

RADIOACTIVE EFFLUENT REPORT
FOR THE
LA CROSSE BOILING WATER REACTOR
(JANUARY 1, 1985 TO JUNE 30, 1985)
DAIRYLAND POWER COOPERATIVE
Docket No. 50-409

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INTRODUCTION:

The La Crosse Boiling Water Reactor, also known as Genoa No. 2, is located on the east bank of the Mississippi River near Genoa, Vernon County, Wisconsin. The plant was designed and constructed by the Allis-Chalmers Manufacturing Company. It was completed in 1967 and has a generation capacity of 50 MW (165 MW (th)). The reactor is owned and operated by Dairyland Power Cooperative (DPC).

For the first half of 1985, the plant has had a maximum dependable capacity factor (MDC net) of 64.6%, which included a 39 day refueling outage in March/April.

The reactor went critical in July 1967 and first contributed electricity to DPC's system in April 1968. After completing full power tests in August 1969, the plant has been operating between 60% and 100% full power, with the exception of plant shutdowns for maintenance and repair.

In accordance with LACBWR Technical Specifications 6.9.3.a, and in compliance with 10 CFR 50.36a(a)(2), this document is the Radioactive Effluent Report for the period January 1 through June 30, 1985.

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RADIOACTIVE EFFLUENT REPORT

EFFLUENT AND WASTE DISPOSAL REPORT
(Supplemental Information)

FACILITY LaCrosse Boiling Water Reactor LICENSEE DAIRYLAND POWER COOPERATIVE
DOCKET NO. 50-409

1. REGULATORY LIMITS

a. Gaseous Effluent Release Limits:

LACBWR's Technical Specifications for gaseous effluent releases of radioactive material limit the release rates, of the sum of the individual radionuclides, in curies per seconds, so that the dose rates to members of the public beyond the Effluent Release Boundary (p. iv) do not exceed 500 mRem/year to the whole body, 3000 mRem/year to the skin from noble gases, and 1500 mRem/year to a critical organ from ^3H , $^{131}\text{I}/^{133}\text{I}$ and particulates with half-lives greater than 8 days.

Also, in accordance with 10CFR50, Appendix I, the Technical Specifications for gaseous effluent radioactive material limit the air dose to a member of the public from noble gases in areas beyond the Effluent Release Boundary to less than 5 mRad gamma and 10 mRad beta per calendar quarter and less than 10 mRad gamma and 20 mRad beta per calendar year. The dose limits from ^3H , $^{131}\text{I}/^{133}\text{I}$ and particulates with half lives greater than 8 days are less than 7.5 mRem per calendar quarter and less than 15 mRem per calendar year to any organ.

Cumulative dose contributions from gaseous effluent releases are determined in accordance with the LACBWR Offsite Dose Calculations Manual at least onch each 31 days.

b. Liquid Effluent Release Limits:

LACBWR's Technical Specifications limits for liquid effluent releases are limited to those concentrations of individual radionuclides such that the diluted discharge does not exceed 1 MPC in a 168 hour week averaged over the calendar year. For dissolved or entrained noble gases, the concentration is limited to a total activity concentration of 2×10^{-4} $\mu\text{Ci/ml}$. For alpha emitting radionuclides, the concentration is limited to a total activity concentration of 4.9×10^{-9} $\mu\text{Ci/ml}$, based upon an actual alpha emitting radionuclide analysis performed on a representative water sample. The values reported in tables 2A and 2B, Liquid Effluents, are based on dilution with the combination of LACBWR and Genoa #3 condenser cooling water flow prior to discharge to the Mississippi River. No credit is taken for further dilution in the mixing zone of the Mississippi River.

Also, in accordance with 10CFR50, Appendix I, the dose commitment to a member of the public from radioactive materials released in liquid effluents to areas beyond the Effluent Release Boundary are limited to less than 1.5 mRem whole body and 5.0 mRem organ per calendar quarter, and less than 3.0 mRem whole body and 10 mRem organ per calendar year via the critical ingestion pathway.

Cumulative quarterly and annual dose contributions from liquid effluent releases are determined for the adult fish ingestion pathway in accordance with the LACBWR Offsite Dose Calculation Manual at least once each 31 days.

c. Solid Radioactive Waste

All solid radioactive wastes are handled in accordance with a Process Control Program as defined by LACBWR procedures in order to assure that all applicable transportation and burial site disposal requirements are met.

2. MAXIMUM PERMISSIBLE CONCENTRATION (MPC)

The MPC used to calculate permissible release rates are obtained from 10 CFR 20, Appendix B, Tables I and II. In addition, the following values are used:

Tritium in Water = 3×10^{-3} Ci/ml.

Tritium in Air = 2×10^{-7} μ Ci/cc.

3. AVERAGE ENERGY

The release rate limits for LACBWR are not based on average energy.

4. ANALYTICAL METHODS

(a) Liquid Effluents

Liquid effluent measurements for gross radioactivity are performed by Ge-Li gamma isotopic analysis of a representative sample from each tank discharged. A composite sample is created by collecting representative aliquots of each sample from each tank batch discharged, and is analyzed monthly for Tritium, and quarterly for Strontium 89 and 90. The radiostrontiums are analyzed by a contractor. In addition, each batch discharged tank is analyzed for alpha activity concentration.

(b) Airborne Particulates

Airborne particulate releases are determined by Ge-Li gamma isotopic analysis. This analysis is performed by analyzing a glass fiber filter paper taken from the stack monitor (Eberline SPING) which continuously isokinetically samples and monitors the stack effluent. This filter is changed and analyzed on an approximate weekly basis and analyzed within 7 days after removal. This filter is also analyzed for alpha activity. A quarterly composite of these filters is sent to a contractor for Sr 89 and 90 analysis.

(c) Radioiodines

Radioiodine releases are determined by Ge-Li gamma analysis of a TEDA impregnated activated charcoal cartridge taken from the stack monitor which continuously isokinetically samples and monitors the stack effluent. This charcoal cartridge is changed approximately weekly and analyzed within 48 hours after removal.

(d) Fission and Activation Gases

The gaseous releases converted into concentration ($\mu\text{Ci/cc}$) are continuously sampled from the stack release flow by two stack monitors, which are inline monitors. These gas concentrations ($\mu\text{Ci/cc}$) are averaged by the monitors microprocessor and flowrate/pressure compensated to obtain the daily gaseous release of the plant. A monthly grab gas sample is taken from a stack monitor. This sample is collected in a 3.7 liter gas Marinelli and gamma analyzed on the Ge-Li detector to determine the isotopic composition of the gaseous release mixture and the gaseous concentration to verify the stack

monitors indicated gaseous concentration ($\mu\text{Ci/cc}$). The Marinelli isotopic concentration fractions are then multiplied times the daily total gaseous releases to determine the individual gaseous isotopic release concentration.

(e) Tritium

Tritium releases are determined by taking a grab sample of the stack atmosphere at the effluent of the stack monitor. Tritium as tritiated water, is removed from the sample stream by condensation, using a cold trap containing an organic compound and dry ice. The condensed water vapor is then distilled and the distillate is analyzed for ^3H concentration, $\mu\text{Ci/cc}$, by internal liquid scintillation spectrophotometry and the results are expressed in terms of tritium release rates. The tritium grab samples are obtained on at least a once/month basis unless the upper reactor cavity is flooded, at which time the sampling frequency is increased to at least once per 7 days.

5. BATCH RELEASES

(a) All airborne effluent releases at LACBWR are from a single Continuous-Elevated Release Point.

(b) Liquid - All liquid effluent releases at LACBWR are batch releases.

This is summarized as follows:

- (1) Number of Batch Releases: 92
- (2) Total Time Period for Batch Releases: 573.2 hours
- (3) Maximum Time Period for a Batch Release: 15.38 hours
- (4) Average Time Period for Batch Releases: 6.30 hours
- (5) Minimum Time Period for a Batch Release: 0.8 hours
- (6) Average Stream Flow Rate During Periods of Release of Effluent into a Flowing Stream: 57,713 ft³/sec

6. ABNORMAL RELEASES - There were no abnormal releases of radioactivity in plant effluents as summarized as follows:

(a) Liquid

- (1) Number of Releases: None
- (2) Total Activity Released: NA

(b) Gaseous

- (1) Number of Releases: None
- (2) Total Activity Released: NA

7. ESTIMATED TOTAL ANALYTICAL ERROR

The reported analytical results contain the following estimated errors:

Counting Error \pm 1 Standard Deviation

Sampling Volume Error \pm 5%

The lower limits of detection (LLD) are expressed in terms of a 4.66 σ as defined in Technical Specifications.

TABLE 1A

EFFLUENT AND WASTE DISPOSAL REPORT (1985)

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	UNIT	QTR	QTR	QTR	QTR	TOTAL
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A. FISSION & ACTIVATION GASES

1. TOTAL RELEASE	Ci	1.72E3	2.39E3			4.11E3
2. AVERAGE RELEASE RATE FOR PERIOD	µCi/Sec	2.21E2	3.04E2			
3. PERCENT OF TECHNICAL SPECIFICATION GAMMA DOSE LIMIT	%	2.21E1	2.68E1			

B. IODINE I-131

1. TOTAL IODINE-131	Ci	6.18E-4	8.61E-4			1.48E-3
2. AVERAGE RELEASE RATE FOR PERIOD I-131	µCi/Sec	7.84E-5	1.12E-4			

C. PARTICULATES

1. PARTICULATES W/HALF- LIVES > 8 DAYS	Ci	2.73E-4	3.22E-4*			
2. AVERAGE RELEASE RATE FOR PERIOD	µCi/Sec	3.46E-5	4.19E-5*			
3. GROSS ALPHA RADIOACTIVITY	Ci	4.57E-6	2.19E-5			

D. TRITIUM

1. TOTAL RELEASE	Ci	2.72E0	5.92E0			8.64E0
2. AVERAGE RELEASE RATE FOR PERIOD	µCi/Sec	3.45E-1	7.53E-1			

E. H-3, I-131/133 & PARTICULATES

PERCENT OF TECHNICAL SPECIFICATION DOSE LIMIT	%	2.60E-1	1.49E0			
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* Values do not include Sr 89/90. Not available from contractor. Will be updated as soon as possible.

TABLE 1B

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1985)

GASEOUS EFFLUENTS - ELEVATED RELEASE

CONTINUOUS MODE

NUCLIDES RELEASED	UNIT	QTR	QTR	QTR	QTR	TOTAL
1. FISSION GASES						
KRYPTON-85	CI	*	*			*
KRYPTON-85M	CI	6.92E1	1.15E2			1.84E2
KRYPTON-87	CI	8.27E1	1.09E2			1.92E2
KRYPTON-88	CI	1.95E2	2.82E2			4.77E2
XENON-133	CI	2.37E2	2.40E2			4.77E2
XENON-135	CI	1.09E3	1.36E3			2.45E3
XENON-135M	CI	2.31E1	8.10E1			1.04E2
XENON-138	CI	2.45E1	6.49E1			8.94E1
KR-89	CI	*	*			*
XE-133M	CI	3.00E-2	4.92E-2			7.92E-2
XE-131M	CI	*	3.83E2			3.83E2
XE-137	CI	2.48E0	1.44E1			1.69E1
AR-41	CI	*	1.38E1			1.38E1
	CI					
	CI					
TOTAL FOR PERIOD	CI	1.72E3	2.66E3			4.38E3

2. IODINES

IODINE-131	CI	6.18E-4	8.61E-4			1.48E-3
IODINE-133	CI	3.71E-4	1.04E-3			1.41E-3
IODINE-135	CI	1.48E-4	1.55E-4			3.03E-4
TOTAL FOR PERIOD	CI	1.14E-3	2.06E-3			3.20E-3

3. SEE FOLLOWING PAGE FOR PARTICULATES.

* Indicates none detected or less than LLD

TABLE 1B - EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1985)
GASEOUS EFFLUENTS - ELEVATED RELEASE - (cont'd)

CONTINUOUS MODE

NUCLIDES RELEASED	UNIT	QTR	QTR	QTR	QTR	TOTAL
3. PARTICULATES						
STRONTIUM-89	CI	7.17E-6	**			
STRONTIUM-90	CI	*	**			
CESIUM-134	CI	*	*			*
CESIUM-137	CI	2.37E-5	8.55E-6			3.23E-5
BARIUM-LANTHANUM-140	CI	1.81E-4	1.94E-4			3.75E-4
CO-57	CI	6.00E-8	2.00E-7			2.60E-7
CO-58	CI	1.00E-6	4.70E-6			5.70E-6
CO-60	CI	4.24E-5	6.48E-5			1.07E-4
CE-144	CI	*	6.80E-6			6.80E-6
CE-141	CI	2.42E-6	1.07E-6			3.49E-6
CR-51	CI	1.93E-6	*			1.93E-6
MN-54	CI	9.33E-6	2.15E-5			3.08E-5
FE-59	CI	*	*			*
ZN-65	CI	*	4.62E-6			4.62E-6
ZR-95	CI	1.77E-6	1.30E-6			3.07E-6
NB-95	CI	2.16E-6	3.14E-6			5.30E-6
RU-RH-106	CI	*	1.01E-5			1.01E-5
RU-103	CI	3.80E-7	9.30E-7			1.31E-6
	CI					
	CI					
	CI					
	CI					
	CI					

* Indicates none detected or less than LLD

** Not available from contractor. Will be updated as soon as possible.

TABLE 2A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1985)

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

UNIT	QTR	QTR	QTR	QTR	TOTAL
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A. FISSION AND ACTIVATION PRODUCTS

1. TOTAL RELEASE (NOT INCL. TRITIUM, GASES, ALPHA)	Ci	4.55E-1	6.34E-1*		
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ml	3.82E-10	9.45E-9*		
3. PERCENT OF MPC LIMIT	%	5.19E-2	6.03E-2*		

B. TRITIUM

1. TOTAL RELEASE	Ci	2.73E1	1.68E1		4.41E1
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ml	4.56E-7	2.50E-7		
3. PERCENT OF MPC LIMIT	%	1.52E-2	8.33E-3		

C. DISSOLVED AND ENTRAINED GASES

1. TOTAL RELEASE	Ci	2.29E-2	9.19E-3		3.21E-2
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ml	3.82E-10	1.37E-10		
3. PERCENT OF MPC LIMIT	%	1.27E-2	4.57E-2		

D. GROSS ALPHA RADIOACTIVITY

1. TOTAL RELEASE	Ci	3.02E-4	2.09E-3		2.39E-3
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E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)	Liters	5.83E5	7.20E5		1.30E6
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F. VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	6.00E10	6.71E10		1.27E11
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* These values do not include Sr 89/90. The values were not available from contractor. Will be updated as soon as possible.

TABLE 2B

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1985)

LIQUID EFFLUENTS

NUCLIDES RELEASED	UNIT	QUARTER	QUARTER	QUARTER	QUARTER
STRONTIUM-89	CI	7.00E-4	**		
STRONTIUM-90	CI	1.69E-3	**		
CESIUM-134	CI	9.50E-4	1.66E-3		
CESIUM-137	CI	2.39E-2	3.66E-2		
IODINE-131	CI	1.27E-2	4.54E-2		
COBALT-58	CI	8.33E-3	7.80E-3		
COBALT-60	CI	2.50E-1	3.71E-1		
IRON-59	CI	1.64E-3	4.48E-3		
ZINC-65	CI	3.32E-3	3.04E-3		
MANGANESE-54	CI	3.84E-2	4.67E-2		
CHROMIUM-51	CI	6.71E-3	2.28E-3		
ZIRCONIUM-NIOBIUM-95	CI	1.17E-3	1.73E-3		
MOLYBDENUM-99	CI	4.99E-3	9.53E-4		
TECHNETIUM-99M	CI	1.57E-2	5.69E-3		
BARIUM-LANTHANUM-140	CI	2.11E-2	5.67E-3		
CERIUM-141	CI	3.91E-4	4.67E-4		
CE-144	CI	1.40E-3	6.34E-4		
CO-57	CI	4.42E-4	1.01E-4		
I-133	CI	2.31E-2	1.31E-2		
I-135	CI	1.00E-2	4.51E-3		
NP-239	CI	1.36E-2	7.13E-4		
RU-103	CI	9.65E-4	7.19E-2		
RU-RH-105	CI	2.41E-3	1.20E-3		
RU-RH-106	CI	6.40E-4	3.04E-3		
SR-91	CI	5.38E-3	1.52E-3		
SR-92	CI	1.09E-3	5.51E-4		
I-132	CI	3.41E-4	2.21E-4		
NA-24	CI	2.02E-4	1.29E-5		
W-187	CI	1.99E-4	*		
AG-110M	CI	2.79E-4	1.33E-3		
ZR-97	CI	2.73E-5	4.89E-5		
CS-136	CI	1.83E-4	*		
CL-38	CI	1.82E-5	*		
NB-97	CI	1.46E-3	3.24E-3		
BA-139	CI	3.24E-5	6.60E-4		
MN-56	CI	3.23E-5	5.10E-5		
Y-92	CI	1.50E-3	*		
TOTAL FOR PERIOD (ABOVE)	CI	4.55E-1	6.34E-1		
XENON-133	CI	7.78E-3	2.04E-3		
XENON-135	CI	1.10E-2	4.60E-3		
XE-131M	CI	*	1.10E-3		
XE-133M	CI	3.86E-5	1.46E-5		
XE-135M	CI	4.60E-3	1.32E-3		
KR-85M	CI	3.22E-6	1.82E-5		
KR-87	CI	5.62E-5	1.07E-4		
KR-88	CI	1.60E-5	*		

* Indicates none detected or less than LLD

** Not available from contractor. Will be updated as soon as possible.

TABLE 3

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1985)

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. TYPE OF WASTE	UNIT	6-MONTH PERIOD	6-MONTH PERIOD	TOTAL
a. SPENT RESINS, FILTER SLUDGES, EVAPORATOR BOTTOMS, ETC.	m ³	9.63		9.63
	Ci	1.76 E2		1.76 E2
b. DRY COMPRESSIBLE WASTE, CONTAMINATED EQUIPMENT, ETC.	m ³	--		--
	Ci	--		--
c. IRRADIATED COMPONENTS, CONTROL RODS, ETC.	m ³	--		--
	Ci	--		--
d. OTHER (DESCRIBE)	m ³	--		--
	Ci	--		--

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (BY TYPE OF WASTE)		Activity (Ci)		
		PERCENT	6-MONTH PERIOD	6-MONTH PERIOD
a.	Mn-54	7.10E0	1.25E1	
	Co-57	1.18E-2	2.07E-2	
	Co-60	4.71E1	8.29E1	
	Zn-65	1.37E0	2.41E0	
	Cs-137	9.20E0	1.62E1	
	Ce/Pr-144	1.78E-1	3.14E-1	
	H-3	5.14E-3	9.05E-3	
	C-14	1.22E-2	2.15E-2	
	Fe-55	2.64E1	4.65E1	
	Ni-59	5.63E-2	9.91E-2	
	Ni-63	4.81E0	8.46E0	
	Sr-90	3.87E-1	6.81E-1	
	Tc-99	5.91E-5	1.04E-4	
	U-235	7.95E-7	1.40E-6	
	U-238	6.70E-7	1.18E-6	
	Pu-238	7.50E-3	1.32E-2	
	Pu-239/240	4.20E-3	7.40E-3	
	Pu-241	3.36E-1	5.91E-1	
	Am-241	3.20E-3	5.63E-3	
	Cm-242	1.70E-2	3.00E-2	
	Cm-244/243	1.48E-3	2.61E-3	
	Fe-59	9.83E-2	1.73E-1	
	Nb-95	2.31E-2	4.00E-2	
	Ru-103	1.76E-2	3.09E-2	

TABLE 3 - (cont'd)

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1985)SOLID WASTE AND IRRADIATED FUEL SHIPMENTS2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION
(BY TYPE OF WASTE)

	PERCENT	ACTIVITY (Ci)	
		6-MONTH PERIOD	6-MONTH PERIOD
Cs-134	5.68E-1	1.00E0	
Ce-141	1.59E-2	2.80E-2	
Sr-89	1.64E-1	2.88E-1	
I-129	2.75E-3	4.84E-3	
Co-58	1.66E0	2.93E0	

3. SOLID WASTED DISPOSITION

<u>NO. OF SHIPMENTS</u>	<u>MODE OF TRANSPORTATION</u>	<u>DESTINATION</u>
2	SOLE USE	BARNWELL, SC

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

<u>NO. OF SHIPMENTS</u>	<u>MODE OF TRANSPORTATION</u>	<u>DESTINATION</u>
NONE		

