



10 CFR 50.36(a)(2)

February 21, 2019

LC-2019-0017

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

La Crosse Boiling Water Reactor
Facility Operating License No. DPR-45
NRC Docket Nos. 50-409 and 72-046

Subject: La Crosse Boiling Water Reactor (LACBWR) Annual Radioactive Environmental Monitoring Report and Radioactive Effluent Release Report

In accordance with Facility Operation License No. DPR-45, Quality Assurance Program Description (QAPD) Appendix C, Section 2.5.1, "Annual Radiological Environmental Monitoring Report," and Section 2.5.2, "Annual Radioactive Effluent Release Report," this letter submits these reports for the year 2018. The reports are required to be submitted prior to March 1 per QAPD Appendix C, Section 2.5 "Reporting Requirements," and are provided as enclosures to this letter.

The Radiological Effluent Release Report also contains changes to the Offsite Dose Calculation Manual (ODCM) per the requirements of QAPD Appendix C, Section 2.2, "Offsite Dose Calculation Manual." There were no changes to the Process Control Program for this reporting period. All revisions to the ODCM approved since the last report are provided as enclosures to this letter.

There are no new regulatory commitments in this submittal.

If you have any questions about this submittal please contact Mr. Joseph Jacobsen at (608) 689-4259.

Respectfully,

Gerard van Noordennen

Gerard van Noordennen
Vice President Regulatory Affairs

IE48
NM5526
NM55

Attachments:

1. LACBWR Annual Radiological Environmental Operating Report
2. LACBWR Offsite Dose Calculation Manual, Revision 5
3. LACBWR Offsite Dose Calculation Manual, Revision 6
4. LACBWR Offsite Dose Calculation Manual, Revision 7

cc: Marlayna Vaaler, U.S. NRC Project Manager
Regional Administrator, U.S. NRC, Region III
Service List (Cover letter only, no attachments)

La Crosse Boiling Water Reactor Service List

cc:

Ken Robuck
President and CEO
EnergySolutions
299 South Main Street, Suite 1700
Salt Lake City, UT 84111

John Sauger
Executive VP and Chief Nuclear Officer
Reactor D & D
EnergySolutions
121 W. Trade Street, Suite 2700
Charlotte, NC 28202

Joseph Nowak
General Manager
LaCrosseSolutions
S4601 State Highway 35
Genoa, WI 54632-8846

Gerard van Noordennen
VP Regulatory Affairs
EnergySolutions
121 W. Trade Street, Suite 2700
Charlotte, NC 28202

Russ Workman
General Counsel
EnergySolutions
299 South Main Street, Suite 1700
Salt Lake City, UT 84111

Jerome Pedretti, Clerk
Town of Genoa
E860 Mundsack Road
Genoa, WI 54632

Jeffery Kitsembel
Division of Energy Regulation
Wisconsin Public Service Commission
P.O. Box 7854
Madison, WI 53707-7854

Paul Schmidt, Manager
Radiation Protection Section
Bureau of Environmental and Occupational Health
Division of Public Health
Wisconsin Department of Health Services
P.O. Box 2659
Madison, WI 53701-2659

Barbara Nick
President and CEO
Dairyland Power Cooperative
3200 East Avenue South
La Crosse, WI 54602-0817

Cheryl Olson, ISFSI Manager
La Crosse Boiling Water Reactor
Dairyland Power Cooperative
S4601 State Highway 35
P.O. Box 817
Genoa, WI 54632-8846

Lane Peters
La Crosse Boiling Water Reactor
Dairyland Power Cooperative
S4601 State Highway 35
Genoa, WI 54632-8846

Thomas Zaremba
Wheeler, Van Sickle and Anderson, S.C.
44 East Mifflin Street, Suite 1000
Madison, WI 53703

John E. Matthews
Morgan, Lewis & Bockius LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004

Attachment 1

LACBWR Annual Radiological Environmental Operating Report

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

FOR THE
LA CROSSE BOILING WATER REACTOR (LACBWR)

(January 1 to December 31, 2018)

LACROSSESOLUTIONS
S4601 STATE HIGHWAY 35
GENOA, WI 54632

TABLE OF CONTENTS

SECTION A: RADIOACTIVE EFFLUENT REPORT

<u>Section</u>	<u>Title</u>	<u>Page</u>
	Introduction	5
1.0	Regulatory Limits	6
2.0	Effluent Release Concentration Limit.....	8
3.0	Average Energy	8
4.0	Analytical Methods.....	8
5.0	Releases.....	9
6.0	Abnormal Releases	10
7.0	Estimated Total Analytical Error.....	11
8.0	Offsite Dose Calculation Summary and Conclusions.....	16
9.0	Offsite Dose Calculation Manual (ODCM) Review.....	17
10.0	Process Control Program (PCP) Review	20
11.0	Errata Data	20

SECTION A: RADIOACTIVE EFFLUENT REPORT

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
1A	Effluent and Waste Disposal – Airborne Particulate Effluents Summation of All Releases.....	11
1B	Effluent and Waste Disposal – Airborne Particulate Effluents Ground Level Release	12
2A	Effluent and Waste Disposal – Liquid Effluents Summation of All Releases.....	13
2B	Effluent and Waste Disposal – Liquid Effluents.....	14
3	Effluent and Waste Disposal 2018 Solid Waste and Irradiated Fuel Shipments.....	15

SECTION B: RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

<u>Section</u>	<u>Title</u>	<u>Page</u>
	Introduction	22
1.0	Sample Collection	23
2.0	Results of the 2018 Environmental Monitoring Survey	24
3.0	Conclusions	27
4.0	Interlaboratory Comparison Program Results	28

SECTION B: RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
4	ISFSI Environmental TLD Locations	33
5	Sample Frequency and Analysis of Radio Environmental Samples	34
6	Low Volume Environmental Air Monitoring Station Locations	35
7	LACBWR Environmental TLD Locations	36
8	Radiological Environmental Samples Collected	37
9	Quarterly Environmental TLD Results in LACBWR Vicinity	38
10	Bi-Weekly Gross Beta Environmental Air Sample Analysis Results	39
11	Bi-Weekly Gamma Spec Env. Air Sample Analysis Results	40
12	Semi Annual Mississippi River Water Analysis Results	53
13	Semi Annual Mississippi River Sediment Analysis Results	54
14	Quarterly Environmental TLD Results for ISFSI Area	55

SECTION B: RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

<u>Figure No.</u>	<u>Title</u>	<u>Page</u>
1	LACBWR Property Map	29
2	LACBWR Environmental Air Sampler Locations	30
3	LACBWR RCA Fence Line Environmental TLD Locations	31
4	ISFSI Environmental TLD Locations	32

SECTION A

RADIOACTIVE EFFLUENT REPORT

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_(th)). The reactor is owned by Dairyland Power Cooperative (DPC).

The reactor went critical in July 1967 and first contributed electricity to the DPC 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 until 1987.

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 Independent Spent Fuel Storage Installation (ISFSI).

In June of 2016 DPC, working with the selected decommissioning contractor LaCrosseSolutions LLC, transferred their NRC License to LaCrosseSolutions LLC for the purposes of decommissioning the site to unconditional release criteria, per license termination plan criteria.

In accordance with LC-RP-PG-004 "Radiological Environmental Monitoring Program and Preparation of the Annual Radiological Environmental Operating Report", this document is the Annual Radiological Environmental Operating Report (AREOR) for the Period January 1 through December 31, 2018.

EFFLUENT AND WASTE DISPOSAL REPORT

(Supplemental Information)

FACILITY: La Crosse Boiling Water Reactor LICENSEE: LaCrosseSolutions

LICENSE NO. DPR-45

DOCKET NO. 50-409 & 72-046

1.0 REGULATORY LIMITS

1.1 Airborne Effluent Release Limits:

LACBWR airborne particulates, with half-lives greater than 8 days, released to areas beyond the Effluent Release Boundary shall be limited to ≤ 7.5 mRem to any organ per calendar quarter and ≤ 15 mRem to any organ per calendar year (10CFR50 Appendix I). The cumulative dose contributions from airborne particulate effluent releases are determined in accordance with the LaCrosseSolutions, LLC Offsite Dose Calculational Manual (ODCM). Additionally, for gaseous effluents of beta radiation in the form of tritium for beyond the Effluent Release Boundary shall be limited to 10 mRad per calendar quarter and 20 mRad per calendar year (10CFR50 Appendix I). The annual values for airborne effluent releases are reported in Table 1A and 1B.

Also, in accordance with the provisions of 40 CFR 190, the restrictions for total dose to any member of the public from all LACBWR related sources and dose pathways are evaluated quarterly and on an annual basis.

1.2 Liquid Effluent Release Limits:

LACBWR's liquid effluent release limitations are those concentrations specified in 10 CFR 20 Appendix B, Table 2, Column 2. The values reported in Tables 2A and 2B, Liquid Effluents, are based on dilution of the effluent with the 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.

Radioactive Effluent Report

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. The cumulative dose contributions from liquid effluent releases are determined in accordance with the *LaCrosseSolutions*, LLC Offsite Dose Calculational Manual.

In accordance with the provisions of 40 CFR 190, the restrictions for total dose to any member of the public from all LACBWR related sources and dose pathways are evaluated quarterly and on an annual basis.

1.3 Solid Radioactive Waste

All solid radioactive wastes are handled in accordance with a Process Control Program as defined by *LaCrosseSolutions*, LLC procedures, in order to assure that all applicable transportation and burial site disposal requirements are met. Table 3 summarizes the annual solid radioactive waste shipment/ disposal statistics for the site.

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 1 or 2.

3.0 AVERAGE ENERGY

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

4.0 ANALYTICAL METHODS

4.1 Liquid Effluents

Liquid effluent measurements for gross radioactivity are performed by HPGe gamma isotopic analysis of a representative sample from each monitor tank prior to discharge. In addition, each batch monitor tank sample is analyzed for gross beta and gross alpha as well as tritium activity concentrations using site approved bench top analysis equipment. 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, Strontium-90, Nickel-59, Nickel-63, Americium-241, Plutonium-238, Plutonium 239/240, and Plutonium-241 by an off-site contractor on a quarterly basis.

4.2 Airborne Particulates

Airborne particulate releases are determined by HPGe gamma isotopic analysis and gross beta and gross alpha analyses of glass fiber filter paper taken from low volume air samplers placed either in prevailing downwind locations or in representative sampling locations on HEPA exhaust systems. The filter paper is change out weekly and analyzed approximately a week later.

Radioactive Effluent Report

5.0 RELEASES

5.1 Airborne

To demonstrate compliance with the limits in Section 1.1 dose contributions have been calculated using a bounding assessment as described in Regulatory Guide 1.21. This analysis is summarized in the current Offsite Dose Calculation Manual. Routine low volume air sampling is in place at four locations outside the RCA in the predominant typical downwind locations, to be used to demonstrate compliance with dose limits in Section 1.1. Any HEPA system exhausting to the outside environment has representative air sampling performed of the exhaust air following passing thru the HEPA system also for the purposes of demonstrating compliance with Section 1.1.

5.2 Liquid

All liquid effluent releases at LACBWR are batch releases as described in the ODCM other than the summary below on the tritium release event to the shallow groundwater layer inside the posted RCA boundary and subsequently to the Mississippi River. The batch releases are summarized as follows:

(1)	Number of Batch Releases:	
(2)	Total Time Period for Batch Releases:	193 hours
(3)	Maximum Time Period for a Batch Release:	7 hours
(4)	Average Time Period for a Batch Release:	5 hours
(5)	Minimum Time Period for a Batch Release:	2.25 hours
(6)	Average Stream Flow Rate During Periods of Release of Effluent into a Flowing Stream:	67,600 ft ³ /sec

Discovery of a ground level surface water source of runoff water contaminated with elemental tritium and a pathway to the shallow groundwater layer in the RCA via an open excavation area was reported to the USNRC and Wisconsin Department of Natural Resources (WDNR) on March 14, 2018. The ground level surface water runoff source of tritium and the release pathway to the shallow groundwater layer was secured, and a hydro-geological contractor initiated an investigation to evaluate the extent of the elemental tritium release in the shallow groundwater layer including

Radioactive Effluent Report

its movement to the Mississippi River outside of the RCA as well as vertical movement in the groundwater layers. The investigation has been completed and documented. The results of the investigation show no significant vertical movement of the elemental tritium thru the groundwater layers and an ultimate release estimated at approximately 920,000 gallons of water containing elemental tritium to the Mississippi River thru the shallow groundwater layer at an average activity level of 3000 pCi/Liter. The release period has been estimated as a time period of March 1, 2018 to the first week of December 2018 at which time the elemental tritium levels are now estimated to be at laboratory minimum detectable limits of 500 pCi/L. The calculated release dose of the estimated 920,000 gallons of water has been evaluated using the logic of the batch release but assuming no G-3 Coal Plant condenser cooling water dilution nor Mississippi River mixing zone dilution.

6.0 **ABNORMAL RELEASES**

There were no abnormal releases of radioactivity in plant effluents which exceeded release limits.

Radioactive Effluent Report

7.0 ESTIMATED TOTAL ANALYTICAL ERROR

The reported analytical results contain the following estimated errors:

Counting Error 95% Confidence Level

Sampling Volume Error ± 5%.

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2018

AIRBORNE PARTICULATE EFFLUENTS – SUMMATION OF ALL RELEASES

		UNIT	QTR 1	QTR 2	QTR 3	QTR 4	TOTAL
A. PARTICULATES							
1.	BETA-GAMMA PARTICULATES WITH HALF-LIVES > 8 DAYS	Ci	1.082 E-04	1.082 E-04	7.21 3E- 05	0	2.885E- 04
2.	AVERAGE RELEASE RATE FOR PERIOD	µCi/Sec	1.374 E-05	1.374 E-05	9.16 E-06	0	—
3.	GROSS ALPHA RADIOACTIVITY	Ci	1.026 E-07	1.026 E-07	6.85 E-08	0	2.737E- 07
4.	TRITIUM	Ci	2.495	2.495	1.66 2	0	6.652
B. PERCENTAGE OF ODCM DOSE LIMITS FOR PARTICULATE EFFLUENT RELEASES							
		%	QTR	QTR	QTR	QTR	YEARLY
1.	ALL RADIONUCLIDES IN PARTICULATE FORM WITH HALF-LIVES GREATER THAN 8 DAYS						
	HIGHEST ORGAN % LIMIT	%	37%	37%	25%	0	50%

NOTE: For tritium airborne releases averaged 3.15E-05 mRad/quarter and overall for the year released a total of 8.40E-05 mRad.

Radioactive Effluent Report

TABLE 1B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2018
AIRBORNE PARTICULATE EFFLUENTS –GROUND LEVEL RELEASE

			CONTINUOUS BATCH MODE			OR	
		UNIT	QTR 1	QTR 2	QTR 3	QTR 4	TOTAL
NUCLIDES RELEASED							
1.	PARTICULATES						
	Fe-55	Ci	1.350E-07	1.350E-07	8.900E-08	0	3.590E-07
	Ni-59	Ci	1.265E-06	1.265E-06	8.430E-07	0	3.373E-06
	Co-60	Ci	6.750E-06	6.750E-06	4.500E-06	0	1.800E-05
	Ni-63	Ci	8.404E-06	8.404E-06	5.603E-06	0	2.241E-05
	Sr-90	Ci	8.450E-07	8.450E-07	5.640E-07	0	2.254E-06
	Nb-94	Ci	1.600E-08	1.600E-08	1.100E-08	0	4.300E-08
	Tc-99	Ci	4.883E-09	4.883E-09	3.255E-09	0	1.302E-08
	Cs-137	Ci	9.308E-06	9.308E-06	6.205E-06	0	2.482E-05
	Eu-152	Ci	7.785E-05	7.785E-05	5.190E-05	0	2.076E-04
	Eu-154	Ci	3.365E-06	3.365E-06	2.244E-06	0	8.974E-06
	Eu-155	Ci	3.375E-08	3.375E-08	2.250E-08	0	9.000E-08
	Np-237	Ci	3.741E-08	3.741E-08	2.493E-08	0	9.975E-08
	Pu-238	Ci	1.265E-08	1.265E-08	8.433E-09	0	3.373E-08
	Pu-239/240	Ci	1.181E-08	1.181E-08	7.8709E-09	0	3.149E-08
	Pu-241	Ci	2.120E-07	2.120E-07	1.412E-07	0	5.652E-07
	Am-241	Ci	3.593E-08	3.593E-08	2.395E-08	0	9.581E-08
	Am-243	Ci	2.148E-09	2.148E-09	1.433E-09	0	5.729E-09
	Cm-243/244	Ci	2.693 E-09	2.693E-09	1.795E-09	0	7.181E-09
	Gases						
	Tritium-	Ci	2.495	2.495	1.662	0	6.652
	TOTAL	Ci	2.495	2.495	1.662	0	6.652

Radioactive Effluent Report

TABLE 2A
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2018
LIQUID EFFLUENTS – SUMMATION OF ALL RELEASES

		UNIT	QTR 1	QTR 2	QTR 3	QTR 4	TOTAL
A	FISSION & ACTIVATION PRODUCTS						
1.	TOTAL RELEASE (NOT INCL. TRITIUM,ALPHA)	Ci	4.43E-05	1.49E-03	1.37E-04	7.96E-06	1.68E-03
2.	AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ ml	1.33E-09	6.12E-09	2.68E-10	7.03E-12	8.73E-10
B.	TRITIUM						
1.	TOTAL RELEASE-batch releases only	Ci	2.98E-05	1.16E-01	1.12E-02	2.61E-03	1.30E-01
	AVERAGE DILUTED CONCENTRATION DURING PERIOD	µCi/ ml	8.97E-10	4.77E-07	2.20E-08	2.31E-09	6.80E-08
C.	DISSOLVED AND ENTRAINED GASES – no releases - no longer analyzed for.						
D.	GROSS ALPHA RADIOACTIVITY						
1.	TOTAL RELEASE	Ci	1.90E-08	0	0	0	1.90E-08
E.	VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)	Liters	1.42E+04	2.31E+05	5.38E+05	1.26E+06	2.04E+06
F.	VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	3.32E+07	2.43E+08	5.12E+08	1.13E+09	1.92E+09
G.	PERCENTAGE OF ODCM LIMITS FOR LIQUID RELEASES*						
			QTR	QTR	QTR	QTR	YEARLY
	HIGHEST ORGAN	%	0.06%	1.54%	0.17%	0.03%	0.90%
	WHOLE BODY	%	0.13%	3.34%	0.39%	0.08%	1.97%

***Includes direct release of groundwater with tritium to the river**

Radioactive Effluent Report

TABLE 2B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2018
LIQUID EFFLUENTS

NUCLIDES RELEASED	UNIT	QTR-1	QTR-2	QTR-3	QTR-4
Fe-55	Ci	0.0	0.0	0.0	0.0
Ni-59	Ci	0.0	0.0	0.0	0.0
Co-60	Ci	0.0	0.0	0.0	0.0
Ni-63	Ci	0.0	1.69E-05	0.0	0.0
Sr-90	Ci	0.0	9.10E-05	1.73E-05	5.52E-06
Cs-137	Ci	4.43E-05	1.38E-03	1.20E-04	2.44E-06
Pu-238	Ci	0.0	0.0	0.0	0.0
Pu-239/240	Ci	5.81E-09	0.0	0.0	0.0
Pu-241	Ci	0.0	0.0	0.0	0.0
Am-241	Ci	1.32E-08	0.0	0.0	0.0
Tritium-includes tritium directly released to river by groundwater	Ci	1.19E-03	1.19E-01	1.47E-02	4.63E-3E-03
TOTAL FOR PERIOD (ABOVE)	Ci	1.23E-03	1.20E-01	1.48E-02	4.632E-03

Radioactive Effluent Report

TABLE 3
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT – 2018
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. SOLID WASTE SHIPPED OFFSITE FOR DISPOSAL (Not Irradiated Fuel)

1. TYPE OF WASTE	UNIT	1 st 6-MONTH PERIOD	2 nd 6-MONTH PERIOD	TOTAL
a. Spent resins, filter sludges, evaporator bottoms, etc.	m ³	0	0	0
	Ci	0	0	0
b. Dry compressible waste, contaminated equipment, etc.	m ³	9,676	6,778	16454
	Ci	203.602	2.028	205.630
c. Irradiated components, control rods, etc.	m ³	0.00	0	0
	Ci	0.00	0	0
d. Other	m ³	0	0.00	0
	Ci	0	0.00	0

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (BY TYPE OF WASTE)	PERCENT OF TOTAL	1 st 6-MONTH PERIOD CURIES	2 nd 6-MONTH PERIOD CURIES	Estimated Error Values %
Cs-137	32.05%	65.84	0.07	+/- 10
Fe-55	11.66	23.95	0.02	+/- 10
Ni-63	26.79	54.02	1.07	+/- 10
H-3	7.18	14.77	0	+/- 10
Pu-241	4.07	8.32	0.05	+/- 10
Co-60	13.12	26.19	0.79	+/- 10
C-14	1.72	3.54	0	+/- 10
Sr-90	1.49	3.05	0	+/- 10
Tc-99	1.09	2.21	0.02	+/- 10
*NOTE: showing all nuclides >1% of total				

3. SOLID WASTE DISPOSITION		
NO. OF SHIPMENTS	MODE OF TRANSPORTATION	DESTINATION
1425	Truck and Rail	Clive, UT

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

NO OF SHIPMENTS MODE OF TRANSPORTATION DESTINATION

NONE

8.0 OFFSITE DOSE CALCULATIONS SUMMARY AND CONCLUSIONS:

8.1 Particulate/Gaseous Effluent Releases

The maximum quarterly offsite dose to any organ from the release of all radionuclides in particulate form with half-lives greater than 8 days was 2.78 mRem. The cumulative 2018 annual maximum organ dose from these radionuclides was also 7.50 mRem. The maximum quarterly offsite dose from gaseous beta emitters in the form of tritium is $3.15\text{E-}05$ mRad/quarter and overall for the year released a total of $8.40\text{E-}05$ mRad.

8.2 Liquid Effluent Releases

The maximum quarterly organ dose from liquid releases was approximately $7.7\text{E-}02$ mRem. The cumulative 2018 annual organ dose was approximately $9.0\text{E-}02$ mRem. The maximum quarterly total body dose for liquid releases was approximately $5.0\text{E-}02$ mRem, and the cumulative 2018 annual total body dose was approximately $5.91\text{E-}02$ mRem.

8.3 Conclusion

All calculated offsite doses were below all ODCM limits for airborne, liquid, and ambient radiation.

Radioactive Effluent Report

9.0 OFFSITE DOSE CALCULATION MANUAL (ODCM) REVIEW

List of Changes to the ODCM

In accordance with ODCM Section 4.6 the following is a summary of changes made to the ODCM thru the revision process during CY 2018 which verified that the level of radioactive effluent controls will be maintained as well as not adversely impact the accuracy or reliability of effluent, dose, or set point calculations.

A summarized list of the changes is presented here, along with a complete copy of the affected ODCM revisions.

1. ODCM Revision 5

Page	Section	Change Summary
4	Summary	Added revised bounding airborne release model details/ results including for tritium. The bounding airborne release model follows Reg. Guide 1.21 requirements.
5	References	Added 2.16 LC-RP-TSD-004 Rev 1 "La Crosse Bounding Airborne Release Assessment".
14	4.1.6	Clarified terms used in formula for the temporary ventilation units calculations.
15	4.2.1 and 4.2.3	Added tritium to the discussions.
18-20	4.2.5	Added tritium into discussions and Appendix I of 10 CFR Part 50 release requirements for gaseous effluents of beta radiation.
21	4.2.5/B.2/3	Corrected average to weekly.
38-40	Appendix A	Updated this section to incorporate the tritium analyses performed in LC-RP-TSD-004 Rev 1 as well as to incorporate the potential curie content release by nuclide and associated dose assessment analyses of adding a two week time interval to take down and remove the bio-shield wall in the Reactor Building.

Radioactive Effluent Report

2. ODCM Revision 6

Page	Section	Change Summary
4	Summary	Added requirements for the use of dewatering operations inside the RCA to remove rainwater and groundwater from open excavation areas by the use of a system of wells. The wells discharge would be directed to the Mississippi River normal liquids discharge NPDES location.
6	3.1-definitions	Defined specifically the types of release: a batch release and dewatering operations release.
10-11	4.1	Introduced concepts of dewatering operations as it applies to release of groundwater from the RCA.
13	4.1.3	Added details to section to specify during dewatering operations that will obtain and analyze samples.
16	4.2.2	Specify that during dewatering operations will perform sampling and analysis of samples.
17-18	4.2.4.A.3	Added to address the specific daily type routine sampling requirements for dewatering operations including limits. Gross alpha and Gross Beta limits set at 10% of the MPC values provided in ODCM for Am-241 and Sr-90 respectively.
19	4.2.4.B.4	Added to address the weekly sampling requirements for dewatering operations to verify that are less than 50% of the MPC concentrations specified in Appendix B, Table 2, Column 2 of 10CFR20 at the release point into the Mississippi River.
20	4.2.4.C.4	Added to provide details to the basis for the limits and methods used in Section 4.2.4.A.3 for dewatering operations.
36	Table 5.2	Clarified the table is to be used for batch releases.

Radioactive Effluent Report

3. ODCM Revision 7

Page	Section	Description of change
4	Summary	Added details to be able to run pump down operations where use a sump pump to pump out groundwater and rainwater intrusions from excavation areas inside the RCA to the temporary discharge piping to the NPDES release point in the Mississippi River.
7	3.1	Define Pump Down Operations
15	4.2.2	Define sampling requirements for pump down operations
16	4.2.4.A.2	Added pump down operations requirements for the presence of dilution flow from the G-3 Coal Plant condensate system as well as wastewater discharge flow limits
18	4.2.4.B.1	Added the specifications for the wastewater discharge pump to be used with pump down operations
18	4.2.4.B.2 and 4.2.4.B.3	Specified minimum G-3 Coal Plant condensate dilution flow requirements and sampling/ analyses/approval requirements for pump down water prior to discharging pump down water to the Mississippi River NPDES release point area.
19	4.2.4.C.2	Specifies the conservative dilution factor to be applied when analyzing pump down water sampling data for compliant waste water release discharges.

The ODCM Revisions 5, 6, and 7 are attached with this report.

10.0 PROCESS CONTROL PROGRAM (PCP) REVIEW

The LaCrosseSolutions, LLC PCP was not revised in 2018.

11.0 Errata Data

None.

SECTION B

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

INTRODUCTION:

The Radiological Environmental Monitoring (REM) Program is conducted to comply with the requirements of the ODCM and in accordance with 10 CFR 50 Part 50.36a and 10 CFR 72.104. The REM Program provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which could potentially lead to radiation doses to Members of the Public resulting from plant effluents. Environmental samples are taken within the surrounding areas of the plant and in selected background locations.

The monitoring program at the LACBWR facility includes monitoring of liquid and airborne particulate releases from the plant, as well as collecting environmental samples of surface air, river water, river sediment, and ambient radiation.

The REM program therefore supplements the Radioactive Effluent analyses by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways using the methodology of the Offsite Dose Calculation Manual (ODCM).

An Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples are performed.

1.0 SAMPLE COLLECTION

Environmental samples are collected from the area surrounding LACBWR at the frequencies outlined in the ODCM and the Environmental Monitoring Program. A series of figures and tables are included in this report to explain the LACBWR environmental program.

- FIGURE 1 This map includes the plant exclusion boundary, roads, other generation plants, and the relationship of the plant to the nearest local community.
- FIGURE 2 This map shows the location of the LACBWR RCA Fence Line Area Environmental TLD Locations.
- FIGURE 3 These maps show the location of environmental low volume air sampler locations.
- FIGURE 4 This map shows the location of ISFSI environmental TLDs.
- TABLE 4 This table logs the environmental TLD locations at the ISFSI.
- TABLE 5 This table shows the sampling frequency of the various environmental samples and the analyses performed on these samples
- TABLE 6 This table shows the environmental air monitoring stations used in LACBWR's environmental program.
- TABLE 7 This table logs the LACBWR environmental TLD locations.
- TABLE 8 This table shows the number of various samples collected and analyzed during 2018.
- TABLE 9 Quarterly Environmental TLD results for LACBWR Area
- TABLE 10 Bi-Weekly Gross Beta Env. Air Sample Analysis Results for LACBWR Vicinity
- TABLE 11 Bi-weekly Gamma Spec Env. Air Sample Analysis Results for LACBWR Vicinity

TABLE 12	Semi Annual Mississippi River Water Analysis Results
TABLE 13	Semi Annual Mississippi River Sediment Analysis Results
TABLE 14	Quarterly Environmental TLD results for ISFSI Area

2.0 RESULTS OF THE 2018 ENVIRONMENTAL MONITORING SURVEYS

During 2018, activity levels in the local environment were trending normal, indicating no significant plant attributed radioactivity.

2.1 PENETRATING RADIATION

The environmental penetrating radiation dose is measured by environmental TLDs.

2.1.1 LACBWR Plant - These environmental TLDs were changed on a quarterly basis. The results for the LACBWR Plant from 2018 are shown on Table 9.

2.1.2 ISFSI – These environmental TLDs are changed on a quarterly basis. Table 14 results for 2018 are shown. During CY 2018 TLD packet locations for #6 and #9 were reversed for the four quarterly changeouts. This was caused by a new changeout radiation protection technician using an incorrect ISFSI location figure from an operating procedure during the changeout operation to guide the changeout process in the field and as a result the #6 and #9 TLDs were reversed (based on the used ISFSI location figure). The operating procedure figure has been corrected and the CY 2019 first quarter TLDs are in their proper location. The impact tied to environmental dose consequences is insignificant as both TLD locations #6 and #9 routinely report on quarterly reads at or below background values.

2.2 AIR PARTICULATE

Air samples were collected continuously from various sites (see Figure 3) around LACBWR. Low volume particulate air samplers were used to collect air samples. The air filter consists of a glass fiber filter with an associated pore size of approximately 0.45 μm . The particulate filters were analyzed bi-weekly for gross beta activity with an internal proportional counter, as well as analyzed by gamma spectroscopy for individual isotopic concentration.

TABLE 10 This table shows the bi-weekly gross beta gamma activity concentration from the air particulate filters.

TABLE 11 This table shows the individual air sample particulate isotopic analysis results.

2.3 RIVER WATER

River water is collected semi-annually. River water samples before the intake structure, at plant outfall, and below the plant outfall are collected and are gamma analyzed for isotopic concentration and tritium analysis. The river water gamma isotopic analysis results are shown in Table 12. The results indicate that there were no significant plant attributable radionuclides in the river water.

2.4 SEDIMENT SAMPLES

Sediment samples are collected semi-annually before the intake structure, at plant outfall, and below the plant outfall. These samples are gamma analyzed and these results appear on Table 13. They indicated that small amounts of plant-attributed radionuclides have accumulated in river sediments near the outfall. The amount of radionuclides in the sediment has declined significantly after plant shutdown. These amounts have remained relatively constant the last few years.

3.0 CONCLUSIONS

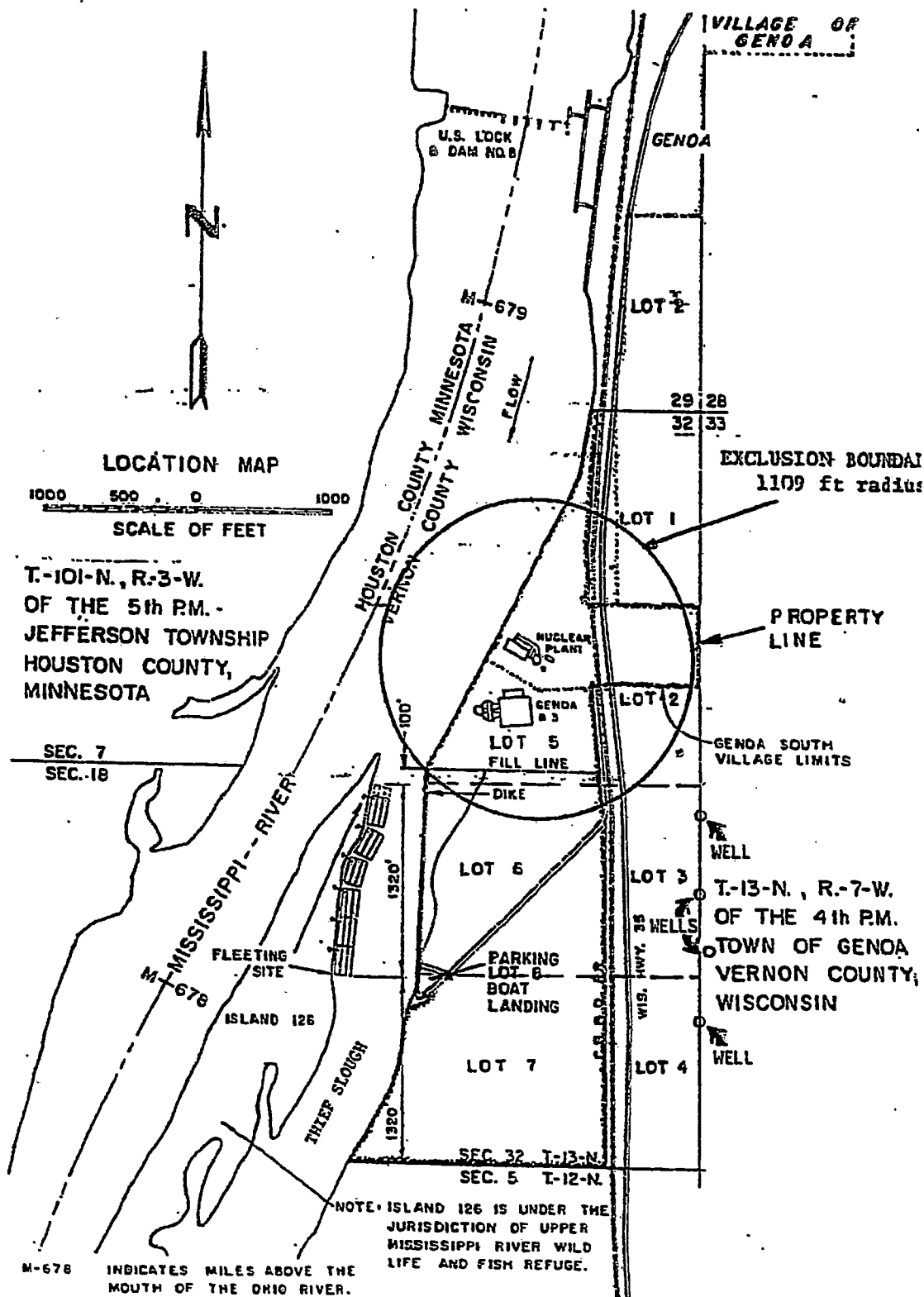
All environmental samples collected and analyzed during 2018 exhibited no significant contribution from LACBWR or ISFSI operations.

4.0 INTERLABORATORY COMPARISON PROGRAM RESULTS

During 2018, interlaboratory comparison samples were obtained from an outside contractor. The equipment used to analyze the environmental samples was tested against the contractors' results. The following are the results of these comparisons.

ANALYSIS	LACBWR RESULTS	CONTRACTOR RESULTS	RATIO
GROSS BETA	204 pCi	210 pCi	0.97
GROSS ALPHA	34.6 pCi	39.6 pCi	0.87
I-131	90.1 pCi/l	80.4 pCi/l	1.12
Cr-51	295 pCi/l	278 pCi/l	1.06
Cs-134	153 pCi/l	160 pCi/l	0.96
Cs-137	128 pCi/l	113 pCi/l	1.14
Co-58	124 pCi/l	111 pCi/l	1.12
Mn-54	170 pCi/l	144 pCi/l	1.18
Fe-59	125 pCi/l	107 pCi/l	1.17
Zn-65	298 pCi/l	246 pCi/l	1.21
Co-60	214 pCi/l	198 pCi/l	1.08
H-3	18700 pCi/l	14500 pCi/l	1.29

FIGURE 1 - LACBWR PROPERTY MAP



RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT - (cont'd)

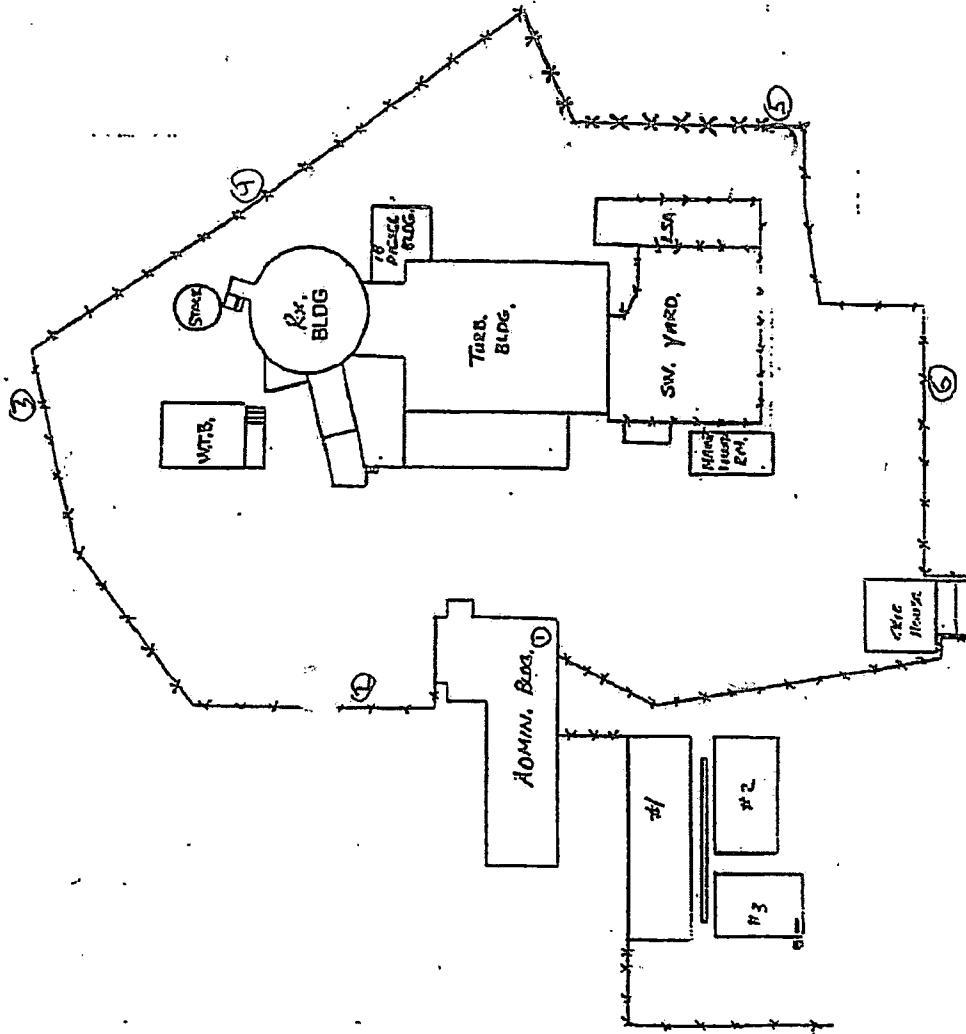


FIGURE 2 - LACBWR RCA FENCELINE ENVIRONMENTAL TLD LOCATIONS

FIGURE 3 – LACBWR ENVIRONMENTAL AIR SAMPLER LOCATIONS

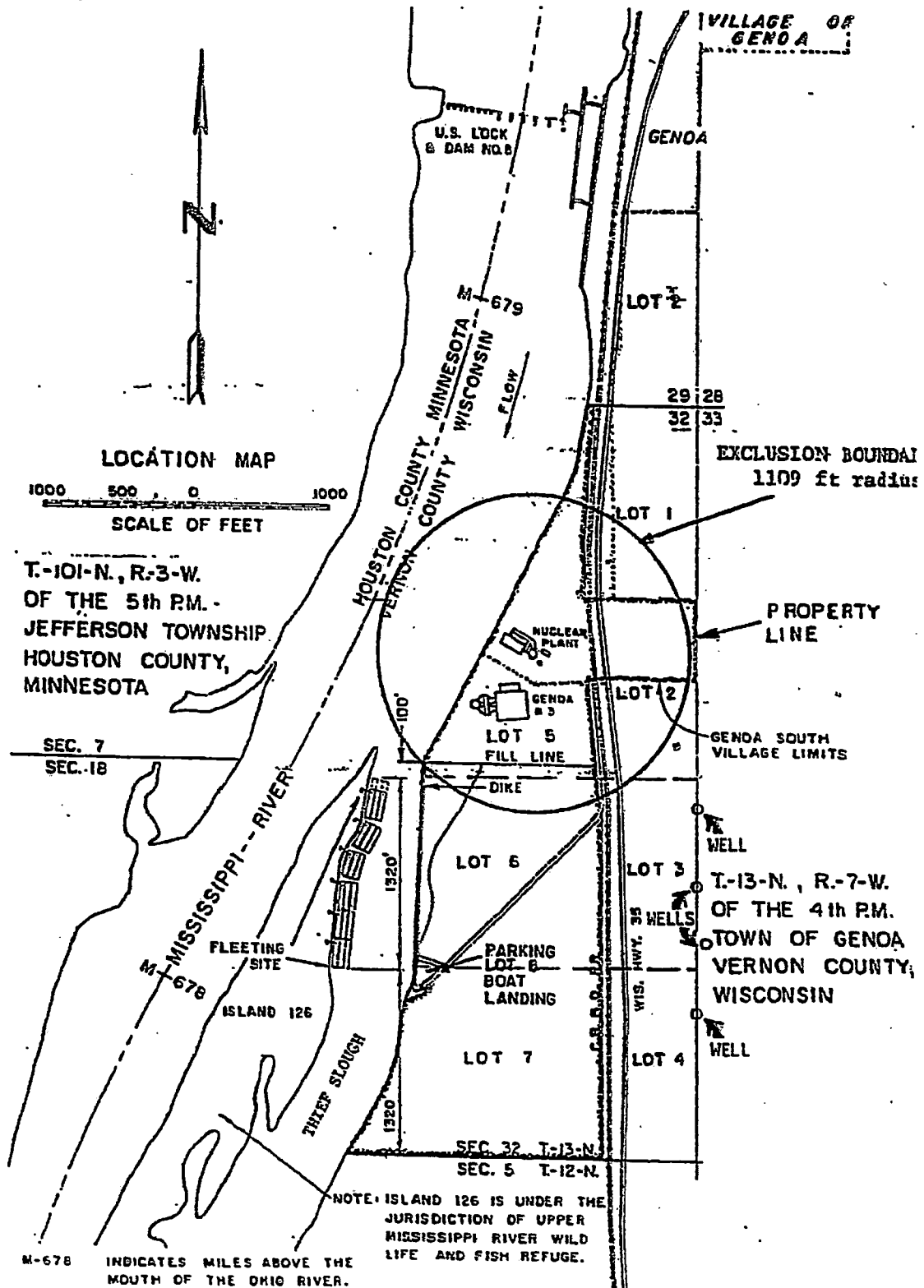


FIGURE 4 - ISFSI ENVIRONMENTAL TLD LOCATIONS

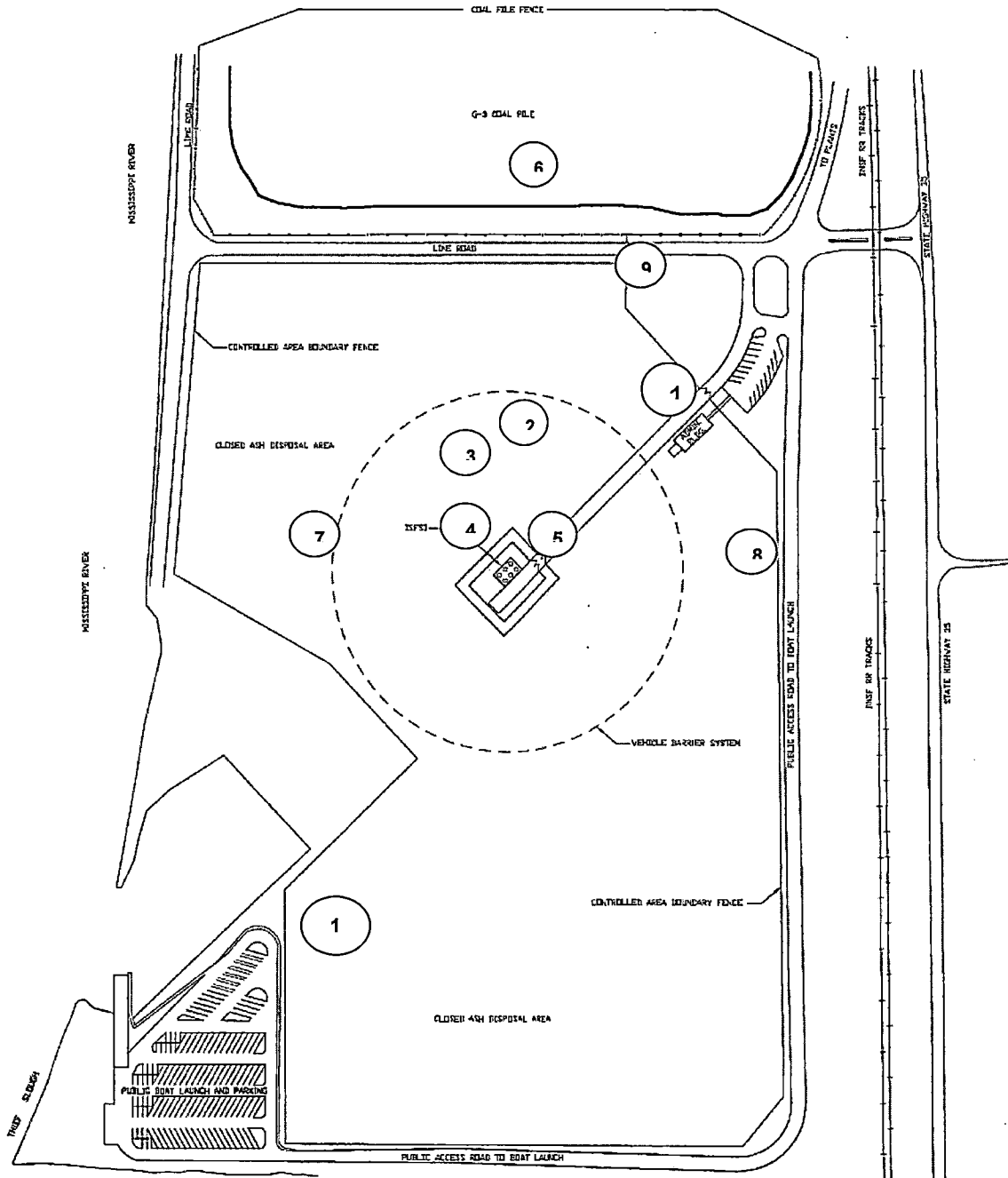


TABLE 4
ISFSI ENVIRONMENTAL TLD LOCATIONS

LOCATION NO	LOCATION
1	ISFSI ADMINISTRATIVE BUILDING WEST
2	ISFSI PROTECTED AREA NORTH EAST SIDE
3	ISFSI PROTECTED AREA NORTH WEST SIDE
4	ISFSI PROTECTED AREA SOUTH WEST SIDE
5	ISFSI PROTECTED AREA SOUTH EAST SIDE
6	ISFSI OWNER CONTROLLED FENCE NORTH
7	ISFSI OWNER CONTROLLED FENCE WEST
8	ISFSI OWNER CONTROLLED FENCE EAST
9	ISFSI OWNER CONTROLLED FENCE NORTH EAST BY HEAVY HAUL PATH
10	ISFSI OWNER CONTROLLED FENCE WEST BY BOAT LANDING

TABLE 5

SAMPLE FREQUENCY AND ANALYSIS OF RADIOLOGICAL ENVIRONMENTAL SAMPLES

<u>SAMPLE</u>	<u>FREQUENCY</u>	<u>ANALYSIS PERFORMED</u>
Environmental TLDs	Quarterly	Dose in mRem
Particulate Air - Glass Fiber Filters	Bi-Weekly	Gross Beta and Gamma Spectroscopy
River Sediment	Semi-annually	Gamma Spectroscopy
River Water	Semi-annually	Gamma Spectroscopy and Tritium (Liquid Scintillation Analyzer)

TABLE 6
LOW VOLUME ENVIRONMENTAL AIR MONITORING STATION LOCATIONS
(Refer to Figure 3)

LOCATION NO.	LOCATION
1	Trailer Park
2	Coal Plant - North Side
3	North of Main Switch Yard
4	Lock and Dam #8 - North Side

TABLE 7

LACBWR ENVIRONMENTAL TLD LOCATIONS

LOCATION NO	LOCATION
1	ADMINISTRATION BUILDING VAULT WEST END
2	RCA FENCE LINE NORTH
3	RCA FENCELINE SOUTHEAST
4	RCA FENCELINE SOUTH
5	RCA FENCE LINE SOUTHWEST
6	RCA FENCE LINE WEST
	G-3 Crib House
	Barge Wash Break Shack
	G-3 Control Room
	LACBWR Warehouse
	Modular Meeting Trailer-East of LACBWR Admin Building

TABLE 8
RADIOLOGICAL ENVIRONMENTAL SAMPLES COLLECTED
JANUARY- DECEMBER 2018

TYPE OF SAMPLE	NUMBER OF SAMPLES
Penetrating Radiation(Environmental TLDs)	84
Air Particulate	104
River Water	6
River Sediment	6

TABLE 9
QUARTERLY ENVIRONMENTAL TLD RESULTS IN THE LACBWR VICINITY
JANUARY- DECEMBER 2018

STATION NO.	1st QUARTER mRem	2nd QUARTER mRem	3rd QUARTER mRem	4th QUARTER mRem
1(*)	BKG	BKG	<0.10	<BKG
2(*)	<0.10	<0.10	<BKG	<BKG
3(*)	0.33	0.10	<BKG	<BKG
4(*)	<0.10	BKG	<BKG	<BKG
5(*)	<BKG	<BKG	<BKG	<BKG
6(*)	<BKG	<BKG	<BKG	<BKG
G-3 Crib House	<BKG	<BKG	<BKG	<BKG
Barge Wash Break Shack	<BKG	<BKG	<BKG	<BKG
G-3 Control Room	<BKG	<BKG	<BKG	<BKG
LACBWR Warehouse	<BKG	<BKG	<BKG	<BKG
Modular Meeting Trailer- East of LACBWR Admin Building	<BKG	<BKG	<BKG	<BKG

ALL BACKGROUND (BKG) CORRECTED RESULTS AND IF WITH () ON RCA FENCELINE HAD OCCUPANCY CORRECTION FACTOR APPLIED IF > BACKGROUND TLD RESULTS*

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 10
BI-WEEKLY GROSS BETA ENVIRONMENTAL AIR SAMPLE RESULTS

COLLECTION DATE	COAL PLANT pCi/m ³	TRAILER COURT pCi/m ³	LOCK AND DAM #8 pCi/m ³	SW MAIN SWITCHYARD pCi/m ³
1-03-2018	.018 ± .001	.023 ± .001	.014 ± .001	.020 ± .001
1-17-2018	.019 ± .001	.026 ± .001	.017 ± .001	.018 ± .001
1-31-2018	.018 ± .001	.021 ± .001	.017 ± .001	.016 ± .001
2-14-2018	.014 ± .001	.021 ± .001	.017 ± .001	.015 ± .001
2-28-2018	.015 ± .001	.016 ± .001	.019 ± .001	.019 ± .001
3-14-2018	.013 ± .001	.014 ± .001	.010 ± .001	.013 ± .001
3-28-2018	.013 ± .002	.013 ± .002	.014 ± .002	.012 ± .002
4-11-2018	.014 ± .001	.014 ± .001	.015 ± .001	.017 ± .002
4-25-2018	.017 ± .002	.018 ± .001	.017 ± .001	.016 ± .001
5-09-2018	.015 ± .001	.017 ± .001	.012 ± .001	.014 ± .001
5-23-2018	.015 ± .001	.014 ± .001	.014 ± .001	.014 ± .001
6-06-2018	.021 ± .002	.022 ± .002	.032 ± .002	.017 ± .001
6-20-2018	.016 ± .001	.015 ± .001	.014 ± .001	.011 ± .001
7-03-2018	.017 ± .001	.014 ± .001	.015 ± .001	.017 ± .001
7-17-2018	.020 ± .001	.028 ± .001	.018 ± .001	.014 ± .001
8-01-2018	.016 ± .001	.014 ± .001	.015 ± .001	.013 ± .001
8-15-2018	.025 ± .002	.025 ± .002	.017 ± .001	.020 ± .001
8-29-2018	.023 ± .001	.023 ± .001	.016 ± .002	.021 ± .001
9-12-2018	.014 ± .001	.014 ± .001	.002 ± .001	.001 ± .001
9-26-2018	.018 ± .002	.015 ± .001	.015 ± .002	.014 ± .001
10-10-2018	.012 ± .001	.011 ± .001	.001 ± .001	.001 ± .001
10-24-2018	.014 ± .001	.011 ± .001	.011 ± .002	.012 ± .001
11-07-2018	.013 ± .001	.014 ± .001	.013 ± .001	.012 ± .001
11-15-2018*	.017 ± .002	.016 ± .002	.013 ± .001	.020 ± .003
12-05-2018	.018 ± .002	.017 ± .002	.014 ± .002	.017 ± .001
12-19-2018	.032 ± .002	.035 ± .002	.026 ± .002	.028 ± .002

***Air Samples pulled early due to site shutdown for holiday the next week**

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS

LOCATION	COAL PLANT pCi/m3	TRAILER COURT pCi/m3	LOCK AND DAM #8 pCi/m3	SW MAIN SWITCHYARD pCi/m3
START DATE	12-21-2017	12-21-2017	12-21-2017	12-21-2017
END DATE	1-03-2018	1-03-2018	1-03-2018	1-03-2018
ISOTOPES				
Cs-134	< 1.18 E-03	< 2.36 E-03	< 2.37 E-03	< 1.08 E-03
Cs-137	< 8.06E-04	2.19E-03	1.67E-03	< 8.86 E-04
Co-60	< 1.14 E-03	< 2.35 E-03	< 2.30 E-03	< 1.14 E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	1-03-2018	1-03-2018	1-03-2018	1-03-2018
END DATE	1-17-2018	1-17-2018	1-17-2018	1-17-2018
ISOTOPES				
Cs-134	< 1.18 E-03	< 2.40 E-03	< 4.24 E-04	< 1.02 E-03
Cs-137	< 7.91 E-04	1.90 E-03	< 3.02 E-04	8.02E-04
Co-60	< 1.18 E-03	< 2.52 E-03	< 4.39 E-04	< 1.04 E-03

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	1-17-2018	1-17-2018	1-17-2018	1-17-2018
END DATE	1-31-2018	1-31-2018	1-31-2018	1-31-2018
ISOTOPES				
Cs-134	<1.11E-03	<2.53E-03	<2.40E-03	<1.00E-03
Cs-137	8.85E-04	<1.86E-03	<1.60E-03	<7.48E-04
Co-60	<1.13E-03	<2.43E-03	<2.40E-03	<1.07E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	1-31-2018	1-31-2018	1-31-2018	1-31-2018
END DATE	2-14-2018	2-14-2018	2-14-2018	2-14-2018
ISOTOPES				
Cs-134	<1.12E-03	<2.25E-03	<2.33E-03	<1.14E-03
Cs-137	1.03E-03	2.37E-03	2.10E-03	8.23E-04
Co-60	<1.08E-03	<2.46E-03	<2.30E-03	<1.16E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	2-14-2018	2-14-2018	2-14-2018	2-14-2018
END DATE	2-28-2018	2-28-2018	2-28-2018	2-28-2018
ISOTOPES				
Cs-134	<1.09E-03	<2.39E-03	<2.40E-03	<1.21E-03
Cs-137	1.36E-03	1.60E-03	<1.60E-03	<5.89E-04
Co-60	<1.13E-03	<2.39E-03	<2.40E-03	<1.22E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	2-28-2018	2-28-2018	2-28-2018	2-28-2018
END DATE	3-14-2018	3-14-2018	3-14-2018	3-14-2018
ISOTOPES/RL*				
Cs-134	<1.11E-03	<2.63E-03	<2.32E-03	<1.01E-03
Cs-137	<9.13E-04	<1.50E-03	<1.58E-03	8.20E-04
Co-60	<1.08E-03	<2.48E-03	<2.45E-03	<1.00E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	3-14-2018	3-14-2018	3-14-2018	3-14-2018
END DATE	3-28-2018	3-28-2018	3-28-2018	3-28-2018
ISOTOPEs				
Cs-134	<1.12E-03	<2.56E-03	<2.38E-03	<1.05E-03
Cs-137	1.20E-03	<1.44E-03	1.84E-03	7.31E-04
Co-60	<1.11E-03	<2.40E-03	<2.49E-03	<1.03E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM # 8	SW MAIN SWITCHYARD
START DATE	3-28-2018	3-28-2018	3-28-2018	3-28-2018
END DATE	4-11-2018	4-11-2018	4-11-2018	4-11-2018
ISOTOPEs				
Cs-134	<3.94E-03	<3.36E-03	<1.44E-03	<3.25E-03
Cs-137	<2.54E-03	<2.77E-03	1.25E-03	2.11E-03
Co-60	<4.12E-03	<3.42E-03	<1.57E-03	<3.27E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m3)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	4-11-2018	4-11-2018	4-11-2018	4-11-2018
END DATE	4-25-2018	4-25-2018	4-25-2018	4-25-2018
ISOTOPES				
Cs-134	<3.95E-03	<3.36E-03	<1.43E-03	<3.18E-03
Cs-137	<4.14E-03	<3.53E-03	<1.53E-03	<3.23E-03
Co-60	<2.47E-03	<3.39E-03	<9.01E-04	<3.22E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWITCHYARD
START DATE	4-25-2018	4-25-2018	4-25-2018	4-25-2018
END DATE	5-09-2018	5-09-2018	5-09-2018	5-09-2018
ISOTOPES				
Cs-134	<3.89E-03	<4.02E-03	<1.45E-03	<3.22E-03
Cs-137	4.94E-03	<2.55E-03	1.27E-03	<2.33E-03
Co-60	<4.10E-03	<4.21E-03	<1.58E-03	<3.26E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	5-09-2018	5-09-2018	5-09-2018	5-09-2018
END DATE	5-23-2018	5-23-2018	5-23-2018	5-23-2018
ISOTOPES				
Cs-134	<3.84E-03	<3.22E-03	<1.48E-03	<3.22E-03
Cs-137	2.95E-03	2.52E-03	1.55E-03	2.52E-03
Co-60	<3.97E-03	<3.40E-03	<1.50E-03	<3.40E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	5-23-2018	5-23-2018	5-23-2018	5-23-2018
END DATE	6-06-2018	6-06-2018	6-06-2018	6-06-2018
ISOTOPES				
Cs-134	<3.97E-03	<3.34E-03	<1.65E-03	<3.21E-03
Cs-137	<3.25E-03	3.55E-03	4.69E-03	<2.64E-03
Co-60	<2.67E-03	<2.16E-03	<1.70E-03	<3.17E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	6-06-2018	6-06-2018	6-06-2018	6-06-2018
END DATE	6-20-2018	6-20-2018	6-20-2018	6-20-2018
ISOTOPES				
Cs-134	<4.00E-03	<3.43E-03	<1.55E-03	< 3.22E-03
Cs-137	<3.24E-03	1.99E-03	1.11E-03	<2.15E-03
Co-60	<4.09E-03	<3.56E-03	<1.57E-03	<3.20E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	6-20-2018	6-20-2018	6-20-2018	6-20-2018
END DATE	7-03-2018	7-03-2018	7-03-2018	7-03-2018
ISOTOPES				
Cs-134	<4.21E-03	<3.56E-03	<1.57E-03	<4.30E-03
Cs-137	3.43E-03	<2.74E-03	<1.67E-03	3.68E-03
Co-60	<4.46E-03	<3.78E-03	<1.72E-03	<2.33E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m3)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	7-03-2018	7-03-2018	7-03-2018	7-03-2018
END DATE	7-17-2018	7-17-2018	7-17-2018	7-17-2018
ISOTOPES				
Cs-134	<3.98E-03	<3.20E-03	<2.16E-03	<2.78E-03
Cs-137	<4.03E-03	<3.24E-03	<1.84E-03	<2.43E-03
Co-60	<4.02E-03	<3.31E-03	<2.13E-03	<2.77E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	7-17-2018	7-17-2018	7-17-2018	7-17-2018
END DATE	8-01-2018	8-01-2018	8-01-2018	8-01-2018
ISOTOPES				
Cs-134	<3.70E-03	<3.16E-03	< 1.34E-03	<3.02E-03
Cs-137	<3.68E-03	<3.26E-03	<1.40E-03	<2.99E-03
Co-60	<3.72E-03	<3.19E-03	<1.14E-03	<2.99E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m3)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	8-01-2018	8-01-2018	8-01-2018	8-01-2018
END DATE	8-15-2018	8-15-2018	8-15-2018	8-15-2018
ISOTOPES				
Cs-134	<3.81E-03	<3.30E-03	<1.43E-03	<3.13E-03
Cs-137	<3.24E-03	2.98E-03	<1.15E-03	<4.49E-03
Co-60	<3.97E-03	<3.51E-03	<1.51E-03	<3.18E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	8-15-2018	8-15-2018	8-15-2018	8-15-2018
END DATE	8-29-2018	8-29-2018	8-29-2018	8-29-2018
ISOTOPES				
Cs-134	<3.87E-03	<3.39E-03	<1.50E-03	<3.16E-03
Cs-137	3.46E-03	<2.39E-03	8.75E-04	<2.37E-03
Co-60	<3.98E-03	<3.45E-03	<1.51E-03	<3.27E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
 (Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	8-29-2018	8-29-2018	8-29-2018	8-29-2018
END DATE	9-12-2018	9-12-2018	9-12-2018	9-12-2018
ISOTOPES				
Cs-134	<3.86E-03	<3.30E-03	<1.47E-03	<3.23E-03
Cs-137	3.15E-03	<2.34E-03	<1.27E-03	2.50E-03
Co-60	<4.08E-03	<3.35E-03	<1.51E-03	<3.44E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	9-12-2018	9-12-2018	9-12-2018	9-12-2018
END DATE	9-26-2018	9-26-2018	9-26-2018	9-26-2018
ISOTOPES				
Cs-134	<3.77E-03	<3.39E-03	<1.51E-03	<3.44E-03
Cs-137	<3.98E-03	<3.49E-03	<1.50E-03	<3.49E-03
Co-60	<3.95E-03	<3.35E-03	<1.49E-03	<3.48E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m3)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	9-26-2018	9-26-2018	9-26-2018	9-26-2018
END DATE	10-10-2018	10-10-2018	10-10-2018	10-10-2018
ISOTOPES				
Cs-134	<3.88E-03	<3.27E-03	<1.48E-03	<3.22E-03
Cs-137	<2.56E-03	<5.23E-03	1.04E-03	2.56E-03
Co-60	<3.94E-03	<3.37E-03	<1.47E-03	<3.24E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	10-10-2018	10-10-2018	10-10-2018	10-10-2018
END DATE	10-24-2018	10-24-2018	10-24-2018	10-24-2018
ISOTOPES				
Cs-134	<3.99E-03	<3.55E-03	<1.49E-03	<3.27E-03
Cs-137	<3.95E-03	<3.27E-03	<1.54E-03	<3.43E-03
Co-60	<2.37 E-03	<3.45E-03	<1.52E-03	<3.35E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	10-24-2018	10-24-2018	10-24-2018	10-24-2018
END DATE	11-07-2018	11-07-2018	11-07-2018	11-07-2018
ISOTOPES				
Cs-134	<3.97E-03	<3.41E-03	<1.48E-03	<3.18E-03
Cs-137	<3.42E-03	<2.84E-03	<9.66E-04	1.93E-03
Co-60	<3.85E-03	<3.61E-03	<1.57E-03	<3.30E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	11-07-2018	11-07-2018	11-07-2018	11-07-2018
END DATE	11-15-2018*	11-15-2018*	11-15-2018*	11-15-2018*
ISOTOPES				
Cs-134	<7.51E-03	<6.19E-03	<2.85E-03	<6.04E-03
Cs-137	<7.22E-03	<3.41E-03	<1.53E-03	<4.33E-03
Co-60	<7.20E-03	<6.11E-03	<2.80E-03	<5.81E-03

* Air Samples pulled early due to site shutdown for holiday the next week

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 11
BI-WEEKLY GAMMA SPEC ENV. AIR SAMPLE ANALYSIS RESULTS (Con't)
(Concentrations in pCi/m³)

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	11-15-2018	11-15-2018	11-15-2018	11-15-2018
END DATE	12-05-2018	12-05-2018	12-05-2018	12-05-2018
ISOTOPES				
Cs-134	<2.86E-03	<2.44E-03	<1.06E-03	<2.42E-03
Cs-137	1.65E-03	1.49E-03	<7.46E-04	<1.61 E-03
Co-60	<2.75E-03	<2.48E-03	<1.06E-03	<2.34 E-03

LOCATION	COAL PLANT	TRAILER COURT	LOCK AND DAM #8	SW MAIN SWICHYARD
START DATE	12-05-2018	12-05-2018	12-05-2018	12-05-2018
END DATE	12-19-2018	12-19-2018	12-19-2018	12-19-2018
ISOTOPES				
Cs-134	<4.21E-03	<3.51E-03	<1.63E-03	<3.35E-03
Cs-137	<2.55E-03	<3.46E-03	<1.54E-03	<1.88E-03
Co-60	<4.20E-03	<3.52E-03	<1.51E-03	<3.29E-03

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 12
SEMI ANNUAL MISSISSIPPI RIVER WATER ANALYSIS RESULTS
(Concentrations in pCi/Liter)

COLLECTION DATE: SAMPLE LOCATION:	SAMPLE #1 LOCK and DAM # 8 4/17/2018	SAMPLE #2 LACBWR OUTFALL 4/17/2018	SAMPLE #3 Dairyland Public River Access 4/17/2018	SAMPLE #1 LOCK and DAM #8 10/15/2018	SAMPLE #2 LACBWR OUTFALL 10/15/2018	SAMPLE #3 Dairyland Public River Access 10/15/2018
ISOTOPES/RL*						
H-3/20000	2550	</= 197	</=197	</=465	</=465	</=465
Mn-54/1000	< 4.16	< 4.18	< 4.06	< 4.05	< 4.12	< 4.01
Co-60/300	< 4.32	< 4.18	< 4.20	< 4.49	< 4.29	< 4.12
Zn-65/300	< 9.24	< 8.85	< 9.28	< 8.86	< 9.33	< 9.05
Cs-134/30	< 4.65	< 4.63	< 4.67	< 4.47	< 4.52	< 4.51
Cs-137/50	< 4.75	< 4.71	< 4.64	< 4.62	< 4.73	< 4.48

RL = REPORTING LEVEL

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 13
SEMI ANNUAL MISSISSIPPI RIVER SEDIMENT ANALYSIS RESULTS
(Concentration in pCi/Kg)

SAMPLE LOCATION COLLECTION DATE	UPSTREAM 04/24/2018	OUTFALL 04/24/2018	DOWNSTREAM 04/24/2018	UPSTREAM 10/17/2018	OUTFALL 10/17/2018	DOWNSTREAM 10/17/2018
ISOTOPES						
Cs-134	< 6.65	<5.17	< 11.90	< 5.23	< 5.01	< 8.98
Cs-137	<5.90	180.00 ± 10.50	65.80 ± 5.16	<4.11	<3.95	33.70 ± 3.21
Co-60	< 5.99	<4.90	< 10.90	< 4.80	< 4.71	< 8.45

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 14
QUARTERLY ENVIRONMENTAL TLD RESULTS FOR ISFSI AREA
JANUARY-DECEMBER 2018

<u>STATION NO.</u>	1st QUARTER mRem	2nd QUARTER mRem	3rd QUARTER mRem	4th QUARTER mRem
1	1.0	<BKG	<BKG	<BKG
2	25.0	22.0	18.0	20.0
3	66.0	83.0	88.0	83.0
4	15.0	12.0	11.0	14.0
5	26.0	23.0	26.0	27.0
6 (*)	BKG	<BKG	<BKG	<BKG
7(*)	<0.1	<BKG	<BKG	<BKG
8 (*)	<0.10	<BKG	<BKG	<BKG
9 (*)	<BKG	<BKG	<BKG	<BKG
10 (*)	<0.10	<BKG	<BKG	<0.10

ALL BACKGROUND CORRECTED AND THOSE ON OWNER CONTROLLED AREA FENCE LINE IDENTIFIED WITH (*) HAD OCCUPANCY FACTOR CORRECTION APPLIED IF > BACKGROUND TLD RESULTS