

SEMIANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

CALLAWAY NUCLEAR PLANT

UNION ELECTRIC COMPANY

LICENSE NPF - 30

JANUARY - JUNE, 1988

8809070082

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1.0

INTRODUCTION

This Semiannual Radioactive Effluent Release Report is for Union Electric Company's Callaway Plant and is submitted in accordance with the requirements of Technical Specification 6.9.1.7. The report covers the period from January 1, 1988 through June 30, 1988.

This report includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the plant. The information is presented in accordance with the format outlined in Appendix B of Regulatory Guide 1.21, Revision 1, June 1974.

All liquid and gaseous effluents discharged during this reporting period were in compliance with the limits of the Callaway Plant Technical Specifications.

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

Specified as follows are the technical specification limits applicable to the release of radioactive material in liquid and gaseous effluents.

2.1.1 Fission and Activation Gases (Noble Gases)

The dose rate due to radioactive noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the site boundary shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation and,
- b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

2.1.2 Radioiodine, Tritium, and Particulates

The dose rate due to Iodine 131 and 133, tritium and all radionuclides in particulate form with half lives greater than eight (8) days released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 1500 mrem/yr to any organ.

The dose to a member of the public from Iodine 131 and 133, tritium, and all radionuclides in particulate form with half-lives greater than eight (8) days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,
- b. During any calendar year: Less than or equal to 15 mrem to any organ.

2.1.3 Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to 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 be limited to $2.0E-04$ microcuries/ml total activity.

The dose or dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

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

2.1.4 Uranium Fuel Cycle Sources

The annual (calendar year) dose or dose commitment to any member of the public due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

2.2 Maximum Permissible Concentrations

2.2.1 The maximum permissible concentration values specified in 10CFR20, Appendix B, Table II, Column 2 are used to calculate release rates and permissible concentrations of liquid radioactive effluents at the unrestricted area boundary. A value of $2.0E-4$ microcuries/ml is used as the MPC for dissolved and entrained noble gases in liquid effluents.

2.2.2 For gaseous effluents, maximum permissible concentrations are not directly used in release rate calculations since the applicable limits are stated in terms of dose rate at the unrestricted area boundary.

2.3 Average Energy

This is not applicable to the Callaway Plant's radiological effluent technical specifications.

2.4 Measurements and Approximations of Total Radioactivity

The quantification of radioactivity in liquid and gaseous effluents was accomplished by performing the sampling and radiological analysis of effluents in accordance with the requirements of Table 4.11-1 and Table 4.11-2 of the Callaway Plant Technical

Specifications (See NUREG-1058, "Technical Specifications, Callaway Plant, Unit No. 1" (October, 1984)).

Gamma spectroscopy was the primary analysis technique used to determine the radionuclide composition and concentration of liquid and gaseous effluents. Composite samples were analyzed for Sr-89, Sr-90, and Fe-55 by an independent laboratory. Tritium and alpha were measured for both liquid and gaseous effluents using liquid scintillation counting and gas flow proportional counting techniques, respectively.

The total radioactivity in effluent releases was determined from the measured concentrations of each radionuclide present and the total volume of effluents discharged. Gross beta or gamma radioactivity measurement techniques were not utilized to approximate the total radioactivity in effluents.

2.5 Batch Releases

2.5.1 Liquid

Number of batch releases: 144

Total time period for batch releases: 41,075 minutes

Maximum time period for a batch release: 703 minutes

Average time period for batch releases: 285 minutes

Minimum time period for a batch release: 60 minutes

Average stream flow during periods of release of effluent into a flowing stream: 74,165 cfs*

*Ref: Letter, L. A. Waite (US Geological Survey) to C. C. Graham (Union Electric Co.) dated July 5, 1988.

2.5.2	Gaseous	<u>Total for the Reporting Period</u>	<u>Non-Outage Related</u>
	Number of batch releases	40	38
	Total time period for batch releases	15,984 minutes	5,331 minutes
	Maximum time period for a batch release	7,822 minutes	856 minutes
	Average time period for batch releases	400 minutes	140 minutes
	Minimum time period for a batch release	66 minutes	66 minutes

2.6 Abnormal Releases

2.6.1 Liquid

Number of releases: 0

Total Activity released: 0

2.6.2 Gaseous

2.6.2.1 Number of releases: 0

2.6.2.2 Total Activity released: 0

3.0 SUMMARY OF GASEOUS RADIOACTIVE EFFLUENTS

3.1 The quantities of radioactive material released in gaseous effluents are summarized in Table 1A and 1B. Note that for this reporting period no gaseous effluents were considered as elevated releases.

4.0 SUMMARY OF LIQUID RADIOACTIVE EFFLUENTS

4.1 The quantities of radioactive material released in liquid effluents are summarized in Table 2A and 2B.

5.0 SOLID WASTES

5.1 The quantities of radioactive material released in shipments of solid waste and irradiated fuel transported from the site during the reporting period are summarized in Table 3. The activity and fractional abundance of each nuclide was determined for each waste type by an independent laboratory based upon radiochemical analysis of samples of that waste type. The curie amount of each nuclide listed in Table 3 was determined as the product of the fractional abundance and the total curies shipped. Those nuclides which comprise at least 1% of the total activity for a particular waste type are presented in Table 3. Additionally, as noted in the "Solid Waste Disposition" section of Table 3, one shipment was released with eventual disposal at the Beatty, NV disposal facility. This shipment was consigned initially to a waste processor in 1987 for supercompaction. Shipment for disposal of the supercompacted waste was made during the 1st half of 1988.

6.0 RELATED INFORMATION

6.1 Unplanned Releases

Unplanned releases are inadvertent or accidental releases of radioactive material, or releases of radioactive material via normal pathways without a release permit or proper authorization, or without proper sampling and analysis, or releases which are conducted in such a manner as to result in significant deviation from the requirements of the release permit.

There were no unplanned releases during the reporting period.

6.2 Changes to the Process Control Program

There were no changes to the PCP during the reporting period.

6.3 Changes to the Offsite Dose Calculation Manual

Revision 5 of the Callaway Plant ODCM was approved February 29, 1988 to incorporate the following:

- a. Revised descriptions of the liquid and gaseous radiation monitors, deleting redundant information (Sections 2 and 3);
- b. Revised liquid setpoint methodology to incorporate monitor background (Section 2);
- c. Revised and clarified methodology for calculating dose to the Nearest Resident and to the Member of the Public from activities within the Site Boundary from direct radiation and from gaseous effluents (Section 4);
- d. Revised Table 6 and figures 5.1A and 5.1B to refine descriptions of environmental TLD locations (Section 5);
- e. Incorporated a description of the environmental TLD testing required to demonstrate compliance with Regulatory Guide 4.13 (Section 5);
- f. Revised Tables 1, 2, 4, and 5 to incorporate dose factors for additional nuclides (sections 2 and 3).
- g. Revised Section 6 to delete material redundant with Section 2.3 of the Callaway Plant FSAR (Section 6);
- h. Several minor clarifications

A complete copy of the ODCM (Rev. 5) is included as Attachment 1 to this report.

6.4 Major Changes to Radwaste Treatment Systems

There were no major changes to Radwaste Treatment Systems during the reporting period.

6.5 Land Use Census Changes

There were no changes in critical receptor locations for dose calculations during the reporting period.

6.6 Inoperability of Effluent Monitoring Instrumentation

All effluent monitoring instrumentation was OPERABLE within the limits specified by Specifications 3.3.3.9 and 3.3.3.10 during the reporting period.

6.7 Instances of Liquid Holdup Tanks or Waste Gas Decay Tanks Exceeding Technical Specification Limits

All liquid tanks and waste gas decay tanks were within the limits of Specifications 3.11.1.4 and 3.11.2.6 during the reporting period.

TABLE 1A

SEMIANNUAL SUMMATION OF GASEOUS RELEASES
ALL AIRBORNE EFFLUENTS
QUARTERS 1 AND 2, 1988

TYPE OF EFFLUENT	UNIT	QUARTER 1	QUARTER 2	EST TOTAL ERROR %
A. FISSION AND ACTIVATION GASES				
1. TOTAL RELEASE	CURIES	2.03E2	2.20E2	20
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	25.8	28.0	
3. PERCENT OF TECH SPEC LIMIT	%	1.5E-3	1.6E-3	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	4.53E-6	1.97E-6	23
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	5.76E-7	2.51E-7	
3. PERCENT OF TECH SPEC LIMIT	%	5.5E-7	2.4E-7	
C. PARTICULATES				
1. PARTICULATES (HALF-LIVES > 8 DAYS)	CURIES	0	3.17E-4	30
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	0	4.03E-5	
3. PERCENT OF TECH SPEC LIMIT	%	0	2.6 E-6	
4. GROSS ALPHA RADICACTIVITY	CURIES	8.27E-7	4.39E-7	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	3.25E0	4.41E0	14
2. AVERAGE RELEASE RATE FOR PERIOD	UCI/SEC	4.13E-1	5.61 E-1	
3. PERCENT OF TECH SPEC LIMIT	%	2.7E-5	3.7 E-5	

TABLE 1B

SEMIANNUAL AIRBORNE CONTINUOUS AND BATCH RELEASES
GROUND LEVEL RELEASES
FISSION GASES, IODINES, AND PARTICULATES
QUARTERS 1 AND 2, 1968

NUCLIDE	UNIT	CONTINUOUS RELEASES		BATCH RELEASES	
		QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
1. FISSION GASES					
Kr-85M	CURIES	4.63E-1	1.03E-1	2.37E-3	1.51E-3
Kr-85	CURIES	0	0	4.18E-2	1.58E0
Kr-87	CURIES	0	0	0	0
Kr-88	CURIES	0	0	9.57E-4	7.63E-4
Xe-131M	CURIES	0	0	8.67E-3	2.14E0
Xe-133M	CURIES	1.01E0	0	2.41E-2	1.44E0
Xe-133	CURIES	1.89E2	4.74E1	1.97E0	1.61E2
Xe-135M	CURIES	0	0	0	0
Xe-135	CURIES	1.01E1	3.15E0	4.11E-2	2.57E0
Xe-138	CURIES	0	0	0	0
Ar-41	CURIES	0	0	1.05E-1	1.63E-1
TOTAL FOR PERIOD	CURIES	2.01E2	5.07E1	2.19E0	1.69E2
2. IODINES					
I-131	CURIES	4.53E-6	1.97E-6	0	0
I-133	CURIES	0	0	0	0
I-135	CURIES	0	0	0	0
TOTAL FOR PERIOD	CURIES	4.53E-6	1.97E-6	0	0
3. PARTICULATES					
H-3	CURIES	3.19E0	3.92E0	6.58E-2	4.88E-1
Co-58	CURIES	0	0	0	0
Co-60	CURIES	0	0	0	0
Rb-88	CURIES	0	0	3.17E-4	0
Sr-89	CURIES	0	0	0	0
Cs-134	CURIES	0	0	0	0
Cs-137	CURIES	0	0	0	0
Sr-90	CURIES	0	0	0	0
G ALPHA	CURIES	8.09E-7	4.34E-7	1.88E-8	5.80E-9
TOTAL FOR PERIOD	CURIES	3.19E0	3.92E0	6.58E-2	4.88E-1

TABLE 2A

SEMIANNUAL SUMMATION OF LIQUID RELEASES
ALL LIQUID EFFLUENTS
QUARTERS 1 AND 2, 1988

TYPE OF EFFLUENT	UNIT	QUARTER 1	QUARTER 2	EST TOTAL ERROR %
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.48E-2	1.96E-2	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	3.12E-8	3.94E-8	
3. PERCENT OF APPLICABLE LIMIT	%	1.5	0.2	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	2.61E2	2.38E2	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	3.39E-4	4.78E-4	
3. PERCENT OF APPLICABLE LIMIT	%	11	16	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	3.31E-1	1.04E-1	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	UCI/ML	6.97E-7	2.09E-7	
3. PERCENT OF APPLICABLE LIMIT	%	0.35	0.10	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	9.20E-4	1.14E-3	29
E. WASTE VOL RELEASED (PRE-DILUTION)				
E. WASTE VOL RELEASED (PRE-DILUTION)	GAL	6.51E6	6.58E6	10
F. VOLUME OF DILUTION WATER USED				
F. VOLUME OF DILUTION WATER USED	GAL	1.19E8	1.25E8	10

TABLE 2B

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
 TOTALS FOR EACH NUCLIDE RELEASED
 QUARTER 1 AND 2, 1988

NUCLIDE	UNIT	CONTINUOUS RELEASES		BATCH RELEASES	
		QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
ALL NUCLIDES					
H-3	CURIES	0	0	1.61E2	2.38E2
Na-24	CURIES	0	0	0	0
Cr-51	CURIES	0	0	0	0
Mn-54	CURIES	0	0	3.18E-4	1.11E-3
Fe-55	CURIES	0	0	3.63E-3	5.47E-3
Fe-59	CURIES	0	0	0	1.43E-5
Co-58	CURIES	0	0	1.63E-3	1.68E-3
Co-60	CURIES	0	0	2.35E-3	5.58E-3
Zn-65	CURIES	0	0	0	0
Rb-88	CURIES	0	0	0	0
Sr-89	CURIES	0	0	2.56E-3	6.31E-4
Zr-95	CURIES	0	0	0	1.71E-4
Nb-95	CURIES	0	0	5.79E-5	4.83E-4
Mo-99	CURIES	0	0	0	0
Tc-99M	CURIES	0	0	0	0
Ag-110m	CURIES	0	0	4.07E-6	0
I-131	CURIES	0	0	2.50E-4	7.35E-5
I-133	CURIES	0	0	0	0
I-135	CURIES	0	0	0	0
Cs-134	CURIES	0	0	8.46E-4	1.02E-3
Cs-136	CURIES	0	0	0	0
Cs-137	CURIES	0	0	1.27E-3	1.51E-3
La-140	CURIES	0	0	0	0
Ce-141	CURIES	0	0	0	0
Ce-144	CURIES	0	0	0	1.77E-3
W-187	CURIES	0	0	0	0
Kr-85	CURIES	0	0	8.98E-4	0
Kr-85M	CURIES	0	0	3.33E-6	0
Xe-131M	CURIES	0	0	2.22E-3	0
Xe-133	CURIES	0	0	3.23E-1	1.03E-1
Xe-133M	CURIES	0	0	2.56E-3	5.17E-4
Xe-135	CURIES	0	0	2.22E-3	6.77E-4
Xe-135M	CURIES	0	0	0	0
Ba-140	CURIES	0	0	0	1.46E-5
Sr-90	CURIES	0	0	1.86E-3	0
G ALPHA	CURIES	0	0	9.20E-4	1.14E-3
UNIDENTIFIED	CURIES	0	0	0	0
Co-57	CURIES	0	0	3.137E-6	3.80E-5
Sn-113	CURIES	0	0	7.47E-6	0
Sb-124	CURIES	0	0	0	1.41E-5
TOTAL FOR PERIOD	CURIES	0	0	1.61E2	2.38E2

TABLE 3

SOLID WASTE & IRRADIATED FUEL SHIPMENTS
QUARTERS 1 & 2, 1988

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (DOES NOT INCLUDE IRRADIATED FUEL)

<u>TYPE OF WASTE</u>		<u>6-MONTH PERIOD</u>	<u>EST. TOTAL ERROR (%)</u>
a. Spent resins, filter sludges evaporator bottoms, etc.		20.6 m ³ 9.29 Ci	±25%
	Cs-137	17.64% 1.64E0 Ci	
	Cs-134	13.28% 1.23E0 Ci	
	Fe-55	13.17% 1.22E0 Ci	
	H-3	12.71% 1.18E0 Ci	
	Co-58	12.42% 1.15E0 Ci	
	Sb-125	9.73% 9.03E-1 Ci	
	Co-60	9.56% 8.88E-1 Ci	
	Ni-63	8.01% 7.44E-1 Ci	
	Mn-54	2.60% 2.42E-1 Ci	
b. Dry compressible waste, contaminated equipment, etc.		29.8 m ³ 1.28E0 Ci	±25%
	Cr-51	22.59% 2.88E-1 Ci	
	Co-58	20.82% 2.66E-1 Ci	
	C-14	11.42% 1.46E-1 Ci	
	Fe-55	10.4% 1.33E-1 Ci	
	Nb-95	9.91% 1.27E-1 Ci	
	Zr-95	6.5% 8.30E-2 Ci	
	Co-60	6.13% 7.83E-2 Ci	
	Ni-63	5.15% 6.58E-2 Ci	
	Mn-54	3.75% 4.79E-2 Ci	
	Ce-144	2.13% 2.72E-2 Ci	
c. Irradiated components, control rods, etc.		0 m ³ 0 Ci	
d. Other		0 m ³ 0 Ci	

Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>	<u>Class of Solid Waste Shipped</u>	<u>Type of Container</u>
3	Truck	Richland, WA	A	LSA
1	Cask	Richland, WA	A	LSA
1*	Truck	Beatty, NV	A	LSA

* Shipped to waste processor 2nd half, 1987. Disposed of in 1st half 1988.

TABLE 3 (cont.)

Solidification Agent

Cement (applicable to waste type "a" only)

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

<u>Number of Shipments:</u>	<u>Mode of Transportation</u>	<u>Destination</u>
0	N/A	N/A

ATTACHMENT 1

OFFSITE DOSE CALCULATION MANUAL CHANGES

The attached is a complete copy of the Callaway Plant Offsite Dose Calculation Manual (Rev. 5, February 1988).