

**RADIOACTIVE EFFLUENT REPORT  
AND  
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT**

**FOR THE  
LA CROSSE BOILING WATER REACTOR (LACBWR)**

**(January 1 to December 31, 2012)**

**DAIRYLAND POWER COOPERATIVE  
3200 EAST AVENUE SOUTH  
LA CROSSE WI 54602-0817**

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**SECTION A**

**RADIOACTIVE EFFLUENT  
REPORT**

## INTRODUCTION:

*The La Crosse Boiling Water Reactor (LACBWR), also known as Genoa Station 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 had a generation capacity of 50 MW (165 MW<sub>(th)</sub>). The reactor is owned by Dairyland Power Cooperative (DPC).*

*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 operated between 60% and 100% full power, with the exception of plant shutdowns for maintenance and repair.*

*In April of 1987 plant operation was ceased. The reactor was defueled and placed in a SAFSTOR mode. In August of 1987 a possession-only license was received. In 2007 the reactor vessel was removed from the site and buried at the Barnwell waste repository. In 2012 all spent fuel was placed in dry storage and placed at the LACBWR ISFSI.*

*In accordance with LACBWR Technical Specifications 6.5.1.1.d and in compliance with 10 CFR 50.36a(a)(2), this document is the Radioactive Effluent Report for the period January 1 through December 31, 2012.*

# EFFLUENT AND WASTE DISPOSAL REPORT

(Supplemental Information)

FACILITY: La Crosse Boiling Water Reactor LICENSEE: Dairyland Power Cooperative

DOCKET NO. 50-409

## 1.0 REGULATORY LIMITS

### a. Gaseous Effluent Release Limits:

LACBWR's stack effluent release limitations for gaseous effluent releases of radioactive material limits the release rate of the sum of the individual radionuclides, so that the dose rates to members of the public beyond the Effluent Release Boundary 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 H-3 and particulates with half-lives greater than 8 days as per the requirements of the Offsite Dose Calculation Manual (ODCM).

Also, in accordance with 10 CFR 50, Appendix I, the ODCM limitations 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 H-3 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.

## EFFLUENT AND WASTE DISPOSAL REPORT - (cont'd)

### b. Liquid Effluent Release Limits:

LACBWR's liquid effluent release limitations for liquid effluent releases are those concentrations specified in 10 CFR 20 Appendix B, Table 2, Column 2. For alpha emitting radionuclides, the concentration is limited to a total activity concentration of  $4.9E-9$   $\mu\text{Ci/ml}$ , 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 Station No. 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 10 CFR 50, 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 dose per calendar quarter, and less than 3.0 mRem whole body and 10 mRem organ dose 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.

### 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.



## 2.0 EFFLUENT RELEASE CONCENTRATION LIMIT

The Effluent Release Concentration used to calculate permissible release rates are obtained from 10 CFR 20, Appendix B, Table 2, Column 2.

## 3.0 AVERAGE ENERGY

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

## 4.0 ANALYTICAL METHODS

### a. Liquid Effluents

Liquid effluent measurements for gross radioactivity are performed by HPGe gamma isotopic analysis of a representative sample from each tank discharged. In addition, each batch discharged tank is analyzed for alpha and tritium activity concentration. A composite sample is created by collecting representative aliquots from each tank batch discharged during a calendar quarter. This composite is analyzed for Iron-55 and Strontium-90 by a contractor on a quarterly basis.

### b. Airborne Particulates

Airborne particulate releases are determined by HPGe gamma isotopic analysis. This analysis is performed by analyzing a glass fiber filter paper taken from the stack monitor 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-90 analysis.

### c. Radioiodines

Since the plant shutdown in April 1987, the I-131/I-133 have decayed completely to stable elements. Amendment 66 to the LACBWR Technical Specifications, deleted

d. Fission and Activation Gases

The concentration of radioactivity ( $\mu\text{Ci/cc}$ ) in gaseous releases from the stack is continuously monitored by two in line stack monitors. These gas concentrations ( $\mu\text{Ci/cc}$ ) are corrected for pressure loss in the sampling system and averaged by the monitors microprocessor. The results are used along with the stack flow rate to obtain the daily gaseous release from the plant. Since the plant shutdown in April 1987, gaseous releases have been immeasurable. All fission gases except Kr-85 have decayed to stable elements. With the removal of spent fuel from the site no fission gases remain. Commencing in 2013 the monitoring for fission and activation gases will be eliminated.

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. The condensed water vapor is then distilled and the distillate is analyzed for H-3 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.

5.0 BATCH RELEASES

a. Airborne

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:

## EFFLUENT AND WASTE DISPOSAL REPORT - (cont'd)

(1)	Number of Batch Releases:	34
(2)	Total Time Period for Batch Releases:	404.5 hours
(3)	Maximum Time Period for a Batch Release:	27.9 hours
(4)	Average Time Period for a Batch Release:	11.9 hours
(5)	Minimum Time Period for a Batch Release:	4 hours
(6)	Average Stream Flow Rate During Periods of Release of Effluent into a Flowing Stream:	23,300 ft <sup>3</sup> /sec

### 6.0 ABNORMAL RELEASES

There were no abnormal releases of radioactivity in plant effluents.

### 7.0 ESTIMATED TOTAL ANALYTICAL ERROR

The reported analytical results contain the following estimated errors:

Counting Error 95% Confidence Level

Sampling Volume Error  $\pm$  5%.

EFFLUENT AND WASTE DISPOSAL REPORT - (cont'd)

TABLE 1A

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2012**

**GASEOUS EFFLUENTS – SUMMATION OF ALL RELEASES**

		UNIT	QTR	QTR	QTR	QTR	TOTAL
<b>A.</b>	<b>FISSION &amp; ACTIVATION GASES</b>						
1.	TOTAL RELEASE	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.	AVERAGE RELEASE RATE FOR PERIOD	μCi/ Sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<b>B.</b>	<b>IODINE I-131 - No longer analyzed for.</b>						
<b>C.</b>	<b>PARTICULATES</b>						
1.	PARTICULATES WITH HALF-LIVES > 8 DAYS	Ci	5.00E-07	3.37E-07	3.86E-06	1.03E-06	5.72E-06
2.	AVERAGE RELEASE RATE FOR PERIOD	μCi/ Sec	6.43E-08	4.29E-08	9.20E-08	1.30E-07	
3.	GROSS ALPHA RADIOACTIVITY	Ci	2.90E-08	4.31E-08	4.50E-08	3.96E-08	1.57E-07
<b>D.</b>	<b>TRITIUM</b>						
1.	TOTAL RELEASE	Ci	6.57E-03	4.39E-03	9.61E-03	2.59E-03	2.32E-02
2.	AVERAGE RELEASE RATE FOR PERIOD	μCi/ Sec	8.45E-04	5.58E-04	1.21E-03	3.26E-04	
<b>E.</b>	<b>PERCENTAGE OF ODCM DOSE LIMITS FOR GASEOUS EFFLUENT RELEASES</b>						
			QTR	QTR	QTR	QTR	YEARLY
1.	NOBLE GAS RELEASE						
	GAMMA	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	BETA	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.	H-3 AND ALL RADIONUCLIDES IN PARTICULATE FORM WITH HALF-LIVES GREATER THAN 8 DAYS						
	GAMMA (Highest Organ)	%	5.38E-05	3.88E-05	1.64E-04	3.95E-05	1.47E-04

**TABLE 1B**

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2012**

**GASEOUS EFFLUENTS – ELEVATED RELEASE**

		CONTINUOUS MODE					
		UNIT	QTR	QTR	QTR	QTR	TOTAL
<b>NUCLIDES RELEASED</b>							
1.	<b>FISSION GASES</b>						
	KRYPTON-85	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL FOR PERIOD	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.	IODINE I-131 - Analysis no longer required.						
3.	<b>PARTICULATES</b>						
	STRONTIUM-90	Ci	0.00E+00	0.00E+00	4.50E-08	0.00E+00	4.50E-08
	CESIUM-134	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	CESIUM-137	Ci	3.54E-07	3.37E-07	1.61E-06	2.87E-07	2.59E-06
	COBALT-60	Ci	1.46E-07	0.00E+00	2.20E-06	7.44E-07	3.09E-06
		Ci					
		Ci					
		Ci					
		Ci					
	TOTALS	Ci	5.00E-07	3.37E-07	3.86E-06	1.03E-06	5.72E-06

EFFLUENT AND WASTE DISPOSAL REPORT - (cont'd)

TABLE 2A

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2012**

**LIQUID EFFLUENTS – SUMMATION OF ALL RELEASES**

		UNIT	QTR	QTR	QTR	QTR	TOTAL
<b>A. FISSION &amp; ACTIVATION PRODUCTS</b>							
1.	TOTAL RELEASE (NOT INCL. TRITIUM, GASES, ALPHA)	Ci	4.36E-03	2.87E-03	9.36E-03	1.22E-02	2.88E-02
2.	AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ ml	2.26E-09	2.32E-09	1.36E-09	7.49E-09	
<b>B. TRITIUM</b>							
1.	TOTAL RELEASE	Ci	4.97E-03	1.64E-03	1.02E-02	1.49E-02	3.17E-02
	AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ ml	2.58E-09	1.33E-09	1.48E-09	1.17E-08	
<b>C. DISSOLVED AND ENTRAINED GASES</b>							
1.	TOTAL RELEASE	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.	AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<b>D. GROSS ALPHA RADIOACTIVITY</b>							
1.	TOTAL RELEASE	Ci	2.45E-05	2.00E-05	5.13E-05	1.00E-04	1.96E-04
<b>E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)</b>							
		Liters	8.23E+04	6.14E+04	2.11E+05	1.10E+05	4.65E+05
<b>F. VOLUME OF DILUTION WATER USED DURING PERIOD</b>							
		Liters	1.93E+09	1.24E+09	6.86E+09	1.27E+09	1.13E+10
<b>G. PERCENTAGE OF ODCM LIMITS FOR LIQUID RELEASES</b>							
			QTR	QTR	QTR	QTR	YEARLY
	HIGHEST ORGAN	%	1.83	1.19	2.11	7.22	6.13
	WHOLE BODY	%	3.89	2.54	4.52	14.50	12.72

EFFLUENT AND WASTE DISPOSAL REPORT - (cont'd)

**TABLE 2B**

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2012**

**LIQUID EFFLUENTS**

NUCLIDES RELEASED	UNIT	QTR	QTR	QTR	QTR
MANGANESE-54	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IRON-55	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
COBALT-60	Ci	4.23E-04	2.90E-04	1.58E-03	7.24E-04
STRONTIUM-90	Ci	9.71E-05	8.34E-05	6.07E-04	2.64E-03
CESIUM-134	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CESIUM-137	Ci	3.84E-03	2.49E-03	7.17E-03	8.83E-03
TOTAL FOR PERIOD (ABOVE)	Ci	4.36E-03	2.87E-03	9.36E-03	1.22E-02
KRYPTON-85	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

**TABLE 3**

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT – 2012**  
**SOLID WASTE AND IRRADIATED FUEL SHIPMENTS**

**A. SOLID WASTE SHIPPED OFFSITE FOR 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 <sup>3</sup>	0	0	0
	Ci	0	0	0
b. DRY COMPRESSIBLE WASTE, CONTAMINATED EQUIPMENT, ETC	m <sup>3</sup>	0	108.9	108.9
	Ci	0	1.584	1.584
c. IRRADIATED COMPONENTS, CONTROL RODS, ETC	m <sup>3</sup>	0	0	0
	Ci	0	0	0
d. OTHER (DESCRIBE)	m <sup>3</sup>	0	0	0
	Ci	0	0	0

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (BY TYPE OF WASTE)	PERCENT OF TOTAL	6-MONTH PERIOD CURIES	6-MONTH PERIOD CURIES
Co-60	15.76	0	0.25
H-3	4.3	0	0.07
Ni-63	76.48	0	1.21
Pu-241	1.2	0	0.02

**3. SOLID WASTE DISPOSITION**

NO. OF SHIPMENTS	MODE OF TRANSPORTATION	DESTINATION
4	Sole use	Clive, UT
1	Sole use	Oak Ridge, TN

**B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)**

NO OF SHIPMENTS      MODE OF TRANSPORTATION      DESTINATION  
 NONE



8.0 OFFSITE DOSE CALCULATIONS SUMMARY AND CONCLUSIONS:

a. Gaseous Effluent Releases

The maximum quarterly offsite gamma dose due to noble gases was 0.00 mRad. The cumulative 2012 annual offsite gamma dose due to noble gases was 0.00 mRad.

The maximum quarterly offsite beta dose due to noble gases was 0.00 mRad. The cumulative 2012 annual offsite beta dose due to noble gases was 0.00 mRad.

The maximum quarterly offsite dose to any organ from the release of H-3 and all radionuclides in particulate form with half-lives greater than 8 days was approximately 1.23E-05 mRem. The cumulative 2012 annual maximum organ dose from these radionuclides was also approximately 2.20E-05 mRem.

The highest historical annual average X/Q equal to 1.82 E-6 sec/m<sup>3</sup> for the period 1985-1987 for the worst case offsite receptor location, in accordance with the ODCM, was used to calculate these offsite dose values.

b. Liquid Effluent Releases

The maximum quarterly organ dose from liquid releases was approximately 3.61E-01 mRem. The cumulative 2012 annual organ dose was approximately 6.13E-01 mRem. The maximum quarterly total body dose for liquid releases was approximately 2.17E-01 mRem, and the cumulative 2012 annual total body dose was approximately 3.82E-01 mRem.

c. Conclusion

All calculated offsite doses were below ODCM limits.

EFFLUENT AND WASTE DISPOSAL REPORT - (cont'd)

9.0 OFFSITE DOSE CALCULATION MANUAL (ODCM) REVIEW

The ODCM was reviewed and modified in 2012 due to the removal of spent fuel from the plant. The ODCM is included in its entirety.

10.0 PROCESS CONTROL PROGRAM (PCP) REVIEW

The PCP was reviewed and modified in 2012 due to the removal of spent fuel from the plant. The PCP is included in its entirety.