity at the air ejector is 700,000 μCi/sec and, hence, is more limiting than the 1.47 x 10⁶ μCi/sec. When using the off gas treatment system, the decay factor is greater than 40, and hence, the 1.47 x 10⁶ μCi/sec is more limiting.~~

~~The trip setpoint should be established by Station Chemistry to ensure Technical Specification Limits are met based on latest conversion factor from mR/hr to μCi/sec. Chemistry should specify the mR/hr corresponding to the following noble gas activity rates at the air ejector monitor:~~

~~With of gas treatment system out of service: ———— ≤ 700,000 μCi/sec~~
~~With all flow thru off gas treatment system: ———— ≤ 1,470,000 μCi/sec~~

~~To avoid having to re-adjust the setpoint with a change in off gas treatment, it is recommended that the alarm correspond to ≤ 700,000 μCi/sec unless a higher value is necessary to continue operations.~~

II.F. GASEOUS MONITOR SETPOINTS (Cont'd)

3. ~~Unit 1~~Site Stack Noble Gas Monitor

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a in order to satisfy ~~*Radiological Effluent Control III.D.2.1.*~~ Units 2 and 3 Technical Specification 3.3.3.10.

The alarm setpoint shall be set at or below the "cps" corresponding to 363,000 μCi/sec from the ~~MP1~~Site ~~s~~Stack noble gas monitor calibration curve. The calibration curve (given as μCi/sec per cps) is determined by assuming a maximum ventilation flow of 180,000 CFM.

The release rate value of 363,000 μCi/sec assumes that 33% of the site limit is assigned to the ~~MP1~~Site ~~s~~Stack. If effluent conditions from the ~~MP1~~Site ~~s~~Stack approach the alarm setpoint, it may be increased if the MP2 or MP3 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.*

4. ~~Unit 1 Main~~Site Stack Sampler Flow Rate Monitor

The ~~MP1 main~~Site ~~s~~Stack sampler flow control alarms on low pressure indicating loss of flow, or on high pressure indicating restricted flow.

The alarm will occur with either (per GEK-27681A):

a. Pressure Switch #1 less than 2" Hg (Low Flow, i.e., damaged filter, filter inadvertently left out)

or

b. Pressure Switch #1 greater than 18" Hg (Restricted Flow, i.e., plugged filter)

or

c. Pressure Switch #2 less than 20" Hg (Restricted Flow, i.e., pump abnormalities)

5. Unit 2 Vent - Noble Gas Monitor

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a in order to satisfy *Technical Specifications 3.3.3.10 and 3.11.2.1.*

The alarm setpoint shall be set at or below the "cpm" corresponding to 95,000 μCi/sec from the MP2 vent noble gas monitor calibration curve. The calibration curve (given as μCi/sec per cpm) is determined by assuming the maximum possible ventilation flow for various fan combinations. Curves for three different fan combinations are normally given.

The release rate value of 95,000 μCi/sec assumes that 33% of the site limit is assigned to the MP2 vent. If effluent conditions from the MP2 vent approach the alarm setpoint, it may be increased if the ~~MP1~~Site ~~s~~Stack or MP3 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.* ~~Prior to decreasing the MP1 stack setpoint, evaluate if the MP1 steam jet air ejector setpoint needs to be changed, to comply with *Radiological Effluent Control III.C.2 (see Section II.F.2).*~~

II.F. GASEOUS MONITOR SETPOINTS (Cont'd)

6. Unit 2 Waste Gas Decay Tank Monitor

Administratively all waste gas decay tank releases are via the ~~MP1~~Site ~~s~~Stack which has a release rate limit typically set at 363,000 μCi/sec (see the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2* for bases). Assuming 33% of the limit is from the ~~MP1~~Site ~~s~~Stack, the release rate limit for ~~MP1~~the Site Stack is 363,000 μCi/sec.

Releases from waste gas decay tanks are much lower than this limit and are based upon a dilution factor of 1000 (dilution less than 1% of the worst case quarter X/Q; 210,000 ft^3/min x 6.3 x 10^{-8} sec/m^3 x 0.028317 m^3/ft^3 x 1/60 min/sec = 1/160,000, which is equivalent to 0.6245% of a dilution factor of 1000) and release rates to maintain offsite concentration below MPC values.

The MP2 waste gas decay tank monitor (given μCi/cc per cpm) calibration curve is used to assure that the concentration of gaseous activity being released from a waste gas decay tank is not greater than the concentration used in discharge permit calculations.

7. Unit 3 Vent Noble Gas Monitor

The instantaneous release rate limit from the site shall be set in accordance with the conditions given in Section II.D.1.a in order to satisfy *Technical Specification 3.3.3.10 and 3.11.2.1.*

The alarm setpoint shall be set at or below a value of 9.5 x 10^{-4} μCi/cc for the MP3 vent.

The release rate value of 9.5 x 10^{-4} μCi/cc assumes that 33% of the site limit is assigned to the MP3 vent. This value corresponds to a release rate of 95,000 μCi/sec and a maximum ventilation flow rate of 210,000 CFM (per memo from G. C. Knight to R. A. Crandall, MP-3-1885, July 19, 1989). If effluent conditions from the MP3 vent approach the alarm setpoint, it may be increased if the ~~MP1~~Site ~~s~~Stack or MP2 vent setpoints are also changed to ensure that the sum of the allowed individual unit noble gas release rates do not exceed the site limit as dictated in Section II.D.1.a, and described in the *REMODCM Technical Information Document (MP-12-REM-REF02), Section 4.2.*

8. Unit 3 Engineering Safeguards Building Monitor

Assuming releases less than 10% of the MP3 FSAR design releases of noble gases *(Table 11.3-11,* 1.4 x 10^4 Ci/year which is equal to 450 μCi/sec) assures that less than 1% of the above instantaneous release rate is added by this intermittent pathway (450/290,000 = 0.16%). Assuming a flow rate of 6,500 CFM (3.05 x 10^6 cc/sec) for this pathway translates this limit to:

$$0.1 \times 450/3.05 \times 10^6 = 1.5 \times 10^{-5}\ \mu Ci/cc$$

The Alarm setpoint shall be set at or below this value.

APPENDIX II.A

REMODCM METHODOLOGY CROSS-REFERENCES

Radiological effluent controls (Section III of the REMODCM for Unit 1, and Radiological Effluent Technical Specifications for Units 2 and 3) 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.

Tables App. II.A-1 (Unit 1) and App. II.A-2 (Units 2 & 3) provide a cross-reference guide between liquid and gaseous effluent release limits and those sections of the REMODCM, which are used to determine compliance. These tables also provide a quick outline of the applicable limits or dose objectives and the required actions if those limits are exceeded. Details of the effluent control requirements and the implementing sections of the REMODCM should be reviewed directly for a full explanation of the requirements.

TABLE APP. II.A-2

MILLSTONE UNITS 2 and 3

EFFLUENT REQUIREMENTS AND METHODOLOGY CROSS REFERENCE

Technical Specification Section	REMODCM Methodology Section	Applicable Limit or Objective	Exposure Period	Required Action
3/4.11.1 Liquid Effluent Concentration	Tables I.C-2 and I.C-3	10CFR20, App. B., Table II, Column 2, and $2x10^{-4}$ µCi/mL for dissolved noble gases*	Instantaneous	Restore concentration to within limits within 15 minutes.
3/4.11.1.2 Dose-Liquids	II.C.1 II.C.2 II.C.3 II.C.4	≤1.5 mrem T.B. ≤5 mrem organ ≤3 mrem T.B. ≤10 mrem organ	Calendar Quarter Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of calculations shall be confirmed by performance of the REMP in Section I.
6.15 Liquid Radwaste Treatment	I.C.2 II.C.5	>0.06 mrem T.B. >0.2 mrem organ	Projected for 31 days	Return to operation Liquid Waste Treatment System.
3/4.11.2 Gaseous Effluents Dose Rate	II.D.1.a II.D.1.b	≤500 mrem/yr T.B. from noble gases* ≤3000 mrem/yr skin from noble gases* ≤1500 mrem/yr organ from particulates with T½ > 8d., I-131, I-133, and tritium*	Instantaneous	Restore release rates to within specifications within 15 minutes.
3/4.11.2.2 Dose-Noble Gases	II.D.2	≤5 mrad gamma air ≤10 mrad beta air ≤10 mrad gamma air ≤20 mrad beta air	Calendar Quarter** Calendar Year	30-day report if exceeded.
3/4.11.2.3 Dose I-131, I-133, Particulates, H-3	II.D.3	≤7.5 mrem organ ≤15 mrem organ	Calendar Quarter** Calendar Year	30-day report if exceeded. Relative accuracy or conservatism of calculations shall be confirmed by performance of the REMP in Section I.
6.15 (Unit 2) 6.13 (Unit 3) Gaseous Radwaste Treatment	I.D.2 II.D.4	>0.02 mrad gamma air >0.04 mrad beta air >0.03 mrem organ	Projected for 31 days (if system not in use)	Return to operation Gaseous Radwaste Treatment System.
3/4.11.3 Total Dose	II.D.6	≤25 mrem T.B.* ≤25 mrem organ* ≤75 mrem thyroid*	12 Consecutive Months**	30-day report if Tech Spec 3.11.1.2, 3.11.2.2, or 3.11.2.3 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.