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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/RENEWED LICENSE NO. DPR-23

2013 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Ladies and Gentlemen:

Attached is the Annual Radioactive Effluent Release Report for the period of January 1, 2013 through December 31, 2013 for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2. This report is submitted in accordance with 10 CFR 50.4 as required by 10 CFR 50.36a(a)(2) and the HBRSEP, Unit No. 2, Technical Specifications Section 5.6.3.

This document contains no new Regulatory Commitments. If you have any questions on this subject, please contact Richard Hightower, Manager – Nuclear Regulatory Affairs at (843) 857-1329.

Sincerely,

W. R. Hightower for

Sharon W. Peavyhouse
Director – Nuclear Organization Effectiveness

SWP/mjp

Attachment

c: V. M. McCree, NRC, Region II
S. P. Lingam, NRC Project Manager, NRR (w/o Attachments)
NRC Resident Inspector

IE48
NRR

DUKE ENERGY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

RENEWED OPERATING LICENSE NO. DPR-23

DOCKET NO. 50-261

RADIOACTIVE AND EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

January 1, 2013 - December 31, 2013

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I. EXECUTIVE SUMMARY

A. Discussion

1. Effluent Controls

The H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, Offsite Dose Calculation Manual specifies controls and dose limits pertaining to releases of radioactivity to the environment. None of these controls or dose limits were exceeded during 2013.

2. Protection Standards

The main objective in the control of radiation is to ensure that any exposure is kept not only within regulatory limits, but As Low As Reasonably Achievable (ALARA). The ALARA concept applies to reducing radiation exposure both to workers at HBRSEP, Unit No. 2, and to the general public. Reasonably achievable means that radiation exposure reduction is based on sound environmental practices, economic decisions, and operating practices. By practicing ALARA, HBRSEP minimizes health risk and environmental detriment, and ensures that exposures are maintained well below regulatory limits.

3. Sources of Radioactivity Released

During normal operations of a nuclear power station, most of the fission products are retained within the fuel and fuel cladding. However, small quantities of radioactive fission and activation products are present in the reactor coolant water. The types of radioactive material released are noble gases, iodines and particulates, and tritium.

The noble gas fission products in the reactor coolant water are released as a gas when the coolant is depressurized. These gases are collected by a system designed for collection and storage for radioactive decay prior to release to the environment.

Small releases of radioactivity in liquids may occur from equipment associated with the reactor coolant system. These liquids are collected and processed for radioactivity removal, prior to and during release.

4. Noble Gas

Some of the fission products released in airborne effluents are radioactive isotopes of noble gases, such as argon and xenon. Noble gases are by nature inert and do not concentrate in humans or other organisms. Noble gases contribute to human radiation exposure as external exposure.

5. Iodines and Particulates

The main contribution of radioactive iodine to human exposure is to the thyroid gland, where the body concentrates iodine. The particulates contribute to internal exposure of tissues such as the muscle, liver, and intestines. These particulates can also be a source of exposure if deposited on the ground.

6. Tritium

Tritium, a radioactive isotope of hydrogen, is a predominate radionuclide in liquid and gaseous effluents. Tritium is produced in the reactor via a number of processes. Tritium is a weak beta particle emitter and contributes very little radiation exposure to the human body, and when tritium is inhaled, ingested, or absorbed it is dispersed throughout the body until eliminated.

7. Processing and Monitoring

Effluents are strictly controlled and monitored to ensure that radioactivity released to the environment is minimal and within regulatory limits. Effluent controls include the operation of radiation monitoring systems, in-plant and environmental sampling and analyses, quality assurance programs for both in-plant and environmental sampling and analyses, and procedures that address effluent and environmental monitoring.

The plant radiation monitoring system provides monitors that are designed to ensure that releases are below regulatory limits. Each instrument provides indication of the amount of radioactivity present and is equipped with alarms and indicators in the control room. The alarm setpoints are set below the regulatory limits, i.e., typically at less than 50 percent of the regulatory limit, to ensure that the limits are not exceeded. If a monitor alarms, batch releases to the environment from a tank is automatically suspended. Additionally, releases are sampled and analyzed in the laboratory prior to discharge to the environment. The sampling and analysis done in the laboratory provides a more sensitive and precise method of determining pre-effluent composition than in-plant monitoring instruments.

The plant has a meteorological tower, which is linked to computers that record the meteorological data. This meteorological data and the results of the Land Use Census are used to verify the ground level dispersion factors contained in the ODCM that are used in calculating the dose to the public.

In addition to in-plant equipment, the company maintains a Radiological Environmental Monitoring Program, which consists of devices used to sample the air and water in the environment. The samples collected from the surrounding environment are analyzed to determine the presence of radioactive material in the environment.

8. Exposure Pathways

Radiological exposure pathways are the methods by which people may become exposed to radioactive material. The major pathways of concern are those which could cause the highest calculated radiation dose. The projected pathways are determined from the type and amount of radioactive material that may have been released, the environmental transport mechanism, and the use of the environment.

Environmental transport mechanisms include, but are not limited to, hydrological (i.e., water) and meteorological (i.e., weather) characteristics of the area. Information on water flow, wind speed and direction, dietary intake of residents, recreational use of the area, and location of homes and farms in the area are some of the many factors used to calculate the potential exposure to offsite personnel.

The release of radioactive gaseous effluents includes pathways such as external whole body exposure, deposition on plants and soils, and human inhalation. The release of radioactive material in liquid effluents includes pathways such as fish consumption and direct exposure from the lake at the shoreline.

Even though radionuclides can reach humans by many different pathways, some radionuclides result in more exposure than others. The critical pathway is the one that, for a specific radionuclide, will result in the greatest exposure to a population, or a specific group of the population, called the critical group. The critical group may vary depending on the radionuclides involved, the age and diet of the group, and other cultural factors. The exposure may be received by the whole body or to a specific organ, with the organ receiving the largest fraction of the exposure called the critical organ.

The exposures to the general public in the area surrounding HBRSEP, Unit No. 2, are calculated for gaseous and liquid releases. The exposure due to radioactive material released in gaseous effluents is calculated using factors such as the amount of radioactive material released the concentration beyond the site boundary, locations of exposure pathways, and usage factors. The exposures calculated due to radioactive materials released in liquid effluents are calculated using factors such as the total volume of liquid, the total volume of dilution water, and usage factors.

9. Plant Operation

HBRSEP, Unit No. 2, operated continuously with the exception of a scheduled refueling outage 9/13/2013 through 11/5/2013, and a forced outage 11/5/2013 through 11/7/2013.

10. Results

The Radioactive Effluent Release Report is a detailed listing of the radioactivity released from the HBRSEP, Unit No. 2, during the period from January 1, 2013 through December 31, 2013. Some of the gaseous and liquid release parameters for this reporting period are summarized below:

GASEOUS EFFLUENTS

	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Fission & Act. Gas	Ci	4.18E-02	3.77E-02	2.71E+00	1.23E-01
I-131	Ci	ND[1]	ND[1]	1.45E-07	1.59E-06
Part. >8 Day Half-Lives	Ci	ND[1]	ND[1]	2.17E-07	2.25E-07
Tritium	Ci	1.86E+00	2.03E+00	3.67E+00	2.40E+00

LIQUID EFFLUENTS

	Units	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Fission & Act. Products	Ci	1.21E-04	6.25E-04	4.24E-03	3.96E-03
Tritium	Ci	1.55E+01	2.21E+02	2.99E+02	6.22E+01
Dilution Volume	Liters	2.46E+11	2.42E+11	2.19E+11	1.83E+11
Waste Volume	Liters	9.07E+04	3.37E+05	9.17E+05	8.77E+05

During the period of January 1, 2013 through December 31, 2013, the estimated maximum individual offsite dose due to radioactivity released in effluents was:

Liquid Effluents:

- Total Body Dose 2.09E-04 millirem
- Critical Organ Dose 3.28E-04 millirem, Liver

Note – an additional 0.192 mrem to a child was estimated based on the evaporation of tritium from Lake Robinson. This is based on Lake Robinson 2013 environmental sample results, 2013 meteorology and represents the dose from the buildup in the lake. This conservatively bounds the dose due to 2013 tritium effluents.

[1] ND, No Detectable Activity

Gaseous Effluents:

- Beta Air Dose 2.34E-02 millirad
- Gamma Air Dose 6.49E-02 millirad
- Critical Organ Dose 1.37E-01 millirem, Thyroid

Note - Carbon-14 releases resulted in 0.104 mrem to the total body of a child and 0.519 mrem to the bone of a child, which is not included in the above doses. It is estimated that 7.3 curies of Carbon-14 were released during 2013.

B. Significant Variances

1. No variances in historical data of significance were identified during this period.

C. Regulatory Compliance

1. The 10 CFR 50, Appendix I, doses were calculated using the Canberra Effluent Management System (EMS[1]). The EMS Software provides day-by-day dose estimates that are conservative because all releases are assigned to the limiting receptor, using the continuous ground level dispersion factors calculated from 2005 - 2009 meteorology. Pathways assumed for the limiting receptors are vegetation, milk, and meat. When projected on a day-by-day basis, utilizing conservative meteorological conditions, the dose commitment from gaseous and liquid effluents is a small fraction of the 10 CFR 50, Appendix I, limits. The direct radiation assessment to the most likely exposed member of the public is reported in the Annual Radiological Environmental Operating Report. During 2013, the results of the direct radiation assessment demonstrated no measurable effect above background from plant operations.
2. There were no changes to the waste solidification Process Control Program (PCP) during this reporting period. See page 36.
3. There were no changes to the Radioactive Waste Systems (i.e., liquid, gaseous, or solid) during this reporting period. See page 36.
4. There was one reportable instrumentation inoperability event during this reporting period. See page 36.
5. There were no outside liquid holdup tanks that exceeded the 10 curie limit during this reporting period. See page 36.
6. There were no Waste Gas Decay Tanks that exceeded the 1.9E+04 curie limit during this reporting period. See page 36.
7. There were no instances of missed compensatory samples during this reporting period. See page 36.
8. There were no revisions to the ODCM during this reporting period. See page 36.
9. There were no dose calculations performed or special reports made as a result of any spills or leaks during this period. See page 37.
10. There were no events associated with a failure to meet an ODCM specified sampling frequency. See page 37.

[1] EMS, Effluent Management System Software is a product of Canberra Nuclear Industries used for determining dose from radioactive effluent releases.

II. SUPPLEMENTAL INFORMATION

A. Regulatory Limits

1. Fission and Activation Gases:

   10 CFR 20 Limits (Instantaneous Release Rate)
   - Total Body Dose ≤500 mrem/yr
   - Skin Dose ≤3000 mrem/yr

   10 CFR 50, Appendix I
   - For Calendar Quarter
     - Gamma Dose ≤5 mrad
     - Beta Dose ≤10 mrad
   - For Calendar Year
     - Gamma Dose ≤10 mrad
     - Beta Dose ≤20 mrad

2. Iodine-131 and 133, Tritium, and Particulates >8 day half-lives:

   10 CFR 20 Limits (Instantaneous Release Rate)
   - Dose from Inhalation (only) to a child to any organ ≤1500 mrem/yr

   10 CFR 50, Appendix I (Organ Doses)
   - For Calendar Quarter ≤7.5 mrem
   - For Calendar Year ≤15 mrem

3. Liquids:

   Concentrations are specified in 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.00E-04 µCi/ml total activity.

   10 CFR 50, Appendix I
   - For Calendar Quarter
     - Total Body Dose ≤1.5 mrem
     - Any Organ Dose ≤5 mrem
   - For Calendar Year
     - Total Body Dose ≤3 mrem
     - Any Organ Dose ≤10 mrem

B. Measurements and Approximations of Total Radioactivity

1. Continuous Gaseous Releases

a) Fission and Activation Gases - The total activity released is determined from the net count rate of the gaseous monitor, its calibration factor, and the total exhaust flow. The activity of radioactive gas is determined by the fraction of that radioactive gas in the isotopic analysis for that period.

b) Iodines - The activity released as Iodine-131, 133, and 135 is based on isotopic analysis of the charcoal cartridge and particulate filter, and the total exhaust flow.

c) Particulates - The activity released via particulates with half-lives greater than eight days is determined by isotopic analysis of particulate filters and the total exhaust flow.

d) Tritium - The activity released as tritium is based on weekly grab sample analysis and total exhaust flow.

e) Carbon 14 – The activity released is determine using NUREG-0017 (GALE Code) Section 2.2.25, as specified in ODCM, Section 3.16 and corrected for Effective Full Power Days (EFPD) for 2013.

2. Batch Gaseous Releases

a) Fission and Activation Gases - The activity released is based on the volume released and the activity of the individual nuclides obtained from an isotopic analysis of the grab sample taken prior to the release.

b) Iodines - The iodines from mixed mode batch releases are included in the iodine determination from the mixed mode continuous Reactor Auxiliary Building release.

c) Particulates - The particulates from mixed mode batch releases are included in the particulate determination from the mixed mode continuous Reactor Auxiliary Building release.

d) Tritium - The activity released as tritium is based on the grab sample analysis of each batch and the batch volume.

e) Carbon 14 – The activity released is determine by using NUREG-0017 (GALE Code) Section 2.2.25, as specified in ODCM, Section 3.16 and corrected for Effective Full Power Days (EFPD) for 2013.

3. Liquid Releases

a) Fission and Activation Products - The total release values (not including tritium, gases, and alpha) are comprised of the sum of the individual radionuclide activities in each release to the discharge canal for the respective quarter. These values represent the activity known to be present in the liquid radwaste effluent.

b) Tritium - The activity released as tritium is based on the grab sample analysis of each batch and the batch volume. For continuous releases, the activity released as tritium is based on analysis of a weekly composite sample. For continuous releases without a composite sampler, the tritium activity is based on analysis of daily grab samples or a composite of grab samples.

c) Alpha - The measured alpha concentration in a monthly composite sample is used to calculate the total release and average diluted concentration during each period.

d) Strontium-89, 90, Nickel-63 and Iron-55 - The total release values are measured quarterly from composite samples.

C. Estimated Total Errors

1. Estimated total errors for gaseous effluents are based on uncertainties in counting equipment calibration, counting statistics, exhaust flow rates, exhaust sample flow rates, non-steady release rates, chemical yield factors, and sample losses for such items as charcoal cartridges.

2. Estimated total errors for liquid effluents are based on uncertainties in counting equipment calibration, counting statistics, non-steady release flow rate, sampling and mixing losses, and volume determinations.

3. Estimated total errors for solid waste are based on uncertainties in equipment calibration, dose rate measurements, geometry, and volume determinations.

III. GASEOUS EFFLUENTS

A. Batch Releases

	Jan - June 2013	July - Dec 2013
Number of batch releases	50	56
Total time period for batch releases	1.75E+04 min	2.46E+04 min
Maximum time period for a batch release	5.20E+02 min	5.73E+03 min
Average time period for a batch release	3.50E+02 min	4.39E+02 min
Minimum time period for a batch release	2.00E+00 min	4.00E+00 min

B. Abnormal Releases

	Jan - June 2013	July – Dec 2013
Number of releases	0	0
Total activity released	0.00E+00 Ci	0.00E+00 Ci

C. Data Tables

The following tables provide the details of gaseous releases:

Table III-A Summation of All Releases
Table III-B Ground Level and Mixed Mode Releases
Table III-C Typical Lower Limits of Detection for Gaseous Effluents

TABLE III-A
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and Activation Gases				
1. Total release	Ci	4.18E-02	3.77E-02	3.24E+01
2. Average release rate for period	µCi/sec	5.37E-03	4.80E-03	
B. Iodines				
1. Total Iodine-131	Ci	ND	ND	6.21E+01
2. Average release rate for period	µCi/sec	ND	ND	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	ND	ND	5.80E+01
2. Average release rate for period	µCi/sec	ND	ND	
3. Gross alpha radioactivity	Ci	ND	ND	
D. Tritium				
1. Total release	Ci	1.86E+00	2.03E+00	5.25E+01
2. Average release rate for period	µCi/sec	2.39E-01	2.58E-01	
E. Carbon-14				
1. Total release[1]	Ci	2.42E-01	2.42E-01	
F. Percent of 10 CFR 50, Appendix I				
1. Quarterly limit				
Gamma air	%	1.99E-02	1.74E-02	
Beta air	%	3.50E-03	3.10E-03	
Organ: Thyroid[2]	%	5.12E-01	5.58E-01	
2. Cumulative Annual limit*				
Gamma air	%	9.93E-03	1.86E-02	
Beta air	%	1.75E-03	3.30E-03	
Organ: Thyroid[2]	%	2.56E-01	5.35E-01	

*Cumulative total for the year-to-date using the methodology in the ODCM.
[1]The estimated releases of Carbon-14 are not based on measurements of effluents, but on the methodology of NUGEG-0017 adjusted for EFPD. The calculated annual release is divided among four calendar quarters, and based on the number of days in each quarter.
[2]The maximum organ dose (determined to be the thyroid from measured effluents) does not include Carbon-14 bone dose of 0.130 mrem per quarter. Total Body dose from Carbon-14 releases is 0.026 mrem per quarter.
ND = None Detected

TABLE III-A
(Continued)
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

		Unit	Quarter 3	Quarter 4	Est. Total Error %
A.	Fission and Activation Gases				
	1. Total release	Ci	2.71E-00	1.23E-01	3.63E+01
	2. Average release rate for period	µCi/sec	3.41E-01	1.54E-02	
B.	Iodines				
	1. Total Iodine-131[3]	Ci	1.45E-07	1.59E-06	1.74E+01
	2. Average release rate for period	µCi/sec	1.83E-08	1.99E-07	
C.	Particulates				
	1. Particulates with half-lives >8 days	Ci	2.17E-07	2.25E-07	1.05E+01
	2. Average release rate for period	µCi/sec	2.73E-08	2.83E-08	
	3. Gross alpha radioactivity	Ci	ND	ND	
D.	Tritium				
	1. Total release	Ci	3.67E+00	2.40E-00	2.31E+01
	2. Average release rate for period	µCi/sec	4.62E-01	3.02E-01	
E.	Carbon-14				
	1. Total release[1]	Ci	2.42E-01	2.42E-01	
F.	Percent of 10 CFR 50, Appendix I				
	1. Quarterly limit				
	Gamma air	%	1.21E+00	4.72E-02	
	Beta air	%	2.18E-01	9.31E-03	
	Organ: Thyroid[2]	%	1.01E-00	6.66E-01	
	2. Cumulative Annual limit*				
	Gamma air	%	6.26E-01	6.49E-01	
	Beta air	%	1.12E-01	1.17E-01	
	Organ: Thyroid[2]	%	1.04E+00	1.37E+00	

*Cumulative total for the year-to-date using the methodology in the ODCM.
[1]The estimated releases of Carbon-14 are not based on measurements of effluents, but on the methodology of NUREG-0017 adjusted for EFPD. The calculated annual release is divided among four calendar quarters, and based on the number of days in each quarter.
[2]The maximum organ dose (determined to be the thyroid from measured effluents) does not include Carbon-14 bone dose of 0.130 mrem per quarter. Total Body dose from Carbon-14 releases is 0.026 mrem per quarter.
[3] Total Iodine-131 detected during the third and fourth quarter as a result of Refueling Outage activities.

TABLE III-B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
GASEOUS EFFLUENTS - GROUND LEVEL AND MIXED MODE RELEASES

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 1	Quarter 2
1. Fission Gases[1]					
Ar-41	Ci	ND	ND	4.17E-02	3.65E-02
Kr-85m	Ci	ND	ND	ND	6.70E-07
Xe-131m	Ci	ND	ND	ND	ND
Xe-133m	Ci	ND	ND	ND	ND
Xe-133	Ci	ND	ND	9.45E-05	1.26E-03
Xe-135	Ci	ND	ND	ND	ND
Total for Period	Ci	ND	ND	4.18E-02	3.77E-02
2. Iodines[1]					
I-131	Ci	ND	ND	ND	ND
Total for Period	Ci	ND	ND	ND	ND
3. Particulates[1]					
Co-58	Ci	ND	ND	ND	ND
Cs-137	Ci	ND	ND	ND	ND
Total for Period	Ci	ND	ND	ND	ND

[1]Mixed mode continuous accountability includes mixed mode batch accountability (but excludes tritium).

TABLE III-B
(Continued)
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
GASEOUS EFFLUENTS - GROUND LEVEL AND MIXED MODE RELEASES

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 3	Quarter 4	Quarter 3	Quarter 4
1. Fission Gases[1]					
Ar-41	Ci	2.17E+00	7.84E-02	3.76E-01	1.68E-02
Kr-85m	Ci	ND	ND	ND	ND
Xe-131m	Ci	ND	ND	1.08E-03	1.76E-04
Xe-133m	Ci	ND	ND	1.47E-03	ND
Xe-133	Ci	3.74E-02	ND	1.28E-01	1.15E-02
Xe-135	Ci	ND	1.58E-02	2.46E-04	ND
Total for Period	Ci	2.20E+00	9.42E-02	5.07E-01	2.85E-02
2. Iodines[1]					
I-131	Ci	1.45E-07	1.54E-06	ND	4.77E-08
Total for Period	Ci	1.45E-07	1.54E-06	ND	4.77E-08
3. Particulates[1]					
Co-58	Ci	ND	ND	ND	2.25E-07
Cs-137	Ci	ND	ND	2.17E-07	ND
Total for Period	Ci	ND	ND	2.17E-07	2.25E-07

[1]Mixed mode continuous accountability includes mixed mode batch accountability (excludes tritium).

TABLE III-C
TYPICAL LOWER LIMITS OF DETECTION FOR GASEOUS EFFLUENTS

Nuclide	LLD (μCi/cc)
H-3	6.85E-09
Ar-41	2.54E-08
Mn-54	9.55E-15
Co-58	5.70E-14
Fe-59	6.00E-14
Co-60	1.41E-14
Zn-65	6.47E-14
Br-82	1.93E-13
Kr-85	2.60E-06
Kr-85m	1.75E-08
Kr-87	4.60E-08
Kr-88	4.52E-08
Sr-89	1.92E-15
Sr-90	8.25E-16
Mo-99	7.40E-13
I-131	5.30E-14
Xe-131m	7.03E-07
I-133	1.20E-12
Xe-133	4.45E-08
Xe-133m	1.29E-07
Cs-134	3.91E-14
I-135	2.21E-09
Xe-135	1.72E-08
Xe-135m	6.63E-08
Cs-137	2.42E-14
Xe-138	2.07E-07
Ba-140	1.67E-13
La-140	5.62E-14
Ce-141	6.23E-14
Ce-144	2.28E-13
Gross Alpha	3.44E-15

IV. LIQUID EFFLUENTS

A. Batch Releases

	Jan - June 2013	July - Dec 2013
Number of batch releases	15	64
Total time period for batch releases	3.35E+03 min	1.57E+04 min
Maximum time period for a batch release	3.30E+02 min	6.61E+02 min
Average time period for a batch release	2.23E+02 min	2.45E+02 min
Minimum time period for a batch release	1.69E+02 min	8.00E+00 min
Average Stream Flow During Release Periods	4.00E+05 gpm	2.53E+05 gpm

B. Abnormal Releases

	Jan - June 2013	July - Dec 2013
Number of releases	0	0
Total activity released	0.00E+00 Ci	0.00E+00 Ci

C. Data Tables

The following tables provide the details of liquid releases:

Table IV-A Summation of All Releases
Table IV-B Continuous Mode and Batch Mode Releases
Table IV-C Typical Lower Limits of Detection for Liquid Effluents

TABLE IV-A
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and Activation Products				
1. Total release (not including tritium, gases, alpha)	Ci	1.21E-04	6.25E-04	1.07E+01
2. Average diluted concentration during period	µCi/ml	4.92E-13	2.59E-12	
B. Tritium				
1. Total release	Ci	1.55E+01	2.21E+02	9.20E+00
2. Average diluted concentration during period	µCi/ml	6.29E-08	9.15E-07	
C. Dissolved and entrained gases				
1. Total release	Ci	1.65E-06	6.10E-05	9.60E+00
2. Average diluted concentration during period	µCi/ml	6.69E-15	2.52E-13	
3. Percent of applicable limit	%	3.34E-09	1.26E-07	
D. Gross alpha radioactivity				
1. Total release	Ci	ND	ND	ND
E. Volume of waste released prior to dilution	Liters	9.07E+04	3.37E+05	
F. Volume of dilution water used during period	Liters	2.46E+11	2.42E+11	
G. Percent of 10 CFR 50, Appendix I				
1. Quarterly Limit				
Organ: GI-LLI, Liver	%	8.86E-06	3.76E-04	
Total body	%	2.85E-05	1.25E-03	
2. Cumulative Annual Limit*				
Organ: Liver, GI-LLI	%	4.43E-06	1.92E-04	
Total body	%	1.42E-05	6.38E-04	

[1] GI-LLI, gastrointestinal-lower large intestine received the highest dose for Quarter 1. GI-LLi & Liver dose contributions were equal for Quarter 2.
*Cumulative total for the year-to-date using the methodology in the ODCM.

TABLE IV-A
(Continued)
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

		Unit	Quarter 3	Quarter 4	Est. Total Error %
A.	Fission and Activation Products				
	1. Total release (not including tritium, gases, alpha)	Ci	4.24E-03	3.96E-03	1.07E+01
	2. Average diluted concentration during period	µCi/ml	1.94E-11	2.16E-11	
B.	Tritium				
	1. Total release	Ci	2.99E+02	6.22E+01	9.20E+00
	2. Average diluted concentration during period	µCi/ml	1.36E-06	3.39E-07	
C.	Dissolved and entrained gases				
	1. Total release	Ci	4.96E-03	4.82E-04	9.60E+00
	2. Average diluted concentration during period	µCi/ml	2.27E-11	2.63E-12	
	3. Percent of applicable limit	%	1.13E-05	1.31E-06	
D.	Gross alpha radioactivity				
	1. Total release	Ci	ND	ND	ND
E.	Volume of waste released prior to dilution	Liters	9.17E+05	8.77E+05	
F.	Volume of dilution water used during period	Liters	2.19E+11	1.83E+11	
G.	Percent of 10 CFR 50, Appendix I				
	1. Quarterly Limit Organ: Liver, GI-LLI[1] Total body	 % %	 3.36E-03 9.00E-03	 2.82E-03 3.62E-03	
	2. Cumulative Annual Limit* Organ: Liver, GI-LLI Total body	 % %	 1.87E-03 5.14E-03	 3.28E-03 6.95E-03	

[1] GI-LLI, gastrointestinal-lower large intestine received the highest dose for Quarter 3 and Quarter 4.
*Cumulative total for the year-to-date using the methodology in the ODCM.

TABLE IV-B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
LIQUID EFFLUENTS - CONTINUOUS MODE AND BATCH MODE RELEASES

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 1	Quarter 2
H-3	Ci			1.55E+01	2.21E+02
Gross Alpha	Ci	ND	ND	ND	ND
Cr-51	Ci	ND	ND	ND	ND
Fe-55	Ci	ND	ND	ND	ND
Fe-59	Ci	ND	ND	ND	ND
Co-57	Ci	ND	ND	ND	6.16E-06
Co-58	Ci	ND	ND	2.83E-06	1.00E-04
Co-60	Ci	ND	ND	2.64E-05	1.10E-04
Ni-63	Ci	ND	ND	4.61E-05	3.64E-04
Sn-117m	Ci	ND	ND	ND	ND
Sb-125	Ci	ND	ND	4.39E-05	4.51E-05
Sb-127	Ci	ND	ND	7.16E-07	ND
Te-123m	Ci	ND	ND	ND	ND
Te-132	Ci	ND	ND	6.88E-07	ND
I-131	Ci	ND	ND	5.33E-07	ND
Cs-137	Ci	ND	ND	ND	ND
Eu-152	Ci	ND	ND	ND	ND
Total for Period	Ci	ND	ND	1.21E-04	6.25E-04
Xe-131m	Ci	ND	ND	ND	ND
Xe-133	Ci	ND	ND	1.65E-06	6.10E-05
Xe-135	Ci	ND	ND	ND	ND
Total for Period	Ci	ND	ND	1.65E-06	6.10E-05

TABLE IV-B
(Continued)
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT - 2013
LIQUID EFFLUENTS - CONTINUOUS MODE AND BATCH MODE RELEASES

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 3	Quarter 4	Quarter 3	Quarter 4
H-3	Ci	ND	ND	2.99E+02	6.22E+01
Gross Alpha	Ci	ND	ND	ND	ND
Cr-51	Ci	ND	ND	ND	3.00E-05
Fe-55	Ci	ND	ND	4.83E-04	3.14E-05
Fe-59	Ci	ND	ND	3.14E-05	1.28E-05
Co-57	Ci	ND	ND	3.36E-06	1.41E-06
Co-58	Ci	ND	ND	1.81E-03	2.01E-03
Co-60	Ci	ND	ND	7.82E-04	3.14E-04
Ni-63	Ci	ND	ND	9.55E-04	1.12E-03
Sn-117m	Ci	ND	ND	6.18E-05	2.07E-04
Sb-125	Ci	ND	ND	5.27E-05	6.38E-06
Sb-127	Ci	ND	ND	ND	ND
Te-123m	Ci	ND	ND	6.34E-05	2.13E-04
Te-132	Ci	ND	ND	ND	ND
I-131	Ci	ND	ND	ND	ND
Cs-137	Ci	ND	ND	2.90E-06	ND
Eu-152	Ci	ND	ND	ND	4.24E-06
Total for Period	Ci	ND	ND	4.24E-03	3.96E-03
Xe-131m	Ci	ND	ND	1.89E-05	ND
Xe-133	Ci	ND	ND	4.93E-03	4.82E-04
Xe-135	Ci	ND	ND	5.38E-06	ND
Total for Period	Ci	ND	ND	4.96E-03	4.82E-04

TABLE IV-C
TYPICAL LOWER LIMITS OF DETECTION FOR LIQUID EFFLUENTS

Nuclide	LLD (µCi/ml)
H-3	4.19E-06
Cr-51	1.25E-07
Mn-54	1.84E-08
Fe-55	8.64E-08
Co-57	2.29E-08
Co-58	2.84E-08
Fe-59	2.88E-08
Co-60	2.48E-08
Zn-65	3.24E-08
Sr-89	3.70E-08
Sr-90	1.36E-08
Nb-95	1.21E-08
Zr-95	2.16E-08
Mo-99	1.61E-07
Tc-99m	2.06E-08
Ag-110m	1.87E-08
Sn-113	2.46E-08
Sb-122	2.72E-08
Te-123m	2.02E-08
Sb-124	1.44E-08
Sb-125	5.20E-08
Xe-127	1.45E-08
I-131	1.67E-08
Xe-131m	1.05E-06
Te-132	1.77E-08
Xe-133	7.07E-08
Xe-133m	1.90E-07
Cs-134	2.04E-08
Xe-135	2.67E-08
Cs-137	1.26E-08
Ba-140	7.30E-08
La-140	2.30E-08
Ce-141	3.71E-08
Ce-144	1.49E-07
Gross Alpha	8.74E-08

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

Report Time Period: January 1, 2013, through December 31, 2013

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (not irradiated fuel)

Waste Class A

Type of Waste	Waste Volume M^3	[1] Activity Curies	[2] Est. Total Error %	No. of Shipments
a. Spent resins, filter sludges, etc.	5.30E+00	7.00E-01	±25%	2
b. Dry compressible waste, contaminated equip, etc.	3.47E+02	6.27E-01	±25%	9
c. Irradiated components, control rods, etc.	N/A	N/A	N/A	N/A
d. Other (describe) Oil, Waste Holdup Tank Sludge/Water	1.94E+01	1.70E+01	±25%	4

[1]Excludes successful GIC/PCW Waste
[2]Estimated

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (Continued)

Report Time Period: January 1, 2013, through December 31, 2013

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Continued)

Estimate of major nuclide composition (by type of waste)

Resins		
Radionuclide	%	Ci
N/A	N/A	N/A
Ni-63	5.74E+01	4.02E-01
Co-60	1.68E+01	1.18E-01
Fe-55	1.26E+01	8.84E-02
C-14	2.29E+00	1.60E-02
Sb-125	2.14E+00	1.50E-02
Co-58	1.95E+00	1.36E-02
H-3	1.49E+00	1.05E-02
Cs-137	1.37E+00	9.63E-03
Mn-54	1.17E+00	8.20E-03
Ni-59	6.08E-01	4.26E-03
Zn-65	5.91E-01	4.14E-03
Tc-99	4.14E-01	2.90E-03

* Other nuclides: Co-57, Cs-134, Sr-90, Ce-144 and I-129

Dry Compressible Waste/Contaminated Equipment		
Radionuclide	%	Ci
Co-60	2.67E+01	1.68E-01
Ni-63	1.81E+01	1.14E-01
Fe-55	1.65E+01	1.03E-01
C-14	1.37E+01	8.56E-02
Cs-137	4.92E+00	3.09E-02
Nb-95	4.38E+00	2.74E-02
Co-58	3.20E+00	2.00E-02
Zr-95	2.61E+00	1.64E-02
H-3	2.21E+00	1.38E-02
Mn-54	2.10E+00	1.32E-02
Ag-110m	1.82E+00	1.14E-02
Cr-51	1.08E-00	6.75E-03

* Other nuclides: Sb-125, Ru-106, Sn-113, Fe-59, Tc-99, Be-7, Te-123m Co-57, Cs-134, Sr-90, Ce-144, Cm-243, Zn-65, Sn-117m, sb-124, Hf-181, Pu-238, Pu-239, Cm-242 and I-129.

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (Continued)
Report Time Period: January 1, 2013, through December 31, 2013

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Continued)
Estimate of major nuclide composition (by type of waste)

Oil		
Radionuclide	%	Ci
Cs-137	3.50E+01	8.31E-04
Co-60	1.81E+01	4.31E-04
Ce-144	1.79E+01	4.25E-04
H-3	1.53E+01	3.64E-04
Co-58	1.06E+01	2.51E-04
C-14	1.73E+00	4.10E-05
Tc-99	134E+00	3.19E-05
I-129	2.88E-02	6.83E-07

Note: Total Curie Quantity and Principle Radionuclides were determined by estimates.

Waste Holdup Tank Sludge/Water		
Radionuclide	%	Ci
Co-60	4.28E+01	7.27E+00
Ni-63	4.15E+01	7.06E+00
C-14	7.26E+00	1.23E+00
Fe-55	5.02E+00	8.53E-01
Sb-125	9.73E-01	1.65E-01
H-3	7.58E-01	1.29E-01
Ni-59	3.74E-01	6.36E-02
Co-58	2.78E-01	4.73E-02
Cs-137	2.30E-01	3.90E-02
Pu-241	1.81E-01	3.07E-02
Mn-54	1.29E-01	2.19E-02
Sr-90	1.03E-01	1.75E-02

* Other nuclides: Ag-108m, Ce-144, Zr-95, nb-95, Tc-99, I-129, Co-57, Sn-113, Pu-238, Am-241 and Cm-243.

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (Continued)

Report Time Period: January 1, 2013, through December 31, 2013

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Continued)

Irradiated Fuel Shipments

Number of Shipments:	0
Mode of Transportation	N/A
Destination	N/A

Solid Waste

Number of Shipments:	15
Mode of Transportation	Highway - Exclusive Use
Destination	Energy Solutions (Barnwell , SC), Duratek Services, Inc.(Oak Ridge, TN)

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (Continued)

Report Time Period: January 1, 2013, through December 31, 2013

B. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (not irradiated fuel)

Waste Class B

Type of Waste	Waste Volume M^3	[1] Activity Curies	[2] Est. Total Error %	No. of Shipments
a. Spent resins, filter sludges, etc.	9.18E+00	1.02E+02	±25%	3
b. Dry compressible waste, contaminated equip, etc.	N/A	N/A	N/A	N/A
c. Irradiated components, control rods, etc.	N/A	N/A	N/A	N/A
d. Other (describe) Oil, Waste Holdup Tank Sludge/Water	N/A	N/A	N/A	N/A

Estimate of major nuclide composition (by type of waste)

Resins		
Radionuclide	%	Ci
Ni-63	5.35E+01	5.45E+01
Fe-55	2.00E+01	2.04E+01
Co-60	1.02E+01	1.04E+01
Co-58	6.17E+00	6.29E+00
Sb-125	3.62E+00	3.69E+00
C-14	2.08E+00	2.12E+00
Mn-54	1.45E+00	1.48E+00
Cs-137	1.38E+00	1.40E+00
Cs-134	5.22E-01	5.32E-01
Co-57	4.92E-01	5.01E-01
Ni-59	3.29E-01	3.35E-01
Sr-90	1.01E-01	1.03E-01

* Other Nuclides: H-3, Ag-110m, Nb-95, Zr-95, Ce-144, Pu-241, Ag-108m, Sb-124, Sn-113, Cm-243, Tc-99, and I-129

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (Continued)

Report Time Period: January 1, 2013, through December 31, 2013

B. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Continued)

Irradiated fuel shipments

Number of Shipments:	0
Mode of Transportation	N/A
Destination	N/A

Solid Waste

Number of Shipments:	3
Mode of Transportation	Highway - Exclusive Use
Destination	Energy Solutions - Barnwell, SC

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

Report Time Period: January 1, 2013, through December 31, 2013

C. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (not irradiated fuel)

Waste Class C

Type of Waste	Waste Volume M[3]	Activity Curies[1]	[2] Est. Total Error %	No. of Shipments
a. Spent resins, filter sludges, etc.	8.79E-01	2.86E+00	±25%	1
b. Dry compressible waste, contaminated equip, etc.	N/A	N/A	N/A	N/A
c. Irradiated components, control rods, etc.	N/A	N/A	N/A	N/A
d. Other (describe) Oil, Waste Holdup Tank Sludge/Water	N/A	N/A	N/A	N/A

[1]Excludes successful GIC/PCW Waste
[2]Estimated

Estimate of major nuclide composition (by type of waste)

Resins		
Radionuclide	%	Ci
Co-60	2.48E+01	7.10E-01
Fe-55	2.17E+01	6.21E-01
Ni-63	1.40E+01	4.00E-01
C-14	1.11E+01	3.19E-01
Co-58	1.02E+01	2.93E-01
Zr-95	6.79E+00	1.94E-01
Co-60	2.48E+01	7.10E-01
Nb-95	6.09E+00	1.74E-01
Sb-125	1.26E+00	3.59E-02
H-3	8.95E-01	2.56E-02
Cr-51	7.69E-01	2.20E-02
Mn-54	5.30E-01	1.52E-02
Sn-113	4.03E-01	1.15E-02

* Other Nuclides : Ag-110m, Tc-99, Te-123m, Sr-90, Ce-144, Co-57, Cs-137, Be-7, Fe-59, Ru-106, I-129, Sb-124, Cs-134, Hf-181, Cm-242, Cm-243

Irradiated Fuel Shipments

Number of Shipments:	0
Mode of Transportation	N/A
Destination	N/A

Solid Waste

Number of Shipments:	0
Mode of Transportation	N/A

VI. 40 CFR 190 DOSE CONFORMANCE

The direct radiation assessment to the most likely exposed member of the public is reported in the Annual Radiological Environmental Operating Report. The results of the assessment demonstrate no measurable affect above background from plant operations. Since no 10 CFR 50, Appendix I, limits have been exceeded and the evaluation of the Independent Spent Fuel Storage Installations indicate only a small fraction of the total dose to the environs, this demonstrates conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation.

VII. METEOROLOGICAL DATA

A. Continuous Release Diffusion Analysis

Table VII-A presents the number and frequency of wind direction occurrences by wind speed class as recorded at the onsite meteorological system during continuous release, for the period January 1, 2013, through December 31, 2013.

The frequencies are presented as a percent of total occurrences for each stability class, as well as a summary for all classes for the lower (10 meter) sensor elevation.

Pertinent information available from the tables are as follows:

1. Stability

Percent occurrence Pasquill Stability categories based on lower level (10 meter) wind distribution:

A	B	C	D	E	F	G
4.42	6.76	7.43	45.80	20.19	8.59	6.80

2. Wind Speed and Wind Direction 10 Meter

Wind at the lower level at Robinson tends to come either from the north or south, or from within 1-2 sectors of those directions. This differs slightly from the upper level winds, where the flow tends to be from the SW and NE quadrants (specifically the SSW and NNE sectors). This difference between upper and lower measurements is not terribly unusual, though is more typical in a region with more undulating terrain. The difference could be a result of local site impacts such as nearby trees. Robinson experiences low wind speeds overall, with over 27.7% of the winds being below 1.5 m/s. This indicates that despite little surrounding topography, there is some local effect limiting winds, particularly at the lower level.

Calm/Light Wind Statistics

Lower Level calms (<0.45 m/s) occur 6.6% of the time.
Upper Level calms (<0.45 m/s) occur 0.6% of the time.
Light winds (<1.5 m/s) occur 27.7% of the time at 10 meters.

TABLE VII-A JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD – GROUND CONTINUOUS RELEASES

1USNRC COMPUTER CODE-XOQDOQ,VERSION 2.0 RUN DATE 20140322 RUN TIME 151934.781

XOQDOQ - GROUND LEVEL RELEASE FROM THE LAKE ROBINSON. 2013 METEOROLOGY.

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS A

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.56	0	0	0.011	0	0.023	0.034	0.011	0	0	0.011	0.011	0.011	0	0	0	0	0.115
3.35	0.08	0.069	0.229	0.103	0.08	0.161	0.264	0.172	0.138	0.103	0.172	0.138	0.069	0.011	0.011	0	1.801
5.59	0.126	0.023	0.046	0.057	0.011	0	0.011	0.103	0.172	0.436	0.252	0.149	0.207	0.184	0.275	0.08	2.134
8.27	0	0	0	0	0	0	0	0	0	0	0.034	0.034	0.034	0.069	0.08	0	0.252
10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.011	0	0.011
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0.21	0.09	0.29	0.16	0.11	0.2	0.29	0.28	0.31	0.55	0.47	0.33	0.31	0.26	0.38	0.08	4.31

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS B

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.56	0	0	0.034	0.011	0.057	0.057	0.069	0.046	0.023	0.023	0.011	0.011	0.011	0	0.011	0	0.367
3.35	0.287	0.241	0.229	0.275	0.161	0.172	0.402	0.298	0.218	0.333	0.562	0.425	0.207	0.161	0.092	0.092	4.153
5.59	0.436	0.069	0.011	0.034	0	0	0.046	0.126	0.138	0.218	0.344	0.138	0.126	0.08	0.161	0.115	2.042
8.27	0	0	0	0	0	0	0	0	0.023	0	0	0	0.046	0.011	0.011	0.011	0.103
10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0.72	0.31	0.28	0.32	0.22	0.23	0.52	0.47	0.4	0.57	0.92	0.57	0.39	0.25	0.28	0.22	6.67

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS C

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.56	0.023	0.08	0.103	0.218	0.092	0.184	0.126	0.023	0.069	0.057	0.046	0.046	0.046	0.011	0	0.046	1.17
3.35	0.597	0.459	0.333	0.287	0.149	0.092	0.184	0.252	0.275	0.298	0.631	0.333	0.241	0.195	0.057	0.115	4.497
5.59	0.344	0.138	0.011	0.023	0	0.023	0	0.092	0.138	0.207	0.149	0.08	0.08	0.161	0.08	0.08	1.606
8.27	0	0	0	0	0	0	0	0	0.046	0.023	0.023	0.023	0.034	0	0.023	0.011	0.184
10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0.96	0.68	0.45	0.53	0.24	0.3	0.31	0.37	0.53	0.59	0.85	0.48	0.4	0.37	0.16	0.25	7.46

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS D

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0.006	0.014	0.02	0.012	0.01	0.011	0.013	0.012	0.007	0.009	0.008	0.007	0.006	0.006	0.004	0.003	0.149
1.56	0.47	1.033	1.434	0.849	0.7	0.792	0.941	0.895	0.528	0.677	0.597	0.505	0.447	0.459	0.264	0.229	10.819
3.35	3.993	3.821	2.639	1.239	0.7	0.367	1.056	3.178	2.662	2.134	1.285	0.734	0.539	0.665	0.436	1.124	26.572
5.59	1.755	0.631	0.103	0.161	0.011	0	0.092	0.665	1.205	0.746	0.47	0.207	0.275	0.184	0.218	1.01	7.733
8.27	0.057	0	0	0	0	0	0	0.023	0.149	0.011	0.034	0.057	0.023	0.011	0.034	0.046	0.447
10.95	0	0	0	0	0	0	0	0	0.08	0	0	0	0	0	0	0	0.08
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	6.28	5.5	4.2	2.26	1.42	1.17	2.1	4.77	4.63	3.58	2.39	1.51	1.29	1.33	0.96	2.41	45.8

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS E

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0.042	0.038	0.031	0.022	0.009	0.007	0.021	0.085	0.109	0.083	0.076	0.063	0.043	0.039	0.034	0.043	0.746
1.56	0.585	0.528	0.436	0.31	0.126	0.103	0.298	1.193	1.526	1.159	1.067	0.883	0.608	0.539	0.482	0.597	10.441
3.35	0.608	0.103	0.229	0.103	0.011	0.011	0.034	1.021	1.239	0.608	0.792	0.287	0.379	0.31	0.665	1.801	8.203
5.59	0	0	0	0	0	0	0	0.057	0.092	0.057	0.126	0.023	0.046	0.046	0.023	0.482	0.952
8.27	0.011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.011
10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1.25	0.67	0.7	0.44	0.15	0.12	0.35	2.36	2.97	1.91	2.06	1.26	1.08	0.93	1.2	2.92	20.35

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS F

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0.062	0.021	0.015	0.015	0.002	0.008	0.027	0.099	0.124	0.133	0.097	0.068	0.048	0.039	0.079	0.149	0.987
1.56	0.344	0.115	0.08	0.08	0.011	0.046	0.149	0.551	0.688	0.734	0.539	0.379	0.264	0.218	0.436	0.826	5.461
3.35	0.115	0	0	0	0	0	0	0.08	0.046	0.092	0.184	0.092	0.126	0.207	0.436	0.757	2.134
5.59	0	0	0	0	0	0	0	0	0	0	0	0.011	0	0	0	0	0.011
8.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0.52	0.14	0.09	0.09	0.01	0.05	0.18	0.73	0.86	0.96	0.82	0.55	0.44	0.46	0.95	1.73	8.59

0JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION ATMOSPHERIC STABILITY CLASS

0UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	SSE	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.36	0.214	0.019	0.013	0.019	0.019	0.006	0.039	0.149	0.182	0.182	0.13	0.13	0.156	0.162	0.338	0.546	2.306
1.56	0.379	0.034	0.023	0.034	0.034	0.011	0.069	0.264	0.321	0.321	0.229	0.229	0.275	0.287	0.597	0.964	4.073
3.35	0.034	0	0	0	0	0	0	0	0	0	0.034	0.023	0	0.023	0.092	0.229	0.436
5.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0.63	0.05	0.04	0.05	0.05	0.02	0.11	0.41	0.5	0.5	0.39	0.38	0.43	0.47	1.03	1.74	6.82

TOTAL HOURS CONSIDERED ARE 8716

0WIND MEASURED AT 10.0 METERS.

0OVERALL WIND DIRECTION FREQUENCY

WIND DIRECTION:	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
FREQUENCY:	10.6	7.4	6.0	3.9	2.2	2.1	3.9	9.4	10.2	8.7	7.9	5.1	4.3	4.1	5.0	9.4	100.0

0OVERALL WIND SPEED FREQUENCY

MAX WIND SPEED (M/S): 0.358 1.565 3.353 5.588 8.270 10.952 15.646

AVE WIND SPEED (M/S): 0.179 0.961 2.459 4.470 6.929 9.611 13.299

WIND SPEED FREQUENCY: 4.19 32.45 47.80 14.48 1.00 0.09 0.00

THE CONVERSION FACTOR APPLIED TO THE WIND SPEED CLASSES IS 0.447

ADDENDUM 1

CHANGES TO ODCM, PCP, AND
RADIOACTIVE WASTE SYSTEMS

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I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (ODCM)

There were no changes to the ODCM during this reporting period.

II. CHANGES TO THE RADIOACTIVE WASTE SYSTEMS

There were no changes to the Radioactive Waste Systems during this reporting period.

III. CHANGES TO THE PROCESS CONTROL PROGRAM (PCP)

There were no changes to the Process Control Program during this reporting period.

IV. CHANGES TO THE LAND USE CENSUS

The Land Use Census is currently performed every 12 months and was last performed in 2013. The results of the 2013 Land Use Census and the 2013 meteorological data identified no changes that required an ODCM change. The next Land Use Census will be performed in 2014.

V. INSTRUMENT INOPERABILITY

There was one reportable instrumentation inoperability event during this reporting period.

Steam Generator Flow Rate measurement device (FIT-1328 A, B, C) was removed from service on 9/14/2013 for > 30 days due to blow down being in service with heat recovery bypassed per the sodium recovery plan. HBR S/G flow rate instruments are designed to be bypassed when S/G blow down flow rates are increased greater than 50 gpm. This is part of the system design. These flow rate instruments are required to be in service per the ODCM, so when they are bypassed, blow down flow is estimated once per shift and enter the ODCM condition. Per the ODCM, Table 2.6-1 – Items 2.B (A) states "With the number of channels operable less than the MCO requirement due to inoperable equipment: Exert best efforts to return the instruments to operable status within 30 days and, if unsuccessful, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner in accordance with Technical Specification 5.6.3" (NCR 530821). Steam Generator flow rate measurement device was returned to service 11/19/2013.

VI. LIQUID HOLDUP TANK CURIE LIMIT

There were no outside liquid holdup tanks that exceeded the ten curie limit during this reporting period.

VII. WASTE GAS DECAY TANK CURIE LIMIT

There were no waste gas decay tanks with a curie content that exceeded the 1.90E+04 curie limit during this reporting period.

VIII. MISSED COMPENSATORY SAMPLES

There were no instances of missed compensatory samples during this reporting period.

IX. SPECIAL GROUND WATER PROTECTION REQUIREMENTS

There were no dose calculations performed or special reports made as a result of any spills or leaks during this period.

Additional groundwater monitoring wells were sampled and analyzed during 2013 as part of the NEI 07-07 Groundwater Protection Initiative. There were a total of twenty-one wells monitored for radiological contaminants; fifteen of these wells are required by the ODCM. The data from the required wells are reported annually in the Annual Radiological Environmental Operating Report.

In 2013, 13 wells previously used as remediation monitoring wells from a 1996 oil spill, were adopted into the radiological groundwater monitoring program during the third quarter sampling evolution. A total of five wells were sampled and the results are included in the table below. This table contains sample results from all wells sampled outside of the ODCM requirement. There were no plant related gamma activity detected. Some of the non ODCM wells contained low level tritium. The following are the results from the six additional wells sampled in 2013.

Groundwater Tritium - 2013
pCi/L

Well ID	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
PDW-05	354	305	300	301
P-1	NS	NS	960	584
P-2	NS	NS	543	<88
MW-10	NS	NS	<7	<63
MW-11	NS	NS	<85	<46
MW-12	NS	NS	<141	<71

X. MISSED ODCM SAMPLES

There were no failures to meet the ODCM specified sample frequencies or analyses during this reporting period.

ADDENDUM 2

CORRECTIONS TO PREVIOUS REPORTS

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