

EFFLUENT AND WASTE DISPOSAL

SEMIANNUAL REPORT

July 1, 1995 - December 31, 1995

CAROLINA POWER & LIGHT COMPANY

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

FACILITY OPERATING LICENSE NO. DPR-23

DOCKET NO. 50-261

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I. EXECUTIVE SUMMARY

A. Discussion

1. Protection Standards

The main objective in the control of radiation is to ensure that any exposure is kept not only within regulatory limits, but As Low As Reasonably Achievable (ALARA). The ALARA concept applies to reducing radiation exposure both to workers at H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2 and to the general public. "Reasonably achievable" means that radiation exposure reduction is based on sound environmental practices, economic decisions, and operating practices. By practicing ALARA, HBRSEP & Carolina Power and Light (CP&L) Company minimize health risk, environmental detriment, and ensure that exposures are maintained well below regulatory limits.

2. Sources of Radioactivity Released

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

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

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

3. Noble Gas

Some of the fission products released in airborne effluents are radioactive isotopes of noble gases, such as krypton, argon, and xenon. Noble gases are by nature inert and do not concentrate in humans or other organisms. Their contribution to human radiation exposure is as an external exposure. The major isotopes released are Argon-41, Xenon-133, and Xenon-135 with half-lives of approximately two hours, five days, and nine hours, respectively. Half-life is defined as the time required for a radioactive isotope to lose 50 percent of its radioactivity by decay. Noble gases are readily dispersed in the atmosphere.

4. Iodines and Particulates

Annual releases of iodines, and those particulates with half-lives greater than eight days are small. Factors such as chemical reactivity and solubility in water, combined with high processing efficiencies, minimize their discharge. The main contribution of radioactive iodine to human exposure is to the thyroid gland, where

the body concentrates iodine. The principal radioactive particulates are Cobalt-58 and Cobalt-60 which contribute to internal exposure of tissues such as the muscle, liver, and intestines. These particulates can also be a source of exposure if deposited on the ground.

5. Tritium

Tritium, a radioactive isotope of hydrogen, is the predominate radionuclide in liquid and gaseous effluents. Tritium is produced in the reactor coolant as a result of neutron interaction with deuterium (also a hydrogen isotope) and boron, both of which are present in the reactor coolant. Tritium contributes very little radiation exposure to the human body, and when it is inhaled or ingested is dispersed throughout the body until eliminated.

6. Processing and Monitoring

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

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

The plant has a meteorological tower which is linked to computers that record the meteorological data. The meteorological data and the release data is used to calculate to dose to the public.

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

7. Exposure Pathways

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

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

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

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

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

## 8. Results

The Radioactive Effluent Release Report is a detailed listing of the radioactivity released from the HBRSEP, Unit No. 2 during the period from July 1, 1995, through December 31, 1995.

During the period of July 1, 1995, through December 31, 1995, the estimated maximum individual offsite dose due to radioactivity released in effluents was:

### Liquid Effluents:

- 0.00237 millirem, total body
- 0.00343 millirem, GI-LLI

### Gaseous Effluents:

- Annual Beta Air Dose 0.00280 millirad
- Annual Gamma Air Dose 0.00325 millirad
- Critical Organ Dose 0.04190 millirem, thyroid

B. Significant Variances

The following are explanations of significant variances in this Semiannual Report:

1. The 10 CFR 50, Appendix I, doses were calculated from the last posted release for the period indicated using the Canberra (Offsite Dose Calculation Manual (ODCM) meteorology) Effluent Management System (EMS). The following is a summary of the comparison of the annual dose commitment of the ODCM and Liquid Annual Doses to All Persons (LADTAP)/GASPAR dose programs.

<u>GASEOUS</u>	<u>UNITS</u>	<u>EMS (ODCM)</u>	<u>LADTAP/GASPAR</u>
Annual Beta Air Dose	mrad	9.01E-03	2.80E-03
Annual Gamma Air Dose	mrad	8.75E-03	3.25E-03
I-131, I-133, Tritium & Part.			
>8 Day Half-Lives Dose	mrem	1.67E-01	4.19E-02

LIQUID

Total Body Dose	mrem	6.16E-03	2.37E-03
Critical Organ Dose	mrem	6.83E-03	3.43E-03

The annual gaseous dose commitment was calculated with GASPAR using batch mixed mode, continuous mixed mode, batch ground level mode, and continuous ground level concurrent meteorology. The ODCM (EMS Software) provides day-by-day dose estimates that are higher because all releases are assigned to the limiting receptor, using the continuous ground level dispersion factors calculated from 1978 meteorology.

The annual liquid dose commitment is lower with LADTAP because total annual dilution flow is used. Day-by-day dose estimates provided by the ODCM using EMS software utilizes dilution flow during actual release periods from HBRSEP, Unit No. 2 or Unit No. 1 only; not both.

2. HBRSEP, Unit No. 2 was shutdown during the period from April 29, 1995, until June 21, 1995, for Refueling Outage 16. HBRSEP, Unit No. 2 was brought to hot shutdown again from June 30, 1995, until July 5, 1995, because of a reactor trip when a Main Steam Valve closed. Since that time, Unit No. 2 ran at steady-state power operations for the remainder of the year. Consequently, variances in most effluent parameters are indicative of the shutdown in the third quarter compared to steady-state operations in the fourth quarter. Some of the gaseous and liquid release parameters for this reporting period are summarized below:

GASEOUS EFFLUENTS

	<u>UNITS</u>	<u>3rd QUARTER</u>	<u>4th QUARTER</u>
Fission & Act. Gas	Ci	3.20E-01	1.46E-01
I-131	Ci	1.24E-06	2.07E-07
Part. >8 Day Half-Lives	Ci	3.22E-07	<LLD
Tritium	Ci	2.25E+00	2.73E+00

3. Virtually all parameters associated with liquid effluents increased in the fourth quarter as compared to the third quarter. This is consistent with the normal progression of the fuel cycle after the June, 1995 - July, 1995 shutdown. Some of the liquid release parameters for this reporting period are shown below:

LIQUID EFFLUENTS

	<u>UNITS</u>	<u>3rd QUARTER</u>	<u>4th QUARTER</u>
Fission & Act. Products	Ci	7.15E-03	4.07E-02
Tritium	Ci	5.03E+01	1.01E+02
Dilution Volume	Liters	2.81E+11	2.82E+11
Waste Volume	Liters	1.24E+06	4.38E+06

C. Regulatory Compliance

1. When projected on a day-by-day basis utilizing conservative meteorological conditions, the dose commitment from gaseous and liquid effluents is a small fraction of the 10 CFR 50, Appendix I limits. The direct radiation assessment to the likely most exposed member of the public is reported in the Annual Radiological Environmental Operating Report. During 1995, the results of the direct radiation assessment demonstrated no measurable effect above background for plant operations. The onsite Independent Spent Fuel Storage Installation is evaluated in Addendum I to this report.
2. There were no changes to the waste solidification Process Control Program (PCP) during this reporting period.
3. There were no changes to the Radioactive Waste Systems (i.e., liquid, gaseous, or solid) during this reporting period.
4. There was a reportable instrumentation inoperability event during this reporting period. See Enclosure 2, page 2, for details.
5. There were no outside liquid holdup tanks that exceeded the ten curie limit during this reporting period.
6. There were no Waste Gas Decay Tanks that exceeded the 1.9E+04 curie limit during this reporting period.
7. There were no revisions to the ODCM during this reporting period.

II. SUPPLEMENTAL INFORMATION

A. Regulatory Limits

1. Fission and Activation Gases:
  - 10 CFR 20 Limits (Instantaneous Release Rate)
    - Total Body Dose  $\leq 500$  mrem/yr
    - Skin Dose  $\leq 3000$  mrem/yr
  - 10 CFR 50, Appendix I
    - For Calendar Quarter
      - Gamma Dose  $\leq 5$  mrad
      - Beta Dose  $\leq 10$  mrad
    - For Calendar Year
      - Gamma Dose  $\leq 10$  mrad
      - Beta Dose  $\leq 20$  mrad
2. Iodine - 131 and 133, Tritium, and Particulates >8 day half-lives:
  - 10 CFR 20 Limits (Instantaneous Release Rate)
    - Dose from Inhalation (only) to a child to any organ  $\leq 1500$  mrem/yr
  - 10 CFR 50, Appendix I (Organ Doses)
    - For Calendar Quarter  $\leq 7.5$  mrem
    - For Calendar Year  $\leq 15$  mrem
3. Liquids:

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

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

B. Measurements and Approximations of Total Radioactivity

1. Continuous Gaseous Releases
  - a. Fission and Activation Gases - The total activity released is determined from the net count rate of the gaseous monitor, its calibration factor, and the total exhaust flow. The activity of radioactive gas is determined by the fraction of that radioactive gas in the isotopic analysis for that period.
  - b. Iodines - The activity released as Iodine-131, 133, and 135 is based on isotopic analysis of the charcoal cartridge and particulate filter and the total vent flow.
  - c. Particulates - The activity released via particulates with half-lives greater than eight days is determined by isotopic analysis of particulate filters and the total vent flow.

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

2. Batch Gaseous Releases

- a. Fission and Activation Gases - The activity released is based on the volume released and the activity of the individual nuclides obtained from an isotopic analysis of the grab sample taken prior to the release.
- b. Iodines - The iodines from mixed mode batch releases are included in the iodine determination from the mixed mode continuous Reactor Auxiliary Building release.
- c. Particulates - The particulates from mixed mode batch releases are included in the particulate determination from the mixed mode continuous Reactor Auxiliary Building release. Ground level batch particulates are reported in the batch mode accountability.
- d. Tritium - The activity released as tritium is based on the grab sample analysis of each batch and the batch volume.

3. Liquid Releases

- a. Fission and Activation Products - The total release values (not including tritium, strontium, Iron-55, and alpha) are comprised of the sum of the individual radionuclide activities in each release to the discharge canal for the respective quarter. These values represent the activity known to be present in the liquid radwaste effluent.
- b. Tritium & Alpha - The measured tritium and alpha concentrations in a monthly composite sample are used to calculate the total release and average diluted concentration during each period.
- c. Strontium-89, 90, and Iron-55 - The total release values are measured quarterly from composite samples.

C. Estimated Total Errors

- 1. Estimated total errors for gaseous effluents are based on uncertainties in counting equipment calibration, counting statistics, vent flow rates, vent sample flow rates, non-steady release rates, chemical yield factors, and sample losses for such items as charcoal cartridges.
- 2. Estimated total errors for liquid effluents are based on uncertainties in counting equipment calibration, counting statistics, non-steady release flow rate, sampling and mixing losses, and volume determinations.
- 3. Estimated total errors for solid waste are based on uncertainties in equipment calibration, dose rate measurements, geometry, and volume determinations.

III. GASEOUS EFFLUENTS

A. Batch Releases

1.	Number of Batch Releases	<u>5.90E+01</u>
2.	Total Time Period for Batch Releases	<u>3.71E+04</u> Min
3.	Maximum Time Period for a Batch Release	<u>1.30E+03</u> Min
4.	Average Time Period for Batch Releases	<u>6.29E+02</u> Min
5.	Minimum Time Period for a Batch Release	<u>6.10E+01</u> Min

B. Abnormal Releases

1.	Number of Releases	<u>0.00E+00</u>
2.	Total Activity Released	<u>0.00E+00</u> Ci

C. Data Tables

The following tables provide the details of gaseous releases:

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

TABLE III-A  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1995  
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	<u>UNITS</u>	<u>3RD QUARTER</u>	<u>4TH QUARTER</u>
A. Fission and Activation Gases:			
1. Total Release	Ci	<u>3.20E-01</u>	<u>1.46E-01</u>
2. Estimated Total Error	%	<u>3.63E+01</u>	<u>3.63E+01</u>
3. Average Release Rate for Period	$\mu\text{Ci/sec}$	<u>4.02E-02</u>	<u>1.84E-02</u>
4. Percent of 10 CFR 50, Appendix I			
<u>Quarterly Limit</u>			
Gamma Air	%	<u>2.60E-02</u>	<u>2.47E-02</u>
Beta Air	%	<u>1.11E-02</u>	<u>6.69E-03</u>
<u>Annual Limit</u>			
Gamma Air	%	<u>8.75E-02*</u>	<u>9.99E-02*</u>
Beta Air	%	<u>4.50E-02*</u>	<u>4.84E-02*</u>
B. Iodines, Particulates, and Tritium:			
<u>Iodines</u>			
1. Total Iodine - 131	Ci	<u>1.24E-06</u>	<u>2.07E-07</u>
2. Estimated Total Error	%	<u>1.74E+01</u>	<u>1.74E+01</u>
3. Average Release Rate for Period	$\mu\text{Ci/sec}$	<u>1.56E-07</u>	<u>2.60E-08</u>
<u>Particulates</u>			
1. Particulates with Half-Lives >8 days	Ci	<u>3.22E-07</u>	<u>&lt;LLD</u>
2. Estimated Total Error	%	<u>1.05E+01</u>	<u>1.05E+01</u>
3. Average Release Rate for Period	$\mu\text{Ci/sec}$	<u>4.05E-08</u>	<u>&lt;LLD</u>
4. Gross Alpha Radioactivity	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>
<u>Tritium</u>			
1. Total Release	Ci	<u>2.25E+00</u>	<u>2.73E+00</u>
2. Estimated Total Error	%	<u>2.31E+01</u>	<u>2.31E+01</u>
3. Average Release Rate for Period	$\mu\text{Ci/sec}$	<u>2.83E-01</u>	<u>3.44E-01</u>
Percent of 10 CFR 50, Appendix I			
<u>Quarterly Limit</u>			
Organ <u>Thyroid</u>	%	<u>4.15E-01</u>	<u>5.01E-01</u>
<u>Annual Limit</u>			
Organ <u>Thyroid</u>	%	<u>1.11E+00*</u>	<u>1.36E+00*</u>

\*Cumulative total for the year-to-date using the methodology in the ODCM.

TABLE III-B  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1995  
GASEOUS EFFLUENTS - GROUND LEVEL AND MIXED MODE RELEASES

		<u>CONTINUOUS MODE</u>		<u>BATCH MODE</u>	
<u>UNITS</u>		<u>3RD QUARTER</u>	<u>4TH QUARTER</u>	<u>3RD QUARTER</u>	<u>4TH QUARTER</u>
1.	<u>FISSION GASES</u>				
Ar-41	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>4.41E-02</u>	<u>4.82E-02</u>
Xe-133	Ci	<u>2.71E-01</u>	<u>9.15E-02</u>	<u>4.41E-03</u>	<u>6.55E-03</u>
Xe-135	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>2.70E-05</u>
Total for Period	Ci	<u>2.71E-01</u>	<u>9.15E-02</u>	<u>4.85E-02</u>	<u>5.48E-02</u>
2.	<u>IODINES<sup>1</sup></u>				
I-131	Ci	<u>1.24E-06</u>	<u>2.07E-07</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>
I-133	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>
I-135	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>
Total for Period	Ci	<u>1.24E-06</u>	<u>2.07E-07</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>
3.	<u>PARTICULATES<sup>1</sup></u>				
Be-7	Ci	<u>3.22E-07</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>
Total for Period	Ci	<u>3.22E-07</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>

<sup>1</sup>Mixed Mode Continuous Accountability includes Mixed Mode Batch Accountability (excludes H-3).

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

<u>NUCLIDE</u>	<u>LLD (<math>\mu\text{Ci/cc}</math>)</u>
H-3	1.00E-06
Be-7	2.05E-15
Ar-41	4.35E-09
Mn-54	1.00E-11
Co-58	1.00E-11
Fe-59	1.00E-11
Co-60	1.00E-11
Zn-65	1.00E-11
Kr-85	2.08E-06
Kr-85m	4.80E-09
Kr-87	1.00E-04
Kr-88	1.00E-04
Sr-89	1.00E-11
Sr-90	1.00E-11
Mo-99	1.00E-11
I-131	1.00E-12
I-133	1.00E-10
Xe-133	1.00E-04
Xe-133m	1.00E-04
Cs-134	1.00E-11
I-135	2.35E-10
Xe-135	1.00E-04
Xe-135m	1.65E-07
Cs-137	1.00E-11
Xe-138	1.00E-04
Ba-140	2.19E-14
La-140	6.36E-14
Ce-141	1.00E-11
Ce-144	1.00E-11
Gross Alpha	1.00E-11

#### IV. LIQUID EFFLUENTS

##### A. Batch Releases

1.	Number of Batch Releases	<u>3.60E+01</u>
2.	Total Time Period for Batch Releases	<u>7.12E+03</u> Min
3.	Maximum Time Period for a Batch Release	<u>5.05E+02</u> Min
4.	Average Time Period for Batch Releases	<u>1.98E+02</u> Min
5.	Minimum Time Period for a Batch Release	<u>1.50E+01</u> Min
6.	Average Stream Flow During Release Periods	<u>5.61E+05</u> GPM

##### B. Abnormal Releases

1.	Number of Releases	<u>0.00E+00</u>
2.	Total Activity Released	<u>0.00E+00</u> Ci

##### C. Data Tables

The following tables provide the details of liquid releases:

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

TABLE IV-A  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1995  
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	<u>UNITS</u>	<u>3RD QUARTER</u>	<u>4TH QUARTER</u>
<u>A. FISSION AND ACTIVATION PRODUCTS</u>			
1. Total Release	Ci	<u>7.15E-03</u>	<u>4.07E-03</u>
2. Estimated Total Error	%	<u>1.07E+01</u>	<u>1.07E+01</u>
3. Average Diluted Concentration	$\mu\text{Ci/ml}$	<u>2.55E-11</u>	<u>1.45E-11</u>
<u>B. TRITIUM</u>			
1. Total Release	Ci	<u>5.03E+01</u>	<u>1.01E+02</u>
2. Estimated Total Error	%	<u>9.20E+00</u>	<u>9.20E+00</u>
3. Average Diluted Concentration	$\mu\text{Ci/ml}$	<u>1.79E-07</u>	<u>3.59E-07</u>
<u>C. DISSOLVED AND ENTRAINED GASES</u>			
1. Total Release	Ci	<u>6.96E-04</u>	<u>2.55E-03</u>
2. Estimated Total Error	%	<u>9.60E+00</u>	<u>9.60E+00</u>
3. Average Diluted Concentration	$\mu\text{Ci/ml}$	<u>2.48E-12</u>	<u>9.05E-12</u>
4. Percent of Applicable Limit	%	<u>1.24E-06</u>	<u>4.53E-06</u>
<u>D. GROSS ALPHA RADIOACTIVITY</u>			
1. Total Release	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>
2. Estimated Total Error	%	<u>1.83E+01</u>	<u>1.83E+01</u>
<u>E. VOLUME OF WASTE RELEASED</u>			
	Liters	<u>1.24E+06</u>	<u>4.38E+06</u>
<u>F. VOLUME OF DILUTION WATER</u>			
	Liters	<u>2.81E+11</u>	<u>2.82E+11</u>
<u>G. PERCENT OF 10 CFR 50, APPENDIX I</u>			
<u>Quarterly Limit</u>			
Organ <u>GI-LLI</u>	%	<u>1.16E-02</u>	<u>NA</u>
Organ <u>Liver</u>	%	<u>NA</u>	<u>2.55E-02</u>
Total Body	%	<u>1.87E-02</u>	<u>7.05E-02</u>
<u>Annual Limit</u>			
Organ <u>GI-LLI</u>	%	<u>5.98E-02</u> *	<u>NA</u> *
Organ <u>Liver</u>	%	<u>NA</u>	<u>6.83E-02</u>
Total Body	%	<u>1.70E-01</u> *	<u>2.05E-01</u> *

\*Cumulative total for the year-to-date using the methodology in the ODCM.

TABLE IV-B  
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1995  
LIQUID EFFLUENTS - CONTINUOUS MODE AND BATCH MODE RELEASES

		<u>CONTINUOUS MODE</u>		<u>BATCH MODE</u>	
<u>PARTICULATES</u>	<u>UNITS</u>	<u>3RD QUARTER</u>	<u>4TH QUARTER</u>	<u>3RD QUARTER</u>	<u>4TH QUARTER</u>
Cr-51	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>9.81E-05</u>	<u>2.13E-05</u>
Mn-54	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>4.84E-06</u>	<u>3.17E-06</u>
Fe-55	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>3.92E-03</u>	<u>2.17E-03</u>
Co-57	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>2.20E-06</u>	<u>&lt;LLD</u>
Co-58	Ci	<u>1.31E-08</u>	<u>&lt;LLD</u>	<u>9.88E-04</u>	<u>4.60E-04</u>
Co-60	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>9.41E-04</u>	<u>7.17E-04</u>
Nb-95	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>9.05E-06</u>	<u>&lt;LLD</u>
Ru-103	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>2.25E-06</u>
Ag-110m	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>1.00E-04</u>	<u>5.36E-05</u>
Sn-113	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>2.15E-06</u>	<u>&lt;LLD</u>
Sb-124	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>6.31E-05</u>	<u>&lt;LLD</u>
Sb-125	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>9.98E-04</u>	<u>5.97E-04</u>
I-133	Ci	<u>8.67E-08</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>
Cs-134	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>6.29E-07</u>	<u>8.61E-06</u>
Cs-137	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>2.16E-05</u>	<u>4.02E-05</u>
Total for Period	Ci	<u>9.98E-08</u>	<u>&lt;LLD</u>	<u>7.15E-03</u>	<u>4.07E-03</u>
2. <u>GASES</u>					
Xe-133	Ci	<u>2.36E-06</u>	<u>&lt;LLD</u>	<u>6.91E-04</u>	<u>2.53E-03</u>
Xe-133m	Ci	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>&lt;LLD</u>	<u>2.02E-05</u>
Xe-135	Ci	<u>1.13E-07</u>	<u>&lt;LLD</u>	<u>2.61E-06</u>	<u>2.02E-06</u>
Total for Period	Ci	<u>2.48E-06</u>	<u>&lt;LLD</u>	<u>6.94E-04</u>	<u>2.55E-03</u>

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

<u>NUCLIDE</u>	<u>LLD (<math>\mu</math>Ci/ml)</u>
H-3	1.00E-05
Cr-51	7.84E-08
Mn-54	5.00E-07
Fe-55	1.00E-06
Co-57	5.26E-09
Co-58	5.00E-07
Fe-59	5.00E-07
Co-60	5.00E-07
Zn-65	5.00E-07
Sr-89	5.00E-08
Sr-90	5.00E-08
Nb-95	1.70E-08
Zr-95	3.05E-08
Mo-99	5.00E-07
Tc-99m	1.28E-08
Ru-103	1.29E-08
Ag-110m	1.56E-08
Sn-113	1.42E-08
Sb-124	7.02E-08
Sb-125	3.39E-08
I-131	1.00E-06
I-133	1.78E-08
Xe-133	1.00E-05
Xe-133m	1.00E-05
Cs-134	5.00E-07
Xe-135	1.00E-05
Cs-137	5.00E-07
Ba-140	5.23E-08
La-140	3.87E-08
Ce-141	5.00E-07
Ce-144	5.00E-07
Gross Alpha	1.00E-07

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS  
REPORT TIME PERIOD JULY 1, 1995, THROUGH DECEMBER 31, 1995

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

WASTE CLASS A

Type of Waste	Unit	6-Month Period	Est. Total Error (%)	Solid. Agent	Cont. Type	Form	No. Ship.
a. Spent resins, filter sludges, evaporator bottoms, etc	m <sup>3</sup> Ci	NA	NA	NA	NA	NA	NA
b. Dry compressible waste, contaminated equip, etc	m <sup>3</sup> Ci	1.17E+01 9.90E-01	2.20E+01 2.20E+01	NA	STP	Compacted / Uncompacted / Incinerable	27
c. Irradiated components, control rods, etc	m <sup>3</sup> Ci	NA	NA	NA	NA	NA	NA
d. Other (describe)	m <sup>3</sup> Ci	NA	NA	NA	NA	NA	NA

STP = Strong Tight Package

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

	%	Ci
a. NA	NA	NA
b. Mn-54	1.31E+00	1.30E-02
Fe-55	6.27E+00	6.21E-02
Co-58	1.02E+01	1.01E-01
Co-60	3.83E+01	3.79E-01
Ni-63	6.97E+00	6.90E-02
Nb-95	1.55E+00	1.53E-02
Ag-110m	1.35E+00	1.34E-02
Cs-134	4.17E+00	4.13E-02
Cs-137	2.96E+01	2.93E-01
* Others	2.93E-01	2.90E-03
c. NA	NA	NA
d. NA,	NA	NA

\* Others include: C-14, Co-57, Zr-95, Ce-144, Am-241.

3. Solid Waste Disposition

Number of Shipments 27  
 Mode of Transportation Sole Use Vehicle  
 Destination Barnwell, S.C.

Total Curie Quantity and Principle Radionuclides were determined by Estimate.

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS (continued)

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

WASTE CLASS C

Type of Waste	Unit	6-Month Period	Est. Total Error (%)	Solid. Agent	Cont. Type	Form	No. Ship.
a. Spent resins, filter sludges, evaporator bottoms, etc	m <sup>3</sup> Ci	5.90E+00 4.57E+01	2.20E+01 2.20E+01	NA	HIC	DEWATERED FILTERS	2
b. Dry compressible waste, contaminated equip, etc	m <sup>3</sup> Ci	NA	NA	NA	NA	NA	NA
c. Irradiated components, control rods, etc	m <sup>3</sup> Ci	NA	NA	NA	NA	NA	NA
d. Other (describe)	m <sup>3</sup> Ci	NA	NA	NA	NA	NA	NA

HIC = High Integrity Container

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

	%	Ci
a. C-14	1.90E+00	8.67E-01
Fe-55	4.70E+01	2.15E+01
Co-58	2.69E+00	1.23E+00
Co-60	3.78E+01	1.73E+01
Ni-63	6.17E+00	2.82E+00
Ce-144	3.83E+00	1.75E+00
* Others	5.97E-01	2.73E-01
b. NA	NA	NA
c. NA	NA	NA
d. NA	NA	NA

\* Others include: H-3, Ni-59, Sr-90, Cs-137, Np-237,  
Pu-238, Pu-239, Pu-240, Am-241, Pu-241, Cm-242, Cm-243, Cm-244.

3. Solid Waste Disposition

Number of Shipments 2  
Mode of Transportation Sole Use Vehicle  
Destination Barnwell, S.C.

C. IRRADIATED FUEL SHIPMENTS

Number of Shipments NA  
Mode of Transportation NA  
Destination NA

Total Curie Quantity and Principle Radionuclides were determined by Estimate.

VI. ANNUAL GASEOUS DOSE ASSESSMENTS

A. Population Distribution

The population distribution was taken from the Updated Final Safety Analysis Report (UFSAR) Section 2.1.3 based on the 1980 U. S. Bureau of the Census data projected for the year 1986.

B. Food Production Distribution

Food yields of agricultural commodities were calculated with the aid of factors published by the USDA<sup>1</sup>. The input parameters for commodities were based on a demographic study performed in September 1987 by the Operations, Training, and Technical Services Department at the Shearon Harris Energy and Environmental Center.

C. Food Production Totals

The total quantity of vegetable products within a 50 mile radius of the HBRSEP, Unit No. 2 is 1.793E+08 kilograms per year.

The total quantity of meat and egg production within a 50 mile radius of the plant is 9.45E+07 kilograms per year.

The total quantity of milk production within a 50 mile radius of the plant is 3.56E+07 liters per year.

D. Source Terms and Meteorological Inputs

The annual source terms were segregated by modes of release (mixed mode batch, mixed mode continuous, ground level continuous, and ground level batch) for dose calculations.

The concurrent meteorology calculations were performed using the XOQDOQ program with open terrain/recirculation factors, derived from 1978 Dames and Moore study, to compliment the above modes of releases. The mixed mode batch release meteorology used the appropriate X/Q probability level to adjust for more adverse diffusion conditions since batch releases are not random.

The dissolved and entrained noble gas source terms of liquid effluents were included with the gaseous source term of ground level continuous airborne effluents for dose assessments.

E. Maximum Individual Doses

To demonstrate conformance with 10 CFR 50, Appendix I, doses were calculated for all sectors for the hypothetical maximum individual at the site boundary, the hypothetical maximum onsite member of the public and the true offsite maximum individual with nearest resident, garden and meat pathways. The doses from the cow/goat-milk-man pathways were excluded since there is no known milk production within a five mile radius of the HBRSEP site based on 1985 through 1995 land use census reports.

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<sup>1</sup>USDA:ERS, "Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products," Statistical Bulletin No. 362 (June 1963).

The Hypothetical Maximum Individual at the site boundary (i.e., SSE Sector) used for Technical Specifications compliance has the highest doses (Table VI-A). The true offsite maximum individual doses are summarized in Table VI-B. The onsite hypothetical maximum member of the public doses are summarized in Table VI-C.

F. Integrated Population Doses

Since there is no known milk production within the five mile radius of the HBRSEP, the milk productions, listed in Section C, Food Production Totals, were used beyond the five mile radius for the integrated population doses. The offsite annual integrated population doses are summarized in Table VI-D.

G. Onsite Integrated and Recreational Population Doses for 1995.

1. The assessment of the radiation doses from radioactive gaseous effluents to members of the public due to their activities inside the site boundary are listed in Table VI-E.

The following assumptions/site specific data were used to assess the onsite total integrated and recreational population doses from gaseous effluents during 1995.

ESTIMATED SITE USAGE DATA

<u>ACTIVITY</u>	<u>LOCATION</u>	<u>USAGE</u>
Spouses in Parking Lot	East Lot	6 people/day, 15 min./day, 240 days/yr
	West Lot	2 people/day, 15 min./day, 240 days/yr
Picnicking	Picnic Area	10 picnics/yr, 100 people/picnic, 4 hrs/picnic
Occupational	Darlington Co. Plant	17 employees, 240 days/yr, 8 hrs/day
	Visitor Ctr.	1 employee, 240 days/yr, 8 hrs/day
Visits	Visitor Ctr.	4000 visitors, 2 hr/visit
Swimming	Lake Robinson	1000 people/day, 180 days/yr, 2 hrs/day
Boating	Lake Robinson	100 boats/day, 4 people/boat, 365 days/yr
Shoreline	Lake Robinson	1000 people/day, 180 days/yr, 4 hrs/day
Fishing	Lake Robinson	14 people/day, 365 days/yr, 6 hrs/day

2. The following exposure pathways were used for the dose assessment based on the activities listed below:

<u>ACTIVITY</u>	<u>EXPOSURE PATHWAY</u>
Spouses in Parking	Ground Plane, Inhalation, Plume Lot
Picnicking	Ground Plane, Inhalation, Plume
Occupational	Ground Plane, Inhalation, Plume
Visits	Ground Plane, Inhalation, Plume
Swimming	Inhalation, Plume
Boating	Inhalation, Plume
Shoreline	Ground Plane, Inhalation, Plume
Fishing	Inhalation, Plume

3. The assumptions below were used for the dose assessment of the maximum onsite individual.

- The maximum onsite individual is an adult.
- The exposure pathways are the same as in 2 above.
- The site usage assumptions are as follows:

<u>ACTIVITY OR LOCATION</u>	<u>DISTANCE METERS</u>	<u>SECTOR</u>	<u>TOTAL HOURS</u>
Swimming	803	E	6.80E+01
	803	ENE	6.80E+01
	803	NE	6.80E+01
	2414	NNE	6.80E+01
	3219	N	6.80E+01
Boating	803	E	3.80E+01
	803	ENE	3.80E+01
	803	NE	3.80E+01
	2414	NNE	3.80E+01
	3219	N	3.80E+01
Fishing	803	E	8.00E+01
	803	ENE	8.00E+01
	803	NE	8.00E+01
	2414	NNE	8.00E+01
	3219	N	8.00E+01
Shoreline	1303	ENE	1.70E+02
	2529	NE	1.70E+02
Visitor Center	302	S	2.00E+00
Darlington Co. Plant	1062	NNW	1.92E+03
Picnic Area	402	SE	4.00E+01
West Parking Lot	402	SW	6.00E+01
East Parking Lot	201	SE	6.00E+01

4. The following data was used in assessing integrated onsite dose:

LAKE ROBINSON

<u>DISTANCE</u> <u>METERS</u>	<u>SECTOR</u>	<u>(TOTAL HRS)</u>	<u>(% LAKE SURFACE)</u>	=	<u>HOURS</u>	<u>PERSON-YRS</u>
3219	N	1.25E+06	0.71	=	8.875E+05	101
2414	NNE	1.25E+06	0.13	=	1.625E+05	19
803	NE	1.25E+06	0.08	=	1.000E+05	11
803	ENE	1.25E+06	0.06	=	7.500E+04	9
803	E	1.25E+06	0.02	=	2.500E+04	3
					<hr/>	
TOTAL				=	1.250E+06	143

OCCUPATIONAL

<u>DISTANCE</u> <u>METERS</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>TOTAL HOURS</u>	<u>PERSON-YRS</u>
1062	Darlington Co. Plant	NNW	3.26E+04	4
302	Visitor Center	S	1.92E+03	1

OTHER

<u>DISTANCE</u> <u>METERS</u>	<u>LOCATION</u>	<u>SECTOR</u>	<u>TOTAL HOURS</u>	<u>PERSON-YRS</u>
201	East Lot	SE	3.60E+02	0.1
402	West Lot	SW	1.20E+02	1.0
402	Picnic Area	SE	4.00E+03	0.9
302	Visitor Center	S	8.00E+03	1.0
2529	Easterling's/ Atkinson's Landing	NE	3.63E+05	42.0
1303	Johnson's Landing	ENE	3.63E+05	41.0

H. DATA TABLES

The following tables provide the details of the Annual Gaseous Dose Assessments:

Table VI-A	Hypothetical Site Boundary Maximum Individual Doses for 1995
Table VI-B	True Offsite Maximum Individual Doses for 1995
Table VI-C	Onsite Hypothetical Maximum Individual Doses for 1995
Table VI-D	Offsite Annual Integrated Population Dose Summary for 1995
Table VI-E	Onsite Annual Integrated and Recreational Population Doses for 1995

TABLE VI-A

GASEOUS PATHWAY  
HYPOTHETICAL SITE BOUNDARY MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

ANNUAL BETA AIR DOSE = 3.06E-03 MILLIRADS  
ANNUAL GAMMA AIR DOSE = 3.42E-03 MILLIRADS

SECTOR: SOUTH-SOUTHEAST  
DISTANCE: 418.0 METERS

<u>ADULT</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.25E-03	4.26E-03
GROUND PLANE	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	2.12E-04
INHALATION	1.05E-02	1.05E-02	3.98E-07	1.05E-02	1.05E-02	1.06E-02	1.06E-02	1.05E-02
VEGETATION	1.90E-02	1.91E-02	5.47E-06	1.90E-02	1.90E-02	1.97E-02	1.90E-02	1.90E-02
MEAT & POULTRY	2.74E-03	2.75E-03	4.77E-07	2.74E-03	2.73E-03	2.79E-03	2.73E-03	2.73E-03
TOTAL	3.47E-02	3.48E-02	2.41E-03	3.47E-02	3.47E-02	3.55E-02	3.47E-02	3.68E-02
<u>TEENAGER</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.25E-03	4.26E-03
GROUND PLANE	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	2.12E-04
INHALATION	1.06E-02	1.06E-02	5.58E-07	1.06E-02	1.06E-02	1.07E-02	1.06E-02	1.06E-02
VEGETATION	2.18E-02	2.18E-02	7.84E-06	2.18E-02	2.18E-02	2.23E-02	2.18E-02	2.18E-02
MEAT & POULTRY	1.63E-03	1.64E-03	3.96E-07	1.63E-03	1.63E-03	1.67E-03	1.63E-03	1.63E-03
TOTAL	3.64E-02	3.65E-02	2.42E-03	3.64E-02	3.64E-02	3.71E-02	3.65E-02	3.85E-02

TABLE VI-A  
(Continued)

GASEOUS PATHWAY  
HYPOTHETICAL SITE BOUNDARY MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

<u>CHILD</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.25E-03	4.26E-03
GROUND PLANE	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	2.12E-04
INHALATION	9.38E-03	9.38E-03	7.55E-07	9.38E-03	9.38E-03	9.52E-03	9.41E-03	9.38E-03
VEGETATION	3.37E-02	3.38E-02	1.79E-05	3.38E-02	3.37E-02	3.45E-02	3.37E-02	3.37E-02
MEAT & POULTRY	1.97E-03	1.97E-03	7.30E-07	1.97E-03	1.97E-03	2.03E-03	1.97E-03	1.97E-03
TOTAL	4.75E-02	4.75E-02	2.43E-03	4.75E-02	4.75E-02	4.85E-02	4.75E-02	4.95E-02
<u>INFANT</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.23E-03	2.25E-03	4.26E-03
GROUND PLANE	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	1.80E-04	2.12E-04
INHALATION	5.39E-03	5.39E-03	5.46E-07	5.39E-03	5.39E-03	5.53E-03	5.41E-03	5.39E-03
TOTAL	7.80E-03	7.80E-03	2.41E-03	7.80E-03	7.80E-03	7.93E-03	7.84E-03	9.86E-03

TABLE VI-B

GASEOUS PATHWAY  
TRUE OFFSITE MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

ANNUAL BETA AIR DOSE = 2.80E-03 MILLIRADS  
 ANNUAL GAMMA AIR DOSE = 3.25E-03 MILLIRADS

SECTOR: SOUTH-SOUTHWEST  
 DISTANCE: 482.8 METERS

<u>ADULT</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.14E-03	4.02E-03
GROUND PLANE	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	8.24E-05
INHALATION	9.50E-03	9.50E-03	1.89E-07	9.50E-03	9.50E-03	9.58E-03	9.51E-03	9.50E-03
VEGETATION	1.72E-02	1.72E-02	2.76E-06	1.72E-02	1.72E-02	1.77E-02	1.72E-02	1.72E-02
TOTAL	2.88E-02	2.89E-02	2.19E-03	2.88E-02	2.88E-02	2.95E-02	2.89E-02	3.08E-02
<u>TEENAGER</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.14E-03	4.02E-03
GROUND PLANE	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	8.24E-05
INHALATION	9.56E-03	9.56E-03	2.65E-07	9.56E-03	9.56E-03	9.65E-03	9.57E-03	9.56E-03
VEGETATION	1.96E-02	1.97E-02	3.59E-06	1.96E-02	1.96E-02	2.01E-02	1.96E-02	1.96E-02
TOTAL	3.14E-02	3.14E-02	2.19E-03	3.14E-02	3.14E-02	3.20E-02	3.14E-02	3.33E-02

TABLE VI-B  
(Continued)

GASEOUS PATHWAY  
TRUE OFFSITE MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

<u>CHILD</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.14E-03	4.02E-03
GROUND PLANE	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	8.24E-05
INHALATION	8.46E-03	8.46E-03	3.59E-07	8.46E-03	8.46E-03	8.56E-03	8.46E-03	8.46E-03
VEGETATION	3.04E-02	3.04E-02	7.88E-06	3.04E-02	3.04E-02	3.12E-02	3.04E-02	3.04E-02
TOTAL	4.11E-02	4.11E-02	2.20E-03	4.11E-02	4.11E-02	4.19E-02	4.11E-02	4.30E-02
<u>INFANT</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.14E-03	4.02E-03
GROUND PLANE	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	7.01E-05	8.24E-05
INHALATION	4.86E-03	4.86E-03	2.76E-07	4.86E-03	4.86E-03	4.96E-03	4.87E-03	4.86E-03
TOTAL	7.05E-03	7.05E-03	2.19E-03	7.05E-03	7.05E-03	7.14E-03	7.07E-03	8.96E-03

TABLE VI-C

GASEOUS PATHWAY  
ONSITE HYPOTHETICAL MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

ANNUAL BETA AIR DOSE = 1.50E-04 MILLIRADS  
ANNUAL GAMMA AIR DOSE = 1.69E-04 MILLIRADS

SECTOR: NORTH-NORTHWEST  
DISTANCE: 1062.0 METERS

<u>ADULT</u>	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	1.10E-04	1.10E-04	1.10E-04	1.10E-04	1.10E-04	1.10E-04	1.12E-04	2.11E-04
GROUND PLANE	4.64E-06	4.64E-06	4.64E-06	4.64E-06	4.64E-06	4.64E-06	4.64E-06	5.45E-06
INHALATION	5.12E-04	5.12E-04	1.01E-08	5.12E-04	5.12E-04	5.16E-04	5.12E-04	5.12E-04
TOTAL	6.27E-04	6.27E-04	1.15E-04	6.27E-04	6.27E-04	6.31E-04	6.28E-04	7.28E-04

TABLE VI-D

GASEOUS PATHWAY  
OFFSITE ANNUAL INTEGRATED POPULATION DOSE SUMMARY FOR 1995  
(PERSON-REM)

	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	3.99E-04	3.99E-04	3.99E-04	3.99E-04	3.99E-04	3.99E-04	4.13E-04	1.11E-03
GROUND PLANE	1.08E-05	1.08E-05	1.08E-05	1.08E-05	1.08E-05	1.08E-05	1.08E-05	1.27E-05
INHALATION	1.09E-02	1.09E-02	2.36E-07	1.09E-02	1.09E-02	1.10E-02	1.09E-02	1.09E-02
VEGETATION	8.23E-03	8.23E-03	6.25E-07	8.23E-03	8.23E-03	8.40E-03	8.23E-03	8.23E-03
COW MILK	8.11E-04	8.10E-04	1.40E-07	8.11E-04	8.11E-04	8.52E-04	8.10E-04	8.10E-04
MEAT & POULTRY	1.68E-03	1.68E-03	5.10E-08	1.68E-03	1.68E-03	1.69E-03	1.68E-03	1.68E-03
TOTAL	2.20E-02	2.20E-02	4.11E-04	2.20E-02	2.20E-02	2.23E-02	2.20E-02	2.27E-02

TABLE VI-E

GASEOUS PATHWAY  
ONSITE ANNUAL INTEGRATED AND RECREATIONAL POPULATION DOSES FOR 1995  
(PERSON-REM)

	<u>TOTAL BODY</u>	<u>GI-TRACT</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
PLUME	2.91E-05	2.91E-05	2.91E-05	2.91E-05	2.91E-05	2.91E-05	2.97E-05	6.77E-05
GROUND PLANE	8.13E-07	8.13E-07	8.13E-07	8.13E-07	8.13E-07	8.13E-07	8.13E-07	9.56E-07
INHALATION	3.61E-04	3.61E-04	9.06E-09	3.61E-04	3.61E-04	3.64E-04	3.61E-04	3.61E-04
TOTAL	3.91E-04	3.91E-04	2.99E-05	3.91E-04	3.91E-04	3.94E-04	3.91E-04	4.29E-04

VII. ANNUAL LIQUID DOSE ASSESSMENTS

A. Environmental Inputs and Assumptions

In this section, parameters which are used in making dose calculations to individuals and populations are described. Extensive use has been made of the parameters outlined in NRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance With 10 CFR Part 50, Appendix I," but these have been supplemented, particularly in the case of population doses, with the site specific information. In the calculation of population doses, considerable reliance has been placed on the selection of clearly conservative assumptions.

1. Mixing Ratios

For all calculations, the mixing ratios used to determine concentrations of isotopes at the point of exposure have been conservatively estimated. For calculation of doses to individuals, the mixing ratio of 0.835 was used to account for dilution by the discharge flow, initial dilution in the lake, and accumulation in the lake. For calculation of population doses, a mixing ratio of 0.817 was used. The method of estimating concentrations of radionuclides in Lake Robinson and downstream of the lake are given below.

Lake Robinson is supplied by surface runoff in several creeks and discharges as a continuance of Black Creek. Condenser cooling water is drawn from the lower end of the lake and is returned near the upper end. Liquid waste enters the lake via the condenser cooling water; since the cooling water flow exceeds the flow through the lake, complete mixing may be assumed.

Assuming zero initial concentration and complete mixing, the time dependent concentration of each radionuclide in the lake due to Plant releases will be

$$C_1 = \frac{Q(1 - e^{-\lambda t})}{V\lambda}$$

where:

- $C_1$  = Average concentration of each radionuclide in the lake (Ci/m<sup>3</sup>)
- $Q$  = Rate of addition of each radionuclide into cooling water (Ci/yr)
- $V$  = Volume of water in lake (m<sup>3</sup>)
- $\lambda$  = Effective loss rate constant of each radionuclide from the lake
- $t$  = Time in years

After equilibrium is reached, the average concentration of each radionuclide in the lake will be

$$C_1 = \frac{Q}{V\lambda}$$

Assuming removal of radioactivity from the lake by outflow, but not by radioactive decay, the effective loss rate constant is

$$\lambda = \frac{f_2}{V}$$

where:  $f_2$  = average volumetric flow from lake ( $\text{m}^3/\text{yr}$ )

After equilibrium is reached, the concentration of each radionuclide in Lake Robinson is represented by

$$C_1 = \frac{Q}{V\lambda} = \frac{Q}{f_2}$$

The concentration of each radionuclide in the discharge canal is determined by:

$$C_d = C_1 + C_a = C_1 + \frac{Q}{f_1} = \frac{Q}{f_2} + \frac{Q}{f_1}$$

where:  $C_d$  is the concentration in the discharge canal ( $\text{Ci}/\text{m}^3$ )  
 $C_1$  is the equilibrium concentration in the lake ( $\text{Ci}/\text{m}^3$ )  
 $C_a$  is the concentration added to the water while passing through the plant -  $Q/f_1$  ( $\text{Ci}/\text{m}^3$ )  
 $f_1$  is the cooling water flow rate ( $\text{m}^3/\text{yr}$ )

Assuming each gallon of water from discharge canal is diluted with 9 gallons of lake water, the concentration at the edge of the mixing zone  $C_m$  is

$$\begin{aligned} C_m &= (C_d + 9C_1) \div 10 \\ &= \left( \frac{Q}{f_1} + \frac{Q}{f_2} + \frac{9Q}{f_2} \right) \div 10 \\ &= \frac{Q}{f_2} + \frac{Q}{10f_1} \end{aligned}$$

The mixing ratio at the edge of the mixing zone  $M_m$  is the ratio:

$$\begin{aligned} M_m &= \frac{\text{concentration at edge of mixing zone}}{\text{concentration in discharge canal}} = \frac{C_m}{C_d} \\ &= \frac{\frac{Q}{f_2} + \frac{Q}{10f_1}}{\frac{Q}{f_2} + \frac{Q}{f_1}} \\ &= \frac{10f_1 + f_2}{10(f_1 + f_2)} \end{aligned}$$

For Lake Robinson  $f_1 = 9.59\text{E}8 \text{ m}^3/\text{yr}$   
 and  $f_2 = 2.15\text{E}8 \text{ m}^3/\text{yr}$   
 thus  $M_m = 0.835$

The mixing ratio for the lake in general  $M_l$  is the ratio

$$\frac{\text{Equilibrium lake concentration}}{\text{Concentration in discharge canal}} = \frac{C_1}{C_d}$$

$$= \frac{\frac{Q}{f_2}}{\frac{Q}{f_1} + \frac{Q}{f_2}} = \frac{f_1}{f_1 + f_2}$$

For Lake Robinson  $M_1 = 0.817$

The validity of ignoring radioactive decay was checked by determining which isotopes were the most significant dose contributors. They were  $\text{Co}^{60}$ ,  $\text{Cs}^{134}$ , and  $\text{Cs}^{137}$ . All of these isotopes have decay constants which are at least 12 times smaller than the loss rate constant of the lake

$$\frac{f_2}{V} = \frac{2.15\text{E}8\text{m}^3/\text{yr}}{5.06\text{E}7\text{m}^3} = 4.24 \text{ per year.}$$

Thus, ignoring normal decay should have little effect.

For Auburndale Plantation the equation for mixing ratio is  $e^{-0.02}$  (distance downstream [Km]). Equation was derived from EPA-520/5-76-005 study.

2. Potable Water Use

There is no potable water use of any water resource which is affected by the HBRSEP liquid discharge. Therefore, no pathways involving potable water are evaluated.

3. Irrigated Foods

Located ten miles east of HBRSEP site, the Auburndale Plantation uses water from Black Creek for irrigating during dry seasons. The following are conservative assumptions that were used for dose calculations:

a. Meat (beef)

1. No Drinking Water for Cattle from Creek
2. Transit Time =  $1.00\text{E}+01$  hours
3. Irrigation Rate =  $1.00\text{E}+02$  liter/ $\text{m}^2$ /month
4. Non-irrigated Feed Fraction =  $9.00\text{E}-01$
5. Total 50 Mile Production =  $1.96\text{E}+08$  kg/yr
6. Total Meat Irrigated =  $1.00\text{E}+06$  kg/yr
7. Food Process Time =  $4.80\text{E}+00$  hours

b. Produce

1. Irrigation rate =  $1.00\text{E}+02$  liters/ $\text{m}^2$ /month
2. Total 50 mile production =  $6.10\text{E}+06$  kg/yr
3. Total crop irrigation =  $4.00\text{E}+03$  kg/yr

c. Leafy Vegetables

1. Irrigation Rate =  $1.00\text{E}+02$  liter/ $\text{m}^2$ /month
2. Total 50 Mile Production =  $2.59\text{E}+08$  kg/yr
3. Total Crop Irrigated =  $2.00\text{E}+03$  kg/yr

4. Other Pathways

No other pathways which would be likely to produce 10% of the dose calculated by these pathways described above were identified for the liquid discharge for HBRSEP, Unit No. 2.

B. Recreational Activities

1. Seasonal Population Variations

Within the 10-mile area surrounding the plant, there are no major seasonal population variations. During the entire year, Lake Robinson is used for fishing, boating, picnicking, and other recreational activities. Based on a 1975 creek and recreational survey, the daily summer peak transient population is approximately 550-650 people. This figure would include people who are boating on Lake Robinson, as well as those using shore facilities. Also, during the winter months, Lake Prestwood, located on the north side of Hartsville, is utilized by local residents for recreation. Lake Prestwood is a comparatively small body of water, and it is estimated that 50-100 people would be using the area on a peak day. Based on this survey, the seasonal variation did not warrant any special dose assessments.

2. Water Recreation for Maximum Individual Doses

Because suitable statistics are unavailable, assumptions were made for purposes of assessing doses from each of the swimming, boating, and shoreline recreational pathways. These assumptions are summarized as follows:

Boating

Adult -  $120 \text{ days/yr} \times 2 \text{ hrs/day} = 240 \text{ hrs/yr}$   
Teen -  $180 \text{ days/yr} \times 2 \text{ hrs/day} = 360 \text{ hrs/yr}$   
Child -  $90 \text{ days/yr} \times 2 \text{ hrs/day} = 180 \text{ hrs/yr}$

Swimming

Adult -  $90 \text{ days/yr} \times 2 \text{ hrs/day} = 180 \text{ hrs/yr}$   
Teen -  $180 \text{ days/yr} \times 2 \text{ hrs/day} = 360 \text{ hrs/yr}$   
Child -  $90 \text{ days/yr} \times 3 \text{ hrs/day} = 270 \text{ hrs/yr}$

Fresh water fish and shoreline exposure: default to NRC Regulatory Guide 1.109 values.

3. Population Doses

The following assumptions/site specifics are listed:

Water Recreation Data

<u>Activity</u>	<u>Location</u>	<u>Usage</u>
Swimming	Lake Robinson	1000 people/day, 180 days/yr, 2 hr/day
	Lake Prestwood	100 people/day 180 days/yr, 2 hr/day
	Black Creek	10 people/mile, 50 miles, 180 days/yr, 2 hr/day
Boating	Lake Robinson	100 boats/day, 4 people/boat, 365 days/yr, 2 hr/day
	Lake Prestwood	10 boats/day, 4 people/boat, 365 days/yr, 2 hr/day
	Black Creek	1 boat/day, 2 people/boat, 180 days/yr, 5.6 hrs/day
Shoreline	Lake Robinson	1000 people/day, 180 days/yr, 4 hr/day
	Lake Prestwood	100 people/day, 180 days/yr, 4 hr/day
	Black Creek	10 people/mile, 50 miles, 365 days/yr, 4 hr/day

4. Aquatic Foods (Fish)

There are no shellfish or aquatic plants harvested in Lake Robinson or within 50 miles downstream of the site. Assuming approximately 8000 fish are taken from the lake each year and an edible yield of 1 kg per fish, this amounts to 8000 kg per year. An additional 800 kg per year are assumed to come from Lake Prestwood and another 8000 kg from the Black Creek downstream of Lake Robinson.

C. Maximum Individual Dose

To demonstrate conformance of 10 CFR 50, Appendix I, doses were calculated for all the age groups for the total body and all organs using the fish, shoreline, swimming, and boating pathways. The hypothetical maximum individual doses for the liquid pathway was calculated to show compliance with Technical Specification. These doses were onsite at the end of the discharge canal in the North Sector and are summarized in Table VII-A.

D. Onsite Integrated Population Doses

The assessment of the radiation doses from radioactive liquid effluents to members of the public due to their activities inside the site boundary are listed in Table VII-B.

E. Annual Integrated Population Doses

The assessment of the annual radiation doses from radioactive liquid effluents within the 50 mile radius of the HBRSEP site (inclusive of the onsite doses) are summarized in Table VII-C.

F. Data Tables

The following tables provide the details of the Annual Liquid Dose Assessment:

Table VII-A	Hypothetical Maximum Individual Doses for 1995
Table VII-B	Lake Robinson (onsite) Annual Integrated and Recreational Population Doses for 1995
Table VII-C	Annual Integrated Population Dose Summary for 1995

TABLE VII-A

LIQUID PATHWAY  
HYPOTHETICAL MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

ADULT DOSES

<u>PATHWAY</u>	<u>SKIN</u>	<u>BONE</u>	<u>LIVER</u>	<u>TOTAL BODY</u>	<u>THYROID</u>	<u>KIDNEY</u>	<u>LUNG</u>	<u>GI-LLI</u>
FISH	0.00E+00	8.14E-04	2.54E-03	2.23E-03	1.68E-03	2.52E-03	1.76E-03	3.30E-03
SHORELINE	1.26E-04	1.08E-04	1.08E-04	1.08E-04	1.08E-04	1.08E-04	1.08E-04	1.08E-04
SWIMMING	0.00E+00	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05
BOATING	0.00E+00	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05	1.16E-05
TOTAL	1.26E-04	9.51E-04	2.68E-03	2.37E-03	1.81E-03	2.66E-03	1.89E-03	3.43E-03

	USAGE (KG/YR, HR/YR)	DILUTION	TIME(HR)	SHORE WIDTH FACTOR = 0.3
FISH	21.0	1.2	24.0	
SHORELINE	12.0	1.2	0.0	
SWIMMING	180.0	1.2	0.0	
BOATING	240.0	1.2	0.0	

TEENAGER DOSES

<u>PATHWAY</u>	<u>SKIN</u>	<u>BONE</u>	<u>LIVER</u>	<u>TOTAL BODY</u>	<u>THYROID</u>	<u>KIDNEY</u>	<u>LUNG</u>	<u>GI-LLI</u>
FISH	0.00E+00	8.68E-04	2.21E-03	1.64E-03	1.30E-03	2.21E-03	1.41E-03	2.49E-03
SHORELINE	7.03E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04	6.02E-04
SWIMMING	0.00E+00	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05
BOATING	0.00E+00	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05
TOTAL	7.03E-04	1.52E-03	2.86E-03	2.29E-03	1.96E-03	2.86E-03	2.06E-03	3.15E-03

	USAGE (KG/YR, HR/YR)	DILUTION	TIME(HR)	SHORE WIDTH FACTOR = 0.3
FISH	16.0	1.2	24.0	
SHORELINE	67.0	1.2	0.0	
SWIMMING	360.0	1.2	0.0	
BOATING	360.0	1.2	0.0	

TABLE VII-A  
 (Continued)

LIQUID PATHWAY  
HYPOTHETICAL MAXIMUM INDIVIDUAL DOSES FOR 1995  
(MILLIREM)

CHILD DOSES

<u>PATHWAY</u>	<u>SKIN</u>	<u>BONE</u>	<u>LIVER</u>	<u>TOTAL BODY</u>	<u>THYROID</u>	<u>KIDNEY</u>	<u>LUNG</u>	<u>GI-LLI</u>
FISH	0.00E+00	1.10E-03	1.90E-03	1.27E-03	1.10E-03	1.89E-03	1.16E-03	1.51E-03
SHORELINE	1.47E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04
SWIMMING	0.00E+00	2.60E-05	2.60E-05	2.60E-05	2.60E-05	2.60E-05	2.60E-05	2.60E-05
BOATING	0.00E+00	8.68E-06	8.68E-06	8.68E-06	8.68E-06	8.68E-06	8.68E-06	8.68E-06
TOTAL	1.47E-04	1.26E-03	2.06E-03	1.43E-03	1.26E-03	2.05E-03	1.32E-03	1.67E-03

	<u>USAGE (KG/YR, HR/YR)</u>	<u>DILUTION</u>	<u>TIME (HR)</u>	<u>SHORE WIDTH FACTOR = 0.3</u>
FISH	6.9	1.2	24.0	
SHORELINE	14.0	1.2	0.0	
SWIMMING	270.0	1.2	0.0	
BOATING	180.0	1.2	0.0	

TABLE VII-B

LIQUID PATHWAY

LAKE ROBINSON (ONSITE) ANNUAL INTEGRATED AND RECREATIONAL POPULATION DOSES FOR 1995  
(PERSON-REM)

<u>PATHWAY</u>	<u>BONE</u>	<u>LIVER</u>	<u>TOTAL BODY</u>	<u>THYROID</u>	<u>KIDNEY</u>	<u>LUNG</u>	<u>GI-LLI</u>	<u>SKIN</u>
FISH	3.69E-04	1.06E-03	8.83E-04	6.76E-04	9.88E-04	7.16E-04	1.19E-03	0.00E+00
SHORELINE	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	6.47E-03	7.56E-03
SWIMMING	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	0.00E+00
BOATING	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05	0.00E+00
TOTAL	6.89E-03	7.58E-03	7.40E-03	7.19E-03	7.51E-03	7.23E-03	7.71E-03	7.56E-03

TABLE VII-C

LIQUID PATHWAY  
ANNUAL INTEGRATED POPULATION DOSE SUMMARY FOR 1995  
(PERSON-REM)

<u>PATHWAY</u>	<u>BONE</u>	<u>LIVER</u>	<u>TOTAL BODY</u>	<u>THYROID</u>	<u>KIDNEY</u>	<u>LUNG</u>	<u>GI-LLI</u>	<u>SKIN</u>
FISH	7.66E-04	2.19E-03	1.83E-03	1.40E-03	2.05E-03	1.49E-03	2.47E-03	0.00E+00
SHORELINE	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.33E-02
SWIMMING	5.51E-05	5.51E-05	5.51E-05	5.51E-05	5.51E-05	5.51E-05	5.51E-05	0.00E+00
BOATING	1.56E-05	1.56E-05	1.56E-05	1.56E-05	1.56E-05	1.56E-05	1.56E-05	0.00E+00
IRRI. VEG.	3.98E-06	3.83E-04	3.83E-04	3.80E-04	3.81E-04	3.82E-04	4.06E-04	0.00E+00
IRRI. LEAFY VEG.	8.56E-07	8.15E-05	8.15E-05	8.09E-05	8.14E-05	8.12E-05	8.87E-05	0.00E+00
IRRI. MEAT	5.41E-06	7.35E-05	7.19E-05	7.02E-05	7.38E-05	7.15E-05	9.40E-05	0.00E+00
TOTAL	1.22E-02	1.42E-02	1.38E-02	1.34E-02	1.40E-02	1.35E-02	1.45E-02	1.33E-02

VIII. 40 CFR 190 DOSE CONFORMANCE

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

IX. METEOROLOGICAL DATA

A. Continuous Release Diffusion Analysis

Table IX-A presents the number and frequency of wind direction occurrences by wind speed class as recorded at the onsite meteorological system during the period January 1, 1995, through December 31, 1995.

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

Pertinent information available from the tables is as follows:

1. Stability

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

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
7.8	4.6	5.8	35.3	26.2	10.4	9.9

2. Wind Speed

10 Meter

Average Speed (mph)	4.8
Percent Calm	1.1
Percent Less than 3.5 mph	36.9

3. Wind Direction

10 Meter

Prevailing	NNE
Percent Occurrence	9.4

TABLE IX-A JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD - CONTINUOUS RELEASES

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS A								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.012	0.000	0.000	0.046	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.081
3.35	0.208	0.150	0.219	0.531	0.462	0.473	0.669	0.404	0.288	0.312	0.231	0.185	0.208	0.092	0.069	0.058	4.558
5.59	0.219	0.104	0.231	0.023	0.000	0.000	0.035	0.127	0.346	0.277	0.427	0.346	0.185	0.196	0.335	0.196	3.046
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.012	0.000	0.000	0.012	0.058	0.092
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.43	0.25	0.46	0.55	0.46	0.52	0.73	0.53	0.63	0.60	0.66	0.54	0.39	0.29	0.42	0.31	7.78

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS B								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.012	0.000	0.012	0.000	0.035	0.046	0.035	0.012	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.162
3.35	0.185	0.254	0.242	0.323	0.231	0.208	0.277	0.265	0.138	0.208	0.254	0.196	0.150	0.208	0.104	0.046	3.288
5.59	0.092	0.092	0.104	0.012	0.000	0.000	0.000	0.058	0.081	0.069	0.092	0.081	0.035	0.138	0.138	0.138	1.131
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.023
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.28	0.36	0.35	0.35	0.23	0.24	0.32	0.36	0.24	0.28	0.36	0.28	0.18	0.35	0.24	0.20	4.60

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS C								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.023	0.023	0.104	0.023	0.058	0.012	0.023	0.000	0.000	0.023	0.000	0.000	0.000	0.000	0.288
3.35	0.531	0.392	0.392	0.450	0.323	0.185	0.254	0.208	0.173	0.381	0.358	0.196	0.092	0.208	0.173	0.150	4.465
5.59	0.069	0.185	0.104	0.046	0.012	0.000	0.000	0.035	0.069	0.138	0.104	0.069	0.035	0.023	0.069	0.081	1.038
8.27	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.035
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.60	0.59	0.52	0.52	0.44	0.21	0.31	0.25	0.27	0.52	0.46	0.29	0.13	0.25	0.24	0.23	5.83

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS D								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.277	0.358	0.635	0.473	0.565	0.485	0.508	0.415	0.312	0.288	0.231	0.346	0.358	0.231	0.312	0.173	5.965
3.35	1.846	4.027	2.942	1.800	1.511	0.692	1.015	1.685	1.465	1.362	1.131	0.854	0.692	0.704	0.842	0.658	23.226
5.59	0.692	1.500	0.288	0.138	0.035	0.012	0.081	0.473	0.785	0.427	0.219	0.185	0.219	0.058	0.231	0.623	5.965
8.27	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.012	0.046	0.012	0.000	0.000	0.000	0.046	0.023	0.035	0.185
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	2.82	5.90	3.87	2.41	2.11	1.19	1.60	2.58	2.61	2.09	1.58	1.38	1.27	1.04	1.41	1.49	35.34

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION

ATMOSPHERIC STABILITY CLASS E

UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.003	0.007	0.005	0.005	0.002	0.001	0.002	0.006	0.012	0.014	0.009	0.006	0.005	0.006	0.005	0.005	0.091
1.56	0.542	0.912	0.681	0.646	0.381	0.208	0.288	0.762	1.569	1.904	1.177	0.831	0.554	0.738	0.646	0.635	12.473
3.35	0.935	1.073	0.438	0.242	0.265	0.127	0.208	0.646	1.800	1.685	0.912	0.704	0.358	0.323	0.923	1.442	12.080
5.59	0.069	0.058	0.012	0.012	0.069	0.000	0.058	0.092	0.196	0.081	0.092	0.162	0.035	0.012	0.069	0.438	1.454
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.069	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.081
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	1.55	2.05	1.14	0.90	0.72	0.34	0.56	1.51	3.65	3.68	2.19	1.71	0.95	1.08	1.64	2.52	26.18

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION

ATMOSPHERIC STABILITY CLASS F

UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.007	0.003	0.001	0.001	0.000	0.000	0.001	0.008	0.016	0.022	0.021	0.013	0.014	0.018	0.023	0.024	0.173
1.56	0.335	0.138	0.058	0.046	0.023	0.000	0.069	0.392	0.727	1.015	0.981	0.565	0.658	0.865	1.050	1.119	8.042
3.35	0.012	0.000	0.000	0.012	0.000	0.000	0.023	0.058	0.196	0.162	0.208	0.150	0.023	0.196	0.577	0.519	2.135
5.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.35	0.14	0.06	0.06	0.02	0.00	0.09	0.46	0.95	1.20	1.21	0.73	0.69	1.08	1.65	1.66	10.36

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION

ATMOSPHERIC STABILITY CLASS G

UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.029	0.007	0.001	0.005	0.001	0.005	0.003	0.013	0.047	0.068	0.075	0.055	0.085	0.148	0.158	0.107	0.808
1.56	0.312	0.081	0.012	0.046	0.012	0.046	0.035	0.138	0.519	0.738	0.819	0.600	0.935	1.615	1.731	1.177	8.815
3.35	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.023	0.012	0.023	0.000	0.035	0.035	0.138	0.288
5.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.35	0.09	0.01	0.05	0.01	0.05	0.04	0.15	0.58	0.83	0.91	0.68	1.02	1.80	1.92	1.42	9.91

TOTAL HOURS CONSIDERED ARE 8667.

WIND MEASURED AT 11.0 METERS.

OVERALL WIND DIRECTION FREQUENCY

WIND DIRECTION:	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
FREQUENCY:	6.4	9.4	6.4	4.8	4.0	2.5	3.7	5.8	8.9	9.2	7.4	5.6	4.6	5.9	7.5	7.8	100.0

IX. METEOROLOGICAL DATA

B. Mixed Mode Batch Release Diffusion Analysis

Table IX-B presents the number and frequency of wind direction occurrences by wind speed class as recorded at the onsite meteorological system during mixed mode batch releases for the period January 1, 1995, through December 31, 1995.

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

TABLE IX-B JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD - MIXED MODE BATCH RELEASES

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS A								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.35	0.183	0.183	0.457	0.091	0.366	0.183	0.091	0.548	0.640	0.091	0.091	0.000	0.457	0.091	0.000	0.091	3.565
5.59	0.457	0.274	0.548	0.000	0.000	0.000	0.000	0.091	0.091	0.183	0.366	0.274	0.457	0.000	0.000	0.000	2.742
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.000	0.091
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.64	0.46	1.01	0.09	0.37	0.18	0.09	0.64	0.73	0.27	0.46	0.27	0.91	0.09	0.09	0.09	6.40

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS B								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.000	0.000	0.000	0.000	0.183	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.183
3.35	0.183	0.091	0.366	0.183	0.091	0.091	0.091	0.640	0.366	0.366	0.091	0.091	0.183	0.000	0.000	0.000	2.834
5.59	0.091	0.366	0.366	0.000	0.000	0.000	0.000	0.091	0.000	0.091	0.000	0.091	0.091	0.183	0.548	0.091	2.011
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.27	0.46	0.73	0.18	0.09	0.09	0.27	0.73	0.37	0.46	0.09	0.18	0.27	0.18	0.55	0.09	5.03

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS C								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.183
3.35	0.274	0.366	0.091	0.000	0.091	0.091	0.091	0.274	0.183	0.548	0.457	0.274	0.091	0.183	0.183	0.366	3.565
5.59	0.000	0.274	0.183	0.000	0.091	0.000	0.000	0.000	0.000	0.000	0.091	0.183	0.000	0.091	0.091	0.091	1.097
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.27	0.64	0.27	0.00	0.18	0.09	0.18	0.37	0.18	0.55	0.55	0.46	0.09	0.27	0.27	0.46	4.85

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS D								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.274	0.183	0.731	0.366	0.183	0.183	0.823	0.548	0.731	0.183	0.183	0.457	0.548	0.183	0.366	0.000	5.942
3.35	2.194	3.474	3.839	1.463	1.006	0.457	0.823	1.280	1.920	1.645	0.823	0.823	0.823	0.823	0.823	0.457	22.671
5.59	0.823	2.011	0.091	0.183	0.000	0.091	0.091	0.274	1.006	0.548	0.640	0.183	0.274	0.000	0.366	0.914	7.496
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.091	0.000	0.000	0.000	0.000	0.091	0.000	0.274
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	3.29	5.67	4.66	2.01	1.19	0.73	1.74	2.10	3.75	2.47	1.65	1.46	1.65	1.01	1.65	1.37	36.38

## JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION

## ATMOSPHERIC STABILITY CLASS E

UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.009	0.018	0.009	0.000	0.000	0.000	0.000	0.018	0.027	0.037	0.018	0.009	0.009	0.009	0.009	0.009	0.183
1.56	0.457	1.280	0.366	0.091	0.183	0.000	0.274	1.097	1.920	2.651	1.645	1.006	0.366	0.914	0.823	0.366	13.438
3.35	1.097	1.188	0.548	0.091	0.457	0.274	0.183	0.366	1.737	1.188	0.548	0.548	0.457	0.183	1.006	1.371	11.244
5.59	0.000	0.000	0.000	0.000	0.366	0.000	0.000	0.183	0.823	0.274	0.091	0.274	0.091	0.091	0.091	0.183	2.468
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.366	0.000	0.000	0.091	0.000	0.000	0.000	0.000	0.457
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	1.56	2.49	0.92	0.18	1.01	0.27	0.46	1.66	4.87	4.15	2.30	1.93	0.92	1.20	1.93	1.93	27.79

## JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION

## ATMOSPHERIC STABILITY CLASS F

UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.027	0.018	0.009	0.018	0.018	0.027	0.027	0.165
1.56	0.548	0.183	0.000	0.183	0.091	0.000	0.000	0.183	0.457	1.188	0.823	0.457	0.731	0.823	1.097	1.006	7.770
3.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.274	0.000	0.091	0.091	0.000	0.274	0.823	0.914	2.560
5.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.56	0.18	0.00	0.18	0.09	0.00	0.00	0.27	0.74	1.22	0.93	0.56	0.75	1.12	1.95	1.95	10.49

## JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION

## ATMOSPHERIC STABILITY CLASS G

UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.018	0.009	0.009	0.000	0.000	0.000	0.000	0.009	0.027	0.064	0.046	0.018	0.064	0.073	0.046	0.082	0.466
1.56	0.366	0.091	0.091	0.000	0.000	0.000	0.000	0.183	0.457	1.188	0.823	0.274	1.097	1.371	0.914	1.463	8.319
3.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.091	0.000	0.000	0.000	0.000	0.091	0.091	0.274
5.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.38	0.10	0.10	0.00	0.00	0.00	0.00	0.19	0.48	1.34	0.87	0.29	1.16	1.44	1.05	1.64	9.06

TOTAL HOURS CONSIDERED ARE 1094.

WIND MEASURED AT 11.0 METERS.

## OVERALL WIND DIRECTION FREQUENCY

WIND DIRECTION:	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
FREQUENCY:	7.0	10.0	7.7	2.7	2.9	1.4	2.7	6.0	11.1	10.5	6.8	5.2	5.8	5.3	7.5	7.5	100.0

IX. METEOROLOGICAL DATA

C. Ground Level Batch Release Diffusion Analysis

Table IX-C presents the number and frequency of wind direction occurrences by wind speed class as recorded at the onsite meteorological system during ground level batch releases for the period January 1, 1995, through December 31, 1995.

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

TABLE IX-C JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD - GROUND LEVEL BATCH RELEASES

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS A								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.35	0.677	0.677	0.541	1.218	0.812	0.677	3.654	0.541	1.218	0.947	1.488	0.812	0.271	0.135	0.135	0.135	13.938
5.59	0.812	0.271	0.406	0.135	0.000	0.000	0.135	0.000	1.083	1.218	0.271	0.135	0.271	0.541	0.541	0.271	6.089
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.135
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	1.49	0.95	0.95	1.35	0.81	0.68	3.79	0.54	2.30	2.30	1.76	0.95	0.54	0.68	0.68	0.41	20.16

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS B								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.35	0.677	0.271	0.406	0.271	0.135	0.406	0.541	0.406	0.541	0.135	0.406	0.541	0.541	0.406	0.135	0.000	5.819
5.59	0.000	0.271	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.406	0.000	0.135	0.135	0.000	0.000	0.406	1.353
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.68	0.54	0.41	0.27	0.14	0.41	0.54	0.41	0.54	0.54	0.41	0.68	0.68	0.41	0.14	0.41	7.17

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS C								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.000	0.135	0.000	0.135	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.406
3.35	0.271	0.135	0.135	0.677	0.406	0.271	0.135	0.271	0.271	0.406	0.406	0.406	0.000	0.271	0.135	0.000	4.195
5.59	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.135	0.135	0.271	0.000	0.000	0.135	0.000	0.135	0.000	0.947
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.27	0.27	0.27	0.68	0.54	0.27	0.14	0.41	0.54	0.68	0.41	0.41	0.14	0.27	0.27	0.00	5.55

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS D								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.135	0.677	0.135	0.271	0.271	0.271	0.541	0.135	0.406	0.000	0.541	0.135	0.000	0.271	0.000	3.789
3.35	0.812	0.947	1.624	0.947	2.165	0.406	1.488	2.706	2.977	1.894	0.677	0.406	0.677	0.677	0.271	0.271	18.944
5.59	1.488	0.406	0.000	0.000	0.000	0.000	0.000	0.406	0.541	0.947	0.000	0.406	0.000	0.000	0.406	1.218	5.819
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	2.30	1.49	2.30	1.08	2.44	0.68	1.76	3.65	3.65	3.25	0.68	1.35	0.81	0.68	0.95	1.49	28.55

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS E								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.406	0.271	0.271	0.812	0.541	0.541	0.271	0.406	0.812	1.894	1.353	1.353	0.406	0.541	0.271	0.541	10.690
3.35	1.218	0.541	0.000	0.406	0.135	0.000	0.271	0.406	2.165	1.759	0.812	0.000	0.135	0.271	0.406	1.624	10.149
5.59	0.271	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.406	0.812
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	1.89	0.81	0.27	1.22	0.68	0.54	0.54	0.81	2.98	3.65	2.17	1.49	0.54	0.81	0.68	2.57	21.65

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS F								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.271	0.135	0.271	0.000	0.000	0.000	0.271	0.135	1.218	1.083	0.541	0.541	0.271	0.541	0.812	0.406	6.495
3.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.135	0.000	0.000	0.000	0.406	0.812	1.488
5.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.27	0.14	0.27	0.00	0.00	0.00	0.27	0.27	1.22	1.08	0.68	0.54	0.27	0.54	1.22	1.22	7.98

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION									ATMOSPHERIC STABILITY CLASS G								
UMAX (M/S)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
0.34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.56	0.000	0.135	0.000	0.135	0.000	0.271	0.000	0.000	0.135	0.271	0.677	0.135	0.271	2.030	2.706	1.894	8.660
3.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.271	0.271
5.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11.18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24.59	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	0.00	0.14	0.00	0.14	0.00	0.27	0.00	0.00	0.14	0.27	0.68	0.14	0.27	2.03	2.71	2.17	8.93

TOTAL HOURS CONSIDERED ARE 739.

WIND MEASURED AT 11.0 METERS.

OVERALL WIND DIRECTION FREQUENCY

WIND DIRECTION:	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
FREQUENCY:	6.9	4.3	4.5	4.7	4.6	2.8	7.0	6.1	11.4	11.8	6.8	5.5	3.2	5.4	6.6	8.3	100.0

CHANGES TO ODCM, PCP, AND  
RADIOACTIVE WASTE SYSTEMS

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I. CHANGES TO THE Offsite Dose Calculation Manual (ODCM)

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

II. CHANGES TO THE RADIOACTIVE WASTE SYSTEMS

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

III. CHANGES TO THE PROCESS CONTROL PROGRAM (PCP)

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

IV. CHANGES TO THE LAND USE CENSUS

There were no changes to the environmental sampling program as a result of the Land Use Census performed in the first six months of 1995.

V. INSTRUMENT INOPERABILITY

The Gas Analyzer, which monitors waste gas streams for potentially explosive mixtures of hydrogen and oxygen, was declared inoperable on November 30, 1993. The analyzer was removed from service when an Engineering Evaluation determined that it was no longer capable of performing "continuous monitoring" as required by plant Technical Specifications. The analyzer was upgraded by Plant Modification No. 1159 which replaced and upgraded broken components for which parts are no longer available. The Gas Analyzer was returned to service September 28, 1995.

VI. LIQUID HOLDUP TANK CURIE LIMIT

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

VII. WASTE GAS DECAY TANK CURIE LIMIT

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

VIII. INDEPENDENT SPENT FUEL STORAGE INSTALLATION

The onsite Independent Spent Fuel Storage Installation, License No. SNM-2502/Docket No. 72-3, became operational during the first six months of 1989. See Addendum I for reporting requirements concerning this facility.

SUPPLEMENTS TO PREVIOUS  
SEMIANNUAL REPORTS

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I. DISCUSSION

There were no changes to previous reports during this reporting period.

INDEPENDENT SPENT FUEL STORAGE INSTALLATION  
H. B. ROBINSON STEAM ELECTRIC PLANT UNIT No. 2  
SEMIANNUAL ENVIRONMENTAL REPORT  
July 1, 1995 - December 31, 1995

CAROLINA POWER & LIGHT COMPANY  
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT No. 2

FACILITY OPERATING LICENSE NO. SNM-2502  
DOCKET NO. 72-3

I. HISTORY OF THE FACILITY

The Independent Spent Fuel Storage Installation (ISFSI) is located within the Protected Area of HBRSEP, Unit No. 2. Currently, the installation contains eight (8) dry storage canisters. The initial canister was loaded on March 16, 1989 and other canisters were loaded on April 11, 1989, April 18, 1989, April 24, 1989, May 2, 1989, May 8, 1989, June 28, 1989, and July 3, 1989.

II. EFFLUENT LIMITS AND CONTROLS

This installation operates under effluent control limits as required by 10 CFR 72.44. However, there are, by design of the sealed storage canisters at the ISFSI, no effluent releases, and all HBRSEP, Unit No. 2 site cask loading and unloading operations and waste treatment will occur at the HBRSEP, Unit No. 2 under the Technical Specifications of its Operating License DPR-23.

III. RADIOLOGICAL EFFLUENT RELEASES

A review of the quarterly surveillance tests performed during this reporting period indicates that NO RADIOACTIVE LIQUID OR GASEOUS RELEASES OCCURRED DURING THIS REPORT PERIOD.

IV. THE ISFSI ENVIRONMENTAL PROGRAM

The ISFSI Environmental Program consists of two air samplers and three thermoluminescent dosimeters (TLD) about the installation plus an unaffected air sampler and TLD site 26 miles East-Southeast (ESE) of the facility. Two of the environmental TLDs are maintained at the air sampling sites adjacent to the plant boundary. These are located South at 0.2 miles and Southwest at 0.3 miles from the ISFSI. A third TLD site is located 0.1 miles North of the installation. The nearest residence is located south to the South-Southeast approximately 0.25 miles from the facility. Air samplers operate continuously and samples are changed weekly. TLDs are changed quarterly.

V. OTHER ENVIRONMENTAL PROGRAMS

In addition to the ISFSI Environmental Program, the HBRSEP, Unit No. 2 Environmental Program is described in Technical Specifications. Section 3.17 (see Carolina Power and Light Company, Technical Specifications and Bases for H. B. Robinson Steam Electric Plant, Unit No. 2, Appendix A to Facility Operating License No. DPR-23, Docket No. 50-261, Darlington County, S.C.). For a comprehensive summary of this program and its results, see also, "Environmental Surveillance Report," H. B. Robinson Steam Electric Plant, Unit No. 2 issued in compliance with the above referenced Technical Specification for this report period.

VI. ISFSI ENVIRONMENTAL MEASUREMENTS  
(Milliroentgen per 90 days)

A. Environmental TLDs

<u>TLD (Location)</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
1 (26 miles ESE) (Control)	13.7	12.6
2 (0.2 miles S)	15.0	14.1
6 (0.3 miles SW)	11.7	13.2
56 (0.1 miles N)	16.8	12.7

B. Air Sampling

Gross Beta Measurements - 3rd Qtr.  
(picocuries per cubic meter)

<u>Air Sampler (Location)</u>	<u>Average</u>	<u>Maximum</u>
1 (26 miles ESE) (Control)	2.16E-02	3.57E-02
2 (0.2 miles S)	1.75E-02	2.93E-02
6 (0.3 miles SW)	2.08E-02	3.57E-02

Gross Beta Measurements - 4th Qtr.  
(picocuries per cubic meter)

<u>Air Sampler (Location)</u>	<u>Average</u>	<u>Maximum</u>
1 (26 miles ESE) (Control)	2.22E-02	3.05E-02
2 (0.2 miles S)	2.12E-02	3.78E-02
6 (0.3 miles SW)	2.39E-02	3.98E-02

A composite analysis of air samples detected no radionuclides from man-made sources for either quarter.

VII. CONCLUSIONS

Based on the above measurements performed during this reporting period, it is concluded that the dose issuing from the ISFSI to the most exposed MEMBER OF THE PUBLIC did not exceed 1 mrem. This is best estimated as presented in the ISFSI Final Safety Analysis Report.

VIII. SUMMARY

This report is submitted in compliance with ISFSI Technical Specification Section 1.4.1 as required pursuant to 10 CFR 72.44(d)(3). Paragraph III specifies liquid and gaseous releases to the environment. Paragraphs VI and VII are provided for estimation of potential radiation dose commitment to the public resulting from effluent release.