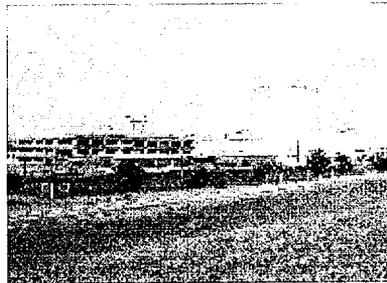


Entergy

**Annual
Radioactive Effluent Release
Report**

January 1, 1999 - December 31, 1999



**Waterford 3 SES
Entergy Operations, Inc.**

Docket Number 50-382

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1.0 Introduction

This Annual Radioactive Effluent Release Report is submitted as required by Waterford 3's Technical Specification 6.9.1.8. It covers the period from January 1, 1999 through December 31, 1999. Information in this report is presented in the format outlined in Appendix B of Regulatory Guide 1.21 and in Section 5.8.1 of the Offsite Dose Calculation Manual (UNT-005-014).

The information contained in this report includes:

- A summary of the quantities of radioactive liquid and gaseous effluents and solid wastes released from the plant during the reporting period.
- A summary of the meteorological data collected during 1999.
- Assessment of radiation doses due to liquid and gaseous radioactive effluents released during 1999.
- A discussion of Unplanned/Abnormal releases that occurred during the reporting period.
- A submittal of changes to the Offsite Dose Calculation Manual and Process Control Program during this reporting period.
- A discussion of why required radioactive effluent monitoring instrumentation was not returned to service within the time specified.
- A discussion of any instances in which effluent samples were not collected within the required frequency.

2.0 Supplemental Information

2.1 Regulatory Limits

The limits applicable to the release of radioactive material in liquid and gaseous effluents are described in the following sections. These limits are addressed by reference in UNT-005-014, Offsite Dose Calculation Manual, and directly in the Technical Requirements Manual (TRM).

2.1.1 Fission and Activation Gases (Noble Gases)

The dose rate due to radioactive noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to:

- 500 mrem/yr to the total body; and,
- 3000 mrem/yr to the skin.

The air dose due to noble gases released in gaseous effluents from the site to areas at or beyond the site boundary shall be limited to the following:

- ◆ During any calendar quarter, Less than or equal to:
 - 5 mrad for gamma radiation; and,
 - 10 mrad for beta radiation.

- ◆ During any calendar year, Less than or equal to:
 - 10 mrad for gamma radiation; and,
 - 20 mrad for beta radiation.

2.1.2 Iodines, Particulates with Half Lives > Eight (8) Days, and Tritium

The dose rate due to Iodine-131 and 133, Tritium, and all radionuclides in particulate form with half lives greater than eight (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.

The dose to a member of the public from Iodine-131 and 133, Tritium, and all radionuclides in particulate form with half lives greater than eight (8) days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

- ◆ During any calendar quarter, Less than or equal to:
 - 7.5 mrem to any organ.
- ◆ During any calendar year, Less than or equal to:
 - 15 mrem to any organ.

2.1.3 Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to ten times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to $2.0E-4$ $\mu\text{Ci/ml}$ (Total Activity).

The dose or dose commitment to a member of the public from radioactive materials in liquid effluents released to unrestricted areas shall be limited to the following:

During any calendar quarter, Less than or equal to:

- 1.5 mrem to the total body; and,
- 5 mrem to any organ, and

During any calendar year, Less than or equal to

- 3 mrem to the whole body; and,
- 10 mrem to any organ.

2.1.4 Uranium Fuel Cycle Sources

The dose or dose commitment to any member of the public due to releases of radioactivity and radiation from uranium fuel cycle sources over 12 consecutive months shall be limited to less than or equal to:

- 25 mrem to the Total Body or any organ (except thyroid organ); and,
- 75 mrem to the Thyroid

2.2 Maximum Permissible Concentrations

2.2.1 Fission and Activation Gases, Iodines, and Particulates, With Half Lives > Eight (8) Days

For gaseous effluents, maximum permissible concentrations are not directly used in release rate calculations since the applicable limits are expressed in terms of dose rate at the site boundary.

2.2.2 Liquid Effluents

Ten times the effluent concentration (EC) values specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 are used as the permissible concentrations of liquid radioactive effluents at the unrestricted area boundary. A value of $2.0E-4$ $\mu\text{Ci/ml}$ is used as the concentration limit for dissolved and entrained noble gases in liquid effluents.

2.3 Average Energy (E-Bar)

This is not applicable to Waterford 3's effluent specifications. E-Bar's are not required to be calculated from effluent release data. The average energy (E-Bar) for the Reactor Coolant System (RCS) is supplied as additional information in the report further below.

2.4 Measurements and Approximations of Total Radioactivity

The quantification of radioactivity in liquid and gaseous effluents was accomplished by performing the sampling and radiological analysis of effluents in accordance with the requirements of Tables 4.11-1 and 4.11-2 of the Technical Requirements Manual (TRM).

2.4.1 Fission and Activation Gases (Noble Gases)

For continuous releases, a gas grab sample was analyzed monthly for noble gases. Each week a Gas Ratio (GR) was calculated according to the following equation:

$$GR = \frac{\text{Average Weekly Noble Gas Monitor Reading}}{\text{Monitor Reading During Noble Gas Sampling}}$$

The monthly sample analysis and weekly Gas Ratio were then used to determine noble gases discharged continuously for the previous week. For gas decay tank and containment purge batch releases, a gas grab sample was analyzed prior to release to determine noble gas concentrations in the batch. In all cases the total radioactivity in gaseous effluents was determined from measured concentrations of each radionuclide present and the total volume discharged.

2.4.2 Iodines and Particulates

Iodines and particulates discharged were sampled using a continuous sampler which contained a charcoal cartridge and a particulate filter. Each week the charcoal cartridge and particulate filter were analyzed for gamma emitters using gamma spectroscopy. The determined radionuclide concentrations and effluent volumes discharged were used to calculate the previous week's activity released. The particulate samples were composited and analyzed quarterly for Sr-89 and Sr-90 by a contract laboratory (Teledyne Brown Engineering). Particulate gross alpha activity was measured weekly using alpha scintillation or gas-flow proportional counting techniques. The determined activities were used to estimate effluent concentrations in subsequent releases until the next scheduled analysis was performed.

Grab samples of continuous and batch releases were analyzed monthly for tritium. The determined concentrations were used to estimate tritium activity in subsequent releases until the next scheduled analysis was performed.

2.4.3 Liquid Effluents

For continuous releases, samples were collected weekly and analyzed using gamma spectroscopy. The measured concentrations were used to determine radionuclide concentrations in the following week's releases. For batch releases, gamma analysis was performed on the sample prior to release.

For both continuous and batch releases, composite samples were analyzed quarterly by a contract laboratory (Teledyne Brown Engineering) for Sr-89, Sr-90, and Fe-55. Samples were composited and analyzed monthly for tritium and gross alpha using liquid scintillation and gas flow proportional counting techniques, respectively. For radionuclides measured in the composite samples, the measured concentrations in the composite samples from the previous month or quarter were used to estimate released quantities of these isotopes in liquid effluents during the current month or quarter.

The total radioactivity in liquid effluent releases was determined from the measured and estimated concentrations of each radionuclide present and the total volume of the effluent discharged.

2.5 Batch Releases

A summary of information for gaseous and liquid batch releases is included in Table 1.

2.6 Unplanned/Abnormal Releases

2.6.1 Unplanned/Abnormal Gaseous Releases

There were no unplanned/abnormal gaseous releases during the reporting period.

2.6.2 Unplanned/Abnormal Liquid Releases

There were no unplanned/abnormal liquid releases during this reporting period.

3.0 Gaseous Effluents

The quantities of radioactive material released in gaseous effluents are summarized in Tables 1A, 1B, and 1C. Note that there were no elevated releases, since all Waterford 3 releases are considered to be at ground level. The estimated total error in % is based upon several statistical uncertainties due to sample counting, efficiency, volume, etc.

4.0 Liquid Effluents

The quantities of radioactive material released in liquid effluents are summarized in Tables 2A and 2B. The estimated total error in % is based upon several statistical uncertainties due to sample counting, efficiency, volume, etc.

5.0 Solid Wastes

The summary of radioactive solid wastes shipped offsite for disposal is listed in Table 3. For certain waste forms, Waterford 3 uses volume reduction services provided by a contractor. These waste forms are identified in Table 3 and the volumes reported reflect the volume of waste shipped offsite, not final disposal volumes. Final disposal volumes for wastes compacted offsite are available upon request. The estimated total error in % is based upon several statistical uncertainties due to sample counting, efficiency, volume, etc.

6.0 Meteorological Data

In Table 4, the hourly meteorological data from January 1, 1999 through December 31, 1999, is presented in the form of a joint frequency distribution of wind speed, wind direction, and atmospheric stability (hourly data is also available upon request). The standard Pasquill classification scheme, as presented in Regulatory Guide 1.23, is used to determine stability class from differential temperature measurements. The Waterford-3 data recovery results by parameter are as follows:

<u>Parameter Monitored</u>	<u>Annual Data Recovery Rate</u>
Differential Temp.	100.00%
Wind Speed	100.00%
Wind Direction	100.00%
<u>Overall*</u>	<u>100.00%</u>

* - Simultaneous occurrence of valid data for all three parameters.

Dispersion and deposition values were determined from the 1999 data and used in the assessment of doses due to gaseous effluents released from site during the 1999 period.

7.0 Assessment of Doses

7.1 Dose Due to Gaseous Effluents

7.1.1 Air Doses at the Site Boundary

Air doses from gaseous effluents were evaluated at the closest offsite location that could be occupied continuously during the term of plant operation and that would result in the highest dose. This location was determined by examining the atmospheric dispersion parameters (χ/Q 's) at the closest offsite locations that could be continuously occupied during plant operation in each of the meteorological sectors surrounding the plant. The location that would have the highest dose would be that location having the most restrictive (largest) χ/Q value.

Based on actual meteorological data collected during 1999, this location was determined to be in the ENE sector at a distance of 966 meters (0.6 miles) from the plant. Doses were assessed at this location in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual considering only beta and gamma exposures in air due to noble gas. The results of these assessments for the year 1999 are summarized as follows:

Beta air dose:	0.29 mrad
Gamma air dose:	0.10 mrad

The above Beta and Gamma air doses represent the following percentage of the Annual Dose limits:

- 1.43% of the Beta air dose limit (20 mrad).
- 1.00% of the Gamma air dose limit (10 mrad).

Dose calculation results are summarized by quarters in Table 5A. The doses were calculated in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual.

7.1.2 Maximum Organ Dose to the Critical Receptor

The maximum organ dose to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than eight (8) days in gaseous effluents released to areas at and beyond the site boundary was determined for 1999.

An assessment of the maximum organ dose was performed for the critical receptor. The critical receptor was assumed to be located at the nearest residence to the plant having the most restrictive atmospheric dispersion (χ/Q) and deposition (D/Q) parameters. Furthermore, it was assumed that the receptor living at this residence consumed food products that were either raised or produced at this residence.

Using land use census and meteorological data for 1999, the residence with the highest χ/Q and D/Q values was determined to be in the ENE sector at a distance of 1448 meters (0.9 miles) from the plant. The dose calculation was performed in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual considering the inhalation, ground plane exposure, and ingestion pathways. The maximum organ dose to the critical receptor was determined to be:

0.40 mrem to the infant thyroid.

This represents 2.67% of the Annual Organ Dose limit (15 mrem).

Dose calculation results are summarized by quarters in Table 5A. The doses were calculated in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual.

7.2 Doses Due to Liquid Effluents

The annual doses to the maximum exposed individual resulting from exposure to liquid effluents released during 1999 from Waterford 3 were:

0.04 mrem to the Total Body.
0.05 mrem to the maximum exposed organ (Liver).

The above doses represent the following percentage of the Annual Dose limits:

1.22% of the Total Body Dose Limit (3 mrem), and
0.50% of the Organ Dose Limit (10 mrem).

Dose calculation results are summarized by quarter in Table 5B. The doses were calculated in accordance with the methodology described in the Waterford 3 Offsite Dose Calculation Manual.

7.3 40 CFR Part 190 Dose Evaluation

In accordance with Technical Requirements Manual (TRM), Specification 3/4.11.4, Total Dose, dose evaluations to demonstrate compliance with Surveillance Requirements 4.11.4.1 and 4.11.4.2 of the Technical Requirements Manual (TRM), dealing with dose from the uranium fuel cycle, need to be performed only if quarterly doses exceed 3 mrem to the total body (liquid releases), 10 mrem to any organ (liquid releases), 10 mrad gamma air dose, 20 mrad beta air dose, or 15 mrem to any organ from radioiodines and particulates.

At no time during 1999 were any of these limits exceeded; therefore, the evaluation was not required.

7.4 Doses to Public Inside the Site Boundary

The Member of the Public inside the site boundary expected to have the maximum exposure due to gaseous effluents would be an employee at the Waterford 1 and 2 fossil fuel plants, located in the NW sector at a distance of approximately 670 meters (0.42 miles) from the plant.

The doses for such an individual were determined by scaling the full-time occupancy doses due to airborne effluents by the occupancy time due to a normal working year. Based on an assumed occupancy of 25% (40 hour work week) and the fact that all employees are adults, the calculated doses were determined to be less than:

4.64E-03 mrem to the maximum exposed organ (Thyroid)

1.06E-02 mrem to the Total body

2.66E-02 mrem to the skin

Doses were calculated according to the methodology described in the Waterford 3 Offsite Dose Calculation Manual considering only the inhalation and ground plane exposure pathways.

8.0 Related Information

8.1 Changes to the Process Control Program

No changes were made to the Process Control Program (PCP), procedure RW-001-210, during the reporting period.

8.2 Changes to the Offsite Dose Calculation Manual

Changes were made to the Waterford 3 Offsite Dose Calculation Manual (ODCM), procedure UNT-005-014, during the reporting period. The changes are discussed below. A complete copy of UNT-005-014 and applicable sections of the Technical Requirements Manual (TRM) are included in this report as attachments.

Revision 6 was performed to make several improvements to the ODCM:

- The ODCM was defined as being comprised of the radiological effluent technical specifications and methodology contained within procedure UNT-005-014 and the applicable sections of the Technical Requirements Manual (TRM). Subsequently, duplicate requirements in UNT-005-014 were removed. A cross-reference was added to UNT-005-014 that lists the applicable sections of the TRM that are defined as being part of the ODCM. This is consistent with actual practice. The TRM is consulted as the primary source of radiological effluent specifications by plant operators. Additionally, the sections of the TRM that are ODCM related will be included in the Annual Effluent Release Report when any changes are made to the ODCM (which includes those sections of the TRM).
- The dose factors contained within UNT-005-014 were updated using more recent reference sources. Additionally, the drinking water pathway was eliminated for liquid releases via the Forty Arpent Canal. This pathway was investigated and was found not to actually exist. It is very unlikely for a member of the public to receive any dose from ingestion of water that combines with effluents released via the Forty Arpent Canal. No municipal drinking water supplies withdraw water from this waterway. Fishing camps found on this drainage basin must carry water out. Cisterns that are recharged from rainwater are not usually used for consumption. The dose factors for releases via the Forty Arpent Canal are determined, accordingly, without the drinking water pathway component.

Revision 6, Change 1 was performed to revise REMP sample locations:

- The location descriptions were updated due to various reasons (such as construction activities near the location, or simply improved descriptions) for three environmental TLD locations (K-1, M-1, Q-5), a ground water sampling location (GWK-1) and a shoreline sediment sampling location (SHWK-1).
- A control milk sampling location was also changed due to the previous supplier ceasing operations (MKQ-45). A new supplier was located (MKR-50) and added to the REMP.
- A new broad leaf vegetation sampling location (BLE-20) was added to the program. This was done in order to meet the requirements in the ODCM/TRM that the control sampling location be located according to the least prevalent wind direction. The previous control location (BLK-15) was retained. When it is determined that the new control location performs acceptably and is reliable, the old control location will be eliminated.

Revision 6, Change 2, an editorial change, was performed to revise noble gas dose factors for exposure to a semi-infinite cloud that are used in gaseous effluent calculations. Several of the dose factors were not properly converted from pico-curies to micro-curies in the table found in UNT-005-014, Attachment 7.4. The computerized effluent release permit system was inspected and all noble gas dose factors in the computer database as well as the calculations that use them were correct.

8.3 Unavailability of REMP Milk Samples

Due to the unavailability of three milk sampling locations within five kilometers of the plant, Broad Leaf sampling is performed in accordance with Technical Requirements Manual (TRM) Table 3.12-1. Milk is collected, when available, from the control location and two identified sampling locations as indicated in UNT-005-014, Offsite Dose Calculation Manual, Attachment 7.13.

8.4 Report of Required Effluent Instrument Inoperability

Technical Requirements Manual (TRM) Specifications 3.3.3.10 and 3.3.3.11 require reporting in the Annual Radioactive Effluent Release Report of why designated inoperable effluent monitoring instrumentation was not restored to operability within the time specified in the Action Statement.

During the reporting period, there were five cases when instrumentation was not restored to operability within the time specified. Of these, four of them were reported in the Annual Radioactive Effluent Release Report for 1998. Two of them that overlapped reporting periods were already resolved and are essentially unchanged. The other two were resolved, later, during the 1999 reporting period. These cases are described in the following sections.

8.4.1 Fuel Handling Building PIG Monitor A (PRM-IRE-5107A) *(New item)*

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 10/10/99 05:25 to 11/12/99 20:45 (33.64 Days)

Release period with monitor out of service: None

Cause of Inoperability: The Kurz mass flow probe had malfunctioned. The Kurz mass flow probe was replaced and calibrated per procedure with satisfactory results.

Reason Operability Not Restored Within Allotted Time: The reason that the monitor was not returned to service within the time specified was due to work scheduling problems. Due to resource sharing (Waterford-3 technicians attending outages at other Entergy facilities), only one qualified I&C radiation monitoring technician was on site. The work on this monitor could not be completed until after greater than thirty days had elapsed.

8.4.2 Gaseous Waste System (GWM) Noble Gas Monitor (PRM-IRE-0648) (Unchanged from 1998 report)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 11/22/98 04:04 to 2/11/99 10:43 (81.28 Days)

2/11/99 15:30 to 4/17/99 21:51 (65.26 Days)

Total period inoperable: 146.74 Days

Number of Batch Releases performed during period: 6

Cause of Inoperability: The initial problem was due to the monitor repeatedly losing sample flow and terminating the release.

Reason Operability Not Restored Within Allotted Time: The reason that the monitor was not returned to service within the time specified was due to several reasons. A lack of manpower during the holidays prevented troubleshooting the problem until 30 days after the problem was identified. Also, a new problem was identified with GWM-306. GWM-306 was not worked until 1/19/99. A functional test and calibration check were performed and the monitor was returned to service on 2/11/99 10:43. Later, that afternoon, the monitor did not function and was again declared out of service. This problem was identified to be a malfunctioning kurz mass flow probe. The installation of the kurz mass flow probe was delayed due to manpower shortages associated with the refueling outage which was in progress at the time. The two events are related enough to consider the two out of service periods as one, which has been done here.

8.4.3 Boron Waste Management (BWM) System Radiation Monitor (PRM-IRE-0627) *(Unchanged from 1998 report)*

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 11/25/98 08:30 to 1/18/99 08:54 (54.02 Days)

Number of Batch Releases performed during period: 34

Cause of Inoperability: Monitor was observed to show large disagreement with laboratory analysis of batch release. Detector lower level discriminator settings were adjusted, a calibration performed, and the monitor was returned to service.

Reason Operability Not Restored Within Allotted Time: The reason the monitor was not returned to service within the time specified was due to the time required to troubleshoot the problem and due to delays encountered in changing procedures. Once the procedure change was approved, the monitor was calibrated, tested and returned to service.

8.4.4 Gaseous Waste System (GWM) Process Flow Rate (GWM-IFIT-0648) (Resolved in 1999)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 11/27/98 15:30 to 11/04/99 16:54 (342.06 Days)

Number of Batch Releases performed during period: 10

Cause of Inoperability: While discharging, the recorder and local instrument indicated approximately 46 SCFM for process flow, however, calculations based upon GDT pressure change yielded a discharge flow rate of approximately 70 SCFM.

Reason Operability Not Restored Within Allotted Time: The reason the instrument was not restored to service within the time specified is due to the length of time necessary to troubleshoot the flow meter and regulator valve (GWM-3094), plus delays in receiving final design engineering input on a substitute flow instrument. The flow instrument was obsolete and no spares were available. A Design Change was required and the process flow instrument was replaced with a new unit and returned to service. The Design Change process required additional time and caused further delays in returning the instrument to service.

8.4.5 Boron Waste Management (BWM) Process Flow Rate (BM-IFT-0627) (Resolved in 1999)

Time Required by Specifications to Restore Operability: 30 Days

Period of Inoperability: 9/30/96 13:30 to 6/21/99 15:40 (994.09 Days)

Number of Batch Releases performed during period: Numerous

Cause of Inoperability: Waste volume determined from flow instrumentation was observed to disagree from calculations derived from tank level change. Troubleshooting identified that the flow transmitter sensing line is incorrectly mounted causing entrapment of air in the sensing line.

Reason Operability Not Restored Within Allotted Time: The reason the instrument had not been restored to service within the time specified is due to problems in identifying the actual affected component and scheduling and prioritization of changes needed to the plant to correct the problem. A Station Modification Request was initiated shortly after problem identification. Changes in the modification process further complicated implementation. An ACTION Statement was in effect to estimate flow every four hours since being declared inoperable in 1996.

Once the flow loop device (BMIFT0627) was identified as the deficient component, along with the cause of the problem, a Design Change was processed to properly re-route the sensing line tubing. The sensing line was re-routed, the transmitter was re-calibrated, and the instrument was returned to service. As a result of investigations into why this component was out of service so long, Waterford-3 has made improvements in prioritizing and performing corrective maintenance on radiation monitoring instrumentation.

8.5 Activity Released Via Secondary Pathways

The following secondary release paths were continuously monitored for radioactivity:

- The Hot Machine Shop Exhaust (AH-35),
- Decontamination Shop Exhaust (AH-34),
- The RAB H&V Equipment Room Ventilation system Exhaust (E-41A and E-41B); and,
- The Switchgear/Cable Vault Area Ventilation System (AH-25).

Continuous sampling for these areas is maintained in order to demonstrate the operability of installed treatment systems and to verify integrity of barriers separating primary and secondary ventilation systems. Sampling for these areas was limited to continuous particulate and iodine sampling and monthly noble gas grab sampling. The activity released via these secondary pathways resulted from routine operations and remained below significant levels.

8.6 Missed Effluent Samples

All effluent samples were collected within the frequency requirements specified in the ODCM/TRM during this reporting period.

8.7 Major Changes to Radioactive Waste Systems

During the reporting period, no major changes were made to any Radioactive Waste Systems. All major changes to Radioactive Waste Systems are included in Waterford 3's FSAR updates.

8.8 Biennial Land Use Census

A land use census was last performed in 1998. The land use census performed in 1998 did not identify any new locations for effluent dose calculations or radiological environmental sampling.

8.9 Gaseous Storage Tank Total Radioactivity Limit

Technical Specification 3/4.11.2.6 specifies that the quantity of radioactivity contained in each gas storage tank be maintained less than or equal to $8.5E+04$ Curies noble gas (considered as Xe-133 equivalent). At no time during the reporting period was this value exceeded.

8.10 Unprotected Outside Tank Total Radioactivity Limit

Technical Specification 3/4.11.1.4 specifies that the quantity of radioactive material contained in each unprotected outdoor tank be maintained less than or equal to $7.85E-04$ Curies (excluding tritium and dissolved and entrained noble gases). During this reporting period, there were no instances in which this limit was exceeded.

9.0 Additional Information

9.1 Reactor Coolant System Average Energy (E-Bar)

The most recent Reactor Coolant System E-Bar calculation was 0.308 MeV/Disintegration from a sample obtained on December 27, 1999. Reactor Coolant System E-Bar is supplied for information only and is not used for effluent dose calculations.

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11.0 Attachments

Attachment 11.1, Copy of Offsite Dose Calculation Manual (ODCM) Procedure, UNT-005-014, Revision 6, Change 2

Attachment 11.2, Copy of Applicable Sections of the Technical Requirements Manual (TRM), which are programmatically part of the ODCM.

Table 1
Batch Release Summary

Batch Release Summary information for 1999 Report Period.

Report Category	:	Batch Release Summary
Release Point	:	All
Type of Release	:	Batch Liquid and Gaseous
Period Start Time	:	01-jan-1999 00:00:00
Period End Time	:	31-dec-1999 23:59:59
Liquid Releases		
Number of Releases	:	124
Total Time for All Releases	:	34708.2 Minutes
Maximum Time for a Release	:	365.0 Minutes
Average Time for a Release	:	279.9 Minutes
Minimum Time for a Release	:	155.0 Minutes
Average Stream Flow	:	706854.8 GPM
Gaseous Releases		
Number of Releases	:	21
Total Time for All Releases	:	6573.0 Minutes
Maximum Time for a Release	:	685.0 Minutes
Average Time for a Release	:	313.0 Minutes
Minimum Time for a Release	:	6.0 Minutes

Batch Release Summary information for 1999 by Quarter.

Report Category	:	Batch Release Summary			
Release Point	:	All			
Type of Release	:	Batch Liquid and Gaseous			
Period Start Time	:	01-jan-1999 00:00:00			
Period End Time	:	31-dec-1999 23:59:59			
Liquid Releases					
		Qtr 1	Qtr 2	Qtr 3	Qtr 4
Number of Releases	:	52	21	28	23
Total Time for All Releases	:	14634.3	5925.7	7747.2	6401.1 Minutes
Maximum Time for a Release	:	352.0	365.0	306.0	324.0 Minutes
Average Time for a Release	:	281.4	282.2	276.7	278.3 Minutes
Minimum Time for a Release	:	215.0	155.0	237.0	239.0 Minutes
Average Stream Flow	:	654925.9	768058.6	713477.7	760901.9 GPM
Gaseous Releases					
		Qtr 1	Qtr 2	Qtr 3	Qtr 4
Number of Releases	:	7	2	8	4
Total Time for All Releases	:	1844.0	871.0	2920.0	938.0 Minutes
Maximum Time for a Release	:	600.0	648.0	685.0	600.0 Minutes
Average Time for a Release	:	263.4	435.5	365.0	234.5 Minutes
Minimum Time for a Release	:	45.0	223.0	6.0	47.0 Minutes

Table 1A
Annual Summation of All Releases by Quarter
All Airborne Effluents

Report Category : Summation of All Releases
Type of Activity : All Airborne Effluents
Period Start Time : 01-jan-1999 00:00:00
Period End Time : 31-dec-1999 23:59:59

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est.Total Error %
A. Fission and Activation Gases						
1. Total Release	Curies	3.18e+02	1.78e-01	2.65e+01	4.63e+01	1.50e+01
2. Average Release Rate for Period	uCi/sec	4.09e+01	2.26e-02	3.34e+00	5.82e+00	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	
B. Radioiodines						
1. Total Iodine-131	Curies	5.93e-04	4.75e-06	2.58e-06	0.00e+00	1.50e+01
2. Average Release Rate for Period	uCi/sec	7.62e-05	6.04e-07	3.25e-07	0.00e+00	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	
C. Particulates						
1. Particulates (Half-lives > 8 Days)	Curies	8.70e-06	3.66e-06	3.32e-06	3.90e-07	1.50e+01
2. Average Release Rate for Period	uCi/sec	1.12e-06	4.66e-07	4.17e-07	4.91e-08	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	
1. Gross Alpha Radioactivity	Curies	1.56e-06	1.03e-06	6.76e-07	1.10e-06	1.50e+01
D. Tritium						
1. Total Release	Curies	1.67e+01	2.38e+01	1.29e+01	1.78e+01	1.50e+01
2. Average Release Rate for Period	uCi/sec	2.15e+00	3.03e+00	1.62e+00	2.24e+00	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	

Table 1B
Annual Airborne Continuous Elevated and Ground Level Releases
Totals for Each Nuclide Released

Report Category : Airborne Continuous Elevated and Ground Level Releases.
: Totals for Each Nuclide Released.
Type of Activity : Fission Gases, Iodines, and Particulates
Period Start Time : 01-jan-1999 00:00:00
Period End Time : 31-dec-1999 23:59:59

Nuclide	Units	Elevated Releases				Ground Releases			
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Fission and Activation Gases									
Xe-133	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.18e+01	0.00e+00	4.00e+00	4.47e+01
Xe-135	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	6.73e+00	0.00e+00	0.00e+00	0.00e+00
Total for Period	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.85e+01	0.00e+00	4.00e+00	4.47e+01
Radioiodines									
I-131	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.87e-04	4.75e-06	2.58e-06	0.00e+00
I-133	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.61e-06	0.00e+00	0.00e+00	0.00e+00
Total for Period	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.93e-04	4.75e-06	2.58e-06	0.00e+00
Particulates									
H-3	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.62e+01	2.38e+01	1.23e+01	1.74e+01
Cr-51	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	6.82e-07	0.00e+00	0.00e+00	0.00e+00
Co-58	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.72e-06	2.66e-07	0.00e+00	0.00e+00
Co-60	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.27e-07	4.01e-07	7.69e-07	0.00e+00
Nb-95	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	4.13e-07	0.00e+00	0.00e+00	0.00e+00
Ru-103	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	6.53e-07	1.49e-07	0.00e+00	0.00e+00
Cs-134	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.53e-07	2.89e-07	7.55e-07	6.94e-08
Cs-137	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.14e-06	1.39e-06	1.79e-06	3.21e-07
Os-185	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.63e-07	0.00e+00	0.00e+00	0.00e+00
Os-191	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.95e-06	1.17e-06	0.00e+00	0.00e+00
Gralpha	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.56e-06	1.03e-06	6.76e-07	1.10e-06
Total for Period	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.62e+01	2.38e+01	1.23e+01	1.74e+01

Table 1C
Annual Airborne Batch Elevated and Ground Level Releases
Totals for Each Nuclide Released

Report Category : Airborne Batch Elevated and Ground Level Releases.
: Totals for Each Nuclide Released.
Type of Activity : Fission Gases, Iodines, and Particulates
Period Start Time : 01-jan-1999 00:00:00
Period End Time : 31-dec-1999 23:59:59

Nuclide	Units	Elevated Releases				Ground Releases			
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Fission and Activation Gases									
Ar-41	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.46e-01	5.29e-02	6.02e-02	2.17e-02
Kr-85	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.22e+00	0.00e+00	1.27e+01	9.20e-01
Kr-85m	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.12e-01	0.00e+00	0.00e+00	0.00e+00
Kr-88	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.24e-02	0.00e+00	0.00e+00	0.00e+00
Xe-131m	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.43e+00	0.00e+00	1.52e-01	0.00e+00
Xe-133	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.12e+02	1.22e-01	9.43e+00	6.40e-01
Xe-133m	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.30e+00	0.00e+00	8.95e-02	0.00e+00
Xe-135	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.05e+00	3.07e-03	6.30e-02	1.06e-02
Total for Period	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.29e+02	1.78e-01	2.25e+01	1.59e+00
Radioiodines									
None									
Particulates									
H-3	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.53e-01	6.19e-02	6.47e-01	3.91e-01
Total for Period	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.53e-01	6.19e-02	6.47e-01	3.91e-01

Table 2A
Annual Summation of All Releases by Quarter
All Liquid Effluents

Report Category : Summation of All Releases
Type of Activity : All Liquid Effluents
Period Start Time : 01-jan-1999 00:00:00
Period End Time : 31-dec-1999 23:59:59

Type of Effluent	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est.Total Error %
A. Fission and Activation Products						
1. Total Release (Not Including Tritium, Gases, and Alpha)	Curies	5.87e-01	1.44e-01	2.27e-01	2.01e-01	1.50e+01
2. Average Diluted Concentration During Period	uCi/sec	1.83e-09	3.77e-10	6.34e-10	5.26e-10	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	
B. Tritium						
1. Total Release	Curies	5.73e+01	1.15e+01	1.24e+02	1.27e+02	1.50e+01
2. Average Diluted Concentration During Period	uCi/sec	1.78e-07	3.01e-08	3.46e-07	3.34e-07	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	
C. Dissolved and Entrained Gases						
1. Total Release	Curies	2.66e+00	5.47e-03	1.63e-01	1.77e-01	1.50e+01
2. Average Diluted Concentration During Period	uCi/sec	8.29e-09	1.44e-11	4.56e-10	4.64e-10	
3. Percent of Applicable Limit	%	n/a	n/a	n/a	n/a	
D. Gross Alpha Radioactivity						
1. Total Release	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.50e+01
E. Waste Volume Released (Pre-Dilution)						
E. Waste Volume Released (Pre-Dilution)	Liters	1.15e+07	1.04e+07	1.36e+07	1.00e+07	1.50e+01
F. Volume of Dilution Water Used						
F. Volume of Dilution Water Used	Liters	3.21e+11	3.81e+11	3.58e+11	3.82e+11	1.50e+01

Table 2B
Annual Liquid Continuous and Batch Releases
Totals for Each Nuclide Released

Report Category : Liquid Continuous and Batch Releases.
: Totals for Each Nuclide Released.
Type of Activity : All Radionuclides
Period Start Time : 01-jan-1999 00:00:00
Period End Time : 31-dec-1999 23:59:59

Nuclide	Units	Continuous Releases				Batch Releases			
		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
All Nuclides									
H-3	Curies	1.59e-02	9.63e-03	5.45e-02	1.65e-02	5.73e+01	1.15e+01	1.24e+02	1.27e+02
Na-24	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.23e-06	0.00e+00	0.00e+00	0.00e+00
Ar-41	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.15e-05	0.00e+00	0.00e+00	0.00e+00
Cr-51	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.97e-02	2.10e-02	1.82e-02	6.00e-03
Mn-54	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	8.75e-03	2.18e-03	3.03e-03	4.58e-03
Fe-55	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	4.77e-02	3.14e-02	2.97e-02	5.41e-02
Fe-59	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.86e-03	1.07e-03	7.50e-04	7.97e-03
Co-57	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.21e-03	1.39e-04	4.33e-04	3.73e-04
Co-58	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.56e-01	4.07e-02	1.24e-01	6.58e-02
Co-60	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.32e-02	8.51e-03	1.78e-02	2.27e-02
Kr-85	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.29e-02	4.99e-04	9.01e-02	9.17e-02
Sr-92	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.41e-06	0.00e+00
Zr-95	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.89e-02	1.16e-02	9.83e-03	9.71e-03
Nb-95	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	6.76e-02	2.02e-02	1.64e-02	1.79e-02
Nb-97	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.50e-05	1.16e-05
Ru-103	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.30e-04	0.00e+00	0.00e+00	0.00e+00
Ru-106	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.04e-04	0.00e+00	0.00e+00
Ag-110m	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.25e-03	2.20e-03	9.83e-04	1.42e-03
Sn-113	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.20e-03	8.26e-04	6.18e-04	1.03e-03
Sb-124	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.81e-04	2.30e-05	8.68e-05	4.68e-05
Sb-125	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.35e-02	3.37e-03	3.44e-03	5.48e-03
Te-132	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.21e-05	0.00e+00	0.00e+00	0.00e+00
I-131	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.11e-03	1.22e-04	5.97e-05	9.25e-05
I-132	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	7.69e-05	0.00e+00	0.00e+00	0.00e+00
I-133	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	6.98e-05
I-135	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.34e-05
Xe-131m	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	3.63e-02	0.00e+00	2.04e-03	1.41e-03
Xe-133	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.59e+00	4.66e-03	7.06e-02	8.18e-02
Xe-133m	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.43e-02	8.22e-05	2.35e-04	6.43e-04
Xe-135	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.63e-04	2.29e-04	2.50e-04	1.67e-03
Cs-134	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.90e-03	3.67e-05	3.02e-04	1.60e-03
Cs-137	Curies	2.42e-06	0.00e+00	0.00e+00	0.00e+00	2.01e-03	0.00e+00	3.86e-04	1.73e-03
Ba-140	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	6.93e-05
La-140	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	2.63e-04	0.00e+00	2.74e-04	1.83e-04
Ce-141	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.59e-05	0.00e+00	8.79e-05	0.00e+00
Ce-144	Curies	0.00e+00	0.00e+00	0.00e+00	0.00e+00	1.34e-05	4.08e-05	0.00e+00	0.00e+00
Total for Period	Curies	1.59e-02	9.63e-03	5.45e-02	1.65e-02	6.05e+01	1.16e+01	1.24e+02	1.28e+02

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

SUMMARY BY MAJOR WASTE TYPES

Waste Stream : Resins, Filters, and Evap Bottoms

10CFR61	Volume			% Error
Waste Class	Ft ³	M ³	Curies Shipped	(Ci)
A	2.02E+02	5.72E+00	6.31E+00 ♦	+/- 25%
B	2.95E+02	8.34E+00	6.36E+02 ♦	+/- 25%
C	1.20E+02	3.75E+00	1.64E+02 ♣	+/- 25%
All	6.17E+02	1.78E+01	8.06E+02	+/- 25%

Waste Stream : Dry Active Waste

10CFR61	Volume			% Error
Waste Class	Ft ³	M ³	Curies Shipped	(Ci)
A	8.96E+03	2.54E+02	5.82E-01 ♣	+/- 25%
B	0.00E+00	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	0.00E+00	+/- 25%
All	8.96E+03	2.54E+02	5.82E-01	+/- 25%

Waste Stream : Irradiated Components

10CFR61	Volume			% Error
Waste Class	Ft ³	M ³	Curies Shipped	(Ci)
A	0.00E+00	0.00E+00	0.00E+00	+/- 25%
B	0.00E+00	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	0.00E+00	+/- 25%
All	0.00E+00	0.00E+00	0.00E+00	+/- 25%

- ♣ Activity determined by estimations
- ♦ Activity determined by measurements

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Waste Stream : Other Waste

10CFR61	Volume			% Error
Waste Class	Ft ³	M ³	Curies Shipped	(Ci)
A	0.00E+00	0.00E+00	0.00E+00	+/- 25%
B	0.00E+00	0.00E+00	0.00E+00	+/- 25%
C	0.00E+00	0.00E+00	0.00E+00	+/- 25%
All	0.00E+00	0.00E+00	0.00E+00	+/- 25%

Waste Stream : Sum of All 4 Categories

10CFR61	Volume			% Error
Waste Class	Ft ³	M ³	Curies Shipped	(Ci)
A	9.16E+03	2.60E+02	6.89E+00	+/- 25%
B	2.95E+02	8.34E+00	6.36E+02	+/- 25%
C	1.20E+02	3.75E+00	1.64E+02	+/- 25%
All	9.58E+03	2.72E+02	8.07E+02	+/- 25%

- ♣ Activity determined by estimations
- ◆ Activity determined by measurements

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Estimate of major nuclide composition (by waste type)**Waste Stream : Resins, Filters, and Evap Bottoms**

Nuclide Name	Percent Abundance	Curies
H-3	0.01%	5.07E-02
C-14	0.05%	4.16E-01
Cr-51	0.70%	5.65E+00
Mn-54	2.93%	2.36E+01
Fe-55	11.86%	9.56E+01
Fe-59	0.02%	2.00E-01
Co-57	0.24%	1.96E+00
Co-58	46.15%	3.72E+02
Co-60	4.44%	3.58E+01
Ni-59	0.09%	7.17E-01
Ni-63	7.76%	6.26E+01
Zn-65	0.01%	1.18E-01
Sr-89	0.02%	1.62E-01
Sr-90	0.03%	2.10E-01
Zr-95	1.14%	9.19E+00
Nb-95	0.72%	5.80E+00
Tc-99	0.00%	3.38E-02
Ag-110m	0.04%	3.29E-01
Sn-113	0.03%	2.04E-01
Sb-124	0.00%	3.30E-02
Sb-125	0.16%	1.31E+00
Cs-134	11.69%	9.43E+01
Cs-137	11.53%	9.29E+01
Ce-144	0.36%	2.87E+00
Pu-238	0.00%	7.27E-04
Pu-239	0.00%	3.90E-04
Pu-240	0.00%	2.35E-04
Pu-241	0.00%	1.59E-02
Am-241	0.00%	3.35E-04
Cm-242	0.00%	5.51E-05
Cm-243	0.00%	9.16E-04
Cm-244	0.00%	6.64E-04
Total	100.00%	8.06E+02

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Estimate of major nuclide composition (by waste type)

Waste Stream : Dry Active Waste

Nuclide Name	Percent Abundance	Curies
H-3	0.17%	9.71E-04
C-14	0.10%	5.51E-04
Cr-51	28.26%	1.65E-01
Mn-54	0.78%	4.52E-03
Fe-55	2.10%	1.22E-02
Fe-59	0.32%	1.84E-03
Co-57	0.02%	8.96E-05
Co-58	35.93%	2.09E-01
Co-60	1.31%	7.63E-03
Ni-59	0.00%	2.42E-05
Ni-63	2.53%	1.47E-02
Zn-65	0.00%	1.68E-05
Sr-89	0.26%	1.53E-03
Sr-90	0.05%	3.11E-04
Zr-95	10.04%	5.85E-02
Nb-95	16.52%	9.62E-02
Tc-99	0.00%	0.00E+00
Ag-110m	0.01%	4.62E-05
Sn-113	0.00%	2.17E-05
Sb-124	0.04%	2.49E-04
Sb-125	0.20%	1.19E-03
Cs-134	0.78%	4.52E-03
Cs-137	0.56%	3.23E-03
Ce-144	0.01%	2.84E-05
Pu-238	0.00%	0.00E+00
Pu-239	0.00%	0.00E+00
Pu-240	0.00%	0.00E+00
Pu-241	0.00%	0.00E+00
Am-241	0.00%	0.00E+00
Cm-242	0.00%	0.00E+00
Cm-243	0.00%	0.00E+00
Cm-244	0.00%	0.00E+00
Total	100.00%	5.82E-01

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Estimate of major nuclide composition (by waste type)

Waste Stream : Irradiated Components

Nuclide Name	Percent Abundance	Curies
H-3	0.00%	0.00E+00
C-14	0.00%	0.00E+00
Cr-51	0.00%	0.00E+00
Mn-54	0.00%	0.00E+00
Fe-55	0.00%	0.00E+00
Fe-59	0.00%	0.00E+00
Co-57	0.00%	0.00E+00
Co-58	0.00%	0.00E+00
Co-60	0.00%	0.00E+00
Ni-59	0.00%	0.00E+00
Ni-63	0.00%	0.00E+00
Zn-65	0.00%	0.00E+00
Sr-89	0.00%	0.00E+00
Sr-90	0.00%	0.00E+00
Zr-95	0.00%	0.00E+00
Nb-95	0.00%	0.00E+00
Tc-99	0.00%	0.00E+00
Ag-110m	0.00%	0.00E+00
Sn-113	0.00%	0.00E+00
Sb-124	0.00%	0.00E+00
Sb-125	0.00%	0.00E+00
Cs-134	0.00%	0.00E+00
Cs-137	0.00%	0.00E+00
Ce-144	0.00%	0.00E+00
Pu-238	0.00%	0.00E+00
Pu-239	0.00%	0.00E+00
Pu-240	0.00%	0.00E+00
Pu-241	0.00%	0.00E+00
Am-241	0.00%	0.00E+00
Cm-242	0.00%	0.00E+00
Cm-243	0.00%	0.00E+00
Cm-244	0.00%	0.00E+00
Total	0.00%	0.00E+00

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Estimate of major nuclide composition (by waste type)

Waste Stream : Other Waste

Nuclide Name	Percent Abundance	Curies
H-3	0.00%	0.00E+00
C-14	0.00%	0.00E+00
Cr-51	0.00%	0.00E+00
Mn-54	0.00%	0.00E+00
Fe-55	0.00%	0.00E+00
Fe-59	0.00%	0.00E+00
Co-57	0.00%	0.00E+00
Co-58	0.00%	0.00E+00
Co-60	0.00%	0.00E+00
Ni-59	0.00%	0.00E+00
Ni-63	0.00%	0.00E+00
Zn-65	0.00%	0.00E+00
Sr-89	0.00%	0.00E+00
Sr-90	0.00%	0.00E+00
Zr-95	0.00%	0.00E+00
Nb-95	0.00%	0.00E+00
Tc-99	0.00%	0.00E+00
Ag-110m	0.00%	0.00E+00
Sn-113	0.00%	0.00E+00
Sb-124	0.00%	0.00E+00
Sb-125	0.00%	0.00E+00
Cs-134	0.00%	0.00E+00
Cs-137	0.00%	0.00E+00
Ce-144	0.00%	0.00E+00
Pu-238	0.00%	0.00E+00
Pu-239	0.00%	0.00E+00
Pu-240	0.00%	0.00E+00
Pu-241	0.00%	0.00E+00
Am-241	0.00%	0.00E+00
Cm-242	0.00%	0.00E+00
Cm-243	0.00%	0.00E+00
Cm-244	0.00%	0.00E+00
Total	0.00%	0.00E+00

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Estimate of major nuclide composition (by waste type)

Waste Stream : Sum of All 4 Categories

Nuclide Name	Percent Abundance	Curies
H-3	0.01%	5.17E-02
C-14	0.05%	4.17E-01
Cr-51	0.72%	5.82E+00
Mn-54	2.93%	2.36E+01
Fe-55	11.85%	9.56E+01
Fe-59	0.03%	2.02E-01
Co-57	0.24%	1.96E+00
Co-58	46.15%	3.72E+02
Co-60	4.44%	3.58E+01
Ni-59	0.09%	7.17E-01
Ni-63	7.76%	6.26E+01
Zn-65	0.01%	1.18E-01
Sr-89	0.02%	1.64E-01
Sr-90	0.03%	2.11E-01
Zr-95	1.15%	9.25E+00
Nb-95	0.73%	5.90E+00
Tc-99	0.00%	3.38E-02
Ag-110m	0.04%	3.29E-01
Sn-113	0.03%	2.04E-01
Sb-124	0.00%	3.32E-02
Sb-125	0.16%	1.31E+00
Cs-134	11.68%	9.43E+01
Cs-137	11.52%	9.29E+01
Ce-144	0.36%	2.87E+00
Pu-238	0.00%	7.27E-04
Pu-239	0.00%	3.90E-04
Pu-240	0.00%	2.35E-04
Pu-241	0.00%	1.59E-02
Am-241	0.00%	3.35E-04
Cm-242	0.00%	5.51E-05
Cm-243	0.00%	9.16E-04
Cm-244	0.00%	6.64E-04
Total	100.00%	8.07E+02

Table 3
Solid Waste Shipped Offsite for Burial or Disposal

Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
1	Kindrick Trucking Inc.	ATG Catalytics LLC
3	Hittman Transport Services	Barnwell Waste Management Facility
4	Hittman Transport Services	GTS Duratek Bear Creek

Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
None ¹	N/A	N/A

Table 4
Joint Frequency Distribution of Meteorological Data

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS A

Wind Direction	Wind Speed (M/S) at 10-m Level												Total
	.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.	10.1-13	13.1-18.0	>18.0	
N	0	0	0	0	1	5	34	9	4	0	0	0	53
NNE	0	0	0	0	1	3	19	4	0	0	0	0	27
NE	0	0	0	0	0	34	149	14	0	0	0	0	197
ENE	0	0	0	0	0	13	14	2	0	0	0	0	29
E	0	0	0	0	0	3	2	0	0	0	0	0	5
ESE	0	0	0	0	0	1	7	1	0	0	0	0	9
SE	0	0	0	0	0	3	11	6	0	0	0	0	20
SSE	0	0	0	0	2	5	12	11	1	0	0	0	31
S	0	0	0	0	1	3	20	28	10	0	0	0	62
SSW	0	0	0	0	0	2	11	6	0	0	0	0	19
SW	0	0	0	0	0	5	29	8	0	0	0	0	42
WSW	0	0	0	0	0	1	6	1	0	0	0	0	8
W	0	0	0	0	0	0	6	0	0	0	0	0	6
WNW	0	0	0	0	0	6	12	7	0	0	0	0	25
NW	0	0	0	0	0	0	7	6	0	0	0	0	13
NNW	0	0	0	0	1	5	23	13	8	0	0	0	50
Total	0	0	0	0	6	89	362	116	23	0	0	0	596

Number of calms for A Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS B

Wind Direction	Wind Speed (M/S) at 10-m Level												Total
	.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.	10.1-13	13.1-18.0	>18.0	
N	0	0	0	1	1	9	10	6	3	0	0	0	30
NNE	0	0	0	0	2	7	11	1	0	0	0	0	21
NE	0	0	0	0	1	29	68	7	0	0	0	0	105
ENE	0	0	0	0	1	11	18	2	0	0	0	0	32
E	0	0	0	0	0	0	2	0	0	0	0	0	2
ESE	0	0	0	0	0	0	7	3	0	0	0	0	10
SE	0	0	0	0	2	5	18	5	0	0	0	0	30
SSE	0	0	0	0	0	11	29	6	0	0	0	0	46
S	0	0	0	0	2	16	22	13	5	2	0	0	60
SSW	0	0	0	0	2	8	7	2	0	0	0	0	19
SW	0	0	0	1	1	13	13	5	0	0	0	0	33
WSW	0	0	0	1	4	16	7	2	0	0	0	0	30
W	0	0	0	1	2	9	7	0	0	0	0	0	19
WNW	0	0	0	0	4	8	9	1	0	0	0	0	22
NW	0	0	0	0	0	4	9	0	0	0	0	0	13
NNW	0	0	0	0	1	7	13	6	2	0	0	0	29
Total	0	0	0	4	23	153	250	59	10	2	0	0	501

Number of calms for B Stability: 0

Table 4
Joint Frequency Distribution of Meteorological Data

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS C

Wind Direction	Wind Speed (M/S) at 10-m Level											Total	
	.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.	10.1-13	13.1-18.0		>18.0
N	0	0	0	0	8	24	5	1	2	0	0	0	40
NNE	0	0	0	1	6	7	9	0	0	0	0	0	23
NE	0	0	0	3	3	26	51	7	0	0	0	0	90
ENE	0	0	0	0	1	7	8	1	0	0	0	0	17
E	0	0	0	0	1	5	1	1	0	0	0	0	8
ESE	0	0	0	0	1	6	5	3	0	0	0	0	15
SE	0	0	0	0	1	6	18	7	1	0	0	0	33
SSE	0	0	0	0	3	6	25	13	3	0	0	0	50
S	0	0	0	0	2	8	15	13	7	1	0	0	46
SSW	0	0	1	1	3	8	11	4	0	0	0	0	28
SW	0	0	0	0	5	9	11	5	0	0	0	0	30
WSW	0	0	0	5	6	16	8	1	0	0	0	0	36
W	0	0	0	0	1	9	12	3	0	0	0	0	25
WNW	0	0	0	0	4	20	7	0	0	0	0	0	31
NW	0	0	0	0	3	4	7	1	0	0	0	0	15
NNW	0	0	0	1	6	13	11	6	0	0	0	0	37
Total	0	0	1	11	54	174	204	66	13	1	0	0	524

Number of calms for C Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS D

Wind Direction	Wind Speed (M/S) at 10-m Level											Total	
	.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.	10.1-13	13.1-18.0		>18.0
N	0	0	2	15	29	43	89	53	16	0	0	0	247
NNE	0	1	2	17	20	40	44	20	3	0	0	0	147
NE	0	1	4	12	27	82	94	21	3	0	0	0	244
ENE	0	0	0	6	13	41	55	18	2	0	0	0	135
E	0	0	1	2	7	8	31	15	0	0	0	0	64
ESE	0	0	0	0	3	13	47	25	1	0	0	0	89
SE	0	1	1	3	7	24	81	31	4	0	0	0	152
SSE	0	0	0	2	11	46	93	32	5	0	0	0	189
S	0	0	2	2	13	33	54	60	9	10	0	0	183
SSW	0	0	1	5	12	34	59	21	2	0	0	0	134
SW	0	1	1	6	18	30	51	7	0	0	0	0	114
WSW	0	0	1	14	21	55	39	1	0	0	0	0	131
W	0	0	3	14	14	26	22	2	0	0	0	0	81
WNW	0	0	0	9	22	23	31	4	0	0	0	0	89
NW	0	0	2	4	11	20	20	13	0	0	0	0	70
NNW	0	0	2	6	16	40	79	41	12	0	0	0	196
Total	0	4	22	117	244	558	889	364	57	10	0	0	2265

Number of calms for D Stability: 0

Table 4
Joint Frequency Distribution of Meteorological Data

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS E

Wind Direction	Wind Speed (M/S) at 10-m Level												Total
	.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.	10.1-13	13.1-18.0	>18.0	
N	1	3	0	13	17	75	88	11	0	0	0	0	208
NNE	0	3	5	11	21	68	59	14	0	0	0	0	181
NE	1	1	2	12	35	89	63	19	1	0	0	0	223
ENE	0	0	1	7	11	63	47	4	0	0	0	0	133
E	0	2	1	5	6	29	37	3	0	0	0	0	83
ESE	0	0	3	5	5	40	72	7	0	0	0	0	132
SE	0	1	0	10	17	83	95	15	0	0	0	0	221
SSE	0	1	3	14	48	142	65	7	0	0	0	0	280
S	0	2	4	17	52	100	89	10	2	0	0	0	276
SSW	1	1	9	35	36	54	48	4	2	0	0	0	190
SW	1	6	9	28	42	48	25	0	0	0	0	0	159
WSW	1	3	10	63	49	30	12	0	0	0	0	0	168
W	0	2	15	57	34	16	9	0	0	0	0	0	133
WNW	0	1	7	21	25	19	4	0	0	0	0	0	77
NW	1	1	3	10	14	33	11	2	0	0	0	0	75
NNW	0	4	4	13	4	33	32	7	0	0	0	0	97
Total	6	31	76	321	416	922	756	103	5	0	0	0	2636

Number of calms for E Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS F

Wind Direction	Wind Speed (M/S) at 10-m Level												Total
	.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.	10.1-13	13.1-18.0	>18.0	
N	0	3	5	17	7	18	9	0	0	0	0	0	59
NNE	0	4	4	14	16	26	2	0	0	0	0	0	66
NE	0	3	4	6	18	46	10	0	0	0	0	0	87
ENE	0	4	5	8	6	13	1	0	0	0	0	0	37
E	1	0	0	5	2	1	0	0	0	0	0	0	9
ESE	1	4	0	4	2	1	0	0	0	0	0	0	12
SE	0	3	2	6	13	21	5	0	0	0	0	0	50
SSE	0	0	7	26	39	32	2	0	0	0	0	0	106
S	0	8	22	71	50	19	0	0	0	0	0	0	170
SSW	0	14	22	94	23	17	0	0	0	0	0	0	170
SW	1	16	31	44	10	3	2	0	0	0	0	0	107
WSW	0	14	35	59	25	3	0	0	0	0	0	0	136
W	1	16	20	50	15	1	1	0	0	0	0	0	104
WNW	0	7	15	23	11	3	0	0	0	0	0	0	59
NW	0	7	6	13	15	4	0	0	0	0	0	0	45
NNW	0	3	9	16	10	12	2	0	0	0	0	0	52
Total	4	106	187	456	262	220	34	0	0	0	0	0	1269

Number of calms for F Stability: 0

Table 4
Joint Frequency Distribution of Meteorological Data

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59 PASQUILL CLASS G

Wind Direction	Wind Speed (M/S) at 10-m Level											Total	
	.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.	10.1-13	13.1-18.0		>18.0
N	1	6	8	15	3	0	0	0	0	0	0	0	33
NNE	1	2	5	11	4	0	0	0	0	0	0	0	23
NE	4	1	5	7	9	1	0	0	0	0	0	0	27
ENE	1	2	2	3	0	0	0	0	0	0	0	0	8
E	1	3	1	1	1	0	0	0	0	0	0	0	7
ESE	0	3	2	1	0	0	0	0	0	0	0	0	6
SE	0	3	0	1	2	5	1	0	0	0	0	0	12
SSE	2	5	4	19	12	6	0	0	0	0	0	0	48
S	1	9	21	46	12	0	0	0	0	0	0	0	89
SSW	4	12	30	63	13	2	0	0	0	0	0	0	124
SW	6	18	41	32	3	0	0	0	0	0	0	0	100
WSW	9	39	48	21	1	1	0	0	0	0	0	0	119
W	13	60	41	32	7	0	0	0	0	0	0	0	153
WNW	9	39	38	26	4	1	0	0	0	0	0	0	117
NW	6	18	9	15	4	1	0	0	0	0	0	0	53
NNW	4	7	18	13	6	2	0	0	0	0	0	0	50
Total	62	227	273	306	81	19	1	0	0	0	0	0	969

Number of calms for G Stability: 0

Total valid hours for all stabilities = 8760
Total invalid hours for all stabilities = 0

Table 5A
Doses Due to Gaseous Radioactive Effluents

Doses due to Noble Gases (mRad or mrem)

Age Group : **All**

Organ	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year Total
Total-body	7.3430e-02	3.2254e-04	3.0674e-03	8.5920e-03	8.5411e-02
Skin	1.7549e-01	4.9445e-04	1.7665e-02	2.0950e-02	2.1460e-01
Air Beta	2.2892e-01	1.9590e-04	2.5085e-02	3.1375e-02	2.8558e-01
Air Gamma	8.5684e-02	3.4274e-04	3.6113e-03	1.0295e-02	9.9934e-02

Doses due to Radioiodines/Particulates/Tritium (mrem)

Age Group : **Adult**

Organ	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year Total
Bone	1.6425e-04	2.9468e-05	4.6398e-05	7.5568e-06	2.4768e-04
Liver	1.1877e-02	1.6647e-02	9.0616e-03	1.2436e-02	5.0022e-02
Total-body	1.1796e-02	1.6643e-02	9.0603e-03	1.2439e-02	4.9938e-02
Thyroid	7.2852e-02	1.7121e-02	9.2993e-03	1.2431e-02	1.1170e-01
Kidney	1.2001e-02	1.6635e-02	9.0419e-03	1.2433e-02	5.0111e-02
Lung	1.1680e-02	1.6629e-02	9.0351e-03	1.2432e-02	4.9776e-02
Gi-lli	1.1730e-02	1.6631e-02	9.0411e-03	1.2436e-02	4.9838e-02
Skin	2.8085e-05	1.8237e-05	3.1563e-05	5.3231e-06	8.3207e-05

Age Group : **Teen**

Organ	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year Total
Bone	2.5246e-04	3.9050e-05	5.9719e-05	9.6284e-06	3.6086e-04
Liver	1.3535e-02	1.8854e-02	1.0271e-02	1.4079e-02	5.6740e-02
Total-body	1.3387e-02	1.8837e-02	1.0252e-02	1.4082e-02	5.6559e-02
Thyroid	9.9723e-02	1.9520e-02	1.0600e-02	1.4072e-02	1.4392e-01
Kidney	1.3733e-02	1.8835e-02	1.0238e-02	1.4075e-02	5.6880e-02
Lung	1.3221e-02	1.8825e-02	1.0228e-02	1.4073e-02	5.6347e-02
Gi-lli	1.3276e-02	1.8822e-02	1.0222e-02	1.4072e-02	5.6392e-02
Skin	2.8085e-05	1.8237e-05	3.1563e-05	5.3231e-06	8.3207e-05

Age Group : **Child**

Organ	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year Total
Bone	5.5654e-04	7.0897e-05	1.0386e-04	1.6493e-05	7.4779e-04
Liver	1.8817e-02	2.6099e-02	1.4219e-02	1.9487e-02	7.8620e-02
Total-body	1.8577e-02	2.6060e-02	1.4173e-02	1.9491e-02	7.8300e-02
Thyroid	1.8213e-01	2.7367e-02	1.4854e-02	1.9474e-02	2.4382e-01
Kidney	1.9107e-02	2.6065e-02	1.4163e-02	1.9478e-02	7.8813e-02
Lung	1.8287e-02	2.6048e-02	1.4144e-02	1.9476e-02	7.7955e-02
Gi-lli	1.8326e-02	2.6042e-02	1.4135e-02	1.9474e-02	7.7978e-02
Skin	2.8085e-05	1.8237e-05	3.1563e-05	5.3231e-06	8.3207e-05

Age Group : **Infant**

Organ	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year Total
Bone	9.7832e-04	7.0088e-05	9.9743e-05	1.5508e-05	1.1637e-03
Liver	9.3995e-03	1.1843e-02	6.4970e-03	8.8155e-03	3.6555e-02
Total-body	8.7642e-03	1.1795e-02	6.4482e-03	8.8254e-03	3.5833e-02
Thyroid	3.6362e-01	1.4651e-02	7.9628e-03	8.8017e-03	3.9504e-01
Kidney	9.5478e-03	1.1801e-02	6.4306e-03	8.8054e-03	3.6585e-02
Lung	8.2792e-03	1.1782e-02	6.4116e-03	8.8032e-03	3.5276e-02
Gi-lli	8.3117e-03	1.1775e-02	6.4013e-03	8.8017e-03	3.5290e-02
Skin	2.8085e-05	1.8237e-05	3.1563e-05	5.3231e-06	8.3207e-05

Table 5B
Doses Due to Liquid Radioactive Effluents

Age Group : **Adult**

Organ	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Year Total
Bone	2.0562e-02	1.8942e-04	2.0841e-03	6.8754e-03	2.9711e-02
Liver	3.3515e-02	3.5582e-04	3.9056e-03	1.2430e-02	5.0207e-02
Total-body	2.4008e-02	2.5359e-04	2.9975e-03	9.2211e-03	3.6480e-02
Thyroid	1.8273e-03	7.3549e-05	2.4072e-04	1.7647e-04	2.3180e-03
Kidney	1.1817e-02	8.8376e-05	1.3527e-03	4.0892e-03	1.7347e-02
Lung	4.7887e-03	8.9264e-05	6.3583e-04	1.5457e-03	7.0595e-03
Gi-lli	1.6854e-02	2.6150e-03	4.6409e-03	4.0560e-03	2.8165e-02