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GNRO-2013/00101

January 8, 2014

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20055-0001

SUBJECT: Grand Gulf Nuclear Station 2012 Annual Radioactive Effluent Release Report, Revision 2 per 10 CFR 50.36a(a)(2)
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERNCES:
1. GNRO-2013/00033, Dated April 30, 2013, Grand Gulf Nuclear Station 2012 Annual Radioactive Effluent Release Report per 10 CR 50.36a(a)(2)
2. GNRO-2013/00040, Dated June 10, 2013, Grand Gulf Nuclear Station 2012 Annual Radioactive Effluent Release Report, Revision 1 per 10 CFR 50.36a(a)(2)

Dear Sir or Madam:

Attached is the Grand Gulf Nuclear Station (GGNS) Annual Radioactive Effluent Release Report (ARERR), Revision 2 for the period January 1 2012 through December 31, 2012. Revision 2 to the 2012 GGNS ARERR incorporates information regarding the Circulating Water Blowdown low flow monitor being out of service for greater than 30 days, a modification made to the liquid radwaste treatment system during 2012, and revision of the solid radwaste shipments detailed in Table 3 of the report. Revisions to the report are identified by a revision bar located on the right side of the page. The need for the inclusion of these items was identified during the June 2013 NRC Radiation Safety Inspection.

There are no commitments contained in this submittal. If you have any questions or need additional information, please contact Richard Sumrall at 601-437-2115.

Sincerely,

JAS/cjb

Attachment: Grand Gulf Nuclear Station 2012 Annual Radioactive Effluent Release Report, Revision 2
cc: (See Next Page)

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Attachment
to
GNRO-2013/00101

Grand Gulf Nuclear Station 2012 Annual Radioactive Effluent Release Report, Revision 2

ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION

ANNUAL
RADIOACTIVE EFFLUENT RELEASE REPORT

January 1, 2012 - December 31, 2012

Josh Murray / 12/9/13

Prepared By

Douglas Wahl / Douglas Wahl / 12/16/13

Reviewed By

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I. INTRODUCTION

This Annual Radioactive Effluent Release Report (ARERR) for the period of January 1 through December 31, 2012, is submitted in accordance with Technical Specifications, Section 5.6.3, of Grand Gulf Nuclear Station (GGNS) License No. NPF-29. The monitoring of radioactive effluents is referenced in Offsite Dose Calculation Manual (ODCM) Appendix A, Sections 6.11 and 6.12.

Airborne discharges at GGNS are considered ground-level releases. All liquid and airborne discharges to the environment were analyzed in accordance with ODCM requirements. All effluent releases were within the concentration and total release limits specified by the ODCM. Projected offsite doses were within the dose limits specified by the ODCM.

The summation of all known gaseous releases during the reporting period is reported in Table 1A.

Elevated gaseous releases are not applicable at GGNS as reported in Table 1B.

The summation of all known ground-level gaseous release during the reporting period is reported in Table 1C.

The radioactive gaseous sampling and analysis program implemented at GGNS is described in Table 1D.

The summation of all liquid releases during the reporting period is reported in Table 2A

The continuous and batch mode liquid releases are reported in Table 2B.

The radioactive liquid waste sampling and analysis program implemented at GGNS is described in Table 2C.

Solid radioactive waste and irradiated fuel shipments during the reporting period are summarized in Table 3.

Groundwater Protection Initiative (GPI) well sample tritium results which are not included in the AREOR are included as Attachment I to the ARERR.

The current revision of the Offsite Dose Calculation Manual is included as Attachment II to the ARERR

The annual summary of meteorological data (joint frequency distribution) will be maintained on site. The option to maintain meteorological data on site is in accordance with ODCM Administrative Controls Section 5.6.3. This data shall be provided to the Nuclear Regulatory Commission (NRC) upon request.

II. DETAILED INFORMATION

A. Regulatory Limits

1. 10CFR20 Limits

a. Fission and Activation Gases - The release rate limit at any time for noble gases to areas at or beyond the site boundary shall be such that:

D_{tb} = average total body dose rate in the current year (mrem/yr)

$= \overline{X/Q}\, \Sigma_i K_i\, Q_i' \leq 500$ mrem/yr

D_s = average skin dose rate in the current year (mrem/yr)

$= \overline{X/Q}\, \Sigma_i\, (L_i + 1.1\, M_i)\, Q_i' \leq 3000$ mrem/yr

where the terms are defined in the GGNS ODCM.

b. Radioiodines, Tritium and Particulates - The release rate limit for the sampling period for all radioiodines, tritium and radioactive materials in particulate form with half-lives greater than 8 days shall be such that:

D_o = average organ dose rate in current year (mrem/yr)

$= \Sigma_i\, W\, P_i\, \overline{Q'_i} \leq 1500$ mrem/yr

where the terms are defined in the GGNS ODCM.

c. Liquid Effluents - The concentration of radioactive materials released in liquid effluents to unrestricted areas from the site shall not exceed at any time ten times the values specified in 10CFR20, Appendix B, Table 2, Column 2. The concentration of dissolved or entrained noble gases, released in liquid effluents to unrestricted areas from all reactors at the site, shall be limited to 2×10^{-4} microcuries/ml total activity.

II. DETAILED INFORMATION (CONT'D)

2. 10CFR50, Appendix I Limits

a. Fission and Activation Gases - The dose from noble gases in gaseous effluents to areas at or beyond the site boundary shall be such that:

D_γ = air dose due to gamma emissions from noble gases

$$= 3.17 \times 10^{-8} \Sigma_i M_i \overline{X/Q'} Q_i \leq 5 \text{ mrad/qtr}$$

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

D_β = air dose due to beta emissions from noble gases

$$= 3.17 \times 10^{-8} \Sigma_i N_i \overline{X/Q'} Q_i \leq 10 \text{ mrad/qtr}$$

$$\leq 20 \text{ mrad/yr}$$

where the terms are defined in the GGNS ODCM.

b. Radioiodines, Tritium and Particulates - The dose to an individual from tritium, I-131, I-133 and radioactive material in particulate form with half-lives greater than 8 days in gaseous effluents shall be such that:

D_p = dose to an individual from tritium, I-131, I-133 and radionuclides in particulate form with half-lives greater than 8 days (mrem)

$$= 3.17 \times 10^{-8} \Sigma_i R_i W' Q_i \leq 7.5 \text{ mrem/qtr Any Organ}$$

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

where the terms are defined in the GGNS ODCM.

c. Liquid Effluents - The dose from radioactive materials in liquid effluents shall be such that:

$$D_{Tau} = \sum_i [A_{iTau} \sum_{l=1}^{m} \Delta t_l C_{il} F_l] \leq 1.5 \text{ mrem/qtr Total Body}$$

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

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

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

where the terms are defined in the GGNS ODCM.

II. DETAILED INFORMATION (CONT'D)

3. 40CFR190 Limits

Doses are calculated for Fission and Activation Gases; Radioiodines and Particulates; and Liquid Effluents according to equations contained in Sections 2.(a), (b), and (c) respectively, with the exception that the limits applied are:

≤25 mrem/yr, Total Body or any Organ except Thyroid

≤75 mrem/yr, Thyroid

≤10 mrad γ/qtr or ≤20 mrad γ/yr, Fission and Activation Gases

≤20 mrad β/qtr or ≤40 mrad β/yr, Fission and Activation Gases

≤15 mrem/qtr or ≤30 mrem/yr, any Organ, Iodine and Particulates

≤3 mrem/qtr or ≤6 mrem/yr, Total Body, Liquid Effluents

≤10 mrem/qtr or ≤20 mrem/yr, any Organ, Liquid Effluents

B. Effluent Concentrations

1. Airborne

The Effluent Concentration Limit (ECL) of radioactive materials in gaseous effluents is limited by the dose rate restrictions given in Section II.A.1.a. In this case, the ECLs are actually determined by the dose factors in Table 2.1-1 of the GGNS ODCM.

2. Liquid

The ECL of radioactive materials in liquid effluents is limited by ten times the values in 10CFR20, Appendix B, Table 2, Column 2. The ECL chosen is the most conservative value of either the soluble or insoluble ECL for each radioisotope.

C. Average Energy

Not applicable for GGNS ODCM Appendix A.

II. DETAILED INFORMATION (CONT'D)

D. Measurements and Approximations of Total Activity

The following discussion details the methods used to measure and approximate the total activity for the following:

Fission and Activation Gases	Particulates
Radioiodines	Liquid Effluents

Tables 1D and 2C give sampling frequencies and Lower Limit of Detection requirements for the analysis of gaseous and liquid effluent streams, respectively.

Values in the attached tables given as zero do not necessarily imply that the radionuclides were not present. A zero indicates that the radionuclide was not present at levels greater than the sensitivity requirements shown in Tables 1D and 2C. For some radionuclides, lower detection levels than required may be readily achievable; when a radionuclide is measured below its stated detection limits, it is reported.

1. For Fission and Activation Gases

The following noble gases are considered in evaluating gaseous airborne discharges:

Kr-87	Kr-88	Xe-133
Xe-133m	Xe-135	Xe-138

Periodic grab samples from Station effluent streams are analyzed by gamma spectral analysis utilizing high-resolution germanium detectors. (See Table 1D for sampling and analytical requirements.) Isotopic values thus obtained are used for dose release rate calculations due to effluent releases as given in Section II.A.1 of this report. The radionuclides that are detected are used in this computation. When no radionuclides are detected, a historical mixture is used. During the period between grab samples, the amount of radioactivity released is based on the effluent monitor readings. Monitors are assigned a calibration factor based upon the last isotopic analysis, using the following relationship:

$$C_i = U_i \div m$$

where

C_i = isotopic calibration factor for isotope i

U_i = concentration of isotope i in the grab sample in μCi/ml.

m = net monitor reading associated with the effluent stream (determined at the time of grab sampling).

II. DETAILED INFORMATION (CONT'D)

These calibration factors, along with the hourly effluent monitor values and flow rates, are entered into the laboratory computer where the release rates for individual radionuclides are calculated and stored. If no activity is detected in the grab sample, the calibration factor defaults to a historical mixture of Kr-88, Xe-133, Xe-135m, Xe-135, and Xe-138.

2. For Particulates and Radioiodines

At a minimum, the following radioiodines and radioactive materials in particulate form to be considered are:

Zn-65	Mo-99
Mn-54	Cs-134
Fe-59	Cs-137
Co-58	Ce-141
Co-60	Ce-144
Sr-89	I-131
Sr-90	I-133

Other radionuclides with half lives greater than 8 days.

3. For Continuous Releases

Continuous sampling is performed on the continuous release points when releasing (i.e.: Offgas/Radwaste Building, Containment Building, Fuel Handling Area, Turbine Building, and Turbine Building Occasional Release Point). Particulate material is collected by filtration. Radioiodines are collected by adsorption onto a charcoal filter. Periodically these filters are removed and analyzed by gamma spectral analysis utilizing high-resolution germanium detectors to identify and quantify radioactive materials collected. Particulate filters are then analyzed for gross alpha and Strontium-89/90 as required. Gross alpha is analyzed using a gas flow proportional technique. Strontium-89/90 values are obtained by chemical separation and subsequent counting analysis using gas flow proportional techniques. Tritium concentrations are determined using distillation and liquid scintillation techniques. During major operational occurrences, the frequency of sampling is increased to satisfy the requirements of footnote "c" of Table 1D, "Radioactive Gaseous Waste Sampling and Analysis," (GGNS ODCM Appendix A, Table 6.11.4-1). Strontium analysis is performed by a qualified contract laboratory. Carbon-14 (C-14) activity of 11.30 Curies released per year in gaseous form was obtained by estimation using EPRI spreadsheet BWR Source Term Calculation (MAL-1)_r1 and the information in NEAD-NS-11-0060-Rev1-EC42519 and adjusted by 236 full power production days. Carbon-14 curies are reported in Tables 1A and 1C of this report and based on a constant release rate throughout the year.

4. For Batch Releases: Gases

Gaseous batch releases are not normally performed at GGNS.

II. DETAILED INFORMATION (CONT'D)

5. For Batch Releases: Liquid Effluents

At a minimum, the radionuclides listed below are considered when evaluating liquid effluents:

H-3	Sr-90
Mn-54	Mo-99
Fe-55	I-131
Co-58	Cs-134
Co-60	Cs-137
Fe-59	Ce-141
Zn-65	Ce-144
Sr-89	

Representative pre-release grab samples are obtained and analyzed as required by Table 2C. Isotopic analyses are performed by gamma spectral analysis utilizing high-resolution germanium detectors. Aliquots of each pre-released sample, proportional to the waste volume released, are composited in accordance with the requirements of Table 2C. Strontium-89/90 and Iron-55 values are obtained by individual chemical separations. Strontium-89/90 is analyzed using gas flow proportional techniques. Iron-55 is analyzed using liquid scintillation techniques. Gross alpha is analyzed using a gas flow proportional technique. Tritium is distilled and then analyzed using liquid scintillation techniques. Dissolved gases are determined employing grab sampling techniques and analyzed by gamma spectral analysis utilizing high-resolution germanium detectors. Iron and Strontium analyses are performed by a qualified contract laboratory.

E. Batch Releases

1. Liquid

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
a. Number of releases	65	60	41	39	205
Time Period (in minutes)					
b. Total for all batches	1.94E+04	1.78E+04	1.25E+04	1.06E+04	6.03E+04
c. Max time for a batch	3.95E+02	3.15E+02	3.20E+02	3.60E+02	3.95E+02
d. Avg time for a batch	2.98E+02	2.96E+02	3.06E+02	2.73E+02	2.94E+02
e. Min time for a batch	5.00E+01	1.00E+01	2.80E+02	1.00E+00	1.00E+00

2. Gaseous

No batch releases occurred during the report period.

II. DETAILED INFORMATION (CONT'D)

F. Abnormal Releases

1. Liquid

a. Number of Releases: 0

b. Total Activity Released: 0.00E+00 Ci

No abnormal liquid releases were identified for this reporting period.

2. Gaseous

a. Number of Releases: 0

b. Total Activity Released: 0.00E+00 Ci

No abnormal gaseous releases were identified for this reporting period.

G. Estimate of Total Error

1. Liquid

The maximum errors are collectively estimated to be as follows:

	Fission & Activation Products	Tritium	Dissolved & Entrained Gases	Gross Alpha
Sampling %	2.60E+01	2.60E+01	2.60E+01	2.60E+01
Measurement %	6.80E+01	6.50E+01	6.10E+01	9.20E+01
TOTAL %	7.30E+01	7.00E+01	6.60E+01	9.50E+01

Sampling errors include uncertainty associated with mixing, representative sampling and discharge volume. Measurement errors include uncertainty associated with instrument calibration and the preparation and counting of low-activity samples. Counting errors are based on measurements of blank samples. For germanium detectors, the least-readily-detectable radioisotope is used to determine the counting error. Calibration errors are calculated by summing the errors associated with the calibration of a particular instrument with a radioactive source.

The total error is calculated by taking the square root of the sum of the squares of the individual errors.

2. Gaseous

The maximum errors (not including sample line loss) are collectively estimated to be as follows:

	Fission & Activation Products	Iodine	Particulate	Alpha	Gross Tritium
Sampling %	3.20E+01	2.30E+01	2.20E+01	2.20E+01	2.30E+01
Measurement %	6.10E+01	6.70E+01	6.50E+01	1.01E+02	6.20E+01
TOTAL %	6.90E+01	7.10E+01	6.90E+01	1.03E+02	6.60E+01

Sampling errors include uncertainty associated with sample flow, vent flow and monitor calibration.

Measurement and total errors are calculated by the same methods used for liquid effluents.

3. Solid Radioactive Waste

Estimated Total Error % for all waste types is ±2.50E+01. Sampling errors include uncertainty associated with mixing and representative sampling.

H. Solid Radioactive Waste Shipments

See Table 3 for shipment information.

I. Meteorological Data

The data recovery for the reporting period was 99.8%. The predominant wind direction was from the Northeast approximately 11.3% of the time. The predominant stability class was class "D" approximately 29.6% of the time. Average wind speed during the reporting period was approximately 4.2 miles per hour at the 33 foot elevation.

The annual meteorological data (Hourly Average Data or Joint Frequency Distribution) will be maintained on site in a file that shall be provided to the NRC upon request.

J. Radioactive Effluent Monitoring Instrumentation Operability

Liquid radwaste effluent radiation monitor was inoperable for >14 days per Limiting Condition for Operation 1-OTS-12-0030. This was documented in Condition Report GGN-2012-06059. ODCM action 6.3.9 B.3 has a completion time of 14 days to restore channel to operable, which was exceeded at 12:46 on April 23, 2012.. Exceeding this completion time requires entry into Condition D with required action D.1 to immediately suspend Liquid Radwaste releases and action D.2 to immediately initiate action to explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner. Restoration of this equipment was delayed by Refueling Outage 18 critical path activities. In addition, a retest delay occurred and was documented in Condition Report GGN-2012-06007.

Circulating water blowdown low flow monitor was out of service from 2/22/201 to 5/29/12 for a total of 97 days due to the system being taken out of service for RF18. Per ODCM 6.3.9 Condition E, circulating discharge water flow was estimated every four hours by reviewing pump curves by Operations. The flow monitor was out greater than 30 days due to the extended power uprate outage.

K. Annual Sewage Disposal Summary

There were 2 sewage sludge shipments in 2012 consisting of 8 B-25 boxes that were shipped to EnergySolutions for Green is Clean.

III. RADIATION DOSE SUMMARY

Indicated below is the annual summary of offsite doses attributable to GGNS during 2012. Inspection of the values indicates that GGNS releases were within the 10CFR50, Appendix I, design objectives.

Since there are no other fuel cycle facilities within 8 km of GGNS, 40CFR190 limits were also met during this period.

A. Water-Related Exposure Pathways

The values calculated in this section utilize the information provided in Tables 2A and 2B of this report and the calculation methodology of the ODCM.

Liquid Effluents

Total body dose and critical organ doses are computed for the maximum exposed individual. The maximum dose contribution from liquid effluents is considered to occur in the adult age group via consumption of fish.

2012 Liquid Effluent Dose (mrem)

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	TOTAL
Bone	1.61E-01	1.26E-01	1.55E-02	5.23E-03	2.68E-01
Liver	2.74E-01	3.09E-01	3.97E-02	1.23E-02	5.64E-01
Thyroid	4.81E-03	1.52E-03	1.02E-03	1.29E-03	8.03E-03
Kidney	1.18E-01	1.82E-01	2.39E-02	6.52E-03	2.98E-01
Lung	2.61E-02	1.03E-02	2.25E-03	2.12E-03	3.55E-02
GI-LLI	9.48E-02	1.69E-01	2.58E-02	1.22E-02	2.76E-01
Whole Body	1.63E-01	1.54E-01	1.95E-02	6.53E-03	3.02E-01

B. Airborne-Related Exposure Pathways

The values presented in this section utilize information provided in Tables 1A and 1C of this report and the calculation methodology of the ODCM. Carbon-14 doses were calculated using Electric Power Research Institute, EPRI, methodology and calculation software which was validated on site using Regulatory Guide 1.109. Dose and dose rates are computed for locations at the site boundary or at unrestricted areas within the site boundary. Because members of the public may, on occasion, be found within the site boundary, two fishing lakes, the recreational vehicle laydown area, and the GGNS Energy Services Center locations were also evaluated.

Consideration of site boundary locations as well as unrestricted areas within and beyond the site boundary provides assurance that offsite doses will not be substantially underestimated while attempting to provide an accurate dose calculation.

Doses for a Member of the Public are computed based on 2012 meteorological data and on the most recent land use census, with the most limiting location used.

During normal operations, the dispersion and deposition factors used for dose calculations are from five-year historical annual average meteorological data.

III. RADIATION DOSE SUMMARY (CONT'D)

Organ Dose

The maximum organ dose to a MEMBER OF THE PUBLIC (critical receptor) from radioiodines, tritium, and particulates was calculated for this report using the most recent land use census and dispersion and deposition parameters from 2012 meteorological data. The critical receptor residence was determined to be located in the southwest sector at a distance of 1432 meters (0.89 miles) from the plant. Pathways considered for use in the organ dose calculations are inhalation, ground plane, grass/cow/meat, and vegetation. There is no grass/cow/milk pathway within five miles of GGNS. It was assumed that the age group receiving the maximum dose lived at the residence and that the receptor consumed food products that were raised or produced at the residence. This dose is documented in the following table as two separate entries. The first organ dose entry excludes C-14 while the second entry includes organ dose from tritium, radioiodines, particulates, and C-14.

Average Total Body and Skin Dose Rate

Individual total body and skin dose rates from exposure to a semi-infinite cloud of noble gas are computed for a location in the southwest sector at a distance of 1368 meters (0.85 miles) from the plant. This location corresponds to the highest annual average atmospheric dispersion factor for a location at or within the site boundary based on 2012 meteorological data.

The total body and skin dose rates reported are the quarterly average of the maximum instantaneous dose rates determined daily during the reporting period and represent the maximum possible dose rate received by members of the public.

Air Dose from Gamma and Beta Emissions

Air doses from gaseous effluents were calculated for this report using dispersion parameters from the 2012 meteorological data. The highest dispersion factor for an unrestricted area was in the southwest sector at the site boundary, 1368 meters (0.85 miles) from the plant.

Direct Radiation

Direct radiation dose is calculated by subtracting average doses measured by thermoluminescent dosimeter (TLD) badges located at control locations from average doses measured by TLD badges located near the site boundary. GGNS reported measured doses in 2012 as net exposure normalized to 92 days.

III. RADIATION DOSE SUMMARY (CONT'D)

Carbon-14

Carbon-14 (C-14) is a naturally occurring isotope of carbon. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Carbon-14 is also produced in commercial nuclear reactors, but the amounts produced are much less than those produced naturally or from weapons testing. In recent years, the analytical methods for determining C-14 have improved. Coincidentally the radioactive effluents from commercial nuclear power plants have also decreased to the point that C-14 has emerged as a principal radionuclide in gaseous effluents.

The only significant dose pathway to a member of the public from C-14 release is through consumption of vegetation. Vegetation incorporates C-14 in form of carbon dioxide (CO_2) during photosynthesis so doses are calculated based on the CO_2 fraction of the carbon released in gaseous form. A CO_2 fraction of 95% is used based on EPRI Technical Report 1021106, "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents". The highest atmospheric dispersion factor for an actual garden based on the land use census was used to determine dose from C-14. Carbon-14 is dispersed as a gas (CO_2) to the garden location, where it is then incorporated into plant material.

Carbon-14 dose is calculated to a MEMBER OF THE PUBLIC for the most age restrictive group (Child) and organ (bone) at the garden location. This doses is then added to dose for the same organ from tritium, iodine, and particulates. This organ dose is recorded and compared to the limit in the following table.

2012 Airborne Effluent Dose (mrem)					
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	TOTAL
Iodine, Tritium & Particulates (excluding Carbon-14)					
Child (mrem)	1.08E-02	1.66E-03	5.81E-03	1.12E-02	2.95E-02
Organ	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid
Applicable Limit	7.5	7.5	7.5	7.5	15
Percent of Limit	1.45E-01	2.21E-02	7.75E-02	1.49E-01	1.97E-01
Iodine, Tritium & Particulates (including Carbon-14)					
Child (mrem)	1.45E+00	3.09E-02	2.68E+00	2.90E+00	7.06E+00
Organ	Bone	Bone	Bone	Bone	Bone
Applicable Limit	7.5	7.5	7.5	7.5	15
Percent of Limit	1.93E+01	4.12E-01	3.57E+01	3.87E+01	4.71E+01
Total Body Dose Rate (mrem/yr)	3.03E-02	3.81E-01	5.90E-01	4.71E-01	
Applicable Limit	500	500	500	500	
Percent of Limit	6.06E-03	7.62E-02	1.18E-01	9.42E-02	
Skin Dose Rate (mrem/yr)	7.33E-02	7.34E-01	8.53E-01	6.98E-01	
Applicable Limit	3000	3000	3000	3000	
Percent of Limit	2.43E-03	2.45E-02	2.84E-02	2.33E-02	
Gamma Air Dose*	9.23E-03	6.34E-02	1.98E-01	1.52E-01	4.23E-01
Applicable Limit	5	5	5	5	10
Percent of Limit	1.85E-01	1.27E+00	3.96E+00	3.05E+00	4.23E+00
Beta Air Dose*	1.31E-02	6.67E-02	7.44E-02	6.20E-02	2.16E-01
Applicable Limit	10	10	10	10	20
Percent of Limit	1.31E-01	6.67E-01	7.44E-01	6.20E-01	1.08E+00
Direct Radiation (mrem)	0.0	0.0	0.1	0.0	0.1

*Measurement units are mrad

IV. OFFSITE DOSE CALCULATION MANUAL/ RADIOACTIVE WASTE TREATMENT SYSTEM CHANGES

A. Offsite Dose Calculation Manual (ODCM)

Revisions 38 and 39 of the ODCM were issued in 2012. The revisions included

Description of Change(s)	Revision Number	Month/Year of Change	Affected Page Number(s)
Revise 6.3.9 to add condition E. Condition E is to acknowledge that as long as flow is monitored and measured, there is no need to suspend dilution flow activities LBDCR 12- 012	38	03/2012	i, ia, vii, viib, A-14
Revise Table 6.3.10-1 Section 3B to include note h. Note h is to acknowledge ≤4 Turbine Building roof hatches may be open in Modes 4 and 5. LDCR 2012-017	39	03/2012	i, vii, viia, viib, 2.0-35, A-26, A-28, A-39, A-41

A current copy of the GGNS ODCM is included in this submittal as Attachment II.

B. Radioactive Waste Treatment Systems

In December 2012 an alternate skid-mounted filtration system was put into operation. The skid-mounted filtration system that is designed to perform the functions of the existing Equipment Drain Filter, SG17D001, and Floor Drain Filter, SG17D003. The filtration system shall be capable of removing suspended solids such that further processing of the waste through the radwaste demineralizers will consistently and reliably produce Condensate Storage Tank (CST) grade water.

The new system is a 150 gallons per minute Solids Removal System (SRS-150) provided by Energy Solutions, LLC, which utilizes inorganic (metallic) cross-flow filter membranes, and is designed to remove solids greater than 0.5 micron in size from liquid radwaste streams. The filter units are constructed similarly to shell and tube heat exchangers and the filter membranes are manufactured in the form of sintered metal tubes made of stainless steel and coated with titanium oxide. With cross-flow filtration, the recirculating feed stream is used to continuously shear filtered particles from the membrane surface.

TABLE 1A
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS – SUMMATION OF ALL RELEASES

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
1. Total Release	Ci	1.35E+01	1.74E+02	1.54E+02	1.11E+02	4.53E+02
2. Avg. Release Rate	uCi/sec	1.71E+00	2.22E+01	1.94E+01	1.39E+01	1.43E+01
3. Percent of TS Limit						
a. Gamma Air	%	1.85E-01	1.27E+00	3.96E+00	3.05E+00	4.23E+00
b. Beta Air	%	1.31E-01	6.67E-01	7.44E-01	6.20E-01	1.08E+00
Iodine-131						
1. Total Release	Ci	1.91E-04	5.02E-06	2.63E-05	1.96E-04	4.18E-04
2. Avg. Release Rate	uCi/sec	2.43E-05	6.38E-07	3.30E-06	2.46E-05	1.32E-06
3. Percent of TS Limit	%	4.40E-02	1.16E-03	6.05E-03	4.51E-02	4.81E-02
Particulates Half Life >= 8 days						
1. Total Release	Ci	3.64E-05	7.99E-05	5.43E-05	5.71E-05	2.28E-04
2. Avg. Release Rate	uCi/sec	4.63E-06	1.02E-05	6.83E-06	7.18E-06	7.20E-06
3. Percent of TS Limit	%	1.42E-03	1.99E-03	2.37E-03	5.41E-03	5.37E-03
Tritium						
1. Total Release	Ci	7.01E+00	1.58E+00	5.06E+00	7.50E+00	2.11E+01
2. Avg. Release Rate	uCi/sec	8.92E-01	2.01E-01	6.36E-01	9.43E-01	6.69E-01
3. Percent of TS Limit	%	9.22E-02	2.08E-02	6.65E-02	9.86E-02	1.39E-01
Carbon 14						
1. Total Release	Ci	2.32E+00	5.00E-02	4.29E+00	4.64E+00	1.13E+01
2. Avg. Release Rate	uCi/sec	2.95E-01	6.36E-03	5.40E-01	5.84E-01	3.57E-01
Gross Alpha						
1. Total Release	Ci	9.59E-08	6.59E-07	6.55E-08	7.93E-08	9.00E-07
2. Avg. Release Rate	uCi/sec	1.22E-08	8.39E-08	8.25E-09	9.97E-09	2.85E-08

TABLE 1B
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS – ELEVATED RELEASES
JANUARY – DECEMBER 2012

(Not Applicable – GGNS Releases Are Considered Ground-Level)

TABLE 1C
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS – GROUND-LEVEL RELEASE-CONTINUOUS

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Gases						
AR-41	Ci	4.16E-02	1.08E-01	3.49E+01	1.95E+01	5.46E+01
KR-85M	Ci	2.65E+00	4.76E-02	2.58E+01	1.68E+01	4.53E+01
KR-87	Ci	0.00E+00	2.41E-01	1.01E+00	6.23E+00	7.48E+00
KR-88	Ci	8.02E-02	3.53E+00	3.79E+01	3.23E+01	7.38E+01
KR-89	Ci	0.00E+00	1.48E+00	1.14E-01	0.00E+00	1.59E+00
XE-133	Ci	1.60E+00	7.89E+01	2.95E+01	1.92E+01	1.29E+02
XE-135	Ci	1.48E+00	7.56E+01	2.16E+01	1.47E+01	1.13E+02
XE-135M	Ci	1.22E+00	9.34E+00	2.57E+00	1.71E+00	1.48E+01
XE-137	Ci	3.12E+00	1.33E+00	1.03E-01	0.00E+00	4.56E+00
XE-138	Ci	3.24E+00	3.74E+00	7.09E-01	3.88E-01	8.08E+00
Totals for Period...	Ci	1.35E+01	1.74E+02	1.54E+02	1.11E+02	4.53E+02
Iodines						
I-131	Ci	1.91E-04	5.02E-06	2.63E-05	1.96E-04	4.18E-04
I-133	Ci	6.58E-04	1.16E-05	3.05E-04	4.30E-04	1.40E-03
I-135	Ci	7.75E-05	0.00E+00	4.88E-04	4.77E-05	6.13E-04
Totals for Period...	Ci	9.26E-04	1.66E-05	8.20E-04	6.73E-04	2.44E-03
Particulates Half Life >= 8 days						
AG-110M	Ci	0.00E+00	0.00E+00	0.00E+00	3.29E-06	3.29E-06
BA-140	Ci	1.41E-05	0.00E+00	0.00E+00	0.00E+00	1.41E-05
CO-58	Ci	0.00E+00	0.00E+00	8.60E-06	3.90E-06	1.25E-05
CO-60	Ci	2.45E-06	1.42E-05	2.23E-06	2.37E-05	4.25E-05
CR-51	Ci	1.53E-06	0.00E+00	0.00E+00	0.00E+00	1.53E-06
CS-134	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CS-137	Ci	0.00E+00	2.11E-06	0.00E+00	1.92E-06	4.03E-06
FE-55	Ci	4.75E-07	1.44E-05	0.00E+00	3.68E-07	1.52E-05
MN-54	Ci	1.35E-06	7.89E-06	4.49E-06	8.63E-06	2.24E-05
RU-106	Ci	0.00E+00	0.00E+00	3.32E-05	8.11E-07	3.40E-05
SR-89	Ci	1.01E-05	1.21E-05	5.60E-06	1.63E-06	2.95E-05
SR-90	Ci	0.00E+00	0.00E+00	2.06E-07	5.04E-07	7.10E-07
ZN-65	Ci	6.40E-06	2.92E-05	0.00E+00	1.23E-05	4.79E-05
Totals for Period...	Ci	3.64E-05	7.99E-05	5.43E-05	5.71E-05	2.28E-04
Other						
H-3	Ci	7.01E+00	1.58E+00	5.06E+00	7.50E+00	2.11E+01
C-14	Ci	2.32E+00	5.00E-02	4.29E+00	4.64E+00	1.13E+01
Gross Alpha	Ci	9.59E-08	6.59E-07	6.55E-08	7.93E-08	9.00E-07

TABLE 1D
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
Radioactive Gaseous Waste Sampling and Analysis Program
JANUARY – DECEMBER 2012

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (uCi/ml)[a]
A. (1) Radwaste Building Ventilation Exhaust	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters (b,e) H-3	$\frac{1x10^{-4}}{1X10^{-6}}$
(2) Fuel Handling Area Ventilation Exhaust	Continuous (d)(f)	7 Days (c) Charcoal Sample	I-131 I-133	$\frac{1x10^{-12}}{1x10^{-10}}$
(3) Containment Ventilation Exhaust	Continuous (d)(f)	7 Days (c) Particulate Sample	Principal Gamma Emitters (e) (I-131, Others)	$1x10^{-11}$
(4A) Turbine Building Ventilation Exhaust	Continuous (d)(f)	31 Days Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
(4B) Turbine Building Occasional Release Point(g) (when in service)	Continuous (d)(f)	92 Days Composite Particulate Sample	Sr-89, Sr-90	$1x10^{-11}$
	Continuous (f)	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	$1x10^{-6}$
B. (1) Offgas Post Treatment Exhaust, whenever there is flow	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters (e)	$1x10^{-4}$
(2) Standby Gas Treatment A Exhaust, whenever there is flow	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters(e)	$1x10^{-4}$
(3) Standby Gas Treatment B Exhaust, whenever there is flow	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters(e)	$1x10^{-4}$

NOTE: Footnotes indicated are listed in GGNS ODCM, Appendix A, Table 6.11.4-1.

TABLE 2A
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

RADIOACTIVE EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS – SUMMATION OF ALL RELEASES

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Products						
1. Total Release	Ci	2.04E-02	2.94E-02	1.85E-02	1.55E-02	8.38E-02
2. Avg. Diluted Conc.	uCi/ml	5.30E-08	7.38E-08	4.44E-08	5.15E-08	5.58E-08
3. Percent of Limit	%	9.82E-02	8.86E-02	3.44E-02	3.25E-02	6.46E-02
Tritium						
1. Total Release	Ci	4.66E+01	1.81E+01	1.81E+01	1.94E+01	1.02E+02
2. Avg. Diluted Conc.	uCi/ml	1.21E-04	4.55E-05	4.33E-05	6.41E-05	6.80E-05
3. Percent of Limit	%	1.21E+00	4.55E-01	4.33E-01	6.41E-01	6.80E-01
Dissolved and Entrained Gases						
1. Total Release	Ci	2.81E-03	6.19E-05	1.12E-03	8.28E-04	4.82E-03
2. Avg. Diluted Conc.	uCi/ml	7.32E-09	1.55E-10	2.68E-09	2.74E-09	3.21E-09
3. Percent of Limit	%	3.66E-03	7.77E-05	1.34E-03	1.37E-03	1.60E-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	6.62E+06	6.17E+06	4.28E+06	3.63E+06	2.07E+07
Volume of dil. water	liters	3.77E+08	3.94E+08	4.13E+08	2.99E+08	1.48E+09

TABLE 2B
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

RADIOACTIVE EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS – CONTINUOUS AND BATCH MODES

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
Fission and Activation Products						
AG-110M	Ci	2.05E-04	1.74E-04	7.11E-05	1.05E-03	1.50E-03
AS-76	Ci	0.00E+00	0.00E+00	3.14E-05	5.23E-05	8.37E-05
AU-199	Ci	7.52E-06	0.00E+00	0.00E+00	6.63E-05	7.38E-05
CO-58	Ci	1.38E-04	1.11E-04	2.51E-05	2.51E-04	5.24E-04
CO-60	Ci	6.02E-03	3.31E-03	1.57E-03	8.46E-04	1.18E-02
CR-51	Ci	5.95E-04	3.25E-05	5.34E-05	2.73E-03	3.41E-03
CS-134	Ci	0.00E+00	9.52E-06	0.00E+00	0.00E+00	9.52E-06
CS-137	Ci	8.59E-04	3.35E-04	4.47E-05	1.89E-05	1.26E-03
CU-67	Ci	0.00E+00	0.00E+00	0.00E+00	4.14E-06	4.14E-06
FE-55	Ci	3.74E-03	1.29E-02	8.88E-03	6.10E-03	3.17E-02
FE-59	Ci	1.40E-04	4.76E-05	0.00E+00	2.30E-04	4.18E-04
I-131	Ci	1.31E-05	0.00E+00	0.00E+00	0.00E+00	1.31E-05
LA-140	Ci	8.40E-04	0.00E+00	6.18E-05	3.51E-05	9.37E-04
MN-54	Ci	4.56E-03	2.08E-03	4.23E-04	8.30E-04	7.90E-03
MO-99	Ci	6.14E-05	0.00E+00	0.00E+00	0.00E+00	6.14E-05
NA-24	Ci	0.00E+00	0.00E+00	0.00E+00	2.58E-05	2.58E-05
PT-195M	Ci	0.00E+00	0.00E+00	0.00E+00	1.94E-05	1.94E-05
RB-88	Ci	1.97E-04	0.00E+00	4.40E-03	1.99E-03	6.59E-03
RU-106	Ci	2.04E-04	2.08E-04	1.16E-03	8.92E-04	2.47E-03
SB-124	Ci	6.43E-05	7.50E-05	0.00E+00	3.39E-05	1.73E-04
SB-125	Ci	3.00E-04	1.49E-03	8.80E-05	0.00E+00	1.88E-03
SE-75	Ci	0.00E+00	0.00E+00	0.00E+00	3.34E-06	3.34E-06
SN-117M	Ci	0.00E+00	0.00E+00	0.00E+00	2.03E-05	2.03E-05
SR-92	Ci	2.53E-06	1.66E-05	0.00E+00	4.52E-05	6.43E-05
TC-99M	Ci	7.27E-05	5.64E-06	4.80E-06	2.39E-06	8.55E-05
W-187	Ci	2.33E-05	0.00E+00	0.00E+00	0.00E+00	2.33E-05
ZN-65	Ci	2.29E-03	8.56E-03	1.68E-03	2.70E-04	1.28E-02
ZN-69M	Ci	2.27E-05	6.72E-06	5.31E-06	1.30E-05	4.77E-05
ZR-97	Ci	0.00E+00	0.00E+00	0.00E+00	1.54E-05	1.54E-05
Totals for Period...	Ci	2.04E-02	2.94E-02	1.85E-02	1.55E-02	8.38E-02
Tritium						
H-3	Ci	4.66E+01	1.81E+01	1.81E+01	1.94E+01	1.02E+02
Totals for Period...	Ci	4.66E+01	1.81E+01	1.81E+01	1.94E+01	1.02E+02
Dissolved and Entrained Gases						
XE-133	Ci	2.68E-03	3.33E-05	4.83E-04	3.61E-04	3.55E-03
XE-133M	Ci	3.77E-05	0.00E+00	0.00E+00	0.00E+00	3.77E-05
XE-135	Ci	9.92E-05	2.87E-05	6.36E-04	4.67E-04	1.23E-03
Totals for Period...	Ci	2.81E-03	6.19E-05	1.12E-03	8.28E-04	4.82E-03
Gross Alpha Radioactivity						
Alpha	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

TABLE 2C
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

RADIOACTIVE EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM
JANUARY – DECEMBER 2012

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (uCi/ml)(a)
A. Batch Waste Release Tanks (c)	Prior to Release Each Batch	Prior to Release Each Batch	Principal Gamma Emitters (d) I-131	$5x10^{-7}$ $1X10^{-6}$
	Prior to Release One Batch /M	31 Days	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
	Prior to Release Each Batch	31 Days Composite (b)	H-3 Gross Alpha	$1x10^{-5}$ $1x10^{-7}$
	Prior to Release Each Batch	92 Days Composite (b)	Sr-89, Sr-90 Fe-55	$5x10^{-8}$ $1x10^{-6}$
B. SSW Basin (Before Blowdown)	Prior to Release Each Blowdown	Prior to Release Each Batch	Principal Gamma Emitters (d) I-131	$5x10^{-7}$ $1x10^{-6}$

NOTE: Footnotes indicated are listed in GGNS ODCM, Appendix A, Table 6.11.1-1.

TABLE 3
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

RADIOACTIVE EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS
JANUARY – DECEMBER 2012

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

1. Type of Waste	Unit	Class A	Class B	Class C	Est. Total Error %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	1.40E+02 5.05E+02	2.86E+00 1.06E+03	0.00E+00 0.00E+00	+/- 25%
b. Dry compressible waste, contaminated equipment, etc.	m^3 Ci	4.38E+03 3.49E+00	0.00E+00 0.00E+00	0.00E+00 0.00E+00	+/- 25%
c. Irradiated components, control rods, etc.	m^3 Ci	0.00E+00 0.00E+00	0.00E+00 0.00E+00	0.00E+00 0.00E+00	+/- 25%
d. Other: Condensate Pre-Coat Septa Bundle	m^3 Ci	4.19E+01 7.93E-02	0.00E+00 0.00E+00	0.00E+00 0.00E+00	+/- 25%

2. Estimate of Major Nuclide Composition (by type of waste)

a. Spent resins, filter sludges, evaporator bottoms, etc.
None
b. Dry compressible waste, contaminated equipment, etc.
None
c. Irradiated components, control rods, etc.
None

d. Other: water tankers

Isotope (greater than 0.1%)	Percent	Curies
Ni-63	0.414	6.50E+00
Co-60	9.097	1.43E+02
Cr-51	0.545	8.55E+00
Cs-137	0.232	3.64E+00
Fe-55	75.449	1.18E+03
Fe-59	0.691	1.08E+01
Mn-54	9.488	1.49E+02
Co-58	0.352	5.52E+00
Zn-65	3.617	5.68E+01

TABLE 3
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1

RADIOACTIVE EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID RADIOACTIVE WASTE AND IRRADIATED FUEL SHIPMENTS
JANUARY – DECEMBER 2012 (Cont)

3. Solid Waste Disposition

Number of Shipments	Destination Name	City	State	Mode of Transportation
72	EnergySolutions(Duratek), LLC	Oak Ridge	TN	Hittman
9	EnergySolutions – Gallaher Road Facility	Oak Ridge	TN	Hittman
10	Studsvik	Erwin	TN	Hittman

NRC Class	Disposal Volume(ft^3)	Description	Number of Containers	Waste Type Description
B	120.3	8/120 HIC	1	Poly HIC – RWCU-A
A	202.2	ES-210	18	Carbon Steel Liner - SRT
A	1290	20' SEALAND	139	20FT Sealand
A	700	20' Intermodal	2	20FT Intermodal
A	90	B-25 box	4	B-25 box
A	800	Water Tanker	2	Water tanker
A	199.4	ES-210 (solidification)	9	Stainless Steel Liner CPS/RWCU-B
A	199.4	ES-210 (solidification)	3	Empty - Stainless Steel Liner

B. Irradiated Fuel Shipments (Disposition)

NUMBER OF SHIPMENTS	MODE OF TRANSPORTATION	DESTINATION
None	N/A	N/A

ATTACHMENT I

Nuclear Energy Institute, NEI, Groundwater Protection Initiative Sample Results

JANUARY – DECEMBER 2012

GPI Ground Water samples are collected from onsite dewatering wells, DW; monitoring wells, MW; observation wells, OW; and sump wells, SW. Samples were analyzed for tritium and selected samples were analyzed for gamma and/or hard to detect (HTD) isotopes (Gross Alpha, Iron-55, Nickel-63, Strontium-89 and Strontium-90). Analyses are to the Lower Level of Detection (LLD) values for the GGNS Radiological Environmental Monitoring Program.

No dose to the public is attributed to ground water since wells with results above MDA are bounded by wells which are <MDA. Tritium, gamma and HTD results are shown in the table below.

All results were less than Reporting Levels of GGNS-ODCM table 6.12.1-2.

LOCATION		DATE	TRITIUM (pCi/L)	GAMMA/HTD (pCi/L)
DW-01		2/9/2012	17800	<MDA
DW-01		6/13/2012	12800	<MDA
DW-01		9/12/2012	16800	<MDA
DW-01		11/7/2012	12600	<MDA
DW-07		9/12/2012	6550	<MDA
DW-07		11/6/2012	8350	<MDA
MW-01		2/9/2012	<239	<MDA
MW-01		6/13/2012	<351	<MDA
MW-01		9/11/2012	380	<MDA
MW-01	DUP	9/11/2012	359	<MDA
MW-01		11/7/2012	<262	<MDA
MW-08		2/8/2012	<326	<MDA
MW-08		6/13/2012	<347	<MDA
MW-08	DUP	6/13/2012	<350	<MDA
MW-09		2/9/2012	<234	<MDA
MW-09		6/13/2012	<342	<MDA
MW-10		6/13/2012	<337	<MDA
MW-13		6/20/2012	<284	<MDA
MW-15		6/20/2012	<342	<MDA
MW-18		6/20/2012	<275	<MDA
MW-21		6/20/2012	<277	<MDA
MW-23		2/9/2012	<233	<MDA
MW-23		6/12/2012	<346	<MDA

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Nuclear Energy Institute, NEI, Groundwater Protection Initiative Sample Results

JANUARY – DECEMBER 2012 (Cont)

LOCATION		DATE	TRITIUM (pCi/L)	GAMMA/HTD (pCi/L)
MW-100B		2/9/2012	<234	<MDA
MW-100B		6/12/2012	<341	<MDA
MW-100B		9/12/2012	<204	<MDA
MW-100B		11/8/2012	<263	<MDA
MW-102B		2/9/2012	<238	<MDA
MW-102B		6/12/2012	<347	<MDA
MW-102B		9/12/2012	347	<MDA
MW-102B		11/7/2012	268	<MDA
MW-103A		9/12/2012	<218	<MDA
MW-103B		2/8/2012	<235	<MDA
MW-103B		6/13/2012	<339	<MDA
MW-103B		9/12/2012	<215	<MDA
MW-103B		11/7/2012	<271	<MDA
MW-104B		2/9/2012	<235	<MDA
MW-104B		6/13/2012	<347	<MDA
MW-104B		9/13/2012	<219	<MDA
MW-104B		11/7/2012	<268	<MDA
MW-105B		2/9/2012	740	<MDA
MW-105B	DUP	2/9/2012	904	N/A
MW-105B		6/12/2012	560	<MDA
MW-105B		9/12/2012	773	<MDA
MW-105B		11/8/2012	823	<MDA
MW-105B	DUP	11/8/2012	665	N/A
MW-106B		2/9/2012	<235	<MDA
MW-106B		6/12/2012	<355	<MDA
MW-106B		9/12/2012	<213	<MDA
MW-106B		11/7/2012	<269	<MDA
MW-107B		2/8/2012	3430	<MDA
MW-107B		6/12/2012	2430	<MDA
MW-107B		9/12/2012	2440	<MDA
MW-107B		11/6/2012	2070	<MDA
MW-108B		2/8/2012	612	<MDA
MW-108B		6/13/2012	604	<MDA
MW-108B		9/12/2012	983	<MDA
MW-108B		11/6/2012	994	<MDA
MW-108B	DUP	11/6/2012	868	N/A
MW-109B		2/8/2012	699	<MDA
MW-109B		6/13/2012	<344	<MDA
MW-109B		9/12/2012	816	<MDA
MW-109B		11/6/2012	591	<MDA

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Nuclear Energy Institute, NEI, Groundwater Protection Initiative Sample Results

JANUARY – DECEMBER 2012 (Cont)

LOCATION		DATE	TRITIUM (pCi/L)	GAMMA/HTD (pCi/L)
MW-110B		2/9/2012	<229	N/A
MW-110B		6/13/2012	<341	<MDA
MW-110B		9/11/2012	<218	<MDA
MW-110B		11/8/2012	<278	<MDA
MW-111B		1/17/2012	10100	<MDA
MW-111B		6/13/2012	18400	<MDA
MW-111B		9/11/2012	11000	<MDA
MW-111B		11/7/2012	8920	<MDA
MW-112B		2/9/2012	<229	<MDA
MW-112B		6/13/2012	<347	<MDA
MW-112B		9/11/2012	<220	<MDA
MW-112B		11/7/2012	<268	<MDA
MW-113B		2/9/2012	356	<MDA
MW-113B		6/13/2012	<350	<MDA
MW-113B	DUP	6/13/2012	<348	<MDA
MW-113B		9/12/2012	<211	<MDA
MW-113B		11/7/2012	352	<MDA
MW-114B		2/9/2012	2340	<MDA
MW-114B		6/13/2012	3260	<MDA
MW-114B		9/12/2012	2460	<MDA
MW-114B	DUP	9/12/2012	2950	<MDA
MW-114B		11/7/2012	2970	<MDA
MW-115B		2/9/2012	5630	<MDA
MW-115B	DUP	2/9/2012	4510	<MDA
MW-115B		6/13/2012	1680	<MDA
MW-115B		9/12/2012	5230	<MDA
MW-115B		11/7/2012	2510	<MDA
MW-118B		1/17/2012	491	<MDA
MW-118B		6/13/2012	1700	<MDA
MW-118B		9/11/2012	1050	<MDA
MW-118B		11/6/2012	1060	<MDA
MW-1007B		6/19/2012	<282	<MDA
MW-1007C		6/14/2012	<286	<MDA
MW-1009B		6/19/2012	<283	<MDA
MW-1012C		6/14/2012	<281	<MDA
MW-1012C	DUP	6/14/2012	<285	<MDA
MW-1019B		6/20/2012	<336	<MDA

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Nuclear Energy Institute, NEI, Groundwater Protection Initiative Sample Results

JANUARY – DECEMBER 2012 (Cont)

LOCATION		DATE	TRITIUM (pCi/L)	GAMMA/HTD (pCi/L)
MW-1020C		6/14/2012	<289	<MDA
MW-1022B		6/19/2012	<334	<MDA
MW-1024C		6/12/2012	<341	<MDA
MW-1026B		6/14/2012	<289	<MDA
MW-1026B		6/19/2012	<288	<MDA
MW-1027B		6/20/2012	372	<MDA
MW-1027C		6/14/2012	<286	<MDA
MW-1027C	DUP	6/14/2012	<289	<MDA
MW-1042C		6/12/2012	<341	<MDA
MW-1045B		6/14/2012	<337	<MDA
MW-1045B	DUP	6/14/2012	<340	<MDA
MW-1082C		6/12/2012	<341	<MDA
MW-1134C		6/12/2012	<342	<MDA
OW-05		6/19/2012	<288	<MDA
OW-209B		2/9/2012	5980	<MDA
OW-209B		6/12/2012	2650	<MDA
OW-209B		9/11/2012	2430	<MDA
OW-209B		11/8/2012	2210	<MDA
OW-1008		6/19/2012	<287	<MDA
OW-1108		6/19/2012	<332	<MDA
SW-103A		6/14/2012	<338	<MDA
SW-103A		9/12/2012	<218	<MDA
SW-103A		11/8/2012	<273	<MDA
SW-103B		2/9/2012	<366	<MDA

(<MDA = less than minimum detectable activity)
(DUP = separate sample collected and analyzed)
(N/A = not analyzed

ATTACHMENT II

Offsite Dose Calculation Manual

The Grand Gulf Nuclear Station Offsite Dose Calculation Manual was previously submitted on April 30, 2013