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10 CFR 50.36(a)(2)
and 72.44(d)(3)

July 14, 2015

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

Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
NRC Docket Nos. 50-317 and 50-318

Calvert Cliffs Nuclear Power Plant
Independent Spent Fuel Storage Installation, License No. SNM-2505
NRC Docket No. 72-8

Subject: Annual Radioactive Effluent Release Report

References:
1. Calvert Cliffs Unit Nos. 1 and 2 Technical Specification 5.6.3
2. Calvert Cliffs ISFSI Technical Specification 6.3

As required by References 1 and 2, the attached Enclosure is provided. Meteorological data is kept in an onsite file and is available upon request.

There are no regulatory commitments contained in this correspondence.

Should you have questions regarding this matter, please contact Mr. Larry D. Smith at (410) 495-5219.

Respectfully,

Mark D. Flaherty
Plant Manager

MDF/PSF/bjm

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NMSS26
NRR
NMSS

Enclosure: Annual Radioactive Effluent Release Report for Calvert Cliffs Nuclear Power Plant and Independent Spent Fuel Storage Installation-2014

cc: NRC Project Manager, Calvert Cliffs
NRC Regional Administrator, Region I
NRC Resident Inspector, Calvert Cliffs
S. Gray, MD-DNR
Director, NMSS
J. Folkwein, ANI

ENCLOSURE

Annual Radioactive Effluent Release Report for Calvert Cliffs Nuclear Power Plant and Independent Spent Fuel Storage Installation-2014

This report covers the period January 1, 2014 to December 31, 2014 for the Calvert Cliffs Nuclear Power Plant

This report covers the period June 1, 2014 to May 31, 2015 for the Independent Spent Fuel Storage Installation

Calvert Cliffs Nuclear Power Plant
July 14, 2015

ENCLOSURE (1)

CALVERT CLIFFS NUCLEAR POWER PLANT AND

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

RADIOACTIVE EFFLUENT RELEASE ANNUAL REPORT - 2014

Facility - Calvert Cliffs Nuclear Power Plant and Independent Spent Fuel Storage Installation

Licensee – Calvert Cliffs Nuclear Power Plant, LLC

This report covers the period January 1, 2014 to December 31, 2014 for Calvert Cliffs Nuclear Power Plant.

This report covers the period June 1, 2014 to May 31, 2015 for the Independent Spent Fuel Storage Installation.

I. REGULATORY LIMITS

A. Fission and Activation Gases

1. The instantaneous release rate of noble gases in gaseous effluents shall not result in a site boundary dose rate greater than 500 mrem/year to the whole body or greater than 3000 mrem/year to the skin (Offsite Dose Calculation Manual (ODCM) Rev. 0802, 3.11.2.1).

2. Gaseous Radwaste Treatment System and the Ventilation Exhaust Treatment System shall be used to reduce gaseous emissions when the calculated gamma-air dose due to gaseous effluents exceeds 1.20 mRad or the calculated beta-air dose due to gaseous effluents exceeds 2.4 mRad at the site boundary in a 92 day period (ODCM 3.11.2.4).

3. The air dose at the site boundary due to noble gases released in gaseous effluents shall not exceed (ODCM 3.11.2.2):

   10 mRad/qtr, gamma-air

   20 mRad/qtr, beta-air

   20 mRad/year, gamma-air

   40 mRad/year, beta-air

4. All of the above parameters are calculated according to the methodology specified in the ODCM.

B. Iodines and Particulates with Half Lives Greater than Eight Days

1. The instantaneous release rate of iodines and particulates in gaseous effluents shall not result in a site boundary dose-rate in excess of 1500 mrem/year to any organ (ODCM 3.11.2.1).

2. The Gaseous Radwaste Treatment System and the Ventilation Exhaust Treatment System shall be used to reduce radioactive materials in gaseous effluents when calculated doses exceed 1.8 mrem to any organ in a 92 day period at or beyond the site boundary (ODCM 3.11.2.4).

3. The dose to a member of the public at or beyond the site boundary from iodine-131 and particulates with half-lives greater than eight days in gaseous effluents shall not exceed (ODCM 3.11.2.3):

   15 mrem/qtr, any organ

   30 mrem/year, any organ

   less than 0.1% of the above limits as a result of burning contaminated oil.

4. All of the above parameters are calculated according to the methodology specified in the ODCM.

C. Liquid Effluents

1. The concentrations of radionuclides in liquid effluents from the plant shall not exceed the values specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for unrestricted areas (ODCM 3.11.1.1).

2. The liquid radwaste treatment system shall be used to reduce the concentration of radionuclides in liquid effluents from the plant when the calculated dose to unrestricted areas exceeds 0.36 mrem to the whole body, or 1.20 mrem to any organ in a 92 day period (ODCM 3.11.1.3).

3. The dose to a member of the public in unrestricted areas shall not exceed (ODCM 3.11.1.2):

   3 mrem/qtr, total body

   10 mrem/qtr, any organ

   6 mrem/year, total body

   20 mrem/year, any organ

4. All liquid dose parameters are calculated according to the methodology specified in the ODCM.

II. MAXIMUM PERMISSIBLE CONCENTRATIONS

A. Fission and Activation Gases

Prior to the batch release of gaseous effluents, a sample of the source is collected and analyzed by gamma spectroscopy for the principal gamma emitting radionuclides. The identified radionuclide concentrations are evaluated and an acceptable release rate is determined to ensure that the dose rate limits of ODCM 3.11.2.1 are not exceeded.

B. Iodines and Particulates with Half Lives Greater than Eight Days

Compliance with the dose rate limitations for iodines and particulates is demonstrated by analysis of the charcoal and particulate samples of the station main vents. The charcoal samples are analyzed by gamma spectroscopy for quantification of radioiodine. The particulate samples are analyzed by gamma spectroscopy for quantification of particulate radioactive material. All of the above parameters are calculated according to the methodology specified in the ODCM.

C. Liquid Effluents

The Maximum Permissible Concentrations (MPCs) used for radioactive materials released in liquid effluents are in accordance with ODCM 3.11.1.1 and the values from 10 CFR Part 20, Appendix B, Table II, Column 2 including applicable table notes. In all cases, the more restrictive (lower) MPC found for each radionuclide is used regardless of solubility.

III. TECHNICAL SPECIFICATION REPORTING REQUIREMENTS

A. Calvert Cliffs Nuclear Power Plant (CCNPP), Technical Specification 5.6.3

1. 2014 Offsite Dose Due to Carbon-14

Dose due to Carbon-14 in gaseous effluents was calculated using the following conditions:

a. C-14 released to the atmosphere: 18.53 Curies of C-14 from Unit 1 and 20.44 curies from Unit 2.

b. Release was consistent throughout the year.

c. Carbon-14 release values were estimated using the methodology included in the Electric Power Research Institute (EPRI) Technical Report 1021106, using the 2014 Calvert Cliffs Nuclear Power Plant assumed parameters of normalized Carbon-14 production rate of 3.822 Ci/GWt-yr, a gaseous release fraction of 0.98, a Carbon-14 carbon dioxide fraction of 0.30, a reactor power rating of 2737 MWt for Unit 1 and 2737 MWt for Unit 2, and equivalent full power operation of 323.18 days for Unit 1 and 356.64 days for Unit 2.

d. Meteorological dispersion factor (X/Q) at the nearest residence and garden location at 1.1 miles in the southwest meteorological sector and to the hypothetical maximally exposed member of the public (child) is 3.38E-7 sec/m^3.

e. Pathways considered were inhalation and leafy vegetation ingestion.

2. 2014 Dose Assessment Summary

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Yearly
Liquid Effluent Dose Limit, Total Body	3 mrem	3 mrem	3 mrem	3 mrem	6 mrem
Total Body Dose	6.61E-04	2.89E-04	4.43E-04	3.74E-04	1.77E-03
% of Limit	2.20E-02	9.63E-03	1.48E-02	1.25E-02	2.94E-02
Liquid Effluent Dose Limit, Any Organ	10 mrem	10 mrem	10 mrem	10 mrem	20 mrem
Organ Dose	1.02E-03	6.80E-04	7.09E-04	4.18E-04	2.50E-03
% of Limit	1.02E-02	6.80E-03	7.09E-03	4.18E-03	1.25E-02
Gaseous Effluent Dose Limit, Gamma Air	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
Gamma Air Dose	3.29E-04	4.03E-05	3.66E-05	2.41E-05	4.30E-04
% of Limit	3.29E-03	4.03E-04	3.66E-04	2.41E-04	2.15E-03
Gaseous Effluent Dose Limit, Beta Air	20 mrad	20 mrad	20 mrad	20 mrad	40 mrad
Beta Air Dose	1.09E-03	2.44E-04	1.22E-03	3.99E-05	2.59E-03
% of Limit	5.44E-03	1.22E-03	6.08E-03	2.00E-04	6.47E-03
Gaseous Effluent Dose Limit, Any Organ (Iodine, Tritium, Particulates with >8 day half-life)	15 mrem	15 mrem	15 mrem	15 mrem	30 mrem
Organ Dose	2.30E-03	4.65E-04	3.22E-04	2.49E-04	3.18E-03
% of Limit	1.54E-02	3.10E-03	2.14E-03	1.66E-03	1.06E-02
Total Body Dose	2.27E-04	3.67E-04	2.26E-04	2.49E-04	1.07E-03
Skin Dose					2.00E-03
C-14 Total Body/Organ	mrem				
Bone Dose	8.51E-03	1.10E-02	1.12E-02	1.13E-02	4.21E-02
Total Body Dose	1.67E-03	2.16E-03	2.20E-03	2.22E-03	8.24E-03

[1] The controlling pathway was the fish and shellfish pathway with adult as the controlling age group and the GI-LLI representing the organ with the highest calculated dose during the calendar year of 2014.

[2] The controlling pathway was the infant-thyroid pathway representing the organ with the highest calculated dose during the calendar year of 2014. There is currently no milk pathway.

3. 40 CFR 190 Total Dose Compliance

Based upon the calendar year 2014 and the ODCM calculations, the maximum exposed individual would receive 0.18% of the allowable dose. During the calendar year 2014, there were no on-site sources of direct radiation that would have contributed to a significant or measurable off-site dose. The direct radiation contribution is measured by both on-site and off-site thermoluminescent dosimeters (TLDs). The results of these measurements did not indicate any statistical increase in the off-site radiation doses attributable to on-site sources. Therefore, no increase in the calculated offsite dose is attributed to the direct exposure from on-site sources. A more detailed evaluation may be found in the Annual Radiological Environmental Operating Report.

EPA 40CFR190 Individual in the Unrestricted Area

	Whole Body	Thyroid	Any Other Organ
Dose Limit	25 mrem	75 mrem	25 mrem
Liquid	1.77E-03	1.15E-03	2.03E-03
Gas	1.07E-03	3.18E-03	3.20E-04
C-14	8.24E-03		4.21E-02
Dose	1.11E-02	4.33E-03	4.45E-02
% of Limit	4.43E-02	5.77E-03	1.78E-01

Child bone dose was used for Any Other Organ due to C-14

4. Solid Waste Report Requirements

During 2014, the types of radioactive solid waste shipped from Calvert Cliffs were dry compressible waste, spent resins, and cartridge filters which were shipped in either High Integrity Containers (HICs) within NRC approved casks, Sea/Land containers, or steel boxes. Appendix A provides a detailed breakdown of the waste shipments for 2014 per Technical Specification 5.6.3. At CCNPP, methods of waste and materials segregation are used to reduce the volume of solid waste shipped offsite for processing, volume reduction, and burial.

5. Offsite Dose Calculation Manual (ODCM) and Process Control Program (PCP) Changes

The ODCM and PCP were not revised in 2014.

B. Radioactive Effluent Monitoring Instrumentation

1. For 2014, inoperable gaseous effluent monitors were returned to service within 30 days in accordance with section 3.3.3.9 of the Offsite Dose Calculation Manual.

2. For 2014, inoperable liquid effluent monitors were returned to service within 30 days in accordance with section 3.3.3.10 of the Offsite Dose Calculation Manual.

C. Independent Spent Fuel Storage Installation (ISFSI), ISFSI Technical Specification 6.3

Four casks of spent fuel were transferred to the ISFSI during the reporting period. No quantity of radionuclides was released to the environment during the ISFSI operation in 2014. Additional information regarding the ISFSI radiological environmental monitoring program is included in the Annual Radiological Environmental Operation Report.

IV. AVERAGE ENERGY

Not Applicable.

V. MEASUREMENTS AND APPROXIMATIONS AND TOTAL RADIOACTIVITY

A. Fission and Activation Gases

1. Batch Releases

Prior to each batch release of gas from a pressurized waste gas decay tank or containment, a sample is collected and analyzed by gamma spectroscopy using a germanium detector for the principal gamma emitting noble gas radionuclides. The total activity released is based on the pressure/volume relationship (gas laws). The Plant Vent Stack Radiation Monitor typically monitors containment releases, and the values from the radiation monitor may be used to assist in the calculation of activity discharged from containment during venting. Carbon-14 is estimated per section III.A.1.

2. Continuous Releases

A gas sample is collected at least weekly from the main vents and analyzed by gamma spectroscopy using a germanium detector for the principal gamma emitting noble gas radionuclides. The total activity released for the week is based on the total sample activity decay corrected to the sample time multiplied by the main vent flow for the week. The Plant Vent Stack Radiation Monitor continuously measures routine plant vent stack releases, per design, and the values from the radiation monitor may be used to assist in the calculation of activity discharged in routine plant vent stack discharges.

During each containment purge, a gas sample is collected and analyzed by gamma spectroscopy using a germanium detector to determine the concentration of principal gamma emitting noble gas radionuclides inside containment. Total activity released during a containment purge is based on continuous radiation monitor responses, grab samples, and purge fan flow rate.

A monthly composite sample is collected from the main vents and analyzed by liquid scintillation for tritium. The total tritium release for the month is based on the sample analysis and the main vent flow.

Carbon-14 is estimated per section III.A.1.

B. Iodine and Particulates

1. Batch Releases

The total activities of radioiodines and particulates released from pressurized waste gas decay tanks, containment purges, and containment vents are accounted for by the continuous release methodology discussed in section V.B.2.

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 (or more often) and are analyzed by gamma spectroscopy using a germanium detector for significant gamma emitting radionuclides. The total activity released for the week is based on the total sample activity decay corrected to the midpoint of the sample period multiplied by the main vent flow for the week. A plate-out correction factor is applied to the results to account for the amount of iodine lost in the sample lines prior to sample collection. The weekly particulate filters are then combined to form monthly and quarterly composites for the gross alpha, strontium-89, and strontium-90 analyses. Iron-55 is analyzed twice per year.

C. Liquid Effluents

1. Batch Releases

Prior to the release of liquid from a waste tank, a sample is collected and analyzed by gamma spectroscopy for the principal gamma emitting radionuclides. To demonstrate compliance with the concentration requirements addressed in Section I.C.1 above, the measured radionuclide concentrations are compared with the allowable MPCs; dilution in the discharge conduit is considered, and an allowable release rate is verified.

The total activity released in each batch is determined by multiplying the volume released by the concentration of each radionuclide. 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 from each release, and this is used to prepare monthly tritium and gross alpha, iron-55, nickel-63, strontium-89, and strontium-90 samples for analysis are prepared quarterly for offsite analysis.

Batch discharges of secondary (normally uncontaminated) waste streams are also monitored for radioactivity. No activity is normally detected in these secondary waste streams (excluding tritium).

There were no major changes to the liquid radwaste system in calendar year 2014.

2. Continuous Releases

To account for activity from continuous releases, a sample is collected and analyzed by gamma spectroscopy for the principal gamma emitting radionuclides. The measured radionuclide concentrations are compared with the allowable MPC concentrations in the discharge conduit, and an allowable release rate is verified.

When steam generator blowdown is discharged to the circulating water conduits, it is sampled and gamma isotopic analysis is performed at a minimum once per week. These results are multiplied by the actual quantity of blowdown to determine the total activity released. The weekly sample is also used to prepare monthly composites for tritium analysis.

During the monitoring for primary-to-secondary leakage low levels of tritium have been detected in the Turbine Building sumps. This water is sampled and analyzed for principal gamma emitting radionuclides weekly and composited. The composite sample is analyzed at least monthly for tritium. The results are multiplied by the actual quantity of liquid released to determine the total activity released.

D. Estimation of Total Error

Total error for all releases was estimated using, as a minimum, the random counting error associated with typical releases. In addition to this random error, the following 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 are usually considered additive.

E. Meteorological Data

A summary of required meteorological data is retained on site in lieu of submission with the Radioactive Effluent Release Report.

F. Reporting and Recordkeeping for Decommissioning

In accordance with 10 CFR 50.75.g, each licensee shall keep records of information important to the safe and effective decommissioning of the facility in an identified location until the license is terminated by the Commission. If records of relevant information are kept for other purposes, reference to these records and their locations may be used. Information the Commission considers important to decommissioning consists of records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site. These records may be limited to instances when significant contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records must include any known information on identification of involved nuclides, quantities, forms, and concentrations.

To assist in the decommissioning, and to provide early and advance detection of any unmonitored releases of radioactive material from the site, groundwater is routinely sampled. These groundwater samples are analyzed for gamma and tritium activity (see Tables below). Sample size and/or count times are adjusted to achieve analytical sensitivities lower than the environmental LLDs for gamma emitters (listed in ODCM Table 4.12-1). Established LLD limits for tritium are approximately 350 pCi/l for tritium.

Groundwater samples were collected from seventeen on-site piezometer tubes throughout 2014. A piezometer tube is a shallow monitoring well which allows access to groundwater at a depth of approximately 40 feet beneath the site. Of the piezometer tubes sampled, only #11 Piezometer Tube showed any plant related activity. This activity was previously identified and evaluated in December of 2005. The activity consists of tritium originating from normal radwaste discharges and was previously reported in the Annual Radioactive Effluent Release Reports. The tritium contamination is contained on site. No drinking water has been affected; the groundwater at this location does not impact any drinking water pathway.

The 2014 analysis result for tritium and gamma are shown in the following tables.

Concentration of Tritium in Groundwater

(Results in units of pCi/L)

Sample Date	Piezometer Tube																
	11	12	13	15	18	19	20	21	22	23	24	25	26	27	28	29	30
03/02/14	478	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
5/19/14	#	#	#	#	#	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
6/24/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	#	#	#	#	#	#	#
07/18/14	825	#	#	#	#	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
8/16/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	#	ND	#	#	ND	ND	ND
8/29/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	ND	ND	#	#	#
11/22/14	1570	#	#	#	#	#	#	#	#	ND	ND	ND	ND	ND	ND	ND	ND
12/13/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	#	#	#	#	#	#	#	#

Tritium Less than Minimum Detectable Activity (<MDA)
ND No Data – Quarterly sample obtained as required.

Gross Concentration of Gamma Emitters

(Results in units of pCi/L)

Sample Date	Piezometer Tube																
	11	12	13	15	18	19	20	21	22	23	24	25	26	27	28	29	30
03/02/14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5/19/14	*	*	*	*	*	*	*	*	*	ND	ND	ND	ND	ND	ND	ND	ND
6/24/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	*	*	*	*	*	*	*
7/18/14	*	*	*	*	*	*	*	*	*	ND	ND	ND	ND	ND	ND	ND	ND
8/16/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	*	ND	*	*	ND	ND	ND
8/29/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	ND	ND	*	*	*
11/22/14	*	*	*	*	*	*	*	*	*	ND	ND	ND	ND	ND	ND	ND	ND
12/13/14	ND	ND	ND	ND	ND	ND	ND	ND	ND	*	*	*	*	*	*	*	*

*All Non-Natural Gamma Emitters < MDA
ND No Data – Quarterly sample obtained as required

VI. BATCH RELEASES

	2014			
	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
A. Liquid				
1. Number of batch releases	15	11	10	11
2. Total time period for batch releases (min)	1.91E+04	4.80E+04	1.37E+05	1.37E+05
3. Maximum time period for a batch release (min)	9.93E+03	4.32E+04	4.46E+04	4.46E+04
4. Average time period for batch releases (min)	1.27E+03	4.37E+03	1.37E+04	1.25E+04
5. Minimum time period for a batch release (min)	2.21E+02	6.00E+01	5.25E+02	5.48E+02
6. Average stream flow during periods of effluent into a flowing stream (liters/min of dilution water)	4.33E+06	4.61E+06	4.59E+06	4.60E+06

B. Gaseous

	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
1. Number of batch releases	25	25	22	14
2. Total time period for batch releases (min)	1.50E+04	1.23E+04	8.63E+03	4.71E+03
3. Maximum time period for a batch release (min)	4.44E+03	3.00E+03	7.04E+02	5.25E+02
4. Average time period for batch release (min)	6.00E+02	4.92E+02	3.92E+02	3.36E+02
5. Minimum time period for a batch release (min)	6.30E+01	1.42E+02	8.50E+01	2.16E+02

VII. ABNORMAL RELEASES

	2014			
	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
A. Liquid				
1. Number of releases	- 0 -	- 0 -	- 0 -	- 0 -
2. Total activity released (Curies)	- 0 -	- 0 -	- 0 -	- 0 -
B. Gaseous				
1. Number of releases	- 0 -	- 0 -	- 0 -	- 0 -
2. Total activity releases (Curies)	- 0 -	- 0 -	- 0 -	- 0 -

APPENDIX A

CALVERT CLIFFS NUCLEAR POWER PLANT AND

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

EFFLUENT AND WASTE DISPOSAL 2014 ANNUAL REPORT

TABLE 1A - REG GUIDE 1.21

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

A. FISSION AND ACTIVATION GASES	UNITS	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	EST. TOTAL ERROR, %
1. Total Release	Ci	1.18E+01	1.86E+00	9.06E+00	3.07E-01	±1.20E+01
2. Average release rate for period	µCi/sec	1.50E+00	2.36E-01	1.15E+00	3.89E-02	
5. Percent of ODCM limit (1)	%	3.29E-03	4.03E-04	3.66E-04	2.41E-04	
6. Percent of ODCM limit (2)	%	5.44E-03	1.22E-03	6.08E-03	2.00E-04	
B. IODINES						
1. Total Iodine - 131	Ci	7.57E-05	1.19E-05	8.65E-06	0.00E+00	±6.50E+00
2. Average release rate for period	µCi/sec	9.61E-06	1.51E-06	1.10E-06	0.00E+00	
3. Percent of ODCM limit	%	(3)	(3)	(3)	(3)	
C. PARTICULATES						
1. Particulates with half lives greater than 8 days	Ci	<LLD	<LLD	<LLD	<LLD	±1.20E+01
2. Average release rate for period	µCi/sec	<LLD	<LLD	<LLD	<LLD	
3. Percent of ODCM limit	%	(3)	(3)	(3)	(3)	

D. TRITIUM

1. Total Release	Ci	5.57E-01	3.89E+00	2.40E+00	2.74E+00	±1.32E+01
2. Average release rate for period	µCi/sec	7.06E-02	4.93E-01	3.04E-01	3.47E-01	

E. GROSS ALPHA

1. Total Release	Ci	<LLD	9.80E-08	6.21E-07	<LLD	±2.50E+01
2. Average release rate for period	µCi/sec	<LLD	1.24E-08	7.88E-08	<LLD	

F. Carbon-14

1. Total Release	Ci	7.87E+00	1.02E+01	1.04E+01	1.05E+1	N/A
2. Average release rate for period	µCi/sec	1.01E+00	1.30E+00	1.31E+00	1.32E+00	

NOTES TO TABLE 1A

(1) Percent of quarterly gamma-air dose limit (10 mRad)

(2) Percent of quarterly beta-air dose limit (20 mRad)

(3) Iodine, Tritium, Carbon-14, and Particulates are treated as a group. % limit can be found in Section III.A.2

TABLE 1C - REG GUIDE 1.21

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

		UNITS	CONTINUOUS MODE				BATCH MODE			
			1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
1. FISSION AND ACTIVATION GASES										
Argon	-41	Ci	<LLD	<LLD	<LLD	<LLD	2.34E-02	2.77E-02	2.76E-02	2.17E-02
Krypton	-85	Ci	2.11E-01	<LLD	<LLD	<LLD	2.08E+00	1.47E+00	8.72E+00	1.36E-01
Krypton	-85m	Ci	2.70E-01	<LLD	<LLD	<LLD	1.81E-05	1.53E-05	<LLD	<LLD
Krypton	-87	Ci	3.86E-04	<LLD	<LLD	<LLD	<LLD	<LLD	1.93E-05	<LLD
Krypton	-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon	-131m	Ci	1.31E-02	<LLD	<LLD	<LLD	4.95E-02	2.69E-04	9.12E-04	<LLD
Xenon	-133	Ci	6.85E+00	1.82E-01	<LLD	<LLD	1.75E+00	7.43E-02	3.09E-01	9.25E-02
Xenon	-133m	Ci	4.33E-03	<LLD	<LLD	<LLD	1.37E-02	6.88E-04	4.21E-03	9.66E-04
Xenon	-135	Ci	5.58E-01	1.06E-01	<LLD	5.47E-02	2.53E-03	7.20E-04	3.31E-03	1.37E-03
Xenon	-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	2.74E-04	<LLD
Xenon	-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period		Ci	7.90E+00	2.87E-01	0.00E+00	5.47E-02	3.93E+00	1.58E+00	9.06E+00	2.52E-01
2. IODINES										

TABLE 1C - REG GUIDE 1.21

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

		UNITS	CONTINUOUS MODE				BATCH MODE			
			1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
Iodine	-131	Ci	7.57E-05	1.19E-05	8.65E-06	<LLD	(1)	(1)	(1)	(1)
Iodine	-132	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Iodine	-133	Ci	4.47E-04	2.50E-04	1.44E-04	1.81E-04	(1)	(1)	(1)	(1)
Iodine	-135	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Total for Period		Ci	5.22E-04	2.62E-04	1.53E-04	1.81E-04	(1)	(1)	(1)	(1)
3. PARTICULATES (half life > 8 days)										
Manganese	-54	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Iron	-55	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Iron	-59	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Cobalt	-58	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Cobalt	-60	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Zinc	-65	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Strontium	-89	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Strontium	-90	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)

TABLE 1C - REG GUIDE 1.21

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES

	UNITS	CONTINUOUS MODE				BATCH MODE			
		1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
Molybdenum -99	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Cesium -134	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Cesium -137	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Cerium -141	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Cerium -144	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
Total for period	Ci	<LLD	<LLD	<LLD	<LLD	(1)	(1)	(1)	(1)
4. GROSS ALPHA RADIOACTIVITY									
Gross Alpha	Ci	<LLD	9.80E-08	6.21E-07	<LLD	<LLD	<LLD	<LLD	<LLD
5. TRITIUM									
Tritium	Ci	5.57E-01	3.47E+00	2.40E+00	2.74E+00	<LLD	4.12E-01	<LLD	<LLD

NOTES TO TABLE 1C

(1) Iodines and particulates in batch releases are accounted for with the main vent continuous samplers when the release is made through the plant main vent.

TABLE 2A - REG GUIDE 1.21

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	UNITS	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	EST. TOTAL ERROR, %
A. FISSION AND ACTIVATION PRODUCTS						
1. Total Release (not including tritium, gases, alpha)	Ci	1.39E-02	6.10E-03	5.46E-03	4.35E-03	±1.03E+01
2. Average diluted concentration during period	µCi/ml	6.03E-12	2.49E-12	1.49E-12	1.18E-12	
3. Percent of ODCM limit (1)	%	1.02E-02	6.80E-03	7.09E-03	4.18E-03	
5. Percent of ODCM limit (2)	%	2.20E-02	9.63E-03	1.48E-02	1.25E-02	
B. TRITIUM						
1. Total Release	Ci	3.31E+02	1.66E+02	3.05E+02	2.85E+02	±1.03E+01
2. Average diluted concentration during period	µCi/ml	1.43E-07	6.78E-08	8.31E-08	7.73E-08	
3. Percent of applicable limit (3)	%	4.77E-03	2.26E-03	2.77E-03	2.58E-03	
C. DISSOLVED AND ENTRAINED GASES						
1. Total Release	Ci	1.58E-02	3.11E-04	1.01E-02	3.09E-04	±1.03E+01
2. Average diluted concentration during period	µCi/ml	6.84E-12	1.27E-13	2.76E-12	8.40E-14	
D. GROSS ALPHA RADIOACTIVITY						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	N/A

E. VOLUME OF WASTE RELEASED (prior to dilution)						
1. Volume processed through radwaste system	liters	1.12E+08	1.07E+08	1.07E+08	1.16E+08	±1.30E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD (4)	liters	2.31E+12	2.45E+12	3.67E+12	3.68E+12	±1.64E+01

NOTES TO TABLE 2A

(1) Percent of I.C.3 Quarterly Organ Dose Limit (10 mrem) to maximum exposed organ

(2) Percent of I.C.3 Quarterly Whole Body Dose Limit (3 mrem)

(3) Limit used is 3 x 10-3 μCi/ml

(4) Includes dilution water used during continuous discharges.

(5) Liquid releases are higher than normal during refueling outages due to noble gases released from failed fuel

TABLE 2B - REG GUIDE 1.21

LIQUID EFFLUENTS

NUCLIDES RELEASED	Units	CONTINUOUS MODE				BATCH MODE			
		1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
Beryllium – 7	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sodium – 24	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Chromium - 51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	1.79E-04	<LLD	<LLD
Manganese - 54	Ci	<LLD	<LLD	<LLD	<LLD	4.31E-05	<LLD	<LLD	2.53E-05
Iron – 55	Ci	(2)	(2)	(2)	(2)	2.75E-03	<LLD	2.45E-03	<LLD
Cobalt – 57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cobalt – 58	Ci	<LLD	<LLD	<LLD	<LLD	7.77E-04	1.18E-03	2.61E-04	3.56E-05
Iron – 59	Ci	<LLD	<LLD	<LLD	<LLD	1.74E-05	<LLD	<LLD	<LLD
Cobalt – 60	Ci	<LLD	<LLD	<LLD	<LLD	1.84E-03	6.00E-04	5.65E-04	2.24E-04
Nickel-63	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	9.82E-04	8.84E-04	1.58E-03
Zinc – 65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium - 89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium - 90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium – 91	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

TABLE 2B - REG GUIDE 1.21

LIQUID EFFLUENTS

NUCLIDES RELEASED	Units	CONTINUOUS MODE				BATCH MODE			
		1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
Strontium - 92	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Niobium - 95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	6.82E-05	<LLD	<LLD
Zirconium - 95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	6.34E-05	<LLD	<LLD
Niobium - 97	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Zirconium - 97	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Molybdenum - 99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Technetium - 99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ruthenium - 103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Rhodium - 105	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ruthenium - 105	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Silver - 110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tin – 113	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tin – 117m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Antimony - 122	Ci	<LLD	<LLD	<LLD	<LLD	6.81E-05	<LLD	<LLD	<LLD

TABLE 2B - REG GUIDE 1.21

LIQUID EFFLUENTS

NUCLIDES RELEASED	Units	CONTINUOUS MODE				BATCH MODE			
		1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
Antimony - 124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Antimony - 125	Ci	<LLD	<LLD	<LLD	<LLD	2.72E-03	<LLD	2.92E-04	7.51E-05
Tellurium – 125m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tellurium - 132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine - 131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine - 132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine – 133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine – 135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium – 134	Ci	<LLD	<LLD	<LLD	<LLD	6.11E-04	3.04E-04	6.90E-05	1.68E-04
Cesium – 136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium – 137	Ci	<LLD	<LLD	<LLD	<LLD	5.09E-03	2.72E-03	9.38E-04	2.23E-03
Barium – 140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Lanthanum - 140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cerium – 144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

TABLE 2B - REG GUIDE 1.21

LIQUID EFFLUENTS

NUCLIDES RELEASED	Units	CONTINUOUS MODE				BATCH MODE			
		1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
Europium – 154	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Europium – 155	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tungsten – 187	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	<LLD	<LLD	<LLD	<LLD	1.39E-02	6.10E-03	5.46E-03	4.35E-03
Krypton – 85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	1.01E-02	<LLD
Xenon - 131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon – 133	Ci	<LLD	<LLD	<LLD	<LLD	1.55E-02	3.11E-04	6.90E-05	3.09E-04
Xenon – 133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon – 135	Ci	<LLD	<LLD	<LLD	<LLD	3.17E-04	<LLD	<LLD	<LLD
Total For Period	Ci	<LLD	<LLD	<LLD	<LLD	1.58E-02	3.11E-04	1.01E-02	3.09E-04
Tritium	Ci	5.75E-02	1.32E-01	9.78E-02	1.53E-01	3.31E+02	1.66E+02	3.05E+02	2.85E+02
Total For Period	Ci	5.75E-02	1.32E-01	9.78E-02	1.53E-01	3.31E+02	1.66E+02	3.05E+02	2.85E+02

NOTES TO TABLE 2B

(1) Less than minimum detectable activity which meets the LLD requirements of ODCM Surveillance Requirement 4.11.1.1.1.

(2) Continuous mode effluents are not analyzed for Fe-55.

TABLE 3A

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of Waste		Units	12-Month Period	Est. Total Error %
a)	Spent resins, Filters	m^3	1.69+01	25%
		Ci	2.56E+02	
b)	Dry compressible waste, contaminated equipment, etc.	m^3	4.14E+02	25%
		Ci	2.76E+00	
c)	Irradiated components, control rods, etc.	m^3	0.00E+00	N/A
		Ci	0.00E+00	
d)	Other (cartridge filters, misc. dry compressible, Oil)	m^3	5.80E+02	25%
		Ci	3.71E-01	
e)	Solidification agent or absorbent	m^3	N/A	N/A

Volume shipped represents waste generated prior to offsite volume reduction.

2. **Estimate of Major Nuclides** (By Type of Waste - Only nuclides >1 % are reported)

Spent Resins, Filters	
Nuclide	Abundance (%)
Mn-54	2.63
Fe-55	14.44
Co-58	7.74
Co-60	21.56
Ni-63	18.54
Cs-134	6.95
Cs-137	25.92

2. **Estimate of Major Nuclides** (By Type of Waste - Only nuclides >1 % are reported)(cont.)

Dry Active Waste	
Nuclide	Abundance (%)
H-3	1.33
C-14	13.57
Fe-55	15.12
Co-58	12.83
Co-60	17.81
Ni-63	16.38
Zr-95	5.68
Nb-95	10.58
Cs-137	2.81
Pu-241	1.30

Irradiated Components	
Nuclide	Abundance (%)
N/A	

Other Waste	
Nuclide	Abundance (%)
H-3	1.33
C-14	13.62
Fe-55	15.14
Co-58	12.79
Co-60	17.85
Ni-63	16.42
Zr-95	5.66
Nb-95	10.50
Cs-137	2.80
Pu-241	1.30

3. **Solid Waste Disposition**

Number of Shipments	Mode of Transportation	Destination
17	Motor Surface Transit (Hittman)	Energy Solutions (Duratek) Oak Ridge, TN
9	Motor Surface Transit (Hittman)	Waste Control Specialists LLC Andrews, TX
3	Motor Surface Transit (Landstar)	Energy Solutions (Duratek) Oak Ridge, TN
2	Motor Surface Transit	Studsvik Processing Facility Memphis, TN

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION) N/A