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SUBJECT: "Effluent & Waste Disposal Semiannual Rept for 880701 - 1231, HB Robinson SEG Plant - Unit 2."

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SUBJECT: Effluent and Waste Disposal Semiannual Report

Gentlemen:

The enclosed Semiannual Radioactive Effluent Release Report for the period of July 1 through December 31, 1988, is submitted pursuant to 10CFR50.36a(a)(2). The Report specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents during the second six months of operation in 1988, to provide the NRC with information to estimate maximum potential annual radiation exposure to the public resulting from effluent releases at H. B. Robinson Unit 2.

Should you require additional or other information, please contact my staff.

Very truly yours,

R. E. Morgan
General Manager
H. B. Robinson S. E. Plant

JMG:bah

Enclosures

cc: Mr. M. L. Ernst
Mr. L. W. Garner (w/o Enclosures)

JE48
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EFFLUENT AND WASTE DISPOSAL

SEMIANNUAL REPORT

7/1/88 - 12/31/88

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON SEG PLANT - UNIT 2

FACILITY OPERATING LICENSE NO. DPR-23

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I. EXECUTIVE SUMMARY

Significant Variances

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

1. The 10CFR50 Appendix I, Percent of Limits, were calculated from the last posted release for the period indicated using the Nuclear Data LRW/GRW (ODCM methodology) release permit generating system. The following is a summary of the comparison of the annual dose commitment of the ODCM and LADTAP/GASPAR dose programs.

<u>GASEOUS</u>	<u>UNITS</u>	<u>LRW/GRW</u>	<u>LADTAP/GASPAR</u>
Annual Beta Air Dose	mrad	3.33E+00	1.03E+00
Annual Gamma Air Dose	mrad	1.21E+00	3.79E-01
I-131, 133, Tritium & Part. >8 Day Dose	mrem	3.27E-01	1.19E-01

LIQUID

Total Body Dose	mrem	7.86E-02	3.04E-02
Critical Organ Dose	mrem	1.09E-01	5.12E-02

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 (GRW 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 ODCM (LRW software) utilize dilution flow during actual release periods.

2. A minimum release time of 2 minutes was reported for gaseous releases. This release was a containment vessel purge to test purge valves.

3. Third Quarter fission and activation gases and their associated doses increased sharply due to 2 unit shutdowns in September, one of which required degassing of the reactor coolant. Also, routine weekly containment vessel purges were begun in July to control containment temperature for personnel entries. The values below reflect the third quarter variances:

<u>Gaseous Releases</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
Fission & Activation Gas (Curies)	1.29E+02	5.81E+02	2.27E+02
Fission & Activation Gas Aver. Rel. Rate (uCi/sec)	1.64E+01	7.31E+01	2.86E+01
Quarterly % Gamma Air Dose	2.63E+00	1.51E+01	4.50E+00
Quarterly % Beta Air Dose	4.19E+00	1.91E+01	7.18E+00

The above parameters increased by a factor of approximately 5 from the 2nd quarter of 1988 to the 3rd quarter of 1988 and decreased by a factor of about .3 from the 3rd quarter to the 4th quarter. The increases seen in the 4th quarter as compared to the 2nd quarter are explained by unit shutdowns in October and the shutdown for refueling in mid-November.

4. The annual percent of allowable thyroid dose is down from 25.3% in 1987 to 2.2% in 1988. This difference can be attributed to iodine releases made in the first quarter of 1987 which totalled 23.5% of the annual limit for the year.
5. The total gaseous release tritium curies decreased from 2.51 curies in the 3rd quarter 1988 to 0.18 curies in the 4th quarter 1988. This is due to decreased RCS boron in the 4th quarter and effluent tritium values becoming, for the most part, non-detectable after the unit shutdown for refueling in mid-November 1988.

6. The number of batch liquid releases for the second half of 1988 was 186 as compared to 71 for the first half of 1988. This constitutes a factor of 2.6 increase. This increase is explained by 4 forced shutdowns and the shutdown for refueling, all in the last half of 1988. The plant startups after the 4 forced shutdowns produced large amounts of reactor coolant to be processed for release. These unit shutdowns and subsequent startups can also be linked to other increased values for the 3rd and 4th quarters that are shown below.

<u>Liquid Releases</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
Fission & Activation Product (Curies)	9.06E-02	3.56E-01	4.32E-01
Dissolved & Entrained Gas (Curies)	1.36E+00	8.77E+00	2.08E+01
Waste Volume (Liters)	7.40E+05	2.52E+06	2.89E+06
Quarterly % Organ Dose	3.00E-01	1.80E-01	1.42E+00
Quarterly % Total Body Dose	7.35E-02	3.32E-01	3.39E+00

7. In the above listed values, the dissolved and entrained gas curies increased by a factor of 6.5 in the 3rd quarter as compared to the 2nd quarter. This is caused not only by the increased release volume but also by the increase in the reactor coolant fission gas inventory near the end of core life. Also, while both the waste volume and percent of total body dose limit increased by about a factor of 4 from the 2nd to 3rd quarter, the percent of organ dose limit actually decreased from the 2nd quarter values. This is due to a difference in the predominant isotopes present in liquid releases between the 2nd and 3rd Quarters. This change in the relative abundance of isotopes also caused a factor of 7.9 increase in the percent of quarterly organ dose limit and a factor of 10.2 increase in the percent of quarterly total body dose limit in the 4th quarter as compared to the 3rd quarter.

Not shown above are the corresponding increases in the annual percents of organ dose and total body dose limits from the 3rd quarter to the 4th quarter.

8. The 1987 and 1986 annual radiological dose assessments have been revised, updated, and included in Enclosure 3 of this report. Open terrain/recirculation correction factors were used in the XOQDOQ calculations to be consistent with the methodology in the Offsite Dose Calculation Manual. Revisions to the onsite recreational doses were not reported since they are insignificant in comparison to site boundary maximum individual and 50 mile integrated population doses.

B. Regulatory Compliance

1. Whether projected on a day-by-day basis utilizing conservative meteorological conditions or assessed using concurrent meteorological conditions, the dose commitment from gaseous and liquid effluents is a small fraction of the 10CFR50, 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. The results of the direct radiation assessment demonstrate no measurable affect above background for Plant operations during 1988, and since no 10CFR50 Appendix I limits have been exceeded, and there are no other nearby uranium fuel cycle sources to be considered, this demonstrates conformance with 40CFR190, Environmental Radiation Protection Standards for Nuclear Power Operation.
2. There were no changes to the waste solidification process control program (PCP) during the second six months of 1988.
3. There were no changes to the Radioactive Waste Systems (liquid, gaseous, or solid) during the second six months of 1988.
4. There was a reportable instrumentation inoperability event during 1988. See Enclosure II.
5. There were no outside liquid holdup tanks that exceeded the 10 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.

II. SUPPLEMENTAL INFORMATION

A. Regulatory Limits

1. Fission and Activation Gases:

10CFR20 Limits (Instantaneous Release Rate)

Total Body Dose ≤ 500 mrem/yr

Skin Dose ≤ 3000 mrem/yr

10CFR50, Appendix I

For Calendar Quarter

Gamma Dose ≤ 5 mrad

Beta Dose ≤ 10 mrad

For Calendar Year

Gamma Dose ≤ 10 mrad

Beta Dose ≤ 20 mrad

2. Iodine - 131 and 133, Tritium, and Particulates ≥ 8 day half-lives:

10CFR20 Limits (Instantaneous Release Rate)

Dose from Inhalation (only) to a child to any organ
 ≤ 1500 mrem/yr

10CFR50, Appendix I (Organ Doses)

For Calendar Quarter ≤ 7.5 mrem

For Calendar Year ≤ 15 mrem

3. Liquids:

Concentrations are specified in 10CFR20, 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 $2.00E-04$ $\mu\text{Ci/ml}$ total activity.

10CFR50, Appendix I

For Calendar Quarter

Total Body Dose ≤ 1.5 mrem

Any Organ Dose ≤ 5 mrem

For Calendar Year

Total Body Dose ≤ 3 mrem

Any Organ Dose ≤ 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 radiogas is determined by the fraction of that radiogas 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 batch releases are included in the iodine determination from the continuous Auxiliary Building release.
- c. Particulates - The particulates from batch releases are included in the particulate determination from the continuous Auxiliary Building release.
- 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 or Black Creek 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>1.43E+02</u>
2. Total Time Period for Batch Releases	<u>5.74E+04</u> Min
3. Maximum Time Period for a Batch Release	<u>3.20E+03</u> Min
4. Average Time Period for Batch Releases	<u>4.01E+02</u> Min
5. Minimum Time Period for a Batch Release	<u>2.00E+00</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	Lower Limits of Detection

TABLE III-A
 EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1988
 GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	UNITS	3RD QUARTER	4TH QUARTER
A. Fission and Activation Gases:			
1. Total Release	Ci	5.81E+02	2.27E+02
2. Estimated Total Error	%	6.00E+01	6.00E+01
3. Average Release Rate for Period	µCi/sec	7.31E+01	2.86E+01
4. Percent of 10CFR50, Appendix I			
<u>Quarterly Limit</u>			
Gamma Air	%	1.51E+01	4.50E+00
Beta Air	%	1.91E+01	7.18E+00
<u>Yearly Limit</u>			
Gamma Air	%	9.88E+00*	1.21E+01*
Beta Air	%	1.31E+01*	1.66E+01*
B. Iodines, Particulates, and Tritium:			
<u>Iodines</u>			
1. Total Iodine - 131	Ci	3.78E-04	3.44E-04
2. Estimated Total Error	%	4.00E+01	4.00E+01
3. Average Release Rate	µCi/sec	4.76E-05	4.33E-05
<u>Particulates</u>			
1. Particulates with Half-Lives >8 days	Ci	5.87E-06	4.94E-06
2. Estimated Total Error	%	4.00E+01	4.00E+01
3. Average Release Rate for Period	µCi/sec	7.38E-07	6.21E-07
4. Gross Alpha Radioactivity	Ci	<LLD	<LLD
<u>Tritium</u>			
1. Total Release	Ci	2.51E+00	1.83E-01
2. Estimated Total Error	%	3.00E+01	3.00E+01
3. Average Release Rate for Period	µCi/sec	3.16E-01	2.30E-02
4. Percent of 10CFR50, Appendix I			
<u>Quarterly Limit</u>			
Organ Thyroid	%	1.36E+00	1.20E+00
<u>Yearly Limit</u>			
Organ Thyroid	%	1.58E+00*	2.18E+00*

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

TABLE III-B
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1988
GASEOUS EFFLUENTS - GROUND LEVEL AND MIXED MODE RELEASES

UNITS	CONTINUOUS MODE		BATCH MODE		
	3RD QUARTER	4TH QUARTER	3RD QUARTER	4TH QUARTER	
1. FISSION GASES					
Ar-41	Ci	2.45E+00	<LLD	1.96E+00	8.75E-02
Kr-85m	Ci	3.30E+00	2.37E-01	7.04E-01	2.08E-01
Kr-85	Ci	6.65E+01	2.90E+01	3.98E-01	1.89E-01
Kr-87	Ci	<LLD	<LLD	8.90E-03	1.47E-01
Kr-88	Ci	<LLD	<LLD	1.15E-01	1.25E-01
Xe-131m	Ci	<LLD	<LLD	3.07E+00	6.38E-01
Xe-133m	Ci	<LLD	<LLD	4.66E+00	1.47E+00
Xe-133	Ci	2.39E+02	9.05E+01	2.15E+02	9.57E+01
Xe-135m	Ci	<LLD	<LLD	1.24E-02	6.53E-02
Xe-135	Ci	3.05E+01	2.96E+00	1.27E+01	5.59E+00
Total for Period	Ci	3.42E+02	1.23E+02	2.39E+02	1.04E+02
2. IODINES¹					
I-131	Ci	3.78E-04	3.43E-04	3.76E-07	1.19E-06
I-133	Ci	2.72E-04	2.07E-04	3.78E-08	<LLD
Total for Period	Ci	6.50E-04	5.50E-04	4.14E-07	1.19E-06
3. PARTICULATES¹					
Cr-51	Ci	<LLD	<LLD	<LLD	8.02E-07
Mn-54	Ci	<LLD	<LLD	<LLD	5.20E-08
Co-57	Ci	<LLD	<LLD	<LLD	5.13E-09
Co-58	Ci	<LLD	7.61E-07	2.41E-07	9.02E-07
Co-60	Ci	<LLD	1.45E-06	4.46E-06	8.04E-07
Nb-95	Ci	<LLD	<LLD	<LLD	4.63E-08
Zr-95	Ci	<LLD	<LLD	<LLD	2.63E-08
Cs-134	Ci	<LLD	<LLD	<LLD	1.87E-08
Cs-137	Ci	<LLD	<LLD	1.17E-06	7.06E-08
Total for Period	Ci	<LLD	2.21E-06	5.87E-06	2.73E-06

¹Continuous Accountability includes Batch Accountability (excludes H-3) for all releases made via the Plant Vent Stack.

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

GRAB SAMPLE ANALYSIS

<u>Nuclide</u>	<u>LLD ($\mu\text{Ci/cc}$)</u>
Ar-41	7.63E-08
Cr-51	3.52E-14
Mn-54	1.00E-11
Co-57	1.75E-15
Co-58	1.00E-11
Fe-59	1.00E-11
Co-60	1.00E-11
Zn-65	1.00E-11
Kr-87	1.00E-04
Kr-88	1.00E-04
Sr-89	1.00E-11
Sr-90	1.00E-11
Nb-95	9.16E-15
Zr-95	1.65E-14
Mo-99	1.00E-11
Xe-131m	2.80E-07
Xe-133m	1.00E-04
I-133	1.00E-10
Cs-134	1.00E-11
Xe-135m	3.55E-06
I-135	7.77E-14
Cs-137	1.00E-11
Xe-138	1.00E-04
Ba/La-140	2.61E-14
Ce-141	1.00E-11
Ce-144	1.00E-11
ALPHA	1.00E-11

IV. LIQUID EFFLUENTS

A. Batch Releases

1. Number of Batch Releases	<u>1.86E+02</u>	
2. Total Time Period for Batch Releases	<u>4.01E+04</u>	Min
3. Maximum Time Period for a Batch Release	<u>4.53E+03</u>	Min
4. Average Time Period for Batch Releases	<u>2.15E+02</u>	Min
5. Minimum Time Period for a Batch Release	<u>5.00E+00</u>	Min
6. Average Stream Flow During Release Periods	<u>4.10E+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	Liquid Effluents
Table IV-C	Lower Limits of Detection

TABLE IV-A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1988
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 Releases	Ci	<u>3.56E-01</u>	<u>4.32E-01</u>
2. Estimated Total Error	%	<u>2.00E+01</u>	<u>2.00E+01</u>
3. Average Diluted Concentration	µCi/ml	<u>1.41E-09</u>	<u>2.73E-09</u>
<u>B. TRITIUM</u>			
1. Total Release	Ci	<u>1.99E+02</u>	<u>7.63E+01</u>
2. Estimated Total Error	%	<u>1.00E+01</u>	<u>1.00E+01</u>
3. Average Diluted Concentration	µCi/ml	<u>7.87E-07</u>	<u>4.83E-07</u>
<u>C. DISSOLVED AND ENTRAINED GASES</u>			
1. Total Release	Ci	<u>8.77E+00</u>	<u>2.08E+01</u>
2. Estimated Total Error	%	<u>2.00E+01</u>	<u>2.00E+01</u>
3. Average Diluted Concentration	µCi/ml	<u>3.47E-08</u>	<u>1.32E-07</u>
4. Percent of Applicable Limit	%	<u>1.73E-02</u>	<u>6.58E-02</u>
<u>D. GROSS ALPHA RADIOACTIVITY</u>			
1. Total Release	Ci	<u><LLD</u>	<u><LLD</u>
2. Estimated Total Error	%	<u>6.00E+01</u>	<u>6.00E+01</u>
<u>E. VOLUME OF WASTE RELEASED</u>			
	Liters	<u>2.52E+06</u>	<u>2.89E+06</u>
<u>F. VOLUME OF DILUTION WATER</u>			
	Liters	<u>2.53E+11</u>	<u>1.58E+11</u>
<u>G. PERCENT OF 10CFR50 APPENDIX I</u>			
<u>Quarterly Limit</u>			
Organ GI-LLI	%	<u>1.80E-01</u>	<u>NA</u>
Organ Liver	%	<u>NA</u>	<u>1.42E+00</u>
Total Body	%	<u>3.32E-01</u>	<u>3.39E+00</u>
<u>Yearly Limit</u>			
Organ Liver	%	<u>3.85E-01*</u>	<u>1.09E+00*</u>
Total Body	%	<u>9.24E-01*</u>	<u>2.62E+00*</u>

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

**See Section I.A.2 of this enclosure for refueling water storage tank drain valve leakage.

TABLE IV-B
 EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT - 1988
 LIQUID EFFLUENTS

1. PARTICULATES	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
Na-24	Ci	6.15E-07	<LLD	<LLD	9.42E-05
Cr-51	Ci	<LLD	5.11E-06	<LLD	1.16E-02
Mn-54	Ci	1.50E-09	4.01E-07	2.06E-03	1.10E-03
Fe-55	Ci	<LLD	<LLD	2.11E-01	2.70E-01
Co-57	Ci	<LLD	<LLD	2.18E-04	7.03E-05
Co-58	Ci	1.73E-09	2.66E-06	7.66E-02	2.83E-02
Fe-59	Ci	<LLD	<LLD	1.83E-05	1.92E-05
Co-60	Ci	2.46E-08	5.21E-06	5.13E-02	2.26E-02
Zn-65	Ci	<LLD	<LLD	2.95E-05	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	6.45E-03
Sr-90	Ci	<LLD	<LLD	1.05E-05	1.66E-05
Nb-95	Ci	<LLD	2.68E-07	<LLD	4.83E-04
Zr-95	Ci	<LLD	<LLD	<LLD	8.48E-06
Nb-97	Ci	<LLD	<LLD	1.54E-03	6.76E-06
Tc-99m	Ci	1.70E-07	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	1.18E-04
Ag-110m	Ci	<LLD	3.95E-07	2.75E-03	3.24E-03
Sn-113	Ci	<LLD	<LLD	<LLD	4.08E-05
Sb-124	Ci	<LLD	6.50E-07	3.00E-03	3.07E-02
Sb-125	Ci	<LLD	1.38E-06	6.45E-03	5.22E-02
I-131	Ci	2.33E-05	5.85E-08	2.46E-05	2.60E-04
I-133	Ci	1.77E-05	<LLD	<LLD	<LLD
Cs-134	Ci	2.91E-07	6.65E-07	3.74E-05	1.39E-03
Cs-137	Ci	3.81E-07	1.06E-06	6.16E-04	2.60E-03
Cs-138	Ci	<LLD	<LLD	<LLD	2.74E-04
Ba-139	Ci	<LLD	<LLD	<LLD	2.69E-04
Ce-139	Ci	<LLD	<LLD	<LLD	4.24E-05
Ce-144	Ci	5.07E-11	1.34E-11	<LLD	<LLD
Total for Period	Ci	4.25E-05	1.79E-05	3.56E-01	4.32E-01

TABLE IV-B
 (Continued)
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1988
LIQUID EFFLUENTS

2. GASES	UNITS	CONTINUOUS MODE		BATCH MODE	
		3rd QUARTER	4th QUARTER	3rd QUARTER	4th QUARTER
Ar-41	Ci	<LLD	<LLD	<LLD	4.48E-05
Kr-85	Ci	<LLD	<LLD	1.05E-02	1.64E-02
Kr-85m	Ci	<LLD	<LLD	<LLD	2.35E-03
Kr-88	Ci	<LLD	<LLD	<LLD	6.18E-04
Xe-127	Ci	<LLD	<LLD	<LLD	3.87E-05
Xe-131m	Ci	<LLD	<LLD	1.30E-01	1.28E-01
Xe-133	Ci	2.29E-05	<LLD	8.53E+00	2.02E+01
Xe-133m	Ci	<LLD	<LLD	8.48E-02	2.81E-01
Xe-135	Ci	7.38E-06	<LLD	1.05E-02	1.78E-01
Total for Period	Ci	3.03E-05	<LLD	8.77E+00	2.08E+01

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

<u>NUCLIDE</u>	<u>LLD (μCi/ml)</u>
Na-24	6.36E-08
Ar-41	1.00E-05
Cr-51	1.13E-07
Fe-55	1.00E-06
Co-57	7.01E-09
Fe-59	5.00E-07
Zn-65	5.00E-07
Kr-85m	1.00E-05
Kr-85	1.00E-05
Kr-88	1.00E-05
Sr-89	5.00E-08
Sr-90	5.00E-08
Nb-95	2.54E-08
Zr-95	4.58E-08
Nb-97	2.24E-06
Tc-99m	1.72E-08
Mo-99	5.00E-07
Ru-106	2.12E-07
Ag-110m	2.32E-08
Sn-113	2.07E-08
Sb-124	1.12E-07
Sb-125	4.97E-08
Xe-127	1.00E-05
Xe-131m	1.00E-05
I-133	2.62E-08
Xe-133m	1.00E-05
Xe-133	1.00E-05
Xe-135	1.00E-05
Ba-139	1.66E-06
Ce-139	8.31E-09
Ba/La-140	7.52E-08
Ce-141	5.00E-07
Ce-144	5.00E-07
Alpha	1.00E-07

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

REPORT TIME PERIOD JULY 1 TO DECEMBER 31, 1988

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

WASTE CLASS A

1. 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 ³ Ci	NA	NA	NA	NA	NA	NA
b. Dry compressible waste, contaminated equip., etc.	m ³ Ci	4.68E+01 3.12E+00	2.00E+01	NA	*STP	Compacted Uncompacted	25
c. Irradiated components, control rods, etc.	m ³ Ci	NA	NA	NA	NA	NA	NA
d. Other (describe)	m ³ Ci	NA	NA	NA	NA	NA	NA

*STP = Strong Type Package

2. Estimate of major nuclide composition (by type of waste) 3. Solid Waste Disposition

		%	Ci
a.	NA	NA	NA
b.	Cr-51	1.01E+00	3.13E-02
	Mn-54	1.75E+00	5.45E-02
	Fe-55	1.54E+01	4.80E-01
	Co-60	7.17E+01	2.23E+00
	Ni-63	7.17E+00	2.23E-01
	Cs-137	1.45E+00	4.52E-02
	Others*	1.66E+00	5.15E-02

Number of Shipments
 Mode of Transportation
 Destination

25
 Sole Use Vehicle
 Barnwell, S. C.

* Others include: H-3, C-14, Co-57, Co-58, Fe-59, Nb-95, Zr-95, Tc-99, Ag-110m, Cs-134

V. SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
 REPORT TIME PERIOD JULY 1 TO DECEMBER 31, 1988

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

WASTE CLASS B

1. 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 ³ Ci	1.02E+01 1.32E+02	2.00E+01	NA	*HIC	Dewatered Resin	3
b. Dry compressible waste, contaminated equip, etc.	m ³ Ci	NA	NA	NA	NA	NA	NA
c. Irradiated components, control rods, etc.	m ³ Ci	NA	NA	NA	NA	NA	NA
d. Other (describe)	m ³ Ci	NA	NA	NA	NA	NA	NA

*HIC = High Integrity Container

2. Estimate of major nuclide composition (by type of waste) 3. Solid Waste Disposition

		%	Ci
a.	Fe-55	3.94E+00	5.21E+00
	Co-58	4.05E+00	5.36E+00
	Co-60	1.59E+01	2.10E+01
	Ni-63	5.52E+01	7.31E+01
	Cs-134	7.86E+00	1.04E+01
	Cs-137	1.28E+01	1.69E+01
	Others*	2.56E-01	3.39E-01
b.	NA	NA	NA

Number of Shipments 3
 Mode of Transportation Sole Use Vehicle
 Destination Barnwell, S. C.

* Others include: H-3, C-14, Sr-90

C. IRRADIATED FUEL SHIPMENTS (Dispositions)

Number of Shipments 0
 Mode of Transportation NA
 Destination NA

VI. ANNUAL GASEOUS DOSE ASSESSMENTS

A. Population Distribution

The population distribution was taken from the updated FSAR 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⁽¹⁾. 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.

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

TABLE IX B (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY

PROGRAM IEM24#32 (E) - 22 JAN 1988

12:07 WEDNESDAY, JANUARY 1989 7

JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

SITE=ROBN PERIOD=YRMB1988 STAB=F

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	0.0/ 0.00	1/ 0.06	/	/	/	/	/	1.0/ 0.06	2.68467
NNE	0.1/ 0.01	4/ 0.23	/	/	/	/	/	4.1/ 0.24	1.83526
NE	0.1/ 0.01	2/ 0.12	2/ 0.12	/	1/ 0.06	/	/	5.1/ 0.29	5.15861
ENE	/	/	/	/	/	/	/	/	/
E	/	/	/	/	/	/	/	/	/
ESE	/	/	/	/	/	/	/	/	/
SE	/	/	/	/	/	/	/	/	/
SSE	0.4/ 0.02	10/ 0.58	6/ 0.35	/	/	/	/	16.4/ 0.94	3.02386
S	1.0/ 0.06	28/ 1.61	5/ 0.29	/	/	/	/	34.0/ 1.96	2.37912
SSW	0.6/ 0.03	16/ 0.92	2/ 0.12	/	/	/	/	18.6/ 1.07	2.25739
SW	0.5/ 0.03	14/ 0.81	8/ 0.46	1/ 0.06	/	/	/	23.5/ 1.35	3.21489
WSW	0.3/ 0.02	8/ 0.46	3/ 0.17	/	/	/	/	11.3/ 0.65	2.36474
W	0.5/ 0.03	13/ 0.75	3/ 0.17	/	/	/	/	16.5/ 0.95	2.40574
WNW	0.2/ 0.01	7/ 0.40	3/ 0.17	/	/	/	/	10.2/ 0.59	2.77752
NW	0.5/ 0.03	15/ 0.86	8/ 0.46	/	/	/	/	23.5/ 1.35	2.81239
NNW	0.8/ 0.05	23/ 1.32	6/ 0.35	/	/	/	/	29.8/ 1.72	2.81907
TOTAL	5.0/ 0.29	141/ 8.12	46/ 2.65	1/ 0.06	1/ 0.06	/	/	194.0/11.17	2.72878

NUMBER OF BAD RECORDS: 0

TABLE IV B (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 13 1989 8

SITE=ROBN PERIOD=YRMB1988 STAB=G

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	0.5/ 0.03	3/ 0.17	/	/	/	/	/	3.5/ 0.20	1.25894
NNE	0.2/ 0.01	1/ 0.06	/	/	/	/	/	1.2/ 0.07	0.84067
NE	/	/	/	/	/	/	/	/	
ENE	/	/	/	/	/	/	/	/	
E	/	/	/	/	/	/	/	0.0/ 0.00	
ESE	/	/	/	/	/	/	/	/	
SE	0.2/ 0.01	1/ 0.06	/	/	/	/	/	1.2/ 0.07	0.79898
SSE	1.6/ 0.09	9/ 0.52	1/ 0.06	/	/	/	/	11.6/ 0.67	2.07426
S	1.3/ 0.07	7/ 0.40	1/ 0.06	/	/	/	/	9.3/ 0.54	1.74903
SSW	2.5/ 0.14	14/ 0.81	4/ 0.23	1/ 0.06	/	/	/	21.5/ 1.24	2.43817
SW	2.2/ 0.13	12/ 0.69	3/ 0.17	/	/	/	/	17.2/ 0.99	2.02325
WSW	2.3/ 0.13	13/ 0.75	2/ 0.12	/	/	/	/	17.3/ 1.00	1.74311
W	1.6/ 0.09	9/ 0.52	2/ 0.12	/	/	/	/	12.6/ 0.73	1.91890
WNW	3.1/ 0.18	17/ 0.98	/	/	/	/	/	20.1/ 1.16	1.41092
NW	3.8/ 0.22	21/ 1.21	1/ 0.06	/	/	/	/	25.8/ 1.49	1.63060
NNW	5.8/ 0.33	32/ 1.84	7/ 0.40	/	/	/	/	44.8/ 2.58	1.81410
TOTAL	25.0/ 1.44	139/ 8.00	21/ 1.21	1/ 0.06	/	/	/	186.0/10.71	1.82772

NUMBER OF BAD RECORDS: 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 through December 31, 1988.

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

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988,
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 1989

SITE=ROBN PERIOD=YRGB1988 SUMMARY OVER ALL STAB

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	0.2/ 0.04	2/ 0.45	13/ 2.90	5/ 1.11	/	/	/	20.2/ 4.50	5.83831
NNE	0.3/ 0.07	4/ 0.89	14/ 3.12	9/ 2.00	/	/	/	27.3/ 6.08	5.78997
NE	0.2/ 0.04	2/ 0.45	10/ 2.23	2/ 0.45	/	/	/	14.2/ 3.16	5.20623
ENE	0.6/ 0.13	7/ 1.56	9/ 2.00	/	/	/	/	16.6/ 3.70	4.04217
E	0.6/ 0.13	8/ 1.78	7/ 1.56	4/ 0.89	/	/	/	19.6/ 4.37	5.62312
ESE	0.2/ 0.04	2/ 0.45	5/ 1.11	2/ 0.45	/	/	/	9.2/ 2.05	5.90239
SE	0.2/ 0.04	3/ 0.67	6/ 1.34	/	2/ 0.45	/	/	11.2/ 2.49	5.62408
SSE	0.6/ 0.13	8/ 1.78	13/ 2.90	/	2/ 0.45	/	/	23.6/ 5.26	4.67852
S	1.6/ 0.36	20/ 4.45	28/ 6.24	18/ 4.01	2/ 0.45	/	/	69.6/ 15.50	5.69608
SSW	1.8/ 0.40	22/ 4.90	29/ 6.46	21/ 4.68	/	/	/	73.8/ 16.44	5.59978
SW	1.0/ 0.22	12/ 2.67	33/ 7.35	10/ 2.23	/	/	/	56.0/ 12.47	5.05356
WSW	1.9/ 0.42	24/ 5.35	11/ 2.45	/	/	/	/	36.9/ 8.22	2.90364
W	0.7/ 0.16	9/ 2.00	6/ 1.34	/	/	/	/	15.7/ 3.50	2.99458
WNW	1.0/ 0.22	13/ 2.90	5/ 1.11	/	/	/	/	19.0/ 4.23	2.36520
NW	0.8/ 0.18	10/ 2.23	1/ 0.22	/	/	/	/	11.8/ 2.63	2.04337
NNW	1.3/ 0.29	16/ 3.56	7/ 1.56	/	/	/	/	24.3/ 5.41	3.05123
TOTAL	13.0/ 2.90	162/ 36.08	197/ 43.88	71/ 15.81	6/ 1.34	/	/	449.0/ 100	4.77731

NUMBER OF BAD RECORDS: 1

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TABLE IV (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 2, 1989

2

SITE=ROBN PERIOD=YRGB1988 STAB=A

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	/	4/ 0.89	/	/	/	4.0/ 0.89	8.71269
NNE	/	/	/	1/ 0.22	/	/	/	1.0/ 0.22	7.95397
NE	/	/	/	/	/	/	/	/	/
ENE	/	1/ 0.22	/	/	/	/	/	1.0/ 0.22	3.25162
E	/	/	/	/	/	/	/	/	/
ESE	/	1/ 0.22	/	/	/	/	/	1.0/ 0.22	2.73470
SE	/	/	/	/	/	/	/	/	/
SSE	/	/	/	/	/	/	/	/	/
S	/	/	1/ 0.22	3/ 0.67	1/ 0.22	/	/	5.0/ 1.11	10.12172
SSW	/	1/ 0.22	/	7/ 1.56	/	/	/	8.0/ 1.78	9.19001
SW	/	/	3/ 0.67	2/ 0.45	/	/	/	5.0/ 1.11	7.25029
WSW	/	/	2/ 0.45	/	/	/	/	2.0/ 0.45	6.92846
W	/	/	1/ 0.22	/	/	/	/	1.0/ 0.22	4.48557
WNW	/	/	3/ 0.67	/	/	/	/	3.0/ 0.67	3.97421
NW	/	/	/	/	/	/	/	/	/
NNW	/	/	/	/	/	/	/	/	/
TOTAL	/	3/ 0.67	10/ 2.23	17/ 3.79	1/ 0.22	/	/	31.0/ 6.90	7.72375

NUMBER OF BAD RECORDS: 0

TABLE IV-5 (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 1989 3

SITE=ROBN PERIOD=YRGB1988 STAB=B

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	1/ 0.22	/	/	/	/	1.0/ 0.22	6.90345
NNE	/	/	/	/	/	/	/	/	
NE	/	/	/	1/ 0.22	/	/	/	1.0/ 0.22	8.78772
ENE	/	/	/	/	/	/	/	/	
E	/	/	2/ 0.45	/	/	/	/	2.0/ 0.45	6.87844
ESE	/	/	/	/	/	/	/	/	
SE	/	/	3/ 0.67	/	/	/	/	3.0/ 0.67	4.58562
SSE	/	/	/	/	/	/	/	/	
S	/	/	3/ 0.67	4/ 0.89	/	/	/	7.0/ 1.56	8.12311
SSW	/	/	4/ 0.89	4/ 0.89	/	/	/	8.0/ 1.78	8.06028
SW	/	/	2/ 0.45	3/ 0.67	/	/	/	5.0/ 1.11	7.98399
WSW	/	/	3/ 0.67	/	/	/	/	3.0/ 0.67	6.13084
W	/	/	/	/	/	/	/	/	
WNW	/	1/ 0.22	/	/	/	/	/	1.0/ 0.22	3.08487
NW	/	/	/	/	/	/	/	/	
NNW	/	/	/	/	/	/	/	/	
TOTAL	/	1/ 0.22	18/ 4.01	12/ 2.67	/	/	/	31.0/ 6.90	7.28859

NUMBER OF BAD RECORDS: 0

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TABLE IX-C (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY

PROGRAM IEM24#32 (E) - 22 JAN 1988

12:01 WEDNESDAY, JANUARY 1989

JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

SITE=ROBN PERIOD=YRGB1988 STAB=C

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	1/ 0.22	1/ 0.22	/	/	/	2.0/ 0.45	7.80390
NNE	/	/	1/ 0.22	4/ 0.89	/	/	/	5.0/ 1.11	8.38085
NE	/	/	1/ 0.22	1/ 0.22	/	/	/	2.0/ 0.45	6.99516
ENE	/	/	1/ 0.22	/	/	/	/	1.0/ 0.22	7.12022
E	/	/	2/ 0.45	/	/	/	/	2.0/ 0.45	6.60330
ESE	/	/	2/ 0.45	/	/	/	/	2.0/ 0.45	5.81957
SE	/	/	1/ 0.22	/	/	/	/	1.0/ 0.22	4.36885
SSE	/	/	1/ 0.22	/	/	/	/	1.0/ 0.22	3.68517
S	/	/	3/ 0.67	3/ 0.67	/	/	/	6.0/ 1.34	8.06236
SSW	/	/	/	6/ 1.34	/	/	/	6.0/ 1.34	9.03507
SW	/	/	1/ 0.22	2/ 0.45	/	/	/	3.0/ 0.67	7.60936
WSW	/	/	/	/	/	/	/	/	
W	/	/	/	/	/	/	/	/	
WNW	/	/	/	/	/	/	/	/	
NW	/	/	/	/	/	/	/	/	
NNW	/	/	/	/	/	/	/	/	
TOTAL	/	/	14/ 3.12	17/ 3.79	/	/	/	31.0/ 6.90	7.64307

NUMBER OF BAD RECORDS: 0

TABLE IX-C (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 1989

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SITE=ROBN PERIOD=YRGB1988 STAB=D

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	1/ 0.22	9/ 2.00	/	/	/	/	10.0/ 2.23	4.74070
NNE	/	1/ 0.22	13/ 2.90	4/ 0.89	/	/	/	18.0/ 4.01	5.70007
NE	/	1/ 0.22	9/ 2.00	/	/	/	/	10.0/ 2.23	4.90412
ENE	/	3/ 0.67	8/ 1.78	/	/	/	/	11.0/ 2.45	4.40978
E	/	6/ 1.34	3/ 0.67	4/ 0.89	/	/	/	13.0/ 2.90	5.92989
ESE	/	1/ 0.22	1/ 0.22	1/ 0.22	/	/	/	3.0/ 0.67	7.32588
SE	/	2/ 0.45	2/ 0.45	/	/	/	/	4.0/ 0.89	3.41421
SSE	/	/	7/ 1.56	/	2/ 0.45	/	/	9.0/ 2.00	7.80390
S	/	1/ 0.22	8/ 1.78	7/ 1.56	/	/	/	16.0/ 3.56	6.75754
SSW	/	3/ 0.67	16/ 3.56	3/ 0.67	/	/	/	22.0/ 4.90	5.44590
SW	/	2/ 0.45	8/ 1.78	1/ 0.22	/	/	/	11.0/ 2.45	4.96763
WSW	/	2/ 0.45	4/ 0.89	/	/	/	/	6.0/ 1.34	4.55227
W	/	1/ 0.22	2/ 0.45	/	/	/	/	3.0/ 0.67	3.75743
WNW	/	1/ 0.22	2/ 0.45	/	/	/	/	3.0/ 0.67	4.41332
NW	/	/	1/ 0.22	/	/	/	/	1.0/ 0.22	5.23595
NNW	/	/	2/ 0.45	/	/	/	/	2.0/ 0.45	4.15207
TOTAL	/	25/ 5.57	95/21.16	20/ 4.45	2/ 0.45	/	/	142.0/31.63	5.48208

NUMBER OF BAD RECORDS: 0

TABLE IX-C (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 1989

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SITE=ROBN PERIOD=YRGB1988 STAB=E

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	1/ 0.22	2/ 0.45	/	/	/	/	3.0/ 0.67	4.31327
NNE	/	2/ 0.45	/	/	/	/	/	2.0/ 0.45	1.63415
NE	/	1/ 0.22	/	/	/	/	/	1.0/ 0.22	1.88427
ENE	/	2/ 0.45	/	/	/	/	/	2.0/ 0.45	3.07654
E	/	2/ 0.45	/	/	/	/	/	2.0/ 0.45	2.74304
ESE	/	/	2/ 0.45	1/ 0.22	/	/	/	3.0/ 0.67	5.90851
SE	/	/	/	/	2/ 0.45	/	/	2.0/ 0.45	14.76571
SSE	/	2/ 0.45	5/ 1.11	/	/	/	/	7.0/ 1.56	3.80905
S	/	11/ 2.45	11/ 2.45	1/ 0.22	1/ 0.22	/	/	24.0/ 5.35	4.42096
SSW	/	10/ 2.23	5/ 1.11	/	/	/	/	15.0/ 3.34	3.51731
SW	/	5/ 1.11	17/ 3.79	1/ 0.22	/	/	/	23.0/ 5.12	4.36667
WSW	/	6/ 1.34	1/ 0.22	/	/	/	/	7.0/ 1.56	2.33926
W	/	5/ 1.11	1/ 0.22	/	/	/	/	6.0/ 1.34	2.64299
WNW	/	3/ 0.67	/	/	/	/	/	3.0/ 0.67	2.06214
NW	/	1/ 0.22	/	/	/	/	/	1.0/ 0.22	2.71802
NNW	/	1/ 0.22	4/ 0.89	/	/	/	/	5.0/ 1.11	4.46223
TOTAL	/	52/11.58	48/10.69	3/ 0.67	3/ 0.67	/	/	106.0/23.61	4.02261

NUMBER OF BAD RECORDS: 0

TABLE IX-C (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 1989

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SITE=ROBN PERIOD=VRGB1988 STAB=F

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	/	/	/	/	/	/	
NNE	0.1/ 0.02	1/ 0.22	/	/	/	/	/	1.1/ 0.24	1.85318
NE	/	/	/	/	/	/	/	/	
ENE	0.1/ 0.02	1/ 0.22	/	/	/	/	/	1.1/ 0.24	1.50452
E	/	/	/	/	/	/	/	/	
ESE	/	/	/	/	/	/	/	/	
SE	0.1/ 0.02	1/ 0.22	/	/	/	/	/	1.1/ 0.24	1.35293
SSE	/	/	/	/	/	/	/	/	
S	0.2/ 0.04	3/ 0.67	2/ 0.45	/	/	/	/	5.2/ 1.16	3.02714
SSW	0.3/ 0.07	5/ 1.11	4/ 0.89	/	/	/	/	9.3/ 2.07	3.21755
SW	0.1/ 0.02	1/ 0.22	/	1/ 0.22	/	/	/	2.1/ 0.47	5.95137
WSW	0.5/ 0.11	7/ 1.56	/	/	/	/	/	7.5/ 1.67	1.86592
W	/	/	/	/	/	/	/	/	
WNW	0.1/ 0.02	2/ 0.45	/	/	/	/	/	2.1/ 0.47	1.65359
NW	0.2/ 0.04	3/ 0.67	/	/	/	/	/	3.2/ 0.71	2.32667
NNW	0.3/ 0.07	5/ 1.11	1/ 0.22	/	/	/	/	6.3/ 1.40	3.14044
TOTAL	2.0/ 0.45	29/ 6.46	7/ 1.56	1/ 0.22	/	/	/	39.0/ 8.69	2.77028

NUMBER OF BAD RECORDS: 0

TABLE IX-C (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 () - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:01 WEDNESDAY, JANUARY 1989

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SITE=ROBN PERIOD=VRGB1988 STAB=G

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	/	/	/	/	/	/	
NNE	/	/	/	/	/	/	/	/	
NE	/	/	/	/	/	/	/	/	
ENE	/	/	/	/	/	/	/	/	
E	/	/	/	/	/	/	/	/	
ESE	/	/	/	/	/	/	/	/	
SE	/	/	/	/	/	/	/	/	
SSE	1.3/ 0.29	6/ 1.34	/	/	/	/	/	7.3/ 1.63	1.32083
S	1.1/ 0.24	5/ 1.11	/	/	/	/	/	6.1/ 1.36	1.44263
SSW	0.6/ 0.13	3/ 0.67	/	1/ 0.22	/	/	/	4.6/ 1.02	3.74095
SW	0.8/ 0.18	4/ 0.89	2/ 0.45	/	/	/	/	6.8/ 1.51	2.34917
WSW	1.9/ 0.42	9/ 2.00	1/ 0.22	/	/	/	/	11.9/ 2.65	1.46216
W	0.6/ 0.13	3/ 0.67	2/ 0.45	/	/	/	/	5.6/ 1.25	2.73645
WNW	1.3/ 0.29	6/ 1.34	/	/	/	/	/	7.3/ 1.63	0.93251
NW	1.3/ 0.29	6/ 1.34	/	/	/	/	/	7.3/ 1.63	1.18835
NNW	2.1/ 0.47	10/ 2.23	/	/	/	/	/	12.1/ 2.69	1.96548
TOTAL	11.0/ 2.45	52/11.58	5/ 1.11	1/ 0.22	/	/	/	69.0/15.37	1.79149

NUMBER OF BAD RECORDS: 0

CHANGES TO ODCM, PCP, AND
RADIOACTIVE WASTE SYSTEMS

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V. INSTRUMENT INOPERABILITY.....	2
VI. LIQUID HOLDUP TANK CURIE LIMIT.....	2
VII. WASTE GAS DECAY TANK CURIE LIMIT.....	2

I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (ODCM)

There were no changes to the Offsite Dose Calculation Manual (ODCM) during this reporting period.

II. CHANGES TO THE RADIOACTIVE WASTE SYSTEMS

There were no changes to the Radioactive Waste Systems during the second six months of 1988.

III. PROCESS CONTROL PROGRAM CHANGES

There were no changes to the Process Control Program (PCP) during this reporting period.

IV. CHANGES IN LAND USE CENSUS

There were no changes to the environmental sampling program as a result of the Land Use Census during this reporting period.

V. INSTRUMENT INOPERABILITY

On November 30, 1988, with the unit at cold shutdown for refueling, the Waste Gas Analyzer was rendered inoperable due to a loss of DC power to its sampling relays. This loss of power was caused by a clearance which was initiated for repair of an unrelated valve control. On December 16, 1988, power was restored and the Waste Gas Analyzer returned to service. During the period of inoperability, daily samples were taken of the "in-service" Waste Gas Decay Tank as required by Plant Technical Specifications, Table 3.5-7, item number 2.b.

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 was no waste gas decay tank with curie content that exceeded the $1.9E+04$ curie limit during this reporting period.

SUPPLEMENTS TO PREVIOUS
SEMIANNUAL REPORTS

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LIST OF SUPPLEMENTAL TABLES/SECTIONS
Enclosure 3

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I. DISCUSSION

Supplements to the Effluent and Waste Disposal Semiannual Report are as follows:

<u>Report Period</u>	<u>Affected Pages</u>
January - June 1988	Enclosure 1, Pages 10-11 and 15-16
July - December 1987	Enclosure 1, Pages 5, 27-29, and 31
July - December 1986	Enclosure 1, Pages 5 and 34-35

A. January - June 1988

Revisions are made to the First Six Months 1988 Semiannual Report to correct curie totals and average release rates for Fission and Activation Gases. These corrections were due to the inclusion of minimum detectable activities in curie totals for the first quarterly period. The percent of 10CFR50, Appendix I Quarterly and Annual Limits were not affected. Also, the average release rate for tritium in gaseous effluents in the second quarter of 1988 was corrected. This correction is due to an apparent error in the original calculation for this value.

Curie totals for the Continuous Release Mode have been changed for the first six months of 1988 to include the release made from the RWST (see Enclosure 1 of this report). The addition of RWST release curies did not affect the Fission and Activation Product average diluted concentration value. However, the "Typical Lower Limits of Detection for Liquid Effluents" table was changed to delete isotopes that were present in both the first and second quarters in both the batch and continuous release modes.

B. July - December 1987 and July - December 1986

Corrections were made to the 1987 and 1986 Second Six Months Semiannual Reports to revise the Annual Gaseous Dose Assessment values. The revised assessment (with open terrain/recirculation correction factors from the Dames and Moore 1978 study applied to the XOQDOQ calculations) for 1987 and 1986 increased the maximum individual dose by a factor of approximately 3.0 for 1987 and 1986. However, the 50-mile integrated population doses decreased by a factor of approximately 1.2 for both years. All of these doses are well below 10CFR50, Appendix I limits.

II. SUPPLEMENTAL DATA TABLES/SECTIONS

The revised data tables and report sections are as follows:

TABLE III-A	Gaseous Effluents - Summation of All Releases (1988)
TABLE III-B	Gaseous Effluents - Ground Level and Mixed Mode Releases (1988)
TABLE IV-B	Liquid Effluents (1988)
TABLE IV-C	Typical Lower Limits of Detection for Liquid Effluents (1988)
SECTION I.A.1	Significant Variances (1987)
TABLE VI-A	Hypothetical Offsite Maximum Individual Doses for 1987
TABLE VI-B	True Offsite Maximum Individual Doses for 1987
TABLE VI-D	Offsite Annual Integrated Population Dose Summary for 1987
SECTION I.A.6	Significant Variances (1986)
TABLE VI-C	Maximum Individual Dose for 1986 From Iodine 131, Iodine 133, Particulates >8 Day Half Lives & Tritium
TABLE VI-D	Annual Integrated Population Dose Summary for 1986

TABLE III-A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT - 1988
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	<u>UNITS</u>	<u>1ST QUARTER</u>	<u>2ND QUARTER</u>
A. Fission and Activation Gases:			
1. Total Release	Ci	<u>9.73E+02</u>	<u>1.30E+02</u>
2. Estimated Total Error	%	<u>6.00E+01</u>	<u>6.00E+01</u>
3. Average Release Rate for Period	μCi/sec	<u>1.24E+01</u>	<u>1.64E+01</u>
4. Percent of 10CFR50 Appendix I			
<u>Quarterly Limit</u>			
Gamma Air	%	<u>2.06E+00</u>	<u>2.63E+00</u>
Beta Air	%	<u>2.83E+00</u>	<u>4.19E+00</u>
<u>Annual Limit</u>			
Gamma Air	%	<u>1.03E+00*</u>	<u>2.34E+00*</u>
Beta Air	%	<u>1.41E+00*</u>	<u>3.51E+00*</u>
B. Iodines, Particulates, and Tritium:			
<u>Iodines</u>			
1. Total Iodine - 131	Ci	<u>1.48E-04</u>	<u>2.01E-04</u>
2. Estimated Total Error	%	<u>4.00E+01</u>	<u>4.00E+01</u>
3. Average Release Rate	μCi/sec	<u>1.88E-05</u>	<u>2.56E-05</u>
<u>Particulates</u>			
1. Particulates with Half-Lives >8 days	Ci	<u>4.82E-07</u>	<u>1.63E-05</u>
2. Estimated Total Error	%	<u>4.00E+01</u>	<u>4.00E+01</u>
3. Average Release Rate for Period	μCi/sec	<u>6.13E-08</u>	<u>2.07E-06</u>
4. Gross Alpha Radioactivity	Ci	<u><LLD</u>	<u><LLD</u>
<u>Tritium</u>			
1. Total Release	Ci	<u>1.87E+00</u>	<u>3.10E+00</u>
2. Estimated Total Error	%	<u>3.00E+01</u>	<u>3.00E+01</u>
3. Average Release Rate for Period	μCi/sec	<u>2.38E-01</u>	<u>3.94E-01</u>
Percent of 10CFR50 Appendix I			
<u>Quarterly Limit</u>			
Organ Thyroid	%	<u>6.94E-01</u>	<u>1.11E+00</u>
<u>Yearly Limit</u>			
Organ Thyroid	%	<u>3.47E-01*</u>	<u>9.02E-01*</u>

*Cumulative total for the year-to-date.

TABLE III-B
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT - 1988
GASEOUS EFFLUENTS - GROUND LEVEL AND MIXED MODE RELEASES

	UNITS	CONTINUOUS MODE		BATCH MODE	
		1ST QUARTER	2ND QUARTER	1ST QUARTER	2ND QUARTER
1. FISSION GASES					
Ar-41	Ci	<LLD	<LLD	1.23E-01	1.34E-01
Kr-85	Ci	6.49E-01	1.73E+01	5.51E-01	2.00E-01
Kr-85m	Ci	<LLD	1.40E-01	9.32E-04	5.76E-02
Kr-87	Ci	<LLD	<LLD	<LLD	7.29E-05
Kr-88	Ci	<LLD	<LLD	4.23E-04	3.51E-02
Xe-131m	Ci	<LLD	<LLD	5.21E-01	2.55E-01
Xe-133	Ci	7.36E+01	8.32E+01	1.84E+01	2.24E+01
Xe-133m	Ci	<LLD	<LLD	8.73E-02	3.76E-01
Xe-135	Ci	3.32E+00	4.23E+00	4.24E-02	1.10E+00
Total for Period	Ci	7.76E+01	1.05E+02	1.97E+01	2.46E+01
2. IODINES₁					
I-131	Ci	1.48E-04	2.01E-04	<LLD	<LLD
I-133	Ci	3.13E-05	1.72E-04	<LLD	<LLD
Total for Period	Ci	1.79E-04	3.73E-04	<LLD	<LLD
3. PARTICULATES					
H-3	Ci	1.57E+00	2.42E+00	3.01E-01	6.78E-01
Co-58	Ci	4.82E-07	<LLD	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	1.55E-05
Cs-137	Ci	<LLD	<LLD	<LLD	8.16E-07
Total for Period	Ci	1.57E+00	2.42E+00	3.01E-01	6.78E-01

₁Continuous Accountability includes Batch Accountability (excludes H-3) for Mixed Mode Releases

TABLE IV-B
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT - 1988
LIQUID EFFLUENTS

		CONTINUOUS MODE		BATCH MODE	
1. PARTICULATES					
	UNITS	1st QUARTER	2nd QUARTER	1st QUARTER	2nd QUARTER
H-3	Ci	1.30E-04	1.30E-04	2.41E+02	1.94E+01
Cr-51	Ci	7.45E-06	7.45E-06	1.24E-03	6.26E-03
Mn-54	Ci	5.84E-07	5.84E-07	4.83E-03	2.03E-03
Fe-55	Ci	<LLD	<LLD	1.05E-02	3.27E-03
Fe-59	Ci	<LLD	<LLD	5.38E-04	4.17E-04
Co-57	Ci	<LLD	<LLD	8.10E-05	2.47E-04
Co-58	Ci	3.88E-06	3.88E-06	3.80E-02	1.77E-02
Co-60	Ci	7.58E-06	7.58E-06	2.19E-02	4.63E-02
Zn-65	Ci	<LLD	<LLD	1.31E-05	<LLD
Sr-90	Ci	<LLD	<LLD	4.06E-07	2.05E-06
Sr-92	Ci	<LLD	<LLD	<LLD	1.19E-06
Zr-95	Ci	<LLD	<LLD	<LLD	1.50E-04
Nb-95	Ci	3.90E-07	3.90E-07	1.12E-04	3.34E-04
Nb-97	Ci	<LLD	<LLD	<LLD	3.49E-06
Tc-99m	Ci	<LLD	<LLD	<LLD	1.51E-04
Ru-106	Ci	<LLD	<LLD	1.13E-06	<LLD
Ag-110m	Ci	5.76E-07	5.76E-07	9.03E-04	5.65E-03
Sn-113	Ci	<LLD	<LLD	4.69E-06	<LLD
Sb-124	Ci	9.45E-07	9.45E-07	4.22E-03	1.42E-03
Sb-125	Ci	2.02E-06	2.02E-06	2.00E-03	4.85E-03
I-131	Ci	4.09E-05	8.52E-08	2.19E-05	5.04E-05
I-133	Ci	1.34E-05	<LLD	<LLD	2.43E-05
Cs-134	Ci	9.69E-07	9.69E-07	1.54E-04	4.89E-04
Cs-137	Ci	1.54E-06	1.54E-06	7.35E-04	1.10E-03
Ba-139	Ci	<LLD	<LLD	<LLD	9.67E-05
Ce-139	Ci	<LLD	<LLD	<LLD	2.26E-05
Total for Period		2.10E-04	1.56E-04	2.41E+02	1.95E+01
2. Gases					
Kr-85	Ci	<LLD	<LLD	3.51E-02	2.04E-03
Xe-131m	Ci	<LLD	<LLD	5.84E-02	1.55E-02
Xe-133m	Ci	<LLD	<LLD	6.38E-03	1.36E-02
Xe-133	Ci	1.62E-05	<LLD	1.97E+00	1.31E+00
Xe-135	Ci	<LLD	<LLD	2.60E-05	1.52E-02
Total for Period		1.62E-05	<LLD	2.07E+00	1.36E+00

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

<u>NUCLIDE</u>	<u>LLD ($\mu\text{Ci/ml}$)</u>
Fe-55	5.00E-07
Co-57	7.00E-09
Fe-59	5.00E-07
Zn-65	5.00E-07
Kr-85	4.01E-06
Sr-89	5.00E-08
Sr-90	5.00E-08
Sr-92	6.39E-09
Zr-95	4.55E-08
Nb-97	2.18E-10
Mo-99	5.00E-07
Tc-99m	2.71E-09
Ru-106	2.12E-07
Sn-113	2.06E-09
Xe-131m	3.75E-07
I-133	1.52E-08
Xe-133	1.00E-05
Xe-133m	1.00E-05
Xe-135	1.00E-05
Ba-139	5.48E-10
Ce-139	8.28E-09
Ba/La-140	7.39E-08
Ce-141	5.00E-07
Ce-144	5.00E-07
Gross Alpha	1.00E-07

I. EXECUTIVE SUMMARY

Significant Variances

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

1. The 10CFR50 Appendix I, Percent of Limits, were calculated from the last posted release for the period indicated using the Nuclear Data LRW/GRW (ODCM methodology) release permit generating system. The following is a summary of the comparison of the annual dose commitment of the ODCM and LADTAP/GASPAR dose programs.

<u>GASEOUS</u>	<u>UNITS</u>	<u>LRW/GRW</u>	<u>LADTAP/GASPAR</u>
Annual Beta Air Dose	mrad	2.31E+00	7.01E-01
Annual Gamma Air Dose	mrad	1.00E+00	2.88E-01
I-131, 133, Tritium & Part. >8 Day Dose	mrad	3.80E+00	1.82E+00

LIQUID

Total Body Dose	mrem	2.09E-01	1.11E-01
Critical Organ Dose	mrem	3.04E-01	1.57E-01

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 (GRW software) provides day-by-day dose estimates that are higher because all releases are assigned to the limiting receptor, using the continuous ground level annual average meteorology from 1978.

The annual liquid dose commitment is lower with LADTAP because total annual dilution flow is used. Day-by-day dose estimates provided by ODCM (LRW software) utilize dilution flow during actual release periods.

2. The total release time for batch gaseous releases reported in the first six months of 1987 was 2.61E+04 minutes versus 4.55E+04 minutes reported in this report, a factor of 1.7 increase. This increase was due to 7 batch containment purges during this reporting period versus only 2 batch containment purges in the first six months report for 1987. Also during this reporting period, there was an increased number of containment pressure reliefs which were due to a leaking air operated valve causing approximately four releases per week in the month of August.
3. A minimum time of 17 minutes was reported for gaseous batch releases. This release was for calibration of the Plant Vent Stack Radiation Monitor.

TABLE VI-A

GASEOUS PATHWAY
HYPOTHETICAL OFFSITE MAXIMUM INDIVIDUAL DOSES FOR 1987
(MILLIREM)

ANNUAL BETA AIR DOSE = 7.005E-01 MILLRADS
 ANNUAL GAMMA AIR DOSE = 2.878E-01 MILLRADS

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
ADULT	2.156E-01	2.136E-01	1.794E-01	2.176E-01	2.201E-01	1.623E+00	2.194E-01	5.151E-01
PLUME	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.814E-01	4.769E-01
GROUND PLANE	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.658E-03
INHALATION	1.220E-02	1.201E-02	3.285E-04	1.240E-02	1.270E-02	1.591E-01	1.193E-02	1.192E-02
VEGETATION	2.413E-02	2.248E-02	2.952E-03	2.586E-02	2.785E-02	1.179E+00	2.161E-02	2.152E-02
MEAT & POULTRY	3.330E-03	3.183E-03	2.683E-04	3.488E-03	3.672E-03	1.092E-01	3.101E-03	3.094E-03
TEENAGER	2.171E-01	2.152E-01	1.797E-01	2.199E-01	2.220E-01	1.432E+00	2.215E-01	5.170E-01
PLUME	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.814E-01	4.769E-01
GROUND PLANE	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.658E-03
INHALATION	1.234E-02	1.209E-02	4.616E-04	1.265E-02	1.306E-02	1.929E-01	1.201E-02	1.200E-02
VEGETATION	2.690E-02	2.532E-02	3.108E-03	2.916E-02	3.072E-02	9.844E-01	2.480E-02	2.464E-02
MEAT & POULTRY	2.009E-03	1.900E-03	2.225E-04	2.165E-03	2.317E-03	7.868E-02	1.853E-03	1.845E-03
CHILD	2.303E-01	2.274E-01	1.831E-01	2.344E-01	2.364E-01	1.997E+00	2.341E-01	5.296E-01
PLUME	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.814E-01	4.769E-01
GROUND PLANE	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.658E-03
INHALATION	1.096E-02	1.065E-02	6.261E-04	1.124E-02	1.160E-02	2.116E-01	1.062E-02	1.061E-02
VEGETATION	4.102E-02	3.858E-02	6.138E-03	4.459E-02	4.603E-02	1.491E+00	3.840E-02	3.817E-02
MEAT & POULTRY	2.441E-03	2.262E-03	4.113E-04	2.652E-03	2.828E-03	1.182E-01	2.238E-03	2.229E-03
INFANT	1.822E-01	1.820E-01	1.764E-01	1.826E-01	1.827E-01	3.656E-01	1.889E-01	4.847E-01
PLUME	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.745E-01	1.814E-01	4.769E-01
GROUND PLANE	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.399E-03	1.658E-03
INHALATION	6.347E-03	6.116E-03	4.887E-04	6.678E-03	6.754E-03	1.897E-01	6.108E-03	6.102E-03

TABLE VI-B

GASEOUS PATHWAY

TRUE OFFSITE MAXIMUM INDIVIDUAL DOSES FOR 1987
(MILLIREM)

ANNUAL BETA AIR DOSE = 6.544E-01 MILLRADS
 ANNUAL GAMMA AIR DOSE = 2.705E-01 MILLRADS

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
ADULT	1.770E-01	1.768E-01	1.657E-01	1.772E-01	1.775E-01	3.172E-01	1.832E-01	4.602E-01
PLUME	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.706E-01	4.474E-01
GROUND PLANE	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.472E-03
INHALATION	1.159E-02	1.141E-02	3.131E-04	1.178E-02	1.207E-02	1.518E-01	1.134E-02	1.133E-02
TEENAGER	1.771E-01	1.769E-01	1.658E-01	1.774E-01	1.778E-01	3.494E-01	1.832E-01	4.603E-01
PLUME	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.706E-01	4.474E-01
GROUND PLANE	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.472E-03
INHALATION	1.173E-02	1.149E-02	4.400E-04	1.202E-02	1.242E-02	1.840E-01	1.142E-02	1.141E-02
CHILD	1.758E-01	1.755E-01	1.660E-01	1.761E-01	1.764E-01	3.673E-01	1.819E-01	4.590E-01
PLUME	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.706E-01	4.474E-01
GROUND PLANE	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.472E-03
INHALATION	1.041E-02	1.012E-02	5.967E-04	1.069E-02	1.103E-02	2.019E-01	1.009E-02	1.009E-02
INFANT	1.714E-01	1.712E-01	1.659E-01	1.717E-01	1.718E-01	3.464E-01	1.776E-01	4.547E-01
PLUME	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.641E-01	1.706E-01	4.474E-01
GROUND PLANE	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.472E-03
INHALATION	6.034E-03	5.813E-03	4.659E-04	6.349E-03	6.422E-03	1.811E-01	5.805E-03	5.800E-03

TABLE VI-D
GASEOUS PATHWAY

OFFSITE ANNUAL INTEGRATED POPULATION DOSE SUMMARY FOR 1987
(PERSON-REM)

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
** TOTAL **	8.595E-02	8.537E-02	6.529E-02	8.660E-02	8.754E-02	5.476E-01	8.917E-02	2.409E-01
PLUME	6.396E-02 74.42%	6.396E-02 74.93%	6.396E-02 97.97%	6.396E-02 73.86%	6.396E-02 73.07%	6.396E-02 11.68%	6.801E-02 76.27%	2.197E-01 91.21%
GROUND PLANE	1.427E-04 0.17%	1.427E-04 0.17%	1.427E-04 0.22%	1.427E-04 0.16%	1.427E-04 0.16%	1.427E-04 0.03%	1.427E-04 0.16%	1.699E-04 0.07%
INHALATION	1.023E-02 11.90%	1.006E-02 11.79%	3.028E-04 0.46%	1.040E-02 12.01%	1.067E-02 12.19%	1.374E-01 25.09%	1.001E-02 11.22%	1.001E-02 4.15%
VEGETATION	8.877E-03 10.33%	8.561E-03 10.03%	6.690E-04 1.02%	9.239E-03 10.67%	9.753E-03 11.14%	2.635E-01 48.11%	8.416E-03 9.44%	8.412E-03 3.49%
COW MILK	9.995E-04 1.16%	9.181E-04 1.08%	1.725E-04 0.26%	1.091E-03 1.26%	1.220E-03 1.39%	6.515E-02 11.90%	8.843E-04 0.99%	8.832E-04 0.37%
MEAT & POULTRY	1.738E-03 2.02%	1.718E-03 2.01%	4.008E-05 0.06%	1.760E-03 2.03%	1.791E-03 2.05%	1.749E-02 3.19%	1.708E-03 1.91%	1.707E-03 0.71%

6. The 10CFR50 Appendix I, Percent of Limits, were calculated from the last posted release for the period indicated using the Nuclear Data LRW/GRW (ODCM methodology) release permit generating system. The following is a summary of the comparison of the annual dose commitment of the ODCM and LADTAP/GASPAR dose programs.

<u>GASEOUS</u>	<u>UNITS</u>	<u>LRW/GRW</u>	<u>LADTAP/GASPAR</u>
Annual Beta Air Dose	mrad	2.12E+00	3.60E-01
Annual Gamma Air Dose	mrad	7.41E-01	1.26E-01
I-131, 133, Tritium & Part. >8 Day Dose	mrem	4.94E+00	8.19E-01
<u>LIQUID</u>			
Total Body Dose	mrem	2.36E-01	6.60E-02
Critical Organ Dose	mrem	3.30E-01	9.70E-02

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

The annual liquid dose commitment is lower with LADTAP when total annual dilution flow is used. Day-by-day dose estimates provided by LRW software utilize dilution flow during actual release periods.

TABLE VI-C

H.B. ROBINSON UNIT NO. 2

MAXIMUM INDIVIDUAL DOSE FOR 1986 FROM IODINE 131, IODINE-133, PARTICULATES >8 DAY HALF LIVES & TRITIUM

ANNUAL BETA AIR DOSE = 3.595E-01 MILLRADS
 ANNUAL GAMMA AIR DOSE = 1.255E-01 MILLRADS

(MILLIREM)

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
ADULT	3.526E-02	3.369E-02	8.598E-03	3.667E-02	3.646E-02	6.505E-01	3.293E-02	3.347E-02
GROUND PLANE	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	6.866E-03
INHALATION	8.822E-03	8.735E-03	1.669E-04	8.920E-03	9.048E-03	7.621E-02	8.906E-03	8.682E-03
VEGETATION	1.811E-02	1.665E-02	2.374E-03	1.932E-02	1.901E-02	5.200E-01	1.590E-02	1.567E-02
MEAT & POULTRY	2.483E-03	2.459E-03	2.097E-04	2.584E-03	2.555E-03	4.844E-02	2.272E-03	2.252E-03
TEENAGER	3.629E-02	3.491E-02	9.314E-03	3.912E-02	3.815E-02	5.687E-01	3.463E-02	3.489E-02
GROUND PLANE	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	6.866E-03
INHALATION	8.905E-03	8.790E-03	2.335E-04	9.063E-03	9.238E-03	9.183E-02	9.065E-03	8.737E-03
VEGETATION	2.006E-02	1.881E-02	3.060E-03	2.260E-02	2.147E-02	4.362E-01	1.835E-02	1.794E-02
MEAT & POULTRY	1.477E-03	1.457E-03	1.731E-04	1.610E-03	1.589E-03	3.480E-02	1.362E-03	1.344E-03
CHILD	4.547E-02	4.362E-02	1.312E-02	5.089E-02	4.860E-02	8.194E-01	4.386E-02	4.400E-02
GROUND PLANE	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	6.866E-03
INHALATION	7.890E-03	7.749E-03	3.152E-04	8.044E-03	8.196E-03	1.003E-01	7.993E-03	7.726E-03
VEGETATION	2.997E-02	2.834E-02	6.641E-03	3.503E-02	3.262E-02	6.612E-01	2.839E-02	2.779E-02
MEAT & POULTRY	1.765E-03	1.683E-03	3.179E-04	1.971E-03	1.934E-03	5.212E-02	1.645E-03	1.623E-03
INFANT	1.041E-02	1.030E-02	6.089E-03	1.058E-02	1.060E-02	9.486E-02	1.046E-02	1.131E-02
GROUND PLANE	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	5.848E-03	6.866E-03
INHALATION	4.558E-03	4.451E-03	2.412E-04	4.728E-03	4.751E-03	8.901E-02	4.616E-03	4.442E-03

TABLE VI-D

H.B. ROBINSON UNIT NO. 2
ANNUAL INTEGRATED POPULATION DOSE SUMMARY FOR 1986
(MANREM)

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
** TOTAL **	4.200E-02	4.159E-02	2.718E-02	4.251E-02	4.280E-02	2.911E-01	4.390E-02	1.688E-01
PLUME	2.544E-02 60.56%	2.544E-02 61.15%	2.544E-02 93.58%	2.544E-02 59.83%	2.544E-02 59.43%	2.544E-02 8.74%	2.775E-02 63.21%	1.527E-01 90.46%
GROUND PLANE	8.682E-04 2.07%	8.682E-04 2.09%	8.682E-04 3.19%	8.682E-04 2.04%	8.682E-04 2.03%	8.682E-04 0.30%	8.682E-04 1.98%	1.019E-03 0.60%
INHALATION	7.369E-03 17.54%	7.286E-03 17.52%	1.611E-04 0.59%	7.461E-03 17.55%	7.576E-03 17.70%	6.806E-02 23.38%	7.411E-03 16.88%	7.249E-03 4.30%
VEGETATION	5.931E-03 14.12%	5.736E-03 13.79%	4.323E-04 1.59%	6.187E-03 14.55%	6.278E-03 14.67%	1.168E-01 40.13%	5.653E-03 12.88%	5.629E-03 3.34%
COW MILK	1.097E-03 2.61%	9.745E-04 2.34%	2.501E-04 0.92%	1.245E-03 2.93%	1.333E-03 3.12%	7.208E-02 24.76%	9.441E-04 2.15%	9.336E-04 0.55%
MEAT & POULTRY	1.299E-03 3.09%	1.294E-03 3.11%	3.319E-05 0.12%	1.318E-03 3.10%	1.313E-03 3.07%	7.848E-03 2.70%	1.272E-03 2.90%	1.269E-03 0.75%

C. Food Production Totals

The total quantity of vegetable products within a 50 mile radius of the Robinson Plant 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 source terms were segregated by modes of release (mixed mode batch, mixed mode continuous, ground level continuous, and ground level batch) for the year 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 10CFR50, 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 H. B. Robinson site based on 1985, 1986, 1987, and 1988 land use census reports.

The hypothetical maximum individual at the site boundary (SSE Sector) used for Technical Specification 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 H. B. Robinson site, 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 1988.

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 1988.

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 Lot	Ground Plane, Inhalation, Plume
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 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
<u>TOTAL</u>				=	<u>1.250E+06</u>	<u>143</u>

OCCUPATIONAL

<u>DISTANCE 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 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
402	Picnic Area	SE	4.00E+03	0.9
302	Visitor Center	S	8.00E+03	1
2529	Easterlings/Atkinsons	NE	3.63E+05	42
1303	Johnson	ENE	3.63E+05	41

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

- Table VI-A Hypothetical Offsite Maximum Individual Doses for 1988
- Table VI-B True Offsite Maximum Individual Doses for 1988
- Table VI-C Onsite Hypothetical Maximum Individual Doses for 1988
- Table VI-D Offsite Annual Integrated Population Dose Summary for 1988
- Table VI-E Onsite Annual Integrated and Recreational Population Doses for 1988

TABLE VI-A

GASEOUS PATHWAY
HYPOTHETICAL OFFSITE MAXIMUM INDIVIDUAL DOSES FOR 1988
(MILLIREM)

ANNUAL BETA AIR DOSE = 1.027E+00 MILLRADS
 ANNUAL GAMMA AIR DOSE = 3.793E-01 MILLRADS

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
ADULT	2.532E-01	2.535E-01	2.334E-01	2.533E-01	2.534E-01	3.227E-01	2.639E-01	7.309E-01
PLUME	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.406E-01	7.079E-01
GROUND PLANE	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	3.158E-03
INHALATION	6.493E-03	6.515E-03	3.002E-05	6.511E-03	6.529E-03	1.682E-02	7.291E-03	6.467E-03
VEGETATION	1.187E-02	1.207E-02	1.882E-04	1.196E-02	1.199E-02	6.615E-02	1.168E-02	1.167E-02
MEAT & POULTRY	1.704E-03	1.784E-03	1.665E-05	1.707E-03	1.706E-03	6.631E-03	1.679E-03	1.678E-03
TEENAGER	2.543E-01	2.545E-01	2.334E-01	2.544E-01	2.545E-01	3.156E-01	2.654E-01	7.320E-01
PLUME	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.406E-01	7.079E-01
GROUND PLANE	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	3.158E-03
INHALATION	6.538E-03	6.553E-03	4.219E-05	6.569E-03	6.593E-03	1.933E-02	7.713E-03	6.508E-03
VEGETATION	1.356E-02	1.376E-02	2.247E-04	1.370E-02	1.369E-02	5.856E-02	1.338E-02	1.336E-02
MEAT & POULTRY	1.019E-03	1.058E-03	1.383E-05	1.024E-03	1.024E-03	4.588E-03	1.002E-03	1.001E-03
CHILD	2.611E-01	2.611E-01	2.337E-01	2.614E-01	2.613E-01	3.492E-01	2.719E-01	7.388E-01
PLUME	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.406E-01	7.079E-01
GROUND PLANE	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	3.158E-03
INHALATION	5.784E-03	5.773E-03	5.724E-05	5.814E-03	5.835E-03	2.023E-02	6.731E-03	5.755E-03
VEGETATION	2.098E-02	2.095E-02	4.747E-04	2.121E-02	2.113E-02	8.923E-02	2.073E-02	2.070E-02
MEAT & POULTRY	1.234E-03	1.238E-03	2.559E-05	1.239E-03	1.239E-03	6.624E-03	1.210E-03	1.209E-03
INFANT	2.365E-01	2.365E-01	2.332E-01	2.365E-01	2.365E-01	2.497E-01	2.472E-01	7.144E-01
PLUME	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.305E-01	2.406E-01	7.079E-01
GROUND PLANE	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	2.685E-03	3.158E-03
INHALATION	3.329E-03	3.315E-03	4.296E-05	3.362E-03	3.362E-03	1.655E-02	3.933E-03	3.309E-03

TABLE VI-B

GASEOUS PATHWAY

TRUE OFFSITE MAXIMUM INDIVIDUAL DOSES FOR 1988
(MILLIREM)

ANNUAL BETA AIR DOSE = 9.808E-01 MILLRADS
 ANNUAL GAMMA AIR DOSE = 3.651E-01 MILLRADS

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
ADULT	2.307E-01	2.307E-01	2.242E-01	2.307E-01	2.307E-01	2.398E-01	2.409E-01	6.885E-01
PLUME	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.317E-01	6.795E-01
GROUND PLANE	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.516E-03
INHALATION	6.472E-03	6.489E-03	2.594E-05	6.489E-03	6.505E-03	1.566E-02	7.079E-03	6.450E-03
TEENAGER	2.307E-01	2.307E-01	2.242E-01	2.307E-01	2.307E-01	2.421E-01	2.412E-01	6.885E-01
PLUME	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.317E-01	6.795E-01
GROUND PLANE	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.516E-03
INHALATION	6.517E-03	6.527E-03	3.646E-05	6.544E-03	6.567E-03	1.790E-02	7.410E-03	6.491E-03
CHILD	2.299E-01	2.299E-01	2.242E-01	2.300E-01	2.300E-01	2.428E-01	2.403E-01	6.878E-01
PLUME	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.317E-01	6.795E-01
GROUND PLANE	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.516E-03
INHALATION	5.766E-03	5.754E-03	4.947E-05	5.791E-03	5.811E-03	1.863E-02	6.485E-03	5.740E-03
INFANT	2.275E-01	2.275E-01	2.242E-01	2.275E-01	2.275E-01	2.393E-01	2.376E-01	6.853E-01
PLUME	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.220E-01	2.317E-01	6.795E-01
GROUND PLANE	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.139E-03	2.516E-03
INHALATION	3.318E-03	3.306E-03	3.737E-05	3.346E-03	3.347E-03	1.509E-02	3.776E-03	3.301E-03

TABLE VI-C

GASEOUS PATHWAY

ONSITE HYPOTHETICAL MAXIMUM INDIVIDUAL DOSES FOR 1988
(MILLIREM)

<u>PATHWAY</u>	<u>TOTAL BODY</u>	<u>GI-LLI</u>	<u>BONE</u>	<u>LIVER</u>	<u>KIDNEY</u>	<u>THYROID</u>	<u>LUNG</u>	<u>SKIN</u>
Plume	3.02E-02	3.02E-02	3.03E-02	3.02E-02	3.02E-02	3.03E-02	2.84E-02	9.29E-02
Ground Plane	5.31E-04	5.31E-04	5.32E-04	5.31E-04	5.31E-04	5.32E-04	4.79E-04	6.23E-04
Inhalation	9.88E-04	9.91E-04	3.14E-06	9.90E-04	9.92E-04	2.07E-03	9.61E-04	9.83E-04
Total	3.18E-02	3.18E-02	3.08E-02	3.18E-02	3.18E-02	3.29E-02	2.99E-02	9.45E-02

ONSITE HYPOTHETICAL MAXIMUM INDIVIDUAL AIR DOSE FOR 1988 FROM RADIONOBLE GASES
(MILLIRADS)

Annual Beta Air Dose 1.33E-01
Annual Gamma Air Dose 4.97E-02

Location: Darlington County Electric Plant (NNW Sector)

TABLE VI-D

GASEOUS PATHWAY

OFFSITE ANNUAL INTEGRATED POPULATION DOSE SUMMARY FOR 1988
(PERSON-REM)

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
** TOTAL **	1.068E-01	1.068E-01	9.380E-02	1.068E-01	1.069E-01	1.320E-01	1.141E-01	4.313E-01
PLUME	9.354E-02 87.59%	9.354E-02 87.60%	9.354E-02 99.72%	9.354E-02 87.56%	9.354E-02 87.52%	9.354E-02 70.87%	1.008E-01 88.37%	4.181E-01 96.93%
GROUND PLANE	1.955E-04 0.18%	1.955E-04 0.18%	1.955E-04 0.21%	1.955E-04 0.18%	1.955E-04 0.18%	1.955E-04 0.15%	1.955E-04 0.17%	2.300E-04 0.05%
INHALATION	6.152E-03 5.76%	6.145E-03 5.75%	2.037E-05 0.02%	6.165E-03 5.77%	6.183E-03 5.78%	1.415E-02 10.72%	6.200E-03 5.44%	6.137E-03 1.42%
VEGETATION	5.275E-03 4.94%	5.269E-03 4.93%	3.795E-05 0.04%	5.294E-03 4.96%	5.317E-03 4.98%	1.844E-02 13.97%	5.248E-03 4.60%	5.247E-03 1.22%
COW MILK	5.351E-04 0.50%	5.311E-04 0.50%	8.980E-06 0.01%	5.399E-04 0.51%	5.461E-04 0.51%	3.745E-03 2.84%	5.292E-04 0.46%	5.292E-04 0.12%
MEAT & POULTRY	1.095E-03 1.03%	1.101E-03 1.03%	2.551E-06 0.00%	1.096E-03 1.03%	1.097E-03 1.03%	1.921E-03 1.46%	1.093E-03 0.96%	1.092E-03 0.25%

TABLE VI-E

GASEOUS PATHWAY

ONSITE ANNUAL INTEGRATED AND RECREATIONAL POPULATION DOSES FOR 1988
(PERSON-REM)

	TOTAL BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
** TOTAL **	6.863E-03	6.863E-03	6.554E-03	6.864E-03	6.865E-03	7.350E-03	7.284E-03	2.654E-02
PLUME	6.519E-03 94.98%	6.519E-03 94.98%	6.519E-03 99.47%	6.519E-03 94.97%	6.519E-03 94.95%	6.519E-03 88.69%	6.935E-03 95.21%	2.619E-02 98.68%
GROUND PLANE	3.368E-05 0.49%	3.368E-05 0.49%	3.368E-05 0.51%	3.368E-05 0.49%	3.368E-05 0.49%	3.368E-05 0.46%	3.368E-05 0.46%	3.962E-05 0.15%
INHALATION	3.085E-04 4.49%	3.082E-04 4.49%	1.258E-06 0.02%	3.093E-04 4.51%	3.104E-04 4.52%	7.878E-04 10.72%	3.125E-04 4.29%	3.076E-04 1.16%
VEGETATION	1.675E-06 0.02%	1.674E-06 0.02%	1.205E-08 0.00%	1.682E-06 0.02%	1.689E-06 0.02%	5.856E-06 0.08%	1.667E-06 0.02%	1.666E-06 0.01%
COW MILK	4.598E-07 0.01%	4.563E-07 0.01%	7.716E-09 0.00%	4.639E-07 0.01%	4.693E-07 0.01%	3.218E-06 0.04%	4.548E-07 0.01%	4.547E-07 0.00%
MEAT & POULTRY	3.479E-07 0.01%	3.497E-07 0.01%	8.103E-10 0.00%	3.482E-07 0.01%	3.484E-07 0.01%	6.100E-07 0.01%	3.470E-07 0.00%	3.470E-07 0.00%

II. 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, 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

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

where: C_1 = Average concentration of each radionuclide in the

lake
(Ci/m³)

Q = Rate of addition of each radionuclide into cooling

water
(Ci/yr)

V = Volume of water in lake (m³)

Λ = 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 (m^3/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 (Ci/m^3)

C_1 is the equilibrium concentration in the lake (Ci/m^3)

C_a is the concentration added to the water while passing through the plant = Q/f_1 (Ci/m^3)

f_1 is the cooling water flow rate (m^3/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:

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

For Robinson $f_1 = 9.59E8 \text{ m}^3/\text{yr}$
and $f_2 = 2.15E8 \text{ m}^3/\text{yr}$
thus $M_m = 0.835$

The mixing ratio for the lake in general M_1 is the ratio

$$\frac{\text{Equilibrium lake concentration}}{\text{Concentration in discharge canal}} = \frac{C_l}{C_d}$$
$$= \frac{\frac{Q}{f_2}}{\frac{Q}{f_1} + \frac{Q}{f_2}} = \frac{f_1}{f_1 + f_2}$$

For 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 Co^{60} , Cs^{134} , and Cs^{137} . All of these isotopes have decay constants which are at least 12 times smaller than the loss rate constant of the lake

$\frac{f_2}{v} = \frac{2.15E8 \text{ m}^3/\text{yr}}{5.06E7 \text{ m}^3} = 4.24$ per year. Thus, ignoring decay should have little effect.

For Auburndale Plantation the equation for mixing ratio is $e^{-.02}$ (distance downstream [Km]). Equation was derived from EPA-520/5-76-005 study.

2. Refueling Water Storage Tank Drain Valve Leakage

a. Description

On December 23, 1988, plant personnel discovered a small leak by the Refueling Water Storage Tank (RWST) drain valve. This leak, estimated at approximately 200 milliliters per day, allowed water from the RWST to enter an outside storm drain.

b. Accountability and Corrective Action

Upon discovery, the leaking drain was sampled for isotopic analysis. Also, sand located in the storm drain pit was sampled for isotopic analysis. Due to the isotopes and their relative abundances found in the liquid and soil samples, the assumption was made that this leak had been in progress for all of 1988. Accordingly, a separate LADTAP calculation was initiated to ensure that 10CFR50, Appendix I dose limits were not exceeded (see Table VII-D). The curie and dose totals of Table IV-A (Enclosure I) include only the period that the West Settling Pond discharge was routed to the plant discharge canal for dilution. The LADTAP calculations assume a one-year release using Settling Pond Discharge flow and Lake Robinson spillway flow for dilution. The weekly analysis of the West Settling Pond composite sample has shown no detectable activity in 1988 since the RWST leakage is diluted by other inputs to the West Settling pond.

In order to secure this release, the following actions were taken:

1. initially, a plastic bag was used to collect the leakage,
2. and a cap was welded into place to seal the end of the drain.

3. Potable Water Use

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

4. Irrigated Foods

Located ten miles east of Robinson Site, the Auburndale Plantation uses water from Black Creek for irrigating. Based on observation, 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 = $1.00E+01$ hours,
3. Irrigation rate = $1.00E+02$ liter/m²/month
4. Non-irrigated feed fraction = $9.00E-01$
5. Total 50 mile production $1.96E+08$ kg/yr
6. Total meat irrigated $1.00E+06$ kg/yr
7. Food process time = $4.80E+00$ hours

b. Produce

1. Irrigation rate = $1.00E+02$ liters/m²/month
2. Total 50 mile production = $6.10E+06$ kg/yr
3. Total crop irrigation = $4.00E+03$ kg

c. Leafy Vegetables

1. Irrigation rate = $1.00E+02$ liter/m²/month
2. Total 50 mile production = $2.59E+08$ kg/yr
3. Total crop irrigated = $2.00E+03$ kg/yr

5. 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 H. B. Robinson 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 days/yr x 2 hrs/day = 240 hrs/yr
 Teen - 180 days/yr x 2 hrs/day = 360 hrs/yr
 Child - 90 days/yr x 2 hrs/day = 180 hrs/yr

Swimming

Adult - 90 days/yr x 2 hrs/day = 180 hrs/yr
 Teen - 180 days/yr x 2 hrs/day = 360 hrs/yr
 Child - 90 days/yr x 3 hrs/day = 270 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	none
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 with 10CFR50, 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 Specifications. 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 H. B. Robinson site (inclusive of the onsite doses) are summarized in Table VII-C.

F. Data Tables

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

Table VII-A	Hypothetical Maximum Individual Doses for 1988
Table VII-B	Lake Robinson (onsite) Annual Integrated and Recreational Population Doses for 1988
Table VII-C	Annual Integrated Population Dose Summary for 1988
Table VII-D	Hypothetical Maximum Individual From RWST Release
Table VII-E	Annual Integrated Population Dose Summary for RWST Release

TABLE VII-A
 LIQUID PATHWAY
 HYPOTHETICAL MAXIMUM INDIVIDUAL DOSES FOR 1988
 (MILLIREM)

A D U L T D O S E S

<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		2.53E-02	3.98E-02	2.83E-02	1.30E-03	1.32E-02	6.16E-03	2.48E-02
Shoreline	2.02E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03	1.72E-03
Swimming		2.23E-04	2.23E-04	2.23E-04	2.23E-04	2.23E-04	2.23E-04	2.23E-04
Boating		1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04
Total	2.02E-03	2.74E-02	4.19E-02	3.04E-02	3.40E-03	1.53E-02	8.25E-03	2.69E-02

	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	

T E E N A G E R D O S E S

(MILLIREM)

<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		2.67E-02	4.09E-02	1.69E-02	1.04E-03	1.33E-02	6.93E-03	1.76E-02
Shoreline	1.13E-02	9.62E-03	9.62E-03	9.62E-03	9.62E-03	9.62E-03	9.62E-03	9.62E-03
Swimming		4.45E-04	4.45E-04	4.45E-04	4.45E-04	4.45E-04	4.45E-04	4.45E-04
Boating		2.23E-04	2.23E-04	2.23E-04	2.23E-04	2.23E-04	2.23E-04	2.23E-04
Total	1.13E-02	3.70E-02	5.12E-02	2.72E-02	1.13E-02	2.36E-02	1.72E-02	2.79E-02

	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 (Cont.)

C H I L D D O S E S

(MILLIREM)

<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		3.35E-02	3.62E-02	8.04E-03	9.07E-04	1.13E-02	5.63E-03	6.63E-03
Shoreline	2.36E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03	2.01E-03
Swimming		3.34E-04	3.34E-04	3.34E-04	3.34E-04	3.34E-04	3.34E-04	3.34E-04
Boating		1.11E-04	1.11E-04	1.11E-04	1.11E-04	1.11E-04	1.11E-04	1.11E-04
Total	2.36E-03	3.59E-02	3.86E-02	1.05E-02	3.36E-03	1.37E-02	8.09E-03	9.09E-03

	USAGE (KG/YR, HR/YR)	DILUTION	TIME(HR)	SHORE WIDTH FACTOR = 0.3
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 1988
(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	1.19E-02	1.74E-02	1.04E-02	4.63E-04	5.70E-03	2.72E-03	8.11E-03	0.00E+00
Shoreline	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.21E-01
Swimming	4.45E-04	4.45E-04	4.45E-04	4.45E-04	4.45E-04	4.45E-04	4.45E-04	0.00E+00
Boating	1.81E-04	1.81E-04	1.81E-04	1.81E-04	1.81E-04	1.81E-04	1.81E-04	0.00E+00
Total	1.16E-01	1.21E-01	1.14E-01	1.04E-01	1.09E-01	1.06E-01	1.12E-01	1.21E-01

TABLE VII-C

LIQUID PATHWAY
ANNUAL INTEGRATED POPULATION DOSE SUMMARY FOR 1988
(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	2.48E-02	3.61E-02	2.15E-02	9.62E-04	1.18E-02	5.65E-03	1.69E-02	0.00E+00
Shoreline	1.82E-01	1.82E-01	1.82E-01	1.82E-01	1.82E-01	1.82E-01	1.82E-01	2.13E-01
Swimming	7.07E-04	7.07E-04	7.07E-04	7.07E-04	7.07E-04	7.07E-04	7.07E-04	0.00E+00
Boating	1.98E-04	1.98E-04	1.98E-04	1.98E-04	1.98E-04	1.98E-04	1.98E-04	0.00E+00
Irri. Veg.	8.93E-05	3.25E-04	3.05E-04	2.49E-04	2.59E-04	2.75E-04	5.00E-04	0.00E+00
Irri. Leafy Veg.	1.72E-05	6.86E-05	6.55E-05	5.49E-05	5.51E-05	5.84E-05	1.30E-04	0.00E+00
Irr. Meat	1.01E-04	1.22E-04	8.37E-05	4.58E-05	4.81E-05	8.25E-05	2.50E-04	0.00E+00
Total	2.08E-01	2.20E-01	2.05E-01	1.84E-01	1.95E-01	1.89E-01	2.01E-01	2.13E-01

TABLE VII-D
LIQUID PATHWAY
 HYPOTHETICAL MAXIMUM INDIVIDUAL FROM RWST RELEASE
 (MILLIREM)

A D U L T D O S E S

<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		2.51E-04	4.29E-04	3.13E-04	1.45E-06	1.42E-04	4.72E-05	1.86E-04
Shoreline	2.55E-06	2.17E-06	2.17E-06	2.17E-06	2.17E-06	2.17E-06	2.17E-06	2.17E-06
Swimming		3.28E-07	3.28E-07	3.28E-07	3.28E-07	3.28E-07	3.28E-07	3.28E-07
Boating		2.18E-07	2.18E-07	2.18E-07	2.18E-07	2.18E-07	2.18E-07	2.18E-07
Total	2.55E-06	2.54E-04	4.31E-04	3.16E-04	4.17E-06	1.45E-04	4.99E-05	1.88E-04

	USAGE (KG/YR, HR/YR)	DILUTION	TIME(HR)	SHORE WIDTH FACTOR = 0.2
Fish	21.0	1.0	48.00	
Shoreline	12.0	1.0	24.00	
Swimming	180.0	1.0	24.00	
Boating	240.0	1.0	24.00	

T E E N A G E R D O S E S

(MILLIREM)

<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		2.65E-04	4.41E-04	1.78E-04	1.35E-06	1.45E-04	5.60E-05	1.31E-04
Shoreline	1.42E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05	1.21E-05
Swimming		6.55E-07	6.55E-07	6.55E-07	6.55E-07	6.55E-07	6.55E-07	6.55E-07
Boating		3.28E-07	3.28E-07	3.28E-07	3.28E-07	3.28E-07	3.28E-07	3.28E-07
Total	1.42E-05	2.79E-04	4.54E-04	1.91E-04	1.45E-05	1.58E-04	6.91E-05	1.44E-04

	USAGE (KG/YR, HR/YR)	DILUTION	TIME(HR)	SHORE WIDTH FACTOR = 0.2
Fish	16.0	1.0	48.00	
Shoreline	67.0	1.0	24.00	
Swimming	360.0	1.0	24.00	
Boating	360.0	1.0	24.00	

TABLE VII-D (Cont.)

C H I L D D O S E S

(MILLIREM)

<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		3.30E-04	3.86E-04	6.92E-05	1.39E-06	1.23E-04	4.42E-05	4.70E-05
Shoreline	2.98E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06
Swimming		4.92E-07	4.92E-07	4.92E-07	4.92E-07	4.92E-07	4.92E-07	4.92E-07
Boating		1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07	1.64E-07
Total	2.98E-06	3.33E-04	3.90E-04	7.24E-05	4.58E-06	1.26E-04	4.74E-05	5.02E-05

	USAGE (KG/YR, HR/YR)	DILUTION	TIME(HR)	SHORE WIDTH FACTOR = 0.2
Fish	6.9	1.0	48.00	
Shoreline	14.0	1.0	24.00	
Swimming	270.0	1.0	24.00	
Boating	180.0	1.0	24.00	

TABLE VII-E
LIQUID PATHWAY
ANNUAL INTEGRATED AND RECREATION POPULATION DOSES FROM RWST RELEASE
(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	1.30E-04	2.06E-04	1.25E-04	4.19E-07	6.80E-05	2.32E-05	6.85E-05	0.00E+00
Shoreline	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.78E-04
Swimming	3.93E-07	3.93E-07	3.93E-07	3.93E-07	3.93E-07	3.93E-07	3.93E-07	0.00E+00
Boating	2.66E-08	2.66E-08	2.66E-08	2.66E-08	2.66E-08	2.66E-08	2.66E-08	0.00E+00
Irrig Veg	2.17E-07	3.21E-07	1.87E-07	2.03E-09	1.01E-07	3.97E-08	2.97E-07	0.00E+00
Irrig Leafy Veg	4.01E-08	6.48E-08	4.50E-08	1.12E-08	2.05E-08	8.03E-09	8.24E-08	0.00E+00
Irrig Meat	3.67E-08	6.58E-08	5.72E-08	1.90E-09	1.86E-08	7.26E-09	2.44E-07	0.00E+00
Total	2.83E-04	3.59E-04	2.77E-04	1.53E-04	2.20E-04	1.76E-04	2.21E-04	1.78E-04

VIII. 40CFR190 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, and since no 10CFR50 Appendix I limits have been exceeded, and there are no other nearby uranium fuel cycle sources to be considered, this demonstrates conformance with 40CFR190, 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 through December 31, 1988.

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>
4.6	4.6	6.3	38.0	23.5	10.3	12.7

2. Wind Speed

10 Meter

Average Speed (mph)	4.8
Percent Calm	2.5
Percent Less than 3.5 mph	37.4

3. Wind Direction

10 Meter

Prevailing Direction	SOUTH
Percent Occurrence	10.5

4. Data Recovery

10 Meter

Percent Good Hours	99.7
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TABLE IX-A
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989 1

SITE=ROBN PERIOD=YRC1988 SUMMARY OVER ALL STAB

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	11.9/ 0.14	163/ 1.86	298/ 3.40	173/ 1.98	12/ 0.14	/	/	657.9/ 7.51	5.70171
NNE	7.0/ 0.08	96/ 1.10	389/ 4.44	296/ 3.38	5/ 0.06	/	/	793.0/ 9.05	6.49193
NE	6.4/ 0.07	88/ 1.00	320/ 3.65	69/ 0.79	2/ 0.02	/	/	485.4/ 5.54	5.30026
ENE	5.6/ 0.06	77/ 0.88	242/ 2.76	19/ 0.22	1/ 0.01	/	/	344.6/ 3.93	4.84764
E	5.6/ 0.06	76/ 0.87	122/ 1.39	15/ 0.17	/	/	/	218.6/ 2.50	4.24425
ESE	5.6/ 0.06	77/ 0.88	105/ 1.20	4/ 0.05	/	/	/	191.6/ 2.19	3.87979
SE	6.6/ 0.08	90/ 1.03	154/ 1.76	14/ 0.16	2/ 0.02	/	/	266.6/ 3.04	4.28100
SSE	17.8/ 0.20	244/ 2.79	364/ 4.16	67/ 0.77	3/ 0.03	/	/	695.8/ 7.94	4.43338
S	24.7/ 0.28	338/ 3.86	380/ 4.34	164/ 1.87	17/ 0.19	/	/	923.7/10.55	4.91594
SSW	24.7/ 0.28	338/ 3.86	353/ 4.03	161/ 1.84	29/ 0.33	/	/	905.7/10.34	5.07449
SW	16.9/ 0.19	231/ 2.64	345/ 3.94	137/ 1.56	18/ 0.21	/	/	747.9/ 8.54	5.19385
WSW	15.3/ 0.17	209/ 2.39	209/ 2.39	57/ 0.65	/	/	/	490.3/ 5.60	4.18905
W	12.8/ 0.15	175/ 2.00	146/ 1.67	59/ 0.67	3/ 0.03	/	/	395.8/ 4.52	4.36044
WNW	15.2/ 0.17	208/ 2.37	113/ 1.29	57/ 0.65	2/ 0.02	/	/	395.2/ 4.51	3.93341
NW	20.3/ 0.23	278/ 3.17	148/ 1.69	43/ 0.49	/	/	/	489.3/ 5.59	3.52486
NNW	26.5/ 0.30	363/ 4.14	284/ 3.24	79/ 0.90	4/ 0.05	/	/	756.5/ 8.64	4.03980
TOTAL	223.0/ 2.55	3051/34.84	3972/45.35	1414/16.15	98/ 1.12	/	/	8758/ 100	4.81572

NUMBER OF BAD RECORDS: 26

TABLE IX-A (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989

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SITE=ROBN PERIOD=YRC1988 STAB=A

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	6/ 0.07	35/ 0.40	3/ 0.03	/	/	44.0/ 0.50	8.96888
NNE	/	/	8/ 0.09	26/ 0.30	1/ 0.01	/	/	35.0/ 0.40	8.72960
NE	/	1/ 0.01	9/ 0.10	10/ 0.11	1/ 0.01	/	/	21.0/ 0.24	7.21075
ENE	/	2/ 0.02	27/ 0.31	7/ 0.08	/	/	/	36.0/ 0.41	6.60423
E	/	/	12/ 0.14	3/ 0.03	/	/	/	15.0/ 0.17	6.15752
ESE	/	2/ 0.02	7/ 0.08	/	/	/	/	9.0/ 0.10	4.73385
SE	/	/	16/ 0.18	1/ 0.01	/	/	/	17.0/ 0.19	5.88726
SSE	/	/	17/ 0.19	11/ 0.13	/	/	/	28.0/ 0.32	7.32509
S	/	1/ 0.01	5/ 0.06	29/ 0.33	6/ 0.07	/	/	41.0/ 0.47	9.63124
SSW	/	1/ 0.01	4/ 0.05	31/ 0.35	10/ 0.11	/	/	46.0/ 0.53	10.50380
SW	/	/	7/ 0.08	24/ 0.27	3/ 0.03	/	/	34.0/ 0.39	9.12122
WSW	/	/	5/ 0.06	7/ 0.08	/	/	/	12.0/ 0.14	8.37780
W	/	/	6/ 0.07	14/ 0.16	/	/	/	20.0/ 0.23	8.35723
WNW	/	/	9/ 0.10	14/ 0.16	/	/	/	23.0/ 0.26	7.98732
NW	/	/	3/ 0.03	8/ 0.09	/	/	/	11.0/ 0.13	7.99036
NNW	/	/	3/ 0.03	4/ 0.05	/	/	/	7.0/ 0.08	7.95397
TOTAL	/	7/ 0.08	144/ 1.64	224/ 2.56	24/ 0.27	/	/	399.0/ 4.56	8.30234

NUMBER OF BAD RECORDS: 0

TABLE IX A (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989

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SITE=ROBN PERIOD=YRC1988 STAB=B

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	16/ 0.18	16/ 0.18	/	/	/	32.0/ 0.37	8.10561
NNE	/	/	18/ 0.21	15/ 0.17	/	/	/	33.0/ 0.38	7.79683
NE	/	1/ 0.01	16/ 0.18	14/ 0.16	/	/	/	31.0/ 0.35	7.37196
ENE	/	1/ 0.01	26/ 0.30	3/ 0.03	/	/	/	30.0/ 0.34	5.96854
E	/	1/ 0.01	12/ 0.14	1/ 0.01	/	/	/	14.0/ 0.16	5.35387
ESE	/	2/ 0.02	10/ 0.11	1/ 0.01	/	/	/	13.0/ 0.15	4.73826
SE	/	/	17/ 0.19	5/ 0.06	/	/	/	22.0/ 0.25	5.96283
SSE	/	/	20/ 0.23	8/ 0.09	1/ 0.01	/	/	29.0/ 0.33	7.12425
S	/	1/ 0.01	15/ 0.17	17/ 0.19	1/ 0.01	/	/	34.0/ 0.39	7.71562
SSW	/	/	18/ 0.21	20/ 0.23	3/ 0.03	/	/	41.0/ 0.47	8.48432
Sw	/	/	19/ 0.22	20/ 0.23	6/ 0.07	/	/	45.0/ 0.51	8.73029
WSw	/	/	11/ 0.13	14/ 0.16	/	/	/	25.0/ 0.29	8.06003
W	/	2/ 0.02	7/ 0.08	13/ 0.15	1/ 0.01	/	/	23.0/ 0.26	7.63425
WNW	/	1/ 0.01	3/ 0.03	10/ 0.11	/	/	/	14.0/ 0.16	7.81105
NW	/	/	5/ 0.06	4/ 0.05	/	/	/	9.0/ 0.10	7.66309
NNW	/	/	1/ 0.01	5/ 0.06	1/ 0.01	/	/	7.0/ 0.08	10.10981
TOTAL	/	9/ 0.10	214/ 2.44	166/ 1.90	13/ 0.15	/	/	402.0/ 4.59	7.53191

NUMBER OF BAD RECORDS: 0

TABLE IX-A (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989

4
89

SITE=ROBN PERIOD=YRC1988 STAB=C

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	26/ 0.30	29/ 0.33	1/ 0.01	/	/	56.0/ 0.64	7.85621
NNE	/	2/ 0.02	33/ 0.38	17/ 0.19	/	/	/	52.0/ 0.59	6.76428
NE	/	/	32/ 0.37	7/ 0.08	/	/	/	39.0/ 0.45	5.87430
ENE	/	/	34/ 0.39	/	/	/	/	34.0/ 0.39	5.47136
E	/	3/ 0.03	18/ 0.21	/	/	/	/	21.0/ 0.24	4.58642
ESE	/	4/ 0.05	23/ 0.26	/	/	/	/	27.0/ 0.31	4.42876
SE	/	5/ 0.06	21/ 0.24	1/ 0.01	/	/	/	27.0/ 0.31	4.61712
SSE	/	1/ 0.01	28/ 0.32	8/ 0.09	/	/	/	37.0/ 0.42	6.06654
S	/	/	20/ 0.23	14/ 0.16	1/ 0.01	/	/	35.0/ 0.40	7.52900
SSW	/	/	27/ 0.31	29/ 0.33	1/ 0.01	/	/	57.0/ 0.65	7.88435
SW	/	1/ 0.01	51/ 0.58	24/ 0.27	2/ 0.02	/	/	78.0/ 0.89	7.16768
WSW	/	1/ 0.01	19/ 0.22	8/ 0.09	/	/	/	28.0/ 0.32	6.78077
W	/	/	16/ 0.18	5/ 0.06	1/ 0.01	/	/	22.0/ 0.25	7.19450
WNW	/	/	7/ 0.08	10/ 0.11	2/ 0.02	/	/	19.0/ 0.22	8.78772
NW	/	1/ 0.01	6/ 0.07	2/ 0.02	/	/	/	9.0/ 0.10	6.85713
NNW	/	/	10/ 0.11	4/ 0.05	/	/	/	14.0/ 0.16	7.10712
TOTAL	/	18/ 0.21	371/ 4.24	158/ 1.80	8/ 0.09	/	/	555.0/ 6.34	6.70298

NUMBER OF BAD RECORDS: 0

TABLE IX-A (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989

5
89

SITE=ROBN PERIOD=YRC1988 STAB=D

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	36/ 0.41	176/ 2.01	86/ 0.98	8/ 0.09	/	/	306.0/ 3.49	6.41789
NNE	/	28/ 0.32	266/ 3.04	233/ 2.66	4/ 0.05	/	/	531.0/ 6.06	6.99961
NE	/	35/ 0.40	221/ 2.52	38/ 0.43	/	/	/	294.0/ 3.36	5.53111
ENE	/	42/ 0.48	140/ 1.60	9/ 0.10	1/ 0.01	/	/	192.0/ 2.19	4.76931
E	/	42/ 0.48	76/ 0.87	11/ 0.13	/	/	/	129.0/ 1.47	4.41681
ESE	/	48/ 0.55	60/ 0.69	2/ 0.02	/	/	/	110.0/ 1.26	3.96577
SE	/	57/ 0.65	94/ 1.07	7/ 0.08	/	/	/	158.0/ 1.80	4.26331
SSE	/	34/ 0.39	168/ 1.92	34/ 0.39	2/ 0.02	/	/	238.0/ 2.72	5.38021
S	/	27/ 0.31	165/ 1.88	69/ 0.79	5/ 0.06	/	/	266.0/ 3.04	6.33420
SSW	/	31/ 0.35	170/ 1.94	60/ 0.69	11/ 0.13	/	/	272.0/ 3.11	6.32669
SW	/	25/ 0.29	140/ 1.60	56/ 0.64	7/ 0.08	/	/	228.0/ 2.60	6.37373
WSW	/	33/ 0.38	101/ 1.15	21/ 0.24	/	/	/	155.0/ 1.77	5.27163
W	/	36/ 0.41	71/ 0.81	25/ 0.29	1/ 0.01	/	/	133.0/ 1.52	5.32923
WNW	/	28/ 0.32	43/ 0.49	22/ 0.25	/	/	/	93.0/ 1.06	5.48894
NW	/	14/ 0.16	51/ 0.58	22/ 0.25	/	/	/	87.0/ 0.99	5.98473
NNW	/	22/ 0.25	70/ 0.80	40/ 0.46	3/ 0.03	/	/	135.0/ 1.54	6.24670
TOTAL	/	538/ 6.14	2012/22.97	735/ 8.39	42/ 0.48	/	/	3327/37.99	5.84368

NUMBER OF BAD RECORDS: 0

TABLE IV (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989 6

SITE=ROBN PERIOD=YRC1988 STAB=E

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	0.7/ 0.01	52/ 0.59	71/ 0.81	7/ 0.08	/	/	/	130.7/ 1.49	4.14377
NNE	0.5/ 0.01	38/ 0.43	64/ 0.73	5/ 0.06	/	/	/	107.5/ 1.23	4.33065
NE	0.5/ 0.01	39/ 0.45	38/ 0.43	/	/	/	/	77.5/ 0.88	3.58577
ENE	0.3/ 0.00	25/ 0.29	14/ 0.16	/	/	/	/	39.3/ 0.45	3.31145
E	0.4/ 0.00	28/ 0.32	4/ 0.05	/	/	/	/	32.4/ 0.37	2.66079
ESE	0.2/ 0.00	17/ 0.19	5/ 0.06	1/ 0.01	/	/	/	23.2/ 0.26	3.12979
SE	0.2/ 0.00	18/ 0.21	6/ 0.07	/	2/ 0.02	/	/	26.2/ 0.30	3.47342
SSE	1.3/ 0.01	97/ 1.11	108/ 1.23	6/ 0.07	/	/	/	212.3/ 2.42	3.94118
S	1.7/ 0.02	127/ 1.45	152/ 1.74	35/ 0.40	4/ 0.05	/	/	319.7/ 3.65	4.53311
SSW	1.6/ 0.02	126/ 1.44	113/ 1.29	19/ 0.22	4/ 0.05	/	/	263.6/ 3.01	4.21062
SW	1.2/ 0.01	90/ 1.03	99/ 1.13	12/ 0.14	/	/	/	202.2/ 2.31	3.91920
WSW	0.8/ 0.01	58/ 0.66	53/ 0.61	7/ 0.08	/	/	/	118.8/ 1.36	3.85223
W	0.8/ 0.01	59/ 0.67	38/ 0.43	2/ 0.02	/	/	/	99.8/ 1.14	3.20835
WNW	0.5/ 0.01	41/ 0.47	37/ 0.42	1/ 0.01	/	/	/	79.5/ 0.91	3.56000
NW	0.6/ 0.01	45/ 0.51	48/ 0.55	7/ 0.08	/	/	/	100.6/ 1.15	4.10485
NNW	0.8/ 0.01	63/ 0.72	133/ 1.52	26/ 0.30	/	/	/	222.8/ 2.54	4.86134
TOTAL	12.0/ 0.14	923/10.54	983/11.22	128/ 1.46	10/ 0.11	/	/	2056/23.48	4.09058

NUMBER OF BAD RECORDS: 0

TABLE IX-A (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 1989 7

SITE=ROBN PERIOD=YRC1988 STAB=F

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	1.5/ 0.02	29/ 0.33	2/ 0.02	/	/	/	/	32.5/ 0.37	1.91863
NNE	0.8/ 0.01	15/ 0.17	/	/	/	/	/	15.8/ 0.18	1.58939
NE	0.4/ 0.00	7/ 0.08	4/ 0.05	/	1/ 0.01	/	/	12.4/ 0.14	3.65638
ENE	0.3/ 0.00	5/ 0.06	1/ 0.01	/	/	/	/	6.3/ 0.07	1.85673
E	0.1/ 0.00	1/ 0.01	/	/	/	/	/	1.1/ 0.01	0.94364
ESE	0.1/ 0.00	2/ 0.02	/	/	/	/	/	2.1/ 0.02	1.23275
SE	0.2/ 0.00	3/ 0.03	/	/	/	/	/	3.2/ 0.04	1.20632
SSE	3.0/ 0.03	56/ 0.64	22/ 0.25	/	/	/	/	81.0/ 0.92	2.55702
S	5.7/ 0.07	108/ 1.23	21/ 0.24	/	/	/	/	134.7/ 1.54	2.43742
SSW	5.0/ 0.06	95/ 1.08	17/ 0.19	1/ 0.01	/	/	/	118.0/ 1.35	2.42230
SW	2.5/ 0.03	48/ 0.55	23/ 0.26	1/ 0.01	/	/	/	74.5/ 0.85	2.89488
WSW	2.4/ 0.03	46/ 0.53	16/ 0.18	/	/	/	/	64.4/ 0.74	2.34329
W	1.9/ 0.02	36/ 0.41	6/ 0.07	/	/	/	/	43.9/ 0.50	2.35822
WNW	2.1/ 0.02	40/ 0.46	11/ 0.13	/	/	/	/	53.1/ 0.61	2.56671
NW	4.3/ 0.05	82/ 0.94	32/ 0.37	/	/	/	/	118.3/ 1.35	2.80182
NNW	4.8/ 0.05	91/ 1.04	41/ 0.47	/	/	/	/	136.8/ 1.56	2.96163
TOTAL	35.0/ 0.40	664/ 7.58	196/ 2.24	2/ 0.02	1/ 0.01	/	/	898.0/ 10.25	2.57936

NUMBER OF BAD RECORDS: 0

Enclosure 1 to Serial: RNPD/89-0360
Page 58 of 77

TABLE IX-A (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

9:33 FRIDAY, JANUARY 20 1989

SITE=ROBN PERIOD=YRC1988 STAB=G

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	9.1/ 0.10	46/ 0.53	1/ 0.01	/	/	/	/	56.1/ 0.64	1.43069
NNE	2.6/ 0.03	13/ 0.15	/	/	/	/	/	15.6/ 0.18	1.11645
NE	1.0/ 0.01	5/ 0.06	/	/	/	/	/	6.0/ 0.07	0.98518
ENE	0.4/ 0.00	2/ 0.02	/	/	/	/	/	2.4/ 0.03	0.96573
E	0.2/ 0.00	1/ 0.01	/	/	/	/	/	1.2/ 0.01	1.04910
ESE	0.4/ 0.00	2/ 0.02	/	/	/	/	/	2.4/ 0.03	0.94489
SE	1.4/ 0.02	7/ 0.08	/	/	/	/	/	8.4/ 0.10	0.93397
SSE	11.0/ 0.13	56/ 0.64	1/ 0.01	/	/	/	/	68.0/ 0.78	1.61055
S	14.6/ 0.17	74/ 0.84	2/ 0.02	/	/	/	/	90.6/ 1.03	1.52756
SSW	16.8/ 0.19	85/ 0.97	4/ 0.05	1/ 0.01	/	/	/	106.8/ 1.22	1.76765
SW	13.2/ 0.15	67/ 0.77	6/ 0.07	/	/	/	/	86.2/ 0.98	1.73766
WSW	14.0/ 0.16	71/ 0.81	4/ 0.05	/	/	/	/	89.0/ 1.02	1.48683
W	8.3/ 0.09	42/ 0.48	2/ 0.02	/	/	/	/	52.3/ 0.60	1.56207
WNW	19.3/ 0.22	98/ 1.12	3/ 0.03	/	/	/	/	120.3/ 1.37	1.31738
NW	26.8/ 0.31	136/ 1.55	3/ 0.03	/	/	/	/	165.8/ 1.89	1.46096
NNW	36.9/ 0.42	187/ 2.14	26/ 0.30	/	/	/	/	249.9/ 2.85	1.96488
TOTAL	176.0/ 2.01	892/10.18	52/ 0.59	1/ 0.01	/	/	/	1121/12.80	1.61420

NUMBER OF BAD RECORDS: 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 through December 31, 1988.

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 evaluation.

TABLE IX-B

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 1989

SITE=ROBN PERIOD=YRMB1988 SUMMARY OVER ALL STAB

LOWNDDEG=	LOWNDSPD							AVERAGE	
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25	TOTAL	LOWNDSPD
N	1.1/ 0.06	20/ 1.15	42/ 2.42	29/ 1.67	1/ 0.06	/	/	93.1/ 5.36	6.24049
NNE	1.1/ 0.06	20/ 1.15	43/ 2.48	42/ 2.42	1/ 0.06	/	/	107.1/ 6.17	6.25210
NE	0.7/ 0.04	13/ 0.75	54/ 3.11	13/ 0.75	1/ 0.06	/	/	81.7/ 4.70	5.47560
ENE	0.8/ 0.05	15/ 0.86	30/ 1.73	4/ 0.23	/	/	/	49.8/ 2.87	4.74366
E	0.4/ 0.02	8/ 0.46	25/ 1.44	6/ 0.35	/	/	/	39.4/ 2.27	5.24077
ESE	0.8/ 0.05	15/ 0.86	10/ 0.58	3/ 0.17	/	/	/	28.8/ 1.66	4.23879
SE	1.2/ 0.07	21/ 1.21	36/ 2.07	3/ 0.17	2/ 0.12	/	/	63.2/ 3.64	4.50962
SSE	3.1/ 0.18	55/ 3.17	101/ 5.81	27/ 1.55	2/ 0.12	/	/	188.1/ 10.83	4.93662
S	3.7/ 0.21	66/ 3.80	77/ 4.43	45/ 2.59	6/ 0.35	/	/	197.7/ 11.38	5.30742
SSW	3.9/ 0.22	69/ 3.97	79/ 4.55	34/ 1.96	5/ 0.29	/	/	190.9/ 10.99	5.11840
SW	3.4/ 0.20	60/ 3.45	73/ 4.20	22/ 1.27	/	/	/	158.4/ 9.12	4.58388
WSW	2.2/ 0.13	40/ 2.30	53/ 3.05	12/ 0.69	/	/	/	107.2/ 6.17	4.47940
W	2.9/ 0.17	51/ 2.94	44/ 2.53	14/ 0.81	1/ 0.06	/	/	112.9/ 6.50	4.29856
WNW	2.4/ 0.14	43/ 2.48	35/ 2.01	6/ 0.35	1/ 0.06	/	/	87.4/ 5.03	3.99053
NW	2.8/ 0.16	50/ 2.88	33/ 1.90	13/ 0.75	/	/	/	98.8/ 5.69	3.94477
NNW	4.5/ 0.26	80/ 4.61	42/ 2.42	5/ 0.29	1/ 0.06	/	/	132.5/ 7.63	3.28514
TOTAL	35.0/ 2.01	626/ 36.04	777/ 44.73	278/ 16.00	21/ 1.21	/	/	1737/ 100	4.81755

NUMBER OF BAD RECORDS: 6

TABLE IV B (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988.
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 1989

2
989

SITE=ROBN PERIOD=YRMB1988 STAB=A

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	/	2/ 0.12	/	/	/	2.0/ 0.12	9.45472
NNE	/	/	/	3/ 0.17	/	/	/	3.0/ 0.17	8.62097
NE	/	/	2/ 0.12	/	/	/	/	2.0/ 0.12	5.56945
ENE	/	/	2/ 0.12	/	/	/	/	2.0/ 0.12	5.61114
E	/	/	/	/	/	/	/	/	
ESE	/	/	/	/	/	/	/	/	
SE	/	/	2/ 0.12	1/ 0.06	/	/	/	3.0/ 0.17	6.30871
SSE	/	/	8/ 0.46	4/ 0.23	/	/	/	12.0/ 0.69	7.25918
S	/	/	2/ 0.12	6/ 0.35	1/ 0.06	/	/	9.0/ 0.52	9.34912
SSW	/	/	2/ 0.12	12/ 0.69	4/ 0.23	/	/	18.0/ 1.04	10.57751
SW	/	/	1/ 0.06	6/ 0.35	/	/	/	7.0/ 0.40	9.25701
WSW	/	/	/	2/ 0.12	/	/	/	2.0/ 0.12	9.29631
W	/	/	3/ 0.17	2/ 0.12	/	/	/	5.0/ 0.29	7.43038
WNW	/	/	5/ 0.29	2/ 0.12	/	/	/	7.0/ 0.40	7.10593
NW	/	/	2/ 0.12	1/ 0.06	/	/	/	3.0/ 0.17	6.84787
NNW	/	/	1/ 0.06	/	/	/	/	1.0/ 0.06	7.38702
TOTAL	/	/	30/ 1.73	41/ 2.36	5/ 0.29	/	/	76.0/ 4.38	8.49898

NUMBER OF BAD RECORDS: 0

TABLE IV B (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 1989 3

SITE=ROBN PERIOD=YRMB1988 STAB=B

LOWNDDEG=	LOWNDSPD							AVERAGE	
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25	TOTAL	LOWNDSPD
N	/	/	4/ 0.23	3/ 0.17	/	/	/	7.0/ 0.40	8.12787
NNE	/	/	2/ 0.12	1/ 0.06	/	/	/	3.0/ 0.17	6.69223
NE	/	1/ 0.06	/	2/ 0.12	/	/	/	3.0/ 0.17	7.73164
ENE	/	/	3/ 0.17	/	/	/	/	3.0/ 0.17	6.10861
E	/	/	3/ 0.17	/	/	/	/	3.0/ 0.17	5.58612
ESE	/	/	1/ 0.06	1/ 0.06	/	/	/	2.0/ 0.12	5.93630
SE	/	/	4/ 0.23	/	/	/	/	4.0/ 0.23	5.30265
SSE	/	/	1/ 0.06	6/ 0.35	/	/	/	7.0/ 0.40	8.50663
S	/	/	2/ 0.12	2/ 0.12	/	/	/	4.0/ 0.23	8.35834
SSW	/	/	4/ 0.23	3/ 0.17	1/ 0.06	/	/	8.0/ 0.46	9.24212
SW	/	/	5/ 0.29	3/ 0.17	/	/	/	8.0/ 0.46	7.69134
WSW	/	/	2/ 0.12	5/ 0.29	/	/	/	7.0/ 0.40	9.23557
W	/	/	1/ 0.06	2/ 0.12	/	/	/	3.0/ 0.17	8.29859
WNW	/	/	2/ 0.12	1/ 0.06	/	/	/	3.0/ 0.17	6.32538
NW	/	/	/	/	/	/	/	/	/
NNW	/	/	/	/	/	/	/	/	/
TOTAL	/	1/ 0.06	34/ 1.96	29/ 1.67	1/ 0.06	/	/	65.0/ 3.74	7.77388

NUMBER OF BAD RECORDS: 0

TABLE IX-B (Continued)

ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (E) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 1989 4

SITE=ROBN PERIOD=YRMB1988 STAB=C

LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	/	/	7/ 0.40	3/ 0.17	/	/	/	10.0/ 0.58	7.27864
NNE	/	1/ 0.06	4/ 0.23	1/ 0.06	/	/	/	6.0/ 0.35	5.90851
NE	/	/	3/ 0.17	2/ 0.12	/	/	/	5.0/ 0.29	5.92296
ENE	/	/	6/ 0.35	/	/	/	/	6.0/ 0.35	5.58890
E	/	/	5/ 0.29	/	/	/	/	5.0/ 0.29	4.84575
ESE	/	1/ 0.06	2/ 0.12	/	/	/	/	3.0/ 0.17	4.16319
SE	/	1/ 0.06	6/ 0.35	1/ 0.06	/	/	/	8.0/ 0.46	5.01084
SSE	/	/	10/ 0.58	3/ 0.17	/	/	/	13.0/ 0.75	6.33906
S	/	/	2/ 0.12	2/ 0.12	/	/	/	4.0/ 0.23	7.07437
SSW	/	/	2/ 0.12	7/ 0.40	/	/	/	9.0/ 0.52	8.63765
SW	/	/	15/ 0.86	1/ 0.06	/	/	/	16.0/ 0.92	6.20935
WSW	/	/	6/ 0.35	/	/	/	/	6.0/ 0.35	5.92518
W	/	/	4/ 0.23	1/ 0.06	1/ 0.06	/	/	6.0/ 0.35	8.41254
WNW	/	/	4/ 0.23	/	1/ 0.06	/	/	5.0/ 0.29	7.39036
NW	/	/	2/ 0.12	/	/	/	/	2.0/ 0.12	5.87794
NNW	/	/	1/ 0.06	/	/	/	/	1.0/ 0.06	3.70185
TOTAL	/	3/ 0.17	79/ 4.55	21/ 1.21	2/ 0.12	/	/	105.0/ 6.04	6.42305

NUMBER OF BAD RECORDS: 0

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TABLE IX B (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 1989

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SITE=ROBN PERIOD=YRMB1988 STAB=D

LOWNDDEG=	LOWNDSPD						TOTAL	AVERAGE LOWNDSPD	
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25			>= 25
N	/	7/ 0.40	25/ 1.44	21/ 1.21	1/ 0.06	/	/	54.0/ 3.11	6.90283
NNE	/	5/ 0.29	35/ 2.01	37/ 2.13	1/ 0.06	/	/	78.0/ 4.49	6.99238
NE	/	3/ 0.17	36/ 2.07	9/ 0.52	/	/	/	48.0/ 2.76	5.91789
ENE	/	9/ 0.52	16/ 0.92	4/ 0.23	/	/	/	29.0/ 1.67	5.01227
E	/	7/ 0.40	15/ 0.86	6/ 0.35	/	/	/	28.0/ 1.61	5.49620
ESE	/	11/ 0.63	6/ 0.35	1/ 0.06	/	/	/	18.0/ 1.04	4.24101
SE	/	14/ 0.81	23/ 1.32	1/ 0.06	/	/	/	38.0/ 2.19	4.08450
SSE	/	12/ 0.69	50/ 2.88	13/ 0.75	2/ 0.12	/	/	77.0/ 4.43	5.66517
S	/	6/ 0.35	45/ 2.59	22/ 1.27	1/ 0.06	/	/	74.0/ 4.26	6.28069
SSW	/	11/ 0.63	46/ 2.65	9/ 0.52	/	/	/	66.0/ 3.80	5.50250
SW	/	10/ 0.58	27/ 1.55	8/ 0.46	/	/	/	45.0/ 2.59	5.36527
WSW	/	6/ 0.35	19/ 1.09	4/ 0.23	/	/	/	29.0/ 1.67	5.39618
W	/	7/ 0.40	20/ 1.15	8/ 0.46	/	/	/	35.0/ 2.01	5.72858
WNW	/	5/ 0.29	12/ 0.69	3/ 0.17	/	/	/	20.0/ 1.15	5.55778
NW	/	2/ 0.12	12/ 0.69	12/ 0.69	/	/	/	26.0/ 1.50	7.04070
NNW	/	3/ 0.17	12/ 0.69	3/ 0.17	1/ 0.06	/	/	19.0/ 1.09	5.98545
TOTAL	/	118/ 6.79	399/22.97	161/ 9.27	6/ 0.35	/	/	684.0/39.38	5.85312

NUMBER OF BAD RECORDS: 0

TABLE IV-B (Continued)
 ENVIRONMENTAL MONITORING SYSTEM CAROLINA POWER & LIGHT COMPANY
 PROGRAM IEM24#32 (B) - 22 JAN 1988
 JOINT OCCURRENCE FREQUENCIES FOR LOWNDDEG AND LOWNDSPD
 RANGES INCLUDE LOWER END POINT, EXCLUDE UPPER END POINT

12:07 WEDNESDAY, JANUARY 1989

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LOWNDDEG=	LOWNDSPD							TOTAL	AVERAGE LOWNDSPD
	CALM	.75-3.5	3.5-7.5	7.5-12.5	12.5-18.5	18.5-25	>= 25		
N	0.2/ 0.01	9/ 0.52	6/ 0.35	/	/	/	/	15.2/ 0.88	3.37120
NNE	0.2/ 0.01	9/ 0.52	2/ 0.12	/	/	/	/	11.2/ 0.64	2.93598
NE	0.2/ 0.01	7/ 0.40	11/ 0.63	/	/	/	/	18.2/ 1.05	3.96993
ENE	0.1/ 0.01	6/ 0.35	3/ 0.17	/	/	/	/	9.1/ 0.52	2.96393
E	0.0/ 0.00	1/ 0.06	2/ 0.12	/	/	/	/	3.0/ 0.17	3.71852
ESE	0.1/ 0.01	3/ 0.17	1/ 0.06	1/ 0.06	/	/	/	5.1/ 0.29	4.03714
SE	0.1/ 0.01	5/ 0.29	1/ 0.06	/	2/ 0.12	/	/	8.1/ 0.47	5.80279
SSE	0.5/ 0.03	24/ 1.38	25/ 1.44	1/ 0.06	/	/	/	50.5/ 2.91	3.70407
S	0.6/ 0.03	25/ 1.44	20/ 1.15	13/ 0.75	4/ 0.23	/	/	62.6/ 3.60	5.40818
SSW	0.6/ 0.03	28/ 1.61	19/ 1.09	2/ 0.12	/	/	/	49.6/ 2.86	3.53923
SW	0.5/ 0.03	24/ 1.38	14/ 0.81	3/ 0.17	/	/	/	41.5/ 2.39	3.55589
WSW	0.3/ 0.02	13/ 0.75	21/ 1.21	1/ 0.06	/	/	/	35.3/ 2.03	4.18823
W	0.5/ 0.03	22/ 1.27	11/ 0.63	1/ 0.06	/	/	/	34.5/ 1.99	3.07822
WNW	0.3/ 0.02	14/ 0.81	9/ 0.52	/	/	/	/	23.3/ 1.34	3.14141
NW	0.3/ 0.02	12/ 0.69	8/ 0.46	/	/	/	/	20.3/ 1.17	3.27708
NNW	0.5/ 0.03	22/ 1.27	15/ 0.86	2/ 0.12	/	/	/	39.5/ 2.27	3.64432
TOTAL	5.0/ 0.29	224/ 12.90	168/ 9.67	24/ 1.38	6/ 0.35	/	/	427.0/ 24.58	3.86073

NUMBER OF BAD RECORDS: 0