3.17 RELEASE OF GASEOUS RADIOACTIVE WASTE

Applicability: Applies to the controlled release of all gaseous waste discharged from the plant which may contain radioactive materials.

Objective: To establish conditions in which gaseous waste containing radioactive materials may be released and to assure that all such releases are within the concentration and dose limits specified in 10 CFR Part 20. In addition, to assure that the releases of gaseous radioactive wastes (above background) to unrestricted areas meet the as low as practicable concept, the following objectives shall apply:

1. Averaged over a yearly interval, the release rate of radioactive isotopes, except I-131 and particulate radioisotopes with half lives greater than 8 days, discharged at the plant stack, shall be limited as follows:

$$\sum \frac{Qi}{(MPC)i} \leq 800 \text{ m}^3/\text{sec}$$

where Qi is the annual controlled release rate (Ci/sec) of radioisotope i and (MPC)i (μci/cc) is defined for radioisotope i in column 1, Table II of Appendix B to 10 CFR 20.

2. Averaged over a yearly interval, the release rate of I-131 and other particulate radioisotopes with half lives longer than 8 days, discharged at the plant stack, shall be limited as follows:

$$\sum \frac{Qi}{(MPC)i} \leq 5.6 \text{ m}^3/\text{sec}$$

where Qi and (MPC)i are as defined above.

Specifications: A. Release Quantities and Concentrations of Radioactive Materials in Gaseous Waste

1. If the experienced rate of release of radioactive materials in gaseous wastes, when averaged over a calendar quarter is such that these quantities if continued at the same release rate for a year would exceed twice the annual objectives, the licensee will:

   a. make an investigation to identify the causes for such release rates;

   b. define and initiate a program of action to reduce such release rates to the design levels;

c. describe these actions in a report to the Commission within 30 days.

2. If the experienced rate of release of radioactive material in gaseous wastes, when averaged over a calendar quarter, is such that these quantities if continued at the same release rate for a year would exceed eight times the annual objectives, the licensee shall define and initiate a program of action to assure that such release rates are reduced, and shall submit a report to the Commission within 7 days describing the causes for such release rates and the course of action taken to reduce them.

3. The rate of release of radioactive materials in gaseous waste from the plant (except I-131 and particulate radioisotopes with half lives greater than 8 days) shall be controlled such that the maximum release rate averaged over any one-hour period shall not exceed:

$$\sum \frac{Qi}{(MPC)i} = 3.1 \times 10^4 \text{ m}^3/\text{sec}$$

B. Treatment and Monitoring

1. At least one exhaust fan shall be in operation when radioactive gaseous wastes are released to the stack.

2. During release of radioactive gaseous waste from the gaseous waste decay drums to the stack, the following conditions shall be met:

a. The gas decay drum effluent monitor and the stack sampling devices for halogens and particulates shall be operable. The normal response of the decay drum effluent monitor shall be verified by comparison with the prerelease sample analysis. The monitor shall be tested prior to any release of radioactive gas from a decay drum and shall be calibrated at refueling intervals. The calibration procedure shall consist of exposing the detector to a referenced calibration source in a controlled reproducible geometry. The source and geometry shall be referenced to the original monitor calibration which provides the applicable calibration curves.

b. The gaseous waste from the decay drums shall be filtered through the high efficiency particulate air filters and the charcoal adsorber provided.

3. a. During normal conditions of plant operation, radioactive gaseous waste from the hydrogenated waste gas system shall be provided a minimum average holdup of 60 days except for low radioactivity gaseous waste resulting from purge and fill operations associated with refueling and reactor startup.

   b. Holdup time less than that specified in B.3.a above shall be covered in the special effluent report required by Section 5.7.E.3 of these specifications.

   c. The maximum activity to be contained in one gas decay tank shall not exceed 88,400 curies of Xe-133 equivalent.

4. During the first indication of primary-to-secondary leakage, concurrent with sufficient fuel defects, a determination of the iodine partition factor for the blowdown tank shall be made.

5. During power operation, the condenser air ejector discharge shall be continuously monitored for gross radiogas activity. Whenever this monitor is inoperable, grab samples shall be taken from the air ejector discharge and analyzed for gross radiogas activity daily.

6. Gases discharged through the stack shall be continuously monitored for gross noble gas and particulate activity. Whenever either of these monitors is inoperable, appropriate grab samples shall be taken and analyzed daily.

7. Purging of the reactor building shall be governed by the following conditions:

   a. Reactor building purge shall be filtered through the high efficiency particulate air filters and charcoal adsorbers whenever the concentration of iodine and particulate isotopes exceed the occupational MPC inside the reactor building.

   b. Reactor building purge shall be filtered through the high efficiency particulate air filters and charcoal adsorbers whenever irradiated fuel is being handled or any object is being handled over irradiated fuel in the reactor building.

C. Sampling and Analysis

In addition to the above continuous sampling and monitoring requirements, gaseous radioactive waste sampling and activity analysis shall be performed in accordance with Table 3.17-1. Records shall be maintained and reports of the sampling and analysis results shall be submitted in accordance with Sections 5.6 and 5.7 of these Specifications.

Basis:

It is expected that the releases of radioactive materials in gaseous waste will be kept within the design objective levels and will not exceed on an instantaneous basis the dose rate limits specified in 10 CFR Part 20.

These levels provide reasonable assurance that the resulting annual exposure from noble gases to the whole body or any organ of an individual will not exceed 5 millirems per year. At the same time, the licensee is permitted the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in releases higher than the design objective levels but still within the concentration limits specified in 10 CFR Part 20. It is expected that using this operational flexibility under unusual operating conditions, the licensee shall exert every effort to kepp levels of radioactive material in gaseous wastes as low as practicable and that annual releases will not exceed a small fraction of the annual average concentration limits specified in 10 CFR Part 20. These efforts shall include consideration of meteorological conditions during releases.

The design objectives have been developed taking into account a combination of system variables including fuel failures, primary system leakage and the performance of radioisotope removal mechanisms. The values assumed for these variables include the following:

a. Reactor coolant fission product concentration corresponding to 0.1% fuel cladding defects;

b. Steam generator primary-to-secondary leak rate of 0.01 gpm;

c. Steam generator blowdown rate of 5 gpm;

d. Reactor coolant leakage to the containment building of 0.25 gpm and four containment vents per year;

e. Partition factor of 1000 for iodine in aerated drains tanks;

f. Gas decay drums average 60 days holdup;

g. Decontamination factor of 1000 for iodine in the degassifier;

h. Charcoal filter efficiency of 99% for iodine on the air ejector, aerated vent and gas decay drum systems.

The application of the above estimates result in the radiogas discharge rates shown in Table 3.17-2.

The noble gas release rate stated in the objectives is based on a X/Q value from the annual meteorological data. The dispersion factor used, 2.59×10^{-5} sec/m^3, is conservative and controls the release rate to a small fraction of 10 CFR Part 20 requirements at the site restricted area boundary (<10 mrem per year).

The I-131 and particulate release rate stated in the objectives limits the concentration at the restricted area boundary to less than 1% of the MPC listed in 10 CFR 20. The release rate also controls the expected concentrations at nearby commercial dairy farms to much less than 1/100,000 of the 10 CFR 20 requirements.

The maximum one-hour release rate limits the dose rate at the site boundary to less than 2 mrem/hour even during period of unfavorable meteorology. (Moderately stable conditions with 2 m/sec wind speed).

The maximum activity in a waste gas decay drum is specified as 88,400 curies of Xe-133 equivalent based on a postulated rupture that allows all of the contents to escape to the atmosphere. This specification limits the maximu offsite dose to well below the limits of 10 CFR 100.

The gaseous waste system is divided into two sections; aerated gases and hydrogenated gases. Low activity, aerated gaseous wastes are discharged to the aerated gas header and through a high efficiency filter to the primary vent stack. Hydrogenated gaseous wastes flow from the surge drum and through the gas compressor which discharges to the waste gas decay drum. The drum is pressurized and then isolated for decay of the gaseous wastes before discharge to the primary vent stack. The gaseous discharge is continuously monitored both in the vent line to the primary auxiliary building fan suction and in the stack. Upon detection of high activity in the vent line or upon the loss of ventilation fan suction, the vent line flow control valve will close, terminating the release of gaseous waste.

The quantity and isotopic proportions of radioactive gases released into the reactor coolant system is dependent upon several factors including fuel leakage, burnup and power level. Changes in power level will affect gaseous generation rates temporarily. Gases are released from the reactor coolant to the gaseous waste system during degassifier treatment of the letdown and leakage water and also during venting of the system. This venting may occasionally be performed to degas the system and so control plant chemistry and/or reduce coolant radioactive gas concentrations to an acceptable value for the protection of plant personnel.

Gaseous waste holdup and decay occurs while it is retained in the reactor coolant system and in the surge drum of the gaseous treatment system. The gaseous waste holdup drums are of sufficient capacity to provide an additional average retention period of 60 days during normal operating conditions.

The low as practicable gaseous release objectives expressed in this Specification are based on the guidelines contained in the proposed Appendix I of 10 CFR 50. Since these guidelines have not been adopted as yet, the release objectives of this Specification will be reviewed at the time Appendix I becomes a regulation to assure that this Specification is based upon the guidelines contained therein.

Table 3.17-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

A. Gas Decay Drum Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis (1)
Gas	Each Drum Release	Gross Gamma	10^{-5} μCi/cc
		Individual Gamma Emitters	10^{-4} μCi/cc (2)

B. Containment Venting Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis (1)
Gas	Each Vent	Gross Gamma	10^{-5} μCi/cc
		Individual Gamma Emitters	10^{-4} μCi/cc (2)
Dehumidified Sample	Each Vent	H-3	10^{-6} μCi/cc

C. Condenser Air Ejector Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis (1)
Gas	Monthly	Gross Gamma	10^{-4} μCi/cc
		Individual Gamma Emitters	10^{-3} μCi/cc (2)

Table 3.17-1 (cont'd)

D. Stack Releases

Sample Type	Sampling Frequency	Type of Activity Analysis	Sensitivity of Analysis (1)
Gas	Quarterly	Gross Gamma	10^{-6} μCi/cc
		Individual Gamma Emitters	10^{-5} μCi/cc (2)
Dehumidified Sample	Each Decay Drum Release	H-3	10^{-6} μCi/cc
Charcoal	Weekly	I-131, I-133, I-135	3×10^{-12} μCi/cc
Particulates	Weekly	Gross β, γ	3×10^{-12} μCi/cc
	Weekly	Ba-140, La-140, I-131	3×10^{-11} μCi/cc
	Monthly Composite of Weekly Samples	Gross β, γ	3×10^{-12} μCi/cc
		Individual Gamma Emitters	3×10^{-11} μCi/cc
	Quarterly Composite of Weekly Samples	Sr-89, Sr-90	1×10^{-11} μCi/cc
	One Weekly Sample/Quarter	Gross α	3×10^{-12} μCi/cc

NOTES:

(1) The above activity analysis sensitivities are based on the projected capability of laboratory instrumentation and techniques to be employed by Maine Yankee. In order to assure that actual Maine Yankee operating experience is utilized, a reevaluation will be performed within 2 years of initial full power operation of the plant.

(2) For certain mixtures of gamma emitters, it may not be possible to measure radionuclides at levels near their sensitivity limits when other nuclides are present in the sample at much higher levels. Under these circumstances, it will be more appropriate to calculate the levels of such radionuclides using observed ratios with those radionuclides which are measurable.

Table 3.17-2

GASEOUS RADIOACTIVE RELEASES

Isotope	Reactor Coolant Concentration (μCi/ml @ 70°F)	Release Rate, μCi/sec				
		Aerated Vents	Air Ejector	Containment Vent	Decay Drums	Total
I-131	2.99-1*	1.28-4	1.09-4	4.2-4	2.0-6	6.6-4
I-132	1.12-1	4.83-5	1.59-6	1.96-6	---	5.2-5
I-133	5.02-1	2.16-4	5.31-5	7.9-5	---	3.5-4
I-134	7.55-2	3.22-5	1.0-7	4.95-8	---	3.2-5
I-135	2.80-1	1.2-4	1.1-5	1.41-6	---	1.3-4
Kr-85	1.04	---	6.56-1	1.2+1	3.4+1	4.7+1
Kr-85m	1.9-1	---	1.2-1	6.27-3	---	1.26-1
Kr-87	1.08-1	---	6.8-2	1.05-3	---	6.9-2
Kr-88	3.26-1	---	2.06-1	6.8-3	---	2.1-1
Xe-131m	1.25-1	---	7.88-2	2.76-1	---	3.6-1
Xe-133	2.52+1	---	1.59+1	2.44+1	---	4.0+1
Xe-135	5.60-1	---	3.53-1	4.26-2	---	4.0-1

*2.99-1 = 2.99×10^{-1}