

April 9, 2001

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station
Docket No. 50-416
License No. NPF-29
2000 Grand Gulf Nuclear Station (GGNS) Annual Environmental
Operating Report (AEOR) and 2000 Annual Radioactive Effluent
Release Report (ARERR)

GNRO-2001/00026

Gentlemen:

Attached is the Grand Gulf Nuclear Station (GGNS) Annual Environmental Operating Report (AEOR) for the period January 1, 2000 through December 31, 2000. This report is submitted in accordance with the Environmental Protection Plan, Appendix B to the GGNS Operating License (NPF-29), Section 5.4, "Station Reporting Requirements".

Also, attached is the GGNS Annual Radioactive Effluent Release Report (ARERR) for the period January 1, 2000 through December 31, 2000. This report is submitted in accordance with the requirements of 10CFR50.36a(a)(2) and the GGNS Technical Specification (TS) 5.6.3. The ARERR also complies with the GGNS Offsite Dose Calculation Manual (ODCM).

If you have questions or require additional information concerning these reports, please contact Ms. L. A. Patterson at (601) 437-6252, or this office at (601) 437-6685.

Yours truly,



CAB/MJL/bcb
attachments:

2000 Annual Environmental Operating Report and
2000 Annual Radioactive Effluent Release Report

cc:

(See Next Page)

April 9, 2001

GNRO-2001/00026

Page 2 of 2

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Entergy Operations, Inc.
GRAND GULF NUCLEAR STATION

**2000
ANNUAL
ENVIRONMENTAL
OPERATING
REPORT**

SUMMARY

The Annual Environmental Operating Report (AEOR) provides information and data obtained from implementation of Grand Gulf Nuclear Station's (GGNS) Environmental Protection Plan (EPP), Appendix B to the GGNS Operating License (NPF-29), which only requires terrestrial issues to be addressed, for the period January 1 through December 31, 2000.

The GGNS Final Environment Statement did not identify any aquatic issues. Consequently, the EPP does not address any. The GGNS National Pollutant Discharge Elimination System (NPDES) Permit issued by the Mississippi Department of Environmental Quality (MDEQ) contains effluent limitations and monitoring requirements for aquatic matters. The MDEQ regulates matters involving water quality and aquatic biota.

This report addresses only those issues required by the EPP. In the past, the AEOR included activities associated with the GGNS Construction Permit, and an Updated Final Safety Analysis Report (UFSAR) requirement which involved reporting regional and perched groundwater levels and precipitation data in the AEOR. However, the Nuclear Regulatory Commission approved cancellation of Construction Permit CPPR-119 for Unit 2 on August 21, 1991 (GNRI-91/00176), and GGNS deleted the UFSAR AEOR reporting requirement in 1993 (GNRI-93/00025); therefore, GGNS terminated reporting activities associated with these items.

1.0 INTRODUCTION

1.1 Impact Assessment and Summary

GGNS personnel monitored the environmental impact of plant operational activities between January 1 and December 31, 2000. The monitoring results contained in the following sections indicate no adverse impact on the environment due to operation of GGNS. In addition, GGNS personnel have not observed harmful effects or evidence of trends toward irreversible damage to the surrounding environment at GGNS.

2.0 ENVIRONMENTAL SURVEILLANCE ACTIVITIES

2.1 Transmission Line Surveys

GGNS discontinued this program in 1988. Section 4.2.1 of the Environmental Protection Plan contains a provision to discontinue these surveys following stabilization of soil and vegetation.

2.2 Cooling Tower Drift Program

GGNS discontinued this program in 1992.

2.3 Environmental Evaluations

The EPP permits changes in GGNS design or operation and performance of tests or experiments that affect the environment, provided they do not involve a change in the EPP or an un-reviewed environmental question. However, EPP requirements do not apply to changes, tests or experiments which do not affect the environment. Also, EPP requirements do not relieve GGNS of 10 CFR 50.59 requirements, "Changes, Tests and Experiments," which address the question of safety associated with proposed changes, tests and experiments.

The EPP excludes changes, tests or experiments from the evaluation:

- If all measurable environmental effects confined to onsite areas previously disturbed during site preparation and plant construction,
or
- If required to achieve compliance with other federal, state or local requirements.

3.0 OBSERVATIONS AND DISCUSSIONS

3.1 Environmental Evaluations

During 2000, GGNS activities did not require any environmental evaluations as outlined in the EPP.

4.0 ADMINISTRATIVE REQUIREMENTS

4.1 EPP Changes

GGNS made no changes to the EPP in 2000.

4.2 EPP Noncompliances

GGNS activities contained no EPP noncompliances during 2000.

4.3 Non-Routine Reports

GGNS submitted no non-routine reports in 2000.

4.4 Potentially Significant Un-reviewed Environmental Issues


GGNS activities did not require any environmental evaluations as outlined in the EPP during 2000. Therefore, un-reviewed environmental issues did not occur.

ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION

ANNUAL
RADIOACTIVE EFFLUENT RELEASE REPORT

January 1, 2000 - December 31, 2000

 / 3/30/01
Prepared By

 / 4/04/01
Reviewed By

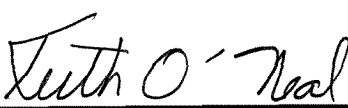
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Approved By

TABLE OF CONTENTS

	SUBJECT	PAGE
I.	INTRODUCTION	4
II.	DETAILED INFORMATION	5
	A. Regulatory Limits	5
	1. 10CFR 20 Limits	5
	a. Fission and Activation Gases	5
	b. Radioiodines and Particulates	5
	c. Liquid Effluents	5
	2. 10CFR 50, Appendix I Limits	6
	a. Fission and Activation Gases	6
	b. Radioiodines and Particulates	6
	c. Liquid Effluents	6
	3. 40CFR 190 Limits	7
	B. Effluent Concentrations	7
	1. Airborne	7
	2. Liquid	7
	C. Average Energy	7
	D. Measurements and Approximations of Total Activity	8
	1. For Fission and Activation Gases	8
	2. For Particulates and Radioiodines	9
	3. For Continuous Releases	9
	4. For Batch Releases: Gases	10
	5. For Batch Releases: Liquid Effluents	10
	E. Batch Releases	11
	1. Liquid	11
	2. Gaseous	11
	F. Unplanned Releases	11
	1. Liquid	11
	2. Gaseous	11

TABLE OF CONTENTS (CONT'D)

SUBJECT	PAGE
G. Estimate of Total Error	11
1. Liquid	11
2. Gaseous	12
3. Solid Radioactive Waste	12
H. Solid Radioactive Waste Shipments	12
I. Meteorological Data	12
J. Radioactive Effluent Monitoring Instrumentation Operability	12
K. Annual Sewage Disposal Summary	12
III. RADIATION DOSE SUMMARY	13
A. Water-Related Exposure Pathway	13
B. Airborne-Related Exposure Pathway	13
IV. OFFSITE DOSE CALCULATION MANUAL/RADIOACTIVE WASTE TREATMENT SYSTEM CHANGES	15
A. Offsite Dose Calculation Manual (ODCM)	15
B. Radioactive Waste Treatment Systems	15
LIST OF TABLES	PAGE
1A Gaseous Effluents – Summation of All Releases	16
1B Gaseous Effluents – Elevated Releases	17
1C Gaseous Effluents – Ground-Level Releases – Continuous	18
1D Radioactive Gaseous Waste Sampling and Analysis Program	19
2A Liquid Effluents – Summation of All Releases	20
2B Liquid Effluents – Continuous and Batch Modes	21
2C Radioactive Liquid Waste Sampling and Analysis Program	22
3 Solid Radioactive Waste and Irradiated Fuel Shipments	23
LIST OF ATTACHMENTS	PAGE
NONE	

I. INTRODUCTION

This Annual Radioactive Effluent Release Report (ARERR) for the period of January 1 through December 31, 2000 is submitted in accordance with Offsite Dose Calculation Manual (ODCM), Section 5.6.3 of Grand Gulf Nuclear Station (GGNS) License No. NPF-29. The monitoring of radioactive effluents is referenced in 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 gaseous releases during the reporting period is given in Table 1A, while elevated releases and ground-level releases are given in Tables 1B and 1C, respectively. Table 1D describes the radioactive gaseous sampling and analysis program implemented at GGNS.

The summation of all liquid releases during the reporting period is given in Table 2A, while continuous and batch mode releases are given in Table 2B. Table 2C describes the radioactive liquid waste sampling and analysis program implemented at GGNS.

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

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

II. DETAILED INFORMATION

A. Regulatory Limits

1. 10CFR 20 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)

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

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

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

where the terms are defined in the GGNS ODCM.

- b. Radioiodines 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)

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

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

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

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

D_{β} = air dose due to beta emissions from noble gases

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

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

where the terms are defined in the GGNS ODCM.

- b. Radioiodines 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)

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

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

where the terms are defined in the GGNS ODCM.

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

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

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

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

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

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 Effluent Concentration Limit (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 total activity for the following:

Fission and Activation Gases	Particulates
Radioiodines	Liquid Effluents

Tables 1D and 2C give sampling frequencies and minimum detectable sensitivity 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 limits 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	Xe-133	Xe-135
Kr-88	Xe-133m	Xe-138

Periodic grab samples from Station effluent streams are analyzed by a computerized pulse height analyzer system 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. Only those radionuclides that are detected are used in this computation. 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 $\mu\text{Ci}/\text{ml}$.

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

The radioiodines and radioactive materials in particulate form to be considered are:

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

Other radionuclides with half lives greater than 8 days.

3. For Continuous Releases

Continuous sampling is performed on the continuous release points (i.e., Offgas/Radwaste Building Vent, Containment Purge, Fuel Handling Area Vent, Turbine Building Vent). Particulate material is collected by filtration. Radioiodines are collected by adsorption onto a charcoal filter. Periodically these filters are removed and analyzed on the pulse height analyzer to identify and quantify radioactive materials collected on the filters. Particulate filters are then analyzed for gross alpha and Strontium-89 and -90 as required. Gross alpha determinations are made using 2-pi gas flow proportional counter. Strontium-89 and -90 values are obtained by chemical separation and subsequent analysis using liquid scintillation 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). Currently, Strontium analysis is performed by a qualified contract laboratory.

Appendix A of Regulatory Guide 1.21 states "In estimating releases for periods when analyses were not performed, the average of the two adjacent data points spanning this period should be used."

On February 2, 2000 the Turbine Building exhaust gaseous release point was unmonitored for approximately 5 hours due to lack of representative sample on the particulate and iodine cartridge. The Turbine Building ventilation was secured for ductwork replacement. The seal steam system exhaust is an input which cannot be isolated at power operation and was experiencing excessive moisture carryover due to performance problems with the seal steam loop seal. At 19:35 on February 2, 2000, moisture was found on the particulate and iodine sample media for the routine sample points as well as the alternate sample point. Immediate action was taken to restore the ventilation system and at 20:44 on February 2, 2000, the ventilation system was declared operable. The sample system was found free of moisture on February 3, 2000 at 00:28.

II. DETAILED INFORMATION (CONT'D)

3. For Continuous Releases (CONT'D)

Particulate-Iodine analyses before and after the time period in question had no detectable activity and were used to estimate the release for the period. Particulate-Iodine analyses during the period had no detectable activity, however, the sample media was wet and determined to be non-representative. Evaluation of the moisture intrusion was documented with Condition Report-GGN-2000-0152.

During startup on September 16, 2000 the Turbine Building exhaust gaseous release point was unmonitored for approximately 48 hours due to lack of representative sample on the particulate filter. During this time, oil from the mechanical vacuum pumps entered the ventilation system and reached the sample media (particulate filter). Radiation Protection particulate filters from various locations in the Turbine Building (unaffected by oil intrusion) did not show any increase in particulate activity. Particulate analyses before and after the time period in question had no detectable activity and were used to estimate the release for the period. Evaluation of the oil intrusion is ongoing and documented with Condition Report-GGN-2000-1370.

4. For Batch Releases: Gases

The processing of batch type releases (from Containment Purge) is analogous to that for continuous releases.

5. For Batch Releases: Liquid Effluents

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 using the computerized pulse height analysis system previously described. 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 chemical separation and counting the separated strontium and iron using liquid scintillation techniques. Gross alpha determinations are made using 2-pi gas flow proportional counter. Tritium is determined using distillation and liquid scintillation techniques. Dissolved gases are determined employing grab sampling techniques and then counting on the pulse height analyzer system. Currently, Iron and Strontium analyses are performed by a qualified contract laboratory.

II. DETAILED INFORMATION (CONT'D)

E. Batch Releases

1. Liquid

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
a. Number of releases	0	9	18	5	32
Time Period (in minutes)					
b. Total for all batches	0.00E+00	2.42E+03	5.58E+03	1.52E+03	9.53E+03
c. Max time for a batch	0.00E+00	3.20E+02	3.35E+02	3.20E+02	3.35E+02
d. Avg time for a batch	0.00E+00	2.69E+02	3.10E+02	3.04E+02	2.98E+02
e. Min time for a batch	0.00E+00	4.00E+00	2.80E+02	2.90E+02	4.00E+00

2. Gaseous

No batch releases were made during the report period.

F. Unplanned Releases

1. Liquid

No unplanned Liquid Releases occurred during the report period.

2. Gaseous

No unplanned Gaseous Releases occurred during the report 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 and, for germanium detectors, the least-readily-detectable radioisotope. Calibration errors are calculated by summing the errors associated with the calibration of a particular instrument with a radioactive source.

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

II. DETAILED INFORMATION (CONT'D)

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 errors include uncertainty associated with instrument calibration and preparation and counting of low-activity samples. Measurement and total errors are calculated by the same methods used for liquid effluents.

3. Solid Radioactive Waste

See Table 3 for error terms.

H. Solid Radioactive Waste Shipments

See Table 3 for shipment information.

I. Meteorological Data

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

No reportable instances of inoperability occurred during the reporting period.

K. Annual Sewage Disposal Summary

Sewage was disposed of during 2000 by drying on drying beds, packaging in "B25" Metal boxes and shipping to US Ecology and GTS Duratek. These companies released the material due to its low activity and buried it in an industrial landfill. A summary of the data is provided in Table 3 Section C.

III. RADIATION DOSE SUMMARY

Indicated below is the annual summary of offsite doses attributable to GGNS during 2000. Inspection of the values indicate 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 have also been met during this period.

All parameters listed were calculated in accordance with the GGNS ODCM.

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 calculational 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.

2000 Liquid Effluent Dose (mrem)					
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	TOTAL
Bone	0.00E+00	1.25E-02	6.06E-03	1.11E-03	1.84E-02
Liver	0.00E+00	3.74E-02	1.27E-02	1.52E-03	4.75E-02
Thyroid	0.00E+00	8.91E-04	1.37E-03	4.15E-04	2.64E-03
Kidney	0.00E+00	2.42E-02	6.91E-03	6.93E-04	2.91E-02
Lung	0.00E+00	1.38E-03	2.43E-03	7.90E-04	4.55E-03
GI-LLI	0.00E+00	2.70E-02	9.37E-03	1.28E-03	3.47E-02
Whole Body	0.00E+00	1.77E-02	6.81E-03	7.77E-04	2.34E-02

B. Airborne-Related Exposure Pathways

The values presented in this section utilize information provided in Tables 1A and 1C of this report and the calculational methodology of the ODCM. Dose and dose rates are computed for locations at the site boundary or at unrestricted areas beyond the site boundary. Because members of the public may, on occasion, be found within the site boundary, locations within the site boundary were considered when selecting locations for dose calculations.

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.

The most limiting location for a member of the public is used for the dose calculations.

Particulate, Radioiodine and Tritium

Organ dose rate from exposure to radioiodines, tritium and particulates are computed for an individual located at the site boundary.

III. RADIATION DOSE SUMMARY (CONT'D)

Organ dose from exposure to radioiodines, tritium and particulates are computed for an individual located in the southwest sector at a distance of 0.89 miles. This location corresponds to a residence beyond the site boundary. 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. Dose factors for the age group receiving the maximum dose are used in the calculation of organ dose and dose rate.

Noble Gases

Gamma and beta air dose and 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 0.85 miles. This location corresponds to the highest annual average atmospheric dispersion for a location at the site boundary.

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 would represent the maximum possible dose received by members of the public.

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 2000 as net exposure [field reading – (transit + shield)] normalized to 92 days.

2000 Airborne Effluent Dose (mrem)					
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	TOTAL
Iodine, Tritium & Particulates	3.92E-02	3.65E-02	3.50E-02	3.81E-02	1.49E-01
Fission and Activation Gases					
Total Body Dose (mrem/yr)	3.17E-02	1.70E-02	4.00E-02	4.75E-02	
Skin Dose (mrem/yr)	6.06E-02	3.24E-02	7.11E-02	8.03E-02	
Gamma Air Dose*	4.09E-03	3.61E-03	4.22E-03	6.14E-03	1.81E-02
Beta Air Dose*	4.42E-03	3.90E-03	4.01E-03	4.99E-03	1.73E-02
Direct Radiation	0.00E+00	0.00E+00	7.00E-01	6.00E-01	1.30E+00

*Measurement units are mrad

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

A. Offsite Dose Calculation Manual (ODCM)

No revisions to the ODCM were processed during the reporting period.

B. Radioactive Waste Treatment Systems

No major changes were made to the liquid or gaseous radwaste treatment systems in 2000.

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 2000	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Gases						
1. Total Release	Ci	8.98E+00	7.92E+00	7.29E+00	8.85E+00	3.30E+01
2. Average Release Rate	uCi/sec	1.14E+00	1.01E+00	9.17E-01	1.11E+00	1.04E+00
3. Percent of TS Limit	%	8.18E-02	7.22E-02	8.43E-02	1.23E-01	1.81E-01
Iodine-131						
1. Total Release	Ci	0.00E+00	0.00E+00	2.57E-05	0.00E+00	2.57E-05
2. Average Release Rate	uCi/sec	0.00E+00	0.00E+00	3.24E-06	0.00E+00	8.13E-07
3. Percent of TS Limit	%	0.00E+00	0.00E+00	5.33E-03	0.00E+00	2.66E-03
Particulates Half Life >= 8 days						
1. Total Release	Ci	6.63E-06	5.06E-07	2.64E-05	3.20E-06	3.67E-05
2. Average Release Rate	uCi/sec	8.44E-07	6.44E-08	3.32E-06	4.02E-07	1.16E-06
3. Percent of TS Limit	%	4.76E-04	3.63E-05	3.76E-04	1.91E-07	4.44E-04
Tritium						
1. Total Release	Ci	2.77E+01	2.58E+01	2.44E+01	2.70E+01	1.05E+02
2. Average Release Rate	uCi/sec	3.53E+00	3.29E+00	3.08E+00	3.40E+00	3.32E+00
3. Percent of TS Limit	%	5.22E-01	4.86E-01	4.60E-01	5.08E-01	9.89E-01
Gross Alpha Radioactivity						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	2.89E-11	2.89E-11
2. Average Release Rate	uCi/sec	0.00E+00	0.00E+00	0.00E+00	3.64E-12	9.15E-13

TABLE 1B
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION UNIT 1
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS – ELEVATED RELEASES
JANUARY – DECEMBER 2000

(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 2000	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Gases						
AR-41	Ci	0.00E+00	0.00E+00	1.85E-01	7.90E-01	9.75E-01
KR-85M	Ci	0.00E+00	0.00E+00	2.42E-02	2.60E-02	5.03E-02
KR-87	Ci	0.00E+00	0.00E+00	7.15E-02	6.41E-02	1.36E-01
KR-88	Ci	1.79E-01	1.58E-01	1.33E-01	1.54E-01	6.24E-01
XE-133	Ci	4.20E+00	3.71E+00	3.18E+00	3.66E+00	1.48E+01
XE-135	Ci	4.02E+00	3.54E+00	3.06E+00	3.50E+00	1.41E+01
XE-135M	Ci	4.74E-01	4.18E-01	3.53E-01	4.06E-01	1.65E+00
XE-138	Ci	1.07E-01	9.48E-02	2.76E-01	2.45E-01	7.24E-01
Totals for Period.....	Ci	8.98E+00	7.92E+00	7.29E+00	8.85E+00	3.30E+01
Iodines						
I-131	Ci	0.00E+00	0.00E+00	2.57E-05	0.00E+00	2.57E-05
I-132	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	2.38E-05	0.00E+00	2.38E-05
I-135	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	4.95E-05	0.00E+00	4.95E-05
Particulates Half Life >= 8 days						
CO-58	Ci	0.00E+00	0.00E+00	1.48E-06	0.00E+00	1.48E-06
CO-60	Ci	6.63E-06	5.06E-07	5.20E-06	0.00E+00	1.23E-05
CR-51	Ci	0.00E+00	0.00E+00	1.97E-05	3.20E-06	2.29E-05
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
Totals for Period.....	Ci	6.63E-06	5.06E-07	2.64E-05	3.20E-06	3.67E-05
Tritium						
H-3	Ci	2.77E+01	2.58E+01	2.44E+01	2.70E+01	1.05E+02
Totals for Period.....	Ci	2.77E+01	2.58E+01	2.44E+01	2.70E+01	1.05E+02
Gross Alpha Radioactivity						
ALPHA	Ci	0.00E+00	0.00E+00	0.00E+00	2.89E-11	2.89E-11
Totals for Period.....	Ci	0.00E+00	0.00E+00	0.00E+00	2.89E-11	2.89E-11

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 2000

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) ($\mu\text{Ci/ml}$) ^a
A. (1) Radwaste Building Ventilation Exhaust	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters (b,e) H-3	1×10^{-4} 1×10^{-6}
(2) Fuel Handling Area Ventilation Exhaust	Continuous (d)(f)	7 Days (c) Charcoal Sample	I-131 I-133	1×10^{-12} 1×10^{-10}
(3) Containment Ventilation Exhaust	Continuous (d)(f)	7 Days (c) Particulate Sample	Principal Gamma Emitters (e) (I-131, Others)	1×10^{-11}
(4) Turbine Building Ventilation Exhaust	Continuous (d)(f)	31 Days Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous (d)(f)	92 Days Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous (f)	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1×10^{-6}
B. (1) Offgas Post Treatment Exhaust, whenever there is flow	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters (e)	1×10^{-4}
(2) Standby Gas Treatment A Exhaust, whenever there is flow	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters(e)	1×10^{-4}
(3) Standby Gas Treatment B Exhaust, whenever there is flow	31 Days Grab Sample (f)	31 Days	Principal Gamma Emitters(e)	1×10^{-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 2000	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Products						
1. Total Release	Ci	0.00E+00	9.71E-03	1.51E-02	5.95E-03	3.07E-02
2. Avg. Diluted Conc.	uCi/ml	0.00E+00	1.40E-07	7.62E-08	1.26E-07	9.77E-08
3. Percent of Limit	%	0.00E+00	1.59E-01	3.57E-02	2.14E-02	6.07E-02
Tritium						
1. Total Release	Ci	0.00E+00	1.36E+01	2.58E+01	6.75E+00	4.61E+01
2. Avg. Diluted Conc.	uCi/ml	0.00E+00	1.95E-04	1.31E-04	1.43E-04	1.47E-04
3. Percent of Limit	%	0.00E+00	1.95E+00	1.31E+00	1.43E+00	1.47E+00
Dissolved and Entrained Gases						
1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Avg. Diluted Conc.	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	0.00E+00	8.27E+05	1.87E+06	5.05E+05	3.20E+06
Volume of dil. water	liters	0.00E+00	6.87E+07	1.96E+08	4.69E+07	3.11E+08

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 2000	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
<hr/>						
Fission and Activation Products						
CO-58	Ci	0.00E+00	6.47E-05	1.52E-05	5.16E-06	8.50E-05
CO-60	Ci	0.00E+00	2.12E-03	1.40E-03	1.17E-04	3.64E-03
CR-51	Ci	0.00E+00	7.56E-04	5.72E-04	1.52E-04	1.48E-03
CS-137	Ci	0.00E+00	7.38E-06	2.32E-05	0.00E+00	3.05E-05
CU-64	Ci	0.00E+00	8.95E-05	1.59E-05	0.00E+00	1.05E-04
FE-55	Ci	0.00E+00	4.75E-03	1.22E-02	5.52E-03	2.25E-02
FE-59	Ci	0.00E+00	5.85E-05	0.00E+00	0.00E+00	5.85E-05
MN-54	Ci	0.00E+00	2.55E-04	4.36E-04	1.61E-05	7.07E-04
NA-24	Ci	0.00E+00	0.00E+00	0.00E+00	6.47E-05	6.47E-05
SB-124	Ci	0.00E+00	3.34E-08	0.00E+00	0.00E+00	3.34E-08
TC-99M	Ci	0.00E+00	3.37E-06	0.00E+00	0.00E+00	3.37E-06
ZN-65	Ci	0.00E+00	1.60E-03	3.82E-04	2.07E-05	2.00E-03
ZN-69M	Ci	0.00E+00	0.00E+00	3.64E-06	4.62E-05	4.98E-05
Totals for Period.....	Ci	0.00E+00	9.70E-03	1.50E-02	5.94E-03	3.07E-02
Tritium						
H-3	Ci	0.00E+00	1.36E+01	2.58E+01	6.75E+00	4.61E+01
Totals for Period.....	Ci	0.00E+00	1.36E+01	2.58E+01	6.75E+00	4.61E+01
Dissolved and Entrained 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
Totals for Period.....	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity						
No Nuclide Activities		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 2000

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) ($\mu\text{Ci/ml}$)(a)
A. Batch Waste Release Tanks (c)	Prior to Release Each Batch	Prior to Release Each Batch	Principal Gamma Emitters (d) I-131	5×10^{-7} 1×10^{-6}
	Prior to Release One Batch /M	31 Days	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	Prior to Release Each Batch	31 Days Composite (b)	H-3 Gross Alpha	1×10^{-5} 1×10^{-7}
	Prior to Release Each Batch	92 Days Composite (b)	Sr-89, Sr-90 Fe-55	5×10^{-8} 1×10^{-6}
B. SSW Basin (Before Blowdown)	Prior to Release Each Blowdown	Prior to Release Each Batch	Principal Gamma Emitters (d) I-131	5×10^{-7} 1×10^{-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 2000

A. Solid Waste Shipped Offsite for Burial or Disposal

1. TYPE OF WASTE	UNITS	1 ST QTR	2 ND QTR	3 RD QTR	4 TH QTR	ESTIMATE TOTAL ERROR (%)
a. RESIN	M ³	7.28E-02	2.62E+01	4.26E+00	5.84E+01	
	*Ci	2.54E+01	1.74E+03	2.30E+01	1.76E+00	7.2E+01
b. DAW	M ³	7.77E+00	5.24E+00	5.52E+00	7.32E+00	
	*Ci	2.94E+00	1.06E+02	1.22E+00	2.27E-01	6.9E+01
c. IRR. COMP.	M ³	None	None	None	None	
	*Ci	None	None	None	None	6.9E+01
d. OTHER	M ³	None	None	None	None	
	*Ci	None	None	None	None	N/A

*Total curie quantity determined by measurement. Total volume used is burial container volume. Resin and DAW solid waste was Class "A" as defined by 10CFR Part 61.

2. Estimate of major nuclide composition (by type of waste as identified above)

a. RESIN

Nuclide	1 st QTR	2 nd QTR	3 rd QTR	4 th QTR
Co-60	7	14	7	6
Fe-55	85	76	86	84
Mn-54	6	7	5	3
Cr-51	<1	2	1	<1
Zn-65	1	1	<1	3
H-3	<1	<1	<1	3
ALL OTHERS	<1	<1	<1	<1

b. DAW - GTS

Nuclide	1 st QTR	2 nd QTR	3 rd QTR	4 th QTR
Co-60	8	8	8	8
H-3	5	5	5	5
Fe-55	83	83	83	83
Mn-54	3	3	3	3
All Others	<1	<1	<1	<1

c. IRR. COMP.

Nuclide	1 st QTR	2 nd QTR	3 rd QTR	4 th QTR
Co-60	N/A	N/A	N/A	N/A
Ni-63	N/A	N/A	N/A	N/A
Fe-55	N/A	N/A	N/A	N/A
Mn-54	N/A	N/A	N/A	N/A
All Others	N/A	N/A	N/A	N/A

d. OTHER

Nuclide	1 st QTR	2 nd QTR	3 rd QTR	4 th QTR
N/A	N/A	N/A	N/A	N/A

**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 (CONT'D)
JANUARY – DECEMBER 2000**

A. Solid Waste Shipped Off Site for Burial or Disposal

3. Solid Waste Disposition

- a. Resins were dewatered in steel liners or High Integrity Containers according to the requirements of the GGNS Process Control Program and shipped to Barnwell, South Carolina, for burial. Some resin was shipped to Allied Technologies Group (ATG) of Oak Ridge, Tennessee or Richland, Washington or Studsvik, Inc. of Erwin, Tennessee for volume reduction prior to burial.

ATG and Studsvik shipped waste to Barnwell, South Carolina or Envirocare of Utah. Resin was dewatered and shipped in liners and High Integrity Containers. No solidification agents or absorbents were used.

- b. Dry Active Waste (DAW) was packaged in 20' sealand containers and shipped to GTS Duratek (GTS) of Oak Ridge, Tennessee and US Ecology of Oak Ridge, Tennessee, for volume reduction. GTS and US Ecology shipped reduced waste to Barnwell, South Carolina or Envirocare of Utah. Reduced volume was used in providing information given in A.1.b.
- c. No waste in this category.
- d. No waste in this category.

NUMBER OF SHIPMENTS	MODE OF TRANSPORTATION	DESTINATION
35	Truck	Barnwell, SC
65	Truck	Envirocare

B. Irradiated Fuel Shipments (Disposition)

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

C. Annual Sewage Sludge Summary

Sewage was disposed of during 2000 by drying on drying beds, packaging in "B25" metal boxes and shipping to US Ecology and GTS Duratek. These companies released the material due to its low activity and buried it in an industrial landfill.

NUMBER OF SHIPMENTS	TOTAL GALLONS	AVERAGE Co-60 ACTIVITY (pCi/kg)	AVERAGE Mn-54 ACTIVITY (pCi/kg)	AVERAGE Cs-137 ACTIVITY (pCi/kg)
5	25,521	3.17E+02	5.90E+01	2.00E-03