ILLINOIS POWER
CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727-0678, TELEPHONE (217) 935-8881

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February 20, 1991

Docket No. 50-461

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Clinton Power Station
Semiannual Radioactive Effluent Release Report

Dear Sir:

Attached is the Semiannual Radioactive Effluent Release Report for Clinton Power Station (CPS) for the period of July 1, 1990-December 31, 1990. This submittal is provided in accordance with the requirements of section 6.9.1.7 of the CPS Technical Specifications.

Sincerely yours,

F. A. Spangenberg, III
Manager, Licensing and Safety

SFB/alh

Attachment

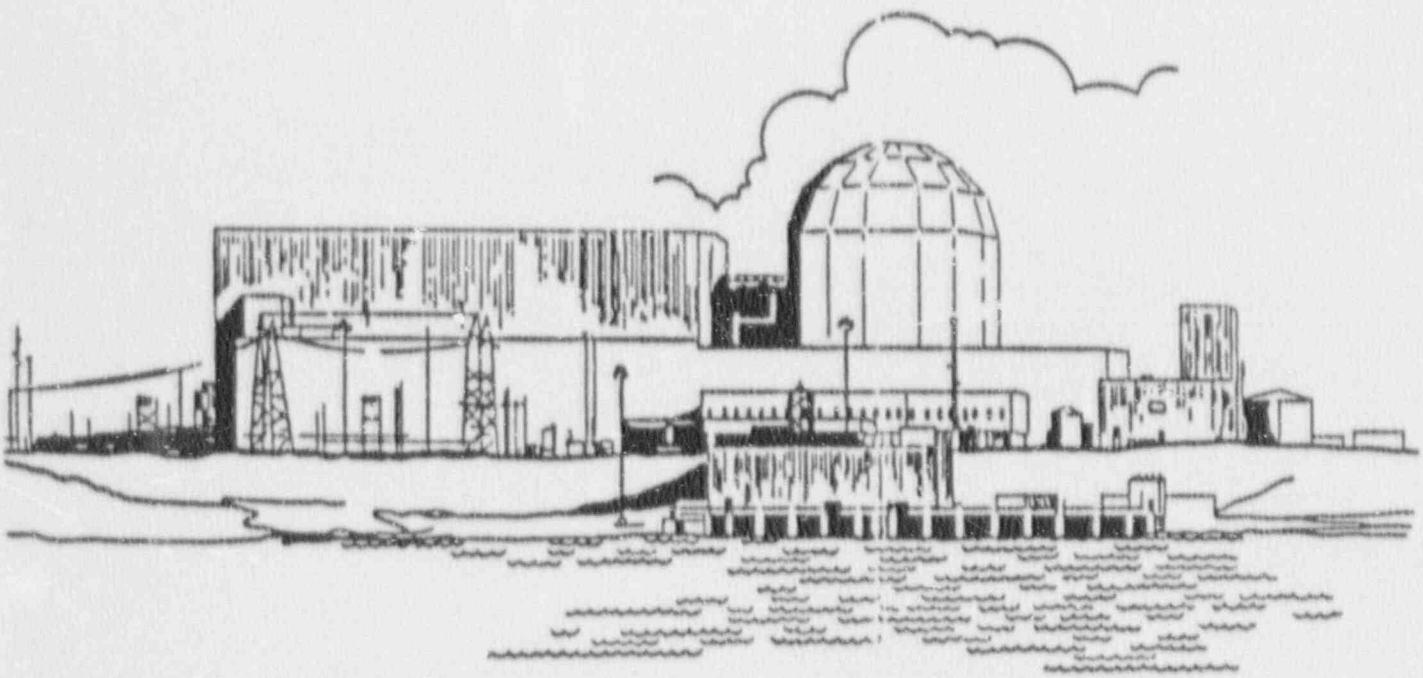
cc: NRC Clinton Licensing Project Manager
NRC Resident Office
NRC Region III, Regional Administrator
Illinois Department of Nuclear Safety

IE48

CLINTON POWER STATION

SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JULY 1, 1990 – DECEMBER 31, 1990



RADIOLOGICAL
PROTECTION
DEPARTMENT

ILLINOIS POWER COMPANY

July 1, 1990 - December 31, 1990

SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR THE

CLINTON POWER STATION

Prepared by

Radiological Environmental Group
Radiation Protection Department

February 28, 1991

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SECTION 1
EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Semiannual Radioactive Effluent Release Report is a detailed description of all radioactive releases (both gaseous and liquid) from the Clinton Power Station (CPS) and the resulting radiation doses for the period from July 1 through December 31, 1990. This report includes a detailed meteorological section which provides the weather history of the area during this period. This information is used to calculate the dose to the public.

The report also includes a summary of the amounts of radioactive material contained in solid waste that is packaged and shipped for offsite disposal at federally-approved burial facilities. In addition, this report notifies the U.S. Nuclear Regulatory Commission (NRC) staff of changes to CPS's Offsite Dose Calculation Manual (ODCM) and Solid Waste Process Control Program (PCP), and exceptions to the CPS effluent monitoring program which must be reported per ODCM Operation Requirements 2.7.1.b and 3.9.2.a.

The NRC requires that nuclear power stations be designed, constructed, and operated in such a way that the amount of radioactive material in effluent releases to unrestricted areas is kept As Low As Reasonably Achievable (ALARA). To assure these criteria are met, the NRC has established limits governing the release of radioactivity in effluents.

CPS was operated in compliance with established limits during this report period. The maximum radiation dose delivered to the inhabitants of the area surrounding CPS, due to radioactivity released from the station, was very small. The radiation dose to people in the vicinity of CPS was calculated for a continuous gaseous release by using the concentration of radioactive material and the weather conditions at the time of the release. Radiation dose to the public was also calculated for liquid batch releases using the concentration of radioactive material and the nonradioactive dilution flow at the time of the release. These doses were only a small fraction of the limit for the most exposed member of the public.

SECTION 2
INTRODUCTION

INTRODUCTION

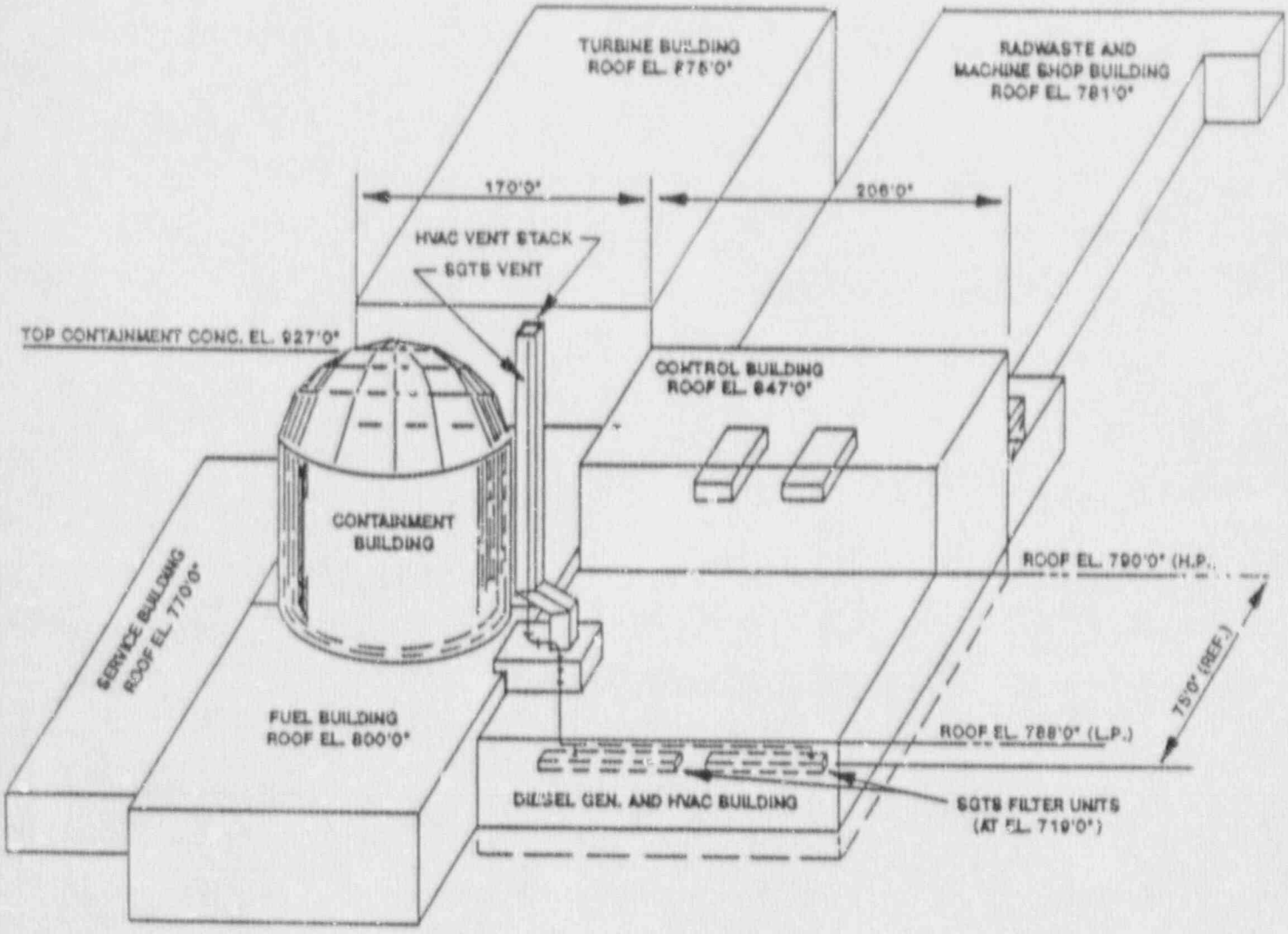
Clinton Power Station is located in Harp Township, DeWitt County approximately six miles east of the city of Clinton in east-central Illinois. Clinton Power Station is a 985 megawatt gross electrical power output boiling water reactor. The reactor and generating units were supplied by General Electric, Sargent and Lundy Engineers served as architect-engineer, and Baldwin Associates was the constructor.

Construction of CPS began in the mid 1970's. Fuel load began in September of 1986 with initial criticality achieved on February 27, 1987. Commercial operation commenced in April 1987 and the reactor reached 100% power for the first time on September 15, 1987.

Airborne effluents are released from CPS via two gaseous effluent release points to the environment: the Common Station Heating, Ventilating, and Air Conditioning (HVAC) Stack and the Standby Gas Treatment System (SGTS) Vent (see Figure 1). Each release point is continuously monitored and a program of periodic sampling and analysis is conducted as specified in the ODCM. Liquid effluents from CPS are released in batch mode and are sampled and analyzed prior to release. Liquid effluents, variable from 10-60 gallons per minute (GPM) or 50-300 GPM, combine with Plant Service Water flow (minimum of approximately 5000 GPM) and Plant Circulating Water flow (0-567,000 GPM) in the Sealwell prior to entering the 3.4 mile discharge flume to Lake Clinton (see Figure 2).

CPS AIRBORNE EFFLUENT RELEASE POINTS

Figure 1

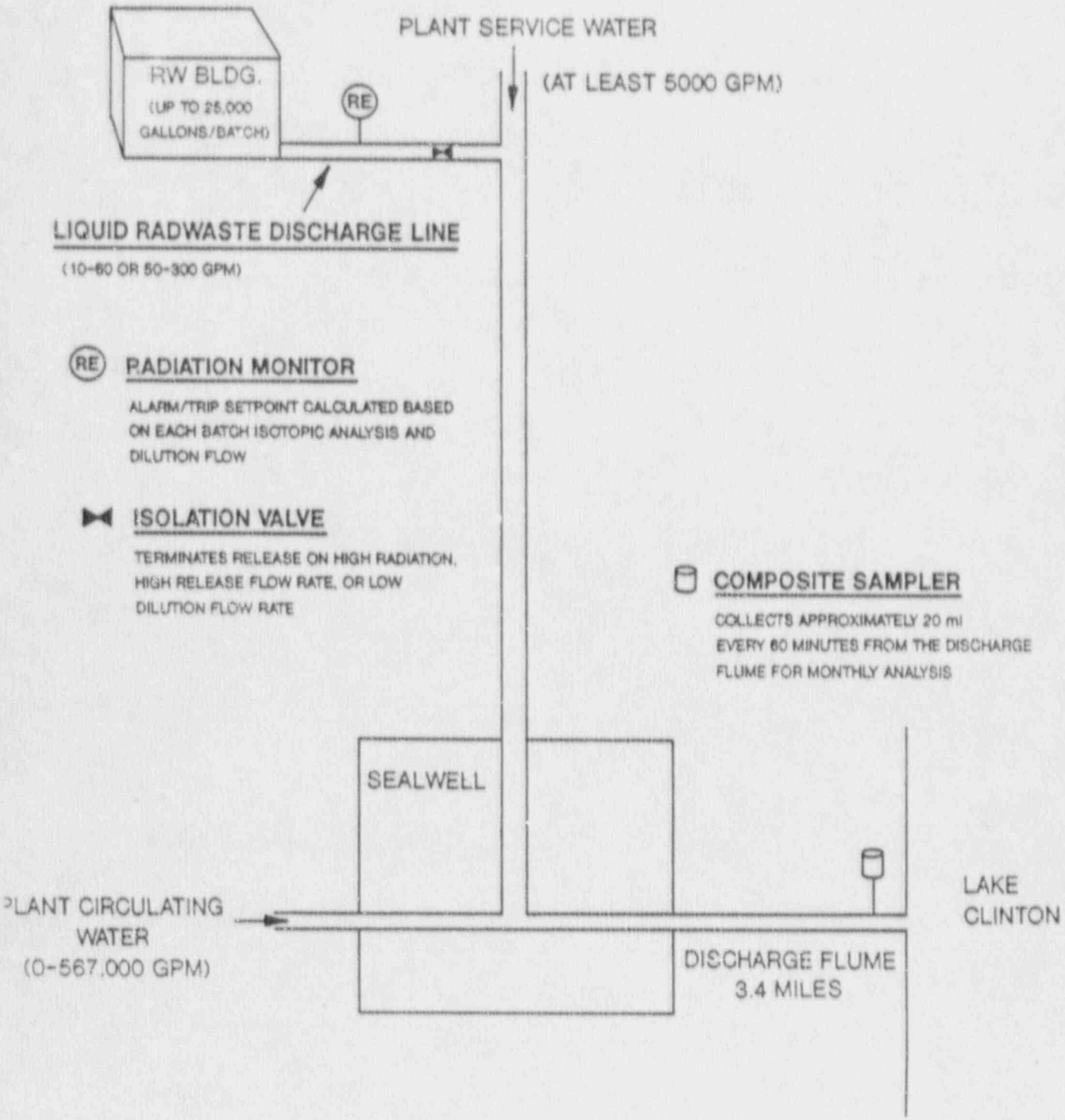


GASEOUS EFFLUENT RELEASE POINT CHARACTERISTICS

	HVAC EXHAUST STACK	SGTS EXHAUST STACK
RELEASE POINT HEIGHT (m)	61	61
BUILDING HEIGHT(m)	58	58
RELEASE POINT GEOMETRY	DUCT	PIPE
RELEASE POINT AREA (m^2)	11.15	0.15
RELEASE POINT DIAMETER (m)	3.77'	0.44
ANNUAL AVERAGE FLOW RATE (ft^3/min)	237,000	4000
VERTICAL EXIT VELOCITY (m/sec)	10.02	12.49

CPS WATERBORNE EFFLUENTS RELEASE PATHWAY

Figure 2



Regulatory Limits

The NRC requires nuclear power plants to be designed, constructed and operated in such a way that the radioactivity in effluent releases to unrestricted areas is kept ALARA. To assure these criteria are met, each license authorizing nuclear reactor operation includes Radiological Effluent Technical Specifications (RETS) governing the release of radioactive effluents (Code of Federal Regulations, Title 10, Part 50, Appendix I). The RETS designate the limits for release of effluents, as well as the limits for doses to the general public from the release of radioactive liquids and gases. Keeping releases within these operating limits demonstrates that the ALARA principle is being met.

The dose to a member of the general public from radioactive material in liquid effluents released to unrestricted areas is limited to:

- Less than or equal to 3 mrem per year to the total body.

-and-

- Less than or equal to 10 mrem per year to any organ.

The dose to air due to release of noble gases in gaseous effluents is limited to:

- Less than or equal to 10 mrad per year for gamma radiation.

-and-

- Less than or equal to 20 mrad per year for beta radiation.

The dose to a member of the general public from iodine-131, tritium and all particulate radionuclides with a half-life greater than eight days in gaseous effluents is limited to:

- Less than or equal to 15 mrem per year to any organ.

These ALARA limits are a fraction of the dose limits established by the Environmental Protection Agency (EPA). In its Environmental Dose Standard of 40CFR190, the EPA established dose limits for members of the public in the vicinity of a nuclear power plant. These dose limits are:

- Less than or equal to 25 mrem per year to the total body.

- Less than or equal to 75 mrem per year to the thyroid.

-and-

- Less than or equal to 25 mrem per year to any other organ.

See Section 3 for more information on regulatory limits.

Processing and Monitoring

Effluents are strictly controlled at CPS to ensure radioactivity released to the environment is minimal and does not exceed release limits. Effluent controls include the operation of radiation monitoring systems in the plant and offsite environmental sampling and analysis programs. In-plant radiation monitoring systems are used to provide a continuous indication of radioactivity and are also used to collect particulate and radioiodine samples. These samples are analyzed in a laboratory to identify the specific concentration of radionuclides being released. Sampling and analysis provide a more sensitive and precise method of determining effluent composition to complement the information provided by real-time monitoring instruments.

Beyond the plant itself, a radiological environmental monitoring program is maintained in accordance with Federal Regulations. The basic purpose of the program is to assess the radiological impact on the environment due to the operation of the Clinton Power Station. Implicit in this purpose is the regulatory requirement to trend and assess radiation exposure rates and radioactivity concentrations that may contribute to human radiation exposure. The program consists of two phases, preoperational and operational. During the preoperational phase of the program, the baseline for the local radiation environment was established. The operational phase of the program includes the objective of making confirmatory measurements to verify that the in-plant controls for the release of radioactive material are functioning as designed. Assessment of the operational impact of CPS on the environment is based on data collected since the reactor started.

Exposure Pathways

Radiological exposure pathways are the means by which people may become exposed to radioactivity released from nuclear facilities. The major pathways of concern are those which could cause the highest calculated radiation dose. These pathways are determined from the type and amount of radioactivity released, the environmental transport mechanism and use of the environment. The environmental transport mechanism includes the meteorological characteristics of the area which will be defined by wind speed and wind direction at the time of the release. This information is used to evaluate how the radionuclides will be distributed in the area. The most important factor in evaluating the exposure pathway is the use of the environment by the people living around CPS. Factors such as location of homes in the area, use of cattle for milk and meat, and the growing of gardens for vegetable consumption are very important considerations in evaluating exposure pathways. Figure 3 illustrates the various effluent exposure pathways considered.

The radioactive gaseous effluent exposure pathways include direct radiation, deposition on plants and soil, and inhalation by animals and humans. The radioactive liquid effluent exposure pathways include drinking water, fish consumption and direct exposure from the lake.

Dose Assessment

Whole body radiation involves the exposure of all organs in the human body to ionizing radiation. Most background radiation exposures consist of whole body exposure although specific organs can receive radiation exposure from distinct radionuclides. These radionuclides enter the body through inhalation and ingestion and seek different organs depending on the nuclide. For example, radioactive iodine selectively concentrates in the thyroid, radioactive cesium collects in muscle and liver tissue, and radioactive strontium in mineralized bone.

The total dose to organs from a given radionuclide also depends on the amount of activity in the organ and the amount of time that the radionuclide remains in the body. Some radionuclides remain for very short periods of time due to their rapid radioactive decay and/or elimination rate from the body, while others may remain longer.

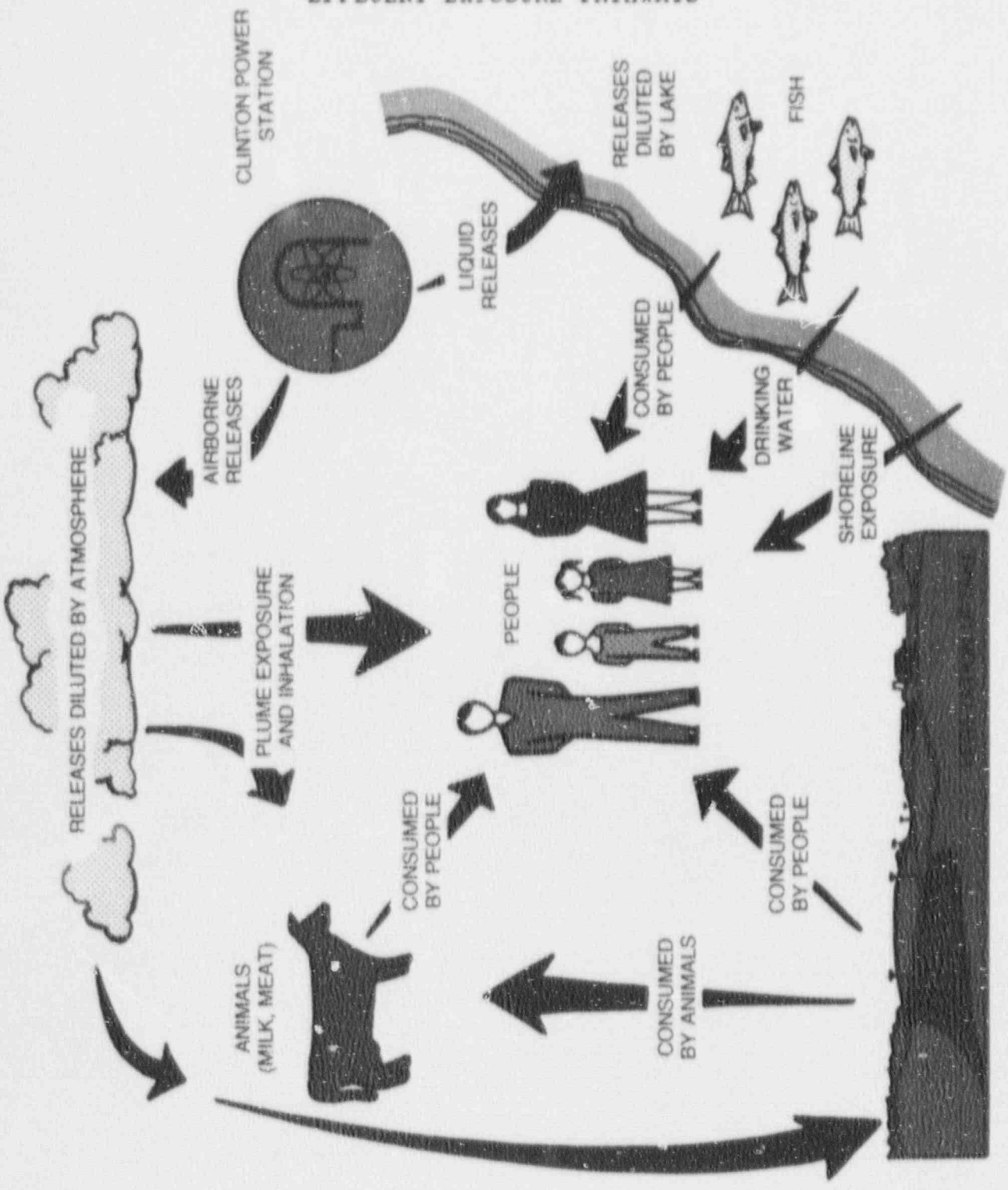
The radiation dose to people in the area surrounding CPS is calculated for each release using the concentrations of radioactive material and the weather conditions present at the time of the release. The dose is calculated in all sixteen geographical sectors surrounding CPS and takes into account the location of the nearest residents, vegetable gardens producing

broad leaf vegetables, dairy and meat animals in all sectors. The calculated dose also uses the concept of a "maximum exposed individual" and "standard man", and the maximum use factors for the environment, such as how much milk an average person drinks and how much air a person breathes in a year.

See Tables 14-21 of Section 6 for more detailed information on dose to the public.

FIGURE 3

EFFLUENT EXPOSURE PATHWAYS



Gaseous Effluents

Gaseous effluent radioactivity released from CPS is classified into two categories, 1) noble gas, and 2) iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days. Noble gases, such as xenon and krypton, are biologically and chemically nonreactive; these radionuclides cause external radiation exposure. Iodine-131, iodine-133, tritium and radionuclides in particulate form with half-lives greater than eight days are the major contributors to internal dose.

See Tables 1, 2, 3 and 9 of Section 4 for more detailed information on gaseous effluents.

Liquid Effluents

Radioactivity in liquid effluents consists of radioactive fission and activation products, tritium and entrained noble gases.

See Tables 4, 5, 6 and 9 of Section 4 for more detailed information on liquid effluents.

Solid Waste Shipments

In order to reduce the radiation exposure to personnel and maintain the ALARA concept, the NRC and the Department of Transportation (DOT) have established limits on the types of radioactive waste and the amount of radioactivity that may be packaged and shipped offsite for burial or disposal. To ensure that CPS is complying with these regulations, the types of waste and the radioactivity present are reported to the NRC.

See Table 7 of Section 4 for more detailed information on solid waste shipments.

SECTION 3

SUPPLEMENTAL INFORMATION

I. REGULATORY LIMITS

A. Gaseous Effluents

1. In accordance with Title 10 of the Code of Federal Regulations (CFR), Part 20, the maximum permissible concentrations for gaseous effluents shall not exceed the values given in 10CFR20, Appendix B, Table II, Column 1. To ensure these concentrations are not exceeded, dose rates due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to the following:

a. Noble gases - Less than or equal to 500 mrem/year to the total body.

- Less than or equal to 3000 mrem/year to the skin.

b. Iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days:

- Less than or equal to 1500 mrem/year to any organ.

2. In accordance with Title 10 of the Code of Federal Regulations, Part 50, Appendix I, air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:

a. Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation during any calendar quarter.

b. Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation during any calendar year.

3. In accordance with 10CFR50, Appendix I, dose to a member of the public (from iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days) in

gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

a. Less than or equal to 7.5 mrem to any organ, during any calendar quarter.

b. Less than or equal to 15 mrem to any organ, during any calendar year.

B. Liquid Effluents

1. The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to the concentrations specified in Title 10 of the Code of Federal Regulations, Part 20, Appendix B, Table II, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 microcuries per milliliter total activity.

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

a. Less than or equal to 1.5 mrem to the total body and less than or equal to 5 mrem to any organ during any calendar quarter.

b. Less than or equal to 3 mrem to the total body and less than or equal to 10 mrem to any organ during any calendar year.

II. MAXIMUM PERMISSIBLE CONCENTRATION

A. Gaseous

1. The maximum permissible concentrations (MPC) for gaseous effluents are specified in Title 10 of the Code of Federal Regulations, Part 20, Appendix B, Table II, Column 1. However, the MPCs of 10CFR20 are not utilized directly for limiting gaseous effluents. The CPS ODCM establishes requirements to limit the release rate of effluents such that discharges of gaseous radioactive material will

not result in dose rates, to a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA , higher than those which would occur if average annual concentrations exceeded MPC limits. The maximum permissible dose rates for gaseous releases are:

a. ODCM Operation Requirement 3.4.1.a (Dose rate at and beyond the site boundary from gaseous effluents in the form of noble gases).

- Less than or equal to 500 mrem/year to the total body.

- Less than or equal to 3000 mrem/year to the skin.

b. ODCM Operation Requirement 3.4.1.b (Dose rate at and beyond the site boundary from gaseous effluents in the form of iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days).

- Less than or equal to 1500 mrem/year to any organ.

B. Liquids

1. The maximum permissible concentrations (MPC) for liquids are those listed in 10CFR20, Appendix B, Table II, Column 2, with the most restrictive MPC (whether soluble or insoluble) being used in all cases. For dissolved and entrained noble gases the MPC of 2.0E-04 microcuries per milliliter is applied. This MPC is based on the Xe-135 MPC in air (submersion dose) converted to an equivalent concentration in water as discussed in the International Commission on Radiological Protection (ICRP), Publication 2.

III. AVERAGE ENERGY

The CPS ODCM limits the dose equivalent rates due to the release of fission and activation gases to less than or equal to 500 mrem per year to the total body and less than or equal to 3000 mrem per year to the skin. Therefore, the average beta and gamma energies ($\bar{E}$) for gaseous effluents

as described in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants", is not applicable.

IV. MEASUREMENT AND APPROXIMATIONS OF TOTAL RADIOACTIVITY

A. Fission and Activation Gases

1. Gas samples are collected monthly and are counted on a high purity germanium detector (HPGe) for principal gamma emitters. The HVAC and SGTS release points are continuously monitored, and the average release flow rates for each release point are used to calculate the total activity released in a given time period.

2. Tritium is collected by passing a known volume of the sample stream through a gas washer containing a known quantity of demineralized water. The collected samples are distilled and analyzed by liquid scintillation. The tritium released was calculated for each release point from the measured tritium concentration, the volume of the sample, the tritium collection efficiency, and the stack exhaust flow rates.

B. Iodines

Iodine is continuously collected on a charcoal cartridge filter via an isokinetic sampling assembly on each release point. Filters are normally exchanged once per week and analyzed on an HPGe system. The daily average flow rates for each release point are averaged for the duration of the sampling period and these results, along with isotopic concentrations, are used to determine total activity released during the time period in question.

C. Particulates

Particulates are continuously collected on a filter paper via an isokinetic sampling assembly on each release point. Filters are normally exchanged once per week and analyzed on an HPGe system. Flow rates and total activity are determined in the same manner as for iodines.

D. Liquid Effluents

Each tank of liquid radwaste is sampled and analyzed for principal gamma emitters prior to release. Each sample tank is recirculated for a sufficient amount of time prior to sampling to ensure that a representative sample is obtained. Samples are analyzed on an HPGe system and release permits are generated based on the values obtained from the isotopic analysis and the most recent values for tritium, gross alpha, iron-55, strontium-89 and strontium-90. An aliquot based on release volume is saved and added to composite containers. The concentrations of composited isotopes and the volumes of the releases associated with these composites establish the proportional relationships that are then utilized for calculating the total activity released for these isotopes.

V. BATCH RELEASES

A. Liquid

	3rd Qtr 90	4th Qtr 90	
1. Number of batch releases:	31	4	
2. Total time period for batch releases:	2,794	372 min.	
3. Maximum time period for batch release:	116	95 min.	
4. Average time period for batch release:	90.1	93 min.	
5. Minimum time period for batch release:	79	90 min.	
6. Average stream flow during periods of release	8.55E+04	5.62E+04	liters per minute
7. Total waste volume:	2.78E+06	3.47E+05	liters
8. Total dilution volume:	2.39E+08	2.09E+07	liters

B. Gaseous

		3rd Qtr 90	4th Qtr 90
1.	Number of batch releases:	0	0
2.	Total time period for batch releases:	N/A	N/A
3.	Maximum time period for batch release:	N/A	N/A
4.	Average time period for batch release:	N/A	N/A
5.	Minimum time period for batch release:	N/A	N/A

VI. DESCRIPTION OF ERROR ESTIMATES

A. Gaseous and Liquid Effluents

Estimates of measurement and analytical error for gaseous and liquid effluents are calculated as follows:

$$E_T = [(E_1)^2 + (E_2)^2 + \ldots(E_n)^2]^{\frac{1}{2}}$$

where, E_T = total percent error
$E_1 \ldots E_n$ = percent error due to calibration standards, laboratory analysis, instruments, sample flow, etc.

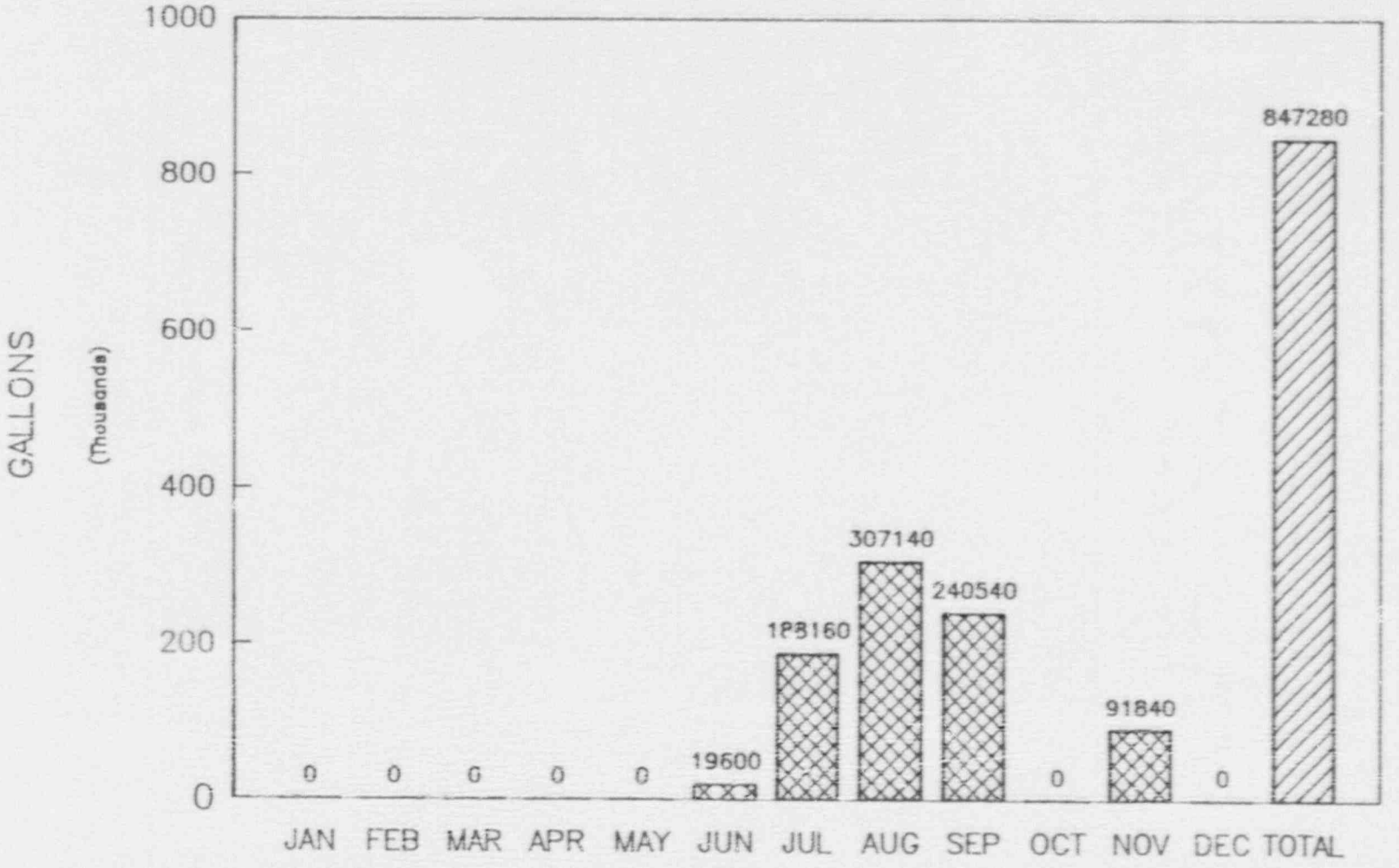
VII. CHANGE IN EXCESS WATER TANK VOLUME

On January 28, 1991 the CPS Nuclear Station Engineering Department (NSED) revised the volume calculations for the Excess Water Tanks, OWE01TA and OWE01TB, based on CPS operating experience. These tanks are utilized when CPS discharges liquid effluents to Clinton Lake. The corrected 100% volumes for each tank are 26,103 gallons. The volume utilized in calculations reported in this document was 25,670 gallons. This change in tank volume represents an approximate 1.6% differential in values (i.e. total liquid volume and curies discharged and the dose to the maximum receptor) reported. Since the error associated with the calibration of tank level instrumentation is estimated to be about 5.5%, it is believed that the volume calculated differential of 1.6% is well within the bounds of error for the instrument. Therefore, the impact of this circumstance is thought to be insignificant and does not warrant any changes to reported values.

FIGURE 4

CLINTON POWER STATION

1990 MONTHLY LIQUID RADWASTE DISCHARGE TOTAL



SECTION 4
EFFLUENT AND WASTE DISPOSAL DATA

TABLE 1

AIRBORNE EFFLUENTS - SUMMATION OF ALL RELEASES
Data Period: July 1, 1990 - December 31, 1990

Nuclide Category	Unit	Continuous Mode 3rd Quarter	Continuous Mode 4th Quarter	Est Total[1] Error, %
A. Fission & Activation Gases				
1. Total Release[2]	Ci	0.00E+00	0.00E+00	28
2. Average Release Rate for Period	uCi/sec	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	
B. Iodine-131				
1. Total Release	Ci	4.13E-05	1.18E-05	33
2. Average Release Rate for Period	uCi/sec	5.24E-06	1.50E-06	
3. Percent of Applicable Limit	%	7.40E-02	2.12E-02	
C. Particulates				
1. Particulates Released with Half-lives >8 Days	Ci	4.50E-03	9.16E-04*	27
2. Average Release Rate for Period	uCi/sec	5.71E-04	1.16E-04*	
3. Percent of Applicable Limit	%	1.13E-03	1.63E-03*	
4. Gross Alpha Activity Released	Ci	3.68E-06	1.51E-06	
D. Tritium				
1. Total Release	Ci	4.12E-01	4.05E-01	105
2. Average Release Rate for Period	uCi/sec	5.22E-02	5.14E-02	
3. Percent of Applicable Limit	%	2.60E-05	2.56E-05	

1 It should be noted that the lower the actual sample activity is with respect to background activity, the greater the counting error. Large errors are reported for the various components of CPS gaseous effluents because of consistently low sample activity.

2 Notation: An entry of 0.00E+00 does not represent the absence of a radionuclide but indicates that the concentration of the nuclide was below the Lower Limit of Detection (LLD) value listed in Table 3.

* Reported values include Sr-89 values based on third quarter 1990 samples analyses and fourth quarter 1990 ventilation exhaust rates.

TABLE 2

AIRBORNE EFFLUENTS (Curies)[3]
Data Period: July 1, 1990 - December 31, 1990

Nuclide	Continuous Mode	
	Third Quarter	Fourth Quarter
A. Gases		
Kr-85		
Kr-85m		
Kr-87		
Kr-88		
Xe-133		
Xe-135		
Xe-135m		
Xe-138		
Others:		
Ar-41		
Total	0.00E+00	0.00E+00
B. Iodines		
I-131	4.[illegible]E-05	1.18E-05
I-132	0.[illegible]0E+00	0.00E+00
I-133	4.80E-05	4.88E-06
I-134	0.00E+00	0.00E+00
I-135	0.00E+00	0.00E+00
Total	8.93E-05	1.66E-05
C. Particulates		
w/Half-lives >8 Days		
Sr-89	2.12E-05	1.93E-05*
Sr-90	0.00E+00	0.00E+00*
Cs-134	0.00E+00	0.00E+00
Cs-137	0.00E+00	0.00E+00
Ba-140	0.00E+00	0.00E+00

3 Notation: An entry of 0.00E+00 does not represent the absence of a radionuclide but indicates that the concentration of the nuclide was below the LLD value listed in Table 3.

* Reported values are estimated based on third quarter 1990 composite analyses and fourth quarter 1990 ventilation exhaust rates.

TABLE 2 (Cont'd)

AIRBORNE EFFLUENTS (Curies)[3]
Data Period: July 1, 1990 - December 31, 199

Nuclide	Continuous Mode	
	Third Quarter	Fourth Quarter
Others:		
Cr-51	4.46E-03	8.54E-04
Mn-54	0.00E+00	6.13E-06
Co-58	3.04E-06	2.18E-06
Fe-59	0.00E+00	0.00E+00
Co-60	2.34E-05	3.44E-05
Zn-65	0.00E+00	0.00E+00
Ag-110m	0.00E+00	0.00E+00
Ce-141	0.00E+00	0.00E+00
Ce-144	0.00E+00	0.00E+00
Total	4.50E-03	9.16E-04

3 Notation: An entry of 0.00E+00 does not represent the absence of a radionuclide but indicates that the concentration of the nuclide was below the LLD value listed in Table 3.

TABLE 3

RADIOACTIVE GASEOUS WASTE LLD VALUES

TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (uCi/ml)
Principal Gamma Emitters[b,c]	$1x10^{-4}$
H-3[c]	$1x10^{-6}$
I-131[d]	$1x10^{-12}$
I-133[d]	$1x10^{-10}$
Principal Gamma Emitters[b,e] (I-131, others)	$1x10^{-11}$
Gross Alpha[f]	$1x10^{-11}$
Sr-89, Sr-90[g]	$1x10^{-11}$

Table 3 Notations

[a]The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \times V \times 2.22 \times 10^6 \times Y \times \exp(-\lambda \Delta t)}$$

Table 3 Notations (Cont'd)

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide (sec^{-1}) and

Δt for plant effluents is the elapsed time between the midpoint of sample collection and the time of counting (sec).

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

[b]The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Semiannual Radioactive Effluent Release Report.

[c]Monthly grab sample and analysis

[d]Continuous charcoal sample analyzed weekly

[e]Continuous particulate sample analyzed weekly

[f]Composite particulate sample analyzed monthly

[g]Composite particulate sample analyzed quarterly

TABLE 4

WATERBORNE EFFLUENTS - SUMMATION OF ALL RELEASES
Data Period: July 1, 1990 - December 31, 1990

Nuclide Category	Unit	BATCH MODE 3rd Quarter	BATCH MODE 4th Quarter	Est.Total Error, %
A. Fission & Activation Products				
1. Total Release	Ci	2.08E-02	8.24E-04*	14
2. Average Diluted Concentration	uCi/ml	8.70E-08	3.94E-08*	
3. Percent of Applicable Limit	%	1.66E+00	6.59E-02*	
B. Tritium				
1. Total Release	Ci	2.35E+00	1.77E-01	5
2. Average Diluted Concentration	uCi/ml	9.83E-06	8.46E-06	
3. Percent of Applicable Limit	%	3.28E-01	2.82E-01	
C. Dissolved and Entrained Gases				
1. Total Release[4]	Ci	0.00E+00	0.00E+00	11+
2. Average Diluted Concentration	uCi/ml	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	
D. Gross Alpha Radioactivity Released	Ci	0.00E+00	0.00E+00	56
E. Volume of Waste Released	gal. liters	7.36E+05 2.78E+06	9.18E+04 3.48E+05	5.5
F. Volume of Dilution Water Used	gal. liters	6.30E+07 2.39E+08	5.52E+06 2.09E+07	3

* Reported values include Fe-55 values based on third quarter 1990 sample analyses and fourth quarter discharge volumes.

4 Notation: An entry of 0.00E+00 does not represent the absence of a radionuclide but indicates that the concentration of the nuclide was below the LLD value listed in Table 6.

\+ This error is associated with the gamma spectroscopy system, even though noble gas activity is <LLD.

TABLE 5

WATERBORNE EFFLUENTS (Curies)[5]

Data Period: July 1, 1990 - December 31, 1990

Batch Mode

Nuclide	Third Quarter	Fourth Quarter
A. Tritium	2.35E+00	1.77E-01
B. Fission & Activation Products		
Cr-51	2.41E-03	8.80E-05
Mn-54	4.35E-03	1.85E-04
Co-58	3.01E-04	7.21E-06
Co-60	1.37E-02	5.44E-04
Fe-55	0.00E+00	0.00E+00*
Fe-59	0.00E+00	0.00E+00
Zn-65	0.00E+00	0.00E+00
Sr-89	0.00E+00	0.00E+00*
Sr-90	0.00E+00	0.00E+00*
Mo-99	0.00E+00	0.00E+00
Sb-124	0.00E+00	0.00E+00
I-131	0.00E+00	0.00E+00
I-133	0.00E+00	0.00E+00
I-135	0.00E+00	0.00E+00
Cs-134	0.00E+00	0.00E+00
Cs-137	0.00E+00	0.00E+00
Ba-140	0.00E+00	0.00E+00
La-140	0.00E+00	0.00E+00
Ce-141	0.00E+00	0.00E+00
Ag-110m	1.34E-04	0.00E+00
Total	2.08E-02	8.24E-04
C. Dissolved and Entrained Gases		
Kr-85		
Kr-85m		
Kr-87		
Kr-88		
Xe-133		
Xe-133m		
Xe-135		
Xe-135m		
Xe-138		
Total	0.00E+00	0.00E+00

5 Notation: An entry of 0.00E+00 does not represent the absence of a radionuclide but indicates that the concentration of the nuclide was below the LLD value listed in Table 6.

* Reported value is estimated based on third quarter 1990 sample analyses and fourth quarter 1990 discharge volumes.

TABLE 6

RADIOACTIVE LIQUID WASTE LLD VALUES

TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[a] (uCi/ml)
Principal Gamma Emitters[b]	5×10^{-7}
I-131	1×10^{-6}
Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
H-3	1×10^{-5}
Gross Alpha	1×10^{-7}
Sr-89, Sr-90	5×10^{-8}
Fe-55	1×10^{-6}

Table 6 Notations

[a]The LLD is defined, for purposes of these requirements, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E \times V \times 2.22 \times 10^6 \times Y \times \exp^{(-\lambda \Delta t)}}$$

Table 6 Notations (Cont'd)

Where:

LLD is the "a priori" lower limit of detection as defined above, as microcuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield, when applicable,

λ is the radioactive decay constant for the particular radionuclide (sec^{-1}) and

Δt for plant effluents is the elapsed time between the midpoint of sample collection and the time of counting (sec).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

[b] The principal gamma emitters for which the LLD requirement applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, and Ce-141. Ce-144 shall also be measured, but with an LLD of 5×10^{-6}. This list does not mean that only these nuclides are to be detected and reported. Other gamma peaks that are measurable, together with those of the above nuclides, shall also be analyzed and reported in the Semiannual Radioactive Effluent Release Report.

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

During this reporting period there were twenty-three (23) radioactive waste shipments and no irradiated fuel shipments from CPS as reported in Table 7. All waste shipped in this reporting period was classified as Class A. In addition, the CPS OCDM requires reporting of the following information for solid waste shipped offsite during the report period:

1. Total curie quantity: 425.6 curies as determined by dose-to-curie and sample concentration methodology estimates.

2. Principal radionuclides: See Table 7, A.2 for listing of measured radionuclides.

3. Source of waste and processing employed: Resins, filter sludges and evaporator bottoms dewatered or solidified in cement. Compacted and non-compacted dry active waste.

4. Type of container: LSA, Type A, and Strong Tight Container.

5. Solidification agent or absorbent: Cement, Bitumen (ATI), Aquaset I and II, and Petroset I and II (no absorbents used).

TABLE 7

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
July 1, 1990 - December 31, 1990

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

1. TYPE OF WASTE		UNIT	6-MONTH PERIOD	EST. TOTAL ERROR, %
a.	Resins, filter sludges, evaporator bottoms, etc.	m^3	1.24E+02	
		Ci	4.25E+02	25
b.	Dry compactible waste, contaminated equipment, etc.	m^3	4.03E+01	
		Ci	6.05E-01	25
c.	Irradiated components control rods, etc.	m^3	0.00E+00	
		Ci	0.00E+00	0
d.	Other	m^3	0.00E+00	
		Ci	0.00E+00	0

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION

	NUCLIDE NAME	PERCENT ABUNDANCE	CURIES
a.	Fe-55	51.50%	2.19E+02
	Co-60	34.69%	1.47E+02
	Mn-54	9.57%	4.06E+01
	Cr-51	1.86%	7.89E+00
	Co-58	1.30%	5.55E+00
	OTHER	1.07%	4.52E+00
b.	Fe-55	54.29%	3.28E-01
	Co-60	24.40%	1.48E-01
	Cr-51	11.20%	6.80E-02
	Mn-54	8.54%	5.20E-02
	Co-58	1.74%	1.00E-02
	OTHER	0.006%	3.60E-05
c.	NONE	N/A	N/A
d.	NONE	N/A	N/A

TABLE 7 (Cont'd)

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
July 1, 1990 - December 31, 1990

3. SOLID WASTE DISPOSITION

NUMBER OF SHIPMENTS	MODE OF TRANSPORTATION	DESTINATION
18	Truck	Richland, WA
5	Truck	Barnwell, SC

B. IRRADIATED FUEL SHIPMENTS (Disposition)

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

TABLE 8

CORRECTIONS TO DATA REPORTED IN PREVIOUS SEMIANNUAL REPORTS

I. CORRECTION TO PERCENT OF APPLICABLE LIMIT

A. Parameter of Concern: Second quarter 1990 percent of applicable limit for tritium in waterborne effluents, Table 4, Item B.3.

1. Reported Value: 5.55E+00%
   Corrected Value: 3.40E-01%

II. CORRECTION OF OMITTED TRITIUM ACTIVITY

A. Parameter of Concern: Third quarter 1989 tritium in waterborne effluents, Table 4, Item A.

1. Reported Value: None reported
   Corrected Value: 1.12E+00 Curies

III. DELETION OF 16.5 CURIES Kr-85

A. Parameter of Concern: First quarter 1990 Kr-85 in airborne effluents, Table 1, Section A, Items 1 and 2.

1. Reported Value: 2.74E+01 Curies
   Corrected Value: 1.09E+01 Curies

2. Reported Value: 3.48E+00 uCi/sec.
   Corrected Value: 1.38E+00 uCi/sec

B. Parameter of Concern: First quarter 1990 Kr-85 in airborne effluents, Table 2, Section A, Kr-85 value and total gases.

1. Reported Value: 2.57E+01 Curies Kr-85
   Corrected Value: 9.20E+00 Curies Kr-85

2. Reported Value: 2.74E+01 Total Curies
   Corrected Value: 1.09E+01 Total Curies

C. Parameter of Concern: First half of 1990, doses to receptors located within the site boundary, plume exposure pathway, Tables 14 through 20.

1. Table 14

   Reported Value: total body = 4.54E-06 mrem
   skin = 2.94E-05 mrem
   Corrected Value: total body = 4.50E-06 mrem
   skin = 2.43E-05 mrem

2. Table 15

Reported Value:	total body = 3.00E-07 mrem skin = 2.42E-05 mrem
Corrected Value:	total body = 2.63E-07 mrem skin = 1.97E-05 mrem

3. Table 16 and Table 17: No changes

4. Table 18

Reported Value:	total body = 3.55E-07 mrem skin = 1.37E-04 mrem
Corrected Value:	total body = 2.97E-06 mrem skin = 6.76E-05 mrem

5. Table 19

Reported Value:	total body = 5.74E-06 mrem skin = 5.59E-05 mrem
Corrected Value:	total body = 5.60E-06 mrem skin = 3.97E-05 mrem

6. Table 20

Reported Value:	total body = 4.78E-05 mrem skin = 2.13E-04 mrem
Corrected Value:	total body = 4.76E-05 mrem skin = 1.85E-04 mrem

TABLE 9

EFFLUENT DATA NOT AVAILABLE FOR
PREVIOUS SEMIANNUAL REPORT[6]
Data Period: April 1, 1990 - June 30, 1990

Nuclide Category	Unit	Second Quarter 1990
A. Airborne Effluents		
1. Sr-89	Ci	2.01E-05
2. Sr-90	Ci	0.00E+00
B. Waterborne Effluents		
1. Fe-55	Ci	4.82E-04

6 Notation: An entry of 0.00E+00 does not represent the absence of a radionuclide but indicates that the concentration was below the LLD value listed in Table 3.

SECTION 5
METEOROLOGICAL DATA
AND
DISPERSION ESTIMATES

METEOROLOGICAL DATA AND DISPERSION ESTIMATES

The meteorological monitoring program began at the Clinton Power Station site on April 13, 1972. The meteorological system consists of a tower 199 feet high with two levels of instrumentation, at the 10-meter and 60-meter levels. Wind directions and speeds at the 10-meter and 60-meter levels are measured by a combined cup and vane sensor. The temperature at these levels is sensed by an aspirated dual temperature sensor. One-half of the dual sensor at each elevation is used for ambient temperature while the other half is used to provide a differential temperature between the 10- and 60-meter levels. Dew-point is measured at the 10-meter level with an aspirated dew-point sensor. Precipitation is measured at ground level by a tipping bucket rain gauge.

Meteorological monitoring instruments have been placed on the Clinton Power Station microwave tower at the 10-meter level to act as a backup to the existing meteorological tower.

Clinton Power Station meteorological data is transmitted to the Main Control Room via a dedicated telephone line. There the signals are received and converted to a 4 to 20 milliamp signal and fed individually to a microprocesror and chart recorders. The microprocessor is part of the Clinton Power Station Radiation Monitoring System. Meteorological data is available via the microprocessors in the Main Control Room, Technical Support Center and Radiation Protection office.

Dispersion modeling for effluents for normal operation of Clinton Power Station is a straight-line, sector-averaged Gaussian plume model designed to estimate average relative concentration at various receptor points. The model was developed in accordance with routine release analysis procedures specified in Regulatory Guide 1.111. For joint frequency input data, periods of calm are distributed in accordance with a directional distribution. For hourly input data, periods of calm are assigned the previous hour's wind direction. Periods of calm are assigned a wind speed value of half the specified instrument threshold value. See Tables 10-13 and Figures 5-7 for more detailed information on meteorology and dispersion data.

TABLE 10

METEOROLOGICAL DATA AVAILABILITY
Data Period: January 1, 1990 - December 31, 1990

Parameter	Percent of Valid Hours During Period
1. Wind Speed	
a. 10-meter Sensor	98%
b. 60-meter Sensor	97%
2. Wind Direction	
a. 10-meter Sensor	98%
b. 60-meter Sensor	97%
3. Temperature	
a. 10-meter	98%
b. Temperature Difference (10m-60m)	96%
4. Percent of hours for which valid 10-meter Wind Speed, Wind Direction, & Delta Temperature were available	96.1%
5. Percent of hours for which valid 60-meter Wind Speed, Wind Direction, & Delta Temperature were available	95.1%

FIGURE 5

CPS WIND ROSE: 10-METER
Data Period: January 1, 1990 - December 31, 1990

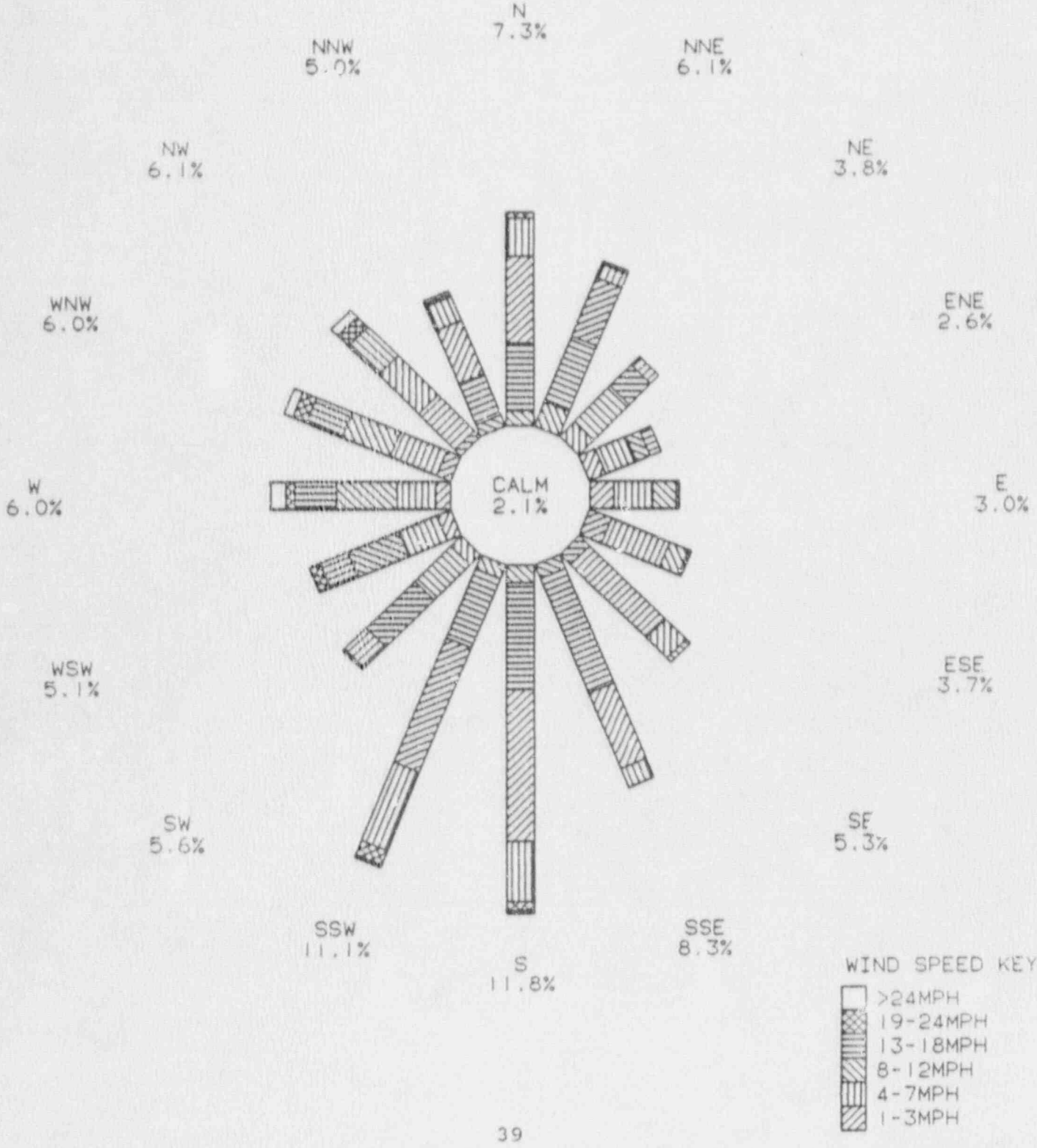


FIGURE 6

CPS WIND ROSE: 60-METER
Data Period: January 1, 1990 - December 31, 1990

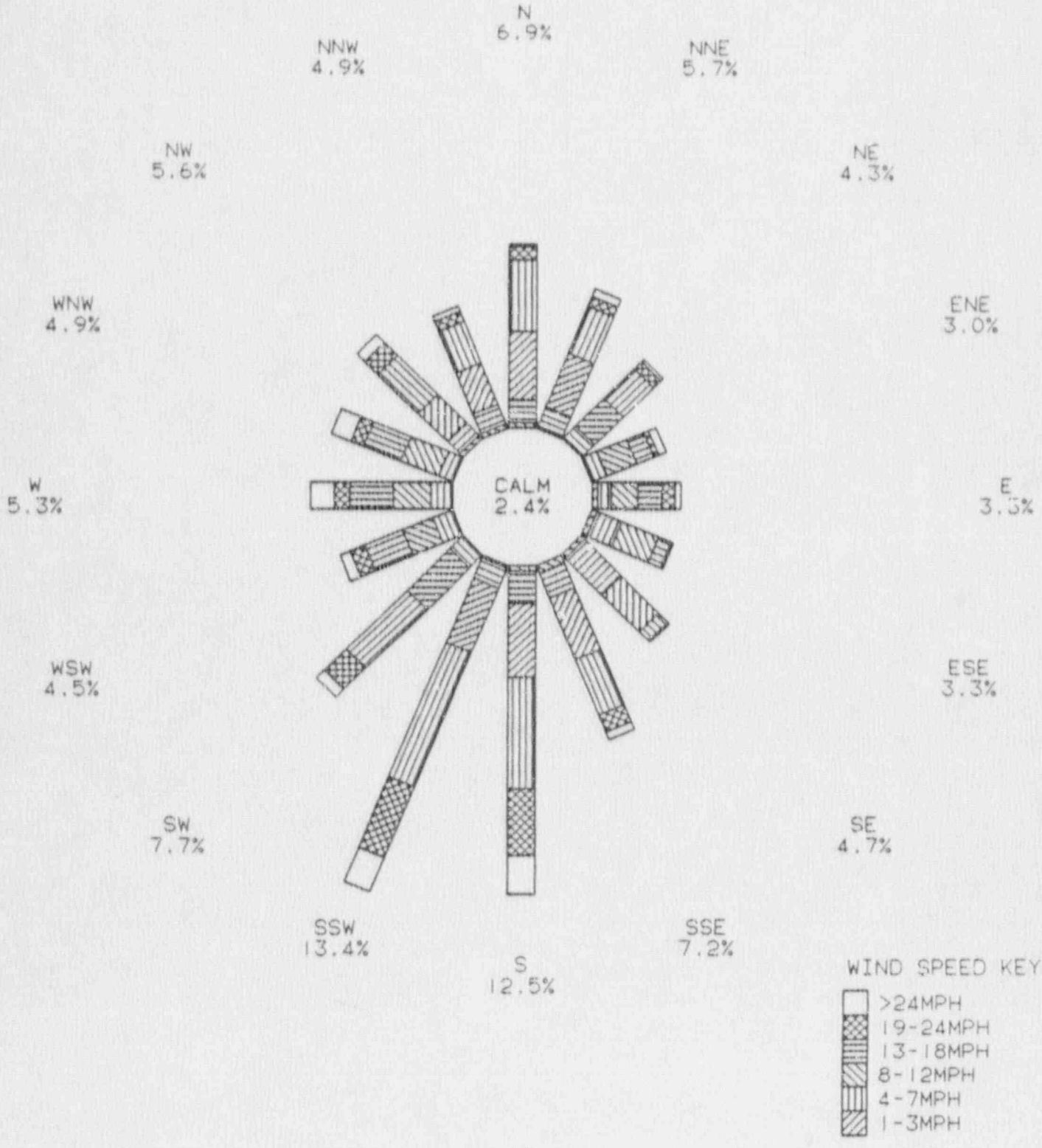
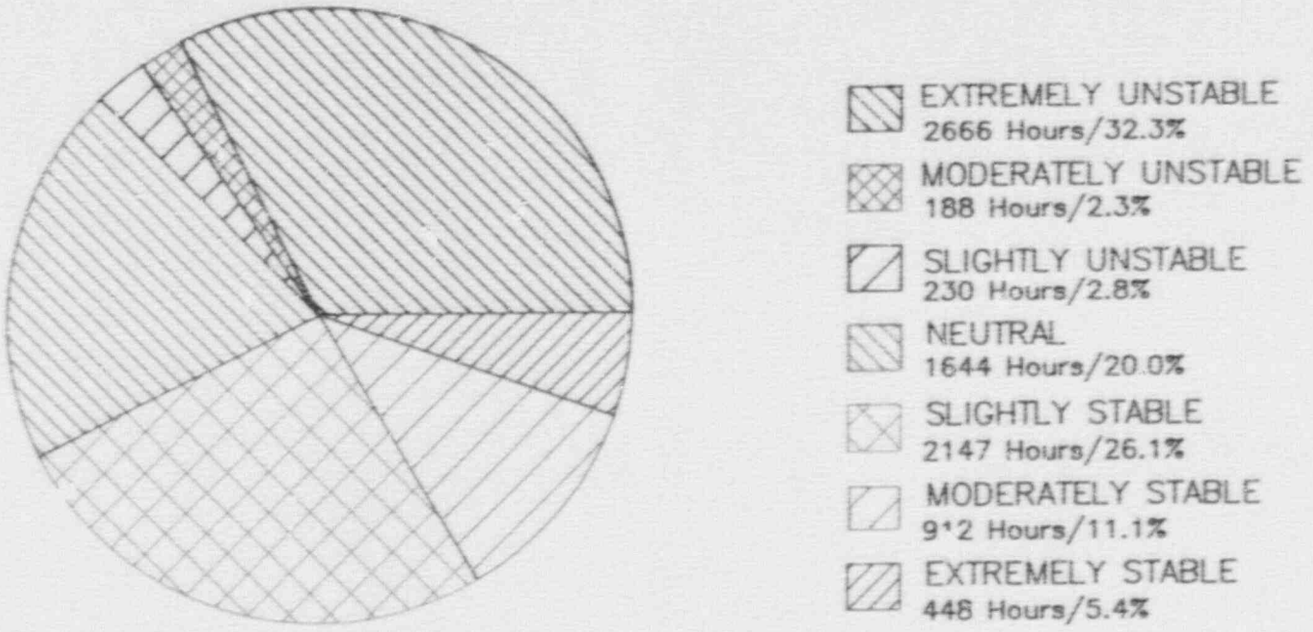


FIGURE 7

CLINTON POWER STATION
DISTRIBUTION OF ATMOSPHERIC STABILITY CLASS

Data Period: January – December 1990



Based on Joint Wind Frequency Distribution at 10 Meters
(8235 Hourly Values)

TABLE 11

CLASSIFICATION OF ATMOSPHERIC STABILITY

Stability Classification	Pasquill Categories	Defining Conditions
Extremely unstable	A	$-0.900 < \Delta T \leq -0.019$
Moderately unstable	B	$-0.019 < \Delta T \leq -0.017$
Slightly unstable	C	$-0.017 < \Delta T \leq -0.015$
Neutral	D	$-0.015 < \Delta T \leq -0.005$
Slightly stable	E	$-0.005 < \Delta T \leq 0.015$
Moderately stable	F	$0.015 < \Delta T \leq 0.040$
Extremely stable	G	$0.040 < \Delta T \leq 0.900$
Invalid		$\Delta T \leq -0.900$ or $\Delta T > 0.900$

ΔT = temperature difference in Celsius degrees per meter

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS A

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1.40E 01	4.40E 01	8.60E 01	4.90E 01	3.00E 00	0.00E-01	1.96E 02
NNE	1.00E 01	5.00E 01	5.70E 01	9.00E 00	2.00E 00	0.00E-01	1.28E 02
NE	6.00E 00	3.40E 01	3.10E 01	6.00E 00	1.00E 00	0.00E-01	7.80E 01
ENE	6.00E 00	1.70E 01	1.70E 01	1.90E 01	0.00E-01	0.00E-01	5.90E 01
E	1.00E 01	3.50E 01	4.40E 01	1.10E 01	1.00E 00	1.00E 00	1.02E 02
ESE	1.10E 01	5.40E 01	3.60E 01	1.10E 01	3.00E 00	0.00E-01	1.15E 02
SE	4.00E 00	9.10E 01	4.00E 01	1.30E 01	2.00E 00	0.00E-01	1.50E 02
SSE	6.00E 00	9.20E 01	8.40E 01	3.00E 01	2.00E 00	0.00E-01	2.14E 02
S	1.00E 01	9.40E 01	1.32E 02	8.00E 01	1.30E 01	7.00E 00	3.36E 02
SSW	1.10E 01	5.40E 01	1.27E 02	9.90E 01	1.90E 01	3.00E 00	3.13E 02
SW	8.00E 00	3.00E 01	9.10E 01	4.80E 01	6.00E 00	0.00E-01	1.83E 02
WSW	4.00E 00	3.40E 01	5.20E 01	2.60E 01	8.00E 00	3.00E 00	1.27E 02
W	8.00E 00	3.10E 01	6.70E 01	3.20E 01	1.70E 01	2.40E 01	1.79E 02
WNW	9.00E 00	4.00E 01	4.60E 01	3.50E 01	2.10E 01	9.00E 00	1.60E 02
NW	1.00E 01	3.50E 01	5.70E 01	5.40E 01	1.50E 01	1.90E 01	1.90E 02
NNW	6.00E 00	3.70E 01	5.80E 01	2.70E 01	3.00E 00	5.00E 00	1.36E 02
TOTAL	1.33E 02	7.72E 02	1.03E 03	5.49E 02	1.16E 02	7.10E 01	2.67E 03

PERIODS OF CALM (HOURS): 8.80OE 01

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5.00E 00	2.70E 01	7.40E 01	6.30E 01	2.00E 00	0.00E-01	1.71E 02
NNE	6.00E 00	1.90E 01	6.60E 01	1.80E 01	9.00E 00	2.00E 00	1.20E 02
NE	5.00E 00	2.10E 01	3.60E 01	2.20E 01	7.00E 00	2.00E 00	9.30E 01
ENE	1.00E 00	1.50E 01	2.60E 01	1.90E 01	6.00E 00	2.00E 01	8.70E 01
E	3.00E 00	1.50E 01	2.60E 01	4.00E 01	3.50E 01	1.30E 01	1.12E 02
ESE	5.00E 00	2.60E 01	3.10E 01	2.00E 01	6.00E 00	0.00E-01	8.80E 01
SE	8.00E 00	6.20E 01	5.20E 01	1.30E 01	0.00E-01	0.00E 00	1.35E 02
SSE	1.10E 01	3.80E 01	5.90E 01	4.10E 01	2.10E 01	3.00E 00	1.75E 02
S	5.00E 00	5.40E 01	9.00E 01	8.40E 01	4.50E 01	4.20E 01	3.22E 02
SSW	5.00E 00	3.20E 01	9.02E 01	9.30E 01	5.00E 01	4.10E 01	3.13E 02
SW	3.00E 00	2.00E 01	8.70E 01	9.40E 01	4.50E 01	1.80E 01	2.67E 02
WSW	6.00E 00	2.80E 01	3.90E 01	3.20E 01	1.20E 01	2.50E 01	1.42E 02
W	4.00E 00	2.50E 01	4.20E 01	4.10E 01	1.30E 01	3.40E 01	1.59E 02
WNW	5.00E 00	2.00E 01	4.10E 01	3.50E 01	1.70E 01	2.70E 01	1.45E 02
NW	1.10E 01	2.90E 01	3.40E 01	5.60E 01	2.20E 01	2.70E 01	1.72E 02
NNW	7.00E 00	2.90E 01	4.70E 01	5.20E 01	1.00E 01	7.00E 00	1.52E 02
TOTAL	9.00E 01	4.60E 02	8.42E 02	7.07E 02	3.00E 02	2.54E 02	2.65E 03

PERIODS OF CALM (HOURS): 7.70E 01

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS B

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	1.00E 00	9.00E 00	7.00E 00	3.00E 00	0.00E-01	2.00E 01
NNE	1.00E 00	2.00E 00	0.00E-01	1.00E 00	1.00E 00	0.00E-01	5.00E 00
NE	0.00E-01	4.00E 00	2.00E 00	1.20E 01	1.00E 00	0.00E-01	1.90E 01
ENE	0.00E-01	0.00E-01	2.00E 00	2.00E 00	0.00E-01	0.00E-01	4.00E 00
E	0.00E-01	1.00E 00	1.00E 00	0.00E-01	0.00E-01	0.00E-01	2.00E 00
ESE	0.00E-01	5.00E 00	3.00E 00	0.00E-01	0.00E-01	0.00E-01	8.00E 00
SE	1.00E 00	3.00E 00	2.00E 00	0.00E-01	0.00E-01	0.00E-01	6.00E 00
SSE	0.00E-01	5.00E 00	6.00E 00	0.00E-01	1.00E 00	0.00E-01	1.20E 01
S	0.00E-01	5.00E 00	8.00E 00	5.00E 00	0.00E-01	1.00E 00	1.90E 01
SSW	0.00E-01	3.00E 00	3.00E 00	6.00E 00	3.00E 00	1.00E 00	1.60E 01
SW	2.00E 00	2.00E 00	1.00E 00	1.00E 00	0.00E-01	0.00E-01	6.00E 00
WSW	0.00E-01	0.00E-01	3.00E 00	1.00E 00	2.00E 00	0.00E-01	6.00E 00
W	0.00E-01	3.00E 00	4.00E 00	4.00E 00	2.00E 00	4.00E 00	1.70E 01
WNW	1.00E 00	1.00E 00	3.00E 00	5.00E 00	0.00E-01	1.00E 00	1.10E 01
NW	0.00E-01	0.00E-01	4.00E 00	9.00E 00	8.00E 00	1.00E 00	2.20E 01
NNW	0.00E-01	3.00E 00	5.00E 00	4.00E 00	1.00E 00	2.00E 00	1.50E 01
TOTAL	5.00E 00	3.80E 01	5.60E 01	5.70E 01	2.20E 01	1.00E 01	1.88E 02

PERIODS OF CALM (HOURS): 1.00E 01

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	0.00E-01	4.00E 00	5.00E 00	2.00E 00	0.00E-01	1.10E 01
NNE	1.00E 00	1.00E 00	5.00E 00	2.00E 00	2.00E 00	3.00E 00	1.40E 01
NE	0.00E-01	0.00E-01	3.00E 00	3.00E 00	5.00E 00	5.00E 00	1.60E 01
ENE	0.00E-01	1.00E 00	1.00E 00	2.00E 00	3.00E 00	0.00E-01	7.00E 00
E	0.00E-01	1.00E 00	0.00E-01	1.00E 00	0.00E-01	0.00E-01	2.00E 00
ESE	0.00E-01	1.00E 00	6.00E 00	3.00E 00	0.00E-01	0.00E-01	1.00E 01
SE	0.00E-01	2.00E 00	2.00E 00	1.00E 00	0.00E-01	0.00E-01	5.00E 00
SSE	0.00E-01	0.00E-01	1.00E 00	3.00E 00	1.00E 00	1.00E 00	6.00E 00
S	0.00E-01	1.00E 00	7.00E 00	6.00E 00	3.00E 00	7.00E 00	2.20E 01
SSW	0.00E-01	1.00E 00	5.00E 00	6.00E 00	2.00E 00	9.00E 00	2.30E 01
SW	0.00E-01	2.00E 00	3.00E 00	1.00E 00	1.00E 00	0.00E-01	7.00E 00
WSW	0.00E-01	3.00E-01	4.00E 00	0.00E-01	1.00E 00	3.00E 00	8.00E 00
W	0.00E-01	1.00E 00	3.00E 00	1.00E 00	4.00E 00	6.00E 00	1.50E 01
WNW	0.00E-01	2.00E 00	2.00E 00	3.00E 00	3.00E 00	6.00E 00	1.60E 01
NW	0.00E-01	1.00E 00	2.00E 00	6.00E 00	5.00E 00	1.00E 00	1.50E 01
NNW	0.00E-01	1.00E 00	2.00E 00	3.00E 00	1.00E 00	4.00E 00	1.10E 01
TOTAL	1.00E 00	1.50E 01	4.80E 01	4.60E 01	3.30E 01	4.50E 01	1.88E 02

PERIODS OF CALM (HOURS): 8.00E 00

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS C

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2.00E 00	0.00E-01	1.00E 01	5.00E 00	7.00E 00	1.00E 00	2.50E 01
NNE	1.00E 00	1.00E 00	7.00E 00	3.00E 00	0.00E-01	0.00E-01	1.20E 01
NE	1.00E 00	3.00E 00	6.00E 00	2.00E 00	0.00E-01	0.00E-01	1.20E 01
ENE	0.00E-01	1.00E 00	8.00E 00	3.00E 00	0.00E-01	0.00E-01	1.20E 01
E	0.00E-01	3.00E 00	2.00E 00	0.00E-01	0.00E-01	1.00E 00	6.00E 00
ESE	1.00E 00	4.00E 00	1.00E 00	0.00E-01	0.00E-01	0.00E-01	6.00E 00
SE	0.00E-01	4.00E 00	7.00E 00	0.00E-01	0.00E-01	0.00E-01	1.10E 01
SSE	1.00E 00	3.00E 00	5.00E 00	4.00E 00	0.00E-01	0.00E-01	1.30E 01
S	0.00E-01	2.00E 00	5.00E 00	7.00E 00	1.00E 00	0.00E-01	1.50E 01
SSW	0.00E-01	2.00E 00	4.00E 00	9.00E 00	5.00E 00	0.00E-01	2.00E 01
SW	0.00E-01	4.00E 00	4.00E 00	2.00E 00	1.00E 00	0.00E-01	1.10E 01
WSW	1.00E 00	1.00E 00	3.00E 00	6.00E 00	1.00E 00	0.00E-01	1.20E 01
W	0.00E-01	2.00E 00	3.00E 00	6.00E 00	2.00E 00	3.00E 00	1.60E 01
WNW	0.00E-01	3.00E 00	3.00E 00	6.00E 00	2.00E 00	1.00E 00	1.50E 01
NW	0.00E-01	5.00E 00	6.00E 00	1.20E 01	4.00E 00	2.00E 00	2.90E 01
NNW	0.00E-01	0.00E-01	1.00E 01	4.00E 00	0.00E-01	1.00E 00	1.50E 01
TOTAL	7.00E 00	3.80E 01	8.40E 01	6.90E 01	2.30E 01	9.00E 00	2.30E 02

PERIODS OF CALM (HOURS): 7.00E 00

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	0.00E-01	5.00E 00	1.00E 01	2.00E 00	0.00E-01	1.70E 01
NNE	0.00E-01	0.00E-01	3.00E 00	6.00E 00	1.00E 00	1.00E 00	1.10E 01
NE	1.00E 00	0.00E-01	4.00E 00	7.00E 00	1.00E 00	0.00E-01	1.30E 01
ENE	0.00E-01	1.00E 00	2.00E 00	5.00E 00	3.00E 00	0.00E-01	1.10E 01
E	0.00E-01	1.00E 00	2.00E 00	2.00E 00	1.00E 00	0.00E-01	6.00E 00
ESE	1.00E 00	4.00E 00	3.00E 00	1.00E 00	0.00E-01	0.00E-01	9.00E 00
SE	0.00E-01	2.00E 00	2.00E 00	4.00E 00	0.00E-01	0.00E-01	8.00E 00
SSE	0.00E-01	1.00E 00	2.00E 00	2.00E 00	2.00E 00	2.00E 00	9.00E 00
S	0.00E-01	0.00E-01	6.00E 00	3.00E 00	5.00E 00	6.00E 00	2.00E 01
SSW	0.00E-01	0.00E-01	5.00E 00	6.00E 00	4.00E 00	1.10E 01	2.60E 01
SW	0.00E-01	1.00E 00	3.00E 00	3.00E 00	3.00E 00	0.00E-01	1.00E 01
WSW	0.00E-01	2.00E 00	2.00E 00	3.00E 00	2.00E 00	2.00E 00	9.00E 00
W	1.00E 00	1.00E 00	2.00E 00	5.00E 00	1.00E 00	7.00E 00	1.70E 01
WNW	0.00E-01	1.00E 00	2.00E 00	4.00E 00	5.00E 00	7.00E 00	1.90E 01
NW	0.00E-01	2.00E 00	4.00E 00	1.10E 01	5.00E 00	2.00E 00	2.40E 01
NNW	0.00E-01	3.00E 00	6.00E 00	5.00E 00	3.00E 00	2.00E 00	1.90E 01
TOTAL	3.00E 00	1.90E 01	5.30E 01	7.50E 01	3.80E 01	4.00E 01	2.28E 02

PERIODS OF CALM (HOURS): 6.00E 00

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS D

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4.00E 00	4.40E 01	9.40E 01	4.90E 01	8.00E 00	1.00E 00	2.00E 02
NNE	9.00E 00	3.80E 01	9.20E 01	3.10E 01	5.00E 00	0.00E-01	1.75E 02
NE	3.00E 00	3.50E 01	3.00E 01	1.20E 01	2.00E 00	0.00E-01	8.20E 01
ENE	3.00E 00	1.60E 01	1.10E 01	4.00E 00	0.00E-01	0.00E-01	3.40E 01
E	1.00E 00	1.50E 01	7.00E 00	0.00E-01	0.00E-01	0.00E-01	2.30E 01
ESE	5.00E 00	2.10E 01	7.00E 00	0.00E-01	0.00E-01	0.00E-01	3.30E 01
SE	0.00E-01	2.80E 01	2.40E 01	3.00E 00	0.00E-01	0.00E-01	5.50E 01
SSE	3.00E 00	4.10E 01	4.20E 01	1.70E 01	0.00E-01	1.00E 00	1.04E 02
S	2.00E 00	2.80E 01	6.50E 01	3.30E 01	7.00E 00	1.00E 00	1.36E 02
SSW	4.00E 00	2.30E 01	7.60E 01	5.00E 01	9.00E 00	2.00E 00	1.64E 02
SW	4.00E 00	1.90E 01	3.30E 01	2.20E 01	5.00E 00	0.00E-01	8.30E 01
WSW	3.00E 00	1.60E 01	1.40E 01	2.30E 01	1.60E 01	1.00E 00	7.30E 01
W	2.00E 00	9.00E 00	2.50E 01	3.70E 01	8.00E 00	1.30E 01	9.40E 01
WNW	3.00E 00	1.10E 01	3.20E 01	4.80E 01	1.90E 01	1.20E 01	1.25E 02
NW	1.00E 00	2.10E 01	4.00E 01	3.80E 01	1.40E 01	5.00E 00	1.19E 02
NNW	1.00E 00	2.60E 01	7.60E 01	3.40E 01	6.00E 00	1.00E 00	1.44E 02
TOTAL	4.80E 01	3.91E 02	6.68E 02	4.01E 02	9.90E 01	3.70E 01	1.64E 03

PERIODS OF CALM (HOURS): 4.10E 01

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1.00E 00	2.10E 01	4.60E 01	8.80E 01	3.10E 01	7.00E 00	1.94E 02
NNE	0.00E-01	2.10E 01	5.60E 01	8.20E 01	1.90E 01	1.60E 01	1.94E 02
NE	1.00E 00	1.00E 01	2.80E 01	4.50E 01	1.00E 01	2.00E 00	9.60E 01
ENE	2.00E 00	7.00E 00	1.80E 01	7.00E 00	6.00E 00	1.00E 00	4.10E 01
E	2.00E 00	4.00E 00	1.20E 01	1.40E 01	1.00E 00	0.00E-01	3.30E 01
ESE	0.00E-01	1.50E 01	2.10E 01	8.00E 00	0.00E-01	0.00E-01	4.40E 01
SE	1.00E 00	1.30E 01	3.20E 01	8.00E 00	4.00E 00	3.00E 00	6.10E 01
SSE	1.00E 00	2.00E 00	3.40E 01	3.00E 01	1.10E 01	9.00E 00	8.70E 01
S	1.00E 00	6.00E 00	3.90E 01	4.60E 01	4.80E 01	3.90E 01	1.79E 02
SSW	2.00E 00	5.00E 00	3.00E 01	6.30E 01	4.70E 01	2.60E 01	1.73E 02
SW	1.00E 00	9.00E 00	1.80E 01	2.60E 01	1.20E 01	4.00E 00	7.00E 01
WSW	1.00E 00	3.00E 00	1.20E 01	1.90E 01	1.40E 01	5.00E 00	5.40E 01
W	2.00E 00	9.00E 00	1.90E 01	4.70E 01	1.30E 01	2.10E 01	9.10E 01
WNW	0.00E-01	5.00E 00	2.10E 01	3.30E 01	1.10E 01	2.70E 01	9.70E 01
NW	0.00E-01	8.00E 00	1.60E 01	4.40E 01	1.30E 01	1.10E 01	9.20E 01
NNW	1.00E 00	1.40E 01	3.50E 01	3.40E 01	1.70E 01	7.00E 00	1.08E 02
TOTAL	1.60E 01	1.52E 02	4.37E 02	5.74E 02	2.57E 02	1.78E 02	1.61E 03

PERIODS OF CALM (HOURS): 4.30E 01

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS E

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	8.00E 00	5.90E 01	4.50E 01	1.00E 00	0.00E-01	0.00E-01	1.13E 02
NNE	1.50E 01	5.40E 01	2.30E 01	1.00E 00	0.00E-01	1.00E 00	9.40E 01
NE	8.00E 00	3.40E 01	1.90E 01	1.00E 00	0.00E-01	0.00E-01	6.20E 01
ENE	1.00E 01	2.80E 01	3.00E 00	2.00E 00	0.00E-01	0.00E-01	4.30E 01
E	1.60E 01	2.50E 01	1.20E 01	0.00E-01	0.00E-01	0.00E-01	5.30E 01
ESE	1.90E 01	5.60E 01	3.00E 00	0.00E-01	0.00E-01	0.00E-01	7.80E 01
SE	1.90E 01	1.11E 02	1.60E 01	4.00E 00	0.00E-01	0.00E-01	1.50E 02
SSE	1.10E 01	1.28E 02	9.40E 01	9.00E 00	1.00E 00	0.00E-01	2.43E 02
S	1.60E 01	9.40E 01	2.04E 02	4.80E 01	3.00E 00	0.00E-01	3.65E 02
SSW	1.40E 01	7.70E 01	1.53E 02	6.90E 01	6.00E 00	0.00E-01	3.19E 02
SW	1.30E 01	3.30E 01	4.70E 01	1.00E 01	1.00E 00	0.00E-01	1.04E 02
WSW	9.00E 00	2.70E 01	5.80E 01	3.10E 01	5.00E 00	0.00E-01	1.30E 02
W	5.00E 00	2.60E 01	4.90E 01	3.30E 01	1.00E 00	2.00E 00	1.16E 02
WNW	6.00E 00	3.60E 01	3.70E 01	1.80E 01	3.00E 00	2.00E 00	1.02E 02
NW	4.00E 00	4.60E 01	4.40E 01	2.00E 00	1.00E 00	0.00E-01	9.70E 01
NNW	1.20E 01	4.30E 01	1.80E 01	5.00E 00	0.00E-01	0.00E-01	7.80E 01
TOTAL	1.85E 02	8.77E 02	8.25E 02	2.34E 02	2.10E 01	5.00E 00	2.15E 03

PERIODS OF CALM (HOURS): 2.50E 01

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4.00E 00	1.90E 01	4.40E 01	3.80E 01	4.00E 01	0.00E-01	1.09E 02
NNE	1.00E 00	1.50E 01	3.50E 01	2.60E 01	6.00E 01	0.00E-01	8.30E 01
NE	0.00E-01	6.00E 00	2.60E 01	3.70E 01	7.00E 01	0.00E-01	7.60E 01
ENE	1.00E 00	4.00E 00	2.90E 01	1.50E 01	0.00E 00	1.00E 00	5.00E 01
E	3.00E 00	7.00E 00	8.00E 00	1.80E 01	0.00E-01	0.00E-01	3.60E 01
ESE	6.00E 00	1.40E 01	2.70E 01	6.00E 00	1.00E 01	0.00E-01	5.40E 01
SE	5.00E 00	3.30E 01	5.10E 01	9.00E 00	3.00E 01	0.00E-01	1.01E 02
SSE	3.00E 00	1.80E 01	8.50E 01	7.80E 01	2.30E 00	8.00E 00	2.15E 02
S	5.00E 00	1.80E 01	7.60E 01	1.37E 02	9.30E 01	3.30E 01	3.62E 02
SSW	3.00E 00	1.60E 01	4.50E 01	1.98E 02	1.24E 01	3.30E 01	4.19E 02
SW	0.00E-01	1.00E 01	4.10E 01	8.00E 01	3.10E 00	8.00E 00	1.70E 02
WSW	3.00E 00	1.70E 01	2.10E 01	3.30E 01	1.20E 00	1.00E 00	8.70E 01
W	3.00E 00	1.00E 01	2.00E 01	2.90E 01	1.10E 01	1.10E 01	8.40E 01
WNW	3.00E 00	8.00E 00	3.70E 01	2.70E 01	8.00E 00	1.00E 00	8.40E 01
NW	1.00E 00	1.20E 01	3.30E 01	3.60E 01	1.30E 01	0.00E-01	9.50E 01
NNW	1.00E 00	1.30E 01	4.10E 01	2.00E 01	0.00E-01	0.00E-01	7.50E 01
TOTAL	4.20E 01	2.20E 02	6.19E 02	7.87E 02	3.36E 01	9.60E 01	2.10E 03

PERIODS OF CALM (HOURS): 4.30E 01

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS F

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4.00E 00	3.40E 01	6.00E 00	0.00E-01	0.00E-01	0.00E-01	4.40E 01
NNE	1.10E 01	3.50E 01	2.00E 00	0.00E-01	0.00E-01	1.00E 00	4.90E 01
NE	1.80E 01	2.20E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	4.00E 01
ENE	1.30E 01	2.20E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	3.50E 01
E	2.60E 01	2.20E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	4.90E 01
ESE	2.10E 01	2.30E 01	2.00E 00	1.00E 00	0.00E-01	0.00E-01	4.70E 01
SE	1.80E 01	4.90E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	6.80E 01
SSE	1.60E 01	8.00E 01	7.00E 00	0.00E-01	0.00E-01	0.00E-01	1.03E 02
S	1.20E 01	7.70E 01	1.70E 01	1.00E 00	0.00E-01	0.00E-01	1.07E 02
SSW	1.10E 01	4.50E 01	2.80E 01	0.00E-01	0.00E-01	0.00E 01	8.40E 01
SW	4.00E 00	2.70E 01	1.90E 01	1.00E 00	0.00E-01	0.00E-01	5.00E 01
WSW	7.00E 00	2.80E 01	2.00E 01	0.00E-01	0.00E-01	0.00E-01	5.50E 01
W	9.00E 00	3.20E 01	2.10E 01	1.00E 00	0.00E-01	0.00E-01	6.30E 01
WNW	9.00E 00	4.20E 01	1.50E 01	0.00E-01	0.00E-01	0.00E-01	6.60E 01
NW	4.00E 00	2.50E 01	6.00E 00	0.00E-01	0.00E-01	0.00E-01	3.50E 01
NNW	4.00E 00	9.00E 00	3.00E 00	0.00E-01	0.00E-01	0.00E-01	1.60E 01
TOTAL	1.87E 02	5.72E 02	1.48E 02	4.00E 00	0.00E-01	1.00E 00	9.12E 02

PERIODS OF CALM (HOURS): 3.00E 00

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4.00E 00	3.00E 00	2.60E 01	1.00E 01	0.00E-01	0.00E-01	4.30E 01
NNE	0.00E-01	3.00E 00	1.40E 01	1.60E 01	0.00E-01	1.00E 00	3.40E 01
NE	2.00E 00	8.00E 00	1.20E 01	1.20E 01	1.00E 00	0.00E-01	3.50E 01
ENE	2.00E 00	4.00E 00	1.20E 01	8.00E 00	0.00E-01	0.00E-01	2.60E 01
E	2.00E 00	4.00E 00	1.20E 01	9.00E 00	0.00E-01	0.00E-01	2.70E 01
ESE	1.00E 00	1.10E 01	2.60E 01	3.00E 00	0.00E-01	0.00E-01	4.10E 01
SE	3.00E 00	3.30E 01	2.10E 01	5.00E 00	1.00E 00	0.00E-01	6.30E 01
SSE	1.00E 00	2.40E 01	2.70E 01	2.30E 01	2.00E 00	0.00E-01	7.70E 01
S	1.00E 00	1.20E 01	2.80E 01	5.90E 01	1.10E 01	0.00E-01	1.11E 02
SSW	0.00E-01	7.00E 00	3.70E 01	7.40E 01	1.20E 01	0.00E-01	1.30E 02
SW	2.00E 00	6.00E 00	1.90E 01	5.00E 01	6.00E 00	0.00E-01	8.30E 01
WSW	1.00E 00	5.00E 00	1.40E 01	2.70E 01	7.00E 00	0.00E-01	5.40E 01
W	1.00E 00	1.00E 00	2.00E 01	2.40E 01	3.00E 00	0.00E-01	4.90E 01
WNW	2.00E 00	4.00E 00	1.70E 01	2.20E 01	1.00E 00	0.00E-01	4.60E 01
NW	0.00E-01	6.00E 00	2.90E 01	1.70E 01	1.00E 00	0.00E-01	5.30E 01
NNW	4.00E 00	6.00E 00	9.00E 00	1.00E 01	0.00E-01	0.00E-01	2.90E 01
TOTAL	2.60E 01	1.37E 02	3.13E 02	3.69E 02	4.50E 01	1.00E 00	9.01E 02

PERIODS OF CALM (HOURS): 1.40E 01

JOINT WIND FREQUENCY DISTRIBUTION BY STABILITY CLASS

Data Period: January 1, 1990 - December 31, 1990

STABILITY CLASS G

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1.10E 01	1.00E 01	5.00E 00	0.00E-01	0.00E-01	0.00E-01	2.60E 01
NNE	3.20E 01	2.60E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	5.90E 01
NE	2.40E 01	1.40E 01	0.00E-01	1.00E 00	0.00E-01	0.00E-01	3.90E 01
ENE	1.90E 01	1.00E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.90E 01
E	1.30E 01	9.00E 00	1.00E 00	0.00E-01	0.00E-01	0.00E-01	2.30E 01
ESE	1.10E 01	1.50E 01	5.00E 00	0.00E-01	0.00E-01	0.00E-01	2.10E 01
SE	4.00E 00	1.50E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	2.00E 01
SSE	9.00E 00	1.50E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.40E 01
S	1.00E 01	1.30E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.30E 01
SSW	6.00E 00	1.60E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.20E 01
SW	1.20E 01	2.50E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	3.80E 01
WSW	1.60E 01	1.40E 01	3.00E 00	0.00E-01	0.00E-01	0.00E-01	3.30E 01
W	1.40E 01	7.00E 00	2.00E 00	0.00E-01	0.00E-01	0.00E-01	2.30E 01
WNW	1.20E 01	7.00E 00	4.00E 00	0.00E-01	0.00E-01	0.00E-01	2.30E 01
NW	3.00E 00	8.00E 00	4.00E 00	0.00E-01	0.00E-01	0.00E-01	1.50E 01
NNW	8.00E 00	8.00E 00	3.00E 00	1.00E 00	0.00E-01	0.00E-01	2.00E 01
TOTAL	2.04E 02	2.12E 02	3.00E 01	2.00E 00	0.00E-01	0.00E-01	4.48E 02

PERIODS OF CALM (HOURS): 5.00E 00

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3.00E 00	6.00E 00	1.00E 01	8.00E 00	0.00E-01	0.00E-01	2.70E 01
NNE	4.00E 00	8.00E 00	5.00E 00	7.00E 00	0.00E-01	0.00E-01	2.40E 01
NE	2.00E 00	6.00E 00	1.50E 01	9.00E 00	0.00E-01	0.00E-01	3.20E 01
ENE	4.00E 00	8.00E 00	1.40E 01	4.00E 00	0.00E-01	0.00E-01	3.00E 01
E	3.00E 00	6.00E 00	2.90E 01	8.00E 00	1.00E 00	0.00E-01	4.90E 01
ESE	2.00E 00	1.00E 01	1.20E 01	4.00E 00	0.00E-01	0.00E-01	2.80E 01
SE	2.00E 00	1.20E 01	4.00E 00	1.00E 00	1.00E 00	0.00E-01	2.00E 01
SSE	9.00E 00	5.00E 00	7.00E 00	1.50E 01	0.00E-01	0.00E-01	3.60E 01
S	3.00E 00	6.00E 00	1.00E 00	1.10E 01	1.00E 00	0.00E-01	2.20E 01
SSW	1.00E 00	6.00E 00	1.10E 01	1.70E 01	2.00E 00	0.00E-01	3.70E 01
SW	3.00E 00	5.00E 00	1.30E 01	1.30E 01	0.00E-01	0.00E-01	3.40E 01
WSW	1.00E 00	6.00E 00	1.00E 01	1.70E 01	2.00E 00	0.00E-01	3.60E 01
W	0.00E-01	1.00E 01	8.00E 00	9.00E 00	1.00E 00	0.00E-01	2.80E 01
WNW	0.00E-01	5.00E 00	1.00E 00	2.00E 00	0.00E-01	0.00E-01	8.00E 00
NW	2.00E 00	2.00E 00	9.00E 00	1.00E 00	0.00E-01	0.00E-01	1.40E 01
NNW	4.00E 00	4.00E 00	5.00E 00	1.00E 01	0.00E-01	0.00E-01	2.30E 01
TOTAL	4.50E 01	1.05E 02	1.54E 02	1.36E 02	8.00E 00	0.00E-01	4.48E 02

PERIODS OF CALM (HOURS): 5.00E 00

ANNUAL AVERAGE RELATIVE CONCENTRATIONS

FOR HVAC STACK

Data Period: January 1, 1990 - December 31, 1990

UNDECAYED AND UNDEPLETED PARTICULATES
(sec/m^3)

KILOMETERS-->	0.2	0.8	1.8	4.0	8.05	12.5	17.3
N	2.35E-06	4.23E-07	1.80E-07	6.47E-08	3.03E-08	2.03E-08	1.35E-08
NNE	2.20E-06	3.97E-07	1.69E-07	6.25E-08	3.07E-08	2.11E-08	1.45E-08
NE	1.15E-06	1.90E-07	8.16E-08	3.17E-08	1.57E-08	1.08E-08	7.41E-09
ENE	1.12E-06	1.98E-07	8.15E-08	2.94E-08	1.41E-08	9.57E-09	6.50E-09
E	1.09E-06	2.23E-07	9.79E-08	3.78E-08	1.91E-08	1.33E-08	9.17E-09
ESE	8.92E-07	1.57E-07	6.74E-08	2.53E-08	1.24E-08	8.48E-09	5.79E-09
SE	7.80E-07	1.47E-07	6.70E-08	2.63E-08	1.33E-08	9.27E-09	6.40E-09
SSE	5.98E-07	1.34E-07	6.79E-08	5.05E-08	3.68E-08	2.89E-08	2.19E-08
S	1.14E-06	1.91E-07	8.72E-08	3.40E-08	1.66E-08	1.13E-08	7.68E-09
SSW	1.09E-06	2.05E-07	9.05E-08	3.37E-08	1.58E-08	1.06E-08	7.06E-09
SW	6.92E-07	1.25E-07	5.47E-08	2.10E-08	1.03E-08	7.06E-09	4.84E-09
WSW	4.94E-07	8.31E-08	3.65E-08	1.47E-08	7.49E-09	5.26E-09	3.68E-09
W	5.75E-07	9.36E-08	3.98E-08	1.55E-08	8.00E-09	5.70E-09	4.06E-09
WNW	5.97E-07	1.00E-07	4.63E-08	2.02E-08	1.06E-08	7.44E-09	5.19E-09
NW	9.99E-07	1.72E-07	7.79E-08	3.26E-08	1.69E-08	1.19E-08	8.28E-09
NNW	1.61E-06	2.88E-07	1.25E-07	4.71E-08	2.30E-08	1.57E-08	1.08E-08

KILOMETERS-->	24.15	32.2	40.25	48.3	56.35	64.4	72.45
N	8.99E-09	6.64E-09	5.22E-09	4.29E-09	3.62E-09	3.13E-09	2.75E-09
NNE	9.83E-09	7.37E-09	5.86E-09	4.85E-09	4.12E-09	3.58E-09	3.16E-09
NE	5.04E-09	3.78E-09	3.01E-09	2.49E-09	2.12E-09	1.84E-09	1.63E-09
ENE	4.38E-09	3.27E-09	2.59E-09	2.14E-09	1.82E-09	1.58E-09	1.39E-09
E	6.30E-09	4.78E-09	3.84E-09	3.21E-09	2.76E-09	2.42E-09	2.15E-09
ESE	3.91E-09	2.92E-09	2.32E-09	1.91E-09	1.62E-09	1.41E-09	1.24E-09
SE	4.37E-09	3.30E-09	2.64E-09	2.19E-09	1.87E-09	1.63E-09	1.45E-09
SSE	1.61E-08	1.26E-08	1.04E-08	8.82E-09	7.65E-09	6.75E-09	6.04E-09
S	5.18E-09	3.87E-09	3.07E-09	2.53E-09	2.15E-09	1.87E-09	1.24E-09
SSW	4.69E-09	3.47E-09	2.74E-09	2.25E-09	1.90E-09	1.65E-09	1.45E-09
SW	3.30E-09	2.48E-09	1.98E-09	1.64E-09	1.40E-09	1.21E-09	1.07E-09
WSW	2.56E-09	1.95E-09	1.57E-09	1.31E-09	1.12E-09	9.81E-10	8.70E-10
W	2.86E-09	2.19E-09	1.77E-09	1.48E-09	1.28E-09	1.12E-09	9.92E-10
WNW	3.57E-09	2.70E-09	2.16E-09	1.79E-09	1.53E-09	1.33E-09	1.18E-09
NW	5.69E-09	4.30E-09	3.43E-09	2.85E-09	2.43E-09	2.11E-09	1.87E-09
NNW	7.31E-09	5.49E-09	4.37E-09	3.62E-09	3.08E-09	2.69E-09	2.37E-09

ANNUAL AVERAGE RELATIVE CONCENTRATIONS

FOR HVAC STACK

Data Period: January 1, 1990 - December 31, 1990

DECAYED NOBLE GASES
(sec/m^3)

KILOMETERS-->	0.2	0.8	1.8	4.0	8.05	12.5	17.3
N	2.35E-06	4.23E-07	1.80E-07	6.43E-08	3.00E-08	2.00E-08	1.33E-08
NNE	2.20E-06	3.97E-07	1.68E-07	6.20E-08	3.00E-08	2.03E-08	1.37E-08
NE	1.15E-06	1.90E-07	8.14E-08	3.15E-08	1.55E-08	1.06E-08	7.24E-09
ENE	1.12E-06	1.98E-07	8.13E-08	2.92E-08	1.39E-08	9.41E-09	6.35E-09
E	1.09E-06	2.23E-07	9.68E-08	3.66E-08	1.78E-08	1.20E-08	8.00E-09
ESE	8.91E-07	1.57E-07	6.73E-08	2.52E-08	1.22E-08	8.29E-09	5.58E-09
SE	7.80E-07	1.46E-07	6.64E-08	2.58E-08	1.28E-08	8.71E-09	5.86E-09
SSE	5.97E-07	1.33E-07	6.69E-08	4.70E-08	3.14E-08	2.30E-08	1.58E-08
S	1.14E-06	1.90E-07	8.69E-08	3.38E-08	1.63E-08	1.11E-08	7.45E-09
SSW	1.09E-06	2.04E-07	9.02E-08	3.35E-08	1.56E-08	1.04E-08	6.88E-09
SW	6.92E-07	1.24E-07	5.46E-08	2.08E-08	1.01E-08	6.93E-09	4.72E-09
WSW	4.93E-07	8.30E-08	3.63E-08	1.46E-08	7.36E-09	5.14E-09	3.57E-09
W	5.74E-07	9.33E-08	3.97E-08	1.55E-08	7.84E-09	5.54E-09	3.90E-09
WNW	5.96E-07	1.00E-07	4.61E-08	2.00E-08	1.04E-08	7.25E-09	5.00E-09
NW	9.98E-07	1.72E-07	7.77E-08	3.23E-08	1.67E-08	1.16E-08	8.01E-09
NNW	1.61E-06	2.88E-07	1.24E-07	4.68E-08	2.27E-08	1.55E-08	1.05E-08

KILOMETERS-->	24.15	32.2	40.25	48.3	56.35	64.4	72.45
N	8.74E-09	6.40E-09	4.99E-09	4.06E-09	3.40E-09	2.91E-09	2.54E-09
NNE	9.02E-09	6.59E-09	5.12E-09	4.14E-09	3.44E-09	2.94E-09	2.54E-09
NE	4.88E-09	3.62E-09	2.86E-09	2.34E-09	1.97E-09	1.70E-09	1.49E-09
ENE	4.23E-09	3.13E-09	2.46E-09	2.00E-09	1.68E-09	1.45E-09	1.26E-09
E	5.21E-09	3.75E-09	2.87E-09	2.29E-09	1.88E-09	1.58E-09	1.36E-09
ESE	3.70E-09	2.72E-09	2.12E-09	1.72E-09	1.44E-09	1.23E-09	1.07E-09
SE	3.87E-09	2.83E-09	2.20E-09	1.78E-09	1.48E-09	1.26E-09	1.09E-09
SSE	1.02E-08	7.07E-08	5.15E-08	3.89E-09	3.02E-09	2.40E-09	1.94E-09
S	4.95E-09	3.65E-09	2.85E-09	2.32E-09	1.95E-09	1.66E-09	1.45E-09
SSW	4.52E-09	3.31E-09	2.58E-09	2.10E-09	1.75E-09	1.50E-09	1.30E-09
SW	3.18E-09	2.36E-09	1.86E-09	1.52E-09	1.28E-09	1.10E-09	9.64E-10
WSW	2.45E-09	1.84E-09	1.47E-09	1.21E-09	1.02E-09	8.81E-10	7.72E-10
W	2.70E-09	2.05E-09	1.63E-09	1.35E-09	1.14E-09	9.85E-09	8.62E-10
WNW	3.40E-09	2.53E-09	2.00E-09	1.64E-09	1.38E-09	1.19E-09	1.03E-09
NW	5.43E-09	4.04E-09	3.18E-09	2.61E-09	2.19E-09	1.88E-09	1.64E-09
NNW	7.04E-09	5.23E-09	4.11E-09	3.36E-09	3.83E-09	2.43E-09	2.12E-09

ANNUAL AVERAGE RELATIVE CONCENTRATIONS

FOR HVAC STACK

Data Period: January 1, 1990 - December 31, 1990

DECAYED AND DEPLETED PARTICULATES AND RADIOIODINES
(sec/m^3)

KILOMETERS-->	0.2	0.8	1.8	4.0	8.05	12.5	17.3
N	2.23E-06	3.79E-07	1.56E-07	5.36E-08	2.43E-08	1.59E-08	1.04E-08
NNE	2.08E-06	3.55E-07	1.46E-07	5.22E-08	2.49E-08	1.69E-08	1.13E-08
NE	1.09E-06	1.71E-07	7.10E-08	2.67E-08	1.28E-08	8.69E-09	5.85E-09
ENE	1.05E-06	1.77E-07	7.02E-08	2.43E-08	1.12E-08	7.48E-09	4.97E-09
E	1.04E-06	2.02E-07	8.58E-08	3.18E-08	1.54E-08	1.04E-08	6.92E-09
ESE	8.46E-07	1.41E-07	5.86E-08	2.13E-08	1.01E-08	6.83E-09	4.57E-09
SE	7.41E-07	1.33E-07	5.92E-08	2.26E-08	1.10E-08	7.50E-09	5.03E-09
SSE	5.69E-07	1.23E-07	6.13E-08	4.63E-08	3.33E-08	2.56E-08	1.88E-08
S	1.08E-06	1.72E-07	7.69E-08	2.92E-08	1.38E-08	9.28E-09	6.19E-09
SSW	1.04E-06	1.84E-07	7.94E-08	2.85E-08	1.28E-08	8.36E-09	5.44E-09
SW	6.57E-07	1.12E-07	4.80E-08	1.78E-08	8.47E-09	5.73E-09	3.86E-09
WSW	4.68E-07	7.47E-08	3.19E-08	1.25E-08	6.22E-09	4.31E-09	2.98E-09
W	5.45E-07	8.39E-08	3.45E-08	1.30E-08	6.54E-09	4.60E-09	3.23E-09
WNW	5.67E-07	9.02E-08	4.07E-08	1.74E-08	8.98E-09	6.24E-09	4.29E-09
NW	9.49E-07	1.54E-07	6.82E-08	2.80E-08	1.43E-08	9.94E-09	6.82E-09
NNW	1.53E-06	2.58E-07	1.08E-07	3.95E-08	1.88E-08	1.27E-08	8.50E-09

KILOMETERS-->	24.15	32.2	40.25	48.3	56.35	64.4	72.45
N	6.68E-09	4.81E-09	3.70E-09	2.98E-09	2.47E-09	2.09E-09	1.81E-09
NNE	7.48E-09	5.47E-09	4.24E-09	3.43E-09	2.85E-09	2.42E-09	2.09E-09
NE	3.89E-09	2.86E-09	2.24E-09	1.82E-09	1.53E-09	1.31E-09	1.13E-09
ENE	3.26E-09	2.38E-09	1.85E-09	1.50E-09	1.25E-09	1.06E-09	9.20E-10
E	4.52E-09	3.27E-09	2.52E-09	2.01E-09	1.66E-09	1.40E-09	1.19E-09
ESE	3.01E-09	2.20E-09	1.71E-09	1.38E-09	1.15E-09	9.77E-10	8.45E-10
SE	3.31E-09	2.41E-09	1.87E-09	1.51E-09	1.25E-09	1.06E-09	9.15E-10
SSE	1.32E-08	9.91E-09	7.79E-09	6.31E-09	5.23E-09	4.41E-09	3.77E-09
S	4.08E-09	2.98E-09	2.32E-09	1.89E-09	1.57E-09	1.34E-09	1.17E-09
SSW	3.51E-09	2.53E-09	1.95E-09	1.56E-09	1.31E-09	1.11E-09	9.59E-10
SW	2.57E-09	1.90E-09	1.49E-09	1.21E-09	1.02E-09	8.73E-10	7.60E-10
WSW	2.04E-09	1.53E-09	1.22E-09	1.00E-09	8.49E-10	7.32E-10	6.41E-10
W	2.24E-09	1.70E-09	1.36E-09	1.12E-09	9.51E-10	8.21E-10	7.20E-10
WNW	2.90E-09	2.16E-09	1.70E-09	1.39E-09	1.17E-09	1.00E-09	8.76E-10
NW	4.61E-09	3.43E-09	2.70E-09	2.20E-09	1.85E-09	1.59E-09	1.39E-09
NNW	5.66E-09	4.17E-09	3.27E-09	2.67E-09	2.24E-09	1.92E-09	1.67E-09

ANNUAL AVERAGE RELATIVE CONCENTRATIONS

FOR HVAC STACK

Data Period: January 1, 1990 - December 31, 1990

DECAYED AND DEPLETED PARTICULATES AND RADIOIODINES (DEPOSITION)
(m^{-2})

KILOMETERS-->	0.2	0.8	1.8	4.0	8.05	12.5	17.3
N	2.94E-08	6.38E-09	2.20E-09	5.35E-10	1.87E-10	1.07E-10	6.18E-11
NNE	2.99E-08	6.44E-09	2.21E-09	5.36E-10	1.87E-10	1.07E-10	6.15E-11
NE	1.34E-08	3.21E-09	1.11E-09	2.71E-10	9.60E-11	5.62E-11	3.30E-11
ENE	1.20E-08	2.84E-09	9.73E-10	2.36E-10	8.23E-11	4.74E-11	2.73E-11
E	1.61E-08	3.64E-09	1.27E-09	3.12E-10	1.09E-10	6.31E-11	3.64E-11
ESE	1.32E-08	2.89E-09	1.00E-09	2.47E-10	8.62E-11	4.97E-11	2.86E-11
SE	1.42E-08	3.31E-09	1.15E-09	2.86E-10	9.85E-11	5.71E-11	3.32E-11
SSE	9.93E-09	2.39E-09	9.57E-10	2.47E-10	8.81E-11	5.15E-11	3.02E-11
S	1.56E-08	3.71E-09	1.35E-09	3.41E-10	1.20E-10	6.97E-11	4.03E-11
SSW	9.72E-09	2.46E-09	9.38E-10	2.47E-10	8.75E-11	5.07E-11	2.94E-11
SW	6.76E-09	1.70E-09	6.26E-10	1.60E-10	5.69E-11	3.31E-11	1.93E-11
WSW	4.58E-09	1.12E-09	4.02E-10	1.02E-10	3.63E-11	2.12E-11	1.25E-11
W	5.22E-09	1.24E-09	4.38E-10	1.09E-10	3.84E-11	2.24E-11	1.31E-11
WNW	4.90E-09	1.29E-09	4.72E-10	1.21E-10	4.32E-11	2.55E-11	1.51E-11
NW	8.02E-09	2.06E-09	7.46E-10	1.88E-10	6.74E-11	3.96E-11	2.34E-11
NNW	1.54E-08	3.45E-09	1.20E-09	2.96E-10	1.04E-10	6.00E-11	3.47E-11

KILOMETERS-->	24.15	32.2	40.25	48.3	56.35	64.4	72.45
N	3.92E-11	2.32E-11	1.67E-11	1.27E-11	1.01E-11	8.26E-12	6.90E-12
NNE	3.49E-11	2.30E-11	1.65E-11	1.26E-11	1.00E-11	8.24E-12	6.92E-12
NE	1.94E-11	1.31E-11	9.57E-12	7.41E-12	5.97E-12	4.94E-12	4.16E-12
ENE	1.56E-11	1.03E-11	7.39E-12	5.63E-12	4.48E-12	3.66E-12	3.06E-12
E	2.08E-11	1.37E-11	9.83E-12	7.46E-12	5.88E-12	4.78E-12	3.96E-12
ESE	1.63E-11	1.08E-11	7.72E-12	5.87E-12	4.64E-12	3.72E-12	3.14E-12
SE	1.91E-11	1.27E-11	9.19E-12	7.02E-12	5.58E-12	4.55E-12	3.79E-12
SSE	1.76E-11	1.18E-11	8.53E-12	6.53E-12	5.18E-12	4.22E-12	3.50E-12
S	2.32E-11	1.54E-11	1.11E-11	8.48E-12	6.73E-12	5.49E-12	4.57E-12
SSW	1.69E-11	1.12E-11	8.10E-12	6.19E-12	4.92E-12	4.01E-12	3.34E-12
SW	1.12E-11	7.47E-12	5.43E-12	4.19E-12	3.35E-12	2.76E-12	2.32E-12
WSW	7.28E-12	4.90E-12	3.58E-12	2.77E-12	2.22E-12	1.84E-12	1.55E-12
W	7.59E-12	5.08E-12	3.71E-12	2.87E-12	2.31E-12	1.92E-12	1.62E-12
WNW	8.90E-12	6.03E-12	4.43E-12	3.43E-12	2.75E-12	2.27E-12	1.90E-12
NW	1.37E-11	9.29E-12	6.80E-12	5.35E-12	4.19E-12	3.44E-12	2.87E-12
NNW	1.99E-11	1.32E-11	9.54E-12	7.30E-12	5.82E-12	4.77E-12	4.00E-12

SECTION 6
DOSE MEASUREMENTS AND ASSESSMENTS

TABLE 14

MAXIMUM* OFFSITE DOSES AND DOSE COMMITMENTS
TO MEMBERS OF THE PUBLIC
Data Period: January 1, 1990 - December 31, 1990

Source		DOSE** 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
A. Waterborne Effluents (mrem)	Organ	0.00E+00	3.58E-03[1]	2.41E-02[1]	1.53-03[1]
	Total Body	0.00E+00	3.28E-04[2]	2.29E-03[2]	1.50E-04[2]
B. Airborne Effluents					
1. Iodines and Particulates	Organ	2.11E-03[3]	5.90E-04[4]	6.43E-04[5]	3.50E-04[4]
	Total Body	7.55E-05[6]	4.96E-06[6]	8.65E-06[6]	2.14E-05[6]
2. Noble Gases:	Gamma	6.88E-04[8]	0.00E+00	0.00E+00	0.00E+00
	Beta	1.30E-03[8]	0.00E+00	0.00E+00	0.00E+00
C. Direct Radiation (mrem)		0.00[7]	0.00[7]	0.00[7]	0.00[7]

THERE ARE NO OTHER URANIUM FUEL CYCLE FACILITIES WITHIN 8 KM OF CPS

* "Maximum" means the largest fraction of the corresponding Appendix I dose design objective.

** The numbered footnotes on the following page briefly explain how each maximum dose was calculated, including the organ and predominant pathway(s).

Footnotes for Table 14

1. Dose to the adult gastrointestinal tract and lower large intestine (GI-LLI) by the fish pathway. Calculated using methodology contained in the CPS Offsite Dose Calculation Manual (ODCM).

2. Dose to the adult total body by the fish pathway. Calculated using methodology contained in the CPS ODCM.

3. Dose to the infant thyroid via the inhalation, cow milk, and ground-plane pathways. Calculated at 4.5 miles North using methodology contained in the CPS ODCM.

4. Dose to the infant thyroid via the inhalation, cow milk and ground-plane pathways. Calculated at 4.5 miles North-Northeast using methodology contained in the CPS ODCM.

5. Dose to the infant thyroid via the inhalation, cow milk and ground-plane pathways. Calculated at 4.5 miles South-Southwest using methodology contained in the CPS ODCM.

6. Dose to the infant total body via the inhalation, cow milk and ground-plane pathways. Calculated at 4.5 miles North-Northeast using methodology contained in the CPS ODCM.

7. Direct radiation dose component from reactor plant operations in conformance with 40CFR190.

8. Dose is independent of age group. Calculated at 0.87 miles North using methodology contained in the CPS ODCM.

DOSES TO MEMBERS OF THE PUBLIC WITHIN THE SITE BOUNDARY

CPS Technical Specification 6.9.1.7 requires that the Semiannual Radioactive Effluent Release Report include an assessment of the radiation doses from radioactive liquids and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents shall be used for determining the gaseous pathway doses. Within the CPS site boundary there are seven areas which are open to members of the public as identified by CPS ODCM Table 3.4-4 (see Figure 8):

- A road at 0.495 kilometers (0.3 miles) in the SE sector
- Agricultural acreage at 1.372 kilometers (0.9 miles) in the SSW sector
- A portion of Clinton Lake at 0.335 kilometers (0.2 miles) in the NW sector
- The Department of Conservation Recreation Area at 1.287 kilometers (0.8 miles) in the ESE sector
- A residence at 1.219 kilometers (0.8 miles) in the SW sector
- A residence at 2.414 kilometers (1.5 miles) in the WSW sector
- A residence at 2.736 kilometers (1.7 miles) in the SSE sector

At all of the above locations, the plume, inhalation and ground-plane exposure pathways are used for dose calculations. No other exposure pathways were identified by the 1990 Annual Land Use Census. All dose calculations were performed using the methodology contained in the CPS ODCM.

FIGURE 8

AREAS WITHIN THE CPS SITE BOUNDARY OPEN TO MEMBERS OF THE PUBLIC

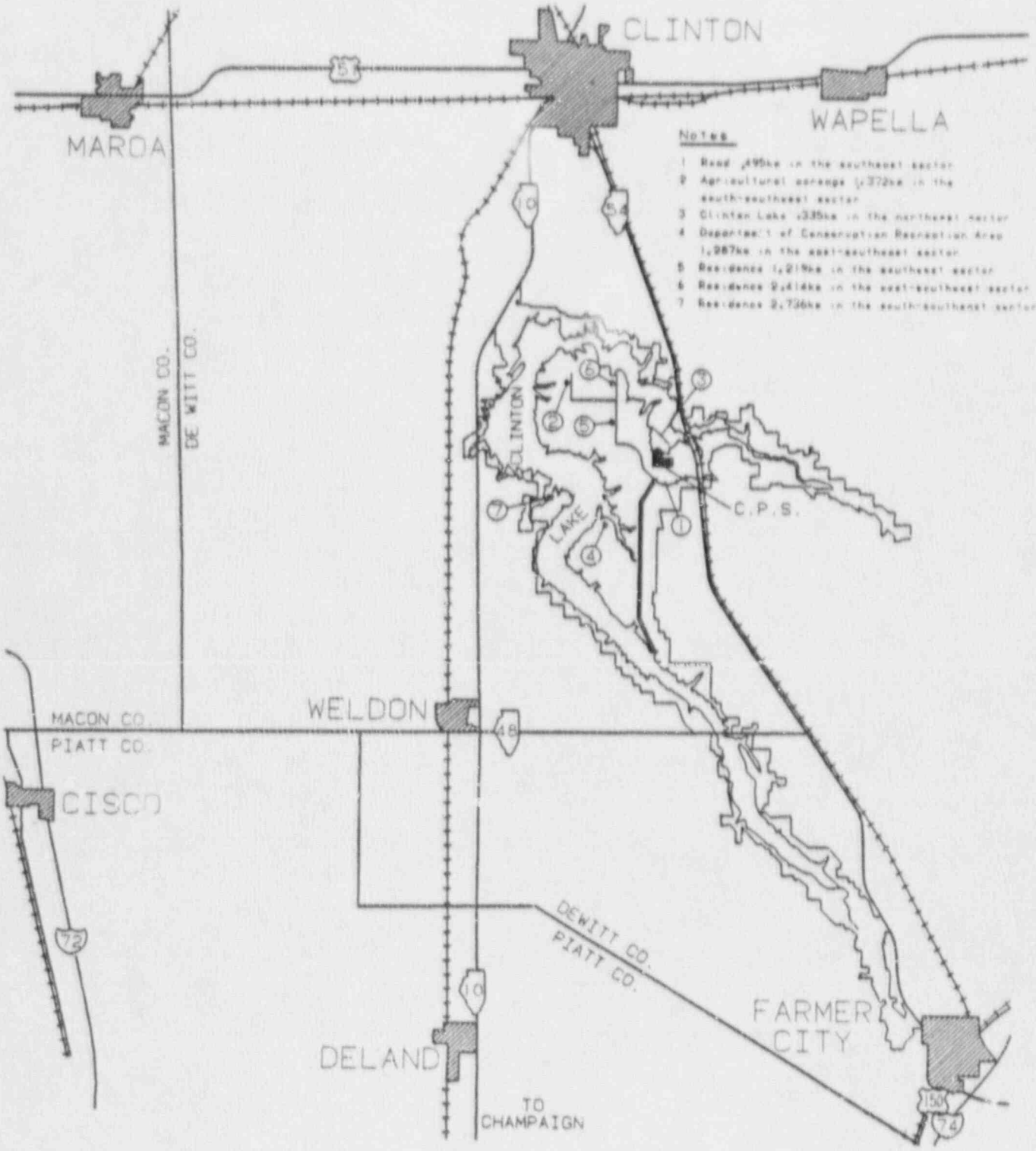


TABLE 15

CALCULATED DOSES TO MEMBERS OF THE PUBLIC DURING USE OF THE ROAD IN THE SOUTHEAST SECTOR WITHIN THE CPS SITE BOUNDARY

Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	4.50E-06
	skin	2.42E-05
ground plane*	total body	6.01E-05
	skin	7.06E-05
inhalation; four highest organ doses:		
	child thyroid	3.60E-06
	teen thyroid	3.46E-06
	adult thyroid	3.05E-06
	infant thyroid	2.88E-06

* Doses via these pathways are not dependent upon age-group.

TABLE 16

CALCULATED DOSES TO MEMBERS OF THE PUBLIC
DURING USE OF THE AGRICULTURAL ACREAGE
IN THE SOUTH-SOUTHWEST SECTOR WITHIN
THE CPS SITE BOUNDARY
Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	2.63E-07
	skin	1.97E-05
ground plane*	total body	5.50E-05
	skin	6.46E-05
inhalation; four highest organ doses:		
	child thyroid	4.52E-05
	teen thyroid	4.25E-05
	infant thyroid	3.79E-05
	adult thyroid	3.63E-05

* Doses via these pathways are not dependent upon age-group.

TABLE 17

CALCULATED DOSES TO MEMBERS OF THE PUBLIC
DURING USE OF CLINTON LAKE IN THE
NORTHWEST SECTOR WITHIN THE CPS
SITE BOUNDARY
Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	0
	skin	0
ground plane*	total body	1.50E-05
	skin	1.77E-05
inhalation; four highest organ doses:		
	child thyroid	6.00E-05
	teen thyroid	5.61E-05
	adult thyroid	4.81E-05
	infant thyroid	3.75E-05

* Doses via these pathways are not dependent upon age-group.

TABLE 18

CALCULATED DOSES TO MEMBERS OF THE PUBLIC
DURING USE OF THE DEPARTMENT OF CONSERVATION
RECREATION AREA IN THE EAST-SOUTHEAST SECTOR
WITHIN THE CPS SITE BOUNDARY
Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	0
	skin	0
ground plane*	total body	1.43E-06
	skin	1.69E-06
inhalation; four highest organ doses:		
	child thyroid	5.53E-06
	teen thyroid	5.05E-06
	infant thyroid	4.87E-06
	adult thyroid	4.19E-06

* Doses via these pathways are not dependent upon age-group.

TABLE 19

CALCULATED DOSES FOR THE RESIDENTS
IN THE SOUTHWEST SECTOR WITHIN
THE CPS SITE BOUNDARY
Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	2.97E-06
	skin	6.76E-05
ground plane*	total body	3.34E-04
	skin	3.94E-04
inhalation; four highest organ doses:		
	child thyroid	2.39E-05
	teen thyroid	2.24E-05
	infant thyroid	2.00E-05
	adult thyroid	1.92E-05

* Doses via these pathways are not dependent upon age-group.

TABLE 20

CALCULATED DOSES FOR THE RESIDENTS
IN THE WEST-SOUTHWEST SECTOR WITHIN
THE CPS SITE BOUNDARY

Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	5.60E-06
	skin	3.97E-05
ground plane*	total body	9.23E-05
	skin	1.09E-04
inhalation; four highest organ doses:		
	child thyroid	7.63E-06
	teen thyroid	7.19E-06
	infant thyroid	6.34E-06
	adult thyroid	6.20E-06

* Doses via these pathways are not dependent upon age-group.

TABLE 21

CALCULATED DOSES FOR THE RESIDENTS
IN THE SOUTH-SOUTHEAST SECTOR WITHIN
THE CPS SITE BOUNDARY

Data Period: January 1, 1990 - December 31, 1990

Exposure Pathway	Organs	Dose (mrem)
plume*	total body	4.76E-05
	skin	1.85E-04
ground plane*	total body	1.56E-04
	skin	1.83E-04
inhalation; four highest organ doses:		
	child thyroid	1.85E-05
	teen thyroid	1.79E-05
	adult thyroid	1.51E-05
	infant thyroid	1.46E-05

* Doses via these pathways are not dependent upon age-group.

SECTION 7

CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL AND TO THE SOLID WASTE PROCESS CONTROL PROGRAM

CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL AND THE SOLID WASTE PROCESS CONTROL PROGRAM

In accordance with CPS Technical Specification 6.14, changes to the CPS ODCM shall be reported in or concurrent with the Semiannual Radioactive Effluent Release Report. No changes were made during this reporting period.

In accordance with CPS Technical Specification 6.13, changes to the Solid Waste Process Control Program are no longer required to be reported in the Semiannual Radioactive Effluent Release Report. This Technical Specification change was implemented on October 16,1990.

SECTION 8
LIMITING CONDITION FOR OPERATION REPORTS AND ODCM OPERATIONAL REQUIREMENTS

LIMITING CONDITION FOR OPERATION REPORTS & ODCM OPERATION REQUIREMENTS

Prior to October 16, 1990, the liquid and gaseous effluent monitoring instrumentation channels that were inoperable for greater than 30 days were reported in the Semiannual Radioactive Effluent Release Report in accordance with Clinton Power Station Technical Specification 3.3.7.11 and 3.3.7.12. Inoperative conditions for effluent instrumentation channels entered after October 16, 1990 are now referred to as Offsite Dose Calculation Manual Operation Requirements (OOR), in accordance with CPS ODCM Operation Requirements 2.7.1 and 3.9.2.

October 16, 1990 was the effective date for implementation of programmatic controls for Radiological Effluent Technical Specifications in the administrative controls section of the Technical Specifications and the relocation of procedural details of Radiological Effluent Technical Specifications to the CPS ODCM, per Nuclear Regulatory Commission (NRC) Generic Letter 89-01.

During this reporting period, four inoperability conditions occurred which require reporting, and one previously reported inoperable condition was restored. The following is a description of these conditions:

Case 1

Information:

Operability Requirement: Technical Specification Table 3.3.7.11-1.2.a
Date Entered: 5-29-90 at 1230
Date Restored: 9-14-90 at 2336

Explanation:

On May 21, 1990, the calibration of the plant service water process radiation monitor, 1RIX-PR036, was initiated. During the performance of this calibration, problems involving acceptance criteria and procedural deficiencies were encountered. An action plan was initiated on July 16, 1990 to troubleshoot the monitor as well as develop new or verify old acceptance criteria. This condition was reported in the last Semiannual Radioactive Effluent Release Report.

Acceptance criteria and procedural deficiencies were corrected, the calibration was completed, and the monitor was returned to service on September 14, 1990 at 2336 hours.

Case 2

Information:

Operability Requirement: Technical Specification Table 3.3.7.11-1.1.a

Date Entered: 7-5-90 at 1130

Date Restored: As of 12-31-90, the instrument had not been restored to an operable condition

Explanation:

The Liquid Radwaste Discharge Process Radiation Monitor, 0RIXPR040, was declared inoperable on July 5, 1990 at 1130 when it failed the source check just prior to a liquid discharge. The cause of this failure was due to high background counts in the sample chamber and adjacent system piping. Efforts were made to lower the background radiation by decontaminating portions of the monitor communicating with the waste stream. Efforts were also made to shield the detector from adjacent system piping which contributes to the overall background counts. During the effort to lower background radiation, the calibration for the instrument expired.

During early October, an in vitro calibration (i.e., detector alignment and some troubleshooting), was initiated to eliminate interference from the high background conditions that still existed. The remainder of the calibration is to be completed upon the arrival of a standard detector shield housing in which the detector will be placed. Receipt of the shield is expected in February 1991. Appropriate connections will be made at the monitor's microprocessor with sufficient lengths of cable to locate the assembly an adequate distance from the high background area to facilitate the completion of the calibration.

Upon completion of the calibration, the high background radiation readings will have to be reduced to acceptable levels prior to restoring the monitor to service.

It should be noted that two independent samples are analyzed and independent verifications of release rate calculations and discharge line valving are performed prior to initiating any radioactive liquid discharge, when 0RIXPR040 is inoperable. These actions are in accordance with the Remedial Requirements listed in Table 2.7-1 of the ODCM.

The monitor is expected to be restored by March 31, 1991. The information pertaining to the restoration of this Limiting Condition for Operation (LCO), that is ODCM Operation Requirement, will be reported in the next Semiannual Radioactive Effluent Release Report.

Case 3

Information:

Operability Requirement: Technical Specification Table 3.3.7.12-1.3.a
Date Entered: 8-5-90 at 1345
Date Restored: 9-14-90 at 1300

Explanation:

The main condenser off-gas hydrogen analyzer "A" was declared inoperable on August 5, 1990 at 1345 due to a flow obstruction at the discharge valve, 1N66-F085A. Approximately one week was spent evaluating whether a permanent or temporary fix was in order. Temporary Modification 90-36 was initiated to run tubing to the "B" analyzer discharge line. The safety evaluation for the modification took approximately two weeks to complete. The modification was installed on August 27, 1990. On August 29, 1990 a calibration was attempted but no sample flow could be obtained. Troubleshooting showed inlet valve, 1N66-F083A, to be obstructed. On August 31, 1990 the surveillance was restarted using an alternate suction flowpath, but this attempt failed due to electronic problems. These problems were corrected on September 5, 1990, and the calibration was completed on September 6, 1990. The 30-day LCO action time limit was exceeded on September 4, 1990 at 1345. Temporary Modification 90-41 was installed to bypass "A" Analyzer inlet valve on September 13, 1990 and the monitor was declared operable on September 14, 1990.

There were two primary reasons for exceeding the 30-day LCO action time limit. First, a significant amount of time, at least one week, was spent evaluating whether to pursue a temporary or a permanent fix. Only after this was decided could the maintenance work order be written and parts be ordered. The requirement for a second temporary modification, 90-41, was the action that ultimately forced CPS to exceed the 30-day LCO action time limit.

Case 4

Information:

Operability Requirement: Technical Specification Table 3.3.7.12-1.1.g
Date Entered: 8-11-89 at 1004
Date Restored: 12-29-90 at 2205

Explanation:

On August 3, 1989, OUIX-PR051 Channel 1, the Standby Gas Treatment System stack flow monitor, was declared inoperable due to the instrument cycling in and out of alarm status during periods of no flow. This condition was reported in the last Semiannual Radioactive Effluent Release Report.

Since the last report, extensive engineering evaluations have been conducted. Temporary modification 90-61 was worked during November and December 1990 to install the necessary electrical grounds. Prior to restoring the monitor to service, a problem with the low flow alarm associated with the flow transmitter had to be corrected. The problem occurs during low flow conditions, causing the monitor to cycle in and out of low flow annunciations. This problem was corrected, and the monitor was restored to service on December 29, 1990 at 2205.

Case 5

Information:

Operability Requirement: ODCM Table 2.7-1.2.c
Date Entered: 11-10-90 at 0000
Date Restored: As of 12-31-90, the instrument had not been restored to an operable condition.

Explanation:

The Fuel Pool Heat Exchanger "A" Service Water Radiation Monitor, 1SIX-PR004, was declared inoperable on 11-10-90 at 0000 because the eighteen month calibration had not been performed. The calibration did not take place because the task was considered a lower priority than the ongoing refueling outage work.

Upon initiation calibration of the monitor during December 1990, the background radiation levels were found to be elevated due to contributions from surrounding system components. This condition has extended the time required to calibrate the monitor. The background readings

will have to be reduced to acceptable levels prior to restoring the monitor to service.

The calibration is scheduled for completion by February 28, 1991. The information pertaining to the restoration of this LCO will be reported in the next Semiannual Radioactive Effluent Release Report.

SECTION 9
MAJOR GHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

In accordance with the CPS ODCM, licensee-initiated major changes to the liquid, gaseous or solid radioactive waste treatment systems shall be reported in the Semiannual Radioactive Effluent Release Report. No major changes to the Waste Treatment Systems were reviewed and approved during this reporting period.

SECTION 10
NEW LOCATIONS FOR DOSE CALCULATION AND/OR ENVIRONMENTAL MONITORING

NEW LOCATIONS FOR DOSE CALCULATION AND/OR ENVIRONMENTAL MONITORING

In accordance with CPS ODCM, new locations for dose calculations and/or environmental monitoring identified by the Annual Land Use Census shall be reported in the Semiannual Radioactive Effluent Release Report. No new environmental monitoring locations were identified in the latest Annual Land Use Census completed on September 26, 1990. However, indicator sample location CL-17 was installed and ultimately implemented on October 22, 1990. Clinton Lake bottom sediments are collected at this location. CL-17 is location in the southwest sector at a distance of 3.5 miles from the HVAC stack at CPS.

The following is a summary of the changes identified by the 1990 Annual Land Use Census.

1.0 Nearest Residence

a. Replace K. Scott residence with K. Dittman at 0.9 mile in NNE sector.
b. No response from C. Groves residence at 2.5 miles in ENE sector.
c. Replace R. Evans residence with Larry Jarosch and John Funk at 1.7 miles in SSE sector.
d. Replace C. Webb residence with Riaz & Farida Baber at 3.0 miles in SSW sector.
e. Replace J. Brias residence with Beth Burns at 1.6 mile in WNW sector.

2.0 Garden Census

a. Identified 60 gardens in the 16 sector within a 5 mile radius, of which 39 produced broad leaf vegetation (spinach, lettuce, cabbage and chard). Specifically broad leaf vegetation was identified for this surveillance. In most cases tomatoes, sweet corn and beans were grown in all sectors.
b. Changes in census locations for the nearest garden identified in 9 of the 16 sectors are shown in the following table.

	1989 Census Location	1990 Census Location
NNE	0.9 mile (K. Scott)	2.0 miles (J. Spencer)
NE	1.2 miles (H. Parramus)	2.0 miles (T. Spencer)
E	1.1 miles (F. L. Reynolds)	1.5 miles (G. Defebaugh)
SE	4.6 miles (J. Weaver)	NONE IDENTIFIED
SSE	2.7 miles (M. West)	NONE IDENTIFIED
S	3.0 miles (L. Disney)	NONE IDENTIFIED
SSW	3.0 miles (C. Webb)	3.2 miles (L. Sugg)
WSW	2.3 miles (J. Holland)	3.4 miles (S. Best)
NNW	1.6 miles (S. Stapleton)	2.3 miles (G. R. Cope)

RADIOLOGICAL

PROTECTION