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SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

7/1/84 - 12/31/84

FLORIDA POWER CORPORATION

CRYSTAL RIVER - UNIT 3

FACILITY OPERATING LICENSE NO. DPR-72

DOCKET NO. 50-302

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I. INTRODUCTION

This Effluent and Waste Disposal Report is submitted as required by Technical Specification 6.9.1.5.d to the Crystal River Unit 3 Facility Operating License No. DPR-72. The data in this report covers the period from July 1, to December 31, 1984.

There have been no changes to the Technical Specification Requirements for effluents and waste disposal of the Facility Operating License during the period of this report.

Crystal River Unit 3 has had no significant measurable radiological impact on the surrounding environment during the reporting period. This is based on the Radiological Environmental Monitoring Program data and the doses calculated for individuals and the population due to effluent releases being significantly below the levels required by 10 CFR 50, Appendix I.

The summations of gaseous and liquid effluents and solid waste shipments are in accordance with the tables in Regulatory Guide 1.21 (Rev. 1, 6/74) Appendix B.

The individual and population doses were calculated using GASPAR (for gaseous effluents) and LADTAP (for liquid effluents) computer codes obtained from the Nuclear Regulatory Commission and revised to include site specific data wherever possible. These doses are summarized in Tables I-1A and B.

The values reported for the activity of nuclides released are the actual measured activities. If no activity for a principle nuclide was detected for a quarter, the total of the lower limits of detection for all samples is reported as "<X.XXE-X". The totals of activity released is a total of only the nuclides that had measured activity.

TABLE I-1A
SUMMATION OF DOSES TO INDIVIDUALS FROM
GASEOUS AND LIQUID EFFLUENT RELEASES

Third Quarter

Beta Air Dose = N/A (Design Objective = 2.00E+01 mrad/yr)
Gamma Air Dose = N/A (Design Objective = 1.00E+01 mrad/yr)

Whole Body Dose

Effluent Release	Distance (Mi.) and Direction	Age Group	Organ	Dose (mrem/yr)	Design Objectives (mrem/yr)
Continuous Gaseous	N/A	-	-	N/A	5.00E+00
Batch Gaseous	N/A	-	-	N/A	
Continuous Liquid	-	Adult	-	8.84E-09	5.00E+00
Batch Liquid	-	Teen	-	2.26E-02	

Organ Dose

Continuous Gaseous	N/A	-	-	N/A	1.50E+01
Batch Gaseous	N/A	-	-	N/A	
Continuous Liquid	-	Adult	GI-LLI	8.84E-09	5.00E+00
Batch Liquid	-	Adult	GI-LLI	1.38E+00	

Fourth Quarter

Beta Air Dose = N/A (Design Objective = 2.00E+0 mrad/yr)
Gamma Air Dose = N/A (Design Objective = 1.00E+01 mrad/yr)

Whole Body Dose

Continuous Gaseous	N/A	-	-	N/A	5.00E+00
Batch Gaseous	N/A	-	-	N/A	
Continuous Liquid	-	Adult	-	5.02E-05	5.00E+00
Batch Liquid	-	Teen	-	3.79E-02	

Organ Dose

Continuous Gaseous	N/A	-	-	N/A	1.50E+01
Batch Gaseous	N/A	-	-	N/A	
Continuous Liquid	-	Adult	GI-LLI	1.23E-03	5.00E+00
Batch Liquid	-	Adult	GI-LLI	6.04E-01	

NOTE: The gaseous doses are not available due to delays in obtaining meteorological data.
A supplemental report will be issued with the gaseous doses when the data is available.

TABLE I-1B

SUMMATION OF DOSES TO THE POPULATION
FROM GASEOUS AND LIQUID EFFLUENT RELEASES

Third Quarter

	Whole Body Dose		Organ Dose		
Effluent Release	Dose (MAN-REM/YR)	Design Objectives (MAN-REM/YR)	Organ	Dose (MAN-REM/YR)	Design Objectives (MAN-REM/YR)
Continuous Gases	N/A	5.00E+02	-	N/A	5.00E+02
Batch Gaseous	N/A		-	N/A	
Continuous Liquid	1.17E-06	-	GI-LLI	1.17E-06	-
Batch Liquid	1.38E+00	-	GI-LLI	1.72E+02	-

Fourth Quarter

Continuous Gaseous	N/A	5.00E+02	-	N/A	5.00E+02
Batch Gaseous	N/A		-	N/A	
Continuous Liquid	4.24E-03	-	GI-LLI	1.04E-01	-
Batch Liquid	3.55E+00	-	GI-LLI	6.54E+01	-

NOTE: The gaseous doses are not available due to delays in obtaining meteorological data.
A supplemental report will be issued with the gaseous doses when the data is available.

II. RELEASES OF AND DOSES FROM GASEOUS EFFLUENTS

1. Regulatory Limits

The Technical Specification limits for gaseous effluent releases are as follows:

A. Specification 3.11.2.1

The dose rate at or beyond the SITE BOUNDARY, due to radioactive materials released in gaseous effluents, shall be limited as follows:

a. Noble gases: less than or equal to 500 mrem/year total body and less than or equal to 3000 mrem/year to the skin.

b. Iodine-131, Tritium, and radioactive particulates with half-lives of greater than 8 days: less than or equal to 1500 mrem/year to any organ.

B. Specification 3.11.2.2

The air dose at or beyond the SITE BOUNDARY, due to radioactive noble gases released in gaseous effluents shall be limited to:

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

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

C. Specification 3.11.2.3

The dose to a MEMBER OF THE PUBLIC from Iodine-131, Tritium, radioactive particulates with half-lives greater than 8 days in gaseous effluents released from the site to areas at or beyond the SITE BOUNDARY shall be limited as follows:

a. During any calendar quarter: less than or equal to 15 mrem to any organ.

D. The maximum activity to be contained in one waste gas storage tank shall not exceed 39,000 Curies (considered as Xe-133).

2. Maximum Permissible Concentrations

The maximum permissible concentrations of nuclides in gaseous releases is based on the resultant doses at the site boundary as determined from the concentrations of nuclides at the release point. The OFFSITE DOSE CALCULATION MANUAL provides the equations and dose factors that relate to the gaseous activity to be released to doses at the site

boundary, and restrictions are placed on quarterly and yearly release rates. The gaseous releases do not exceed the concentration limits specified in 10 CFR 20 and are as low as reasonably achievable in accordance with the requirements of 10 CFR 50. The total dose and dose rate calculations are derived from the methodology in NUREG-0133 and the dose factors in Reg. Guide 1.109.

3. Measurements and Approximations of Total Radioactivity

The gaseous effluent release via the Auxiliary Building Exhaust is treated as a continuous release subdivided into discrete periods of filter changes and the radioactivity measured as follows:

A. Fission and Activation Gases - The total activity released is based on the total vent flow and the activity of the individual nuclides obtained from an isotopic analysis of a grab sample taken at least weekly.

B. Iodines - The activity released as Iodine-131, 133, and 135 is based on the charcoal cartridge activities (RMA-2I), the particulate filters activities (RMA-2P) and the total vent flow.

C. Particulates - The activity released via particulates with half-lives greater than eight days is determined by isotopic analysis of particulate filters (RMA-2P) and the total vent flow.

The radioactivity released by batch releases of the Waste Gas Decay Tanks via the Auxiliary Building Exhaust is measured as follows:

A. Fission and Activation Gases - The activity released is based on the volume released and the activity of the individual nuclides obtained from an isotopic analysis of a grab sample taken prior to the release.

B. Iodines - The iodines from batch releases are included in the iodine determination from the continuous Auxiliary Building releases.

C. Particulates - The particulates from batch releases are included in the particulate determination from the continuous Auxiliary Building release.

D. Tritium - The activity released as tritium is based on a grab sample analysis of each batch and the batch volume.

The radioactivity released by purge releases of the Reactor Building through the Reactor Building vent is measured as follows:

A. Fission and Activation Gases - The total activity released is based on the total vent flow and the activity of the individual nuclides obtained from an isotopic analysis of a grab sample taken prior to the beginning of the Reactor Building purge and at least weekly during continuous ventilation.

B. Iodines - The total curies released as iodine-131, 133 and 135 were determined from the charcoal cartridge activities (RMA-1I) and the particulate filter activities (RMA-1P).

C. Particulate - The total curies released via particulates with half-lives greater than eight days are determined by isotopic analysis of each purge particulate filter (RMA-1P).

D. Tritium - The total curies released as tritium are based on grab samples taken for each purge (or the average if more than one grab sample was taken).

Estimated errors are based on errors in counting equipment calibration, counting statistics, vent flow rates, vent sample flow rates, nonsteady release rates, chemical yield factors and sample losses for such items as charcoal cartridges.

A. Fission and Activation Gas Total Release as calculated from process monitor readings and grab sample isotopics.

Monitor Statistical Error	30%
Monitor Error in Calibration	50%
Vent Flow Rate	10%
Non-Steady Release Rate	20%
	110%

B. I-131 Total Release as calculated from charcoal and particulate filter activity.

Statistical Error	60%
Counting Equipment Calibration	10%
Vent Flow Rate	10%
Vent Sample Flow Rate	10%
Non-Steady Release Rate	10%
Losses from Charcoal Cartridge	10%
	110%

C. Particulates with half-lives greate than eight days release as calculated from particulate filter activities.

Statistical Error	60%
Counting Equipment Calibration	10%
Vent Flow Rate	10%
Vent Sample Flow Rate	10%
Non-Steady Release Rate	10%
	100%

D. Total Tritium release as calculated from periodic grab sample analyses.

Water Vapor in Sample Stream Determination	20%
Vent Flow Rate	10%
Counting Calibration and Statistics	10%
Non-Steady Release Rate	50%
	90%

4. Batch and Unplanned Releases

The batch gaseous effluent releases may be summarized as follows:

	7/1/84 - 12/31/84
Number of Batch Releases	2.30E+01
Total time for all releases (minutes)	1.70E+04
Maximum time for any one release (minutes)	1.26E+03
Average time for all releases (minutes)	7.38E+02
Minimum time for any one release (minutes)	8.00E+01
Number of Unplanned Releases	0.00E+00
Total Unplanned Activity Released (Curies)	0.00E+00

The summation of gaseous effluent releases is in Table II-1 and the summation of nuclides in gaseous effluent ground level releases is in Table II-2.

There were no unplanned releases for the third and fourth quarters of 1984.

TABLE II-1

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 7/1/84 - 12/31/84

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 3	Quarter 4	Est.Total Error %
A. Fission and Activation Gases				
1. Total Release	Ci	4.39E+02	4.63E+02	1.10E+02
2. Average Release Rate for Period	µCi/sec	5.58E+01	5.89E+01	
3. Percent of Technical Specification Limit	%	5.08E-01	9.08E-01	
B. Iodines				
1. Total Iodine - 131	Ci	7.57E-06	7.33E-05	1.01E+02
2. Average Release Rate for Period	µCi/sec	9.63E-07	9.32E-06	
3. Percent of Technical Specification Limit	%	6.31E-01	9.08E-01	
C. Particulates				
1. Particulates with half-lives > 8 days	Ci	1.80E-05	4.87E-05	1.00E+02
2. Average Release Rate for Period	µCi/sec	2.29E-06	6.19E-06	
3. Percent of Technical Specification Limit	%	6.31E-01	9.08E-06	
4. Gross Alpha Radioactivity	Ci	6.18E-08	2.15E-08	
D. Tritium				
1. Total Release	Ci	6.08E+00	2.58E+00	9.00E+01
2. Average Release Rate for Period	µCi/sec	7.73E-01	3.28E-01	
3. Percent of Technical Specification Limit	%	6.31E-01	9.08E-01	

TABLE II-2

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 7/1/84 - 12/31/84

GASEOUS EFFLUENTS - GROUND-LEVEL RELEASES

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter 3	Quarter 4	Quarter 3	Quarter 4
1. Fission gases					
krypton-85	Ci	1.11E+00	3.94E+00	1.48E-01	1.90E+00
krypton-85m	Ci			4.95E-02	3.47E-02
krypton-87	Ci	<5.12E+01	2.74E+00	<1.49E-02	6.37E-03
krypton-88	Ci	<2.96E+01	<2.96E+01	<2.17E-02	<1.58E-01
xenon-133	Ci	3.15E+02	2.18E+02	3.81E+01	1.47E+02
xenon-133m		<4.76E+01	<4.76E+01	3.06E-01	1.26E+00
xenon-135	Ci	8.28E+01	7.99E+01	1.31E+00	1.35E+00
xenon-135m	Ci		3.78E+00		
xenon-131m	Ci			7.22E-01	2.83E+00
xenon-138	Ci	<6.95E+02	<6.95E+02	<5.25E-02	<3.82E-01
	Ci				
	Ci				
	Ci				
unidentified	Ci				
Total for Period	Ci	3.98E+02	3.09E+02	4.07E+01	1.54E+02
Iodines					
iodine-131	Ci	7.57E-06	7.33E-05		
iodine-133	Ci		2.69E-06		
	Ci				
Total for Period	Ci	7.57E-06	7.60E-05		
3. Particulates					
manganese-54	Ci	<2.49E-05	<2.49E-05		1.24E-07
iron-59	Ci	<7.24E-05	<7.24E-05		
cobalt-58	Ci	<2.97E-04	1.57E-07		
cobalt-60	Ci	<2.91E-05	<2.91E-05		
zinc-65	Ci	<4.74E-05	<4.74E-05		
molybdenum-99		<1.71E-04	<1.71E-04		
cesium-134	Ci	<1.96E-05	<1.96E-05		
cesium-137	Ci	<2.15E-05	<2.15E-05		
cerium-141	Ci	<1.05E-04	<1.05E-04		
cerium-144	Ci	<2.65E-05	9.07E-07		
iodine-131	Ci	<8.92E-06	<8.92E-06		
strontium-89	Ci	<5.79E-03	5.96E-07		
strontium-90	Ci	<5.79E-03	3.17E-07		
	Ci				
	Ci				
	Ci				
	Ci				
unidentified	Ci	1.79E-05	3.08E-05	4.16E-08	2.16E-07
Total	Ci	1.79E-05	3.28E-05	4.16E-08	3.40 E-07

TABLE II-3
Doses to Individuals from Continuous Gaseous Effluent Releases

THIRD QUARTER

Beta Air Dose = N/A (4.0 miles, E)
Gamma Air Dose = N/A (4.0 miles, E)

	Whole Body Dose			Organ Dose			
Pathway	Distance (Mi.) and Direction	Age Group	Dose (mrem/yr)	Distance (Mi.) and Direction	Age Group	Organ	Dose (mrem/yr)
Plume Immersion	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cow Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Goat Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A

FOURTH QUARTER

Beta Air Dose = N/A (4.0 miles, E)
Gamma Air Dose = N/A (4.0 miles, E)

	Whole Body Dose			Organ Dose			
Pathway	Distance (Mi.) and Direction	Age Group	Dose (mrem/yr)	Distance (Mi.) and Direction	Age Group	Organ	Dose (mrem/yr)
Plume Immersion	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cow Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Goat Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE II-4
Doses to Individuals from Batch Gaseous Effluent Releases

THIRD QUARTER

Beta Air Dose = N/A (4.0 miles, E)
Gamma Air Dose = N/A (4.0 miles, E)

	Whole Body Dose			Organ Dose			
Pathway	Distance (Mi.) and Direction	Age Group	Dose (mrem/yr)	Distance (Mi.) and Direction	Age Group	Organ	Dose (mrem/yr)
Plume Immersion	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cow Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Goat Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A

FOURTH QUARTER

Beta Air Dose = N/A (4.0 miles, E)
Gamma Air Dose = N/A (4.0 miles, E)

	Whole Body Dose			Organ Dose			
Pathway	Distance (Mi.) and Direction	Age Group	Dose (mrem/yr)	Distance (Mi.) and Direction	Age Group	Organ	Dose (mrem/yr)
Plume Immersion	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cow Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Goat Milk Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE II-5

Doses to the Population from Continuous Gaseous Effluent Releases

THIRD QUARTER

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose Dose (Man-Rem)
Plume Immersion	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A
Milk Consumption	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A
Total	N/A	N/A	N/A

FOURTH QUARTER

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose Dose (Man-Rem)
Plume Immersion	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A
Milk Consumption	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A
Total	N/A	N/A	N/A

TABLE II-6

Doses to the Population from Batch Gaseous Effluent Releases

THIRD QUARTER

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose Dose (Man-Rem)
Plume Immersion	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A
Milk Consumption	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A
Total	N/A	N/A	N/A

FOURTH QUARTER

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose Dose (Man-Rem)
Plume Immersion	N/A	N/A	N/A
Ground Contamination	N/A	N/A	N/A
Inhalation	N/A	N/A	N/A
Vegetable Consumption	N/A	N/A	N/A
Milk Consumption	N/A	N/A	N/A
Meat Consumption	N/A	N/A	N/A
Total	N/A	N/A	N/A

III. RELEASES OF AND DOSES FROM LIQUID EFFLUENTS

There are four sources of liquid effluents released to the discharge canal: 1) the Laundry and Shower Sump Tanks, 2) the Evaporator Condensate Storage Tanks, 3) the Regeneration Waste Neutralization Tank, and 4) the Condenser Hotwell. The Laundry Tanks and Evaporator Condensate Storage Tanks are batch type releases made through the plant liquid release monitor RML-2. The Regeneration Waste Tank discharges are batch type, the Condenser Hotwell discharges are continuous types, both of which are made through plant liquid release monitor RML-7.

1. Regulatory Limits

The Technical Specification limits for liquid effluent releases are as follows:

Specification 3.11.1.1

The concentration of radioactive material released to UNRESTRICTED AREAS shall be less than or equal to the concentrations specified in 10 CFR 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 be less than or equal to 2×10^{-4} microcuries/ml. total activity.

Specification 3.11.1.2

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive material is in liquid effluents released to UNRESTRICTED AREAS shall be limited as follows:

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

b. During any calendar year to less than or equal to 2 mrem to the total body and to less than or equal to 10 mrem to any organ.

2. Radionuclide Concentrations

The maximum permissible concentration values used in determining allowable liquid release concentrations are taken from 10 CFR 20, Appendix B, Table II, Column 2. Release rate and dilution ratio for each batch are determined by a mixed nuclide MPC calculation performed before the release of the batch.

The concentration of each of the gamma emitting nuclides specifically noted in Figure III-1 is measured individually due to the requirements of the Technical Specification. If any of the following radionuclides, manganese-54, iron-59, cesium-137, cerium-141, or cerium 144 are less than their LLD value, an a-priori system LLD for each isotope is used to calculate the minimum detectable release activity.

Individual measurements are made on proportional composite liquid radwaste samples to determine the Fe-55, Sr-89, and Sr-090 concentration to be applied to individual release calculations.

A distillation and liquid scintillation counting technique is used to measure the tritium concentration on each batch release.

The measured and calculated concentration values for each batch are used to calculate the dilution ratio, release rate, dilution rate, and expected doses prior to the release. The release data is then updated with actual release conditions and stored on a computer disc file. The disc file data is used to assure that quarterly and annual release limits are not exceeded.

Bases used for the data of Table III-1 are as follows:

A. Fission and activation products - The total release values (not including tritium, gases, gross alpha) are comprised of the sum of the individual radionuclide activities released to the discharge canal for the respective quarter. These values represent the activity known to be present in the liquid radwaste effluent. Percent of applicable limit is then determined by dividing the calculated total body or organ dose by the applicable Technical Specification limit and then multiplying the result by 100. The most restrictive percent of limit is then used.

B. Tritium - The measured tritium concentration is used to calculate the total release and average diluted concentration during each period. The average diluted concentration divided by the MPC limit, 3×10^{-3} µCi/ml, is converted to give the percent of applicable limit.

limit, 3×10^{-3} µCi/ml, is converted to percent to give the percent of applicable limit.

C. Dissolved and entrained gases - Concentrations of dissolved and entrained gases in liquid effluents are measured by Ge(Li) spectroscopy on a sample from each liquid release. Dissolved and entrained gases for which measured concentrations are determined include noble gases with half lives greater than 8 hours. Iodine radionuclides in any form are determined during the isotopic analysis for each release, therefore a separate analysis for possible gaseous forms is not performed.

The average diluted concentration of the dissolved and entrained gases is divided by the MPC limit, 2×10^{-4} µCi/ml, and converted to give the percent of applicable limit.

3. Measurements and Approximations of Total Radioactivity

Details of the analytical procedures for liquid radwaste analysis are as follows:

	Measurement	Frequency	Method
1.	Gamma Isotopic	Each Release	Ge(Li) spectrometry with on-line computer
2.	Gross Beta	Each Release	Liquid scintillation
3.	Sr-89	Monthly Composite	Chemical separation and beta scintillation counting
4.	Sr-90	Monthly Composite	Chemical separation and beta scintillation counting
5.	Tritium	Each Release	Distillation and liquid scintillation counting
6.	Alpha	Monthly Composite	Alpha scintillation
7.	Dissolved Gases	Each Release	Ge(Li) spectrometry with on-line computer
8.	Fe-55	Each Release	Chemical separation and liquid scintillation counting

Estimated errors are based on errors in counting equipment calibration, counting statistics, nonsteady release flow rate, chemical yield factors, sampling and mixing losses, and volume determinations.

A. Fission and Activation Products Total Release as calculated for each batch.

Statistical Error at MDA	60%
Waste Volume	10%
Counting Equipment Calibration	10%
Sampling and Mixing	20%
	100%

B. Total Tritium Release as calculated from a monthly composite.

Waste Volume	10%
Counting Equipment Calibration	10%
Sampling and Mixing	20%
	40%

C. Dissolved and Entrained Gases Total Release as calculated from one batch per month.

Statistical Error at MDA	60%
Waste Volume	10%
Counting Equipment Calibration	10%
Sampling and Mixing	20%
	100%

D. Total Gross Alpha Radioactivity Release as calculated from a monthly composite.

Statistical Error at MDA	60%
Waste Volume	10%
Counting Equipment Calibration	10%
Sampling and Mixing	20%
	100%

4. Batch and Unplanned Releases

The batch liquid effluent releases may be summarized as follows:

	7/1/84 - 12/31/84
Number of Batch Releases	3.45E+02
Total Time for all Releases (minutes)	3.14E+04
Maximum Time for any one Release (minutes)	3.00E+02
Average Time for all Releases (minutes)	9.11E+01
Minimum time for any one Release (minutes)	1.00E+00
Average dilution flow of Units 1, 2, and 3 during all Releases (liters/minutes)	2.74E+07
Number of Unplanned Releases	0.00E+00
Total Unplanned Activity Releases (Curie)	0.00E+00

The summation of liquid effluent releases is in Table III-1 and the summation of nuclides in liquid effluent releases is in Table III-2. These releases are based on the dilution of the radioactive liquid effluent by the nuclear services water of Unit 3.

The doses to individuals from liquid effluent releases are in Table III-3 and the doses to the population from liquid effluent releases are in Table III-4. These doses are based on the dilution of the radioactive liquid effluents by the condenser cooling water of Units 1, 2, and 3.

There were no unplanned releases for the third and fourth quarters of 1984.

Figure III-1

METHODS OF MEETING 10 CFR 20, APPENDIX B, TABLE II, COLUMN 2 MPC LIMITS

MPC RANGE (μCi/ml)	GAMMA-RAY EMITTERS	BETA EMITTERS	ALPHA EMITTERS
	I-131, I-132, I-133	Sr-89, Sr-90	
$<9 \times 10^{-6}$	I-135, Cs-134	(Separation and Beta Scintillation Counting)	
	(Ge(Li) Gamma-Ray Spectroscopy)	Fe-55 (Separation and Liquid Scintillation Counting)	All (Alpha Counting Sensitivity 10^{-7} μCi/ml as Pu-239)
	Ba-La-140, Na-24, Cu-64	Tritium	
	Co-60, Fe-59, Zn-65	(Distillation and Liquid Scintillation Counting 10^{-5} μCi/ml)	
$\geq 9 \times 10^{-6}$	Ag-110m, Mn-54, Co-58		
	Zr-Nb-95, Cs-Ba-137		
	As-76, F-18, Cr-51	All others	
	Np-239, Ce-141	(Liquid Scintillation Counting 10^{-5} μCi/ml as Cs-137)	
	Mo-Tc-99, Ce-Pr-144		
	(Ge(Li) Gamma-Ray Spectroscopy)		

TABLE III-1

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 7/1/84 - 12/31/84
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 3	Quarter 4	Est.Total Error %
A. Fission and Activation Products				
1. Total Release (not including tritium, gases, alpha)	Ci	8.08E-02	7.85E-02	1.00E+02
2. Average diluted concentration during period	µCi/ml	1.35E-07	7.60E-08	
3. Percent of applicable limit	%	4.46E+00	9.26E+00	
B. Tritium				
1. Total Release	Ci	7.96E+01	8.88E+01	4.00E+01
2. Average diluted concentration during period	µCi/ml	1.33E-04	8.59E-05	
3. Percent of applicable limit	%	4.43E+00	2.86E+00	4.00E+01
C. Dissolved and entrained gases				
1. Total release	Ci	1.66E+00	3.38E+00	1.00E+02
2. Average diluted concentration during period	µCi/ml	2.78E-06	3.27E-06	
3. Percent of applicable limit	%	1.39E+00	1.64E+00	
D. Gross alpha radioactivity				
1. Total release	Ci	4.18E-05	3.98E-05	1.00E+02
E. Volume of Waste released (prior to dilution)				
1. Batch and Continuous Modes	Gallons	2.65E+06	3.05E+06	1.00E+01
F. Volume of dilution water used during period				
1. Batch and Continuous Modes	Gallons	1.55E+08	2.70E+08	1.00E+01

TABLE III-2

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 7/1/84 - 12/31/84

LIQUID EFFLUENTS

		CONTINUOUS MODE		BATCH MODE	
Nuclides Released	Unit	Quarter 3	Quarter 4	Quarter 3	Quarter 4
chromium-51	Ci				1.92E-03
manganese-54	Ci	<1.14E-05	<1.08E-05	1.01E-04	5.53E-04
manganese-56	Ci				2.55E-04
iron-55	Ci	<2.42E-04	3.91E-04	2.96E-03	7.09E-03
iron-59	Ci	<3.12E-05	<2.98E-05	<9.82E-04	1.43E-04
cobalt-58	Ci	<1.36E-05	<1.30E-05	1.51E-03	2.39E-02
cobalt-60	Ci	<1.52E-05	<1.46E-05	7.12E-03	4.28E-03
zinc-65	Ci	<2.12E-05	<2.03E-05	<6.68E-04	<8.14E-04
strontium-89	Ci	<1.21E-05	<1.16E-05	1.14E-05	1.05E-04
strontium-90	Ci	<1.21E-05	<1.16E-05	<3.81E-04	2.48E-05
strontium-92	Ci			7.55E-03	1.09E-03
zirconium-95	Ci				3.09E-04
zirconium-97	Ci			6.63E-04	7.12E-05
molybdenum-99	Ci	<8.03E-05	<7.67E-05	<2.53E-03	<3.08E-03
technetium-99m	Ci			2.08E-04	1.11E-04
ruthenium-106	Ci			5.63E-04	
silver-110m	Ci			1.77E-02	3.40E-03
iodine-131	Ci	<1.08E-05	<1.03E-05	6.91E-04	5.24E-04
iodine-133				3.22E-04	9.05E-05
cesium-134	Ci	<1.66E-05	<1.59E-04	8.31E-05	3.74E-03
cesium-137	Ci	<1.57E-05	<1.50E-05	4.04E-04	1.03E-02
barium-139	Ci				1.01E-04
barium-140	Ci				4.77E-05
lanthanum-140	Ci			3.08E-07	2.02E-04
cerium-141	Ci	<1.85E-05	<1.76E-05	<5.81E-04	<7.07E-04
cerium-144	Ci	<3.40E-06	<8.02E-06	<2.46E-04	2.46E-06
niobium-95	Ci			6.07E-05	5.06E-04
argon-41	Ci				7.30E-03
krypton-85	Ci				9.88E-04
krypton-85m	Ci			4.09E-05	1.43E-04
xenon-131m	Ci			2.56E-02	4.56E-02
xenon-133	Ci	9.42E-05		1.61E+00	3.26E+00
xenon-133m	Ci			1.22E-02	3.09E-02
Xe-135	Ci	4.78E-05		1.81E-02	3.90E-02
Unidentified	Ci	3.19E-05		4.08E-02	1.95E-02
Total for period (above)	Ci	1.74E-04	3.91E-04	1.75E+00	3.46E+00

TABLE III-3

Doses to Individuals from Liquid Effluent Releases

THIRD QUARTER - CONTINUOUS RELEASES

	Whole Body Dose		Organ Dose		
Pathway	Age Group	Dose (mrem/yr)	Age Group	Organ	Dose (mrem/yr)
Fish	Adult	7.10E-09	Adult	GI-LLI	7.10E-09
Invertebrates	Adult	1.75E-09	Adult	GI-LLI	1.75E-09
Shoreline Use	-	0.00E+00	-	-	0.00E+00
Total	Adult	8.84E-09	Adult	GI-LLI	8.84E-09

FOURTH QUARTER - CONTINUOUS RELEASES

	Whole Body Dose		Organ Dose		
Pathway	Age Group	Dose (mrem/yr)	Age Group	Organ	Dose (mrem/yr)
Fish	Adult	1.94E-05	Adult	GI-LLI	4.77E-04
Invertebrates	Adult	3.08E-05	Adult	GI-LLI	7.56E-04
Shoreline Use	-	0.00E+00	-	-	0.00E+00
Total	Adult	5.02E-05	Adult	GI-LLI	1.23E-03

THIRD QUARTER - BATCH RELEASES

	Whole Body Dose		Organ Dose		
Pathway	Age Group	Dose (mrem/yr)	Age Group	Organ	Dose (mrem/yr)
Fish	Adult	6.89E-03	Adult	GI-LLI	1.07E+00
Invertebrates	Adult	5.40E-03	Adult	GI-LLI	3.15E-01
Shoreline Use	Teen	1.30E-02	Teen	Skin	1.53E-02
Total	Teen	2.26E-02	Adult	GI-LLI	1.38E+00

FOURTH QUARTER - BATCH RELEASES

	Whole Body Dose		Organ Dose		
Pathway	Age Group	Dose (mrem/yr)	Age Group	Organ	Dose (mrem/yr)
Fish	Adult	2.01E-02	Adult	GI-LLI	3.94E-01
Invertebrates	Adult	1.20E-02	Adult	GI-LLI	2.08E-01
Shoreline Use	Teen	1.53E-02	Teen	Skin	1.79E-02
Total	Teen	3.79E-02	Adult	GI-LLI	6.04E-01

TABLE III-4
Doses to the Population from Liquid Effluent Releases

THIRD QUARTER - CONTINUOUS RELEASES

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose (Man-Rem)
Sport Fish	1.09E-06	GI-LLI	1.09E-06
Commercial Fish	1.12E-09	GI-LLI	1.12E-09
Sport Invertebrate	7.51E-08	GI-LLI	7.51E-08
Commercial Invertebrate	5.42E-10	GI-LLI	5.42E-10
Shoreline Use	0.00E+00	-	0.00E+00
Swimming	0.00E+00	Thyroid	0.00E+00
Boating	0.00E+00	Thyroid	0.00E+00
Total	1.17E-06	GI-LLI	1.17E-06

FOURTH QUARTER - CONTINUOUS RELEASES

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose (Man-Rem)
Sport Fish	2.93E-03	GI-LLI	7.20E-02
Commercial Fish	3.02E-06	GI-LLI	7.41E-05
Sport Invertebrate	1.30E-03	GI-LLI	3.20E-02
Commercial Invertebrate	9.36E-06	GI-LLI	2.30E-04
Shoreline Use	0.00E+00	-	0.00E+00
Swimming	1.33E-11	Thyroid	1.33E-11
Boating	1.33E-11	Thyroid	1.33E-11
Total	4.24E-03	GI-LLI	1.04E-01

THIRD QUARTER - BATCH RELEASES

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose (Man-Rem)
Sport Fish	1.07E+00	GI-LLI	1.59E+02
Commercial Fish	1.11E-03	GI-LLI	1.62E-01
Sport Invertebrate	2.52E-01	GI-LLI	1.31E+01
Commercial Invertebrate	1.81E-03	GI-LLI	9.41E-02
Shoreline Use	5.83E-02	Skin	6.84E-02
Swimming	5.97E-04	Thyroid	5.97E-04
Boating	5.97E-04	Thyroid	5.97E-04
Total	1.38E+00	GI-LLI	1.72E+02

FOURTH QUARTER - BATCH RELEASES

Pathway	Whole Body Dose (Man-Rem)	Organ	Organ Dose (Man-Rem)
Sport Fish	2.94E+00	GI-LLI	5.67E+01
Commercial Fish	3.02E-03	GI-LLI	5.74E-02
Sport Invertebrate	5.33E-01	GI-LLI	8.57E+00
Commercial Invertebrate	3.80E-03	GI-LLI	6.13E-02
Shoreline Use	6.86E-02	Skin	8.02E-02
Swimming	4.65E-04	Thyroid	4.65E-04
Boating	4.65E-04	Thyroid	4.65E-04
Total	3.55E+00	GI-LLI	6.54E+01

IV. SOLID WASTE SHIPMENTS

Solid waste shipments from the plant may include solidified liquid waste, dry compressed waste, spent resins, irradiated components and spent fuel.

1. Regulatory Limits

The Technical Specification for solid waste shipment reporting is as follows:

Specification 6.9.1.5(d)

The radioactive effluent release report shall include the following information for each type of solid waste shipped offsite during the report period:

1. container volume,
2. total curie quantity (specify whether determined by measurement or estimate),
3. principle radionuclides (specify whether determined by measurement or estimate),
4. type of waste (e.g., spent resin, compacted dry waste, evaporator bottoms),
5. type of container (e.g., LSA, Type A, Type B, large quantity), and
6. solidification agent (e.g., cement).

The summation of solid waste and irradiated fuel shipments is presented in Table IV-1 and Shipment Summaries in Table IV-2.

TABLE IV-1

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 7/1/84 - 12/31/84
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Non irradiated fuel)

1. Type of waste		Unit	Second 6-month period	Est. Total Error, %
a.	Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	1.68E+2 1.10E+3	2.00E+1
b.	Dry compressible waste, contaminated equip, etc.	m^3 Ci	1.78E+1 3.61E-1	5.00E+1
c.	Irradiated components, control rods, etc.	m^3 Ci	2.55E+0 7.70E+2	5.00E+1
d.	Other (describe)	m^3 Ci	. E+ . E+	. E+

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

a.	Cs-134	%	2.97E+1
	Cs-137	%	3.23E+1
	Co-58	%	2.40E+0
	H-3	%	2.57E+0
	Co-60	%	3.00E+0
b.	Cs-134	%	9.94E+0
	Cs-137	%	1.93E+1
	Co-58	%	1.02E+1
	Co-60	%	2.50E+1
	I-131	%	1.65E+1
	Ni-63	%	1.25E+1
c.	Co-60	%	6.40E+1
	Ni-63		3.20E+1

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
25	Transport Truck - Exclusive Use Vehicle	Chem-Nuclear Systems, Inc. Barnwell, SC

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	NA	NA

- TABLE IV-2 -

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT

7/1/84 - 12/31/84

SHIPMENT SUMMARY

DATE AND SHIPMENT NO.	CONTAINER VOLUME	TOTAL CURIES	ISOTOPES	WASTE TYPE	CONTAINER TYPE	SOLIDIF. AGENT
07/12/84 84-34	322 ft^3	1.71 E-4	Co-60, I-131, Cs-134, Cs-137, Tritium	SC	LSA	N/A
07/19/84 84-36	322 ft^3	7.35 E-4	Cs-134, Cs-137, Tritium	SC	LSA	N/A
07/26/84 84-37	121 ft^3	327.61	Mn-54, Co-60, Co-58, Cs-137, Cs-134, Ni-63	SR	LSA	N/A
08/14/84 84-39	322 ft^3	4.96 E-4	Cs-134, Cs-137, Tritium	SC	LSA	N/A
08/23/84 84-40	121 ft^3	6.057	Mn-54, Co-60, Co-58, I-131, Cs-134, Cs-137, Ni-63	SR	LSA	N/A
08/30/84 84-41	322 ft^3	1.60 E-4	Co-60, Sb-122, I-131, Cs-134, Cs-137, Tritium	SC	LSA	N/A
09/06/84 84-42	322 ft^3	9.86 E-5	Sb-122, Cs-134, Cs-137, Tritium	SC	LSA	N/A
09/13/84 84-44	121 ft^3	214	Co-60, Cs-134, Cs-137, Ni-63	SR	LSA	N/A
09/24/84 84-46	84 x 7.5 ft^3	3.62 E-1	Ag-110m, Co-58, Co-60, Cs-134, Cs-137, I-137, Mn-54, Ni-63	CW	LSA	N/A
09/25/84 84-47	322 ft^3	1.19 E-4	Co-60, Sb-122, Cs-134, Cs-137, Tritium	SC	LSA	N/A
09/27/84 84-48	121 ft^3	214	Co-60, Cs-134, Cs-137, Ni-63	SR	LSA	N/A
10/04/84 84-49	322 ft^3	7.37 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
10/11/84 84-50	121 ft^3	214	Co-60, Cs-134, Cs-137, Ni-63	SR	LSA	N/A
10/15/84 84-51	322 ft^3	7.37 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
10/18/84 84-52	322 ft^3	6.74 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
10/23/84 84-53	322 ft^3	6.13 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
11/02/84 84-54	322 ft^3	5.47 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
11/05/84 85-55	322 ft^3	5.06 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A

WASTE TYPE: SR = Spent Resin
SC = Secondary Resin
CW = Compacted Waste
EB = Wvaporator Bottoms
CE = Contaminated Equipment
IC = Irradiated Components
F = Filters

DATE AND SHIPMENT NO.	CONTAINER VOLUME	TOTAL CURIES	ISOTOPES	WASTE TYPE	CONTAINER TYPE	SOLIDIF. AGENT
11/26/84 84-56	121 ft^3	7.02	Cr-51, Mn-54, Co-60, Co-58, Ag-110m, Cs-134, Cs-137, Tritium	SR	LSA	N/A
11/28/84 84-57	322 ft^3	5.22 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
12/10/84 84-58	121 ft^3	11.1	Cr-51, Mn-54, Co-60, Co-58, Nb-95, Cs-134, Cs-137, Ni-63	SR	LSA	N/A
12/11/84 84-59	322 ft^3	4.32 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
12/13/84 84-60	322 ft^3	2.98 E-5	Cs-134, Cs-137, Tritium	SC	LSA	N/A
12/18/84 84-61	121 ft^3	67.08	Mn-54, Co-60, Sb-122, Cs-134, Cs-137, Ni-63, Sr-89	SR	LSA	N/A
12/20/84 84-62	121 ft^3	35.3	Cr-51, Mn-54, Fe-59, Co-60, Co-58, Zr-95, Nb-95, Cs-134, Cs-137, Ni-63	SR	LSA	N/A

WASTE TYPE: SR = Spent Resin; SC = Secondary Resin; CW = Compacted Waste; EB = Evaporator Bottoms; CE = Contaminated Equipment; IC = Irradiated Components; F = Filters

V METEOROLOGICAL DATA

The historical meteorological data is being recovered manually and the summary tables will be submitted in a supplemental report as soon as the data is available.

VI TECHNICAL SPECIFICATION REPORTS

Technical Specification Sections 3.3.3.8, 3.3.3.9, and 3.12.1.2.b require reporting out of specification conditions in the Effluent and Waste Disposal Semiannual Report. There were no reports as required by the above specifications for the period of this report.

VII ODCM AND PCP CHANGES

Technical Specifications Section 6.9.1.5.d requires reporting of changes to the Offsite Dose Calculation Manual (ODCM) and the Process Control Program (PCP) in the Semiannual Radioactive Effluent Release Report.

Revisions to the ODCM for the period of this report are included in this section. The changes are marked for ease of review.

There were no revisions to the Process Control Program for the period of this report.

Setpoint Calculation 1.4-5
Plant Discharge Line Monitor (RM-L2)
(Batch Type Releases)

INTRODUCTION

Following completion of the analyses required by Section 1.2-4 and determination of release rates and concentration limits in accordance with Section 1.3-2, the monitor setpoint requires adjustment to ensure that alarm and pathway isolation occur if the nuclide concentration or release rate exceeds the limits determined.

METHODOLOGY

Evaporator Condensate Storage Tank or Laundry and Shower Sump Tank contents are circulated through radiation monitor RM-L2 and returned to the auxiliary building sump to obtain the actual count rate at RM-L2 for the concentration contained in the tank for release. The observed count rate is adjusted for release flow, background and statistical counting variations, particular to this release flow path. The resulting value is used as the alarm/trip setpoint and RM-L2 is adjusted to this value prior to initiating the release.

CALCULATION

$$\text{Monitor Setpoint (CPM)} = \left(\frac{\text{Net CPM} \times \text{Admin. Factor}}{\Sigma C_i/MPC_i}\right)\left(\frac{F_R + F_D}{F_R}\right) + Bkg + 3.3\sqrt{Bkg}$$

where:

Net CPM = The observed monitor count rate, in counts per minute.

Admin. Factor = Administration Factor to account for error in setpoint determination. Admin. Factor = 0.8.

$\Sigma C_i/MPC_i$ = The ratio of the actual gamma emitting concentrations (excluding dissolved and entrained gases) of the tank contents to be released to the Maximum Permissible Concentration (MPC) as listed in 10 CFR 20, Table II, Column 2 for unrestricted areas.

F_R = The release flow rate of waste to be discharged in gallons per minute. A maximum flow rate of 100 gpm will be used for the Evaporator Condensate Storage Tanks and 40 gpm for the Laundry and Shower Sump Tanks.

F_D = The dilution flow from the Nuclear Services Sea Water system in gallons per minute.

BKG = The background count rate at RM-L2 in counts per minute (cpm).

$3.3\sqrt{BKg}$ = A statistical spread on the background count rate which represents a 99.95% confidence level on monitor counting. This factor is included to prevent inadvertent high/trip alarms due to random counts on the monitor. Only the positive (+) side of the spread is applied.

Setpoint Calculation 1.4-7
Turbine Building Basement Discharge Line Monitor (RM-L7)
(Batch Type Releases)

INTRODUCTION

Following completion of the analyses required by Section 1.2-4 and determination of release rates and concentration limits in accordance with Section 1.3-2, the monitor setpoint requires adjustment to ensure that alarm and pathway isolation occur if the nuclide concentration or release rate exceeds the limits determined.

METHODOLOGY

Station Drain Tank (SDT-1) contents are circulated through radiation monitor RM-L7 and returned to the sump to obtain the actual count rate at RM-L7 for the concentration contained in the tank for release. The observed count rate is adjusted for release flow, background and statistical counting variations, particular to this release flow path. The resulting value is used as the alarm/trip setpoint and RM-L7 is adjusted to this value prior to initiating the release.

CALCULATION

$$\text{Monitor Setpoint (CPM)} = \left(\frac{\text{Net CPM} \times \text{Admin. Factor}}{\Sigma C_i/MPC_i}\right)\left(\frac{F_R + F_D}{F_R}\right) + Bkg + 3.3\sqrt{Bkg}$$

where:

Net CPM = The observed monitor count rate, in counts per minute.

Admin. Factor = Administration Factor to account for error in setpoint determination. Admin. Factor = 0.8.

$\Sigma C_i/MPC_i$ = The ratio of the actual gamma emitting concentrations (excluding dissolved and entrained gases) of the tank contents to be released to the Maximum Permissible Concentration (MPC) as listed in 10 CFR 20, Table II, Column 2 for unrestricted areas.

F_R = The release flow rate of waste to be discharged in gallons per minute. A maximum flow rate of 600 gpm will be used.

F_D = The dilution flow from the Nuclear Services Sea Water system in gallons per minute.

BKG = The background count rate at RM-L7 in counts per minute (cpm).

$3.3\sqrt{BKg}$ = A statistical spread on the background count rate which represents a 99.95% confidence level on monitor counting. This factor is included to prevent inadvertent high/trip alarms due to random counts on the monitor. Only the positive (+) side of the spread is applied.

NOTE: If there are no gamma emitting nuclides identified, the setpoint derived from 1.4-6 will be used.

REVISION 2

DOSE CALCULATION 4.3-2
(RADIOIODINES & PARTICULATES)

The dose to an individual at or beyond the SITE BOUNDARY due to Iodine-131, Tritium and radioactive particulates with half lives of greater than 8 days is calculated as follows:

$$D = 3.17 \times 10^{-8} \quad R_i (W\ Q_i)$$

where:

- D = The radiation dose to an individual at or beyond the UNRESTRICTED AREA BOUNDARY, in mrem.
- R_i = The dose factor for each identified radionuclide, i, in m^2 (mrem/year) per uCi/sec or mrem/year per uCi/m^3.
- W = (X/Q) for the inhalation pathway, 2.5×10^{-6} sec/m^3.
- W = (D/Q) for the food and ground plane pathway, 1.9×10^{-8} m^{-2}.
- Q_i = The releases of the radionuclides of concern in μCi, over the calendar quarter or calendar year, as appropriate.

Reference:

NUREG 0133, Section 5.3.1
FSAR, Table 2-20