

SEMI-ANNUAL EFFLUENT RELEASE REPORT
FOR CALVERT CLIFFS NUCLEAR POWER PLANT

SECOND HALF - 1984

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CALVERT CLIFFS NUCLEAR POWER PLANT
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT 1/
SUPPLEMENTAL INFORMATION

Facility - Calvert Cliffs Nuclear Power Plant

Licensee - Baltimore Gas & Electric Company

I. REGULATORY LIMITS

A. Fission and Activation Gases:

1. The instantaneous release rate of gross activity, except for I-131 and particulates with half-lives longer than eight days shall not exceed

$$\sum \frac{Q_i}{(3.85 \times 10^5) (MPC)_i} \leq 1$$

where Q_i is the release rate in Ci/sec for isotope i and $(MPC)_i$ is the maximum permissible concentration of isotope i as defined in Appendix B, Table II, Column i , 10 CFR 20.

2. The release rates of gross gaseous activity shall not exceed 16 percent of the values specified in I.A.1. above when averaged over any calendar quarter. See Table 1A, A3.
3. The release rates of gross gaseous activity shall not exceed 8 percent of the values specified in I.A.1. above when averaged over 12 consecutive months. See Table 1A, A4.

1/ Submitted in accordance with Section 5.6.1.b of Appendix B of the Environmental Technical Specifications

B. Iodines and Particulates, Half-Lives >8 Days:

1. The release rate from the main vents of I-131 and particulates with half-lives greater than eight days released to the environment as part of airborne effluents shall not exceed 2.0 uCi/sec.
2. The release rates of I-131 and particulates shall not exceed 8 percent of the value specified in I.B.1. above when averaged over any calendar quarter. See Table 1A, B3.
3. It should be noted that "iodines" as used here includes only iodine-131 since the Technical Specifications only refer to it specifically. Such other iodines, i.e., iodine-133, iodine-135, etc., are treated as gross activity and are included in I.A.1. and I.A.2.
4. The release rates of I-131 and particulates shall not exceed 4 percent of the values specified in I.B.1 above when averaged over any 12 consecutive months. See Table 1A, B4.

C. Liquid Effluents:

1. The release rate of radioactive liquid effluents, excluding tritium and noble gases, shall not exceed 10 curies per unit during any calendar quarter.
2. The radioactivity release concentrations in liquid effluents from the plant shall not exceed the values specified in 10 CFR, Part 20, Appendix B, for unrestricted areas.

II. MAXIMUM PERMISSIBLE CONCENTRATIONS

The MPC's used for radioactive materials released in liquid and gaseous effluents are in accordance with Technical Specifications and/or are derived from the use of notes to Appendix B, 10 CFR, Part 20. In all cases, the most restrictive (lowest) MPC found for each isotope is used regardless of solubility.

The following limits were used to calculate the percent of applicable limit in Table 2A:

- A. Fission and Activation Products - Limit used 1×10^{-7} uCi/ml. This limit was used as given in the notes to Appendix B, Table II, Column 2 of 10 CFR 20.
- B. Tritium - Limit used 3×10^{-3} uCi/ml.
This limit was used as given in Appendix B, Table II, Column 2 of 10 CFR 20.
- C. Dissolved and Entrained Gases - Limit used 3×10^{-6} uCi/ml.
This limit was used as given in Appendix B, Table II, Column 2 of 10 CFR 20.

III. AVERAGE ENERGY - not applicable

IV. MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY

A. Fission and Activation Gases:

1. Batch Releases

Prior to each batch release of gas from a pressurized gas decay tank, a sample is collected and analyzed for each significant isotope using a Ge(Li) detector. The total activity released is based on the pressure/volume relationship (gas laws) of the tank prior to and after the release.

Prior to and after the release of gas as a result of purging containment, samples are collected and analyzed for each significant isotope using a Ge(Li) detector. The total activity released is based on containment volume and purge rate with activity buildup while purging is being considered.

2. Continuous releases

During the release of gas from the main vents, samples are collected and analyzed at least weekly for each significant isotope using a Ge(Li) detector. The total activity released for the week is based on the total sample activity decay corrected to the midpoint of the sample period and multiplied by the main vent flow for the week.

B. Iodine and Particulates:

1. Batch releases

Total activity released from a pressurized gas decay tank as iodines and particulates is measured by the same methods as fission and activation gases.

Prior to and after the release of gas as a result of purging containment, iodines are sampled using a charcoal filter and particulates are sampled using a particulate filter. These filters are analyzed for each significant isotope using a Ge(Li) detector. The total activity released is based on containment volume and purge rate with activity buildup while purging is being considered.

2. Continuous releases

During the release of gas from the main vents, samples of iodines and particulates are collected using a charcoal and particulate filter respectively. The filters are removed weekly and are analyzed for each significant isotope using a Ge(Li) detector. The total activity released for the week is based on the activity found on the filters multiplied by the main vent flow for the week. The activity on the filters is corrected for decay and buildup during the sample period. These weekly particulate filters are then composited to form monthly and quarterly composites at which time gross alpha and strontium 89 and 90 are analyzed.

C. Liquid Effluents:

1. Batch releases

Prior to the release of liquid from a monitor tank, a sample is collected and analyzed for the concentration of each significant gamma energy peak to demonstrate compliance with Section I.C.1 above using the water flow rate in each discharge conduit into which the effluent is discharged at the time of discharge. The total activity released in each batch is determined by multiplying the volume released times the concentration of each isotope. The actual volume released is based on the difference in tank levels prior to and after the release. A proportional composite sample is also withdrawn for each week's releases, and this is used in turn to prepare monthly and quarterly composites for use in analyses of gross alpha and strontium 89 and 90.

2. Continuous releases

Steam generator blowdown is sampled daily and these samples are used in turn to prepare a weekly blowdown composite based on each day's blowdown. The weekly composite is analyzed for each significant isotope using a Ge(Li) detector and these results are multiplied by the actual quantity of blowdown to determine the total activity released. The weekly composite is also used to prepare monthly and quarterly composites for use in analyses of tritium, gross alpha, and strontium 89 and 90.

D. Estimation of Total Error:

Total error on all releases was estimated using as a minimum the random counting error associated with typical releases. In addition to the random error, the detector to sample geometry systematic error during gamma counting was determined. This included an estimate of sample volume error and sample pipetting error. More specifically the following other systematic errors were also examined:

1. Liquid

- a. Error in volume of liquid released prior to dilution during batch releases.
- b. Error in volume of liquid released via steam generator blowdown.
- c. Error in amount of dilution water used during the reporting period.

2. Gases

- a. Error in main vent release flow.
- b. Error in sample flow rate.
- c. Error in containment purge release flow.
- d. Error in gas decay tank pressure.

Where errors could be estimated they were usually considered additive.

V. BATCH RELEASES

	<u>1984</u>	
	<u>3rd Quarter</u>	<u>4th Quarter</u>
A. <u>Liquid:</u>		
1. Number of batch releases	5.30E+01	4.80E+01
2. Total time period for batch release (hours)	4.38E+02	4.56E+02
3. Maximum time period for a batch release (min)	1.16E+03	9.85E+02
4. Average time period for batch releases (min)	4.96E+02	5.70E+02
5. Minimum time period for a batch release (min)	2.90E+01	7.50E+01
6. Average stream flow during periods of effluent into a flowing stream (liters/min of dilution water)	4.64E+06	4.64E+06
B. <u>Gaseous:</u>		
1. Number of batch releases	3.90E+01	2.90E+01
2. Total time period for batch releases (min)	2.25E+04	1.32E+04
3. Maximum time period for a batch release (min)	8.60E+03	6.82E+03
4. Average time period for batch release (min)	5.78E+02	4.56E+02
5. Minimum time period for a batch release (min)	5.00E+00	5.00E+00

VI. ABNORMAL RELEASES

	<u>3rd</u> <u>Quarter</u>	<u>4th</u> <u>Quarter</u>
A. <u>Liquid:</u>		
1. Number of releases	- 0 -	- 0 -
2. Total activity released (Curies) <u>2/</u>		
B. <u>Gaseous:</u>		
1. Number of releases	- 0 -	- 0 -
2. Total activity releases (Curies)		

2/ Excluding tritium and dissolved gases

TABLE 1A - REG GUIDE 1.21
CALVERT CLIFFS NUCLEAR POWER PLANT
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT
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GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

		Units	3rd Quarter	4th Quarter	Est. Total Error, %
A. Fission and activation gases					
1.	Total Release	Ci	5.96E+02	8.22E+02	2.15E+01
2.	Average release rate for period	uCi/sec	7.58E+01	1.05E+02	
3.	Percent of tech. spec. limit (1)	%	4.35E-01	6.40E-01	
4.	Percent of tech. spec. limit (2)	%	1.86E+00	1.46E+00	
B. Iodines					
1.	Total iodine - 131	Ci	1.45E-02	7.63E-03	1.84E+01
2.	Average release rate for period	uCi/sec	1.84E-03	9.71E-04	
3.	Percent of tech. spec. limit (3)	%	1.15E+00	6.07E-01	
4.	Percent of tech. spec. limit (4)	%	4.25E+00	2.36E+00	
C. Particulates					
1.	Particulates with half lives greater than 8 days	Ci	2.21E-04 **	3.37E-06 **	1.84E+01
2.	Average release rate for period	uCi/sec	2.81E-05	4.28E-07	
3.	Percent of tech. spec. limit (3)	%	1.75E-02	2.68E-04	
4.	Percent of tech. spec. limit (4)	%	1.62E-02	1.10E-02	
5.	Gross alpha radioactivity	Ci	< 8.98E-06	< 1.25E-04	
D. Tritium					
1.	Total Release	Ci	1.04E+00	5.83E-01	2.18E+01
2.	Average release rate for period	uCi/sec	1.33E-01	7.42E-02	
3.	Percent of tech. spec. limit (1)	%	1.07E-03	6.02E-04	

- (1) Percent of I.A.2 for each quarter
(2) Percent of I.A.3 for previous 12 months
(3) Percent of I.B.2 for each quarter
(4) Percent of I.B.3 for previous 12 months

** Does not include strontium 89, 90 values.

TABLE 1C REG GUIDE 1.21

CALVERT CLIFFS NUCLEAR POWER PLANT

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GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

		Units	Continuous Mode		Batch Mode	
			3rd Quarter	4th Quarter	3rd Quarter	4th Quarter
1.	Fission and activation gases					
	krypton	- 85m	Ci		3.39E-02	5.60E-01
	krypton	- 88	Ci		9.75E-02	1.08E-02
	xenon	- 131m	Ci		3.43E+00	3.80E+00
	xenon	- 133	Ci	2.42E+02	3.54E+02	2.91E+02
	xenon	- 133m	Ci	9.20E+00	6.10E+01	1.84E+00
	xenon	- 135	Ci	6.09E+00	4.11E+01	5.12E+00
	argon	- 41	Ci		6.73E-02	2.61E-02
	krypton	- 87	Ci		8.07E-03	1.57E-04
	krypton	- 85	Ci		4.71E-01	5.54E-01
	Total For Period		Ci	2.57E+02	4.56E+02	3.02E+02
2.	Halogens					
	iodine	- 131	Ci	1.44E-02	7.59E-03	6.93E-05
	iodine	- 132	Ci	2.67E-04		8.42E-04
	iodine	- 133	Ci	3.19E-02	1.70E-02	1.24E-04
	iodine	- 135	Ci	1.02E-02	2.57E-03	4.19E-06
	bromine	- 82	Ci	1.30E-05		7.57E-05
	iodine	- 134	Ci			2.72E-06
	Total For Period		Ci	5.68E-02	2.72E-02	1.12E-03

TABLE 1C REG GUIDE 1.21 (CONT'D)
CALVERT CLIFFS NUCLEAR POWER PLANT
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GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

3.	Particulates	Units	Continuous Mode		Batch Mode	
			3rd Quarter	4th Quarter	3rd Quarter	4th Quarter
	strontium - 89	Ci	**	**		
	strontium - 90	Ci	**	**		
	rubidium - 88*	Ci			1.71E-02	4.39E-03
	cobalt - 58	Ci	2.58E-06		1.40E-06	3.39E-07
	cesium - 138*	Ci			1.06E-04	1.21E-04
	cesium - 134	Ci			2.02E-06	4.54E-08
	cesium - 137	Ci	5.40E-06	2.05E-06	1.80E-05	7.51E-07
	lanthanum 140*	Ci	3.77E-04		3.92E-10	
	molybdenum 99*	Ci			1.09E-09	
	tellurium 132	Ci			9.41E-08	1.82E-07
	cobalt 57	Ci			1.09E-07	
	barium 140	Ci	1.91E-04			
	Total For Period	Ci	5.76E-04	2.05E-06	1.72E-02	4.51E-03

* Particulates with half lives less than eight days.

** Strontium 89, 90 results will be included in an updated report.

TABLE 2A - REG GUIDE 1.21

CALVERT CLIFFS NUCLEAR POWER PLANT

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LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

A. Fission and activation products	Units	3rd Quarter	4th Quarter	Est. Total Error, %
1. Total Release (not including tritium, gases, alpha)	Ci	2.82E-01	3.47E-01	2.16E+01
2. Average diluted concentration during period	uCi/ml	4.83E-10	5.62E-10	
3. Percent of applicable limit	%	4.83E-01	5.62E-01	
B. Tritium				
1. Total Release	Ci	2.09E+02	2.47E+02	1.81E+01
2. Average diluted concentration during period	uCi/ml	3.58E-07	4.05E-07	
3. Percent of applicable limit	%	1.20E-02	1.35E-02	
C. Dissolved and entrained gases				
1. Total Release	Ci	6.16E-02	1.17E-02	2.00E+01
2. Average diluted concentration during period	uCi/ml	1.00E-10	1.90E-11	
3. Percent of applicable limit	%	3.35E-03	6.34E-04	
D. Gross alpha radioactivity				
1. Total Release	Ci	< 8.64E-03	< 4.76E-03	3.00E+00
E. Volume of Waste Releases (prior to dilution)				
	liters	1.03E+07	1.14E+07	3.00E+00
F. Volume of dilution water used during period				
	liters	5.85E+11	6.11E+11	1.40E+01

TABLE 2B REG GUIDE 1.21

CALVERT CLIFFS NUCLEAR POWER PLANT

EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT

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LIQUID EFFLUENTS

Nuclides Released		Units	Continuous Mode (1)		Batch Mode	
			3rd Quarter	4th Quarter	3rd Quarter	4th Quarter
strontium	- 89	Ci			**	**
strontium	- 90	Ci			**	**
cesium	- 134	Ci			1.69E-03	5.91E-03
cesium	- 137	Ci			1.01E-02	1.92E-02
iodine	- 131	Ci			1.53E-02	1.25E-02
cobalt	- 58	Ci			5.78E-02	2.32E-01
cobalt	- 60	Ci			2.36E-02	1.62E-02
manganese	- 54	Ci			2.51E-03	1.74E-03
chromium	- 51	Ci			1.82E-02	1.86E-02
zirconium	- 95	Ci			7.38E-03	9.76E-04
niobium	- 95	Ci			1.44E-02	3.31E-03
molybdenum	- 99	Ci			1.09E-04	4.48E-05
barium	- 140	Ci			7.22E-04	
iodine	- 133	Ci			2.46E-03	9.13E-03
antimony	- 125	Ci			3.68E-02	7.73E-04
cobalt	- 57	Ci			1.43E-05	
silver	- 110m	Ci			3.16E-02	2.07E-02
cerium	- 141	Ci			2.16E-03	
tin	- 113	Ci			2.31E-03	4.32E-04
sodium	- 24	Ci			8.62E-06	1.56E-03
ruthenium	- 103	Ci			1.05E-03	

TABLE 2B REG GUIDE 1.21 (CONT'D)

CALVERT CLIFFS NUCLEAR POWER PLANT

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LIQUID EFFLUENTS

Nuclides Released	Units	Continuous Mode (1)		Batch Mode	
		3rd Quarter	4th Quarter	3rd Quarter	4th Quarter
antimony - 122	Ci				7.89E-05
cerium - 144	Ci			4.47E-02	2.79E-03
unidentified	Ci			< 5.15E-03	< 5.70E-03
Total For Period	Ci			2.78E-01	3.51E-01

** Strontium 89, 90 results will be included in an updated report.

TABLE 2B REG GUIDE 1.21 (CONT'D)

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LIQUID EFFLUENTS

Nuclides Released		Units	Continuous Mode (1)		Batch Mode	
			3rd Quarter	4th Quarter	3rd Quarter	4th Quarter
Xenon	- 133	Ci			2.62E-02	1.08E-02
Xenon	- 135	Ci			5.66E-04	9.03E-04
		Ci				

- (1) Continuous mode releases, i.e., nuclides released, are less than "unidentified" unless otherwise noted.

TABLE 3A
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT
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SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of Waste	Units	6-Month Period	Est. Total Error %
a. Spent resin, filter sludge evaporator bottoms, etc.	m ³	1.88E+01	
b. Dry compressible waste, contaminated equipment, etc.	Ci	5.64E+02	2.00E+01
c. Irradiated components, control rods, etc.	m ³	9.57E+01	
d. Other (describe)	Ci	3.12E+00	5.00E+01
	m ³	4.44E+00	
	Ci	3.69E+04	5.00E+01

2. Estimate of major nuclides (by type of waste)*

a.	Cadmium - 109	5.24E+00%
	Cobalt - 58	6.33E+00%
	Cesium - 137	3.49E+01%
	Cesium - 134	1.86E+01%
	Manganese - 54	3.11E+00%
	Cobalt - 60	4.11E+00%
	Antimony - 122	2.15E+00%
	Strontium - 90	2.75E-01%
	Nickel - 63	2.46E+01%
b.	Cobalt - 60	3.56E+01%
	Cobalt - 58	3.25E+00%
	Cesium - 137	1.72E+01%
	Cesium - 134	5.62E+00%
	Manganese - 54	2.44E+00%
	Nickel - 63	3.24E+01%
c.	Manganese - 54	1.13E+00%
	Iron - 55	6.96E+01%
	Cobalt - 60	3.91E+01%
	Nickel - 63	9.91E+00%

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
22	Motor surface transit	Barnwell, S. C.
2	Motor surface transit	Richland, Wash.

* Only nuclides greater than 1% were reported.