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Subject: Radioactive Effluent Release Report for 2011
River Bend Station – Unit 1
Docket No. 50-458
License No. NPF-47

Enclosed is the River Bend Station (RBS) Annual Radioactive Effluent Release Report for the period January 1, 2011, through December 31, 2011. This report is submitted in accordance with the RBS Technical Specifications, Section 5.6.3.

No commitments are contained in this letter. Should you have any questions regarding the enclosed information, please contact Mr. Joseph A. Clark, at (225) 381-4177.

A handwritten signature in black ink, appearing to read "JAC/wjf", written over a horizontal line.

JAC/wjf

Enclosure

TE48
NRR

Radioactive Effluent Release Report for 2011

RBG-47237

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2011 ANNUAL EFFLUENT RELEASE REPORT

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I. INTRODUCTION

This is the annual Radioactive Effluent Release Report for the period of January 1, 2011, through December 31, 2011. This report is submitted in accordance with Technical Specification 5.6.3 of Appendix A to River Bend Station (RBS) License Number NPF-47.

II. SUPPLEMENTAL INFORMATION

A. Regulatory Limits

1. 10CFR50, Appendix I Limits

a) Fission and Activation Gases

In accordance with Technical Requirement (TR) 3.11.2.2, the air dose due to noble gases released in gaseous effluent to areas at and beyond the SITE BOUNDARY shall be limited to:

$$\begin{aligned}
 D_{\text{Gamma-Air}} &= \text{gamma air dose from radioactive noble gases in millirad (mrad)} \\
 &= 3.17\text{E-}8 \sum_{i=1}^n M_i \overline{(X/Q)} Q_i \begin{matrix} \leq 5 \text{ mrad/qtr} \\ \leq 10 \text{ mrad/yr} \end{matrix}
 \end{aligned}$$

$$\begin{aligned}
 D_{\text{Beta-Air}} &= \text{beta air dose from radioactive noble gases in millirad (mrad)} \\
 &= 3.17\text{E-}8 \sum_{i=1}^n N_i \overline{(X/Q)} Q_i \begin{matrix} \leq 10 \text{ mrad/qtr} \\ \leq 20 \text{ mrad/yr} \end{matrix}
 \end{aligned}$$

b) Radioiodines (I-131 & I-133) and Particulate

In accordance with Technical Requirement 3.11.2.3, the dose to a MEMBER OF THE PUBLIC from radioiodines (I-131 and I-133), tritium (H-3) and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluent releases to areas at and beyond the SITE BOUNDARY shall be limited to:

$$D_{\text{I\&8DPt}} = \text{Dose in mrem to the organ } (\tau) \text{ for the age group of interest from}$$

radioiodine (I-131, I-133, tritium, and 8 day particulate via the pathway of interest.)

$$= 3.17E-08 (F_o) \sum_{I=1}^n P_{i\tau} (X/Q) Q_i \quad \text{and}$$

$$= 3.17E-08 (F_o) \sum_{I=1}^n R_{i\tau} (D/Q) Q_i \quad \text{and}$$

$$D_{\tau} = \sum_{z=1}^n D_{I\&8DP\tau} \leq 7.5 \text{ mrem/qtr}$$

$$\leq 15 \text{ mrem/yr}$$

(above terms defined in the RBS ODCM)

c) Liquid Effluent

In accordance with Technical Requirement 3.11.1.2, the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluent released to UNRESTRICTED AREAS shall be limited to:

$$D_{i\tau} = \frac{A_{i\tau} \Delta t Q_i}{(DF) D_w}$$

and

$$D_{TOTAL\tau} = \sum_{i=1}^n D_{i\tau}$$

$D_{TOTAL\tau}$ = Total dose commitment to the organ (τ) due to all releases during the desired time interval in mrem

and

$$D_{TOTAL} \quad \text{Total Body} \leq 1.5 \text{ mrem/qtr}$$

$$\leq 3 \text{ mrem/yr}$$

$$D_{TOTAL} \quad \text{Any Organ} \leq 5 \text{ mrem/qtr}$$

$$\leq 10 \text{ mrem/yr}$$

(above terms defined in RBS ODCM)

2. 40CFR190 Limits

In accordance with Technical Requirement 3.11.4, the annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC, due to releases of radioactivity and to radiation from uranium fuel cycle sources, shall be limited to:

≤ 25 mrem to the total body or any organ (except the thyroid)

≤ 75 mrem to the thyroid

3. Miscellaneous Limits

a. Technical Requirement 3.11.2.1 - Fission and Activation Gases

In accordance with Technical Requirement 3.11.2.1, the dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be less than or equal to 500 millirems/year (mrem/yr) to the total body and less than or equal to 3000 mrem/yr to the skin:

DR_{TB} = Dose rate to the total body in mrem/yr

$$= \sum_{i=1}^n K_i \overline{(X/Q)} \dot{Q}_i \leq 500 \text{ mrem/yr and}$$

DR_{SKIN} = Dose rate to the skin in mrem/yr

$$= \sum_{i=1}^n L_i + 1.1M_i \overline{(X/Q)} \dot{Q}_i \leq 3000 \text{ mrem/yr}$$

(above terms defined in RBS ODCM)

b. Technical Requirement 3.11.2.1 - Radioiodine (I-131 & I-133) and Particulate

In accordance with Technical Requirement 3.11.2.1, the dose rate due to radioiodines, tritium, and all radionuclides in particulate form with half-lives greater than 8 days released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to less than or equal to 1500 mrem/yr to any organ:

$DR_{I\&SDP\tau}$ = Dose rate to the organ τ for the age pathway group of interest from Radioiodines (I-131 & I-133), tritium, and 8 day particulate via the inhalation pathway in mrem/yr.

$$= \sum_{i=1}^n P_i \overline{(X/Q)} \cdot Q_i \leq 1500 \text{ mrem/yr}$$

(above terms defined in RBS ODCM)

c. Technical Requirement 3.11.1.1 - Liquid Effluent

In accordance with Technical Requirement 3.11.1.1, the concentration of radioactive material released in liquid effluent to UNRESTRICTED AREAS shall be limited to ten times the concentrations specified in 10CFR20, 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 2.0E-04 microcuries/milliliter total concentration.

d. Technical Requirement 3.11.2.5 - Ventilation Exhaust Treatment

In accordance with Technical Requirement 3.11.2.5, the VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses, due to gaseous effluent releases to areas and beyond the SITE BOUNDARY would exceed 0.3 mrem to any organ in a 31-day period.

e. Technical Requirement 3.11.1.3 - Liquid Radwaste Treatment System

In accordance with Technical Requirement 3.11.1.3, the liquid radwaste treatment system shall be used to reduce the radioactive materials in liquid waste prior to their discharge when the projected doses, due to the liquid effluent, to UNRESTRICTED AREAS would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31-day period.

B. Effluent Concentration Limits

1. Gaseous Releases

The concentrations of radioactive gaseous releases are based on the dose rate restrictions in RBS Technical Requirements, rather than the Effluent Concentration Limits (ECL) listed in 10CFR20 Appendix B, Table 2, Column 1.

2. Liquid Releases

The Effluent Concentration Limits of radioactive materials in liquid effluents are limited to ten times 10CFR20, Appendix B, Table 2, Column 2.

C. Measurements and Approximations of Total Radioactivity

1. Gaseous Effluent

a. Fission and Activation Gases

Periodic grab samples are obtained from the Main Plant Exhaust Duct, Fuel Building Exhaust Vent and Radwaste Building Exhaust Vent. These samples are analyzed using high purity germanium detectors coupled to computerized pulse height analyzers. The sampling and analysis frequencies are described in Table 1F.

Sampling and analysis of these effluent streams provide noble gas radionuclide relative abundance that can then be applied to the noble gas gross activity and gross activity release rate to obtain nuclide specific activities and release rates. The noble gas gross activity released within a specific time period is determined by integrating the stack monitor release rate over the considered time period. If no activity was detected between the stack grab sample and a significant increase in hourly averages was recorded, the nuclide relative abundance of the last sample (or the last similar event), which indicated the presence of activity, was used to obtain nuclide specific activities. Correction factors for the monitors are derived and applied for each sampling period whenever noble gas radionuclides are detected in the effluent stream.

b. Particulate and Radioiodine (I-131 & I-133)

Particulates, Iodine-131 and Iodine-133 are continuously sampled from the three release points using a particulate filter and charcoal cartridge in line with a sample pump (stack monitor pump). These filters and charcoal cartridges are removed and analyzed in accordance with the frequencies specified in Table 1F. Analysis is performed to identify and quantify radionuclides using high purity germanium detectors coupled to computerized pulse height analyzers. Given the nuclide specific activity concentrations, process flow rate, and duration of the sample, the nuclide specific activity released to the environment can be obtained. Due to the continuous sampling process, it is assumed that the radioactive material is released to the environment at a constant rate within the sampling period. Strontium-89 and Strontium-90 (Sr-89 and Sr-90)

are quantitatively analyzed by counting by scintillation techniques (Cherenkov counting). Gross alpha analysis is performed using a zinc sulfide scintillation counter.

c. Tritium

Tritium grab samples are obtained from the three gaseous release points at the specified frequencies listed in Table 1F using an ice bath condensation collection method. The collected sample is then analyzed using a liquid scintillation counter. Given the tritium concentration, process flow rate, and time period for which the sample is obtained, the tritium activity released to the environment can be determined. Due to the frequency of sampling, it is assumed that the tritium is released to the environment at a constant rate within the time period for which the sample is obtained.

d. Carbon-14 (C-14)

C-14 release details are discussed in Section VI.

e. Nickel-63

Upon reviewing recent River Bend Station solid radwaste disposal information, the decision was made to analyze for Nickel-63 in the gaseous and liquid effluent pathways. In the fourth quarter 2011, Nickel-63 was quantified in the Fuel Building composite stack samples. An additional aliquot was counted which confirmed the result. A subsequent sample was also analyzed for Iron-55 producing results less than the minimum detectable concentration. A second verification sample has not been analyzed for Nickel-63. Since final verification cannot be made prior to the submittal of this report, Nickel-63 is included in the gaseous curie and dose calculations for 2011. Nickel-63 was not detected in the liquid effluent composite sample.

2. Liquid Effluent

Representative grab samples are obtained from the appropriate sample recovery tank and analyzed prior to release of the tank in accordance with the frequencies listed in Table 2E. Analysis for gamma emitting nuclides (including dissolved and entrained noble gases) is performed using a high purity germanium detector coupled to a computerized pulse height analyzer. Tritium concentration is determined using a liquid scintillation counter. Strontium-89 and Strontium-90 are quantitatively analyzed by scintillation techniques (Cherenkov counting). Iron-55 is counted with a

liquid scintillation counter after digestion of the iron. Gross alpha analysis is performed using a zinc sulfide scintillation counter. The activity of each nuclide released to the environment is determined from the nuclide specific concentration and total tank volume released. A spot-check was made for Nickel-63 with liquid scintillation method in the third quarter 2011. The result was less than the minimum detectable concentration.

D. Batch Releases

1. Liquid Effluents

Batch releases and receiving stream flow from River Bend Station during the reporting period of January 1, 2011, through December 31, 2011 are shown in Table 2D.

The Mississippi River stream flow is obtained by averaging data from the U. S. Army Corp of Engineers website using flow gauge data at Tarbert Landing.

2. Gaseous Effluents

There were no routine batch releases of gaseous effluents from River Bend Station during the reporting period of January 1, 2011, through December 31, 2011.

E. Abnormal Releases

Number of abnormal liquid releases: 1

In December 2011, a positive tritium sample result was confirmed for a groundwater monitoring sample from well PZ-01 located near the Field Administration Building. The result was 48,244 pCi/L. No gamma emitters or hard-to-detect radioisotopes were detected. This release is discussed in more detail in Section XVI.

Number of abnormal gaseous releases: 1

On September 15, 2011, it was identified that a potential unmonitored release pathway could be occurring due to the fact that the Turbine Building ventilation at the 67-foot elevation was positive with respect to the C-Tunnel. The C-Tunnel discharge is through the Normal Switchgear Building, which is not a monitored gaseous release point. It is not known for certain if activity was actually released via this building vent. An effluent dose calculation was performed that demonstrated that if the activity in C-Tunnel was actually released from the Normal Switchgear Building for an entire year, any dose to the public released via this pathway would be

less than 10 percent of normal effluents and is considered insignificant per Regulatory Guide 1.109.

The probable cause of the C-Tunnel being more negative than the Turbine Building was determined to be a severely degraded intake filter. Maintenance was performed on the filter correcting the flow imbalance from the Turbine Building 67' into the C-Tunnel. Additional long-term maintenance practices were reviewed and revised.

F. Estimate of Total Error

1. Liquid

The maximum error associated with sample collection, laboratory analysis, and discharge volume is collectively estimated to be:

Fission and Activation Products: $\pm 14.2\%$

Tritium: $\pm 14.2\%$

Dissolved and Entrained Noble Gases: $\pm 14.2\%$

Gross Alpha Radioactivity: $\pm 14.2\%$

2. Gaseous

The maximum error (not including sample line loss) associated with sample flow, process flow, sample collection, monitor accuracy and laboratory analysis are collectively estimated to be:

Noble Gases: $\pm 37.0\%$

Iodines : $\pm 18.6\%$

Particulate: $\pm 18.6\%$

Tritium: $\pm 18.2\%$

3. Determination of Total Error

The total error (i.e., collective error due to sample collection, laboratory analysis, sample flow, process flow, monitor accuracy, etc.) is calculated using the following equation:

$$E_T = \sqrt{((E_1)^2 + (E_2)^2 + \dots(E_n)^2)}$$

where:

E_T = total error

$E_1, E_2 \dots E_n$ = individual errors due to sample collection, laboratory analysis, sample flow, process flow, monitor accuracy, etc.

III. GASEOUS EFFLUENT SUMMARY INFORMATION

Refer to the Table 1 series for the summation of gaseous releases. It should be noted that an entry of "0.00E+00" Curie (Ci) or microcurie/second (uCi/sec) in this section indicates that the concentration of the particular radionuclide was below the Lower Limit of Detection (LLD) as listed in Table 1F. Also, any nuclide not appearing in the tables was < LLD for all four quarters.

IV. LIQUID EFFLUENT SUMMARY INFORMATION

Refer to the Table 2 series for the summation of liquid releases. It should be noted that an entry of "0.00E+00" Ci or uCi/ml in this section indicates that the concentration of the particular radionuclide was below the Lower Limit of Detection (LLD) as listed in Table 2E. Also, any nuclide not appearing in the tables was < LLD for all four quarters.

V. SOLID WASTE

Refer to Table 3, for Solid Waste and Irradiated Fuel Shipments.

VI. RADIOLOGICAL IMPACT ON MAN (40CFR190)

An assessment (see summary below) was made of radiation doses to the likely most-exposed member of the public from River Bend and other nearby uranium fuel cycle sources (none within five miles). The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC, due to releases of radioactivity and to radiation from uranium fuel cycle sources, shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

Carbon-14 (C-14)

The bounding annual dose from C-14 was calculated using guidance from Regulatory Guide 1.21, Revision 2, and the methodology in Regulatory Guide 1.109, Appendix C and Appendix E. The C-14 source term of 11 curies was taken from the site calculation PR(C)-359-3A, Gaseous Releases per NUREG-0016 Revision 1. Carbon-14 does not have dose factors associated with standing on contaminated ground; therefore, no ground plane dose was calculated. There is no milk pathway within five miles of River Bend Station so this pathway is not evaluated. RBS does not take credit for decay in the X/Q. This calculation assumes the inhalation, meat and vegetation pathways are at the site boundary in the sector with the highest X/Q. The dose from liquid effluents is not calculated as the dose contribution from C-14 is considered to be insignificant as indicated in Regulatory Guide

1.21, Revision 2. According to EPRI 1021106, Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents, 95% of the carbon released is in the form of carbon dioxide and this contributes the highest dose to man. The ingestion pathway, specifically vegetation, is the most likely route of intake for man. An assumption has been made for gaseous releases that plants obtain all of their C-14 from carbon dioxide.

Dose not including C-14:

Organ	mrem
Total Body	7.80E-02
Skin	7.62E-02
Thyroid	1.30E-01
Other Organ	7.85E-02

Bounding Dose from C-14 only:

Organ	mrem
Total Body	9.39E-01
Skin	0.00E+00
Thyroid	9.39E-01
Other Organ (Bone)	4.70E+00

In addition, an assessment of doses was made for members of the public due to their activities inside the site boundary. Parameters and assumptions used to make this determination can be found in Table 4. The results of the calculations can be found in Table 5. The maximally exposed member of the public was an employee staying at RBS during the week and is conservatively calculated to have stayed at least four days per week for 50 weeks. It should be noted that liquid effluent pathway dose was not considered since these individuals would not engage in activities that would allow exposure to this pathway.

VII. METEOROLOGICAL DATA

See Tables 6 and 7 for the cumulative joint frequency distributions and annual average data for continuous releases. The meteorological recovery for 2011 was 96.8 %.

VIII. RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION OPERABILITY

The 2011 Technical Requirements Manual (TRM) 3.3.11.2 instrumentation Limited Condition of Operation was reviewed to see if RBS had entered Action E.2. Two entries into Action E.2 were found for Technical Requirement 3.3.11.2 occurring on February 2, 2011, and July 24, 2011. Each entry declared CWS-FE-113 (Cooling Tower Blowdown

Line Flow Element) inoperability. No liquid radwaste discharges occurred during either of the times that Action E.2 was entered.

CWS-FE-113 had repeated cases of intermittent alarms from low flow indications in the Auxiliary Control Room flow recorder. Troubleshooting was performed, using station surveillance test procedures, to determine the cause of the alarms. Due to the intermittent nature of the alarms, it was difficult determining the exact cause of the low flow indications. A continuation of intermittent alarms led to an extensive investigation and troubleshooting process for the entry dated July 24, 2012. A number of issues were identified and corrected which led to a significant improvement in CWS-FR113 (flow recorder) performance. The probable cause for the erratic readings was eventually determined to be poor conduction caused by corrosion and weak connections in the analog circuit. The circuit has been in service since plant startup, and parts of the circuit are located in a dark, damp, sometimes underwater, environment which most likely accelerated the corrosion at the connections. No additional issues have been documented since the repairs were completed.

IX. RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION OPERABILITY

The minimum number of channels required to be OPERABLE as described in Table 3.3.11.3-1 of Technical Requirement 3.3.11.3 were, if inoperable at any time in the period January 1, 2011, through December 31, 2011, restored to operable status within the required time. Reporting of inoperable channels is therefore not required in this report.

X. LIQUID HOLD UP TANKS

The maximum quantity of radioactive material, excluding tritium and dissolved or entrained noble gases, contained in any unprotected outdoor tank during the period of January 1, 2011, through December 31, 2011 was less than or equal to the 10 curie limit as required by Technical Specification 5.5.8.b.

XI. RADIOLOGICAL ENVIRONMENTAL MONITORING

There were no changes to the Radiological Environmental Monitoring Program during the reporting period January 1, 2011, through December 31, 2011.

XII. LAND USE CENSUS

The Land Use Census was not conducted in 2011. The next scheduled land use census as required by Technical Requirements Manual (TRM) (TR 3.12.2) is in 2012.

XIII. OFFSITE DOSE CALCULATION MANUAL (ODCM)

There were no changes to the ODCM in 2011.

XIV. MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS, AND SOLID WASTE TREATMENT SYSTEMS

Engineering performed a review of the Asset Suite database to evaluate non-administrative design changes completed or partially completed during 2011 involving the subject systems (i.e. changes classified as evaluations or nuclear changes). These design changes were then reviewed to determine if there have been any major changes to the subject systems. The review was based on a major change being defined as a modification which affected the method of processing or the effluent from the system. Also, to be a "major change" the change must have affected the USAR.

The Engineering Changes (EC's) to liquid, solid or gaseous radwaste systems implemented during this time period were:

EC 1382 "Install Fan Belt Guards over Belts and Pulleys of N64-PNLPL001 and 2" – this engineering change did not affect the method of gaseous radwaste processing as the guard was installed on the exterior of the component as a personnel safety measure and did not change the function, capacity or other parameter of the component and did not affect the USAR.

EC 23473 "De-Activate Auxiliary Control Room Alarms Associated with Deferred Equipment" – this engineering change did not affect the method of liquid or solid radwaste processing as the alarms were associated with equipment deferred during construction and not discussed in the USAR.

No EC was identified as being completed during this time period that modified any radioactive waste system major component such that the processing method or effluent was changed. Also, no changes were identified affecting the method of processing solid, liquid or gaseous waste or the isotopic composition or the quantity of liquid, solid, or gaseous waste as described in the USAR.

In conclusion, no design changes were completed during the specified time period that constituted a major change to either the liquid, solid or gaseous radwaste treatment systems.

XV. PROCESS CONTROL PROGRAM (PCP)

The PCP (EN-RW-105) was revised in 2011. The changes were editorial in nature. A copy is in Attachment 1.

XVI. INDUSTRY GROUND WATER PROTECTION INITIATIVE (GPI) – FINAL GUIDANCE DOCUMENT (NEI 07-07) OBJECTIVE ANNUAL REPORTING

Ground water samples for gamma radiation and tritium were taken in support of the GPI. These samples are not part of the Radiological Environmental Monitoring Program. The sample results for 2011 are located in Table 8.

In December 2011, a positive groundwater sample was confirmed in monitoring well PZ-01. Only tritium (48,245 pCi/L/4.82E-05 uCi/mL) was identified in the sample. Followup sampling has also been around this general concentration. This was the first positive groundwater sample since RBS began sampling to support the NEI groundwater protection initiative in the third quarter 2007. Voluntary communications to State and Local stakeholders was performed as required by NEI 07-07. A multi-disciplinary team was assembled to investigate and determine the source of the tritium. As of the writing of this annual report the source has not been determined. Once the source is determined, procedures or measures will be adopted to prevent recurrence of this or similar incidents as applicable. Additional monitoring wells are being installed and buried piping inspections are being performed to identify the source and determine followup actions.

The estimated dose to the public is less than the 10CFR50 Appendix I levels. It is estimated that it will take approximately 16 years for the activity detected in monitoring well PZ-01 to leave the owner controlled area and to reach the Mississippi River. The current understanding of the groundwater hydrology is that this activity will flow via the Upland Terrace aquifer to the Mississippi River alluvial aquifer and into the Mississippi River and will not affect offsite wells in the vicinity of River Bend Station. The nearest known drinking water supply that could be affected by the activity detected in PZ-01 is many miles downstream in the Mississippi River below Baton Rouge, LA. Due to the significant dilution volume of the Mississippi River, it is highly unlikely that the concentration of tritium detected in well PZ-01 will have any meaningful impact offsite.

All of the remaining samples taken in support of the GPI were less than the Lower Limit of Detection as required in Technical Requirement 3.12.1 (Environmental LLDs) except for some gamma samples in the second quarter 2011. The failure to meet the required LLDs was due to equipment availability and laboratory capacity. Actions were taken to prevent reoccurrence of this situation.

TABLE 1A
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
1. Total Release	Ci	2.67E+01	2.35E+01	1.17E+01	2.15E+01	8.34E+01
2. Avg. Release Rate	uCi/sec	3.44E+00	2.98E+00	1.48E+00	2.70E+00	2.64E+00
3. % Applicable Limit % (1)		2.57E-01	3.72E-01	1.26E-01	1.69E-01	4.62E-01
Iodine-131						
1. Total Release	Ci	2.64E-04	4.03E-04	2.03E-04	4.17E-04	1.29E-03
2. Avg. Release Rate	uCi/sec	3.40E-05	5.12E-05	2.56E-05	5.24E-05	4.08E-05
3. % Applicable Limit % (2)		1.60E-01	1.73E-01	8.68E-02	1.77E-01	2.98E-01
Particulates Half Life >= 8 days						
1. Total Release	Ci	1.65E-04	6.02E-04	5.68E-04	3.28E-04	1.66E-03
2. Avg. Release Rate	uCi/sec	2.12E-05	7.66E-05	7.14E-05	4.12E-05	5.27E-05
3. % Applicable Limit % (2)		1.09E-02	3.52E-02	2.01E-02	3.31E-02	4.94E-02
Tritium						
1. Total Release	Ci	5.50E+00	3.64E+00	3.05E+00	3.08E+00	1.53E+01
2. Avg. Release Rate	uCi/sec	7.07E-01	4.63E-01	3.84E-01	3.88E-01	4.84E-01
3. % Applicable Limit % (2)		1.80E-01	1.15E-01	7.71E-02	8.27E-02	2.27E-01
Carbon-14						
1. Total Release	Ci	2.72E+00	2.74E+00	2.77E+00	2.77E+00	1.10E+00
2. Avg. Release Rate	uCi/sec	3.50E-01	3.49E-01	3.48E-01	3.48E-01	3.49E-01
3. % Applicable Limit % (2)		1.15E+01	1.56E+01	1.57E+01	1.57E+01	2.71E+01

1) Either the gamma air dose limit of 5 mrad/qtr or beta air dose limit of 10 mrad/qtr (T.R. 3.11.2.2.a), which ever is most limiting.

2) The % of applicable limit is determined by comparing the dose contribution to the critical organ limits of TRM 3.11.2.3

TABLE 1B
GASEOUS EFFLUENTS - GROUND RELEASES - CONTINUOUS MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
XE-133	Ci	5.97E-01	0.00E+00	0.00E+00	0.00E+00	5.97E-01
XE-133M	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	Ci	1.27E+00	2.52E+00	5.23E-01	4.33E-01	4.75E+00
XE-135M	Ci	3.50E-01	1.06E+00	4.13E-01	3.64E-01	2.19E+00
Totals for Period...	Ci	2.22E+00	3.58E+00	9.36E-01	7.98E-01	7.54E+00
Iodines						
I-131	Ci	4.79E-05	2.04E-06	0.00E+00	0.00E+00	4.99E-05
I-133	Ci	3.94E-06	0.00E+00	0.00E+00	0.00E+00	3.94E-06
Totals for Period...	Ci	5.18E-05	2.04E-06	0.00E+00	0.00E+00	5.39E-05
Particulates Half Life >= 8 days						
CE-141	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-57	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CR-51	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-59	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MN-54	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NB-95	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	Ci	0.00E+00	0.00E+00	0.00E+00	4.94E-07	4.94E-07
RU-103	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-106	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ZN-65	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Totals for Period...	Ci	0.00E+00	0.00E+00	0.00E+00	4.94E-07	4.94E-07
Tritium						
H-3	Ci	2.45E+00	1.55E+00	9.87E-01	1.08E+00	6.07E+00

TABLE 1C
GASEOUS EFFLUENTS - GROUND RELEASES - BATCH MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
XE-133	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135M	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Totals for Period...	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines						
I-131	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Totals for Period...	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates Half Life >= 8 days						
BA-140	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MN-54	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-90	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ZN-65	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Totals for Period...	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium						
H-3	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 1D

GASEOUS EFFLUENTS - MIXED MODE RELEASES - CONTINUOUS MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
AR-41	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	Ci	2.07E+00	5.38E-01	0.00E+00	1.26E-01	2.73E+00
KR-87	Ci	5.77E-01	0.00E+00	0.00E+00	0.00E+00	5.77E-01
KR-88	Ci	6.10E-01	1.48E+00	0.00E+00	0.00E+00	2.09E+00
XE-131M	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	Ci	6.90E-01	5.14E-01	3.54E-01	9.54E-01	2.51E+00
XE-133M	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-135	Ci	1.09E+01	7.73E+00	3.84E+00	8.23E+00	3.07E+01
XE-135M	Ci	8.39E+00	9.62E+00	6.61E+00	1.13E+01	3.60E+01
XE-137	Ci	3.82E-01	0.00E+00	0.00E+00	0.00E+00	3.82E-01
XE-138	Ci	9.15E-01	0.00E+00	0.00E+00	0.00E+00	9.15E-01
Totals for Period...	Ci	2.45E+01	1.99E+01	1.08E+01	2.07E+01	7.59E+01
Iodines						
I-131	Ci	2.17E-04	4.00E-04	2.03E-04	4.17E-04	1.24E-03
I-133	Ci	9.13E-04	3.02E-03	1.74E-03	2.87E-03	8.54E-03
Totals for Period...	Ci	1.13E-03	3.42E-03	1.94E-03	3.29E-03	9.78E-03
Particulates Half Life >= 8 days						
BA-140	Ci	7.48E-05	3.14E-04	3.24E-04	1.81E-04	8.94E-04
CE-139	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CE-141	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-58	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CR-51	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-134	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-59	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MN-54	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU-103	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-89	Ci	9.04E-05	2.88E-04	2.44E-04	1.47E-04	7.69E-04
SR-90	Ci	0.00E+00	6.79E-09	2.30E-07	8.70E-09	2.46E-07
ZN-65	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Totals for Period...	Ci	1.65E-04	6.02E-04	5.68E-04	3.27E-04	1.66E-03

TABLE 1D (continued)
GASEOUS EFFLUENTS - MIXED MODE RELEASES - CONTINUOUS MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Tritium						
H-3	Ci	3.04E+00	2.09E+00	2.06E+00	2.01E+00	9.20E+00
Carbon-14						
C-14	Ci	2.72E+00	2.74E+00	2.77E+00	2.77E+00	1.10E+01

Table 1E
SUPPLEMENTAL INFORMATION
GASEOUS EFFLUENTS - BATCH MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Number of releases		0	0	0	0	0
Total release time	minutes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Maximum release time	minutes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average release time	minutes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Minimum release time	minutes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 1F
RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) uCi/ml
A. Main Plant Exhaust Duct	M Grab Sample	M	Principal Gamma Emitters	1.00E-04
			H-3	1.00E-06
B. Fuel Building Ventilation Exhaust Duct	M Grab Sample	M	Principal Gamma Emitters	1.00E-04
			H-3	1.00E-06
C. Radwaste Building Ventilation Exhaust Duct	M Grab Sample	M	Principal Gamma Emitters	1.00E-04
D. All Release Types as listed in A, B, & C above	Continuous	W Charcoal Sample	I-131	1.00E-12
			I-133	1.00E-10
	Continuous	W Particulate Sample	Principal Gamma Emitters (I-131, Others)	1.00E-11
	Continuous	M Composite Particulate Sample	Gross Alpha	1.00E-11
	Continuous	Q Composite Particulate Sample	Sr-89, Sr-90	1.00E-11
	Continuous	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1.00E-06

W = At least once per 7 days

M = At least once per 31 days

Q = At least once per 92 days

Table 1G
GASEOUS ANNUAL DOSE SUMMARY REPORT

=== I&P DOSE LIMIT ANALYSIS =====

Period-Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Q1 - T.Spec Any Organ	CHILD	THYROID	2.63E-02	7.50E+00	3.51E-01
Q2 - T.Spec Any Organ	CHILD	THYROID	2.42E-02	7.50E+00	3.23E-01
Q3 - T.Spec Any Organ	CHILD	THYROID	1.38E-02	7.50E+00	1.83E-01
Q4 - T.Spec Any Organ	CHILD	THYROID	2.20E-02	7.50E+00	2.93E-01
Yr - T.Spec Any Organ	CHILD	THYROID	8.62E-02	1.50E+01	5.75E-01

Carbon-14 (Bounding calculation)

Q1 - T.Spec Any Organ	CHILD	BONE	1.16E+00	7.50E+00	1.55E+01
Q2 - T.Spec Any Organ	CHILD	BONE	1.17E+00	7.50E+00	1.56E+01
Q3 - T.Spec Any Organ	CHILD	BONE	1.18E+00	7.50E+00	1.57E+01
Q4 - T.Spec Any Organ	CHILD	BONE	1.18E+00	7.50E+00	1.57E+01
Yr - T.Spec Any Organ	CHILD	BONE	4.70E+00	1.50E+01	3.13E+01

=== NG DOSE LIMIT ANALYSIS =====

Period-Limit	Dose (mrad)	Limit (mrad)	% of Limit
Q1 - T.Spec Gamma	1.29E-02	5.00E+00	2.57E-01
Q1 - T.Spec Beta	1.11E-02	1.00E+01	1.11E-01
Q2 - T.Spec Gamma	1.86E-02	5.00E+00	3.72E-01
Q2 - T.Spec Beta	1.27E-02	1.00E+01	1.27E-01
Q3 - T.Spec Gamma	6.31E-03	5.00E+00	1.26E-01
Q3 - T.Spec Beta	3.67E-03	1.00E+01	3.67E-02
Q4 - T.Spec Gamma	8.45E-03	5.00E+00	1.69E-01
Q4 - T.Spec Beta	4.92E-03	1.00E+01	4.92E-02
Yr - T.Spec Gamma	4.62E-02	1.00E+01	4.62E-01
Yr - T.Spec Beta	3.24E-02	2.00E+01	1.62E-01

TABLE 2A

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
1. Total Release	Ci	9.61E-05	1.71E-04	1.89E-04	0.00E+00	4.56E-04
2. Avg. Diluted Conc.	uCi/ml	9.50E-11	1.21E-10	1.30E-10	0.00E+00	8.57E-11
3. % Applicable Limit	% (1)	1.08E-04	2.98E-05	2.23E-05	0.00E+00	6.00E-05
Tritium						
1. Total Release	Ci	9.04E+00	1.20E+01	7.17E+00	0.00E+00	2.82E+01
2. Avg. Diluted Conc.	uCi/ml	8.94E-06	8.53E-06	4.91E-06	0.00E+00	5.30E-06
3. % Applicable Limit	% (1)	1.23E-04	2.08E-04	8.40E-05	0.00E+00	1.47E-04
Dissolved and Entrained Gases						
1. Total Release	Ci	5.28E-03	9.94E-03	2.82E-03	0.00E+00	1.80E-02
2. Avg. Diluted Conc.	uCi/ml	5.22E-09	7.07E-09	1.94E-09	0.00E+00	3.39E-09
3. % Applicable Limit	% (2)	2.61E-03	3.55E-03	9.66E-04	0.00E+00	1.70E-03
Gross Alpha Radioactivity						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Volume of liquid waste	liters	9.05E+05	1.60E+06	1.09E+06	0.00E+00	3.60E+06
Volume of dil. water	liters	1.01E+09	1.40E+09	1.46E+09	1.44E+09	5.31E+09

(1) The most limiting dose compared to the total body and critical organ limits of TRM 3.11.1.2.a.

(2) Technical Requirement 3.11.1.1 limit of 2.00E-04 uCi/ml for dissolved and entrained noble gases in liquid effluent.

TABLE 2B
LIQUID EFFLUENTS - CONTINUOUS MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Gases						
** No Nuclide Activities **	
Tritium						
** No Nuclide Activities **	
Dissolved and Entrained Gases						
** No Nuclide Activities **	
Gross Alpha Radioactivity						
** No Nuclide Activities **	

TABLE 2C

LIQUID EFFLUENTS - BATCH MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
CO-60	Ci	8.71E-05	1.71E-04	1.89E-04	0.00E+00	4.47E-04
MN-54	Ci	8.98E-06	0.00E+00	0.00E+00	0.00E+00	8.98E-06
Totals for Period...	Ci	9.61E-05	1.71E-04	1.89E-04	0.00E+00	4.56E-04
Tritium						
H-3	Ci	9.04E+00	1.20E+01	7.17E+00	0.00E+00	2.82E+01
Dissolved and Entrained Gases						
XE-133	Ci	2.27E-03	4.73E-03	1.10E-03	0.00E+00	8.10E-03
XE-133M	Ci	0.00E+00	1.38E-04	0.00E+00	0.00E+00	1.38E-04
XE-135	Ci	3.01E-03	5.07E-03	1.72E-03	0.00E+00	9.81E-03
Totals for Period...	Ci	5.28E-03	9.94E-03	2.82E-03	0.00E+00	1.80E-02
Gross Alpha Radioactivity						
** No Nuclide Activities **	

Table 2D
 SUPPLEMENTAL INFORMATION
 LIQUID EFFLUENTS - BATCH MODE

REPORT FOR 2011	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Number of releases		18	29	20	0	67
Total release time	minutes	6.02E+03	1.07E+04	7.48E+03	0.00E+00	2.42E+04
Maximum release time	minutes	4.00E+02	4.00E+02	4.35E+02	0.00E+00	4.35E+02
Average release time	minutes	3.35E+02	3.67E+02	3.74E+02	0.00E+00	3.61E+02
Minimum release time	minutes	1.08E+02	3.27E+02	3.06E+02	0.00E+00	1.08E+02

		<u>QTR 1</u>	<u>QTR 2</u>	<u>QTR 3</u>	<u>QTR 4</u>
Average Mississippi River stream flow during periods of release of effluent into a flowing stream	ft ³ /sec	478,656	1,097,297	439,228	438,652

TABLE 2E
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) uCi/ml
A. Batch Waste Release (Liquid Radwaste Recovery Sample Tanks)	P Each Batch	P Each Batch	Principal Gamma Emitters: <u>except</u> for Ce-144	5.00E-07
				5.00E-06
			I-131	1.00E-06
	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1.00E-05
	P Each Batch	M Composite	H-3	1.00E-05
			Gross Alpha	1.00E-07
	P Each Batch	Q Composite	Sr-89, Sr-90	5.00E-08
			Fe-55	1.00E-06

P = Prior to each radioactive release

M = At least once per 31 days

Q = At least once per 92 days

Table 2F
LIQUID ANNUAL DOSE SUMMARY REPORT

Report for: 2011

Release ID: 10 All Liquid Release Points

Liquid Receptor

=== SITE DOSE LIMIT ANALYSIS =====

Period - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
Qtr 1 - T.Spec Any Organ	ADULT	GILLI	7.24E-06	5.00E+00	1.45E-04
Qtr 1 - T.Spec Total Body	ADULT	TBODY	2.22E-06	1.50E+00	1.48E-04
Qtr 2 - T.Spec Any Organ	ADULT	GILLI	4.61E-06	5.00E+00	9.22E-05
Qtr 2 - T.Spec Total Body	ADULT	TBODY	3.30E-06	1.50E+00	2.20E-04
Qtr 3 - T.Spec Any Organ	ADULT	GILLI	2.38E-06	5.00E+00	4.75E-05
Qtr 3 - T.Spec Total Body	ADULT	TBODY	1.39E-06	1.50E+00	9.28E-05
Qtr 4 - T.Spec Any Organ	ADULT	GILLI	0.00E+00	5.00E+00	0.00E+00
Qtr 4 - T.Spec Total Body	ADULT	TBODY	0.00E+00	1.50E+00	0.00E+00
2011 - T.Spec Any Organ	ADULT	GILLI	1.04E-05	1.00E+01	1.04E-04
2011 - T.Spec Total Body	ADULT	TBODY	4.90E-06	3.00E+00	1.63E-04

TABLE 3
Solid Waste and Irradiated Fuel Shipments
Reporting Period from 01/01/11 to 12/31/11

A. Solid Waste Shipped for Burial or Disposal (Not Irradiated Fuel)

1. <u>Type of Waste</u>	<u>Units</u>	<u>12 Month Period</u>	<u>Waste Class</u>	<u>Estimated Error %</u>
Spent Resins, Filter	m3	4.88E+01	A	± 25%
Sludges, Evaporator	Ci	1.01E+02	A	
Bottoms, Etc.	m3	0.00E+00	B	
	Ci	0.00E+00	B	
	m3	0.00E+00	C	
	Ci	0.00E+00	C	
<hr/>				
Dry Compressible Wastes,	m3	6.22E+02	A	± 25%
Contaminated Equipment	Ci	6.30E-01	A	
Etc.				
<hr/>				
Irradiated Components,	m3	0.00E+00		
Control Rods, Etc.	Ci	0.00E+00		
<hr/>				
Other	m3	1.95E+01	A	± 25%
(Water, EHC, Waste Oil,	Ci	5.10E-02	A	
etc.)				
<hr/>				

**Effluent and Waste Disposal Annual Report 2011 Year
Solid Waste and Irradiated Fuel Shipments
Reporting Period from 01/01/11 to 12/31/11
Table 3 (continued)**

2. Estimates of Major Nuclides by Waste Stream

Resins, Filters, Evaporator Bottoms, Etc. (Min 1%)			Dry Compressible Wastes, Contaminated Equipment, Etc. (Min 1%)			Other Water, EHC, Waste Oil, Etc. (Min 1%)		
Isotope	% Abundance	Curies	Isotope	% Abundance	Curies	Isotope	% Abundance	Curies
FE-55	49.135	4.96E+01	FE-55	56.055	3.53E-01	FE-55	56.081	2.86E-02
CO-60	35.621	3.60E+01	CO-60	39.436	2.49E-01	CO-60	39.319	2.01E-02
ZN-65	5.730	5.78E+00	MN-54	2.156	1.36E-02	MN-54	2.190	1.12E-03
NI-63	5.021	5.07E+00						
MN-54	1.870	1.89E+00						
CS-137	1.337	1.35E+00						

No Control Rods, Etc. were shipped in 2011

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
17	Truck	Energy Solutions (Bear Creek) - Oak Ridge, TN
5	Truck	Energy Solutions (Gallaher) - Oak Ridge, TN
7	Truck	Clive Disposal Facility (Containerized) - Clive, UT

B. Irradiated Fuel Shipments Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
0	N/A	N/A

TABLE 4
ASSUMPTIONS/PARAMETERS FOR DOSES TO
A MEMBER OF THE PUBLIC INSIDE SITE BOUNDARY

MEMBER OF THE PUBLIC	LOCATION	DISTANCE ⁽¹⁾ METERS	SECTOR	DURATION (HR/YEAR) ⁽²⁾
People Entering Site Without Consent	Alligator Bayou	2500	SW	40
National Guard	Activity Center	994	WNW	0 ⁽³⁾
Workers staying onsite	Activity Center Trailer City	994	WNW	2400 ⁽⁴⁾

- (1) The approximate distances from main plant vent exhaust to location.
- (2) Liquid dose pathway is not considered due to the nature of activities that individuals are engaged in.
- (3) National Guard/State Police are being evaluated, if applicable, for dose while stationed on site as members of the public. The adult age group is the only age group considered in this category. No National Guard in 2011.
- (4) Workers began staying at the Activity Center Trailer City beginning April 10, 2007 and have been permitted to stay long term. During refueling outages additional workers were on site for about 60 days. The long term individuals will be the receptors for this pathway. For 2011, this conservative estimate is based on 12 hours per day, 4 days per week for 50 weeks, totaling 2400 hours. The adult age group is the only age group considered for this activity.

TABLE 5
DOSES TO MEMBERS OF THE PUBLIC ON SITE
FROM GASEOUS RELEASES 2011

	<u>Critical Organ Dose Annual (mrem)</u>	<u>Total Body Dose Annual (mrem)</u>	<u>Skin Dose Annual (mrem)</u>	<u>Annual Duration Factor</u>
Alligator Bayou	3.15E-05	1.08E-04	1.80E-04	4.57E-03
Workers staying onsite	4.30E-03	1.19E-02	2.09E-02	2.74E-01

Table 6
2011 Year Meteorological Data - Joint Frequency Tables

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 ALL STABILITY CLASSES

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	77	65	60	109	102	178	77	1	0	0	0	0	669
NNE	72	26	57	88	90	103	12	0	0	0	0	0	448
NE	84	48	45	85	85	67	19	0	0	0	0	0	433
ENE	56	69	53	79	61	63	17	0	0	0	0	0	398
E	55	72	62	67	37	16	1	0	0	0	0	0	310
ESE	31	48	54	101	59	44	3	0	0	0	0	0	340
SE	25	57	92	214	212	219	35	1	0	0	0	0	855
SSE	13	18	47	164	180	277	164	8	0	0	0	0	871
S	16	27	41	139	161	289	262	14	0	0	0	0	949
SSW	24	27	54	100	94	99	89	4	0	0	0	0	491
SW	16	27	56	65	50	66	24	0	0	0	0	0	304
WSW	11	18	26	46	72	119	16	0	0	0	0	0	308
W	34	44	41	41	77	94	7	0	0	0	0	0	338
WNW	47	79	41	45	64	108	37	0	0	0	0	0	421
NW	64	85	64	69	59	102	95	7	0	0	0	0	545
NNW	72	99	66	59	62	158	129	8	0	0	0	0	653
TOTAL	697	809	859	1471	1465	2002	987	43	0	0	0	0	8333

NUMBER OF CALMS: 148
 NUMBER OF INVALID HOURS: 279
 NUMBER OF VALID HOURS: 8481
 TOTAL HOURS FOR THE PERIOD: 8760

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS A

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22- .50	.51- .75	.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	>18	TOT.
N	0	0	0	0	4	14	15	0	0	0	0	0	33
NNE	0	0	0	0	3	17	4	0	0	0	0	0	24
NE	0	0	1	0	8	13	5	0	0	0	0	0	27
ENE	0	0	2	2	9	15	2	0	0	0	0	0	30
E	0	0	1	6	9	5	0	0	0	0	0	0	21
ESE	0	0	0	6	10	14	1	0	0	0	0	0	31
SE	0	1	1	3	16	69	10	0	0	0	0	0	100
SSE	0	0	0	0	3	16	33	2	0	0	0	0	54
S	0	0	0	0	0	17	44	1	0	0	0	0	62
SSW	0	0	1	0	0	1	12	1	0	0	0	0	15
SW	0	0	0	0	3	6	4	0	0	0	0	0	13
WSW	0	0	0	4	1	11	1	0	0	0	0	0	17
W	0	0	1	0	4	3	0	0	0	0	0	0	8
WNW	0	0	0	1	3	11	8	0	0	0	0	0	23
NW	0	1	0	2	1	1	14	2	0	0	0	0	21
NNW	0	0	1	1	3	6	10	2	0	0	0	0	23
TOTAL	0	2	8	25	77	219	163	8	0	0	0	0	502

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 502
 TOTAL HOURS FOR THE PERIOD: 502

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS B

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
N	0	0	0	1	0	5	7	0	0	0	0	0	13
NNE	0	0	0	0	6	6	0	0	0	0	0	0	12
NE	0	0	0	0	3	4	0	0	0	0	0	0	7
ENE	0	0	0	1	6	3	0	0	0	0	0	0	10
E	0	0	1	0	2	1	0	0	0	0	0	0	4
ESE	0	0	0	3	4	3	0	0	0	0	0	0	10
SE	0	0	0	1	9	14	5	0	0	0	0	0	29
SSE	0	0	0	1	4	13	18	1	0	0	0	0	37
S	0	1	1	1	0	7	28	1	0	0	0	0	39
SSW	0	0	0	0	0	3	10	1	0	0	0	0	14
SW	1	0	0	1	1	4	4	0	0	0	0	0	11
WSW	0	0	0	0	1	10	3	0	0	0	0	0	14
W	0	0	0	0	2	6	1	0	0	0	0	0	9
WNW	0	0	0	0	0	8	3	0	0	0	0	0	11
NW	0	0	0	1	1	1	7	1	0	0	0	0	11
NNW	0	0	0	0	1	4	9	2	0	0	0	0	16
TOTAL	1	1	2	10	40	92	95	6	0	0	0	0	247

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 247
 TOTAL HOURS FOR THE PERIOD: 247

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS C

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
N	0	0	0	0	2	8	3	0	0	0	0	0	13
NNE	0	0	0	1	3	13	1	0	0	0	0	0	18
NE	0	0	0	0	3	7	1	0	0	0	0	0	11
ENE	0	0	0	2	5	2	0	0	0	0	0	0	9
E	0	0	1	4	0	1	0	0	0	0	0	0	6
ESE	0	0	1	5	7	1	0	0	0	0	0	0	14
SE	0	1	0	3	7	13	3	1	0	0	0	0	28
SSE	0	0	0	2	3	15	25	1	0	0	0	0	46
S	0	0	0	1	2	11	52	5	0	0	0	0	71
SSW	0	0	0	0	1	6	12	0	0	0	0	0	19
SW	0	0	0	1	2	3	3	0	0	0	0	0	9
WSW	0	0	0	0	3	7	4	0	0	0	0	0	14
W	0	0	1	1	6	4	0	0	0	0	0	0	12
WNW	0	0	0	0	2	5	2	0	0	0	0	0	9
NW	0	1	0	1	0	4	8	0	0	0	0	0	14
NNW	0	0	0	1	2	11	27	0	0	0	0	0	41
TOTAL	0	2	3	22	48	111	141	7	0	0	0	0	334

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 334
 TOTAL HOURS FOR THE PERIOD: 334

RIVER BEND STATION
JOINT FREQUENCY TABLE
STABILITY CLASS D

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND .22- .51- .76- 1.1- 1.6- 2.1- 3.1- 5.1- 7.1- 10.1- 13.1- >18 TOT.
DIR .50 .75 1.0 1.5 2.0 3.0 5.0 7.0 10.0 13.0 18.0

N	2	3	5	34	70	142	50	1	0	0	0	0	307
NNE	1	3	14	31	55	61	7	0	0	0	0	0	172
NE	3	5	9	33	30	28	13	0	0	0	0	0	121
ENE	3	4	7	26	16	37	15	0	0	0	0	0	108
E	4	6	19	34	20	7	1	0	0	0	0	0	91
ESE	4	4	13	42	27	25	2	0	0	0	0	0	117
SE	4	10	27	76	94	77	16	0	0	0	0	0	304
SSE	2	1	13	45	97	190	87	4	0	0	0	0	439
S	0	5	12	42	76	198	134	7	0	0	0	0	474
SSW	2	7	14	32	66	79	55	2	0	0	0	0	257
SW	1	3	9	37	36	50	13	0	0	0	0	0	149
WSW	0	2	6	29	51	75	8	0	0	0	0	0	171
W	2	4	9	22	56	74	5	0	0	0	0	0	172
WNW	0	5	11	27	43	72	23	0	0	0	0	0	181
NW	0	3	8	33	45	88	64	4	0	0	0	0	245
NNW	0	5	7	22	38	130	82	4	0	0	0	0	288

TOTAL 28 70 183 565 820 1333 575 22 0 0 0 0 3596

NUMBER OF CALMS: 2

NUMBER OF INVALID HOURS: 0

NUMBER OF VALID HOURS: 3598

TOTAL HOURS FOR THE PERIOD: 3598

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS E

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
N	4	4	15	35	20	9	2	0	0	0	0	0	89
NNE	5	3	19	38	20	6	0	0	0	0	0	0	91
NE	6	6	18	38	30	11	0	0	0	0	0	0	109
ENE	11	12	19	26	20	3	0	0	0	0	0	0	91
E	9	15	15	18	6	2	0	0	0	0	0	0	65
ESE	4	26	22	33	11	1	0	0	0	0	0	0	97
SE	8	26	46	103	76	43	1	0	0	0	0	0	303
SSE	0	9	22	85	65	35	1	0	0	0	0	0	217
S	7	9	16	80	81	56	4	0	0	0	0	0	253
SSW	9	13	30	59	26	10	0	0	0	0	0	0	147
SW	4	10	32	22	8	3	0	0	0	0	0	0	79
WSW	4	10	13	11	16	15	0	0	0	0	0	0	69
W	11	13	17	16	8	5	1	0	0	0	0	0	71
WNW	9	16	14	13	15	11	1	0	0	0	0	0	79
NW	9	11	19	20	9	7	2	0	0	0	0	0	77
NNW	9	6	5	20	17	7	1	0	0	0	0	0	65
TOTAL	109	189	322	617	428	224	13	0	0	0	0	0	1902

NUMBER OF CALMS: 10
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 1912
 TOTAL HOURS FOR THE PERIOD: 1912

RIVER BEND STATION
JOINT FREQUENCY TABLE
STABILITY CLASS F

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

WIND	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		

N	15	12	17	24	2	0	0	0	0	0	0	0	70
NNE	12	4	14	16	2	0	0	0	0	0	0	0	48
NE	10	9	9	13	11	4	0	0	0	0	0	0	56
ENE	6	7	6	12	5	3	0	0	0	0	0	0	39
E	6	14	10	5	0	0	0	0	0	0	0	0	35
ESE	10	10	12	10	0	0	0	0	0	0	0	0	42
SE	5	13	14	26	10	3	0	0	0	0	0	0	71
SSE	7	6	7	26	7	7	0	0	0	0	0	0	60
S	5	8	8	14	2	0	0	0	0	0	0	0	37
SSW	8	6	7	7	1	0	0	0	0	0	0	0	29
SW	7	7	13	3	0	0	0	0	0	0	0	0	30
WSW	3	3	7	2	0	1	0	0	0	0	0	0	16
W	6	18	8	2	1	2	0	0	0	0	0	0	37
WNW	18	22	7	4	1	1	0	0	0	0	0	0	53
NW	11	22	18	11	3	1	0	0	0	0	0	0	66
NNW	13	21	11	9	1	0	0	0	0	0	0	0	55

TOTAL	142	182	168	184	46	22	0	0	0	0	0	0	744
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NUMBER OF CALMS: 24

NUMBER OF INVALID HOURS: 0

NUMBER OF VALID HOURS: 768

TOTAL HOURS FOR THE PERIOD: 768

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS G

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 30 FOOT

WIND SPEED (METERS/SECOND)

 WIND .22- .51- .76- 1.1- 1.6- 2.1- 3.1- 5.1- 7.1- 10.1- 13.1- >18 TOT.
 DIR .50 .75 1.0 1.5 2.0 3.0 5.0 7.0 10.0 13.0 18.0

N	56	46	23	15	4	0	0	0	0	0	0	0	144
NNE	54	16	10	2	1	0	0	0	0	0	0	0	83
NE	65	28	8	1	0	0	0	0	0	0	0	0	102
ENE	36	46	19	10	0	0	0	0	0	0	0	0	111
E	36	37	15	0	0	0	0	0	0	0	0	0	88
ESE	13	8	6	2	0	0	0	0	0	0	0	0	29
SE	8	6	4	2	0	0	0	0	0	0	0	0	20
SSE	4	2	5	5	1	1	0	0	0	0	0	0	18
S	4	4	4	1	0	0	0	0	0	0	0	0	13
SSW	5	1	2	2	0	0	0	0	0	0	0	0	10
SW	3	7	2	1	0	0	0	0	0	0	0	0	13
WSW	4	3	0	0	0	0	0	0	0	0	0	0	7
W	15	9	5	0	0	0	0	0	0	0	0	0	29
WNW	20	36	9	0	0	0	0	0	0	0	0	0	65
NW	44	47	19	1	0	0	0	0	0	0	0	0	111
NNW	50	67	42	6	0	0	0	0	0	0	0	0	165

 TOTAL 417 363 173 48 6 1 0 0 0 0 0 0 0 1008

NUMBER OF CALMS: 112

NUMBER OF INVALID HOURS: 0

NUMBER OF VALID HOURS: 1120

TOTAL HOURS FOR THE PERIOD: 1120

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 ALL STABILITY CLASSES

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	1	1	9	11	31	140	249	30	0	0	0	0	472
NNE	0	3	9	21	36	145	240	6	0	0	0	0	460
NE	1	3	7	25	30	116	250	21	3	2	0	0	458
ENE	1	2	9	24	54	98	179	73	28	1	0	0	469
E	0	3	9	26	48	110	89	46	14	1	0	0	346
ESE	1	2	8	30	37	176	439	113	11	0	0	0	817
SE	1	6	7	23	44	162	316	38	2	1	0	0	600
SSE	1	5	14	25	37	195	368	80	5	0	0	0	730
S	2	8	4	33	62	218	516	141	17	0	0	0	1001
SSW	1	3	9	34	54	197	240	53	7	0	0	0	598
SW	1	5	8	28	80	191	78	17	3	0	0	0	411
WSW	0	2	14	32	74	216	115	4	0	0	0	0	457
W	3	2	6	32	69	207	119	4	0	0	0	0	442
WNW	0	0	5	17	32	121	101	33	5	0	0	0	314
NW	3	2	5	18	24	102	161	50	10	1	0	0	376
NNW	3	4	6	18	30	127	253	72	14	0	0	0	527
TOTAL	19	51	129	397	742	2521	3713	781	119	6	0	0	8478

NUMBER OF CALMS: 3
 NUMBER OF INVALID HOURS: 279
 NUMBER OF VALID HOURS: 8481
 TOTAL HOURS FOR THE PERIOD: 8760

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS A

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	3	15	3	0	0	0	0	21
NNE	0	0	1	0	0	3	21	1	0	0	0	0	26
NE	0	0	0	0	0	6	18	1	1	0	0	0	26
ENE	0	0	0	0	0	9	20	13	1	0	0	0	43
E	0	0	0	1	1	6	11	6	1	0	0	0	26
ESE	0	0	0	1	1	11	50	23	4	0	0	0	90
SE	0	0	0	0	1	5	33	7	0	0	0	0	46
SSE	0	0	0	1	1	2	13	19	1	0	0	0	37
S	0	0	0	0	1	1	28	28	4	0	0	0	62
SSW	0	0	0	0	0	1	3	13	1	0	0	0	18
SW	0	0	0	0	2	1	5	1	0	0	0	0	9
WSW	0	0	0	0	0	9	9	2	0	0	0	0	20
W	0	0	0	0	1	2	5	1	0	0	0	0	9
WNW	0	0	0	0	1	5	8	10	2	0	0	0	26
NW	0	0	0	0	0	0	9	7	1	1	0	0	18
NNW	0	0	0	0	0	3	10	9	3	0	0	0	25
TOTAL	0	0	1	3	9	67	258	144	19	1	0	0	502

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 502
 TOTAL HOURS FOR THE PERIOD: 502

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS B

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-	.51-	.76-	1.1-	1.6-	2.1-	3.1-	5.1-	7.1-	10.1-	13.1-	>18	TOT.
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	1	11	3	0	0	0	0	15
NNE	0	0	0	0	1	0	4	0	0	0	0	0	5
NE	0	0	0	0	0	6	7	2	0	0	0	0	15
ENE	0	0	0	0	0	4	4	2	0	0	0	0	10
E	0	0	0	0	0	2	4	2	0	0	0	0	8
ESE	0	0	0	0	0	7	7	6	0	0	0	0	20
SE	0	1	0	0	1	4	11	4	0	0	0	0	21
SSE	0	0	0	0	0	2	16	12	1	0	0	0	31
S	0	0	0	0	0	0	17	16	3	0	0	0	36
SSW	0	0	0	0	2	1	9	4	0	0	0	0	16
SW	0	0	0	0	0	2	3	2	1	0	0	0	8
WSW	0	0	0	1	0	7	9	0	0	0	0	0	17
W	0	0	0	0	0	2	10	1	0	0	0	0	13
WNW	0	0	0	0	0	1	5	3	0	0	0	0	9
NW	0	0	0	0	0	1	4	8	0	0	0	0	13
NNW	0	0	0	0	0	1	3	3	3	0	0	0	10
TOTAL	0	1	0	1	4	.41	124	68	8	0	0	0	247

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 247
 TOTAL HOURS FOR THE PERIOD: 247

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS C

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22- .50	.51- .75	.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	>18	TOT.
N	0	0	0	0	0	3	10	1	0	0	0	0	14
NNE	0	0	0	0	0	5	12	0	0	0	0	0	17
NE	0	0	0	0	0	6	5	2	0	0	0	0	13
ENE	0	0	0	0	0	3	3	1	1	0	0	0	8
E	0	0	0	0	0	6	4	0	0	0	0	0	10
ESE	0	0	0	0	4	6	15	1	0	0	0	0	26
SE	0	0	0	0	2	4	9	3	0	1	0	0	19
SSE	0	0	0	0	0	3	28	10	0	0	0	0	41
S	0	0	0	0	0	2	32	23	3	0	0	0	60
SSW	0	0	0	0	0	5	14	9	1	0	0	0	29
SW	0	0	0	0	1	2	2	3	1	0	0	0	9
WSW	0	0	0	1	2	5	8	0	0	0	0	0	16
W	0	1	0	0	0	9	4	0	0	0	0	0	14
WNW	0	0	0	0	1	2	5	0	1	0	0	0	9
NW	0	0	0	1	0	2	5	5	1	0	0	0	14
NNW	0	0	0	0	0	1	17	17	0	0	0	0	35
TOTAL	0	1	0	2	10	64	173	75	8	1	0	0	334

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 334
 TOTAL HOURS FOR THE PERIOD: 334

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS D

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.0	10.1-13.0	13.1-18.0	>18	TOT.
N	0	0	3	7	15	87	132	22	0	0	0	0	266
NNE	0	0	1	8	15	64	95	3	0	0	0	0	186
NE	0	2	1	14	13	32	43	6	2	2	0	0	115
ENE	0	0	3	10	24	28	43	32	26	1	0	0	167
E	0	2	6	7	20	25	24	10	10	1	0	0	105
ESE	0	1	2	9	15	68	99	45	7	0	0	0	246
SE	0	1	1	9	16	71	97	19	1	0	0	0	215
SSE	0	2	4	10	10	75	194	39	3	0	0	0	337
S	0	1	2	8	25	91	257	72	7	0	0	0	463
SSW	0	0	6	6	22	60	141	27	5	0	0	0	267
SW	0	1	2	8	29	81	37	11	1	0	0	0	170
WSW	0	0	4	8	28	103	67	2	0	0	0	0	212
W	0	0	1	8	28	105	71	1	0	0	0	0	214
WNW	0	0	0	7	14	58	62	18	1	0	0	0	160
NW	1	0	0	7	12	42	97	29	8	0	0	0	196
NNW	0	1	2	8	16	63	140	41	8	0	0	0	279
TOTAL	1	11	38	134	302	1053	1599	377	79	4	0	0	3598

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 3598
 TOTAL HOURS FOR THE PERIOD: 3598

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS E

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22- .50	.51- .75	.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	>18 TOT.
N	0	0	4	2	6	16	41	0	0	0	0	69
NNE	0	2	3	8	4	22	47	2	0	0	0	88
NE	0	0	3	3	4	23	65	6	0	0	0	104
ENE	1	1	2	4	15	18	51	13	0	0	0	105
E	0	0	0	8	12	20	23	13	3	0	0	79
ESE	0	1	2	8	8	36	155	28	0	0	0	238
SE	1	1	4	5	8	39	95	5	1	0	0	159
SSE	0	2	5	6	15	60	92	0	0	0	0	180
S	2	5	2	7	14	81	161	2	0	0	0	274
SSW	0	2	2	12	12	81	59	0	0	0	0	168
SW	0	2	3	12	18	56	17	0	0	0	0	108
WSW	0	0	4	7	19	54	11	0	0	0	0	95
W	2	0	1	10	15	44	16	1	0	0	0	89
WNW	0	0	2	2	9	11	9	1	1	0	0	35
NW	0	1	0	5	5	16	20	1	0	0	0	48
NNW	1	1	3	4	7	23	32	2	0	0	0	73
TOTAL	7	18	40	103	171	600	894	74	5	0	0	1912

NUMBER OF CALMS: 0
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 1912
 TOTAL HOURS FOR THE PERIOD: 1912

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS F

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22- .50	.51- .75	.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	>18 TOT.
N	0	0	0	1	5	12	16	0	0	0	0	34
NNE	0	0	2	4	4	14	29	0	0	0	0	53
NE	1	0	1	2	5	11	44	4	0	0	0	68
ENE	0	0	0	4	5	16	24	12	0	0	0	61
E	0	1	0	3	4	8	13	13	0	0	0	42
ESE	1	0	2	7	5	20	58	6	0	0	0	99
SE	0	1	0	5	4	16	46	0	0	0	0	72
SSE	0	0	0	2	5	14	13	0	0	0	0	34
S	0	0	0	5	9	20	16	0	0	0	0	50
SSW	0	0	0	7	5	19	9	0	0	0	0	40
SW	1	0	1	3	8	16	4	0	0	0	0	33
WSW	0	0	1	2	8	21	7	0	0	0	0	39
W	0	0	1	6	11	15	7	0	0	0	0	40
WNW	0	0	0	5	3	17	4	1	0	0	0	30
NW	0	1	3	2	0	16	13	0	0	0	0	35
NNW	1	0	0	1	3	11	21	0	0	0	0	37
TOTAL	4	3	11	59	84	246	324	36	0	0	0	767

NUMBER OF CALMS: 1
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 768
 TOTAL HOURS FOR THE PERIOD: 768

RIVER BEND STATION
 JOINT FREQUENCY TABLE
 STABILITY CLASS G

FROM 1/01/11 0:00 TO 12/31/11 23:00

PRIMARY SENSORS - 150 FOOT

WIND SPEED (METERS/SECOND)

WIND DIR	.22- .50	.51- .75	.76- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 5.0	5.1- 7.0	7.1- 10.0	10.1- 13.0	13.1- 18.0	>18	TOT.
N	1	1	2	1	5	18	24	1	0	0	0	0	53
NNE	0	1	2	1	12	37	32	0	0	0	0	0	85
NE	0	1	2	6	8	32	68	0	0	0	0	0	117
ENE	0	1	4	6	10	20	34	0	0	0	0	0	75
E	0	0	3	7	11	43	10	2	0	0	0	0	76
ESE	0	0	2	5	4	28	55	4	0	0	0	0	98
SE	0	2	2	4	12	23	25	0	0	0	0	0	68
SSE	1	1	5	6	6	39	12	0	0	0	0	0	70
S	0	2	0	13	13	23	5	0	0	0	0	0	56
SSW	1	1	1	9	13	30	5	0	0	0	0	0	60
SW	0	2	2	5	22	33	10	0	0	0	0	0	74
WSW	0	2	5	13	17	17	4	0	0	0	0	0	58
W	1	1	3	8	14	30	6	0	0	0	0	0	63
WNW	0	0	3	3	4	27	8	0	0	0	0	0	45
NW	2	0	2	3	7	25	13	0	0	0	0	0	52
NNW	1	2	1	5	4	25	30	0	0	0	0	0	68
TOTAL	7	17	39	95	162	450	341	7	0	0	0	0	1118

NUMBER OF CALMS: 2
 NUMBER OF INVALID HOURS: 0
 NUMBER OF VALID HOURS: 1120
 TOTAL HOURS FOR THE PERIOD: 1120

Table 7
ATMOSPHERIC DISPERSION AND DEPOSITION RATES FOR
THE MAXIMUM INDIVIDUAL DOSE CALCULATIONS

Analysis	Location (meters)	Ground Level Releases	Mixed Mode Releases
Gamma air dose (3) and Beta Air Dose	994 m WNW (Containment)	CHI/Q - 421.0	CHI/Q - 33.1
Maximum Receptor (4)	994 m WNW	CHI/Q - 421.0	CHI/Q - 33.1
Resident		D/Q - 50.3	D/Q - 18.0
Garden			
Meat animal			
Immersion			
Milk animal (5)	7,000 m WNW	CHI/Q - 3.58 D/Q - 0.38	CHI/Q - .870 D/Q - .223
Other on-site Receptors	115 m ENE	CHI/Q - 5977.0 D/Q - 529.7	CHI/Q - 407.5 D/Q - 46.9
	275 m N	CHI/Q - 1644.0 D/Q - 345.6	CHI/Q - 169.1 D/Q - 68.4
	2500 SW	CHI/Q - 34.45 D/Q - 3.35	CHI/Q - 4.65 D/Q - 1.40

Notes:

- (1) All CHI/Q = 10^{-7} sec/m³
- (2) All D/Q = 10^{-9} m⁻²
- (3) Maximum offsite location (property boundary) with highest CHI/Q (unoccupied).
- (4) Maximum hypothetical occupied offsite location with highest CHI/Q and D/Q.
- (5) No milk animal within 5 miles radius, hypothetical location in worst sector.
- (6) Other onsite receptors
- (7) Revisions to X/Q and D/Q can be performed using NUREG/CR-2919, XOQDOQ, Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations

Table 8
Groundwater Monitoring Well Sample Results

GROUND WATER MONITORING SAMPLES (H-3) - RBS

LLD (pCi/l)			3000
LAB ID	LOCATION	DATE	TRITIUM
20110355	PZ-03	3/22/2011	< 399
20110356	MW-100	3/22/2011	< 386
20110357	MW-19	3/22/2011	< 416
20110358	MW-104	3/22/2011	< 402
20110359	MW-103	3/22/2011	< 432
20110360	MW-102	3/22/2011	< 386
20110361	MW-101	3/22/2011	< 411
20110363	MW-18	3/23/2011	< 402
20110364	MW-08	3/23/2011	< 400
20110365	MW-102	3/23/2011	< 401
20110366	MW-02	3/23/2011	< 402
20110367	MW-02D	3/23/2011	< 401
20110368	MW-10	3/23/2011	< 399
20110369	MW-06	3/23/2011	< 402
20110892	MW-08	6/22/2011	< 412
20110893	MW-19	6/22/2011	< 414
20110894	MW-102	6/22/2011	< 468
20110895	MW-103	6/22/2011	< 411
20110896	MW-104	6/22/2011	< 422

LLD (pCi/l)			3000
LAB ID	LOCATION	DATE	TRITIUM
20110897	MW-18	6/22/2011	< 410
20110898	MW-102	6/22/2011	< 511
20110899	PZ-03	6/22/2011	< 408
20110900	MW-100	6/22/2011	< 452
20110909	MW-04	6/23/2011	< 414
20110910	MW-10	6/23/2011	< 409
20110912	MW-101	6/23/2011	< 396
20110913	MW-06	6/23/2011	< 395
20110914	MW-02	6/23/2011	< 445
20110915	DUP-MW-02	6/23/2011	< 399
20111330	MW-100	9/20/2011	< 620
20111331	PZ-03	9/20/2011	< 627
20111332	SW-102	9/20/2011	< 618
20111333	SW-103	9/20/2011	< 627
20111335	MW-02	9/21/2011	< 620
20111336	MW-02 eb	9/21/2011	< 621
20111337	MW-06	9/21/2011	< 622
20111338	MW-06 DUP	9/21/2011	< 615
20111339	MW-10	9/21/2011	< 648
20111340	MW-102	9/21/2011	< 649
20111341	MW-04	9/21/2011	< 667

LLD (pCi/l)			3000
LAB ID	LOCATION	DATE	TRITIUM
20111342	MW-08	9/21/2011	< 645
20111343	MW-18	9/21/2011	< 656
20111344	MW-19	9/21/2011	< 647
20111345	SW-101	9/21/2011	< 649
20111346	SW-104	9/21/2011	< 661
20111602	MW-05	12/6/2011	< 674
20111603	MW-03	12/6/2011	< 670
20111604	MW-02	12/6/2011	< 687
20111605	MW-06	12/6/2011	< 639
20111606	MW-10	12/6/2011	< 671
20111607	MW-102	12/6/2011	< 671
20111608	MW-102 DUP	12/6/2011	< 672
20111630	PZ-01 DUP	12/6/2011	40,488
20111631	PZ-01	12/6/2011	40,617
20111632	MW-09	12/6/2011	< 637
20111633	PZ-03	12/6/2011	< 676
20111634	MW-100	12/6/2011	< 678
20111635	SW-101	12/6/2011	< 639
20111644	MW-07	12/7/2011	< 644
20111645	MW-08	12/7/2011	< 642
20111646	MW-20	12/7/2011	< 665

LLD (pCi/l)			3000
LAB ID	LOCATION	DATE	TRITIUM
20111647	MW-18	12/7/2011	< 701
20111648	MW-19	12/7/2011	< 705
20111649	T-14	12/7/2011	< 669
20111650	MW-17	12/7/2011	< 704
20111651	MW-21	12/7/2011	< 668
20111652	PZ-02	12/7/2011	< 667
20111673	MW-12	12/7/2011	< 703
20111674	MW-14	12/7/2011	< 644
20111675	MW-15	12/7/2011	< 650
20111676	MW-15 DUP	12/7/2011	< 644
20111677	MW-11	12/7/2011	< 674
20111678	MW-01	12/7/2011	< 681
20111679	MW-13	12/7/2011	< 676
20111680	SW-103	12/7/2011	< 667
20111681	SW-104	12/7/2011	< 664
20111682	SW-102	12/7/2011	< 682
20111683	MW-16	12/7/2011	< 669
20111734	PZ-01	12/19/2011	48,016
20111735	PZ-01 DUP	12/19/2011	48,245
20111736	MW-04	12/19/2011	< 727

GROUND MONITORING WELL SAMPLES (GAMMA) - RBS

LLD (pCi/l)			15	15	30	15	30	15	30	15	15	18	60	15
LAB ID	LOCATION	DATE	MN-54	CO-58	FE-59	CO-60	ZN-65	NB-95	ZR-95	I-131	CS-134	CS-137	BA-140	LA-140
20110355	PZ-03	3/22/2011	< 8.22	< 7.70	< 21.12	< 9.47	< 20.46	< 7.75	< 16.57	< 14.95	< 8.23	< 7.34	< 38.03	< 13.82
20110356	MW-100	3/22/2011	< 10.64	< 6.56	< 18.21	< 10.42	< 18.79	< 10.19	< 14.69	< 14.81	< 7.61	< 10.57	< 45.54	< 14.82
20110357	MW-19	3/22/2011	< 10.56	< 8.10	< 15.97	< 6.98	< 13.67	< 7.82	< 11.41	< 12.95	< 8.31	< 5.88	< 35.78	< 14.82
20110358	MW-104	3/22/2011	< 6.90	< 9.96	< 15.48	< 8.58	< 19.27	< 8.22	< 16.37	< 10.50	< 12.35	< 11.84	< 29.90	< 11.00
20110359	MW-103	3/22/2011	< 8.66	< 7.15	< 15.65	< 8.01	< 15.12	< 10.53	< 12.95	< 14.57	< 8.19	< 7.92	< 37.59	< 14.65
20110360	MW-102	3/22/2011	< 9.16	< 10.51	< 19.77	< 8.98	< 22.25	< 8.68	< 10.28	< 14.97	< 8.69	< 6.53	< 47.71	< 13.28
20110361	MW-101	3/22/2011	< 8.73	< 9.05	< 10.42	< 9.47	< 25.20	< 9.60	< 16.53	< 14.70	< 10.54	< 8.08	< 40.53	< 11.81
20110363	MW-18	3/23/2011	< 8.74	< 6.77	< 20.95	< 7.95	< 21.88	< 12.86	< 16.29	< 14.12	< 8.22	< 7.00	< 36.57	< 10.69
20110364	MW-08	3/23/2011	< 5.81	< 4.80	< 8.12	< 6.41	< 11.25	< 7.12	< 10.91	< 8.70	< 7.22	< 7.87	< 27.94	< 12.35
20110365	MW-102	3/23/2011	< 7.16	< 11.06	< 16.08	< 8.76	< 16.97	< 10.27	< 13.71	< 14.66	< 9.57	< 9.02	< 43.18	< 12.36
20110366	MW-02	3/23/2011	< 8.23	< 8.16	< 16.49	< 9.70	< 24.95	< 9.85	< 15.44	< 14.27	< 10.81	< 10.50	< 47.04	< 12.94
20110367	MW-02D	3/23/2011	< 10.01	< 8.10	< 11.33	< 8.88	< 10.28	< 10.49	< 18.29	< 10.54	< 10.36	< 10.60	< 37.31	< 11.91

LLD (pCi/l)			15	15	30	15	30	15	30	15	15	18	60	15
LAB ID	LOCATION	DATE	MN-54	CO-58	FE-59	CO-60	ZN-65	NB-95	ZR-95	I-131	CS-134	CS-137	BA-140	LA-140
20110368	MW-10	3/23/2011	< 7.52	< 8.98	< 12.98	< 9.44	< 20.40	< 10.47	< 14.38	< 13.32	< 9.75	< 9.14	< 24.02	< 13.93
20110369	MW-06	3/23/2011	< 11.71	< 8.27	< 21.39	< 7.69	< 19.49	< 10.10	< 15.60	< 12.66	< 9.90	< 11.98	< 43.88	< 13.75
20110370	EB-final	3/23/2011	< 5.04	< 4.89	< 16.31	< 5.42	< 14.53	< 7.66	< 16.96	< 8.25	< 8.57	< 9.45	< 28.57	< 7.40
20110892	MW-08	6/22/2011	< 11.02	< 11.15	< 20.93	< 7.90	< 27.00	< 13.46	< 20.23	< 11.23	< 9.27	< 12.95	< 41.70	< 14.60
20110893	MW-19	6/22/2011	< 7.90	< 7.54	< 16.32	< 8.50	< 18.58	< 12.02	< 13.18	< 8.31	< 8.67	< 8.23	< 28.25	< 10.48
20110894	MW-102	6/22/2011	< 2.91	< 3.12	< 6.04	< 2.96	< 6.10	< 4.43	< 6.19	< 11.18	< 2.99	< 2.96	< 24.08	< 8.32
20110895	MW-103	6/22/2011	< 12.04	< 13.70	< 39.49	< 12.78	< 29.02	< 23.68	< 25.51	< 100.81	< 10.62	< 12.61	< 154.87	< 45.70
20110897	MW-18	6/22/2011	< 5.88	< 8.11	< 16.07	< 7.28	< 16.95	< 8.55	< 11.94	< 7.66	< 8.79	< 8.24	< 24.85	< 13.53
20110898	MW-102	6/22/2011	< 3.53	< 3.75	< 7.02	< 3.72	< 7.40	< 4.74	< 6.65	< 12.93	< 4.05	< 3.41	< 26.85	< 9.74
20110899	PZ-03	6/22/2011	< 12.13	< 7.61	< 23.81	< 9.64	< 25.31	< 11.99	< 15.67	< 11.23	< 12.91	< 12.41	< 36.28	< 13.99
20110900	MW-100	6/22/2011	< 3.49	< 3.85	< 7.36	< 3.62	< 8.20	< 5.19	< 6.47	< 13.04	< 3.53	< 3.46	< 28.46	< 9.77
20110909	MW-04	6/23/2011	< 6.98	< 17.78	< 22.04	< 9.43	< 22.86	< 16.94	< 19.01	< 76.35	< 8.54	< 10.66	< 100.12	< 43.67
20110910	MW-10	6/23/2011	< 11.96	< 13.69	< 27.18	< 10.95	< 21.75	< 21.08	< 23.14	< 71.27	< 11.83	< 10.12	< 124.34	< 33.81
20110913	MW-06	6/23/2011	< 10.46	< 10.80	< 39.82	< 14.93	< 24.66	< 23.31	< 24.36	< 73.56	< 12.20	< 13.31	< 132.83	< 37.23

LLD (pCi/l)			15	15	30	15	30	15	30	15	15	18	60	15
LAB ID	LOCATION	DATE	MN-54	CO-58	FE-59	CO-60	ZN-65	NB-95	ZR-95	I-131	CS-134	CS-137	BA-140	LA-140
20110914	MW-02	6/23/2011	< 8.94	< 11.34	< 28.08	< 11.19	< 27.12	< 23.36	< 17.42	< 73.42	< 10.13	< 9.92	< 114.60	< 41.86
20110915	MW-02 dup	6/23/2011	< 12.67	< 12.50	< 34.02	< 12.43	< 23.11	< 23.01	< 15.83	< 80.13	< 11.24	< 14.76	< 120.96	< 33.04
20111330	MW-100	9/20/2011	< 12.90	< 9.11	< 20.80	< 11.70	< 20.10	< 9.73	< 13.60	< 10.90	< 9.47	< 11.70	< 27.20	< 11.60
20111331	PZ-03	9/20/2011	< 11.40	< 11.90	< 23.70	< 3.20	< 26.50	< 11.40	< 20.60	< 8.97	< 8.94	< 9.39	< 28.70	< 13.70
20111332	SW-102	9/20/2011	< 11.60	< 9.45	< 17.70	< 7.14	< 17.10	< 10.40	< 15.90	< 10.20	< 11.20	< 11.80	< 37.80	< 9.90
20111333	SW-103	9/20/2011	< 14.50	< 14.30	< 17.40	< 10.30	< 29.50	< 12.50	< 22.50	< 11.60	< 10.80	< 14.00	< 32.10	< 14.20
20111335	MW-02	9/21/2011	< 10.60	< 11.50	< 22.20	< 7.63	< 21.30	< 14.40	< 18.00	< 10.10	< 9.19	< 13.70	< 39.30	< 9.30
20111337	MW-06	9/21/2011	< 13.00	< 11.60	< 26.30	< 12.90	< 28.00	< 14.80	< 21.00	< 12.80	< 10.20	< 13.60	< 47.00	< 14.30
20111338	MW-06 DUP	9/21/2011	< 14.70	< 11.00	< 20.70	< 12.30	< 13.10	< 13.30	< 18.00	< 11.90	< 11.80	< 11.90	< 39.40	< 13.60
20111339	MW-10	9/21/2011	< 8.77	< 11.40	< 17.90	< 9.99	< 17.10	< 8.21	< 19.70	< 10.80	< 6.91	< 10.60	< 35.30	< 14.10
20111340	MW-102	9/21/2011	< 7.91	< 9.65	< 13.60	< 9.74	< 15.20	< 7.49	< 15.20	< 10.30	< 8.30	< 9.06	< 32.80	< 13.70
20111341	MW-04	9/21/2011	< 9.94	< 10.50	< 17.10	< 11.20	< 21.30	< 8.76	< 15.40	< 9.75	< 6.66	< 10.30	< 42.70	< 3.56
20111342	MW-08	9/21/2011	< 9.58	< 8.63	< 17.60	< 10.40	< 19.80	< 9.66	< 14.90	< 10.10	< 9.58	< 11.20	< 37.00	< 12.20

LLD (pCi/l)			15	15	30	15	30	15	30	15	15	18	60	15
LAB ID	LOCATION	DATE	MN-54	CO-58	FE-59	CO-60	ZN-65	NB-95	ZR-95	I-131	CS-134	CS-137	BA-140	LA-140
20111343	MW-18	9/21/2011	< 11.10	< 7.86	< 17.80	< 8.03	< 5.05	< 11.00	< 19.00	< 9.05	< 7.02	< 12.00	< 40.70	< 14.40
20111344	MW-19	9/21/2011	< 9.58	< 10.10	< 17.60	< 9.01	< 17.10	< 10.30	< 16.30	< 9.54	< 8.63	< 7.63	< 41.40	< 9.68
20111345	SW-101	9/21/2011	< 12.10	< 10.10	< 23.00	< 3.08	< 15.90	< 14.00	< 13.50	< 8.09	< 12.20	< 13.80	< 41.00	< 11.30
20111346	SW-104	9/21/2011	< 10.10	< 7.57	< 14.80	< 10.20	< 16.70	< 8.77	< 20.20	< 8.64	< 7.95	< 9.80	< 44.00	< 11.90
20111602	MW-05	12/6/2011	< 13.50	< 9.67	< 24.20	< 11.50	< 18.90	< 9.38	< 21.70	< 9.60	< 9.53	< 14.70	< 53.30	< 11.70
20111603	MW-03	12/6/2011	< 11.60	< 8.78	< 18.10	< 11.70	< 24.20	< 12.90	< 22.00	< 11.10	< 7.64	< 13.80	< 40.80	< 13.50
20111604	MW-02	12/6/2011	< 8.58	< 7.98	< 18.30	< 10.60	< 20.20	< 8.51	< 13.30	< 8.58	< 8.68	< 9.70	< 38.10	< 13.90
20111605	MW-06	12/6/2011	< 11.50	< 9.23	< 21.10	< 11.70	< 22.20	< 10.10	< 16.70	< 11.60	< 7.93	< 11.80	< 26.40	< 14.30
20111606	MW-10	12/6/2011	< 15.60	< 14.30	< 18.30	< 14.90	< 20.10	< 13.80	< 24.70	< 12.60	< 13.90	< 16.20	< 25.20	< 12.50
20111607	MW-102	12/6/2011	< 11.00	< 14.20	< 23.20	< 10.50	< 26.00	< 9.95	< 9.29	< 8.14	< 6.92	< 9.30	< 32.60	< 3.87
20111608	MW-102 DUP	12/6/2011	< 9.59	< 11.50	< 15.70	< 11.90	< 24.10	< 11.60	< 16.60	< 11.30	< 9.10	< 7.42	< 45.70	< 13.60
20111630	PZ-01 DUP	12/6/2011	< 10.30	< 12.20	< 20.10	< 9.02	< 19.90	< 11.30	< 15.20	< 11.10	< 9.60	< 10.60	< 37.20	< 13.50
20111631	PZ-01	12/6/2011	< 10.20	< 11.60	< 15.10	< 7.12	< 13.70	< 12.80	< 18.10	< 11.70	< 9.17	< 11.50	< 29.20	< 3.77

LLD (pCi/l)			15	15	30	15	30	15	30	15	15	18	60	15
LAB ID	LOCATION	DATE	MN-54	CO-58	FE-59	CO-60	ZN-65	NB-95	ZR-95	I-131	CS-134	CS-137	BA-140	LA-140
20111632	MW-09	12/6/2011	< 8.22	< 7.44	< 15.60	< 8.65	< 16.20	< 7.57	< 8.78	< 11.50	< 6.16	< 7.23	< 35.00	< 13.80
20111633	PZ-03	12/6/2011	< 7.21	< 7.23	< 14.80	< 6.44	< 14.60	< 8.01	< 11.30	< 10.40	< 7.49	< 7.97	< 36.00	< 12.40
20111634	MW-100	12/6/2011	< 7.58	< 7.45	< 12.10	< 5.16	< 10.00	< 6.75	< 13.00	< 10.80	< 5.33	< 6.15	< 29.50	< 11.80
20111644	MW-07	12/7/2011	< 5.23	< 5.06	< 10.20	< 4.54	< 14.20	< 6.24	< 10.10	< 14.60	< 5.63	< 5.04	< 33.90	< 10.50
20111645	MW-08	12/7/2011	< 4.60	< 4.99	< 10.10	< 4.64	< 10.20	< 6.87	< 8.74	< 13.90	< 4.35	< 4.96	< 35.00	< 11.80
20111646	MW-20	12/7/2011	< 4.34	< 5.08	< 7.81	< 4.76	< 8.19	< 5.87	< 8.36	< 11.60	< 4.58	< 4.38	< 29.70	< 13.10
20111647	MW-18	12/7/2011	< 5.95	< 6.72	< 11.00	< 5.59	< 10.50	< 7.43	< 10.00	< 15.00	< 5.90	< 5.71	< 30.70	< 12.40
20111648	MW-19	12/7/2011	< 6.33	< 5.70	< 14.70	< 4.48	< 11.60	< 8.20	< 11.10	< 14.30	< 6.01	< 6.24	< 32.10	< 13.30
20111649	T-14	12/7/2011	< 4.95	< 5.27	< 11.50	< 3.79	< 8.13	< 7.48	< 9.55	< 11.80	< 4.64	< 5.46	< 33.90	< 11.70
20111650	MW-17	12/7/2011	< 5.65	< 5.70	< 12.10	< 4.43	< 11.20	< 5.17	< 8.67	< 13.60	< 4.98	< 6.63	< 32.80	< 13.50
20111651	MW-21	12/7/2011	< 5.39	< 5.01	< 8.26	< 4.06	< 11.20	< 6.68	< 9.15	< 14.70	< 4.24	< 5.09	< 30.10	< 12.40
20111652	PZ-02	12/7/2011	< 3.11	< 3.49	< 8.13	< 3.23	< 6.43	< 4.23	< 6.58	< 14.90	< 3.24	< 2.94	< 30.10	< 10.60
20111673	MW-12	12/7/2011	< 9.70	< 5.56	< 13.10	< 10.80	< 13.60	< 11.00	< 19.60	< 11.80	< 8.56	< 9.72	< 36.70	< 13.30

LLD (pCi/l)			15	15	30	15	30	15	30	15	15	18	60	15
LAB ID	LOCATION	DATE	MN-54	CO-58	FE-59	CO-60	ZN-65	NB-95	ZR-95	I-131	CS-134	CS-137	BA-140	LA-140
20111674	MW-14	12/7/2011	< 7.67	< 6.52	< 13.10	< 7.13	< 9.87	< 6.59	< 12.10	< 9.34	< 7.07	< 5.89	< 32.00	< 12.50
20111675	MW-15	12/7/2011	< 9.64	< 9.29	< 14.40	< 10.10	< 19.50	< 12.10	< 18.20	< 14.40	< 10.30	< 11.10	< 48.60	< 4.22
20111676	MW-15 DUP	12/7/2011	< 7.56	< 8.49	< 19.90	< 9.92	< 14.70	< 8.58	< 16.90	< 13.80	< 9.91	< 8.52	< 48.40	< 14.30
20111677	MW-11	12/7/2011	< 8.48	< 7.37	< 13.50	< 8.03	< 18.10	< 5.68	< 16.50	< 12.00	< 9.00	< 7.71	< 34.50	< 13.30
20111678	MW-01	12/7/2011	< 6.44	< 8.39	< 11.70	< 6.40	< 13.40	< 8.20	< 12.10	< 9.30	< 6.94	< 7.83	< 39.00	< 13.90
20111679	MW-13	12/7/2011	< 6.11	< 6.68	< 12.70	< 5.60	< 13.30	< 7.16	< 11.20	< 14.30	< 5.00	< 5.76	< 44.00	< 13.60
20111680	SW-103	12/7/2011	< 2.84	< 2.70	< 5.66	< 2.06	< 5.16	< 3.63	< 5.59	< 14.20	< 2.19	< 2.64	< 22.70	< 8.45
20111681	SW-104	12/7/2011	< 2.91	< 3.26	< 7.69	< 3.09	< 5.48	< 4.16	< 6.73	< 14.80	< 2.90	< 2.94	< 31.30	< 9.69
20111682	SW-102	12/7/2011	< 4.99	< 4.26	< 9.84	< 5.17	< 10.70	< 6.80	< 7.47	< 13.50	< 4.87	< 5.67	< 43.60	< 13.10
20111683	MW-16	12/7/2011	< 5.56	< 5.62	< 11.30	< 4.79	< 9.68	< 6.27	< 11.00	< 14.90	< 3.74	< 5.15	< 32.40	< 11.60
20111736	MW-04	12/19/2011	< 9.93	< 9.07	< 16.90	< 11.10	< 29.50	< 12.40	< 20.00	< 8.81	< 12.60	< 11.40	< 39.70	< 11.70

Attachment 1

Process Control Program

Procedure Contains NMM REFLIB Forms: YES NO

Effective Date	Procedure Owner:	Mark L. Carver	Governance Owner:	Mark L. Carver
11/11/11	Title:	Manager, Fleet Radwaste	Title:	Manager, Fleet Radwaste
	Site:	HQN	Site:	HQN

Exception Date*	Site	Site Procedure Champion	Title
	ANO	Jim Smith	Manager, RP
N/A	BRP	N/A	N/A
	GGNS	Tom Trichell	Manager, RP
12/14/11	IPEC	Reid Tagliamonte	Manager, RP
12/14/11	JAF	Eric Wolf	Manager, RP
	PLP	Chuck Sherman	Manager, RP
	PNPS	Jack Priest	Manager, RP
	RBS	Glenn Pierce	Manager, RP
	VY	David Tkatch	Manager, RP
	W3	Darrell Newman	Manager, RP (acting)
N/A	NP	N/A	N/A
N/A	HQN	Mark L. Carver	Manager, Fleet Radwaste

Site and NMM Procedures Canceled or Superseded By This Revision
None

Process Applicability Exclusion All Sites:

Specific Sites: ANO BRP GGNS IPEC JAF PLP PNPS RBS VY W3 NP

Change Statement

- Editorial Change --
 - Under the Site Applicability column for the NRC letters 1.98.091 and 1.88.078 listed in section 8.0, Vermont Yankee (VY) was changed to Pilgrim Nuclear Power Station (PNPS), ANO correction and addition of two VTY items
 - Updated same ANO correction in Step 5.8 (1) and 5.8 (3)

* JAF and IPEC effective date exceptions due to conditional site requirements within step 5.8 [4]

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PROCESS CONTROL PROGRAM				

1.0 PURPOSE

The Process Control Program (PCP) requires formulas, sampling, analyses, test and determinations to be made to ensure that the processing and packing of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61 and 71, State Regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste. The scope of a PCP is to assure that radioactive waste will be handled, shipped, and disposed of in a safe manner in accordance with approved site or vendor procedures, whichever is applicable. **[GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 1]**

- 1.1 The purpose of this document is to provide a description of the solid radioactive waste Process Control Program (PCP) at all the Entergy fleet sites. The PCP describes the methods used for processing, classification and packaging low-level wet radioactive waste into a form acceptable for interim on-site storage, shipping and disposal, in accordance with 10 CFR Part 61 and current disposal site criteria.
- 1.2 To ensure the safe operation of the solid radwaste system, the solid radwaste system will be used in accordance with this Process Control Program to process radioactive wastes to meet interim on-site storage, shipping and burial ground requirements.
- 1.3 This document addresses the process control program in the context of disposal criteria, on-site processing and vendor processing requirements.
- 1.4 The Process Control Program implements the requirements of 10CFR50.36a and General Design Criteria 60 of Appendix A to 10CFR Part 50. The process parameters included in the Process Control Program may include but are not limited to waste type, waste pH, waste/liquid/solidification agent/catalyst ratios, waste oil content, waste principal chemical constituents, and mixing and curing times.
- 1.5 This document does NOT address the requirements for 10CFR Part 61.56 (waste characteristics) for material sent to intermediate processors, because the final treatment and packaging is performed at the vendor facilities.

2.0 REFERENCES

- [1] EN-QV-104, "Entergy Quality Assurance Program Manual Control"
- [2] Title 49, Code of Federal Regulations
- [3] Title 10, Code of Federal Regulations, Part 20

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- [4] Title 10, Code of Federal Regulations, Part 61
- [5] Title 10, Code of Federal Regulations, Part 71, Appendix H **[QAPM, Section A.1.c]**
- [6] Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification, 11 May 1983
- [7] Disposal Site Criteria and License
- [8] Waste Processor Acceptance Criteria
- [9] EN-LI-100, "Process Applicability Determination"
- [10] NRC Information and Enforcement Bulletins
 - NRC Information Notice 79-19: Packaging of Low-Level Radioactive Waste for Transport and Burial.
 - NRC Information Notice 80-24: Low-Level Radioactive Waste Burial Criteria.
 - NRC Information Notice 80-32: Clarification of Certain Requirements for Exclusive-Use Shipments of Radioactive Materials.
 - NRC Information Notice 80-32, Rev. 1: Clarification of Certain Requirements for Exclusive-Use Shipments of Radioactive Materials.
 - NRC Information Notice 83-05: Obtaining Approval for Disposing of Very-Low-Level Radioactive Waste - 10CFR Section 20.302.
 - NRC Information Notice 83-10: Clarification of Several Aspects Relating to Use of NRC-Certified Transport Packages.
 - NRC Information Notice 83-33: Non-Representative Sampling of Contaminated Oil.
 - NRC Information Notice 84-50: Clarification of Scope of Quality Assurance Programs for Transport Packages Pursuant to 10CFR 50 Appendix B.
 - NRC Information Notice 84-72: Clarification of Conditions for Waste Shipments Subject to Hydrogen Gas Generation.
 - NRC Information Notice 85-92: Surveys of Wastes Before Disposal from Nuclear Reactor Facilities.
 - NRC Information Notice 86-20: Low-Level Radioactive Waste Scaling Factors, 10CFR 61.
 - NRC Information Notice 86-90: Requests to Dispose of Very Low-Level Radioactive Waste Pursuant 10CFR 20.302

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- NRC Information Notice 87-03: Segregation of Hazardous and Low-Level Radioactive Wastes
 - NRC Information Notice 87-07: Quality Control of On-Site Dewatering/ Solidification Operations by Outside Contractors
- [11] NRC Information and Enforcement Bulletins (continued)
- NRC Information Notice 89-27: Limitations on the Use of Waste Forms and High Integrity Containers for the Disposal of Low-Level Radioactive Waste
 - NRC Information Notice 92-62: Emergency Response Information Requirements for Radioactive Material Shipments
 - NRC Information Notice 92-72: Employee Training and Shipper Registration Requirements for Transporting Radioactive Materials
 - NRC Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program".
- [12] Nureg-0800 Standard Review Plan Section 11.4 Revision 2, Solid Waste Management Systems.
- [13] NRC Waste Form Technical Position, Revision 1 Jan 24 1991.
- [14] NRC SECY 94-198 Review of Existing Guidance Concerning the Extended Storage of Low-Level Radioactive Waste.
- [15] EPRI TR-106925 Rev-1, Interim On-Site Storage of Low Level Waste: Guidelines for Extended Storage - October 1996
- [16] NRC Branch Technical Position On Concentration Averaging And Encapsulation Jan 17 1995
- [17] Commitment Documents (U-2 and U-3)
- IPN-99-079, "Supplement to Proposed Changes to Technical Specifications Incorporating Recommendations of Generic Letter 89-01 and the Revised 10 CFR Part 20 and 10 CFR Part 50.36a.
 - Appendix B Technical Specifications, Section 4.5 [IP, RECS ODCM Part 1]

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3.0 DEFINITIONS

- [1] **Batch** – A quantity of waste to be processed having essentially consistent physical and chemical characteristics as determined through past experience or system operation knowledge by the Radwaste Shipping Specialist. A batch could be a waste tank, several waste tanks grouped together or a designated time period such as between outages as with the DAW waste stream. An isolated quantity of feed waste to be processed having essentially constant physical and chemical characteristics. (The addition or removal of water will not be considered to create a new batch).
- [2] **Certificate of Compliance** - Document issued by the USNRC regulating use of a NRC licensed cask or issued by (SCDHEC) South Carolina Department of Health and Environmental Conservation regulating a High Integrity Container.
- [3] **Chelating Agents** - EDTA, DTPA, hydroxy-carboxylic acids, citric acid, carbolic acid and glucinic acid.
- [4] **Compaction** - The process of volume reducing solid waste by applying external pressure.
- [5] **Confirmatory Analysis** - The practice of verifying that gross radioactivity measurements using MCA are reasonably consistent with independent laboratory sample data.
- [6] **Dewatered Waste** - Wet waste that has been processed by means other than solidification, encapsulation, or absorption to meet the free standing liquid requirements of 10CFR Part 61.56 (a)(3) and (b)(2).
- [7] **De-watering** - The removal of water or liquid from a waste form, usually by gravity or pumping.
- [8] **Dilution Factor** - The RADMAN computer code factor to account for the non-radioactive binder added to the waste stream in the final product when waste is solidified.
- [9] **Dry Waste** - Radioactive waste which exist primarily in a non-liquid form and includes such items as dry materials, metals, resins, filter media and sludges.
- [10] **Encapsulation** - Encapsulation is a means of providing stability for certain types of waste by surrounding the waste by an appropriate encapsulation media.
- [11] **Gamma-Spectral-Analysis** - Also known as IG, MCA, Ge/Li and gamma spectroscopy.
- [12] **Gross Radioactivity Measurements** - More commonly known as dose to curie conversion for packaged waste characterization and classification.

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- [13] **Homogeneous** - Of the same kind or nature; essentially alike. Most Volumetric waste streams are considered homogeneous for purposes of waste classification.
- [14] **Incineration** – The process of burning a combustible material to reduce its volume and yield an ash residue.
- [15] **Liquid Waste** - Radioactive waste that exist primarily in a liquid form and is contained in other than installed plant systems, to include such items as oil, EHC fluid, and other liquids. This waste is normally processed off-site.
- [16] **Low-Level Radioactive Waste (LLW)** - Those wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste has the same meaning as in the Low-Level Waste Policy Act, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).
- [17] **Measurement of Specific Radionuclides** - More commonly known as direct sample or container sample using MCA data for packaged waste characterization and classification.
- [18] **Operable** - A system, subsystem, train, component or device SHALL be OPERABLE or have OPERABILITY when it is capable of performing its specified functions(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).
- [19] **Prequalification Program** - The testing program implemented to demonstrate that the proposed method of wet waste processing will result in a waste form acceptable to the land disposal facility and the NRC.
- [20] **Processing** - Changing, modifying, and/or packaging radioactive waste into a form that is acceptable to a disposal facility.
- [21] **Quality Assurance/Quality Control** - As used in this document, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material structure, component, or system to predetermined requirements.

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- [22] **Reportable Quantity Radionuclides (RQ)** - Any radionuclide listed in column (1) of Table 2 of 49CFR Part 172.101 which is present in quantities as listed in column (3) of Table 2 of 49CFR Part 172.101.
- [23] **Sampling Plan** - A program to ensure that representative samples from the feed waste and the final waste form are obtained and tested for conformance with parameters stated in the PCP and waste form acceptance criteria.
- [24] **Scaling Factor** - A dimensionless number which relates the concentration of an easy to measure radionuclide (gamma emitter) to one which is difficult to measure (beta and/or alpha emitters).
- [25] **Significant Quantity** - For purposes of waste classification all the following radionuclide values SHALL be considered significant and must be reported on the disposal manifest.
- Any value (real or LLD) for radionuclides listed in Appendix G to 10CFR20 (H-3, C-14, I-129, Tc-99).
 - Greater than or equal to 1 percent of the concentration limits as listed in 10CFR Part 61.55 Table 1.
 - Greater than or equal to 1 percent of the Class A concentration limits listed in 10CFR Part 61.55 Table 2.
 - Greater than or equal to 1 percent of the total activity.
 - Greater than or equal to 1 percent of the Reportable Quantity limits listed on 49CFR Part 172.101 Table 2.
- [26] **Solidification** - The conversion of wet waste into a free-standing monolith by the addition of an agent so that the waste meets the stability and free-standing liquid requirements of the disposal site.
- [27] **Special Radionuclides** - The RADMAN computer code term for radionuclides listed in Appendix G to 10CFR20 (i.e., H-3, C-14, I-129 & Tc-99)
- [28] **Stability** – Structural stability per 10CFR61.2, Waste Form Technical Position, and Waste Form Technical Position Revision 1. This can be provided by the waste form, or by placing the waste in a disposal container or structure that provides stability after disposal. Stability requires that the waste form maintain its structural integrity under the expected disposal conditions.

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- [29] **Training** - A systematic program that ensures a person has knowledge of hazardous materials and hazardous materials regulations.
- [30] **Type A Package** - Is the packaging together with its radioactive contents limited to A1 or A2 as appropriate that meets the requirements of 49CFR Part 173.410 and Part 173.412, and is designed to retain the integrity of containment and shielding under normal conditions of transport as demonstrated by the tests set forth in 49CFR Part 173.465 or Part 173.466 as appropriate.
- [31] **Type B Package** - Is the packaging together with its radioactive contents that is designed to retain the integrity of containment and shielding when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in 10CFR Part 71.
- [32] **Volume Reduction** – any process that reduces the volume of waste. This includes but is not limited to, compaction and incineration.
- [33] **Waste Container** - A vessel of any shape, size, and composition used to contain the waste media.
- [34] **Waste Form** - Waste in a waste container acceptable for disposal at a licensed disposal facility.
- [35] **Waste Stream** - A Plant specific and constant source of waste with a distinct radionuclide content and distribution.
- [36] **Waste Type** – A single packaging configuration and waste form tied to a specific waste stream.

4.0 RESPONSIBILITIES

- [1] The **Vice President Operations Support (VPOS)** is responsible for the implementation of this procedure.
- [2] Each site **Senior Nuclear Executive (SNE)** is responsible for ensuring that necessary site staff implements this procedure.
- [3] The **Low Level RadWaste (LLRW) Focus Group** is responsible for evaluating and recommending changes and revisions to this procedure.

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[4] Each site **RP Department – Radwaste Supervisor / Specialist** (title may vary at the site's respectively) has the overall responsibility for implementing the PCP and is responsible for processing and transportation is tasked with the day-to-day responsibilities for the following:

- Implementing the requirements of this document.
- Ensuring that radioactive waste is characterized and classified in accordance with 10CFR Part 61.55 and Part 61.56.
- Ensuring that radioactive waste is characterized and classified in accordance with volume reduction facility and disposal site licenses and other requirements.
- Designating other approved procedures (if required) to be implemented in the packaging of any specific batch of waste.
- Providing a designated regulatory point of contact between the Plant and the NRC, volume reduction facility or disposal site.
- Maintaining records of on-site and off-site waste stream sample analysis and Plant evaluations.
- Suspending shipments of defectively processed or defectively packaged radioactive wastes from the site when the provisions of this process control program are not satisfied.

5.0 **DETAILS**

An isotopic analysis SHALL be performed on every batch for each waste stream so that the waste can be classified in accordance with 10CFR61. The isotopic and curie content of each shipping container SHALL be determined in accordance with 49CFR packaging requirements. The total activity in the container may be determined by either isotopic analysis or by dose-rate-to-curie conversion.

5.1. **Precautions and Limitations**

[1] **Precautions**

- (a) Radioactive materials SHALL be handled in accordance with applicable radiation protection procedures.
- (b) All radioactive waste must be processed or packaged to meet the minimum requirements listed in 10CFR Part 61.56 (a) (1) through (8).

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- (c) If the provisions of the Process Control Program are not satisfied, suspend shipment of the defectively processed or defectively packaged waste from the site. Shipment may be accomplished when the waste is processed / packaged in accordance with the Process Control Program.
- (d) The generation of combustible gases is dependent on the waste form, radioactive concentration and accumulated dose in the waste. Changes to organic inputs (e.g. oil) to waste stream may change biogas generation rates.

[2] Limitations

- (a) Only qualified personnel will characterize OR package radioactive waste OR radioactive materials for transportation or disposal.
- (b) All site personnel that have any involvement with radioactive waste management computer software SHALL be familiar with its functions, operation and maintenance.

5.2. Waste Management Practices

[1] Waste processing methods include the following:

- (a) Present and planned practice is NOT to solidify or encapsulate any waste streams.
- (b) Waste being shipped directly for burial in a HIC (High Integrity Container) is dewatered to less than 1 percent by volume prior to shipment.
- (c) Waste being shipped directly for burial in a container other than a HIC is dewatered to less than 0.5 percent by volume prior to shipment.
- (d) IF solidification is required in the future, THEN at least one representative test specimen from at least every 10th batch of each type of radioactive waste will be checked to verify solidification.
 - (1) IF any specimen fails to verify solidification, THEN the solidification of the batch under test SHALL be suspended until such time as additional test specimens can be obtained, alternative solidification parameters can be determined, and a subsequent test verifies solidification. If alternative parameters are determined, the subsequent tests shall be verified using the alternative parameters determined.

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5.2[1](d), continued

- (2) IF the initial test specimen from a batch of waste fails to verify solidification, THEN provide for the collection and testing of representative test specimens from each consecutive batch of the same type of waste until at least 3 consecutive initial test specimens demonstrates solidification. The process **SHALL** be modified as required to assure solidification of subsequent batches of waste.

- [2] Operation and maintenance of dewatering systems and equipment include the following:
- (a) Present and planned practice is to utilize plant personnel supplemented by vendor personnel or contracted vendor personnel, to operate **AND** maintain dewatering systems and equipment (as needed to meet disposal site requirements).
 - (b) All disposal liners are manufactured by and purchased from QA-approved vendors.
- [3] ALARA considerations are addressed in all phases of the processes involving handling, packaging **AND** transfer of any type OR form of radioactive waste (dewatered or dry). Resin, charcoal media, spent filter cartridges **AND** sludges are typically processed within shields. Sluicible demineralizers are shielded when in service. Radiation exposure and other health physics requirements are controlled by the issuance of a Radiation Work Permit (RWP) for each task.

5.3. Waste Stream Sampling Methods and Frequency

- [1] The following general requirements apply to Plant waste stream sampling:
- (a) Treat each waste stream separately for classification purposes.
 - (b) Ensure samples are representative of or can be correlated to the final waste form.
 - (c) Determine the density for each new waste stream initially or as needed (not applicable for DAW and filters).
 - (d) Perform an in-house analysis for gamma-emitting radionuclides for each sample sent to an independent laboratory.
 - (e) Periodically perform in-house analysis for gamma emitting radionuclides for comparison to the current data base values for gamma emitters. (The current database is usually based on the most recent independent laboratory results.)
 - (f) Resolve any discrepancies between in-house results **AND** the independent laboratory results for the same or replicate sample as soon as possible.
 - (g) Maintain records of on-site and off-site waste stream sample analysis and evaluations.

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- [2] When required, waste stream samples should be analyzed, re-evaluated and if necessary, shipped to a vendor laboratory for additional analysis. The same is true when there is a reason to believe that an equipment or process change has significantly altered the previously determined scaling factors by a factor of 10.

Specific examples include but are not limited to:

- Changes in oxidation reduction methods such as zinc, injection, hydrogen water chemistry,
- Changes in purification methods including media specialization, media distribution, ion/cation ratios,
- Changes in fuel performance criteria including fuel leaks
- Other changes in reactor coolant chemistry.
- Sustained, unexplained, changes in the routinely monitored Beta/Alpha ratios, as determined by Radiation Protection,
- When there is an extended reactor shutdown (> 90 days).
- When there are changes to liquid waste processing, such as bypassing filters, utilizing filters or a change in ion exchange media.
- When there are changes to the waste stream that could change the biogas generation rate.

- [3] The following requirements apply to infrequent or abnormal waste types:
- (a) Infrequent OR abnormal waste types that may be generated must be evaluated on a case-by-case basis.
 - (b) The RP Department Supervisor / Specialist responsible for processing AND shipping will determine if the waste can be correlated to an existing waste stream.
 - (c) IF the radioactive waste cannot be correlated to an existing waste stream, THEN the RP Department Supervisor / Specialist responsible for processing and shipping SHALL determine specific off-site sampling and analysis requirements necessary to properly classify the material.
- [4] Specific sampling methods and data evaluation criteria are detailed in EN-RW-104 for specific waste streams.

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5.4. Waste Classification

[1] General requirements for scaling factors include the following:

- (a) The Plant has established an inferential measurement program whereby concentrations of radionuclides which cannot be readily measured are estimated through ratio-ing with radionuclides which can be readily measured.
- (b) Scaling factor relationships are developed on a waste stream-specific basis. These relationships are periodically revised to reflect current independent lab data from direct measurement of samples. The scaling factor relationships currently used by the sites are as follows:
 - Hard to detect ACTIVATION product radionuclides and C-14 are estimated by using scaling factors with measured Co-60 activities.
 - Hard to detect FISSION product radionuclides and H-3, Tc-99 and I-129 are estimated by using scaling factors with measured Cs-137 activities.
 - Hard to detect TRANSURANIC radionuclides are estimated by using scaling factors with measured Ce-144 activities. Where Ce-144 cannot be readily measured, transuranics are estimated by using scaling factors with measured Cs-137 activities. Second order scaling of transuranics is acceptable when Cs-137 and Ce-144 are not readily measurable.

[2] General requirements for the determination of total activity and radionuclide concentrations include the following:

- (a) The activity for the waste streams is estimated by using either Gross Radioactivity Measurement OR Direct Measurement of Radionuclides. Current specific practices are as follows:
 - DAW - Gross radioactivity measurement in conjunction with the RADMAN computer codes, other approved computer codes or hand calculation.
 - Filters - Gross radioactivity measurement in conjunction with the FILTRK computer code, other approved computer codes or hand calculation.
 - All Other Waste Streams - Direct measurement of radionuclides in conjunction with the RADMAN computer codes, other approved computer codes or hand calculation.
- (b) Determination of the NRC waste classification is performed by comparing the measured or calculated concentrations of significant radionuclides in the final waste form to those listed in 10CFR Part 61.55.

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5.5. Quality Control

- [1] The RADMAN computer code provides a mechanism to assist the Plant in conducting a quality control program in accordance with the waste classification requirements listed in 10CFR Part 61.55. All waste stream sample data changes are written to a computer data file for future review and reference.
- [2] Audits and Management Review includes the following:
- (a) Appendix G to 10CFR20 requires conduct of a QC program which must include management review of audits.
 - (b) Management audits of the Plant Sampling and Classification Program SHALL be periodically performed to verify the adequacy of maintenance sampling and analysis.
 - (c) Audits and assessments are performed and documented by any of the following:
 - Radiation Protection Department
 - Quality Assurance Department
 - Qualified Vendors
 - (d) Certain elements of the Entergy Quality Assurance Program Manual are applied to the Process Control Program. **[QAPM, Section A.1.c]**

5.6. Dewatering Operations

- [1] Processing requirements during dewatering operations include the following:
- (a) All dewatering operations are performed per approved Plant or vendor operating procedures and instructions.
 - (b) Dewatering limitations and capabilities are verified by vendor Topical Reports or Operating and Testing Procedures.
- [2] Dewatered resin activity limitations include the following:
- (a) Dewatered resins will not be shipped off-site that have activities which will produce greater than 1.0E+8 rads total accumulated dose over 300 years. This is usually verified by comparing the container specific activity at the time of shipment to the following concentration limits for radionuclides with a half-life greater than five years:
 - 10 Ci (0.37 TBq) per cubic foot.
 - 350 uCi (12.95 MBq) per cubic centimeter

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5.7. Waste Packaging

Waste in final form will be packaged in accordance with Title 10 and Title 49 of the Code of federal regulations and in accordance with current burial site criteria as is detailed in EN-RW-102.

5.8. Administrative Controls

- [1] Information on solid radioactive waste shipped off-site is reported annually to the Nuclear Regulatory Commission in the Annual Radioactive Effluent Release Report as specified by the Offsite Dose Calculation Manual (ODCM) or Technical Specification. **[ANO1 Technical Specifications - 5.6.3] [ANO2 Technical Specifications – 6.6.3] [WF3 Technical Specifications – 6.9.18] [GGNS ODCM – 5.6.3.c] [JAF Technical Specifications – 5.6.3] [PLP ODCM, Appendix A – IV. A].**
- [2] All changes to the PCP SHALL be documented. All records of reviews performed SHALL be retained as required by the Quality Assurance Program. The documentation of the changes **SHALL [GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 2]:**
 - (a) Contain sufficient information to support the change with appropriate analyses or evaluations justifying the change.
 - (b) Include a determination that the change will maintain the overall conformance of the solidified waste product (if applicable) to existing requirements of Federal, State or other applicable regulations.
- [3] All changes in the Process Control Program and supporting documentation are included in each site's next Annual Radiological Effluent Release Report to the Nuclear Regulatory Commission. **[ANO ODCM - L3.2.1.C] [VTY TRM 6.12]**
- [4] The changes to EN-RW-105 SHALL become effective upon review and acceptance by the site's General Plant Manager except as listed below:
 - (a) For Grand Gulf Nuclear Station, the changes to RW-105 SHALL be accomplished as specified in Grand Gulf Nuclear Station Technical Requirements Manual (TRM) Section 7.6.3.8. The changes SHALL become effective upon review and acceptance by the On-site Safety Review Committee (OSRC) and the approval of the GGNS Plant General Manager. **[GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 2]**

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5.8[4], continued

- (b) For River Bend Nuclear Station, the procedure approval along with changes to RW-105 SHALL be accomplished per the River Bend Nuclear Station Technical Requirements, Section 5.5.14.1. The changes SHALL become effective upon review and acceptance by approval from the River Bend Nuclear Station Plant Manager or Radiation Protection Manager. **[RBS Technical Requirements – 5.5.14.1, 5.5.14.2 & 5.8.2]**
- (c) For Waterford 3, the procedure approval along with changes to RW-105 SHALL be accomplished per Waterford 3 Technical Specifications 6.13.2. The changes SHALL become effective upon review and acceptance by the Waterford 3 General Plant Manager. **[WF3 Technical Specifications – 6.13.2.b]**
- (d) For James A. FitzPatrick Nuclear Station, the procedure approval along with changes to EN-RW-105 SHALL be accomplished per the James A. FitzPatrick Station Technical Specifications, Section 5.6.3. The changes SHALL become effective upon review and acceptance through approval from the James A. FitzPatrick Nuclear Station On-Site Safety Review Committee. **[JAF UFSAR, Chapter 11.3.5]**
- (e) For Vermont Yankee, Changes to the Process Control Program SHALL become effective after review and acceptance by the (OSRC) On-Site Safety Review Committee and the Site VP.
- (f) For IPEC, Changes to the Process Control Program SHALL become effective after final review and acceptance by the On-Site Safety Review Committee (OSRC).

5.9. **Vendor Requirements**

- [1] Vendors performing radwaste services under 10CFR61 and 10CFR71 requirements will be on the Entergy Qualified Supplier's List (QSL). **[QAPM, Section A.1.c]**
- [2] Vendors performing radwaste services on-site are to comply with the following:
 - (a) Dewatering and solidification services SHALL have a NRC-approved Topical Report or other form of certification documenting NRC approval of the processes and associated equipment/containers.
 - (b) All vendor procedures utilized for performing on-site radwaste processing services (to assure compliance with 10 CFR Parts 20, 61 and 71, State Regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste) will be reviewed per the requirements of EN-LI-100, technically by the applicable site's Radiation Protection organization and only be accepted per the approvals specified in Section 5.8 [4].

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5.9[2], continued

- (c) All changes to vendor procedures for ongoing on-site radwaste services will be reviewed technically by the site's Radiation Protection organization and screened per the requirements of EN-LI-100. Significant procedural changes will require the approvals specified in Section 5.8 [4]. During screening, the level of significance for procedural changes on equipment and process parameters may warrant the full 10CFR50.59 documentation and approval process.
- (d) Plant management SHALL review vendor(s) topical reports and test procedures per applicable requirements in Section 5.8.

NOTE

The PCP does not have to include the vendor's Topical Report if it has NRC approval, or has been previously submitted to the NRC.

- (e) Plant management review will assure that the vendor's operations and requirements are compatible with the responsibilities and operation of the Plant.
- (f) Training requirements and records listed in Section 5.10 also apply to contracted vendors.

5.10. Miscellaneous

[1] Special tools and equipment

- (a) Frequency of Use and Descriptions

Required tools and equipment will vary depending on the specific process and waste container that is used. The various tools and equipment which may be required are detailed in specific procedures developed to govern activities described in this document.

[2] Pre-requisites

- (a) Maintenance of Regulatory Material

Ensure that a current set of DOT, NRC, EPA and applicable State regulations, vendor processing facility and disposal site regulations and requirements are maintained at the site and are readily available for reference. The use of web based regulations is acceptable.

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(b) Representative Radionuclide Sample Data

Ensure that representative radionuclide sample data is on file for each active waste stream. Unless operation conditions or changes in processing methods require increased sample frequency, data is considered to be current if it meets the requirements of EN-RW-104.

(c) Initial and Cyclic Training

- A training program SHALL be developed, implemented and maintained for all personnel involved in processing, packaging, handling and transportation of radioactive waste to ensure radwaste operations are performed within the requirements of NRC Information Bulletin 79-19 and 49CFR Part 172.700 through Part 172.704.
- Training requirements and documentation also apply to contracted on-site vendors.

NOTE

Cyclic training is defined as within three years for DOT, and two years for IATA

(d) Specific employee training is required for each person who performs the following job functions [172.702(b)].

- Classifies hazardous materials.
- Packages hazardous materials.
- Fills, loads and/or closes packages.
- Marks and labels packages containing hazardous materials.
- Prepares shipping papers for hazardous materials.
- Offers or accepts hazardous materials for transportation.
- Handles hazardous materials.
- Marks or placards transport vehicles.
- Operates transport vehicles.
- Works in a transportation facility and performs functions in proximity to hazardous materials which are to be transported.
- Inspects or tests packages.

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5.10[2] continued

- (e) Cyclic training is defined as within three years for DOT & within two years for IATA.

Copies of training records are required for as long as a person is employed and 90 days thereafter. The records should include, as a minimum, the following:

- Trainee's name and signature
- Training dates
- Training material or source reference
- Trainer's information

6.0 INTERFACES

- [1] EN-LI-100, "Process Applicability Determination"
- [2] EN-RW-104, "Scaling Factors"
- [3] EN-QV-104, "Entergy Quality Assurance Program Manual Control"

7.0 RECORDS

- [1] Documentation of pertinent data required to classify waste and verify solidification will be maintained on each batch of processed waste as required by approved procedures.
- [2] Documentation will also be maintained to ensure that containers, shipping casks, and methods of packaging wastes meet applicable Federal regulations and disposal site criteria. The records of reviews performed and documents associated with these reviews will be maintained as QA records.

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8.0 SITE SPECIFIC COMMITMENTS

Document	Document Section	NMM Procedure Section	Site Applicability
ANO ODCM	L3.2.1.C	5.8 [3]	ANO
ANO1 Technical Specifications	5.6.3	5.8 [1]	ANO
ANO2 Technical Specifications	6.6.3	5.8 [1]	ANO
RBS Technical Requirements	5.5.14	*	RBS
RBS Technical Requirements	5.5.14.1	5.8 [3] 5.8 [4] (b)	RBS
RBS Technical Requirements	5.5.14.2	5.8 [4] (b)	RBS
RBS Technical Requirements	5.8.2	5.8 [4] (b)	RBS
WF3 Technical Specifications	1.22	*	WF3
WF3 Technical Specifications	6.9.18	5.8 [1]	WF3
WF3 Technical Specifications	6.13.2.b	5.8 [4] (c)	WF3
JAF ODCM	6.2.1	5.8 [1]	JAF
JAF Technical Specifications	5.6.3	5.8 [1], 5.8 [4]	JAF
JAF FSAR	Chapters 7 and 11	5.8 [4]	JAF
11759 – NRC IN 79-19	All	*	WF3
GGNS UFSAR, Chapter 16B.1 / TRM	7.6.3.8 paragraph 1	1.0	GGNS
GGNS ODCM	5.6.3.c	5.8 [1]	GGNS
GGNS FSAR	11.4.5.S2	5.9 [2](a)	GGNS
GGNS FSAR	11.4.2.3AS7	5.9 [2](a)	GGNS
IPN-99-079	All	*	IPEC
Appendix B Technical Specifications	Section 4.5, RECS ODCM Part 1	*	IPEC
PLP Technical Specifications	5.5.15	5.8 [4]	PLP
PLP ODCM	Appendix A – IV. A	5.8 [1]	PLP
NRC Letter 1.98.091	All	*	PNPS
NRC Letter 1.88.078	All	*	PNPS
VY Technical Specifications	6.4.H	*	VY
VY ODCM	10.1	5.8 [1]	VY
VY TRM	6.12	5.8 (3)	VY
QAPM	Section A.1.c	*	All

* Covered by directive as a whole or by various paragraphs of the directive.

9.0 ATTACHMENTS

None