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Daniel Muller, Assistant Director for Environmental Projects, L

ENVIRONMENTAL TECHNICAL SPECIFICATIONS FOR MONTICELLO NUCLEAR GENERATING PLANT

Plant Name: Monticello, Unit 1
Licensing Stage: OL
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Enclosed are the Environmental Technical Specifications for the radioactive waste treatment and monitoring sections for Monticello Nuclear Generating Plant, Unit 1.

lsl

Victor Benaroya, Chief
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Directorate of Licensing

Enclosure:
As stated

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PROPOSED TECHNICAL SPECIFICATIONS FOR

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NUMBER 50-263

2.4 LIMITING CONDITIONS FOR OPERATION

Radioactive Discharges

Objective: To define the limits and conditions for the controlled release of radioactive materials in liquid and gaseous effluents to the environs to ensure that these releases are as low as practicable. These releases should not result in radiation exposures in unrestricted areas greater than a few percent of natural background exposures. The release rate for all effluent discharges shall be within the limits specified in 10 CFR Part 20.

To ensure that the releases of radioactive material above background to unrestricted areas will be as low as practicable as defined in Appendix I to 10 CFR Part 50, the following design objectives apply:

For liquid wastes:

a. The annual dose above background to the total body or any organ of an individual from all reactors at a site should not exceed 5 mrem in an unrestricted area.

b. The annual total quantity of radioactive materials in liquid waste, excluding tritium and dissolved gases, discharged from each reactor should not exceed 5 Ci.

For gaseous wastes:

c. The annual total quantity of noble gases above background discharged from the site should result in an air dose due to gamma radiation of less than 10 mrad, and an air dose due to beta radiation of less than 20 mrad, at any location near ground level which could be occupied by individuals at or beyond the boundary of the site.

d. The annual total quantity of all radioiodines and radioactive material in particulate forms above background from all reactors at a site should not result in an annual dose to any organ of an individual in an unrestricted area from all pathways of exposure in excess of 15 mrem.

e. The annual total quantity of iodine-131 discharged from each reactor at a site should not exceed 1 Ci.

2.4.1 Specifications for Liquid Waste Discharges

a. The concentration of radioactive materials released in liquid wastes from all reactors at the site shall not exceed the values specified in 10 CFR Part 20, Appendix B, Table II, Column 2, for unrestricted areas.

b. The release rate of radioactive materials in liquid wastes, excluding tritium and dissolved gases, shall not exceed 10 Ci/reactor/calendar quarter.

c. The release rate of radioactive materials in liquid wastes, excluding tritium and dissolved gases, shall not exceed 20 Ci/reactor in any 12 consecutive months.

d. During release of radioactive wastes, the effluent control monitor shall be set to alarm and to initiate the automatic closure of the waste discharge valve prior to exceeding the limits specified in 2.4.1.a above.

e. The operability of the automatic isolation valves in the liquid discharge line shall be demonstrated quarterly.

f. The equipment installed in the liquid radioactive waste system shall be maintained and shall be operated to process radioactive liquid wastes prior to their discharge when the projected cumulative release rate will exceed 1.25 Ci/reactor/calendar quarter, excluding tritium and dissolved gases.

g. The maximum radioactivity to be contained in any liquid radwaste tank that can be discharged directly to the environs shall not exceed 10 Ci, excluding tritium and dissolved gases.

h. When the release rate of radioactive materials in liquid wastes, excluding tritium and dissolved gases, exceeds 2.5 Ci/ reactor/calendar quarter, the licensee shall make an investigation to identify the causes of such release rates, define and initiate a program

of action to reduce such release rates to the design objective levels listed in Section 2.4, and report these actions to the Commission within 30 days from the end of the quarter during which the release occurred.

2.4.2 Specifications for Liquid Waste Sampling and Monitoring

a. Plant records shall be maintained of the radioactive concentration and volume before dilution of liquid waste intended for discharge, and the average dilution flow and length of time over which each discharge occurred. Reports and sample analyses results shall be submitted in accordance with Section 5.6.1 of these specifications. Estimates of the total error associated with each reported value shall be included.

b. Prior to release of each batch of liquid waste, a sample shall be taken from that batch and analyzed for the concentration of each

significant gamma energy peak in accordance with Table 2.4-1 to demonstrate compliance with Specification 2.4.1 using the flow rate of the stream into which the waste is discharged during the period of discharge.

c. Sampling and analysis of liquid radioactive waste shall be performed in accordance with Table 2.4-1. Prior to taking samples from a monitoring tank, at least two tank volumes shall be recirculated.

d. The radioactivity in liquid wastes shall be continuously monitored and recorded during release. Whenever these monitors are inoperable for a period not to exceed 72 hours, two independent samples of each tank to be discharged shall be analyzed and two plant personnel shall independently check valving prior to the discharge. If these monitors are inoperable for a period exceeding 72 hours, no release from a liquid waste tank shall be made and any release in progress shall be terminated.

e. The flow rate of liquid radioactive waste shall be measured and recorded during release.

f. All liquid radwaste effluent radiation monitors shall be calibrated at least quarterly by means of a radioactive source which has been calibrated to a National Bureau of Standards source. Each monitor shall also have a functional test monthly and an instrument check prior to making a release.

Bases: The release of radioactive materials in liquid waste to unrestricted areas shall not exceed the concentration limits specified in 10 CFR Part 20 and should be as low as practicable in accordance with the requirements of 10 CFR Part 50.36a. These specifications provide reasonable assurance that the resulting annual exposure to the total body or any organ of an individual in an unrestricted area will not exceed 5 mrem. At the same time, these specifications permit 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 by using this operational flexibility under unusual operation conditions, and exerting every effort to keep levels of radioactive material in liquid wastes as low as practicable, the annual releases will not exceed a small fraction of the concentration limits specified in 10 CFR Part 20.

The design objectives have been developed based on operating experience taking into account a combination of variables including defective fuel, primary system leakage, and the performance of the various waste treatment systems, and are consistent with Appendix I to 10 CFR Part 50.

Specification 2.4.1.a requires the licensee to limit the concentration of radioactive materials in liquid wastes from the site to levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2, for unrestricted areas. This specification provides assurance that no member of the general public will be exposed to liquid containing radioactive materials in excess of limits considered permissible under the Commission's Rules and Regulations using the guidelines given in Regulatory Guide 1.21.

Specifications 2.4.1.b and 2.4.1.c establish the upper limits for the release of radioactive materials in liquid effluents. The intent of these Specifications is to permit the licensee the flexibility of operation 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 levels normally achievable when the plant and the liquid waste treatment systems are functioning as designed. Releases of up to these limits will result in concentrations of radioactive material in liquid wastes at small percentages of the limits specified in 10 CFR Part 20.

Specifications 2.4.1.d and 2.4.1.e require that suitable equipment to control and monitor the releases of radioactive materials in liquid wastes are operating during any period these releases are taking place consistent with the requirements of 10 CFR Part 50, Appendix A, Design Criterion 64.

Specification 2.4.1.f requires that the licensee maintain and operate the equipment installed in the liquid waste systems to reduce the release of radioactive materials in liquid effluents to as low as practicable consistent with the requirements of 10 CFR Part 50.36a. Normal use and maintenance of installed equipment in the liquid waste system provides reasonable assurance that the quantity released will not exceed the design objective. In order to keep releases of radioactive materials as low as practicable, the specification requires, as a minimum, operation of equipment whenever it appears that the projected cumulative discharge rate will exceed one-fourth of this design objective annual quantity during any calendar quarter.

Specification 2.4.1.g limits the amount of radioactivity that may be inadvertently released to the environment to an amount that will not exceed the Technical Specification limit.

In addition to limiting conditions for operation listed under Specification 2.4.1.b and 2.4.1.c the reporting requirements of Specification 2.4.1.h delineate that the licensee shall identify the cause whenever the release rate of radioactive materials in liquid wastes exceed one-half the design objective annual quantity during any calendar quarter and describe the proposed program of action to reduce such release rate to design objective levels on a timely basis. This report must be filed within 30 days following the calendar quarter in which the release occurred.

The sampling and monitoring requirements given under Specification 2.4.2 provide assurance that radioactive materials in liquid wastes are properly controlled and monitored in conformance with the requirements of Design Criteria 60 and 64. These requirements provide the data for the licensee and the Commission to evaluate the plant's performance relative to radioactive liquid wastes released to the environment. Reports on the quantities of radioactive materials released in liquid wastes are furnished to the Commission according to Section 5.6.1 of these Technical Specifications in conformance with Regulatory Guide 1.21. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

The environmental release points to be monitored in Section 2.4.2 include all the monitored release points as provided for in Table 2.4.3.

2.4.3 Specifications for Gaseous Waste Discharges

a. (1) The release rate limit of noble gases shall be:

$$\sum_{i \to n} Q_s \left[5\ E_\gamma + 2\ E_\beta \right] + Q_v \left[28\ E_\gamma + 64\ E_\beta \right] \leq 1$$

where Q_s = release rate from main stack in Ci/sec (elevated release)

Q_v = release rate from vents in Ci/sec (ground release)

i = the individual nuclide. n = total nuclides.

$\bar{E}_\gamma$ = the average gamma energy per disintegration

$\bar{E}_\beta$ = the average beta energy per disintegration

Refer to Table 2.4-5 for $\bar{E}_\gamma$ and $\bar{E}_\beta$ values to be used.

(2) The release rate limit of all radioiodines and radioactive materials in particulate form with half-lives greater than eight days, released to the environs as part of the gaseous wastes shall be:

$$4.9 \times 10^4 Q_s + 2.7 \times 10^6 Q_v \leq 1$$

where Q_s = release rate from the main stack in Ci/sec (as elevated release)

Q_v = release rate from the vents in Ci/sec (ground release)

b. (1) The average release rate of noble gases during any calendar quarter shall be:

$$\sum_{i \to n} Q_s\left[31\ E_\gamma + 6.2\ E_\beta\right] + Q_v\left[180\ E_\gamma + 200\ E_\beta\right] \leq 1$$

(2) The average release rate of noble gases during any 12 consecutive months shall be:

$$\sum_{i \to n} Q_s\left[63\ E_\gamma + 13\ E_\beta\right] + Q_v\left[350\ E_\gamma + 400\ E_\beta\right] \leq 1$$

(3) The average release rate of all iodines and radioactive materials in particulate form with half-lives greater than eight days during any calendar quarter shall be:

$$6.1 \times 10^5 Q_s + 3.4 \times 10^7 Q_v \leq 1$$

(4) The average release rate of all iodines and radioactive materials in particulate form with half-lives greater than eight days during any period of 12 consecutive months shall be:

$$1.2 \times 10^6 Q_s + 6.7 \times 10^7 Q_v \leq 1$$

(5) The amount of iodine-131 released during any calendar quarter shall not exceed 2 Ci.

(6) The amount of iodine-131 released during any period of 12 consecutive months shall not exceed 4 Ci.

c. Should the conditions of 2.4.3.c(1), (2) or (3) listed below exist, the licensee shall make an investigation to identify the causes of the release rates, define and initiate a program of action to reduce the release rates to design objective levels listed in Section 2.4 and report these actions to the Commission within 30 days from the end of the quarter during which the releases occurred.

(1) If the average release rate of noble gases during any calendar quarter is:

$$\sum_{i \to n} Q_s \left[125\, E_\gamma + 25\, E_\beta \right] + Q_v \left[700\, E_\gamma + 800\, E_\beta \right] > 1$$

(2) If the average release rate of all iodines and radioactive materials in particulate form with half-lives greater than eight days during any calendar quarter is:

$$2.5 \times 10^6\, Q_s + 1.4 \times 10^8\, Q_v > 1$$

(3) If the amount of iodine-131 released during any calendar quarter is greater than 0.5 Ci.

The offgas monitor shall be operating and set to alarm and to initiate the automatic closure of the waste gas discharge valve prior to exceeding the limits specified in 2.4.3.a(1) above. The operability of the automatic isolation valves shall be demonstrated quarterly.

e. If the offgas monitor is not operating, a shutdown shall be initiated so that the reactor will be in the hot shutdown condition within 10 hours.

f. If the release rate of noble gases from the main condenser vacuum system is:

$$\sum_{i \to n} Q_s \left[63 \quad E_\gamma + 13 \quad E_\beta \right]$$

for a period of greater than 48 hours, notify the Commission in writing within 10 days, identifying the causes of activity. The report should include the flow rate of the offgas from the main condenser vacuum system, and the activity measured downstream of the main condenser vacuum system prior to holdup, and at a point upstream of the point of release.

g. The reactor containment shall be purged through the standby gas treatment system.

h. At least two hydrogen monitors in the offgas line downstream of the recombiners shall be operable during power operation. If the hydrogen concentration reaches an alarm set point of four percent by volume, the offgas flow shall be stopped by closing the valves downstream of the recombiners. Whenever either of these hydrogen monitors are not inoperable during power operation, a program shall be initiated to bring the activity releases within two percent of the limits specified in 2.4.3a(1), and grab samples shall be taken and analyzed for hydrogen concentration each shift. Calibration of the monitoring system shall be performed weekly.

2.4.4 Specifications for Gaseous Waste Sampling and Monitoring

a. Plant records shall be maintained and reports of the sampling and analysis results shall be submitted in accordance with Section 5.6.1 of these Specifications. Estimates of the total error associated with each reported value should be included.

b. Gaseous releases to the environment, except as noted in Specification 2.4.4.c below, shall be continuously monitored for gross radioactivity and the flow measured and recorded. Whenever these monitors are inoperable, grab samples shall be taken and analyzed daily for gross radioactivity. If these monitors are inoperable for more than seven days, these releases shall be terminated.

c. An isotopic analysis shall be made of a representative sample of gaseous activity, excluding tritium, at the discharge of the steam jet air ejectors and at a point prior to dilution and discharge.

(1) within one month of initial criticality,

(2) at least monthly thereafter,

(3) following each refueling outage,

(4) if the gaseous waste monitors indicate an increase of greater than 50% in the steady state fission gas release after factoring out increases due to power changes.

d. All waste gas monitors shall be calibrated at least quarterly by means of a known radioactive source which has been calibrated to a National Bureau of Standards source. Each monitor shall have a functional test at least monthly and an instrument check at least daily.

e. Sampling and analysis of radioactive material in gaseous waste, particulate form, and radioiodine shall be performed in accordance with Table 2.4-2.

Bases: The release of radioactive materials in gaseous wastes to unrestricted areas shall not exceed the concentration limits specified in 10 CFR Part 20, and should be as low as practicable in accordance with the requirements of 10 CFR Part 50.36 These specifications provide reasonable assurance that the resulting annual air dose due to gamma radiation will not exceed 10 mrad, and an annual air dose due to beta radiation will not exceed 20 mrad from noble gases, and that the annual dose to any organ of an individual from iodines and particulates will not exceed 15 mrem. At the same time these specifications permit the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided with 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, and by exerting every effort to keep levels of radioactive material in gaseous wastes as low as practicable, the annual releases will not exceed a small fraction of the concentration limits specified in 10 CFR Part 20. These efforts should include consideration of meteorological conditions during releases.

There is a reduction factor of 243 by which the maximum permissible concentration of radioactive iodine in air should be reduced to allow for the grass-cow-milk pathway.

This factor has been derived for radioactive iodine, taking into account the milk pathway. It has been applied to radionuclides of iodine and to all radionuclides in particulate form with a half-life greater than eight days. The factor is not appropriate for iodine where milk is not a pathway of exposure or for the other radionuclides.

The design objectives have been developed based on operating experience taking into account a combination of system variables including defective fuel, primary system leakage, and the performance of the various waste treatment systems.

For Specification 2.4.3.a(1) dose calculations have been made for the critical sector. These calculations consider site meteorology, buoyancy characteristics, and radionuclide content of the effluent of each unit. Meteorological calculations for offsite locations were performed, and the most critical one was selected to set the release rate. The controlling distance is 756 meters to the south-southeast.

The gamma dose contribution was determined using the equation 7.63 in Section 7-5.2.5 of Meteorology and Atomic Energy - 1968. The releases from vents are considered to be ground level releases which could result in a beta dose from cloud submersion. The beta dose

contribution was determined using Equation 7.21, as described in Section 7-4.1 of Meteorology and Atomic Energy - 1968. The beta dose contribution was determined on the basis of an infinite cloud passage with semi-infinite geometry for a ground level release (submersion dose). The beta and gamma components of the gross radioactivity in gaseous effluents were combined to determine the allowable continuous release rate. Based on these calculations, a continuous release rate of gross radioactivity in the amount specified in 2.4.3.a(1) will not result in offsite annual doses above background in excess of the limits specified in 10 CFR Part 20.

The average gamma and beta energy per disintegration used in the equation of Specification 2.4.3.a(1) will be based on the average composition of gases determined from the plant vent and ventilation exhausts. The average energy per beta or gamma disintegration for those radioisotopes determined to be present from the isotopic analyses are given in Table 2.4-5. Where isotopes are identified that are not listed in Table 2.4-5 the gamma energy are determined from Table of Isotopes, C. M. Lederer, J. M. Hollander, and I. Perlman, Sixth Edition, 1967 and the beta energy shall be as given in USNRDL-TR-802, II. Spectra of Individual Negatron Emitters (Beta Spectra), O. Hogan, P. E. Zigman, and J. L. Mackin.

For Specification 2.4.3.a(2), dose calculations have been made for the critical sectors and critical pathways for all radioiodines and radioactive material in particulate form with half-lives greater than

eight days. The calculations consider site meteorology for these releases.

For radioiodines and radioactive material in particulate form with half-lives greater than eight days, the critical location for ground releases is the SSE sector at a distance of 756 meters where the X/Q is 4.4×10^{-6} sec/m^3 for the dose, due to inhalation. The critical location for elevated releases is the SSE sector at a distance of 756 meters where the X/Q is 1.2×10^{-7} sec/m^3 for the dose, due to inhalation. The nearest milk cow is located in the NW sector at a distance of 2410 meters where the X/Q is 1.1×10^{-6} sec/m^3 for ground releases, and 2.0×10^{-8} sec/m^3 for elevated releases. The grass-cow-milk-child thyroid chain is controlling.

The assumptions used for these calculations are: (1) onsite meteorological data for the most critical 22.5 degree sector; (2) credit for building wake; and (3) a reconcentration factor of 243 was applied for possible ecological chain effects from radioactive iodine and particulate releases where applicable.

Specification 2.4.3.b establishes upper limits for the releases of noble gases, iodines and particulates with half-lives greater than eight days, and iodine-131 at twice the design objective annual

quantity during any calendar quarter, or four times the design objective annual quantity during any period of 12 consecutive months. The intent of this specification is to permit the licensee the flexibility of operation to assure that the public is provided a dependable source of power under unusual operating conditions which may temporarily result in higher releases than the objectives.

In addition to the limiting conditions for operation of Specifications 2.4.3.a and 2.4.3.b, the reporting requirements of 2.4.3.c delineate that the cause be identified whenever the release of gaseous effluents exceeds one-half the design objective annual quantity during any calendar quarter, and describe the proposed program of action to reduce such release rates to the design objectives.

Specification 2.4.3.d and 2.4.3.e are in accordance with Design Criterion 64.

Specification 2.4.3.f is to monitor the performance of the core. A sudden increase in the activity levels of gaseous releases may be the result of defective fuel. Since core performance is of utmost importance in the resulting doses from accidents, a report must be filed within 10 days following the specified increase in gaseous radioactive releases.

Specification 2.4.3.g requires that the primary containment atmosphere receive treatment for the removal of gaseous iodine and particulates prior to its release.

Specification 2.4.3.h requires that hydrogen concentration in the system shall be monitored at all times.

The sampling and monitoring requirements given under Specification 2.4.4 provide assurance that radioactive materials released in gaseous wastes are properly controlled and monitored in conformance with the requirements of Design Criteria 60 and 64. These requirements provide the data for the licensee and the Commission to evaluate the plant's performance relative to radioactive wastes released to the environment. Reports on the quantities of radioactive materials released in gaseous effluents are furnished to the Commission on the basis of Section 5.6.1 of these Technical Specifications and in conformance with Regulatory Guide 1.21. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

The environmental release points to be monitored in Section 2.4.4 include all the monitored release points as provided for in Table 2.4-4.

2.4.5 Specifications for Solid Waste Handling and Disposal

a. Measurements shall be made to determine or estimate the total curie quantity and principle radionuclide composition of all radioactive solid waste shipped offsite.

b. Solid wastes in storage and preparatory to shipment shall be monitored and packaged to assure compliance with 10 CFR Part 20, 10 CFR Part 71, and 49 CFR Parts 171-178.

c. Reports of the radioactive solid waste shipments, volumes, principle radionuclides, and total curie quantity, shall be submitted in accordance with Section 5.6.1.

Bases: The requirements for solid radioactive waste handling and disposal given under Specification 2.4.5 provide assurance that solid radioactive materials stored at the plant and shipped offsite are properly controlled, monitored, and packaged in conformance with 10 CFR Part 20, 10 CFR Part 71, and 49 CFR Parts 171-178. These requirements provide the data for the licensee and the Commission to evaluate the handling and storage facilities for solid radwaste, and to evaluate the environmental impact of offsite shipment and storage. Reports on the quantities and amounts of the radionuclides, and volumes of the shipments, shall be furnished to the Commission according to Section 5.6.1 of these Technical Specifications. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

Table 2.4-1

RADIOACTIVE LIQUID SAMPLING AND ANALYSIS

Liquid Source	Sampling Frequency	Type of Activity Analysis	Detectable Concentration (μCi/ml)[3]
A. Monitor Tank Releases	Each Release	Individual Gamma Emitters	5×10^{-7} [2]
	One Batch/Month	Dissolved Gases	10^{-5}
	Weekly Composite[1]	Ba-La-140, I-131	10^{-6}
		Sr-89	5×10^{-8}
	Monthly Composite[1]	H-3	10^{-5}
		Gross α	10^{-7}
	Quarterly Composite[1]	Sr-90	5×10^{-8}
B. Primary Coolant	Weekly[4]	I-[illegible]1, I-133	10^{-6}

Table 2.4-1 (Continued)

NOTES:

(1) A composite sample is one in which the quantit, of liquid sampled is proportional to the quantity of liquid waste discharged from the plant.

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

(3) The detectability limits for activity analysis are based on technical feasibility and on the potential significance in the environment of the quantities released. For some nuclides, lower detection limits may be readily achievable and when nuclides are measured below the stated limits, they should also be reported.

(4) The power level and cleanup or purification flow rate at the sample time shall also be reported.

Table 2.4-2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS

Gaseous Source	Sampling Frequency	Type of Activity Analysis	Detectable Concentrations (uCi/ml)(1)
A. Containment Purge Releases	Each Release	Individual Gamma Emitters	10^{-4} (3)
		H-3	10^{-6}
B. Environmental Release Points	Monthly (Gas Samples)	Individual Gamma Emitters	10^{-4} (2)(3)
		H-3	10^{-6}
	Weekly (Charcoal Sample)	I-131	10^{-12} (4)
	Monthly (Charcoal Sample)	I-133, I-135	10^{-10}
	Weekly (Particulates)	Individual Gamma Emitters (at least for Ba-La-140, I-131	10^{-11} (4)
	Monthly Composite(5) (Particulates)	Sr-89	10^{-11}
		Gross α	10^{-11}
	Quarterly Composite(5) (Particulates)	Sr-90	10^{-11}

Table 2.4-2 (Continued)

NOTES:

(1) The above detectability limits for activity analysis are based on technical feasibility and on the potential significance in the environment of the quantities released. For some nuclides, lower detection limits may be readily achievable and when nuclides are measured below the stated limits, they should also be reported.

(2) Analyses shall also be performed following each refueling, startup or similar operational occurrence which could alter the mixture of radionuclides.

(3) 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.

(4) When the average daily gross radioactivity release rate exceeds that given in 2.4.3.c.(1) or where the steady state gross radioactivity release rate increases by 50% over the previous corresponding power level steady state release rate, the iodine and particulate collection device shall be removed and analyzed to determine the change in iodine-131 and particulate release rate. The analysis shall be done daily following such change until it is shown that a pattern exists which can be used to predict the release rate; after which it may revert to weekly sampling frequency.

(5) To be representative of the average quantities and concentrations of radioactive materials in particulate form released in gaseous effluents, samples should be collected in proportion to the rate of flow of the effluent stream or in proportion to the volume of each batch of effluent releases. Prior to analyses, all samples taken for the composite should be thoroughly mixed in order for the composite sample to be representative of the average effluent release.

Table 2.4-3

BWR-Liquid Waste System

Location of Process and Effluent Monitors and Samplers Required By Technical Specifications

			Measurement					
Process Stream or Release Point	Continuous Monitor	Grab Sample Station	Gross Activity	I	Dissolved Gases	Alpha	H-3	Isotop Analys
*High Purity Waste Sample (Test) Tank		X		X	X	X	X	X
Floor Drain Waste Sample (Test) Tank		X		X	X	X	X	X
Chemical Waste Sample (Test) Tank		X		X	X	X	X	X
**Detergent Waste Collector Tank		X		X	X	X	X	X
Primary Coolant System		X		X				
Liquid Radwaste Discharge Pipe	X		X					
Service Water Discharge Pipe	X		X					
Outdoor Storage Tanks - Dikes or Retention Ponds	X		X					X
Emergency Core Cooling System	X		X					
Nuclear Closed Cooling System	X		X					

* In some BWR's the High Purity Waste System may not have a waste sample (test) tank. The processed liquid will be routed directly to the condensate storage tank or to the floor drain waste sample (test) tank.

** In most BWR's the contents of the detergent waste collector tank are sampled, analyzed and then filtered prior to release through the liquid radwaste discharge pipe. The detergent waste system must be designed with either a split tank or two separate collection or sample (test) tanks to permit isolation of the tanks for mixing, sampling and analysis prior to release.

Table 2.4-4

BWR-Gaseous Waste System

Location of Process and Effluent Monitors and Samplers Required By Technical Specifications

Process Stream or Release Point	Continuous Monitor	Grab Sample Station	Measurement NG	I	Part	H-3
Condenser/Air Ejector (downstream)	X	X	X			
Main Stack	X	X	X	X	X	X
Building Ventilation Systems						
Reactor Containment Building	X	X	X	X	X	X
*Radwaste Building	X	X	X	X	X	X
*Turbine Building	X	X	X	X	X	X
*Fuel Handling & Storage Building	X	X	X	X	X	X
*Auxiliary Building	X	X	X	X	X	X
**Mechanical Vacuum Pump	X	X	X	X	X	X
**Turbine Gland Seal Condenser	X	X	X	X	X	X

* If any or all of the building ventilation systems are routed to a single release point the need for a continuous monitor at the individual building exhaust discharge point to the main exhaust duct is eliminated. One continuous monitor at the final release point is sufficient.

** Normally the offgases from the mechanical vacuum pump will be discharged downstream of the turbine gland seal condenser vent and the need for individual monitors on each system is eliminated. One continuous monitor at the final release point is sufficient.

Table 2.4-5

AVERAGE ENERGY PER DISINTEGRATION

Isotope	$\overline{E}_\gamma$, mev/dis	(Ref)	$\overline{E}_\beta$, mev/dis[3]	(Ref)
Kr-83m	0.00248	(1)	0.0371	(1)
Kr-85	0.0022	(1)	0.250	(1)
Kr-85m	0.159	(1)	0.253	(1)
Kr-87	0.793	(1)	1.32	(1)
Kr-88	1.95	(1)	0.377	(1)
Kr-89	2.22	(2)	1.37	(2)
Kr-90	2.10	(2)	1.01	(2)
Xe-131m	0.0201	(1)	0.143	(1)
Xe-133	0.0454	(1)	0.135	(1)
Xe-133m	0.042	(1)	0.19	(1)
Xe-135	0.247	(1)	0.317	(1)
Xe-135m	0.432	(1)	0.095	(1)
Xe-137	0.194	(1)	1.64	(1)
Xe-138	1.18	(1)	0.611	(1)

(1) ORNL-4923, Radioactive Atoms - Supplement I, M. S. Martin, November 1973.

(2) NEDO-12037, "Summary of Gamma and Beta Emitters and Intensity Data; M. E. Meek, R. S. Gilbert, January 1970. (The average β energy was computed from the maximum energy using the ICRP II equation, not the 1/3 value assumption used in this reference.)

(3) The average β energy includes conversion electrons.