

**BYRON NUCLEAR POWER STATION**  
**ANNUAL RADIOLOGICAL EFFLUENT RELEASE REPORT**  
**(ARERR)**  
**2011**

**BYRON NUCLEAR POWER STATION  
UNIT 1/2 DOCKET NUMBER STN-50-454/455  
RADIOACTIVE EFFLUENT RELEASE REPORT  
January 2011 - December 2011  
Supplemental Information**

**1. Regulatory Limits**

**a. Fission and activation products:**

Tech Spec Whole Body	=	500 mrem/year
Skin	=	3000 mrem/year
10CFR50 Gamma	=	5 mrad/quarter; 10 mrad/year
Beta	=	10 mrad/quarter; 20 mrad/year

**b. Iodine: (summed with particulate, see below)**

**c. Particulates with half-lives > 8 days:**

Tech Spec Organ	=	1500 mrem/year
10CFR50 Organ	=	7.5 mrem/quarter; 15 mrem/year

**d. Liquid Effluents:**

10CFR50 Whole Body	=	1.5 mrem/quarter; 3 mrem/year
Organ	=	5 mrem/quarter; 10 mrem/year

**2. Maximum Permissible Concentration**

- a. Fission and Activation Products: 10CFR20 Appendix B Table 2**
- b. Iodine: 10CFR20 Appendix B Table 2**
- c. Particulates: 10CFR20 Appendix B Table 2**
- d. Liquid Effluents: 10 X 10CFR20 Appendix B Table 2**

**3. Average Energy: This item is not applicable. Release rates are calculated using an isotopic mix rather than average energy.**

**4. Measurements and Approximations of Total Radioactivity**

- a. Fission and activation products: Prior to release, the isotopic content is determined. Released activity is calculated using volume of release, which is determined by the change in tank or containment pressure. Additional methods of calculation utilize historical data and assign an isotopic mix, which is representative of normal vent stack isotopics.**
- b. Particulate, tritium and iodine sampling media for the plant vent stacks are collected and isotopically analyzed weekly.**

- c. Liquid effluents: Isotopic analysis is performed on each batch release prior to its release. Total release activity is calculated using volume of release. Total tritium activity released is calculated from the highest of a monthly circulating water blowdown composite activity or a sum of the input composite activities.
  - d. Analysis results that are less than the lower limit of detection (<LLD) are reported in units of uCi/cc or uCi/ml unless otherwise noted. All LLD values are listed in Attachment A.
5. Batch Releases:
- a. Liquid:
    - 1. Number of batch releases = 105
    - 2. Total time period for batch releases = 15,083 minutes
    - 3. Maximum time period for a batch release = 673 minutes
    - 4. Average time period for a batch release = 144 minutes
    - 5. Minimum time period for a batch release = 47 minutes
    - 6. Average stream flow during periods of release of effluent into a flowing stream = 222 m<sup>3</sup>/sec, based on information from the U.S. Geological Survey Byron Gauging Station.
  - b. Gaseous:
    - 1. Number of batch releases = 361
    - 2. Total time period for batch releases = 57,225 minutes
    - 3. Maximum time period for a batch release = 4,080 minutes
    - 4. Average time period for batch releases = 159 minutes
    - 5. Minimum time period for a batch release = 8 minutes
6. Abnormal Releases:
- a. Liquid - None
  - b. Gaseous – None
7. 2011 Radiological Groundwater Protection Program (RGPP) Results Summary:

In 2011, thirteen (13) Radiological Groundwater Protection Program (RGPP) monitoring wells were sampled. The samples were obtained in March, May, July, and November and analyzed for tritium. In addition, a study of gamma, beta, alpha, and hard-to-detect radioisotopes was performed in accordance with Nuclear Energy Institute (NEI) 07-07, Groundwater Protection Initiative, for the samples obtained in May. None of the May samples showed concentrations of radionuclides above what is considered background levels. Three wells contained levels of tritium above the lower limit of detection (LLD) of 200 pCi/L. They were: AR-4 (875 pCi/L in March, 818 pCi/L in May, 777 pCi/L in July, 912 pCi/L in November), AR-11 (827 pCi/L in March, 919 pCi/L in May, 1,150 pCi/L in July, 894 pCi/L in November), and AR-7 (<LLD in March, <LLD in May, 291 pCi/L in July, 269 pCi/L in August, 314 pCi/L in September, 318 pCi/L in November). Wells AR-4 and AR-11 are near the Circulating Water Blowdown piping, where historical leakage through vacuum breakers was known to have occurred. Both of these wells are showing a slow but gradual decrease in tritium concentration since first sampled in 2006. Well AR-7, located just west of the plant structures, last showed tritium above the LLD (228 pCi/L) in 2008. The tritium in this well is believed to be from precipitation recapture of permitted gaseous release of tritium from the plant that has entered the well during rainfall events as a result of improperly compacted soil





## **SUMMARY**

Calculations based on gaseous and liquid effluents and meteorological data indicate that public dose due to radioactive material attributable to Byron Station during the period does not exceed any regulatory or Offsite Dose Calculation Manual (ODCM) limits.

The Total Effective Dose Equivalent (TEDE) due to licensed activities at Byron Station calculated for the maximum exposed individual for the period is 2.62E-01 mrem. The annual limit on TEDE is 100 mrem.

The assessment of radiation doses to the public is performed in accordance with the ODCM. The results of these analyses confirm that the station is operating in compliance with 10CFR50 Appendix I, 10CFR20 and 40CFR190.

There were no additional operational controls implemented in 2011 that affected radiological effluents.

There were no measurements which exceeded the reporting levels, including any that would not have been attributable to station effluents.

The results of the current radiological environmental monitoring program are approximately the same as those found during the pre-operational studies conducted at Byron Station.

## **RELEASES**

### **Gaseous Effluents to the Atmosphere**

A total of 1.40E+00 curies of fission and activation gases were released with a maximum average quarterly release rate of 1.36E-01  $\mu\text{Ci/sec}$ .

A total of 7.47E-05 curies of 1-131 were released during the year with a maximum average quarterly release rate of 5.36E-06  $\mu\text{Ci/sec}$ .

A total of 1.37E-06 curies were released as airborne particulate matter with a maximum average quarterly release rate of 1.32E-07  $\mu\text{Ci/sec}$ .

A total of 8.23E+00 curies of other (C-14, Br-82) radioisotopes were released with a maximum average quarterly release rate of 2.86E-01  $\mu\text{Ci/sec}$ .

A total of 5.95E+01 curies of tritium were released with a maximum average quarterly release rate of 2.51E+00  $\mu\text{Ci/sec}$ .

Gross alpha-emitting radionuclides were below detectable limits.

### **Liquids Released to Rock River**

A total of 2.66E+10 liters of radioactive liquid wastes containing 2.52E-02 curies of

fission and activation products were discharged with a maximum quarterly average concentration of  $2.46\text{E-}09$   $\mu\text{Ci/ml}$ .

A total of  $2.58\text{E}+03$  curies of tritium were discharged with a maximum quarterly average concentration of  $4.26\text{E-}04$   $\text{uCi/ml}$ .

A total of  $1.23\text{E-}03$  curies of dissolved and entrained gases were discharged with a maximum quarterly average concentration of  $2.90\text{E-}10$   $\text{uCi/ml}$ .

Gross alpha-emitting radionuclides were below detectable limits.

## **DOSE TO MAN**

### **GASEOUS EFFLUENT PATHWAYS**

#### **Noble Gas - Gamma Dose Rates**

Offsite Gamma air and whole body dose rates for the period were calculated based on measured release rates, isotopic composition of the noble gases, and average meteorological data. The maximum gamma air dose was  $5.02\text{E-}05$  mrad based on measured effluents and average meteorological data, and  $8.68\text{E-}06$  mrad based on measured effluents and concurrent meteorological data.

#### **Noble Gas - Beta Air and Skin Dose Rates**

The range of beta particles in air is relatively small (on the order of a few meters or less). Consequently, plumes of gaseous effluents may be considered "semi-infinite" for the purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate due to the effect of the beta particle energies, thickness of inert skin, and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of  $7.0\text{ mg/cm}^2$  and an occupancy factor of 1.0 is used. The skin dose based on measured effluents and concurrent meteorological data was  $1.23\text{E-}05$  mrem.

The maximum offsite beta air dose for the year based on measured effluents and average meteorological data was  $2.25\text{E-}05$  mrad, and  $1.60\text{E-}05$  mrad based on measured effluents and concurrent meteorological data.

#### **Radioactive Iodine & Particulate**

The human thyroid exhibits a significant capacity to concentrate ingested or inhaled iodine. I-131 released during routine operation of the station may be made available to man resulting in dose to the thyroid. C-14 is also included in this category. C-14 exhibits a capacity to concentrate in bone. C-14 is released in gaseous form and is absorbed into vegetation through photosynthesis. The principal pathways of interest for C-14 are the consumption of vegetation by humans and milk from which animals have ingested C-14 through the consumption of vegetation. With the requirement to report C-14 dose in 2011 and the addition of C-14 to plant effluents, human dose in this category is primarily driven by the release of C-14 from the plant.

The hypothetical dose to the maximum exposed individual living near the station via ingestion of milk and vegetation was calculated. The source of milk and vegetation was assumed to be at the nearest site boundary with the cows pastured and vegetation grown from May through October. The maximum organ dose from radioactive iodine and particulate (including C-14) to any organ was  $6.71\text{E-}01$  mrem (child/bone) based on measured effluents and average meteorological data, and  $6.11\text{E-}01$  mrem (child/bone) based on measured effluents concurrent meteorological data. The maximum dose from radioactive iodine and particulate (including C-14) to the whole body was  $1.37\text{E-}01$  mrem (child) based on measured effluents and average meteorological data, and  $1.26\text{E-}01$  mrem (child) based on measured effluents and concurrent meteorological data.

#### Gaseous Total Dose

The maximum total dose from gaseous releases to any organ was  $6.71\text{E-}01$  mrem (child/bone) based on measured effluents and average meteorological data, and  $6.11\text{E-}01$  mrem (child/bone) based on measured effluents and concurrent meteorological data. The maximum total dose from gaseous releases to the whole body was  $1.37\text{E-}01$  mrem (child) based on measured effluents and average meteorological data, and  $1.26\text{E-}01$  mrem (child) based on measured effluents and concurrent meteorological data .

#### **LIQUID EFFLUENT PATHWAYS**

The principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water and eating aquatic foods. Liquid dose was calculated based on the ingestion of potable water and sport fish. It should be noted, however, there are currently no communities within 10 km downstream of the plant using the Rock River for drinking water. NRC-developed equations are used to calculate the doses to the whole body, bone, liver, thyroid, kidney, lung, lower GI tract, and skin. Specific parameters for use in the equations are given in the Exelon Offsite Dose Calculation Manual (ODCM).

The maximum dose from liquid releases to any organ was  $2.15\text{E-}01$  mrem (adult/gilli). The maximum dose from liquid releases to the whole body was  $1.49\text{E-}01$  mrem (adult).

#### **GASEOUS + LIQUID TOTAL DOSE**

The maximum total dose to any organ via both gaseous and liquid effluents is  $6.72\text{E-}01$  mrem (child/bone). The maximum dose to the whole body via both gaseous and liquid effluents is  $2.62\text{E-}01$  mrem (child).

#### Dose Limits to Members of the Public

Byron Station did not exceed any of the dose limits as shown below based on concurrent or historical meteorological data.

- The RETS limits on dose or dose commitment to a member of the public due to radioactive materials in liquid effluents from each reactor is 1.5 mrem to the whole

body or 5 mrem to any organ during any calendar quarter and 3 mrem to the whole body or 10 mrem to any organ during a calendar year.

- The RETS limits on air dose due to noble gases released in gaseous effluents to a member of the public from each reactor is 5 mrad for gamma radiation or 10 mrad for beta radiation during any calendar quarter and 10 mrad for gamma radiation or 20 mrad for beta radiation during a calendar year.
- The RETS limits on dose to a member of the public due to radioactive iodine & particulate with half-lives greater than eight days in gaseous effluents released from each reactor is 7.5 mrem to any organ during any calendar quarter and 15 mrem to any organ during a calendar year.
- The 10CFR20 limit on Total Effective Dose Equivalent to individual members of the public is 100 mrem.

#### **SITE METEOROLOGY**

Detailed records of the site meteorological measurements taken during each calendar quarter of the year are maintained by the meteorological vendor, retained on site, and are available upon request. The data are presented as cumulative joint frequency distributions of the wind direction for the 250' level and wind speed class by atmospheric stability class determined from the temperature difference between the 250' and 30' levels. Data recovery for all measurements on the meteorological tower was 99.8% during 2011.

# SOLID RADIOACTIVE WASTE FOR BURIAL 1<sup>ST</sup> QUARTER 2011

DATE	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT	DESTINATION	VOLUME (m <sup>3</sup> ) PER SHIPMENT	CURIES* PER SHIPMENT
3/8/11	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE LIMITED QUANTITY OF MATERIAL, 7, UN2910, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX(2), NONE	EXCLUSIVE-USE	Kingston, TN	1.54E+01	9.28E-03
3/10/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (1), NONE	EXCLUSIVE-USE	Oak Ridge, TN	3.06E+01	8.98E-04
3/29/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	6.73E+01	5.11E-02
Quarterly Totals		Number of Shipments:	3	1.13E+02	6.13E-02
* Calculated using measured ratios				CUBIC M	CURIES

# SOLID RADIOACTIVE WASTE FOR BURIAL 2<sup>ND</sup> QUARTER 2011

DATE	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT	DESTINATION	VOLUME (m <sup>3</sup> ) PER SHIPMENT	CURIES* PER SHIPMENT
4/2/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	6.76E+01	4.30E-02
4/4/11	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE LIMITED QUANTITY OF MATERIAL, 7, UN2910, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX(1), NONE	EXCLUSIVE-USE	Oak Ridge, TN	1.26E+01	8.04E-05
4/12/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	6.76E+01	3.38E-02
4/14/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (1), NONE	EXCLUSIVE-USE	Oak Ridge, TN	3.41E+01	2.13E+00
4/21/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	6.80E+01	5.68E-02
5/16/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, CLASS A, GENERAL DESIGN PACKAGE (GDP), CASK(1), NONE	EXCLUSIVE-USE	Clive, UT	4.53E+00	3.84E+00
5/18/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, CLASS A, GENERAL DESIGN PACKAGE (GDP), CASK(1), NONE	EXCLUSIVE-USE	Clive, UT	4.67E+00	3.71E+00
6/14/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	6.63E+01	1.75E-01
6/14/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX (1), NONE	EXCLUSIVE-USE	Oak Ridge, TN	3.47E+01	6.47E-01
Quarterly Totals		Number of Shipments:	9	3.60E+02	1.06E+01
* Calculated using measured ratios				CUBIC M	CURIES

# SOLID RADIOACTIVE WASTE FOR BURIAL 3<sup>RD</sup> QUARTER 2011

DATE	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT	DESTINATION	VOLUME (m <sup>3</sup> ) PER SHIPMENT	CURIES* PER SHIPMENT
7/11/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, CLASS A, GENERAL DESIGN PACKAGE (GDP), CASK(1), NONE	EXCLUSIVE-USE	Clive, UT	4.67E+00	1.25E+01
7/25/11	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE LIMITED QUANTITY OF MATERIAL, 7, UN2910, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX(7), NONE	EXCLUSIVE-USE	Kingston, TN	1.98E+01	1.43E+02
8/22/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, CLASS A, GENERAL DESIGN PACKAGE (GDP), CASK(1), NONE	EXCLUSIVE-USE	Clive, UT	4.53E+00	6.00E+00
8/24/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, CLASS A, GENERAL DESIGN PACKAGE (GDP), CASK(1), NONE	EXCLUSIVE-USE	Clive, UT	4.53E+00	4.61E+01
Quarterly Totals		Number of Shipments:	4	3.35E+01	6.46E+01
* Calculated using measured ratios				CUBIC M	CURIES

# SOLID RADIOACTIVE WASTE FOR BURIAL 4<sup>TH</sup> QUARTER 2011

DATE	DISPOSITION OF MATERIAL (DESCRIPTION, CLASS, TYPE AND SOLIDIFYING AGENT)	MODE OF TRANSPORT	DESTINATION	VOLUME(m <sup>3</sup> ) PER SHIPMENT	CURIES* PER SHIPMENT
10/6/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX(2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	4.11E+01	4.83E-02
10/6/11	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), 7, UN3321, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX(2), NONE	EXCLUSIVE-USE	Oak Ridge, TN	7.16E+01	1.44E-02
11/30/11	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE LIMITED QUANTITY OF MATERIAL, 7, UN2910, FISSILE EXCEPTED, CLASS A, GENERAL DESIGN PACKAGE (GDP), 20' METAL BOX(2), NONE	EXCLUSIVE-USE	Kingston, TN	2.68E+01	1.31E-02
Quarterly Totals		Number of Shipments:	3	1.40E+02	7.58E-02
* Calculated using measured ratios				CUBIC M	CURIES



**SOLID RADIOACTIVE WASTE FOR BURIAL**  
**Estimated Solid Waste Composition**  
**2011**

Resins, Filters, Evap Bottoms			
2011			
Volume (m3)		2.09E+01	
Class		A	
Nuclide	% Abund	Curies	uCi/mi
H-3	10.740	6.70E+00	3.21E-01
Cr-51	0.002	1.15E-03	5.50E-05
Mn-54	0.016	3.94E-01	1.94E-02
Fe-55	1.149	7.17E-01	3.43E-02
Fe-59	0.001	5.90E-04	2.82E-05
Co-57	0.308	1.91E-01	9.14E-03
Co-58	75.341	4.70E+01	2.25E+00
Co-60	2.020	1.26E+00	6.03E-02
Ni-69	0.084	4.01E-02	1.92E-03
Ni-63	8.929	5.57E-00	2.67E-01
Sr-90	0.002	1.34E-03	6.41E-05
Zr-95	0.000	2.41E-04	1.15E-05
Nb-95	0.045	2.80E-02	1.34E-03
Cs-134	0.019	1.20E-02	5.74E-04
Cs-137	0.131	8.18E-02	3.91E-03
Ce-144	0.635	3.99E-01	1.89E-02

Dry Active Waste			
2011			
Volume (m3)	5.70E+02		
Class	A		
Nuclide	% Abund	Curies	uCi/ml
H-3	0.381	3.97E-03	6.96E-06
Cr-51	0.626	6.58E-03	1.21E-06
Mn-54	1.446	1.59E-02	2.79E-05
Fe-55	53.846	5.92E-01	1.04E-03
Fe-59	0.178	1.98E-03	3.44E-06
Co-57	0.195	2.14E-03	3.75E-06
Co-58	24.103	2.65E-01	4.65E-04
Co-60	10.369	1.14E-01	2.00E-04
Ni-63	6.612	7.27E-02	1.26E-04
Zn-65	0.108	1.16E-03	2.04E-06
Zr-95	0.556	6.11E-03	1.07E-05
Nb-95	0.857	9.42E-03	1.65E-05
Sn-113	0.020	2.15E-04	3.77E-07
Sb-125	0.476	5.23E-03	9.18E-06
Te-123m	0.004	4.73E-05	8.30E-08
Cs-137	0.156	1.71E-03	3.00E-06
Cs-144	0.076	8.36E-04	1.47E-06
Pu-238	0.000	1.21E-06	2.12E-09
Pu-241	0.014	1.54E-04	2.70E-07

Other Waste			
2011 - Combined Packages, Oil, Sea Lands			
Volume (m3)	5.59E+01		
Class	A		
	% Abund	Curies	uCi/ml
H-3	27.439	3.25E+00	5.81E-02
C-14	0.328	3.90E-02	6.98E-04
Cr-51	0.809	7.21E-02	1.29E-03
Mn-54	0.724	8.57E-02	1.53E-03
Fe-55	7.483	8.84E-01	1.58E-02
Fe-59	0.084	9.68E-03	1.78E-04
Co-57	0.288	3.41E-02	6.10E-04
Co-58	33.602	3.98E+00	7.12E-02
Co-60	8.478	7.67E-01	1.37E-02
Ni-59	0.168	1.97E-02	3.52E-04
Ni-63	20.769	2.46E+00	4.40E-02
Zn-65	0.030	3.53E-03	6.31E-05
Sr-90	0.003	3.62E-04	6.30E-06
Zr-95	0.088	1.04E-02	1.88E-04
Nb-95	0.203	2.40E-02	4.29E-04
Tc-99	0.048	5.67E-03	1.01E-04
Ru-106	0.023	2.69E-03	4.81E-05
Ag-110m	0.008	9.10E-04	1.63E-05
Sn-113	0.018	1.79E-03	3.20E-05
Sb-124	0.047	5.56E-03	9.93E-05
Sb-125	1.288	1.80E-01	2.68E-03
Te-123m	0.008	9.88E-04	1.77E-05
Te-125m	0.036	4.32E-03	7.73E-05
Te-132	0.000	2.35E-12	4.20E-14
I-129	0.000	1.40E-06	2.50E-08
Xe-133	0.000	2.26E-07	4.04E-09
Ce-134	0.001	6.68E-05	1.19E-06
Ce-137	0.088	1.04E-02	1.88E-04
Ce-144	0.177	2.10E-02	3.78E-04
Pu-238	0.000	2.02E-05	3.61E-07
Pu-239	0.000	6.53E-06	1.17E-07
Pu-241	0.011	1.34E-03	2.40E-05
Am-241	0.000	4.52E-06	8.09E-08
Cm-242	0.000	7.57E-06	1.35E-07
Cm-243	0.000	4.21E-06	7.53E-08

[illegible]

## **Process Control Program (PCP) for Radioactive Wastes**

**There were no changes made to RW-AA-100, Process Control Program (PCP) for Radioactive Waste, in 2011.**

## Error Analysis

The following is an estimate of the errors associated with effluent monitoring and analysis. The estimate is calculated using the square root of the sum of the squares methodology.

### 1. Gaseous Effluents

Qme=3.33%  
RM=N/A  
ECe=5%  
Stdcse/Smpicse=5%  
qme=N/A

---

Total error = 7.8%

### 2. Liquid Effluents

Qme=3.33%  
RM=N/A  
ECe=N/A  
Stdcse/Smpicse=5%  
qme=2.22%

---

Total error = 6.4%

### 3. Waste Resin

Qme=10.0%  
RM=N/A  
ECe=5%  
Stdcse/Smpicse=5%  
qme=1.0%

---

Total error = 12.3%

### 4. DAW, Mechanical Filters, and Contaminated Metal

Qme=10.0%  
RM=N/A  
ECe=N/A  
Stdcse/Smpicse=5%  
qme=N/A

---

Instrument calibration error = 10%

Total error = 11.2%

Qme = the process quantity measurement error associated with the release point (e.g. flow, level measurements)

RM = error associated with the radiation monitor used in quantifying releases through the release point

ECe = error associated with the collection efficiency of the sample media

Stdcse = one-sigma counting error associated with the counting instrument of interest

Smpicse = one-sigma counting error associated with a sample of a given geometry that is used for the release point of interest

qme = sample quantity measurement error associated with the sample of interest

### Miscellaneous Information

- A. As required by Technical Specification 5.6.2, meteorological and environmental impact information is reported in the 2011 Annual Radiological Environmental Operating Report (AREOR) or is retained on file to be provided upon request.
- B. No limits were exceeded in liquid hold up tanks as stated in Technical Specification 5.5.12 or in waste gas decay tanks as stated in Technical Specification 5.5.12 during the 2011 reporting period.
- C. There were no irradiated fuel shipments during the 2011 reporting period. Independent Spent Fuel Storage Installation (ISFSI) campaign began in 2010 when used fuel was removed from the Spent Fuel Pool (SFP), placed into six (6) casks, each containing 32 fuel bundles, and transferred to an outdoor storage pad. No additional casks were placed on the pad in 2011. In 2010, additional dosimeters were placed at the site boundary nearest to the storage pad (in between the pad and the nearest resident) in order to measure any potential off site dose from the storage pad. Data from the dosimeters, when compared to the existing environmental dosimeters, showed no statistical difference. As a result, there is currently no off site dose contribution from the ISFSI facility.
- D. There were no REMP sample results that exceeded any technical specification limits or analytical results investigation levels during the 2011 reporting period. REMP composite surface water samples from point BY-12, Rock River downstream of the plant liquid effluent discharge, detected tritium results of 225 pCi/L (2<sup>nd</sup> Quarter), 584 pCi/L (3<sup>rd</sup> Quarter), and 352 pCi/L (4<sup>th</sup> Quarter), against a lower detection limit of 200 pCi/L. These positive sample results can be attributed to one or more weekly samples being obtained shortly after a permitted liquid discharge, and are not unexpected. The results are well below the TRM reportable limit of 30,000 pCi/L. There are no communities using the Rock River for drinking water within 10 km downstream of the station.
- E. There were no elevated releases during the 2011 reporting period. All gaseous releases were via vent stacks and are considered mixed mode releases.
- F. There was one liquid effluent radiation release monitor that exceeded its inoperability time limit as stated in TRM TLCO 3.11.a. The ORE-PR001, Radwaste Release Tank Monitor, was declared inoperable on 12/28/10 and returned to service on 2/23/11. The reason the ORE-PR001 monitor was extended beyond the 14 day reporting requirement was due to an obsolete part on the monitor. Flow indicating switch, 0FIS-PR173, failed and Byron did not have a replacement. Radio frequency interference (RFI) considerations increased the duration of the search for a new part. Additional time was required because a modification was needed, as a like-for-like part was not available. Shortly after the modification was completed the work package was created and the Instrument Maintenance Department installed a new switch that has been functioning properly since the installation.
- G. Each week, particulate sample filters are obtained from vent stack effluent rad monitors, isotopically analyzed in accordance with the ODCM and TRM 3.11, and saved. Each quarter, the saved filters are composited and sent to an off-site vendor laboratory for hard-to-detect analyses (gross alpha, Sr-89, Sr-90) in accordance with TRM 3.11. When preparing the filter composites for 2011 Second Quarter, vent stack effluent filters (1/2RE-PR028, 1/2RE-PR029) for the week of 3/27/11 - 4/3/11 were obtained and analyzed for gamma activity, but the filters could not be located in preparation for shipment to the off-site vendor. As a result, the 2011 Second Quarter U1/U2 Vent Stack particulate filter composites did not include filters from 3/27/11 - 4/3/11. These filters contained no detectable gamma activity and as typical, vendor lab results indicated there was no

detectable gross alpha, Sr-89, Sr-90 activity for this set of composite filters. Corrective actions were put in place to help prevent recurrence.

- H. In August of 2010, liquid process radiation monitors were found with non-conservative high and alert setpoints. Methodology for the calculations performed in 1997 were found to be in error as they did not correctly account for the individual isotopic release criteria set forth in 10 CFR 20 Appendix B, Table 2, Column 2. The error affected the following liquid rad monitors:

0RE-PR001, Liquid Radwaste Effluent  
0RE-PR005, Turbine Building Fire and Oil Sump  
0RE-PR009, U-0 Component Cooling Heat Exchanger Water Outlet  
0RE-PR010, Station Blowdown  
0RE-PR041, Condensate Polisher High and Low Sumps  
1RE-PR002, RCFC 1A & 1C Essential Service Water Outlet  
1RE-PR003, RCFC 1B & 1D Essential Service Water Outlet  
1RE-PR009, U-1 Component Cooling Heat Exchanger Water Outlet  
2RE-PR002, RCFC 2A & 2C Essential Service Water Outlet  
2RE-PR003, RCFC 2B & 2D Essential Service Water Outlet  
2RE-PR009, U-2 Component Cooling Heat Exchanger Water Outlet

In 2011, an extent of condition review was performed on gaseous effluent rad monitors, where the following monitors were found to have non-conservative alarm setpoints:

1RE-PR001, U1 Containment Purge effluent particulate channel  
2RE-PR001, U2 Containment Purge effluent particulate channel  
1RE-PR028, U1 Auxiliary Building Vent Effluent noble gas channel  
2RE-PR028, U2 Auxiliary Building Vent Effluent noble gas channel

The setpoints for 1/2RE-PR001 particulate channels were non-conservative based on assumptions regarding detector response and the setpoints for 1/2RE-PR028 noble gas channels were non-conservative based on a difference in the percentage of the maximum permissible release rate as described in the ODCM.

Although the setpoint calculation discrepancies were in the non-conservative direction, there was no impact to 10CFR20 compliance for liquid releases or 10CFR50 Appendix I compliance for gaseous releases. Permits generated subsequent to each release based on analyzed effluent stream activity verify that no release concentration or off-site dose limits are exceeded.

Engineering changes were initiated, and the liquid effluent setpoints were revised in December 2010. The gaseous effluent setpoints were revised in December 2011.

- I. There were no unplanned or abnormal releases of radioactivity from the site to unrestricted areas during the 2011 reporting period.
- J. On March 11, 2011, an earthquake off the east coast of Japan triggered a massive tsunami that ultimately caused nuclear accidents to four of the six Fukushima Daiichi reactors. The radioactive plume reached the United States, where low levels of radioactivity were measured at nearly all nuclear reactor sites. Low levels of Iodine-131, Iodine-132, and Iodine-133 were measured on U1 and U2 vent stack effluent samples obtained between March 14 and April 17, 2011. One of the release paths through the plant vent stacks is from the auxiliary building, which draws outside air as a makeup source. While iodine is not usually present in vent stack samples under normal conditions, it is not uncommon for small amounts to be released through the plant vent stacks during outages as a result of primary

system draining activities. Byron Unit 1 happened to be in an outage during the same time the post-Fukushima iodine measurements were observed at Byron and at other nuclear sites. These measurements were observed on samples taken between 3/14/11 and 4/17/11. Although it is believed the vent stack iodine measurements obtained during this time were due to the Fukushima accident, all vent stack iodine measurements were conservatively included in the Byron 2011 effluent program and resultant dose calculations. The low levels of iodine measured in these samples did not result in a significant increase to calculated off-site dose for 2011.

- K. There was one revision made to the Off Site Dose Calculation Manual (ODCM) in 2011. ODCM Rev 7 was issued on 2/10/11. The revision incorporated NRC requirements to include Carbon-14 (C-14) in nuclear plant gaseous effluents, changed several outer ring TLD locations, reflected newly-measured GPS sample locations, changed milk and groundwater sample locations, and included other administrative changes and corrections.
- L. Attached are offsite dose calculation reports for January through December of 2011.

The following are the maximum annual calculated cumulative offsite doses resulting from Byron airborne releases in 2011 based on concurrent meteorological data:

**Unit 1:**

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air <sup>(1)</sup>	$3.610 \times 10^{-6}$ mrad	North-Northwest
beta air <sup>(2)</sup>	$3.690 \times 10^{-6}$ mrad	North-Northwest
whole body <sup>(3)</sup>	$6.222 \times 10^{-2}$ mrem	North-Northwest
skin <sup>(4)</sup>	$4.440 \times 10^{-6}$ mrem	North-Northwest
organ <sup>(5)</sup> (child-bone)	$3.065 \times 10^{-1}$ mrem	North-Northwest

**Unit 1 Compliance Status**

10 CFR 50 Appendix I	Yearly Objective		% of Appendix I
gamma air	10.0	mrad	0.00
beta air	20.0	mrad	0.00
whole body	5.0	mrem	1.24
skin	15.0	mrem	0.00
organ	15.0	mrem	2.04

**Unit 2:**

<u>Dose</u>	<u>Maximum Value</u>	<u>Sector Affected</u>
gamma air <sup>(1)</sup>	$5.070 \times 10^{-6}$ mrad	North-Northwest
beta air <sup>(2)</sup>	$1.230 \times 10^{-6}$ mrad	North-Northwest
whole body <sup>(3)</sup>	$6.351 \times 10^{-2}$ mrem	North-Northwest
skin <sup>(4)</sup>	$7.820 \times 10^{-6}$ mrem	North-Northwest
organ <sup>(5)</sup> (child-bone)	$3.043 \times 10^{-1}$ mrem	North-Northwest

**Unit 2 Compliance Status**

10 CFR 50 Appendix I	Yearly Objective		% of Appendix I
gamma air	10.0	mrad	0.00
beta air	20.0	mrad	0.00
whole body	5.0	mrem	1.27
skin	15.0	mrem	0.00
organ	15.0	mrem	2.03

- 
- <sup>(1)</sup> Gamma Air Dose - GASPAR II, NUREG-0597  
<sup>(2)</sup> Beta Air Dose - GASPAR II, NUREG-0597  
<sup>(3)</sup> Whole Body Dose - GASPAR II, NUREG-0597  
<sup>(4)</sup> Skin Dose - GASPAR II, NUREG-0597  
<sup>(5)</sup> Inhalation and Food Pathways Dose - GASPAR II, NUREG-0597

Data recovery: 99.8%

**Attachment A, 2011 Radioactive Effluent Release Report  
2011 Lower Limits of Detection (LLD's)**

<b>Nuclide</b>	<b>Gaseous LLD (uCi/cc)</b>	<b>Nuclide</b>	<b>Liquid LLD (uCi/ml)</b>
H3	4.72E-08	H3	1.89E-06
Ar41	3.58E-07	Na24	3.27E-08
Cr51	3.00E-12	Cr51	2.01E-07
Mn54	3.72E-13	Mn54	3.88E-08
Co58	3.63E-13	Fe55	8.85E-07
Fe59	1.35E-12	Co57	2.20E-08
Co60	1.23E-12	Co58	3.18E-08
Zn65	1.45E-12	Fe59	1.11E-07
Br82	6.08E-13	Co60	5.67E-08
Kr85m	1.72E-07	Zn65	5.30E-08
Kr87	3.71E-07	Sr85	3.36E-08
Kr88	5.16E-07	Sr89	3.98E-08
Sr89	1.78E-13	Sr-90	3.01E-08
Sr-90	4.59E-14	Sr92	4.08E-08
Mo99	2.56E-13	Nb95	3.14E-08
I131	7.18E-13	Zr95	5.19E-08
Xe131m	5.79E-06	Mo99	1.82E-08
I133	5.94E-13	Ag110m	3.87E-08
Xe133	2.50E-07	Sb122	5.02E-08
Xe133m	1.17E-06	Te123m	2.01E-08
Cs134	6.08E-13	Sb124	3.07E-08
I135	3.92E-12	Sb125	5.64E-08
Xe135	1.08E-07	Te125m	5.61E-06
Cs137	5.88E-13	Sb128	2.70E-08
Xe138	6.46E-07	I131	3.05E-08
Ba140	1.70E-12	I132	3.58E-08
La140	2.76E-13	Te132	2.08E-08
Ce141	3.89E-13	I133	2.68E-08
Ce144	1.58E-12	Xe133	4.53E-08
Gross Alpha	5.03E-14	Cs134	4.17E-08
		Xe135	2.30E-08
		Cs137	3.80E-08
		Ba140	9.55E-08
		La140	1.45E-08
		Ce141	3.91E-08
		Ce144	1.50E-07
		Gross Alpha	2.67E-07
		Gross Beta	2.31E-07



EFFLUENT AND WASTE DISPOSAL REPORT  
SUPPLEMENTAL INFORMATION  
GASEOUS EFFLUENTS - BATCH MODE  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		58	67	44	45	214
Total release time	minutes	1.41E+04	2.09E+04	2.79E+03	4.51E+03	4.23E+04
Maximum release time	minutes	4.08E+03	3.79E+03	1.82E+02	8.83E+02	4.08E+03
Average release time	minutes	2.43E+02	3.12E+02	6.33E+01	1.00E+02	1.98E+02
Minimum release time	minutes	2.30E+01	3.20E+01	1.60E+01	3.40E+01	1.60E+01

Note: Waste Gas Decay Tank releases are included with Unit 1 data

EFFLUENT AND WASTE DISPOSAL REPORT  
SUPPLEMENTAL INFORMATION  
GASEOUS EFFLUENTS - BATCH MODE  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		37	33	42	35	147
Total release time	minutes	2.53E+03	2.65E+03	5.51E+03	4.23E+03	1.49E+04
Maximum release time	minutes	1.15E+02	1.55E+02	2.25E+03	2.18E+03	2.25E+03
Average release time	minutes	6.82E+01	8.03E+01	1.31E+02	1.21E+02	1.01E+02
Minimum release time	minutes	1.80E+01	3.30E+01	8.00E+00	1.70E+01	8.00E+00

EFFLUENT AND WASTE DISPOSAL REPORT  
SUPPLEMENTAL INFORMATION  
LIQUID EFFLUENTS - BATCH MODE  
Unit 1 & Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		28	31	32	14	105
Total release time	minutes	6.54E+03	4.14E+03	3.45E+03	9.61E+02	1.51E+04
Maximum release time	minutes	6.73E+02	4.50E+02	2.23E+02	2.02E+02	6.73E+02
Average release time	minutes	2.33E+02	1.34E+02	1.08E+02	6.86E+01	1.44E+02
Minimum release time	minutes	6.10E+01	4.60E+01	5.60E+01	4.70E+01	4.60E+01
Avg. dil. water flow	gpm	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Note: Liquid releases are divided evenly between units

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 1A  
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
<b>Fission and Activation Gases</b>						
1. Total Release	Ci	1.10E-01	1.20E-01	4.05E-02	8.20E-03	2.80E-01
2. Avg. Release Rate	uCi/sec	1.41E-02	1.53E-02	5.10E-03	1.03E-03	8.88E-03
<b>Iodine-131</b>						
1. Total Release	Ci	1.75E-05	1.60E-06	(1)	(1)	1.91E-05
2. Avg. Release Rate	uCi/sec	2.25E-06	2.04E-07	(1)	(1)	6.05E-07
<b>Particulates Half Life &gt;= 8 days</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)
<b>Others</b>						
1. Total Release	Ci	9.55E-01	7.99E-01	1.18E+00	1.20E+00	4.13E+00
2. Avg. Release Rate	uCi/sec	1.23E-01	1.02E-01	1.48E-01	1.51E-01	1.31E-01
<b>Tritium</b>						
1. Total Release	Ci	3.95E+00	3.01E+00	3.14E+00	5.31E+00	1.54E+01
2. Avg. Release Rate	uCi/sec	5.07E-01	3.82E-01	3.95E-01	6.68E-01	4.89E-01
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 1C  
GASEOUS EFFLUENTS - MIXED MODE - CONTINUOUS RELEASES  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
<b>Fission and Activation Gases</b>						
XE-133	Ci	6.41E-02	8.42E-02	2.93E-02	(1)	1.78E-01
XE-135	Ci	6.32E-06	(1)	(1)	(1)	6.32E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	6.41E-02	8.42E-02	2.93E-02	(1)	1.78E-01
<b>Iodines</b>						
I-131	Ci	1.75E-05	1.60E-06	(1)	(1)	1.91E-05
I-132	Ci	3.48E-04	(1)	(1)	(1)	3.48E-04
		-----	-----	-----	-----	-----
Totals for Period...	Ci	3.66E-04	1.60E-06	(1)	(1)	3.67E-04
<b>Particulates Half Life &gt;= 8 days</b>						
No Nuclide Activities		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<b>Others</b>						
C-14	Ci	9.55E-01	7.99E-01	1.18E+00	1.20E+00	4.13E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	9.55E-01	7.99E-01	1.18E+00	1.20E+00	4.13E+00
<b>Tritium</b>						
H-3	Ci	3.76E+00	2.80E+00	3.02E+00	4.04E+00	1.36E+01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	3.76E+00	2.80E+00	3.02E+00	4.04E+00	1.36E+01
<b>Gross Alpha Radioactivity</b>						
No Nuclide Activities		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 1C  
GASEOUS EFFLUENTS - MIXED MODE - BATCH RELEASES  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<hr/>						
<b>Fission and Activation Gases</b>						
AR-41	Ci	1.21E-02	2.78E-03	7.65E-03	5.99E-03	2.85E-02
KR-85M	Ci	(1)	1.25E-04	(1)	(1)	1.25E-04
KR-87	Ci	(1)	6.89E-06	(1)	(1)	6.89E-06
KR-88	Ci	(1)	8.40E-05	(1)	(1)	8.40E-05
XE-131M	Ci	4.91E-05	(1)	(1)	(1)	4.91E-05
XE-133	Ci	3.14E-02	2.90E-02	3.32E-03	2.21E-03	6.60E-02
XE-133M	Ci	4.98E-04	5.52E-04	8.11E-05	(1)	1.13E-03
XE-135	Ci	1.91E-03	3.58E-03	1.93E-04	(1)	5.68E-03
<hr/>						
Totals for Period...	Ci	4.60E-02	3.61E-02	1.12E-02	8.20E-03	1.02E-01
<hr/>						
<b>Iodines</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
<b>Particulates Half Life &gt;= 8 days</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
<b>Others</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
<b>Tritium</b>						
H-3	Ci	1.87E-01	2.05E-01	1.26E-01	1.27E+00	1.79E+00
<hr/>						
Totals for Period...	Ci	1.87E-01	2.05E-01	1.26E-01	1.27E+00	1.79E+00
<hr/>						
<b>Gross Alpha Radioactivity</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

Note: Waste Gas Decay Tank curies are split evenly between Unit 1 & Unit 2

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 1A  
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
<b>Fission and Activation Gases</b>						
1. Total Release	Ci	9.49E-01	1.28E-01	4.48E-02	1.48E-03	1.12E+00
2. Avg. Release Rate	uCi/sec	1.22E-01	1.63E-02	5.64E-03	1.86E-04	3.55E-02
<b>Iodine-131</b>						
1. Total Release	Ci	2.42E-05	3.14E-05	(1)	(1)	5.56E-05
2. Avg. Release Rate	uCi/sec	3.11E-06	4.00E-06	(1)	(1)	1.76E-06
<b>Particulates Half Life &gt;= 8 days</b>						
1. Total Release	Ci	(1)	1.04E-06	3.35E-07	(1)	1.37E-06
2. Avg. Release Rate	uCi/sec	(1)	1.32E-07	4.22E-08	(1)	4.35E-08
<b>Others</b>						
1. Total Release	Ci	1.13E+00	1.02E+00	8.80E-01	1.08E+00	4.10E+00
2. Avg. Release Rate	uCi/sec	1.45E-01	1.30E-01	1.11E-01	1.35E-01	1.30E-01
<b>Tritium</b>						
1. Total Release	Ci	1.56E+01	1.02E+01	1.10E+01	7.26E+00	4.41E+01
2. Avg. Release Rate	uCi/sec	2.00E+00	1.30E+00	1.38E+00	9.13E-01	1.40E+00
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Release Rate	uCi/sec	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 1C  
GASEOUS EFFLUENTS - MIXED MODE - CONTINUOUS RELEASES  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
XE-133	Ci	8.98E-01	8.42E-02	2.93E-02	(1)	1.01E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	8.98E-01	8.42E-02	2.93E-02	(1)	1.01E+00
Iodines						
I-131	Ci	2.42E-05	3.14E-05	(1)	(1)	5.56E-05
I-132	Ci	6.07E-04	(1)	(1)	(1)	6.07E-04
I-133	Ci	1.69E-05	(1)	(1)	(1)	1.69E-05
		-----	-----	-----	-----	-----
Totals for Period...	Ci	6.48E-04	3.14E-05	(1)	(1)	6.80E-04
Particulates Half Life >= 8 days						
CO-58	Ci	(1)	1.04E-06	3.35E-07	(1)	1.37E-06
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	1.04E-06	3.35E-07	(1)	1.37E-06
Others						
BR-82	Ci	6.08E-06	(1)	(1)	(1)	6.08E-06
C-14	Ci	1.13E+00	1.02E+00	8.80E-01	1.08E+00	4.10E+00
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.13E+00	1.02E+00	8.80E-01	1.08E+00	4.10E+00
Tritium						
H-3	Ci	1.54E+01	1.01E+01	1.09E+01	7.19E+00	4.35E+01
		-----	-----	-----	-----	-----
Totals for Period...	Ci	1.54E+01	1.01E+01	1.09E+01	7.19E+00	4.35E+01
Gross Alpha Radioactivity						
No Nuclide Activities		(1)	(1)	(1)	(1)	(1)
		-----	-----	-----	-----	-----
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 1C  
GASEOUS EFFLUENTS - MIXED MODE - BATCH RELEASES  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<hr/>						
<b>Fission and Activation Gases</b>						
AR-41	Ci	4.11E-03	3.93E-03	1.73E-03	9.99E-04	1.08E-02
KR-85M	Ci	(1)	1.26E-04	(1)	(1)	1.26E-04
KR-87	Ci	(1)	6.91E-06	(1)	(1)	6.91E-06
KR-88	Ci	(1)	8.40E-05	(1)	(1)	8.40E-05
XE-131M	Ci	1.07E-02	(1)	(1)	(1)	1.07E-02
XE-133	Ci	3.35E-02	3.49E-02	1.35E-02	4.77E-04	8.24E-02
XE-133M	Ci	4.98E-04	5.48E-04	8.09E-05	(1)	1.13E-03
XE-135	Ci	2.09E-03	3.80E-03	1.94E-04	(1)	6.08E-03
<hr/>						
Totals for Period...	Ci	5.09E-02	4.34E-02	1.55E-02	1.48E-03	1.11E-01
<hr/>						
<b>Iodines</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
<b>Particulates Half Life &gt;= 8 days</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
<b>Others</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
<b>Tritium</b>						
H-3	Ci	1.89E-01	1.52E-01	1.39E-01	6.83E-02	5.48E-01
<hr/>						
Totals for Period...	Ci	1.89E-01	1.52E-01	1.39E-01	6.83E-02	5.48E-01
<hr/>						
<b>Gross Alpha Radioactivity</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

Note: Waste Gas Decay Tank curies are split evenly between Unit 1 & Unit 2

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2A  
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
<b>Fission and Activation Products</b>						
1. Total Release	Ci	3.63E-03	3.69E-03	3.83E-03	1.49E-03	1.26E-02
2. Avg. Diluted Conc.	uCi/ml	1.23E-09	1.09E-09	1.03E-09	4.63E-10	9.53E-10
<b>Tritium</b>						
1. Total Release	Ci	6.29E+02	3.30E+02	2.75E+02	5.70E+01	1.29E+03
2. Avg. Diluted Conc.	uCi/ml	2.13E-04	9.78E-05	7.38E-05	1.77E-05	9.73E-05
<b>Dissolved and Entrained Gases</b>						
1. Total Release	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
2. Avg. Diluted Conc.	uCi/ml	1.45E-10	7.92E-12	4.33E-11	(1)	4.64E-11
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
<b>Volume of liquid waste liters</b>						
		2.95E+09	3.38E+09	3.72E+09	3.22E+09	1.33E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11



EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2A - Release Tank  
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
<b>Fission and Activation Products</b>						
1. Total Release	Ci	3.63E-03	3.69E-03	3.83E-03	1.49E-03	1.26E-02
2. Avg. Diluted Conc.	uCi/ml	3.14E-06	2.81E-06	2.80E-06	2.58E-06	2.86E-06
<b>Tritium</b>						
1. Total Release	Ci	5.47E+02	3.15E+02	2.35E+02	5.29E+01	1.15E+03
2. Avg. Diluted Conc.	uCi/ml	4.73E-01	2.40E-01	1.72E-01	9.16E-02	2.61E-01
<b>Dissolved and Entrained Gases</b>						
1. Total Release	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
2. Avg. Diluted Conc.	uCi/ml	3.70E-07	2.04E-08	1.18E-07	(1)	1.39E-07
<b>Gross Alpha Radioactivity</b>						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
 <b>Volume of liquid waste liters</b>						
		1.16E+06	1.31E+06	1.37E+06	5.78E+05	4.41E+06

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2A - Circulating Water Blowdown  
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<hr/>						
Fission and Activation Products						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Tritium						
1. Total Release	Ci	8.12E+01	1.52E+01	4.01E+01	4.11E+00	1.41E+02
2. Avg. Diluted Conc.	uCi/ml	2.76E-05	4.51E-06	1.08E-05	1.28E-06	1.06E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters						
		2.95E+09	3.38E+09	3.72E+09	3.22E+09	1.33E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2B  
LIQUID EFFLUENTS - CONTINUOUS MODE  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<hr/>						
Fission and Activation Products						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Tritium						
H-3	Ci	8.12E+01	1.52E+01	4.01E+01	4.11E+00	1.41E+02
<hr/>						
Totals for Period...	Ci	8.12E+01	1.52E+01	4.01E+01	4.11E+00	1.41E+02
<hr/>						
Dissolved and Entrained Gases						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)
<hr/>						
Gross Alpha Radioactivity						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
<hr/>						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2B  
LIQUID EFFLUENTS - BATCH MODE  
Unit 1

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
<b>Fission and Activation Products</b>						
CO-57	Ci	4.57E-06	1.23E-06	4.41E-06	4.35E-06	1.46E-05
CO-58	Ci	1.81E-03	2.72E-03	3.39E-03	1.15E-03	9.07E-03
CO-60	Ci	6.21E-04	5.69E-04	3.20E-04	1.06E-04	1.62E-03
CR-51	Ci	(1)	2.11E-04	(1)	1.37E-04	3.48E-04
CS-137	Ci	(1)	1.28E-06	(1)	(1)	1.28E-06
FE-55	Ci	1.10E-03	(1)	(1)	(1)	1.10E-03
FE-59	Ci	1.02E-05	4.30E-05	1.76E-05	5.18E-05	1.23E-04
I-132	Ci	(1)	4.49E-06	(1)	(1)	4.49E-06
MN-54	Ci	3.22E-05	1.44E-05	1.40E-05	2.48E-05	8.55E-05
NB-95	Ci	3.46E-06	1.17E-05	2.36E-05	7.31E-06	4.61E-05
SB-125	Ci	4.78E-05	7.50E-05	5.76E-05	1.14E-05	1.92E-04
SB-126	Ci	1.42E-06	(1)	(1)	(1)	1.42E-06
SN-113	Ci	(1)	2.21E-05	(1)	(1)	2.21E-05
TE-123M	Ci	(1)	1.44E-05	(1)	(1)	1.44E-05
ZR-95	Ci	(1)	7.18E-06	5.48E-06	(1)	1.27E-05
-----						
Totals for Period...	Ci	3.63E-03	3.69E-03	3.83E-03	1.49E-03	1.26E-02
-----						
<b>Tritium</b>						
H-3	Ci	5.47E+02	3.15E+02	2.35E+02	5.29E+01	1.15E+03
-----						
Totals for Period...	Ci	5.47E+02	3.15E+02	2.35E+02	5.29E+01	1.15E+03
-----						
<b>Dissolved and Entrained Gases</b>						
XE-133	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
-----						
Totals for Period...	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
-----						
<b>Gross Alpha Radioactivity</b>						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
-----						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2A  
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----						
Fission and Activation Products						
1. Total Release	Ci	3.63E-03	3.69E-03	3.83E-03	1.49E-03	1.26E-02
2. Avg. Diluted Conc.	uCi/ml	1.23E-09	1.09E-09	1.03E-09	4.63E-10	9.53E-10
Tritium						
1. Total Release	Ci	6.29E+02	3.30E+02	2.75E+02	5.70E+01	1.29E+03
2. Avg. Diluted Conc.	uCi/ml	2.13E-04	9.78E-05	7.38E-05	1.77E-05	9.73E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
2. Avg. Diluted Conc.	uCi/ml	1.45E-10	7.92E-12	4.33E-11	(1)	4.64E-11
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		2.95E+09	3.38E+09	3.72E+09	3.22E+09	1.33E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2A - Release Tank  
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Products						
1. Total Release	Ci	3.63E-03	3.69E-03	3.83E-03	1.49E-03	1.26E-02
2. Avg. Diluted Conc.	uCi/ml	3.14E-06	2.81E-06	2.80E-06	2.58E-06	2.86E-06
Tritium						
1. Total Release	Ci	5.47E+02	3.15E+02	2.35E+02	5.29E+01	1.15E+03
2. Avg. Diluted Conc.	uCi/ml	4.73E-01	2.40E-01	1.72E-01	9.16E-02	2.61E-01
Dissolved and Entrained Gases						
1. Total Release	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
2. Avg. Diluted Conc.	uCi/ml	3.70E-07	2.04E-08	1.18E-07	(1)	1.39E-07
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste	liters	1.16E+06	1.31E+06	1.37E+06	5.78E+05	4.41E+06

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2A - Circulating Water Blowdown  
LIQUID EFFLUENTS - SUMMATION BY RELEASE POINT  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<hr/>						
Fission and Activation Products						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Tritium						
1. Total Release	Ci	8.12E+01	1.52E+01	4.01E+01	4.11E+00	1.41E+02
2. Avg. Diluted Conc.	uCi/ml	2.76E-05	4.51E-06	1.08E-05	1.28E-06	1.06E-05
Dissolved and Entrained Gases						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Gross Alpha Radioactivity						
1. Total Release	Ci	(1)	(1)	(1)	(1)	(1)
2. Avg. Diluted Conc.	uCi/ml	(1)	(1)	(1)	(1)	(1)
Volume of liquid waste liters		2.95E+09	3.38E+09	3.72E+09	3.22E+09	1.33E+10

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2B  
LIQUID EFFLUENTS - CONTINUOUS MODE  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Products						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period... Ci		(1)	(1)	(1)	(1)	(1)
 Tritium						
H-3	Ci	8.12E+01	1.52E+01	4.01E+01	4.11E+00	1.41E+02
-----	-----	-----	-----	-----	-----	-----
Totals for Period... Ci		8.12E+01	1.52E+01	4.01E+01	4.11E+00	1.41E+02
 Dissolved and Entrained Gases						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period... Ci		(1)	(1)	(1)	(1)	(1)
 Gross Alpha Radioactivity						
No Nuclide Activities Ci		(1)	(1)	(1)	(1)	(1)
-----	-----	-----	-----	-----	-----	-----
Totals for Period... Ci		(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11



EFFLUENT AND WASTE DISPOSAL REPORT  
TABLE 2B  
LIQUID EFFLUENTS - BATCH MODE  
Unit 2

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----						
Fission and Activation Products						
CO-57	Ci	4.57E-06	1.23E-06	4.41E-06	4.35E-06	1.46E-05
CO-58	Ci	1.81E-03	2.72E-03	3.39E-03	1.15E-03	9.07E-03
CO-60	Ci	6.21E-04	5.69E-04	3.20E-04	1.06E-04	1.62E-03
CR-51	Ci	(1)	2.11E-04	(1)	1.37E-04	3.48E-04
CS-137	Ci	(1)	1.28E-06	(1)	(1)	1.28E-06
FE-55	Ci	1.10E-03	(1)	(1)	(1)	1.10E-03
FE-59	Ci	1.02E-05	4.30E-05	1.76E-05	5.18E-05	1.23E-04
I-132	Ci	(1)	4.49E-06	(1)	(1)	4.49E-06
MN-54	Ci	3.22E-05	1.44E-05	1.40E-05	2.48E-05	8.55E-05
NB-95	Ci	3.46E-06	1.17E-05	2.36E-05	7.31E-06	4.61E-05
SB-125	Ci	4.78E-05	7.50E-05	5.76E-05	1.14E-05	1.92E-04
SB-126	Ci	1.42E-06	(1)	(1)	(1)	1.42E-06
SN-113	Ci	(1)	2.21E-05	(1)	(1)	2.21E-05
TE-123M	Ci	(1)	1.44E-05	(1)	(1)	1.44E-05
ZR-95	Ci	(1)	7.18E-06	5.48E-06	(1)	1.27E-05
-----						
Totals for Period...	Ci	3.63E-03	3.69E-03	3.83E-03	1.49E-03	1.26E-02
-----						
Tritium						
H-3	Ci	5.47E+02	3.15E+02	2.35E+02	5.29E+01	1.15E+03
-----						
Totals for Period...	Ci	5.47E+02	3.15E+02	2.35E+02	5.29E+01	1.15E+03
-----						
Dissolved and Entrained Gases						
XE-133	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
-----						
Totals for Period...	Ci	4.27E-04	2.67E-05	1.61E-04	(1)	6.15E-04
-----						
Gross Alpha Radioactivity						
No Nuclide Activities	Ci	(1)	(1)	(1)	(1)	(1)
-----						
Totals for Period...	Ci	(1)	(1)	(1)	(1)	(1)

(1) Less than minimum detectable activity which meets the lower limit of detection (LLD) requirements of TRM Section 3.11

# 40CFR190 URANIUM FUEL CYCLE DOSE REPORT

## LIQUID DOSE SUMMARY

Unit 1 & 2

Report for: 2011

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 1 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	3.32E-04	4.48E-02	4.43E-02	4.43E-02	4.44E-02	4.99E-02	0.00E+00	4.47E-02
TEEN	3.48E-04	3.37E-02	3.32E-02	3.33E-02	3.34E-02	3.71E-02	0.00E+00	3.36E-02
CHILD	4.57E-04	3.75E-02	3.71E-02	3.71E-02	3.72E-02	3.84E-02	0.00E+00	3.75E-02
INFANT	2.64E-06	1.65E-02	1.65E-02	1.65E-02	1.65E-02	1.65E-02	0.00E+00	1.65E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 1 ===

Quartr - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 1 - Admin. Any Organ	ADULT	GILLI	4.99E-02	3.75E+00	1.33E+00
Qtr 1 - Admin. Total Body	ADULT	TBODY	4.47E-02	1.13E+00	3.97E+00

Qtr 1 - T.Spc. Any Organ ADULT GILLI 4.99E-02 5.00E+00 9.97E-01

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors ( 0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	8.88E+01
MN-54	3.91E-01
FE-55	2.60E-01
FE-59	7.56E-02
CO-58	2.98E+00
CO-60	2.72E+00
NB-95	4.73E+00

Qtr 1 - T.Spc. Total Body ADULT TBODY 4.47E-02 1.50E+00 2.98E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors ( 0% or greater to total)

Nuclide	Percentage
---------	------------

H-3	9.91E+01
MN-54	2.72E-02
FE-55	1.18E-01
FE-59	9.70E-03
CO-58	3.68E-01
CO-60	3.57E-01
NB-95	4.67E-04

# 40CFR190 URANIUM FUEL CYCLE DOSE REPORT

## LIQUID DOSE SUMMARY

Unit 1 & 2

Report for: 2011

Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) === QUARTER 2 ===

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB
ADULT	3.40E-04	3.64E-02	3.57E-02	3.58E-02	3.57E-02	5.21E-02	0.00E+00	3.65E-02
TEEN	3.63E-04	2.75E-02	2.68E-02	2.69E-02	2.68E-02	3.83E-02	0.00E+00	2.75E-02
CHILD	4.55E-04	3.05E-02	2.98E-02	2.99E-02	2.99E-02	3.39E-02	0.00E+00	3.05E-02
INFANT	4.76E-07	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02	0.00E+00	1.32E-02

=== SITE DOSE LIMIT ANALYSIS === QUARTER 2 ===

Quartr - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 2 - Admin. Any Organ	ADULT	GILLI	5.21E-02	3.75E+00	1.39E+00
Qtr 2 - Admin. Total Body	ADULT	TBODY	3.65E-02	1.13E+00	3.25E+00

Qtr 2 - T.Spc. Any Organ ADULT GILLI 5.21E-02 5.00E+00 1.04E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors ( 0% or greater to total)

Nuclide	Percentage
H-3	6.85E+01
CR-51	8.21E-02
MN-54	2.35E-01
FE-59	4.26E-01
CO-58	6.00E+00
CO-60	3.35E+00
ZR-95	2.35E-03
NB-95	2.14E+01
I-132	2.04E-05
CS-137	1.57E-02

Qtr 2 - T.Spc. Total Body ADULT TBODY 3.65E-02 1.50E+00 2.43E+00

Critical Pathway: Fresh Water Fish - Sport (FFSP)

Major Contributors ( 0% or greater to total)

Nuclide	Percentage
H-3	9.76E+01
CR-51	4.66E-04
MN-54	2.09E-02
FE-59	6.98E-02
CO-58	9.46E-01
CO-60	5.61E-01
ZR-95	7.16E-07
NB-95	2.71E-03

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Nuclide	Percentage
I-132	5.42E-05
CS-137	7.57E-01