QUAD CITIES STATION

RADIOACTIVE WASTE AND ENVIRONMENTAL MONITORING

ANNUAL REPORT 1983

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QUAD CITIES NUCLEAR POWER STATION

RADIOACTIVE WASTE AND ENVIRONMENTAL MONITORING

ANNUAL REPORT 1983

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INTRODUCTION

Units 1 and 2 of the Quad Cities Station located near Cordova, Illinois next to the Mississippi River, are 800 MWe boiling water reactors, similar in design to Dresden Units 2 and 3. The plant has been designed to keep releases to the environment at levels below those specified in the regulations.

Liquid effluents from Quad Cities are released to the Mississippi River in controlled batches after radioassay of each batch. Gaseous effluents are released to the atmosphere after delay to permit decay of short half-life gases. Releases to the atmosphere are calculated on the basis of analyses of daily grab samples of noble gases and continuously collected composite samples of iodine and particulate matter. The results of effluent analyses are summarized on a monthly basis and reported to the Nuclear Regulatory Commission as required per Technical Specifications. Airborne concentrations of noble gases, I-131 and particulate radioactivity in off-site areas are calculated using effluent and meteorological data on isotopic composition of effluents.

Environmental monitoring is conducted by sampling at indicator and reference (background) locations in the vicinity of the Quad Cities plant to measure changes in radiation or radioactivity levels that may be attributable to plant operations. If significant changes attributable to Quad Cities are measured, these changes are correlated with effluent releases. External gamma radiation exposure from noble gases and I-131 in milk are the most critical pathways at this site; however, an environmental monitoring program is conducted which includes other pathways of less importance.

SUMMARY

Gaseous and liquid effluents for the period remained at a fraction of the Technical Specification limits. Calculations of environmental concentrations based on effluent, Mississippi River flow, and meteorological data for the period indicate that consumption by the public of radionuclides attributable to the plant are unlikely to exceed the regulatory limits. Gamma radiation exposure from noble gases released to the atmosphere represented the critical pathway for the period with a maximum individual dose estimated to be 0.18 mrem for the year, when a shielding and occupancy factor of 0.7 is assumed. Environmental monitoring results confirm that dose via other pathways was not significant.

1.0 EFFLUENTS

1.1 Gaseous Effluents to the Atmosphere

Measured concentrations and isotopic composition of noble gases, radioiodine, and particulate radioactivity released to the atmosphere during the year, are listed in Table 1.1-1. A total of 1.20 E+04 curies of fission and activation gases was released with an average release rate of 3.82E+02 µCi/sec.

A total of 0.18 curies of I-131 was released during the year with an average release rate of 2.94E-01 µCi/sec.

A total of 0.25 curies of beta-gamma emitters and 3.74E-05 curies of alpha emitters was released as airborne particulate matter, with an average release rate of 8.04E-03 µCi/sec.

A total of 5.04E+02 curies of tritium was released, with an average release rate of 1.59E+01 µCi/sec.

1.2 Liquids Released to the Mississippi

A total of 2.69E+06 liters of radioactive liquid waste (prior to dilution) containing 0.14 curies (excluding tritium, gases, and alpha) were discharged after dilution with a total of 1.94E+09 liters of water. These wastes were released at a quarterly average concentration of 3.51E-07 µCi/ml during the first and second quarters, dicharged on an unidentified nuclide basis; and 5.39E-08 µCi/ml during the third and fourth quarters, which is 4.0% of the Technical Specification release limits for unidentified radioactivity. A total of 2.80E-05 curies of alpha radioactivity and 3.88 curies of tritium were released. Quarterly release estimates and principal radio-nuclides in liquid effluents are given in Table 1.2-1.

2.0 SOLID RADIOACTIVE WASTE

Solid radioactive wastes were shipped to Richland, Washington; Beatty, Nevada; and Barnwell Nuclear Center, South Carolina. The record of waste shipments is summarized in Table 2.0-1.

3.0 DOSE TO MAN

3.1 Gaseous Effluent Pathways

Gamma Dose Rates

Gamma air and whole body dose rates off-site were calculated based on measured release rates, isotopic composition of the noble gases, and meteorological data for the period (Table 3.1-1). Isodose contours of whole body dose are shown in Figure 3.1-1 for the year. Based on measured effluents and meteorological data, the

maximum dose to an individual would be 0.18 mrem for the year, with an occupancy or shielding factor of 0.7 included. The maximum gamma air dose was 0.30 mrad.

Beta Air and Skin Rates

The range of beta particles in air is relatively small (on the order of a few meters or less): consequently, plumes of gaseous effluents may be considered "infinite" for purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate because this depends on the beta particle energies, thickness of inert skin, and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of 7 mg/cm^2 and an occupancy factor of 1.0 is used. The skin dose from beta and gamma radiation for the year was 0.27 mrem.

The air concentrations of radioactive noble gases at the off-site receptor locations are given in Figure 3.1-2. The maximum off-site beta air dose for the year was 0.08 mrad.

Radioactive Iodine

The human thyroid exhibits a significant capacity to concentrate ingested or inhaled iodine, and the radioiodine, I-131, released during routine operation of the plant, may be made available to man thus resulting in a dose to the thyroid. The principal pathway of interest for this radionuclide is ingestion of radioiodine in milk by an infant. Calculation made in previous years indicate that contributions to doses from inhalation of I-131 and I-133, and I-133 in milk are negligible.

Iodine-131 Concentrations in Air

The calculated concentration contours for I-131 in air are shown in Figure 3.1-3. Included in these calculations is an iodine cloud depletion factor which accounts for the phenomenon of elemental iodine deposition on the ground. The maximum off-site average concentration is estimated to be 1.58E-01 pCi/m^3 for the year.

Dose to Infant's Thyroid

The hypothetical thyroid dose to an infant living near the plant via ingestion of milk was calculated. The radionuclide considered was I-131 and the source of milk was taken to be the nearest dairy farm with the cows pastured from May to October. The maximum infant's thyroid dose was 0.05 mrem during the year (Table 3.1-1).

Concentrations of Particulates in Air

Concentration contours of radioactive airborne particulates are shown in Figure 3.1-4. The maximum off-site average level is estimated to be 8.98E-01 pCi/m^3.

Summary of Doses

Table 3.1-1 summarizes the doses resulting from releases of airborne radioactivity via the different exposure pathways.

3.2 Liquid Effluent Pathways

The three principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water, eating aquatic foods, and exposure while walking on the shoreline. Not all of these pathways are applicable at a given time or station but a reasonable approximation of the dose can be made by adjusting the dose formula for season of the year or type and degree of use of the aquatic environment. NRC* developed equations were used to calculate the doses to the whole body, lower GI tract, thyroid, bone and skin; specific parameters for use in the equations are given in the Commonwealth Edison Off-site Dose Calculation Manual. The maximum whole body dose for the year was 0.01 mrem and no organ dose exceeded 0.02 mrem.

4.0 SITE METEOROLOGY

A summary of the site meteorological measurements taken during each quarter of the year is given in Appendix II. The data are presented as cumulative joint frequency distributions of 296' level wind direction and wind speed class by atmospheric stability class determined from the temperature difference between the 296' and 33' levels. Data recovery for all measurements on the tower was about 98.4%.

5.0 ENVIRONMENTAL MONITORING

Table 5.0-1 provides an outline of the radiological environmental monitoring program as required in current Technical Specifications. This program went into effect in November 1977 and differs from previous programs in the number and types of analyses performed. Tables 5.0-2 to 5.0-5 summarize data for the year.

Except for tables of special interest, tables listing all data are no longer included in the annual report. All data tables are available for inspection at the Station or in the Corporate offices.

Specific findings for various environmental media are discussed below.

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* Nuclear Regulatory Commission, Regulatory Guide 1.109 (Rev. 1).

5.1 Gamma Radiation

External radiation dose from on-site sources and noble gases released to the atmosphere was measured at six indicator and ten reference (background) locations using solid lithium fluoride thermoluminescent dosimeters (TLD). A comparison of the TLD results for reference stations with on-site and off-site indicator stations is included in Table 5.1-1. Additional TLDs, a total of 61 were installed on June 1, 1980 such that each sector was covered at both five miles and the site boundary.

5.2 Airborne I-131 and Particulate Radioactivity

Concentrations of airborne I-131 and particulate radioactivity at monitoring locations are summarized in Tables 5.0-2 through 5.0-5. Locations of the samplers are shown in figure 5.0-1. Airborne I-131 remained below the LLD of 0.1 pCi/m^3 throughout the year.

Gross beta concentrations ranged from 0.010 to 0.118 pCi/m^3 at indicator locations with an average concentration of 0.031 pCi/m^3 for the year. No radioactivity attributable to station operation was detected in any sample.

5.3 Aquatic Radioactivity

Surface water samples were collected daily and composited for analysis weekly from the Inlet Canal, Blowdown Diffuser Pipe, Spray Canal Blowdown Pipe, East Moline Water Works, and Davenport Water Works. The cooling water samples were analyzed weekly for gross beta concentrations. A composite sample from each quarter from the blowdown diffuser pipe did not indicate measurable radioactivity attributable to station operation. Exclusive of one sample, annual mean gross beta concentration in the blowdown diffuser pipe water sample measured 4.6 pCi/l while annual mean beta concentration in water collected at inlet canal measured 4.2 pCi/l indicating that there was no measurable amount of radioactivity attributable to the station releases, except in one sample.

The sample collected on 28 October 1983 from Spray Canal Blowdown yielded 1586±28 pCi/l of gross beta activity. Gamma scanning of the sample yielded the following results: Mn-54 48±11 pCi/l; Co-58 36±11 pCi/l; Co-60 1160±26 pCi/l; Nb-95 28±10 pCi/l and Ru-106 430±94 pCi/l. Presence of these isotopes in the sample is station related.

Samples from the two water works were composited monthly and analyzed for gamma emmiters. All samples analyzed were below the limits of detection for the program indicating that there was no measurable amount of radioactivity due to station operation present.

Levels of gamma radioactivity in fish collected were measured and found in all cases to be below the lower limits of detection for the program.

A sediment sample was analyzed by gamma spectrometry. Gamma-emitters were either below the limits of detection or at the level usually encountered in the environment (Cs-137, 0.35 pCi/g dry weight) indicating the presence of no radioactivity due to station operation.

5.4 Milk

Milk samples were collected monthly from November through April and weekly from May through October and analyzed for iodine-131. Sampled locations were the Hansen Dairy Farm located about 5.5 miles northeast of the Station, and Musal Dairy Farm located 5.5 miles southwest of the Station. Radioiodine was below the limits of detection of 0.5 pCi/l during the grazing period (May to October) and 5.0 pCi/l during the non-grazing period (November to April).

5.5 Special Collection

No special collections were made during the period.

6.0 ANALYTICAL PROCEDURES

A description of the procedures used for analyzing radioactivity in environmental samples is given in Appendix III.

7.0 MILCH ANIMAL CENSUS

A census of milch animals was conducted within five miles of the Station and the finding is presented below. The survey was conducted by "door-to-door" canvas and by information from Illinois and Iowa Agricultural Agents. The census was conducted by G. Kreuder on August 2, 1983.

There were no dairy farms within a five mile radius of the Quad Cities Nuclear Power Station.

8.0 NEAREST RESIDENT CENSUS

A census of the rearest residents was conducted by G. Kreuder on August 2, 1983. The location of residences remained unchanged from the previous census.

APPENDIX I

DATA TABLES AND FIGURES

Table 1.1-1

QUAD CITIES NUCLEAR POWER STATION

QCP 100-S25
Revision 1
May 1983

ID/13B

EFFLUENT AND WASTE DISPOSAL
SEMI-ANNUAL REPORT Jan.-June 1983
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 1st	Quarter 2nd	Est. Total Error, %
A. FISSION & ACTIVATION GASES				
1. Total Release	Ci	2.25E03	4.02E03	
2. Average release rate for period	µCi/sec	2.90E 02	5.11E02	
3. a. Percent of Tech Spec limit Chimney	%	7.7E-02	9.42E-02	
b. Percent of Tech Spec limit Stack	%	3.0E-01	3.16E-01	
B. IODINES				
1. Total Iodine-131	Ci	2.69E-02	6.42E-02	
2. Average release rate for period	µCi/sec	3.46E-01	8.17E-01	
3. a. Percent of Tech Spec limit station.	%	2.98E-01	4.53E-01	
C. PARTICULATES				
1. Particulates with half-lives > 8 days	Ci	3.66E-02	1.77E-01	
2. Average release rate for period	µCi/sec	4.71E-03	2.25E-02	
3. Gross alpha radioactivity		3.43E-05	1.16E-06	
D. TRITIUM				
1. Total Release	Ci	1.1[illegible]E00	8.75E00	
2. Average release rate for period	µCi/sec	1.43E-01	1.11E00	

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

ID/13B

EFFLUENT AND WASTE DISPOSAL
SEMI-ANNUAL REPORT July - December, 1983
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter Third	Quarter Fourth	Est. Total Error, %
A. FISSION & ACTIVATION GASES				
1. Total Release	Ci	3.58E03	2.20E03	
2. Average release rate for period	µCi/sec	4.51E02	2.77E02	
3. a. Percent of Tech Spec limit Chimney	%	9.28E-02	5.56E-02	
b. Percent of Tech Spec limit Stack	%	3.78E-01	2.14E-01	
B. IODINES				
1. Total Iodine-131	Ci	5.77E-02	3.41E-02	
2. Average release rate for period	µCi/sec	7.26E-03	4.28E-03	
3. a. Percent of Tech Spec limit station.	%	4.07E-01	1.84E-01	
C. PARTICULATES				
1. Particulates with half-lives > 8 days	Ci	3.11E-02	8.15E-03	
2. Average release rate for period	µCi/sec	3.91E-03	1.03E-03	
3. Gross alpha radioactivity		5.80E-07	1.40E-06	
D. TRITIUM				
1. Total Release	Ci	6.61E00	4.88E02	
2. Average release rate for period	µCi/sec	8.32E-01	6.14E01	

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

GASEOUS EFFLUENTS, 1983
Elevated Release

Nuclides Released	Unit	Continuous Mode Quarter 1st	Continuous Mode Quarter 2nd	Batch Mode Quarter	Batch Mode Quarter
1. Fission gases					
Kr-85	Ci	<LLD	<LLD		
Kr-85m	Ci	8.20E01	1.88E02		
Kr-87	Ci	2.24E01	2.22E02		
Kr-88	Ci	4.59E01	2.64E02		
Xe-133	Ci	2.69E02	1.06E03		
Xe-135	Ci	4.36E02	6.80E02		
Xe-135m	Ci	2.93E02	3.36E02		
Xe-138	Ci	5.87E02	7.01E02		
	Ci				
	Ci				
	Ci				
Unidentified	Ci	<LLD	<LLD		
Total for Period	Ci	1.73E03	3.45E03		
2. Iodines					
I-131	Ci	2.25E-02	4.87E-02		
I-133	Ci	1.01E-01	2.72E-01		
I-135	Ci	1.50E-01	1.46E-01		
Total for Period	Ci	2.74E-01	4,67E-01		

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

GASEOUS EFFLUENTS - Elevated Release, 1983

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter Third	Quarter Fourth	Quarter	Quarter
1. Fission gases					
Kr-85	Ci	<LLD	<LLD		
Kr-85m	Ci	2.59E02	2.69E02		
Kr-87	Ci	1.25E02	5.08E01		
Kr-88	Ci	3.81E02	3.80E02		
Xe-133	Ci	9.84E02	9.09E02		
Xe-135	Ci	1.88E02	1.43E02		
Xe-135m	Ci	1.72E02	6.5E00		
Xe-138	Ci	8.71E02	1.88E01		
	Ci				
	Ci				
	Ci				
Unidentified	Ci	<LLD	<LLD		
Total for Period	Ci	2.98E03	1.78E03		
2. Iodines					
I-131	Ci	4.48E-02	E-02		
I-133	Ci	2.5	9.38E-02		
I-135	Ci	1.53E00	1.21E-01		
Total for Period	Ci	1.83E00	2.47E-01		

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

GASEOUS EFFLUENTS, 1983

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 1st	Quarter 2nd	Quarter	Quarter
3. Particulates					
Sr-89	Ci	1.01E-03	4.25E-04		
Sr-90	Ci	1.52E-04	5.50E-05		
Cs-134	Ci	<LLD ------>			
Cs-137	Ci	2.11E-04	2.53E-04		
Ba-140	Ci	1.43E-02	1.75E-02		
La-140 less than 8 day half-life	Ci	<LLD	<LLD		
Cr-51	Ci				
Mn-54	Ci				
Co-58	Ci				
Co-60	Ci	9.45E-03	2.14E-04		
I-131	Ci	2.85E-03	2.06E-03		
Ag-110m	Ci	<LLD<------>			
Ce 141	Ci	5.0E-05	2.77E-05		
	Ci				
	Ci				
	Ci				
	Ci				
Unidentified	Ci				

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

GASEOUS EFFLUENTS- Elevated Release , 1983

		Continuous Mode		Batch Mode	
Nuclides Released	**Unit**	Quarter Third	Quarter Fourth	Quarter	Quarter
3. Particulates					
Sr-89	Ci	6.52E-04	5.74E-04		
Sr-90	Ci	3.8E-05	1.50E-05		
Cs-134	Ci	3.35E-05	2.00E-05		
Cs-137	Ci	3.68E-04	3.30E-04		
Ba-140	Ci	7.91E-03	2.31E-03		
La-140 Less than 8 Day Half Life	Ci	<LLD	<LLD		
Cr-51	Ci	<LLD	<LLD		
Mn-54	Ci	<LLD	<LLD		
Co-58	Ci	<LLD	<LLD		
Co-60	Ci	4.17E-04	6.17E-04		
I-131	Ci	7.72E-04	1.76E-03		
Ag-110m	Ci	<LLD	<LLD		
Ce-141	Ci	<LLD	2.58E-05		
	Ci				
	Ci				
	Ci				
	Ci				
Unidentified	Ci	<LLD	<LLD		

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

GASEOUS EFFLUENTS, 1983

		Continuous Mode		Batch Mode	
Nuclides Released	**Unit**	Quarter 1st	Quarter 2nd	Quarter	Quarter
1. Fission Gases					
Kr-85	**Ci**	<LLD	<LLD		
Kr-85m	**Ci**		<LLD		
Kr-87	**Ci**		1.20E01		
Kr-88	**Ci**				
Xe-133	**Ci**	5.86E01	2.84E02		
Xe-135	**Ci**	1.20E02	1.12E02		
Xe-135m	**Ci**	3.40E02	1.56E02		
Xe-138	**Ci**	<LLD			
	Ci				
Unidentified	**Ci**	<LLD	<LLD		
Total for Period	**Ci**	5.18E02	5.63E02		
2. Iodines					
I-131	**Ci**	4.25E-03	1.55E-02		
I-133	**Ci**	2.13E-02	4.72E-02		
I-135	**Ci**	3.66E-02	1.14E-01		
Total for Period	**Ci**	6.22E-02	1.77E-01		

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

QCP 100-S25
Revision 1

GASEOUS EFFLUENTS - Ground Release, 1983

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter Third	Quarter Fourth	Quarter	Quarter
1. Fission Gases					
Kr-85	Ci	<LLD	<LLD		
Kr-85m	Ci	9.50E00	<LLD		
Kr-87	Ci	<LLD	<LLD		
Kr-88	Ci	1.30E01	< LLD		
Xe-133	Ci	1.94E02	2.06E02		
Xe-135	Ci	2.02E02	2.21E02		
Xe-135m	Ci	1.86E02	<LLD		
Xe-138	Ci	<LLD	<LLD		
	Ci				
Unidentified	Ci	<LLD	<LLD		
Total for Period	Ci	6.04E02	4.27E02		
2. Iodines					
I-131	Ci	1.28E-02	2.18E-03		
I-133	Ci	3.36E-02	7.14E-03		
I-135	Ci	8.38E-01	2.64E-02		
Total for Period	Ci	8.85E-01	3.57E-03		

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

GASEOUS EFFLUENTS, 1983

		Continuous Mode		Batch Mode	
Nuclides Released	**Unit**	Quarter 1st	Quarter 2nd	Quarter	Quarter
3. Particulates					
Sr-89	**Ci**	2.42E-05	1.93E-05		
Sr-90	**Ci**	2.35E-06	3.89E-06		
Cs-134	**Ci**	5.90E-05	3.71E-05		
Cs-137	**Ci**	3.96E-04	3.04E-04		
Ba-140	**Ci**	4.81E-03	2.59E-03		
La-140 less than 8 day half-life	**Ci**	<LLD ---------->			
Cr-51	**Ci**	2.10E-04	1.01E-03		
Mn-54	**Ci**	1.38E-04	1.19E-04		
Co-58	**Ci**	7.30E-06	1.58E-04		
Co-60	**Ci**	4.49E-03	2.42E-03		
I-131	**Ci**	1.43E-03	2.50E-03		
Ag-110m	**Ci**	7.10E-06	<LLD		
Tc99m	**Ci**	3.63E-04	1.37E-03		
Zn65	**Ci**	<LLD	4.62E-04		
Ce 141	**Ci**	↓	9.02E-06		
	Ci				
	Ci				
Unidentified	**Ci**				

Table 1.1-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

QCP 100-S25
Revision 1

GASEOUS EFFLUENTS - Ground Release , 1983

		Continuous Mode		Batch Mode	
Nuclides Released	**Unit**	**Quarter** Third	**Quarter** Fourth	**Quarter**	**Quarter**
3. Particulates					
Sr-89	**Ci**	6.59E-05	6.0E-05		
Sr-90	**Ci**	5.12E-06	1.35E-05		
Cs-134	**Ci**	5.26E-05	8.38E-05		
Cs-137	**Ci**	4.77E-04	5.54E-04		
Ba-140	**Ci**	2.30E-03	3.54E-04		
La-140 Less Than 8 Day Half Life	**Ci**	<LLD	<LLD		
Cr-51	**Ci**	5.69E00	9.12E-05		
Mn-54	**Ci**	1.99E-04	2.56E-04		
Co-58	**Ci**	7.92E-05	2.44E-05		
Co-60	**Ci**	4.98E-03	5.53E-03		
I-131	**Ci**	1.68E-03	5.13E-04		
Ag-110m	**Ci**	1.93E-05	2.11E-05		
Tc 99m	**Ci**	6.12E-04	<LLD		
Cs 136	**Ci**	3.00E-05	<LLD		
Zn 65	**Ci**	6.41E-04	1.47E-05		
Ce 141	**Ci**	<LLD	1.4E-05		
	Ci				
Unidentified	**Ci**	<LLD	<LLD		

Table 1.2-1

QUAD CITIES NUCLEAR POWER STATION

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES, 1983

	Unit	Quarter 1st	Quarter 2nd	Est. Total Error, %
A. FISSION AND ACTIVATION PRODUCTS				
1. Total release (not including tritium, gases, alpha)	Ci	6.79E-02	224E-02	
2. Average diluted concentration during period	µCi/ml	5.07E-07	1.95E-07	
3. Percent of applicable limit	%	4.61E00	5.76E00	
4. Maximum diluted concentration during period	µCi/ml	2.70E-07	2.3E-06	
B. TRITIUM				
1. Total release	Ci	1.77E00	4.69E-01	
2. Average diluted concentration during period	µCi/ml	1.34E-05	4.08E-06	
3. Percent of applicable limit	%	4.46E-01	1.36E-01	
C. DISSOLVED AND ENTRAINED GASES				
1. Total release	Ci	2.25E-03	7.51E-04	
2. Average diluted concentration during period	µCi/ml	1.70E-08	6.53E-09	
3. Percent of applicable limit	%	5.68E-04	2.18E-04	
D. GROSS ALPHA RADIOACTIVITY				
1. Total release	Ci	1.52E-13	1.08E-14	
2. Average concentration released	µCi/ml	1.15E-18	9.36E-20	
E. VOLUME OF WASTE RELEASED (prior to dilution)	Liters	7.10E05	3.31E05	
F. VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	1.32E08	1.15E08	

Table 1.2-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

QCP 100-S25
Revision 1

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES, 1983

	Unit	Quarter Third	Quarter Fourth	Est. Total Error, %
A. FISSION AND ACTIVATION PRODUCTS				
1. Total release (not including tritium, gases, alpha)	Ci	2.40E-02	2.27E-02	
2. Average diluted concentration during period	µCi/ml	1.67E-08	9.1E-08	
3. Percent of applicable limit	%	4.40E-01	1.30E00	
4. Maximum diluted concentration during period	µCi/ml	4.4E-05	1.5E-05	
B. TRITIUM				
1. Total release	Ci	8.08E-01	8.35E-01	
2. Average diluted concentration during period	µCi/ml	5.65E-07	3.35E-06	
3. Percent of applicable limit	%	1.88E-02	1.12E-01	
C. DISSOLVED AND ENTRAINED GASES				
1. Total release	Ci	1.40E-02	1.67E-03	
2. Average diluted concentration during period	µCi/ml	9.7E-09	6.71E-09	
3. Percent of applicable limit	%	3.24E-04	2.24E-04	
D. GROSS ALPHA RADIOACTIVITY				
1. Total release	Ci	5.90E-07	5.75E-06	
2. Average concentration released	µCi/ml	4.10E-13	2.31E-11	
E. VOLUME OF WASTE RELEASED (prior to dilution)	Liters	6.72E+05	9.74E05	
F. VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	1.44E09	2.49E08	

Table 1.2-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

LIQUID EFFLUENTS, 1983

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 1st	Quarter 2nd	Quarter	Quarter
Sr-89	Ci	1.98E-02	5.85E-04		
Sr-90	Ci	7.02E-03	2.28E-05		
Tc99m Cs-134	Ci	3.6E-04 2.0E-04	7.7E-04 9.1E-04		
Ce 141 Cs-137	Ci	2.8E-05 1.7E-03	7.7E-06 2.3E-03		
I-133 I-131	Ci	5.3E-04 4.8E-04	1.9E-03 6.34E-04		
Sr-91 Co-58	Ci	1.3E-03 3.1E-04	7.7E-04 2.8E-04		
I-135 Co-60	Ci	2.8E-04 2.7E-02	9.8E-04 4.2E-03		
Sr-92 Fe-59	Ci	1.2E-04 <LLD	<LLD <LLD		
Na 24 Zn-65	Ci	2.2E-04 5.7E-05	6.1E-04 6.4E-05		
Mn-54	Ci	5.4E-04	4.6E-04		
Cr-51	Ci	8.7E-04	9.0E-04		
Zr-95	Ci	<LLD	<LLD		
Nb-95	Ci	<LLD	<LLD		
Mo-99	Ci	5.0E-04	6.0E-04		
Ag-110m	Ci	1.5E-05	3.7E-05		
Ba-140	Ci	3.1E-03	9.7E-04		
Cs-136	Ci	<LLD	5.5E-05		
La-140 Less than 8 day half-life	Ci				
	Ci				
Unidentified	Ci				
Total for Period (above)	Ci	6.7E-02	2.28E-02		
Xe-133	Ci	1.7E-03	1.8E-04		
Xe-135	Ci	5.3E-04	5.7E-04		

Prepared by D. J. Tuetsi

Approved by T. J. Brown
Rad/Chem Supervisor

Table 1.2-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

LIQUID EFFLUENTS, 1993

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter Third	Quarter Fourth	Quarter	Quarter
Sr-89	Ci	1.02E-03	1.43E-04		
Sr-90	Ci	2.93E-05	6.9E-05		
Ce 141 Cs-134	Ci	2.9E-05 2.63E-04	7.34E-05 4.01E-04		
Cs-137	Ci	2.24E-03	3.65E-03		
I-131	Ci	4.13E-03	1.35E-03		
I-133 Co-58	Ci	2.92E-03 5.47E-04	2.27E-04 3.25E-04		
Sr 91 Co-60	Ci	5.30E-04 5.88E-03	7.75E-05 1.20E-03		
I-135 Fe-59	Ci	8.2E-04 <LLD	1.45E-04 <LLD		
Na-24 Zn-65	Ci	3.0E-04 4.53E-04	1.81E-04 6.20E-04		
Ni 65 Mn-54	Ci	7.21E-04	1.84E-04 8.00E-04		
Ru 103 Cr-51	Ci	4.7E-04	5.38E-05 1.02E-03		
Ce 144 Zr-95	Ci	<LLD	3.45E-05 2.26E-04		
Sr 92 Nb-95	Ci	<LLD	2.96E-05 5.72E-05		
Mo-99	Ci	1.4E-03	3.96E-04		
Ag-110m	Ci	1.41E-04	2.42E-04		
Ba-140	Ci	8.09E-04	7.23E-05		
Cs-136	Ci	5.8E-05	<LLD		
Less Than 8 Day Half La-140 Life	Ci	<LLD	<LLD		
Tc 99m	Ci	1.28E-03	1.28E-04		
Unidentified	Ci	<LLD	<LLD		
Total for Period (above)	Ci	2.40E-02	7.13E-02		
Xe-133	Ci	6.6E-04	1.16E-03		
Xe-135	Ci	6.5E-04	1.24E-04		
Kr-88		1.3E-02	3.79E-04		

Prepared by V. J. Quiles

Approved by T. J. Kovach
Rad-Chem Supervisor

Table 1.2-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

ERRATA FOR LIQUID ALPHA RADIOACTIVITY, 1983

	1st Qtr 1983	2nd Qtr. 1983
TOTAL RELEASE IN CURIES	2.08E-05	8.39E-07
AVERAGE CONCENTRATION IN uci/ml	1.58E-10	7.29E-12

Table 2.0-1

QUAD CITIES NUCLEAR POWER STATION

JANUARY 1983

Readable copies of these data points will follow as soon as they are received from Quad Cities Station, as per discussion between C. Bennett, L. Duchek of CECo and M.C. Schumacher of NRC, Region III, on March 28, 1984.

Table 2.0-1 (continued)
QUAD CITIES NUCLEAR POWER STATION

[illegible]

FEBRUARY 1983

[illegible]	[illegible]	[illegible] date	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Readable copies of these data points will follow as soon as they are received from Quad Cities Station, as per discussion between C. Bennett, L. Duchek of CECo and M.C. Schumacher of NRC, Region III, on March 28, 1984.

Table 2.0-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

[illegible] RADIOACTIVE WASTE SUMMARY

[illegible] 1/2

[illegible]

MARCH 1983

Date	[illegible]	Batch Release Date	Volume	Radioactivity
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Readable copies of these data points will follow as soon as they are received from Quad Cities Station, as per discussion between C. Bennett, L. Duchek of CECo and M.C. Schumacher of NRC, Region III, on March 28, 1984.

Table 2.0-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

[illegible]

[illegible]

[illegible]

APRIL 1983

[illegible]	[illegible]	[illegible] DATE	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Readable copies of these data points will follow as soon as they are received from Quad Cities Station, as per discussion between C. Bennett, L. Duchek of CECo and M.C. Schumacher of NRC, Region III, on March 28, 1984.

Table 2.?-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

MAY 1983

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	28[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Readable copies of these data points will follow as soon as they are received from Quad Cities Station, as per discussion between C. Bennett, L. Duchek of CECo and M.C. Schumacher of NRC, Region III, on March 28, 1984.

Table 2.0-1 (continued)

QUAD CITIES NUCLEAR POWER STATION

[illegible]

[illegible]

[illegible]

JUNE 1983

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Readable copies of these data points will follow as soon as they are received from Quad Cities Station, as per discussion between C. Bennett, L. Duchek of CECo and M.C. Schumacher of NRC, Region III, on March 28, 1984.

Table 2.0-1 (continued)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

QUAD-CITIES STATION

7/1983

DATE	CO TRANS	BURIAL SITE	VOLUME	MILLICURIES
07/06/83	CN	BSC	85.00	40540.00
07/07/83	CN	BSC	105.00	9409.77
07/08/83	CN	BSC	105.00	10411.79
07/08/83	CN	BSC	105.00	10685.20
07/11/83	CN	BSC	105.00	10553.30
07/11/83	CN	BSC	105.00	10885.30
07/12/83	CN	BSC	85.00	40540.00
07/14/83	HACKE	USE	1210.50	42.50
07/15/83	CN	BSC	105.00	11184.40
07/18/83	CN	BSC	105.00	10785.68
07/18/83	CN	USE	105.00	6115.00
07/19/83	CN	BSC	85.00	40540.00
07/21/83	CN	BSC	105.00	10361.94
07/22/83	CN	BSC	105.00	10204.04
07/25/83	CN	BSC	105.00	8846.20
07/25/83	CN	BSC	105.00	1804.04
07/26/83	CN	BSC	85.00	40540.00
07/28/83	CN	USE	105.00	7280.26
07/29/83	CN	USE	105.00	12401.38

* *

	MONTHLY TOTALS		3020.50	293130.80

USE - U.S. ECOLOGY
BSC - BARNWELL SOUTH CAROLINA
CN - CHEM NUCLEAR CO.

Table 2.0-1 (continued)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

QUAD-CITIES STATION

8/1983

DATE	CO TRANS	BURIAL SITE	VOLUME	MILLICURIES
08/01/83	CN	USE	105.00	8672.27
08/01/83	CN	USE	105.00	9453.52
08/02/83	CN	BSC	85.00	39628.04
08/04/83	HACKE	USE	1203.00	26.03
08/05/83	CN	BSC	105.00	2401.70
08/08/83	CN	BSC	105.00	5615.58
08/08/83	CN	USE	105.00	6909.55
08/09/83	CN	BSC	85.00	109331.43
08/11/83	CN	USE	105.00	1668.54
08/15/83	CN	USE	105.00	718.29
08/12/83	CN	BSC	105.00	4238.25
08/15/83	CN	USE	105.00	5574.13
08/16/83	CN	BSC	85.00	109331.43
08/18/83	HACKE	USE	1101.25	36.38
08/19/83	CN	BSC	105.00	5197.20
08/22/83	CN	BSC	105.00	2997.05
08/22/83	CN	BSC	105.00	3049.34
08/23/83	CN	BSC	85.00	109331.43
08/25/83	CN	USE	105.00	330.37
08/26/83	CN	USE	105.00	8908.03
08/29/83	CN	BSC	105.00	5305.03
08/29/83	CN	BSC	105.00	5507.74
08/30/83	CN	BSC	85.00	109331.43

* *

MONTHLY TOTALS	4409.25	553764.76

USE - U.S. ECOLOGY
BSC - BARNWELL SOUTH CAROLINA
CN - CHEM NUCLEAR CO.

Table 2.0-1 (continued)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

QUAD-CITIES STATION

9/1983

DATE	CO TRANS	BURIAL SITE	VOLUME	MILLICURIES
09/01/83	CN	USE	105.00	7481.27
09/07/83	CN	BSC	85.00	109331.43
09/08/83	CN	USE	105.00	9852.80
09/08/83	CN	USE	105.00	13765.81
09/09/83	CN	USE	105.00	15691.25
09/12/83	CN	BSC	105.00	15246.80
09/12/83	CN	BSC	105.00	15436.96
09/13/83	CN	BSC	85.00	14010.16
09/15/83	CN	USE	105.00	10220.77
09/16/83	CN	BSC	105.00	14398.70
09/19/83	CN	BSC	105.00	14338.01
09/19/83	CN	BSC	105.00	14884.70
09/21/83	HACKE	USE	1289.75	212.94
09/22/83	CN	BSC	105.00	471.93
09/23/83	CN	BSC	105.00	14678.40
09/26/83	CN	BSC	105.00	15613.88
09/26/83	CN	BSC	105.00	14155.60
09/29/83	CN	USE	105.00	7645.82
09/30/83	CN	BSC	105.00	518.70

* *

	MONTHLY TOTALS		3139.75	307955.95

USE - U.S. ECOLOGY
BSC - BARNWELL SOUTH CAROLINA
CN - CHEM NUCLEAR CO.

Table 2.0-1 (continued)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

ROAD-CITIES STATION

10/1983

DATE	CO TRANS	BURIAL SITE	VOLUME	MILLICURIES
10/03/83	CN	USE	105.00	10521.45
10/05/83	CN	BSC	105.00	23543.64
10/06/83	HACKE	USE	1289.75	356.11
10/07/83	CN	BSC	105.00	29934.80
10/07/83	CN	USE	105.00	1619.06
10/11/83	CN	BSC	85.00	32100.59
10/11/83	CN	USE	85.00	153800.00
10/12/83	CN	BSC	105.00	570.50
10/13/83	HACKE	USE	1105.50	59.73
10/13/83	CN	BSC	85.00	32100.59
10/14/83	CN	BSC	105.00	22409.29
10/14/83	CN	USE	105.00	5935.63
10/17/83	CN	BSC	105.00	22089.93
10/18/83	CN	BSC	85.00	32100.59
10/19/83	CN	USE	105.00	6041.79
10/20/83	CN	BSC	105.00	21050.61
10/21/83	CN	BSC	105.00	21823.70
10/21/83	CN	BSC	105.00	21823.79
10/24/83	CN	BSC	105.00	14907.00
10/24/83	CN	BSC	105.00	20847.89
10/25/83	CN	BSC	85.00	32100.59
10/26/83	CN	BSC	105.00	22533.80
10/26/83	CN	USE	105.00	2809.92
10/27/83	HACKE	USE	1289.75	239.48
10/28/83	CN	BSC	105.00	22569.10
10/28/83	CN	BSC	105.00	576.60
10/31/83	CN	USE	105.00	1776.56
10/31/83	CN	USE	105.00	621.51
	MONTHLY TOTALS		6210.00	561864.25

USE - U.S. ECOLOGY
BSC - BARNWELL SOUTH CAROLINA
CN - CHEM NUCLEAR CO.

Table 2.0-1 (continued)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

QUAD-CITIES STATION

11/1983

DATE	CO TRANS	BURIAL SITE	VOLUME	MILLICURIES
11/01/83	CN	BSC	85.00	32100.59
11/02/83	CN	BSC	105.00	8162.77
11/04/83	HACKE	USE	510.00	71.53
11/04/83	CN	USE	105.00	1763.00
11/07/83	CN	BSC	105.00	21025.36
11/07/83	CN	BSC	105.00	21699.59
11/08/83	CN	BSC	85.00	30057.82
11/09/83	CN	BSC	105.00	22069.91
11/09/83	CN	BSC	105.00	20121.13
11/10/83	HACKE	USE	1289.75	178.35
11/14/83	CN	BSC	105.00	14844.20
11/15/83	CN	USE	141.80	2763.00
11/14/83	CN	BSC	105.00	14765.32
11/16/83	CN	BSC	105.00	14526.10
11/17/83	HACKE	USE	1029.50	92.69
11/18/83	CN	BSC	105.00	1699.80
11/18/83	CN	BSC	105.00	1674.20
11/21/83	CN	BSC	105.00	2752.80
11/22/83	HACKE	USE	1214.60	83.56
11/23/83	CN	BSC	105.00	8474.70
11/23/83	CN	BSC	105.00	5133.50
11/28/83	CN	BSC	105.00	5387.06
11/28/83	CN	BSC	105.00	5220.80
11/29/83	CN	USE	141.80	1197.77
11/30/83	CN	BSC	105.00	4374.01
11/30/83	CN	USE	105.00	3048.24

* *

MONTHLY TOTALS	6387.45	243327.80

USE - U.S. ECOLOGY
BSC - BARNWELL SOUTH CAROLINA
CN - CHEM NUCLEAR CO.

Table 2.0-1 (continued)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

QUAD-CITIES STATION

12/1983

DATE	CO TRANS	BURIAL SITE	VOLUME	MILLICURIES
12/01/83	HACKE	USE	1240.50	125.98
12/02/83	CN	USE	105.00	4177.89
12/02/83	CN	BSC	105.00	3327.55
12/05/83	CN	USE	105.00	5004.35
12/05/83	CN	USE	105.00	5356.50
12/06/83	CN	USE	144.98	437.98
12/07/83	CN	BSC	105.00	2187.36
12/08/83	HACKE	USE	1210.50	103.39
12/09/83	CN	BSC	105.00	2109.24
12/12/83	CN	USE	105.00	9524.34
12/14/83	CN	BSC	105.00	6743.54
12/14/83	CN	BSC	105.00	7067.43
12/16/83	HACKE	USE	1289.75	122.47
12/19/83	CN	BSC	105.00	5787.42
12/20/83	CN	BSC	105.00	1118.90
12/20/83	CN	BSC	105.00	6114.50
12/21/83	CN	BSC	105.00	4527.70
12/21/83	CN	BSC	105.00	2698.60
12/28/83	HACKE	USE	1289.75	79.97
12/30/83	CN	BSC	105.00	5804.08
12/30/83	CN	BSC	105.00	5223.30

* *

	MONTHLY TOTALS	6855.48	77642.49

USE - U.S. ECOLOGY
BSC - BARNWELL SOUTH CAROLINA
CN - CHEM NUCLEAR CO.

Figure 3.1-1

Estimated Cumulative Gamma Dose (mrem) from the Quad Cities Station for the period January-December 1983.

Isopleth Labels
Small figure - multiply by 10^{-2}
Large figure - multiply by 10^{-3}

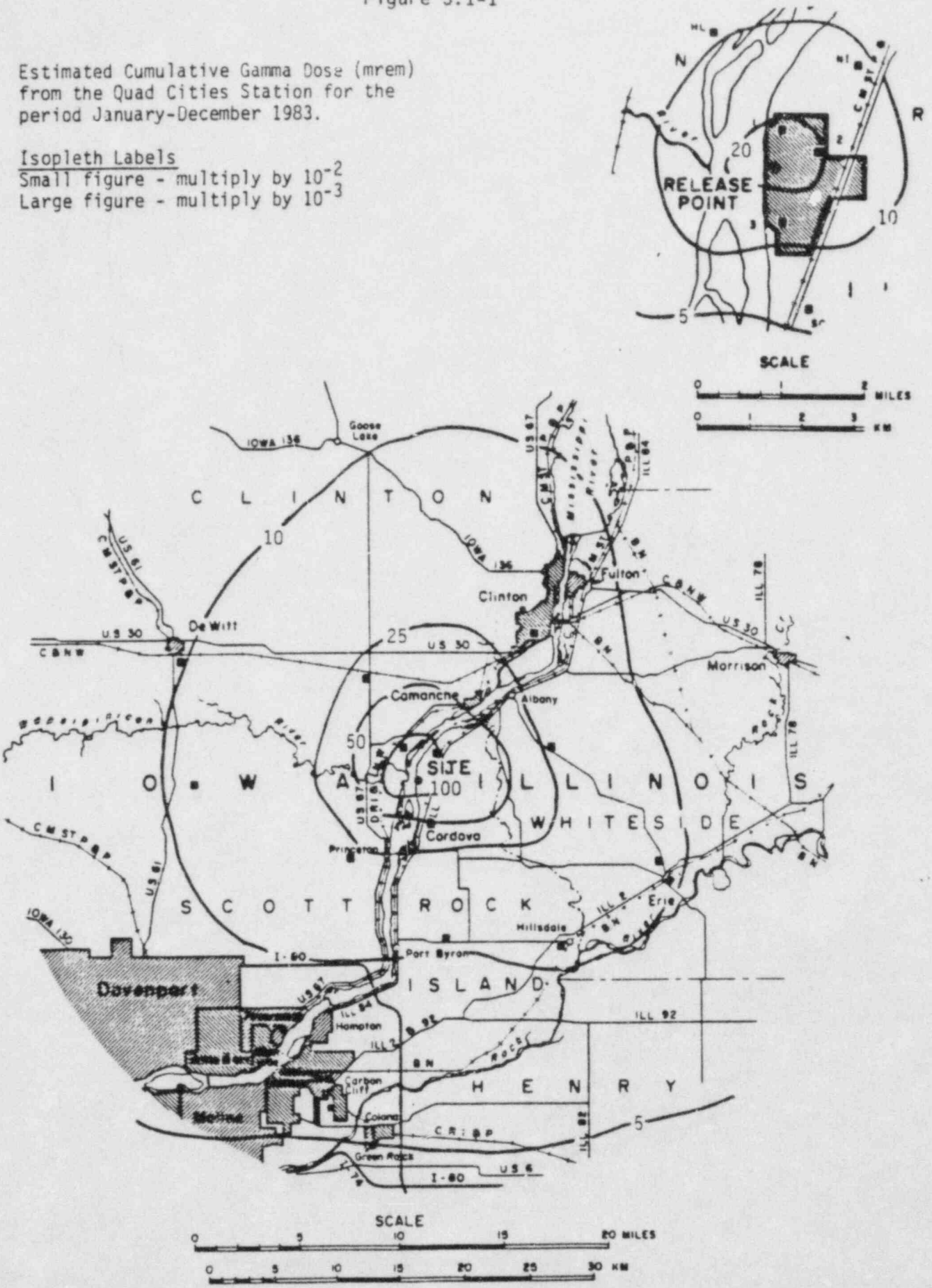


Figure 3.1-2

Estimated Total Concentration (pCi/m^3) of Iodine from the Quad Cities Station for the period January-December 1983.

Isopleth Labels
Small figure - multiply by 10^{-3}
Large figure - multiply by 10^{-3}

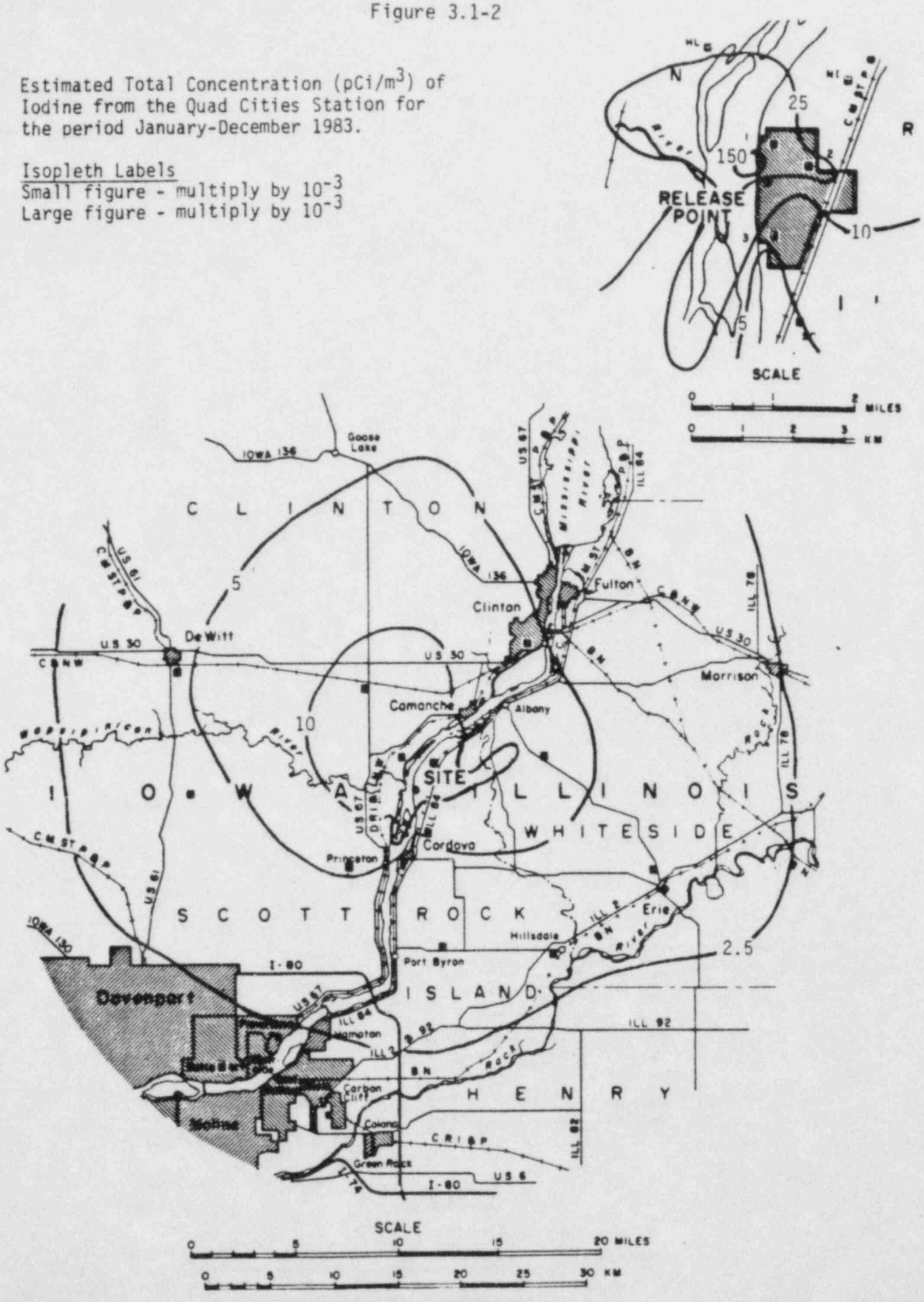


Figure 3.1-3

Estimated Total Concentration (pCi/m^3) of Noble Gases from the Quad Cities Station for the period January-December 1983.

Isopleth Labels
Small figure - multiply by 10^1
Large figure - multiply by 10^0

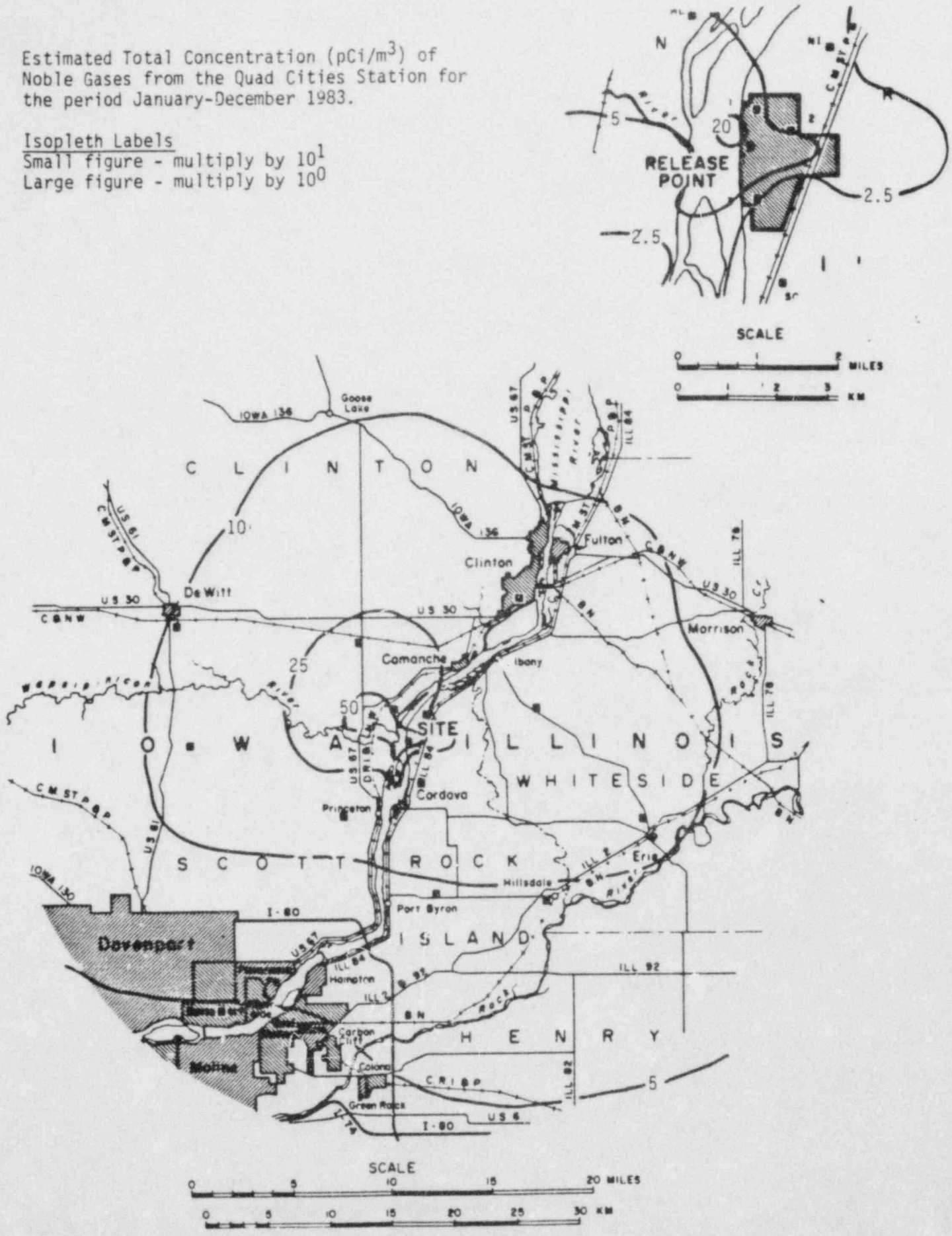
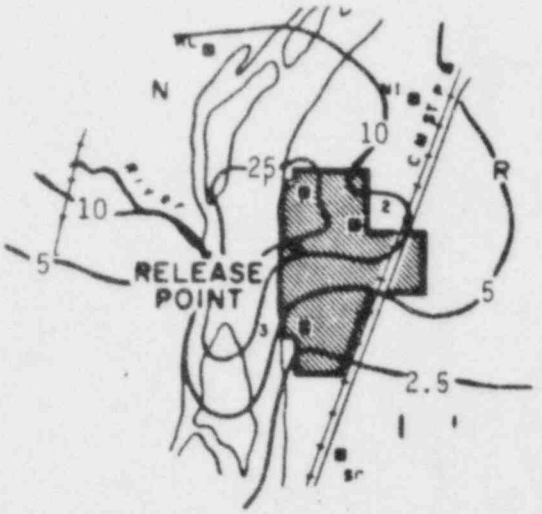


Figure 3.1-4

Estimated Total Concentration (pCi/m^3) of Particulate Matter from the Quad Cities Station for the period January-December 1983.

Isopleth Labels
Small figure - multiply by 10^{-2}
Large figure - multiply by 10^{-3}



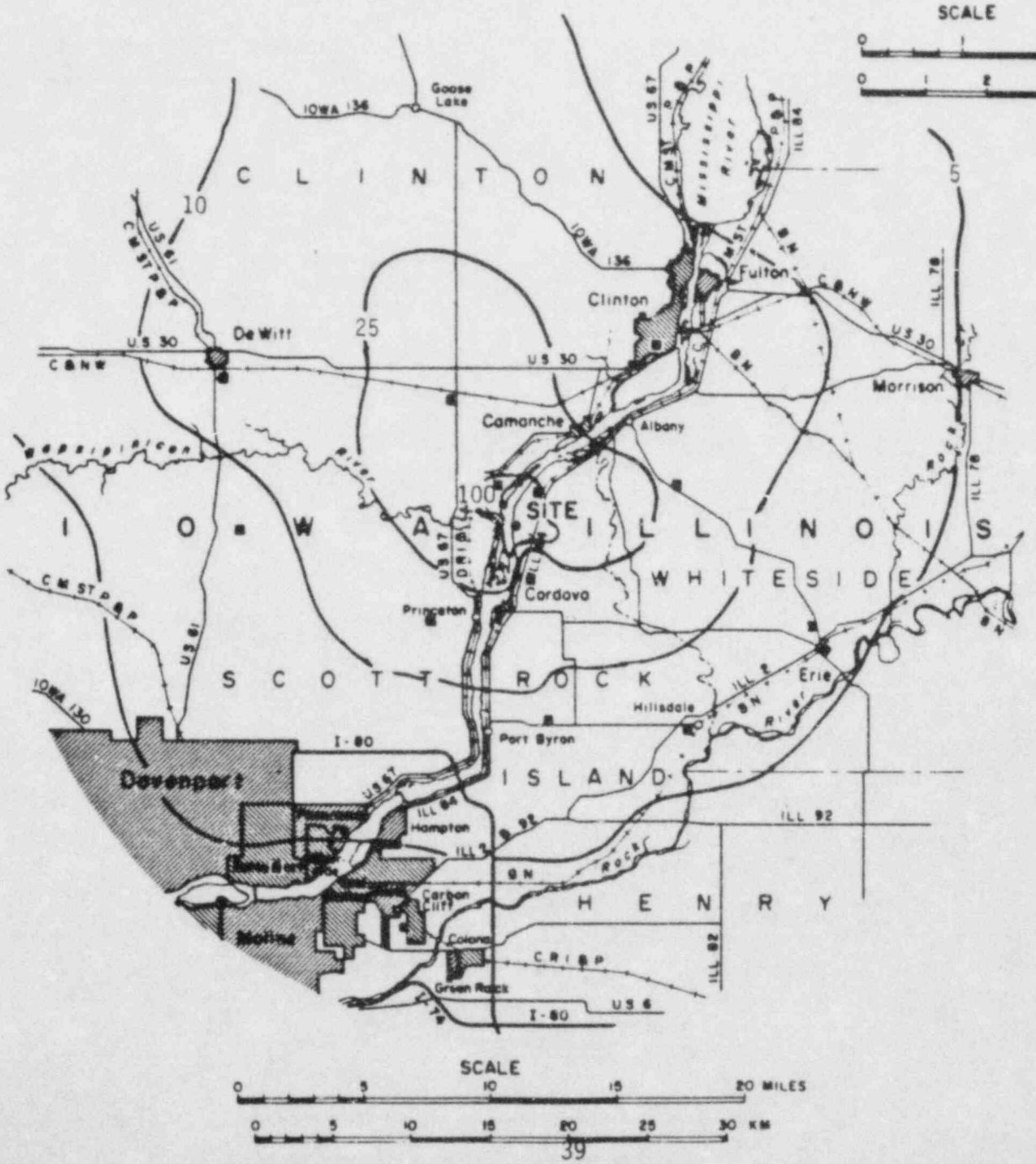


Table 3.1-1

QUAD CITIES STATION - UNIT 1
MAXIMUM DOSES RESULTING FROM AIRBURNE RELEASES
PERIOD OF RELEASE OCTOBER 1, 1983 - DECEMBER 31, 1983 DATE OF CALCULATION 03/15/84

TYPE	CURRENT PERIOD	CURRENT QUARTER	THIRD QUARTER	SECOND QUARTER	FIRST QUARTER	ANNUAL
GAMMA AIR (MRAD)	0.197E-01(W)	0.197E-01(W)	0.760E-01(N)	0.418E-01(NNE)	0.345E-01(W)	0.152E 00(*)
BETA AIR (MRAD)	0.740E-02(WNW)	0.740E-02(WNW)	0.188E-01(WNW)	0.760E-02(WNW)	0.517E-02(SW)	0.383E-01(WNW)
WHOLE BODY (MREM)	0.104E-01(N)	0.104E-01(N)	0.456E-01(N)	0.188E-01(NNE)	0.178E-01(N)	0.916E-01(N)
SKIN (MREM)	0.153E-01(N)	0.153E-01(N)	0.656E-01(N)	0.256E-01(NNE)	0.273E-01(N)	0.133E 00(N)
ORGAN (MREM)	0.805E-03(WNW)	0.805E-03(WNW)	0.192E-01(WNW)	0.474E-02(WNW)	0.131E-02(WNW)	0.260E-01(WNW)
CRITICAL ORG-PERS	TH-IN	TH-IN	TH-IN	TH-IN	TH-IN	TH-IN

COMPLIANCE STATUS

TYPE	10 CFR 50 APP. I QUARTERLY OBJECTIVE	% OF APP. I	10 CFR 50 APP.I YEARLY OBJECTIVE	% OF APP. I
GAMMA AIR (MRAD)	5.0	0.39	10.0	1.52
BETA AIR (MRAD)	10.0	0.07	20.0	0.19
WHOLE BODY (MREM)	2.5	0.42	5.0	1.83
SKIN (MREM)	7.5	0.20	15.0	0.89
ORGAN (MREM)	7.5	0.01	15.0	0.17
CRITICAL ORGAN-PERSON		(TH-IN)		(TH-IN)

CRITICAL ORGANS: BN=BONE, LV=LIVER, TB=TOTAL BODY
TH=THYROID, KD=KIDNEY, LN=LUNG, GI=GI-LLI
CRITICAL PERSON: AD=ADULT, IN=INFANT

Table 3.1-1 (continued)

QUAD CITIES STATION - UNIT 2
MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES
PERIOD OF RELEASE OCTOBER 1, 1983 - DECEMBER 31, 1983 DATE OF CALCULATION 03/15/84

TYPE	CURRENT PERIOD	CURRENT QUARTER	THIRD QUARTER	SECOND QUARTER	FIRST QUARTER	ANNUAL
GAMMA AIR (MRAD)	0.197E-01(W)	0.197E-01(W)	0.760E-01(N)	0.418E-01(NNE)	0.345E-01(W)	0.152E 00(N)
BETA AIR (MRAD)	0.740E-02(WNW)	0.740E-02(WNW)	0.188E-01(WNW)	0.760E-02(WNW)	0.517E-02(SW)	0.383E-01(WNW)
WHOLE BODY (MREM)	0.104E-01(N)	0.104E-01(N)	0.456E-01(N)	0.188E-01(NNE)	0.178E-01(N)	0.916E-01(N)
SKIN (MREM)	0.153E-01(N)	0.153E-01(N)	0.656E-01(N)	0.256E-01(NNE)	0.273E-01(N)	0.133E 00(N)
ORGAN (MREM)	0.805E-03(WNW)	0.805E-03(WNW)	0.192E-01(WNW)	0.474E-02(WNW)	0.131E-02(WNW)	0.260E-01(WNW)
CRITICAL ORG-PERS	TH-IN	TH-IN	TH-IN	TH-IN	TH-IN	TH-IN

COMPLIANCE STATUS

TYPE	10 CFR 50 APP. I QUARTERLY OBJECTIVE	% OF APP. I	10 CFR 50 APP.I YEARLY OBJECTIVE	% OF APP. I
GAMMA AIR (MRAD)	5.0	0.39	10.0	1.52
BETA AIR (MRAD)	10.0	0.07	20.0	0.19
WHOLE BODY (MREM)	2.5	0.42	5.0	1.83
SKIN (MREM)	7.5	0.20	15.0	0.89
ORGAN (MREM)	7.5	0.01	15.0	0.17
CRITICAL ORGAN-PERSON		(TH-IN)		(TH-IN)

CRITICAL ORGANS: BN=BONE, LV=LIVER, TH=TOTAL BODY
TH=THYROID, KD=KIDNEY, LN=LUNG, GI=GI-LLI
CRITICAL PERSON: AD=ADULT, IN=INFANT

Table 3.2-1

[illegible] UNITS UNIT ONE
MAXIMUM DOSES (DEEP) RESULTING FROM LIQUID EFFLUENTS
PERIOD OF RELEASE = 1/ 1/83 TO 12/31/83 CALCULATED 02/09/84 *

DOSE TYPE	1ST QUARTER 1/83- 3/83	2ND QUARTER 4/83- 6/83	3RD QUARTER 7/83- 9/83	4TH QUARTER 10/83-12/83	ANNUAL
TOTAL BODY	1.76E-03	2.46E-03	9.75E-04	1.57E-03	6.76E-03
INTERNAL ORGAN	5.35E-03	3.43E-03	1.44E-03	2.31E-03	1.02E-02
	BONE	LIVER	LIVER	LIVER	BONE

* THIS IS A REPORT FOR THE CALENDAR YEAR 1983

COMPLIANCE STATUS - 10 CFR 50 APP. I

	QTRLY OBJ	1ST QTR 1/83- 3/83	2ND QTR 4/83- 6/83	3RD QTR 7/83- 9/83	4TH QTR 10/83- 12/83	YRLY OBJ	% OF APP. I
		---------- % OF APP I. ----------					
TOTAL BODY (MREM)	1.5	0.12	0.16	0.06	0.10	3.0	0.23
CRIT. ORGAN(MREM)	5.0	0.11	0.07	0.03	0.05	10.0	0.10
		BONE	LIVER	LIVER	LIVER		BONE

Table 3.2-1 (continued)

two

GRAND CITIES UNIT

MAXIMUM DOSES (MREM) RESULTING FROM LIQUID EFFLUENTS
PERIOD OF RELEASE - 1/ 1/83 TO 12/31/83 CALCULATED 02/09/84 *

DOSE TYPE	1ST QUARTER 1/83- 3/83	2ND QUARTER 4/83- 6/83	3RD QUARTER 7/83- 9/83	4TH QUARTER 10/83-12/83	ANNUAL
TOTAL BODY	1.76E-03	2.40E-03	9.75E-04	1.57E-03	6.76E-03
INTERNAL ORGAN	5.35E-03	3.43E-03	1.44E-03	2.31E-03	1.02E-02
	BONE	LIVER	LIVER	LIVER	BONE

* THIS IS A REPORT FOR THE CALENDAR YEAR 1983

COMPLIANCE STATUS - 10 CFR 50 APP. I

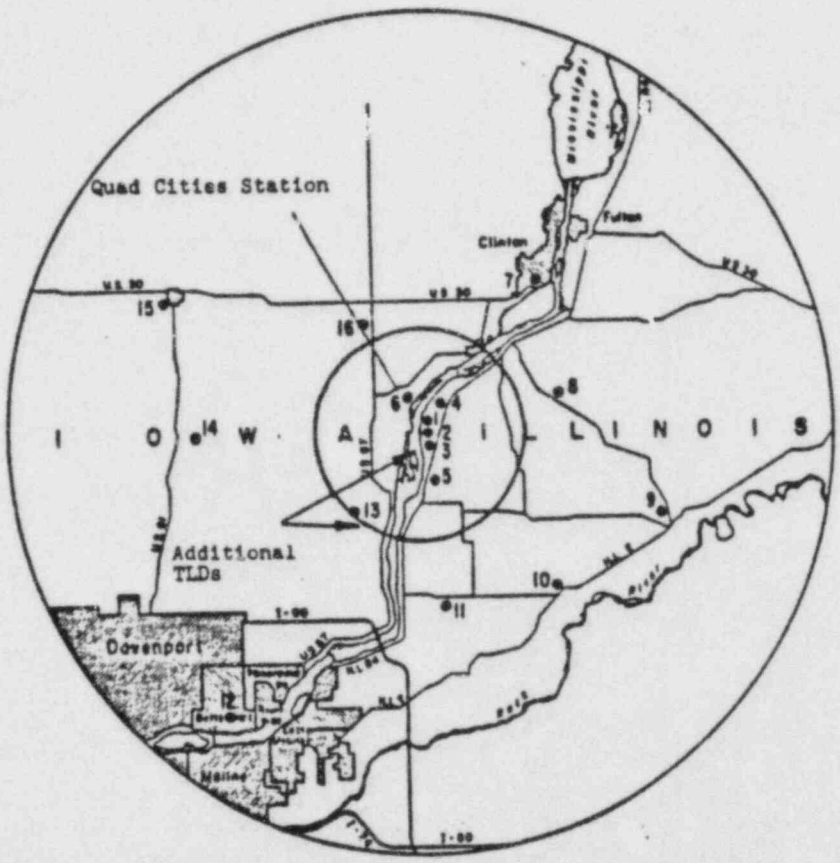
	QTRLY OBJ	1ST QTR 1/83- 3/83	2ND QTR 4/83- 6/83	3RD QTR 7/83- 9/83	4TH QTR 10/83- 12/83	YRLY OBJ	% OF APP. I
		% OF APP I.					
TOTAL BODY (MREM)	1.5	0.12	0.16	0.06	0.10	3.0	0.23
CRIT. ORGAN(MREM)	5.0	0.11	0.07	0.03	0.05	10.0	0.10
		BONE	LIVER	LIVER	LIVER		BONE

Figure 5.0-1

LOCATIONS OF FIXED ENVIRONMENTAL RADIOLOGICAL MONITORING STATIONS

Air Samplers

1 - Onsite Station 1
2 - Onsite Station 2
3 - Onsite Station 3
4 - NITRIN
5 - Saddle Club Dairy
6 - Hanson's Boat Landing
7 - Clinton
8 - Sikkema Farm
9 - Erie
10 - Hillsdale
11 - Port Byron
12 - Bettendorf
13 - Princeton
14 - Utica Ridge Road
15 - De Witt
16 - Low Moor



TLD

Same as air samplers plus a sufficient number of additional dosimeters placed near the site and near 5 miles to assure, to the extent practical, that one dosimeter is located at each range in each of the 16 meteorological sctors,

QUAD CITIES NUCLEAR POWER STATION

Standard Radiological Sampling Program

Old Code	New Code	Loc. Type[a]	Location Description	Media							
				Air Samples	TLDs	Milk	Public Water	Cooling Water	Sediment	Fish	Census
Q-14	Q-01		On-site No. 1	X	X						
-15	-02		On-site No. 2	X	X						
-16	-03		On-site No. 3	X	X						
-01	-04		Nitrin	X	X						
-06	-05		Saddle Club Dairy	X	X						
-12	-06		Hanson's Boat Landing	X	X						
-02	-07	C	Clinton	X	X						
-03	-08	C	Sikkema Farm	X	X						
-04	-09	C	Erie	X	X						
-05	-10	C	Hillsdale	X	X						
-07	-11	C	Port Byron	X	X						
-08	-12	C	Bettendorf	X	X						
-09	-13	C	Princeton	X	X						
-10	-14	C	Utica Ridge Road	X	X						
-11	-15	C	DeWitt	X	X						
-13	-16	C	Low Moor	X	X						
-17	-17		Musal Dairy Farm			X					X
-34	-18		Turner Farm			X					X
-20	-19		East Moline Water Works				X				
-21	-20		Davenport Water Works				X				
-18	-21	C	Inlet Canal					X			
-19	-22		Discharge Canal					X			
-27	-23		Lock & Dam No. 14 (Mississippi River)						X		
-27	-24		Davenport Fish Market (Pool No. 14, Mississippi River)							X	

[a] Control (background) locations are indicated by a "C" in this column. All other locations are indicators.

TABLE 5.0-1

QUAD CITIES STANDARD RADIOLOGICAL MONITORING PROGRAM

Sample Media	Collection Site[a]	Type of Analysis	Frequency	Non-Routine Reporting Levels[b]
1. Air Monitoring	(a) Onsite and near Field	1. Filter - gross beta[c]	1. Weekly	Cs-134 10, Cs-137 20 pCi/m^3
	(1) Onsite Station #1 (2) Onsite Station #2 (3) Onsite Station #3 (4) Nitrin (5) Saddle Club Dairy Farm (6) Hanson's Boat Landing	2. Charcoal - I-131	2. Bi-weekly[d]	0.9 pCi/m^3
		3. Sampling Train - Test and Maintenance	3. Weekly	
	(b) Far Field	1. Filter Exchange	1. Weekly	Same as 1 (a)
	(1) Clinton (2) Sikkema Farm (3) Erie (4) Hillsdale (5) Port Byron (6) Bettendorf (7) Princeton (8) Utica Ridge Road (9) DeWitt (10) Low Moor	2. Charcoal Exchange	2. Bi-weekly	When analyses
		3. Sampling Train - Test and Maintenance	3. Weekly	are made
2. TLD	Same as 1	Gamma Radiation	Quarterly	
3. Fish	Pool 14 of Mississippi	Gamma isotopic	Semi-annually	Mn-54 $3x10^4$, Fe-59 $1x10^4$ Co-58 $3x10^4$, Co-60 $1x10^4$ Zn-65 $2x10^4$, Cs-134 $1x10^3$ Cs-137 $2x10^3$ pCi/Kg wet weight
4. Milk	(a) Hansen Dairy	I-131	1. Weekly - Grazing Season - May to Oct	I-131 3 pCi/l Cs-134 60 pCi/l Cs-137 70 pCi/l
	(b) Musal Dairy		2. Monthly - Nov to Apr	Ba-La-140 300 pCi/l

TABLE 5.0-1 (continued)

QUAD CITIES STANDARD RADIOLOGICAL MONITORING PROGRAM

Sample Media	Collection Site	Type of Analysis	Frequency	Non-Routine Reporting Levels[b]
5. Public Water	(a) East Moline Water Works (b) Davenport Water Works	1. Gamma Isotopic	1. Monthly Analysis of Weekly Composites	(See footnote e)
6. Cooling Water[f]	(a) Inlet (b) Discharge	1. Gross Beta	1. Weekly	
7. Sediment	(a) Lock and Dam No. 14	Gamma Isotopic	Annually	
8. Dairy Census	(a) Site Boundary to 2 miles	(a) Enumeration by a door-to-door or equivalent counting technique	Annually, during grazing season	
	(b) 2 miles to 5 miles	(b) Enumeration by using referenced information from county agricultural agents or other reliable sources.		
	(c) At dairies listed in item 4.	(c) Inquire as to feeding practices. (1) pasture only (2) Feed and chop only (3) Pasture and feed; if both, ask farmer to estimate fraction of food from pasture <25% 25-50% 50-75% >75%		

[a] Additional information giving the distance and direction of individual sampling locations may be found in Appendix III of the 1978 Annual Report.

[b] Average concentration over calendar quarter.

[c] A gamma isotopic analysis shall be performed whenever the gross beta concentration in a sample exceeds by five times (5x) the average concentration of the preceding calendar quarter for the sample location.

[d] Bi-weekly shall mean that the frequency is once every other week.

[e] H-3 2×10^4, Mn-54 1×10^3, Fe-59 2×10^2, Co-58 6×10^2, Co-60 2×10^2, Zn-65 2×10^2, Zr-Nb-95 4×10^2, I-131 2, Cs-134 30, Cs-137 50, Ba-La-140 1×10^2 pCi/l.

[f] Provided by station personnel.

Table 5.0-2

Environmental Radiological Monitoring Program Quarterly Summary

Name of facility Quad Cities Nuclear Power Station Docket No. 50-254, 50-265

Location of facility Rock Island, Illinois (County, State) Reporting Period 1st Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of non-routine Results
				Location	Mean Range		
Air Particulates (pCi/m^3)	Gross Beta 77	0.01	0.022 (76/77) (0.011-0.039)	Q-03, Onsite #3 0.6 mi @ 170°	0.026 (13/13) (0.015-0.039)	None	0
Airborne Iodine (pCi/m^3)	I-131 36	0.10	<LLD	-	-	None	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 16	3.0	12.9 (6/6) (11.7-13.4)	Q-11, Port Byron 8.0 mi @ 170°	15.9 (1/1) -	13.1 (10/10) (11.6-15.9)	0
Milk (pCi/l)	I-131 6	5.0	<LLD	-	-	None	0
Cooling Water (pCi/l)	Gross Beta 36	2.0	4.6 (24/24) (2.7-9.9)	Q-22B, Spray Canal Blowdown at Station	5.4 (12/12) (3.8-9.9)	4.4 (12/12) (3.6-5.7)	0
	Tritium 1	200	<LLD	-	-	None	0
Public Water (pCi/l)	Gamma Spec. 6						
	Cs-134	10.0	<LLD	-	-	None	0
	Cs-137	10.0	<LLD	-	-	None	0
	Other Gammas	20.0	<LLD	-	-	None	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

Table 5.0-3

Environmental Radiological Monitoring Program Quarterly Summary

Name of facility Quad Cities Nuclear Power Station Docket No. 50-254, 50-265

Location of facility Rock Island, Illinois (County, State) Reporting Period 2nd Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of non-routine Results
				Location	Mean Range		
Air Particulates (pCi/m^3)	Gross Beta 78	0.01	0.019 (69/78) (0.010-0.034)	Q-03, Onsite #3 0.6 mi @ 170°	0.021 (12/13) (0.011-0.034)	None	0
Airborne Iodine (pCi/m^3)	I-131 42	0.10	<LLD	-	-	None	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 16	3.0	12.5 (6/6) (11.0-13.4)	Q-11, Port Byron 8.0 mi @ 170°	14.8 (1/1) -	12.6 (10/10) (11.2-14.8)	0
Milk (pCi/l)	I-131 18	5/0.5*	<LLD	-	-	None	0
Cooling Water (pCi/l)	Gross Beta 39	1.0	4.2 (26/26) (2.8-5.4)	Q-22B, Spray Canal Blowdown at Station	4.6 (13/13) (2.8-5.4)	4.2 (13/13) (2.6-6.0)	0
	Tritium 1	200	<LLD	-	-	None	0
Public Water (pCi/l)	Gamma Spec. 6						
	Cs-134	10.0	<LLD	-	-	None	0
	Cs-137	10.0	<LLD	-	-	None	0
	Other Gammas	20.0	<LLD	-	-	None	0
Fish (pCi/g wet)	Gamma Spec. 9						
	Cs-134	0.1	<LLD	-	-	None	0
	Cs-137	0.1	<LLD	-	-	None	0
	Other Gammas	0.2	<LLD	-	-	None	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

* November - April LLD = 5.0; May - October LLD = 0.5.

Table 5.0-4

Environmental Radiological Monitoring Program Quarterly Summary

Name of facility Quad Cities Nuclear Power Station Docket No. 50-254, 50-265

Location of facility Rock Island, Illinois (County, State) Reporting Period 3rd Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of non-routine Results
				Location	Mean Range		
Air Particulates (pCi/m^3)	Gross Beta 78	0.01	0.033 (76/78) (0.010-0.118)	Q-02, Onsite #2 0.5 mi @ 70°	0.035 (13/13) (0.016-0.092)	None	0
Airborne Iodine (pCi/m^3)	I-131 36	0.10	<LLD	-	-	None	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 16	3.0	12.7 (6/6) (11.4-15.0)	Q-09, Erie 13 mi @ 110°	21.3 (1/1) -	13.7 (10/10) (11.7-21.3)	0
Milk (pCi/l)	I-131 26	0.5	<LLD	-	-	None	0
Cooling Water (pCi/l)	Gross Beta 42	1.0	4.6 (26/26) (1.6-7.7)	Q-22B, Spray Canal Blowdown at Station	5.3 (13/13) (1.6-7.7)	4.0 (13/13) (2.6-5.5)	0
	Tritium 1	200	<LLD	-	-	None	0
Public Water (pCi/l)	Gamma Spec. 6						
	Cs-134	10.0	<LLD	-	-	None	0
	Cs-137	10.0	<LLD	-	-	None	0
	Other Gammas	20.0	<LLD	-	-	None	0
Bottom Sediments	Gamma Spec. 1						
	Cs-134	0.1	<LLD	-	-	None	0
	Cs-137	0.1	0.35 (1/1)	Q-23, Lock & Dam #14 Mississippi River 15.0 mi @ 210°	0.35 (1/1)	None	0
	Other Gammas	0.2	<LLD	-	-	None	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

Table 5.0-5

Environmental Radiological Monitoring Program Quarterly Summary

Name of facility Quad Cities Nuclear Power Station Docket No. 50-254, 50-265

Location of facility Rock Island, Illinois (County, State) Reporting Period 4th Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean		Control Locations Mean[a] Range	Number of non-routine Results
				Location	Mean Range		
Air Particulates (pCi/m^3)	Gross Beta 78	0.01	0.047 (78/78) (0.029-0.090)	Q-04, Nitrin 1.5 mi @ 40°	0.050 (13/13) (0.035-0.090)	None	0
Airborne Iodine (pCi/m^3)	I-131 42	0.10	<LLD	-	-	None	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 16	3.0	13.4 (6/6) (11.4-15.5)	Q-08, Sikkema Farm 7.0 mi @ 70°	15.7 (1/1) -	13.7 (10/10) (11.9-15.7)	0
Milk (pCi/l)	I-131 14	5/0.5*	<LLD	-	-	None	0
Cooling Water (pCi/l)	Gross Beta 38	1.0	68.3 (25/25) (2.8-1586)	Q-22B, Spray Canal Blowdown at Station	137.8 (12/12) (4.3-1586)	4.2 (13/13) (3.2-6.7)	1
	Tritium 1	200	<LLD	-	-	None	0
Public Water (pCi/l)	Gamma Spec. 6						
	Cs-134	10.0	<LLD	-	-	None	0
	Cs-137	10.0	<LLD	-	-	None	0
	Other Gammas	20.0	<LLD	-	-	None	0
Fish (pCi/g wet)	Gamma Spec. 8						
	Cs-134	0.1	<LLD	-	-	None	0
	Cs-137	0.1	<LLD	-	-	None	0
	Other gammas	0.2	<LLD	-	-	None	0

[a] Mean and range based on detectable measurements only. Fractions indicated in parentheses.
* November - April LLD = 5.0; May - October LLD = 0.5.

QUAD CITIES

Table 5.1-1

Gamma radiation as measured by Thermoluminescent Dosimeters (TLDs)

Standard Radiological Monitoring Program

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Placed:		12-31-82	4-01-83	7-01-83, 8-10-83*	10-01-83
Date Removed:		4-01-83	7-01-83	10-01-83	12-31-83
Days in the Field:		91	91	92,52*	91
Location		Average mR/Qtr			
On-Site Indicator Locations					
Q-01	On-Site No. 1	13.2±0.8	13.0±1.0	12.1±1.0	13.0±0.6
Q-02	On-Site No. 2	13.4±0.9	13.0±1.1	15.0±1.6	15.5±0.8
Q-03	On-Site No. 3	12.6±1.0	12.8±1.5	11.6±0.8[a]	12.8±1.2
Mean ± s.d.		13.1±0.4	12.9±0.1	12.9±1.8	13.8±1.5
Off-Site Indicator Locations					
Q-04	Nitrin	11.7±0.8	11.0±1.1	11.4±0.8	11.4±2.6
Q-05	Saddle Club Dairy	13.1±0.7	11.8±0.9	12.1±0.4	12.8±0.8
Q-06	Hanson's Dock	13.4±1.0	13.4±0.7	13.9±1.6	15.1±1.2
Mean ± s.d.		12.7±0.9	12.1±1.2	12.5±1.3	13.1±1.9
Background Locations					
Q-07	Clinton	11.6±0.7	11.2±1.0	12.2±1.0	11.9±1.4
Q-08	Sikkema Farm	13.2±0.6	13.1±0.8	12.6±0.6	15.7±1.0
Q-09*	Erie	13.7±0.9	13.5±0.6	21.3±1.7	14.0±1.4
Q-10	Hillsdale	14.0±0.7	13.1±1.1	13.0±0.9	14.2±0.9
Q-11	Port Byron	15.9±0.9	14.8±0.9	16.0±1.4	15.1±3.1
Q-12	Bettendorf	14.3±0.9	13.1±0.9	13.2±0.7	13.2±0.8
Q-13	Princeton	11.6±1.2	12.4±0.9	13.0±1.0	13.3±0.8
Q-14	Utica Ridge Road	12.4±0.8	11.2±0.6	11.7±0.7	12.7±1.3
Q-15	DeWitt	11.9±0.9	11.6±0.9	12.4±0.9	13.7±0.9
Q-16	Low Moor	12.2±0.7	12.0±0.6	11.8±1.8	12.8±1.0
Mean ± s.d.		13.1±1.4	12.6±1.1	13.7±2.9	13.7±1.1

[a] Q-03C TLDs results; TLDs from Q-03 were lost in the field.

QUAD CITIES

Table 5.1-1 (continued)

Gamma radiation as measured by TLDs (continued)

Special Program

Inner Ring, Near Site Boundary, Indicator Locations

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Placed:	12-31-82	4-01-83	7-01-83, 7-29-83*	10-01-83
Date Removed:	4-01-83	7-01-83	10-01-83	12-31-83
Days in the Field:	91	91	92,65*	91
Location	Average mR/Qtr			
Q-101-1	11.5±0.6	11.0±1.2	12.6±1.0	12.0±1.2
Q-101-2	11.5±0.6	10.9±0.6	10.8±0.6	11.5±0.7
Q-102-1	12.9±0.5	12.2±0.7	13.0±1.7	13.8±0.9
Q-102-2	12.4±0.5	12.9±0.7	11.2±0.6	14.1±1.0
Q-103-1	11.5±0.8	11.1±0.6	11.5±1.1	11.6±0.8
Q-103-2	11.0±0.6	10.5±0.9	9.5±1.2	11.1±1.0
Q-104-1	11.3±1.0	11.1±0.8	11.0±1.2	11.7±0.7
Q-104-2	11.3±0.9	10.5±1.1	11.5±0.9	11.6±0.9
Q-105-1	11.3±1.4	10.7±0.6	9.8±0.7	12.4±0.8
Q-105-2	11.6±1.0	11.6±0.9	11.3±0.8	12.0±0.8
Q-106-1	11.9±0.7	9.8±1.8	11.4±0.6	11.9±0.8
Q-106-2	12.3±2.1	12.2±0.9	11.4±0.7	12.7±0.7
Q-107-1	11.6±0.6	12.5±0.7	11.9±0.8	13.0±1.1
Q-107-2	11.1±0.6	10.8±0.9	10.8±0.4	11.3±0.9
Q-108-1	11.8±1.0	11.2±1.3	11.1±0.8	11.4±1.7
Q-108-2	12.2±0.5	11.3±0.7	11.0±1.4	12.8±0.7
Q-109-1	11.6±0.8	10.4±0.7	10.7±0.7	10.9±1.3
Q-109-2	10.9±0.8	11.0±1.0	11.0±0.9	12.2±1.2
Q-111-1	14.1±0.7	12.4±1.0	12.5±0.6	15.6±0.8
Q-111-2	11.5±1.0	10.6±0.7	10.8±0.8	12.7±1.1
Q-112-1	11.2±0.5	11.4±1.2	12.0±0.8	12.3±0.9
Q-112-2	13.4±1.1	12.4±0.7	12.1±0.6	13.4±1.3
Q-113-1	11.5±0.7	11.8±0.5	10.8±0.8	11.7±0.9
Q-113-2*	ND[a]	ND[a]	16.4±0.9	11.9±1.2
Q-114-1*	ND[a]	ND[a]	17.6±1.1	10.4±0.8
Q-114-2	11.8±0.6	11.4±0.9	11.1±0.8	12.1±0.6
Q-115-1	12.0±0.5	11.4±0.7	10.9±0.7	12.5±1.1
Q-115-2	13.2±0.8	ND[b]	12.0±0.4	12.7±0.9
Q-116-1	12.6±1.0	12.2±0.6	11.7±0.5	13.5±1.0
Q-116-2	11.4±0.5	11.5±0.7	10.5±0.6	12.7±0.7
Mean ± s.d.	11.9±0.8	11.4±0.8	11.7±1.6	12.3±1.1

[a] ND = No data; TLDs were not placed due to construction in the area.
[b] ND = No data; TLDs were lost in the field.

Table 5.1-1 (continued)

Gamma radiation as measured by TLDs (continued)

Special Program

Outer Ring, Near 5 Mile Radius, Indicator Locations

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Placed:	12-31-82	4-01-83	7-01-83	10-01-83
Date Removed:	4-01-83	7-01-83	10-01-83	12-31-83
Days in the Field:	91	91	92	91
Location	Average mR/Qtr			
Q-201-1	13.6±0.5	12.6±0.6	12.6±0.5	14.7±0.8
Q-201-2	11.7±1.7	13.5±0.7	12.2±0.4	13.5±1.2
Q-202-1	11.1±0.5	10.8±0.8	10.8±0.5	11.8±0.7
Q-202-2	11.6±0.8	11.3±0.6	10.6±0.6	11.9±1.0
Q-203-1	12.6±0.9	11.6±1.1	11.6±0.6	13.3±1.8
Q-203-2	13.9±1.0	13.0±0.6	12.8±0.8	14.5±1.1
Q-204-1	14.5±0.9	14.0±1.2	13.1±1.0	14.3±1.1
Q-204-2	ND[a]	13.1±1.0	13.2±0.8	15.7±1.5
Q-205-1	13.4±1.0	13.8±0.7	13.6±1.8	17.8±1.8
Q-205-2	13.4±1.4	12.8±0.9	13.0±0.7	14.6±0.5
Q-206-1	12.6±0.5	12.5±0.9	12.2±1.2	13.8±0.6
Q-206-2	13.2±0.5	12.8±0.6	12.9±1.8	14.5±1.1
Q-207-1	13.4±1.1	13.7±0.8	12.9±0.5	13.9±1.0
Q-207-2	11.7±0.9	11.2±0.8	11.4±0.7	12.0±0.6
Q-208-1	12.6±1.2	10.8±2.0	11.2±0.6	12.9±0.7
Q 208-2	13.3±0.7	12.9±1.0	11.9±0.6	13.9±0.7
Q-209-1	13.2±0.6	13.1±0.6	12.6±0.9	13.0±0.6
Q-209-2	12.3±0.9	10.6±2.1	11.3±0.5	12.0±1.0
Q-210-1	12.0±0.7	12.3±0.5	11.1±0.5	13.9±1.6
Q-210-2	13.6±0.7	14.7±0.8	13.0±0.7	14.1±0.6
Q-211-1	14.9±1.0	14.5±0.9	13.0±0.8	15.1±0.7
Q-212-1	15.5±2.1	14.2±0.9	12.2±0.9	13.9±0.7
Q-212-2	11.3±0.4	11.9±1.5	10.4±0.4	12.6±0.9
Q-213-1	12.1±0.7	12.5±0.9	10.8±0.8	12.6±1.2
Q-213-2	11.2±0.5	11.0±0.9	10.3±1.0	11.8±1.2
Q-214-1	13.5±1.2	12.4±1.1	11.6±1.4	13.4±1.5
Q-214-2	13.3±0.7	13.3±0.7	13.8±0.7	15.0±0.7
Q-215-1	14.3±0.6	13.6±0.7	12.7±0.5	15.2±1.2
Q-215-2	14.7±0.7	14.7±1.0	13.3±1.0	14.7±0.9
Q-216-1	12.8±0.6	12.9±0.7	11.9±0.5	12.1±2.5
Q-216-2	13.4±0.8	13.9±1.2	13.2±0.6	15.5±1.0
Mean ± s.d.	13.0±1.1	12.8±1.2	12.2±1.0	13.8±1.4

[a] ND = No data; TLDs lost in the field.

APPENDIX II

METEOROLOGICAL DATA

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	1	1
SE	0	0	1	0	1	0	2
SSE	0	0	0	3	1	0	4
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	2	0	0	2
WSW	0	0	0	1	0	0	1
W	0	0	0	2	0	0	2
WNW	0	0	2	0	0	0	2
NW	0	0	1	0	0	0	1
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	0	4	8	2	1	16

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	1	0	0	0	0	1
NE	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	1	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	0	3	1	0	4
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	1	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	1	1	3	2	0	8

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	2	1	3
SE	0	0	0	1	0	0	1
SSE	0	0	0	2	0	0	2
S	0	0	0	3	0	0	3
SSW	0	1	1	0	0	0	2
SW	0	0	1	1	0	0	2
WSW	0	0	1	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	2	1	3	7	2	1	16

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - NEUTRAL (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	8	21	5	0	34
NNE	0	5	24	5	0	0	34
NE	0	8	20	28	28	3	87
ENE	0	15	14	19	8	0	56
E	2	7	13	21	18	3	64
ESE	0	9	20	25	11	3	68
SE	1	10	18	11	0	2	42
SSE	1	7	31	23	18	4	84
S	2	5	26	36	10	0	79
SSW	1	24	21	15	4	0	65
SW	2	11	10	6	0	0	29
WSW	0	4	19	5	2	0	30
W	0	4	20	51	29	6	110
WNW	1	7	17	33	6	10	74
NW	0	7	25	54	16	1	103
NNW	0	7	29	79	30	0	145
VARIABLE	0	0	0	0	0	0	0
TOTAL	10	130	315	432	185	32	1104

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 103

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	4	8	21	4	0	37
NNE	0	1	13	17	3	0	34
NE	0	3	16	37	11	0	67
ENE	0	3	17	15	18	9	62
E	1	15	35	19	8	2	80
ESE	0	3	17	20	7	0	47
SE	1	11	22	18	3	1	56
SSE	0	2	18	49	6	0	75
S	2	5	15	34	12	0	68
SSW	0	9	9	1	2	0	21
SW	0	5	8	4	0	0	17
WSW	1	3	11	5	0	0	20
W	0	2	8	37	6	0	53
WNW	0	3	16	24	2	0	45
NW	0	5	19	20	3	0	47
NNW	0	4	12	1	0	0	17
VARIABLE	0	0	0	0	0	0	0
TOTAL	5	78	244	322	85	12	746

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 34

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	1	0	0	0	1
NNE	0	1	1	2	0	0	4
NE	0	1	3	3	1	0	8
ENE	0	0	3	2	0	0	5
E	0	0	1	4	0	0	5
ESE	0	0	5	5	1	0	11
SE	0	0	3	8	6	0	17
SSE	0	0	2	10	0	0	12
S	0	1	7	10	0	0	18
SSW	0	0	2	2	0	0	4
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	1	2	1	1	0	0	5
WNW	2	2	6	2	0	0	12
NW	0	1	1	0	0	0	2
NNW	1	0	0	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	4	8	36	49	8	0	105

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 8

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	1	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	1	0	0	0	1
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	1	0	0	0	1
S	0	1	4	0	0	0	5
SSW	0	2	2	0	0	0	4
SW	1	1	0	0	0	0	2
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	4	10	0	0	0	15

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 3

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 2

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	5	1	0	0	6
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	2	0	0	0	2
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	1	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	7	1	1	0	9

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - NEUTRAL (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	13	12	5	5	36
NNE	0	2	17	13	5	2	39
NE	0	2	4	7	4	0	17
ENE	0	2	2	7	7	1	19
E	0	2	4	3	0	9	18
ESE	0	3	21	16	2	0	42
SE	0	2	13	20	2	0	37
SSE	1	6	6	10	3	0	26
S	0	8	14	7	14	4	47
SSW	1	17	31	18	3	2	72
SW	1	9	17	12	5	3	47
WSW	0	7	10	8	6	13	44
W	0	10	21	26	12	4	73
WNW	1	10	16	13	24	7	71
NW	0	6	12	24	6	1	49
NNW	0	1	12	35	4	1	53
VARIABLE	0	0	0	0	0	0	0
TOTAL	4	88	213	231	102	52	690

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 1

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	6	23	22	7	0	59
NNE	1	6	20	20	4	5	56
NE	2	18	5	26	25	23	99
ENE	1	16	22	30	12	3	84
E	2	5	22	53	24	9	115
ESE	1	6	24	27	11	4	73
SE	1	8	10	25	8	0	52
SSE	3	3	17	28	31	12	94
S	1	2	15	18	31	7	74
SSW	2	12	30	15	6	3	68
SW	2	5	17	24	6	0	54
WSW	3	5	11	18	9	0	46
W	1	5	33	45	7	0	91
WNW	1	7	18	40	10	1	77
NW	0	6	21	33	13	0	73
NNW	1	7	17	18	3	0	46
VARIABLE	0	0	0	0	0	0	0
TOTAL	23	117	305	442	207	67	1161

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 10

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	3	2	0	1	0	6
NNE	0	1	1	0	1	0	3
NE	1	2	1	0	0	0	4
ENE	1	2	3	2	0	0	8
E	0	3	8	7	1	0	19
ESE	2	3	3	13	2	0	23
SE	0	2	4	14	3	0	23
SSE	0	0	9	17	3	0	29
S	0	1	5	10	2	0	18
SSW	1	6	3	6	0	0	16
SW	1	2	7	11	4	0	25
WSW	1	0	7	7	1	0	16
W	0	0	7	6	0	0	13
WNW	1	2	3	9	0	0	15
NW	1	3	5	3	0	0	12
NNW	0	3	0	1	0	0	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	9	33	68	106	18	0	234

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	0	2	1	0	0	0	3
E	0	0	1	0	0	0	1
ESE	0	0	0	2	1	0	3
SE	1	0	1	4	0	0	6
SSE	0	0	1	7	0	0	8
S	1	0	1	2	0	0	4
SSW	0	3	3	2	0	0	8
SW	1	2	4	6	0	0	13
WSW	1	0	3	2	0	0	6
W	0	2	4	4	0	0	10
WNW	1	2	1	0	0	0	4
NW	0	1	0	0	0	0	1
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	6	12	20	29	1	0	68

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 11

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	4	0	0	4
SSW	0	0	1	1	0	0	2
SW	0	0	2	0	0	0	2
WSW	0	0	0	0	0	0	0
W	0	0	0	1	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	3	6	0	0	9

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - NEUTRAL (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	5	9	8	2	0	24
NNE	0	1	3	16	0	0	20
NE	0	3	4	0	1	0	8
ENE	0	1	1	1	0	0	3
E	0	2	3	1	0	0	6
ESE	0	6	2	2	0	0	10
SE	0	4	12	7	3	0	26
SSE	0	7	24	14	3	1	49
S	0	9	23	13	3	2	50
SSW	0	28	31	11	1	0	71
SW	1	22	32	23	1	0	79
WSW	1	23	17	7	2	1	51
W	0	17	24	11	5	0	57
WNW	0	11	11	14	6	0	42
NW	0	3	12	3	7	0	25
NNW	0	2	8	5	4	0	19
VARIABLE	0	0	0	0	0	0	0
TOTAL	2	144	216	136	38	4	540

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 14

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	18	27	8	0	0	53
NNE	0	23	17	8	0	0	48
NE	1	22	25	17	0	0	65
ENE	0	17	33	9	0	1	60
E	2	12	14	9	2	1	40
ESE	1	6	11	10	0	0	28
SE	0	12	20	21	5	0	58
SSE	0	13	15	15	15	1	59
S	0	16	25	43	24	5	113
SSW	1	16	39	14	8	3	81
SW	1	12	20	22	12	4	71
WSW	1	9	19	25	6	0	60
W	1	3	12	25	6	1	48
WNW	0	12	9	40	1	0	62
NW	0	12	28	21	1	0	62
NNW	3	17	18	15	1	0	54
VARIABLE	0	0	0	0	0	0	0
TOTAL	11	220	332	302	81	16	962

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 67

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	5	3	0	0	0	9
NNE	2	1	7	2	0	0	12
NE	0	2	8	9	1	0	20
ENE	0	2	3	4	0	0	9
E	1	0	5	5	0	0	11
ESE	2	3	7	8	3	0	23
SE	1	2	14	18	4	0	39
SSE	0	3	10	34	6	1	54
S	2	4	17	26	9	0	58
SSW	0	5	15	4	0	0	24
SW	0	1	9	7	2	0	19
WSW	0	1	7	11	2	0	21
W	0	1	2	4	7	0	14
WNW	1	2	0	10	0	0	13
NW	1	3	1	0	0	0	5
NNW	0	3	2	0	0	0	5
VARIABLE	0	0	0	0	0	0	0
TOTAL	11	38	110	142	34	1	336

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 25

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	1	0	0	0	0	0	1
ENE	3	6	2	0	0	0	11
E	1	2	5	0	0	0	8
ESE	0	3	2	5	0	0	10
SE	0	1	5	41	2	0	49
SSE	2	2	10	31	1	0	46
S	0	8	21	30	2	0	61
SSW	0	11	15	2	0	0	28
SW	0	6	10	4	0	0	20
WSW	1	0	4	4	1	0	10
W	0	0	1	3	0	0	4
WNW	0	0	0	1	0	0	1
NW	0	3	0	0	0	0	3
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	9	42	75	121	6	0	253

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 2

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 0

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - NEUTRAL (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	11	8	41	22	3	85
NNE	1	6	4	19	2	11	43
NE	0	3	3	14	7	0	27
ENE	1	1	5	7	6	15	35
E	1	6	22	34	8	9	80
ESE	0	13	22	9	2	3	49
SE	1	4	18	8	0	0	31
SSE	0	4	7	11	2	1	25
S	1	10	12	10	6	0	39
SSW	1	13	28	12	18	0	72
SW	2	10	7	11	7	0	37
WSW	1	8	13	19	16	32	89
W	2	12	22	26	11	4	77
WNW	0	8	49	55	19	0	131
NW	1	8	11	35	23	0	78
NNW	0	8	8	26	8	2	52
VARIABLE	0	0	0	0	0	0	0
TOTAL	12	125	239	337	157	80	950

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 41

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	8	16	5	0	0	29
NNE	0	7	21	12	1	2	43
NE	0	2	10	26	3	0	41
ENE	2	6	13	40	31	0	92
E	1	2	9	19	24	1	56
ESE	1	6	9	28	11	4	59
SE	1	4	12	23	5	0	45
SSE	0	3	14	32	14	4	67
S	1	8	10	22	21	3	65
SSW	0	8	13	17	19	1	58
SW	5	9	28	31	9	0	82
WSW	2	6	11	23	10	2	54
W	3	5	10	27	20	10	75
WNW	3	5	9	27	14	20	78
NW	0	8	31	14	8	0	61
NNW	1	8	4	6	2	0	21
VARIABLE	0	0	0	0	0	0	0
TOTAL	20	95	220	352	192	47	926

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 16

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	2	2	0	0	4
NNE	1	0	5	0	0	0	6
NE	1	1	3	1	3	0	9
ENE	0	1	1	4	0	0	6
E	0	2	1	7	1	0	11
ESE	0	1	3	8	1	0	13
SE	0	0	1	8	5	0	14
SSE	0	2	8	10	1	0	21
S	0	3	10	4	0	0	17
SSW	0	2	6	11	0	0	19
SW	0	1	3	2	0	0	6
WSW	0	1	0	1	2	0	4
W	0	2	6	5	4	0	17
WNW	0	0	4	2	9	0	15
NW	1	0	3	2	1	0	7
NNW	1	1	3	6	0	0	11
VARIABLE	0	0	0	0	0	0	0
TOTAL	4	17	59	73	27	0	180

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

QUAD CITIES NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 296-33 FT)
WINDS MEASURED AT 296 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .8-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	0	0	0	0	1
NNE	1	5	1	0	0	0	7
NE	0	3	0	0	0	0	3
ENE	0	0	0	0	0	0	0
E	0	2	5	2	0	0	9
ESE	0	0	0	1	1	0	2
SE	0	0	1	5	0	0	6
SSE	0	0	5	7	0	0	12
S	0	1	11	8	2	0	22
SSW	0	1	4	7	1	0	13
SW	0	1	3	1	0	0	5
WSW	0	0	0	0	0	0	0
W	0	0	0	0	5	0	5
WNW	0	0	0	0	4	0	4
NW	0	0	1	0	0	0	1
NNW	0	0	1	1	0	0	2
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	14	32	32	13	0	92

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 0

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 3

APPENDIX III

ANALYTICAL PROCEDURES

SECTION 1.0

SAMPLE PREPARATION

Different classes of samples require different preparations. In general, food products are prepared as for home use, while others are dried and ashed as received.

1.1 Fish

1. Wash the fish.

2. Fillet and place the flesh immediately (to prevent moisture loss) in a 500 cc plastic container. Add a few cc of formaldehyde. Seal and record wet weight.

   NOTE: If bones are to be analyzed, boil remaining fish in water for about 1 hour. Clean the bones. Air dry, weigh and record as wet weight. Dry at 125° C. Record dry weight. Ash at 800° C, cool, weigh, and record the ash weight. Grind to a homogeneous sample. The sample is ready for analysis.

3. Gamma scan fillet without delay or store in a freezer.

4. After gamma spectroscopic analysis is completed transfer the sample to a drying pan and dry at 125° C.

5. Cool, weigh, and record dry weight.

6. Ash by gradually increasing the temperature to 450° C. If considerable amounts of carbon remain after overnight ashing, the sample should be brushed and placed back in the muffle furnace until ashing is completed. Record ash weight. The sample is now ready for analysis.

   NOTE: If there is sufficient quantity, use surplus flesh for drying and ashing, instead of waiting for gamma scanning to be completed.

1.2 Bottom Sediments and Soil

1. Air dry the entire sample. Grind or pulverize the sample and sieve through a #20 mesh screen.

2. For gamma-spectroscopic analysis, seal 500 cc of the ground sample in a Marinelli beaker. Record dry weight.

3. Seal the remaining sample (up to 1 kg) in a plastic container and save for other analyses or for possible future rechecking.

1.3 Drinking (clear) water (EPA Method 900.0)

A representative sample must be collected from a free-flowing source of drinking water, and should be large enough so that adequate aliquots can be taken to obtain the required sensitivity.

It is recommended that samples be preserved at the time of collection by adding enough 1N HNO_3 to the sample to bring it to pH 2 (15 ml 1N HNO_3 per liter of sample is usually sufficient) If samples are to be collected without preservation, they should be brought to the laboratory within 5 days, then preserved and held in the original container for a minimum of 16 hours before analysis or transfer of the sample.

The container choice should be plastic over glass to prevent loss due to breakage during transportation and handling.

If the sample was not acidified at the time of collection, use the following procedure:

Procedure

1. Remove 100 ml of sample for tritium analysis, if required.

   NOTE: Water should not be acidified for tritium analysis. If samples are acidified in the field, an additional aliquot should be collected.

2. Add 15 ml of 1N HNO_3 per liter of sample in the original container.

3. Hold the sample in the original container for a minimum of 16 hours before analysis or transfer of the sample.

4. When taking an aliquot for analysis, take acid addition into account. For example:

Sample volume to be analyzed	Volume of aliquot required
200 ml	203 ml
400 ml	406 ml
600 ml	609 ml
800 ml	812 ml
1000 ml	1015 ml
2000 ml	2030 ml
3000 ml	3045 ml
3500 ml	3552 ml

For other volumes, adjust aliquots correspondingly, at the rate of 1.5 ml per 100 ml of sample.

2.1 Airborne Particulates

2.1.1. Gross Alpha and/or Gross Beta Activity

Procedure

1. Store the sample for 5 days from the day of collection to allow for decay of short-lived radon and thoron daughters.

2. Place a 47 mm filter on a stainless steel planchet and count the sample in a proportional counter.

3. Calculate the activity in pCi/m^3 using computer program AIRPAT.

Calculations

Gross alpha (beta) activity:

$$(pCi/m^3) = \frac{A}{B \times C \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 \quad E_b^2}}{B \times C \times 2.22}$$

Where:

A = net alpha (beta) count rate (cpm)
B = efficiency for counting alpha (beta) activity (cpm/dpm)
C = volume of sample (m^3)
E_{sb} = counting error of sample plus background
E_b = counting error of background

2.2.2 Gross Alpha and/or Gross Beta Activity in Dissolved Solids (see note)

Principle of Method

Water samples containing suspended matter are filtered through a membrane filter and the filtrate is analyzed. The filtered water sample is evaporated and the residue is transferred to a tared planchet for counting gross alpha and/or gross beta activity.

Reagents

Lucite: 0.5 mg/ml in acetone
Nitric acid, HNO_3: 3N
Nitric acid, HNO_3: concentrated

Apparatus

Filters; Millipore, membrane Type AA, 0.8 μ
Filtration equipment
Planchets (Standard 2" x 1/8" Beckman planchet)
Proportional counter

Procedure

1. Filter a volume of sample containing not more than 100 mg of dissolved solids for alpha assay, or not more than 200 mg of dissolved solids for beta assay.

   Note: For gross alpha and gross beta assay in the same sample limit amount of solids to 100 mg.

2. Wash the non-filterable solids on the filter. (Save the filters with suspended matter for separate analyses. See Section 2.2.1).

3. Evaporate the filtrate to NEAR dryness on a hot plate. Add 25 ml concentrated HNO_3 and evaporate to NEAR dryness.

Note: For analysis of total residue (for clear water) proceed as described above but do not fiter the water. Measure out the appropriate amount and proceed with step 3.

4. With distilled water and a few drops of 3N HNO_3, transfer the residue to a 50 ml beaker. Evaporate to NEAR dryness.

5. Transfer quantitatively the residue to a TARED PLANCHET, using an eye dropper.

6. Wash the beaker with distilled water and combine the washing and the residue in the planchet. Evaporate to dryness.

7. Bake in muffle furnace at 500° C for 45 min., cool and weigh.

8. Add a few drops (6-7 drops) of lucite solution and dry under the infrared lamp for 10-20 minutes.

9. Store the sample in a desiccator until it is to be counted.

10. Count the gross alpha and/or the gross beta activity in a low background proportional counter.

11. Calculate the activity in pCi/l using computer program OWATAB.

Calculations:

Gross alpha (beta) activity:

$$(\text{pCi/liter}) = \frac{A}{B \times C \times D \times 2.22} \pm \frac{2\sqrt{E_{sb}^2 + E_b^2}}{B \times C \times D \times 2.22}$$

Where:

A = net alpha (beta) count (cpm)
B = efficiency for counting alpha (beta) activity (cpm/dpm)
C = volume of sample (liters)
D = correction factor for self-absorption in the sample
E_{sb} = counting error of sample plus background
E_b = counting error of background

Reference: Radioassay Procedures for Environmental Samples, U.S. Department of Health, Education and Welfare. Environmental Health Series, January 1967.

3.1 Airborne Particulates - Gamma Spectroscopic analyses by Ge(Li) Detector

1. Put the air filter in a filter cup container.
2. Place the filter cup on a Ge(Li) detector.
3. Determine the gamma spectrum using 4096 or 8192 channel of gamma spectrometer with a setting of 0.5 KeV or 0.25 KeV per channel.
4. Identify gamma emitters (if present) by their respective energy peaks.

Calculations

1. Calculate the gamma activities using the computer program GAMMA 1 or GAMMA 2.

3.2 Airborne Iodine

3.2.1 Spectroscopic Analyses by Automatic Gamma Counter

Transfer charcoal to a plastic scintillation vial. Place the vial in the Automatic Gamma Counter (Packard Instrument Co. Model 5975) and count. Record the time.

Calculations

$$A = \frac{B}{2.22 \times C \times D \times e^{-\lambda t}}$$

Where:

A = activity of I-131 at the time of collection (pCi/m^3)
B = net count rate of I-131 in the 0.36 MeV peak
C = efficiency for counting I-131 activity in 0.36 MeV peak (cpm/dpm)
D = volume of sample (m^3)
e = the base of the natural logarithm = 2.7183
λ = decay constant $= \frac{0.693}{t_{1/2}} = \frac{0.693}{8.08} = 0.08577$
t = time (days) between the midpoint of collection and counting.

3.2.2 Spectroscopic Analysis by Ge(Li) Detector

1. Transfer charcoal to a small plastic bag.
2. Label the plastic bag with the corresponding project, location and date of collection and seal it.
3. Place packed charcoal in a 500 cc. Marinelli beaker (all locations) and seal with tape.
4. Place it on the Ge(Li) detector and count. Record time.

Calculations

Calculation is done by the computer by running the Program GAMMA 2.

3.3 Water - Gamma Spectroscopic Analyses by Ge (Li) Detector

Procedure

1. Measure 3.5 liters of water into a Marinelli beaker.
2. Place the beaker inside the shield on a Ge(Li) detector.
3. Count long enough to meet LLD requirements.
4. After counting, identify gamma emitters (if present) by their respective energy peaks.
5. Store the spectrum on a disc using computer by executing "RUN STORE."
6. After storing, calculate gamma activities, using computer program GAMMA 1 or GAMMA 2.
7. Transfer the sample back to the original container for further analyses.

3.4 Soils and Bottom Sediments - Gamma Spectroscopic Analyses by Ge(Li) Detector

Procedure

1. Transfer the portion of the ground sample set aside for gamma scanning into a 500 ml Marinelli container.
2. Record the dry weight.
3. Place the container inside the shield on a Ge(Li) detector.
4. Count the gamma activity long enough to meet the minimum sensitivity requirements.
5. After counting, identify gamma emitters (if present) by their respective energy peaks.
6. Store the spectrum on a disc using the computer by executing "RUN STORE."
7. After storing, calculate gamma activities using computer Program GAMMA 1 or GAMMA 2.
8. Transfer the sample back to the original container for further analyses.

3.5 Fish and Wildlife - Gamma Spectroscopic Analyses by Ge(Li) Detector

Procedure

1. Transfer a portion of the clean wet flesh of fish or animal into a 500 ml Marinelli container.
2. Record wet weight.
3. Add a few cc of formaldehyde and seal the container.
4. Place the container inside the shield on a Ge(Li) detector.
5. Count long enough to meet the minimum sensitivity requirements.
6. After counting, identify gamma emitters (if present) by their respective energy peaks.
7. Store the spectrum on a disc using computer by executing "RUN STORE."
8. After storing, calculate gamma activities using computer program GAMMA 1 or GAMMA 2.
9. Transfer the sample back to the original container for further analyses.

3.6 Ambient Gamma Radiation

A. Thermoluminescent Dosimeters (TLD) - Light Response (Efficiency)

Harshaw Lithium Fluoride TLD-100 chips, 1/8" x 1/8" x 0.035".

Procedure

1. Rinse the chips with warm trichloroethylene followed by the methanol rinse. Dry.
2. Place the chips in a platinum crucible.
3. Anneal for 1 hour at 400°C.
4. Cool quickly by placing the crucible on a metal plate.
5. Anneal for 2 hours at 100°C.

   Note: Avoid exposing the chips to the fluorescent light.
6. Seal 5 chips each in black plastic.
7. Mount the packs on the turntable.
8. Position the Ra-226 needle in the middle of the turntable and start rotation (appr. 60 revolutions per minute). Record the time.
9. Irradiate the chips for 2-6 hrs.
10. Remove the packages from the turntable. Return the Ra-226 needle to the lead container. Record the time.
11. Take the chips out of the plastic bag and place them in the vial.
12. Postanneal the chips for 10 minutes at 100°C.
13. Read each chip in the TLD Reader (For test procedure see "Performance Test Procedure for TLD Reader").
14. Calculate mean $\pm$ one sigma deviation of five chips.
15. Calculate light response of TLD's (correction factor) by the following equation:

Section 3.6 (continued)

Calculations

$$C.F.\ (\text{nanocoulombs/mrem}) = \frac{A}{B}$$

Where:

C.F = correction factor to be applied in calculating exposure of field TLD's
A = Net reading in nanocoulombs
B = known exposure to TLD's

The exposure to the TLD's (B) is calculated as follows:

$$\text{mrem/hr} = \frac{8400 \times \text{mg Ra-226}}{r^2}$$

For our setup use the following parameters:

Ra-226 = 0.0922 $\pm$ 1.5%

r = 19.6 cm

Thus:

$$\text{mrem/hr} = \frac{8400 \times 0.0933}{384.16} = 2.040$$

The total exposure (B) is equal to:

B (mrem) = 2.040 x hours

3.7 Procedure for Preparation and Readout of TLD Chips

Materials

Harshaw Lithium Fluoride TLD-100 chips, 1/8" x 1/8" x 0.035".
Black plastic bags or boxes
Plastic sealer
Vacuum needle (for handling the chips)
TLD reader

Note: Never handle the chips with bare hands. Use plastic-covered forceps or vacuum needle. Handle them gently, e.g. do not drop them into the vial or on the table. They chip off easily, resulting in efficiency change.

Procedure

1. Rinse the chips with warm trichloroethylene followed by the methanol rinse. Dry.
2. Place the chips in a platinum crucible.
3. Anneal for 1 hour at 400°C.
4. Cool quickly by placing the crucible on a metal plate.
5. Anneal for 2 hours at 100°C.
6. Seal 3 to 5 chips (depending on the specifications) in black plastic or plastic boxes.
7. Label and send out by U.S. Mail.
8. Upon arrival at the lab, store TLDs in the big shield until readout day. Do not store longer than a few days.
9. Connect chips reader one day prior to readout.
10. Turn on gas for a few minutes before readout. Adjust to the mark.
11. Set parameter on the 2000P as follows:

HV - 470 V (It is 970 V, internal volts = 500).
Readout time: 20"
T_1 - 140° C (Preset)
T_2 - 250° C (Preset)
Rise time: -12°/sec (Preset)
Preheat - 100° C (Preset)
Start reading - 90° C

12. Prepare the chips as follows (do this before proceeding to the next step).
    12.1 Turn on small muffler furnace or drying oven and adjust to 100°C. Use glass thermometer. Muffler's indicator is not accurate. Let furnace stabilize.

    12.2 Unpack the chips (under reduced incandescent light) and gently place them in the glass vials marked with appropriate location numbers.

    12.3 Place the vials in the furnace. Preanneal for 10 min. at 100°C.

13. Open the drawer and read the standard. It should read 5.70±0.04. Adjust HV, if needed. Take 3 readings after final adjustment. Record.

14. Close the drawer.

15. Check bkg. It should read about 0.7-0.8 in 20". If it is higher, adjust the knob in the back of 2000 P (on left side when facing the instrument).

    Note: Adjust bkg as low as possible but do not let the needle hit zero. The instrument will not record below zero.

16. Make 10 bkg readings (no chip in). Record. Read (do not record) at least 2 dummies to stabilize the temperature.

17. Place the chip in, wait until temperature goes down to 90° C and press "read" button. Make sure the chip is in the cavity of the heating plate.

18. After readout is completed, record the reading, open the drawer, and place next chip.

19. Repeat Steps 17 and 18 until all chips are read out.

    Note: If reading will last longer than 1.5-2.0 hrs., check the standard and bkg about every 2.0 hrs.

20. After readout is completed, turn off the gas.

21. For calculations, use computer program OGTLD.PUB.

3.8 Tritium in Water (Direct Method)

Principle of Method

The water sample is purified by distillation, and portion of the distillate is transferred to a counting vial containing a scintillation fluid. The contents of the vial are then mixed and counted in a liquid scintillation counter.

Reagents

Scintillation medium, insta-gel scintillator
Tritium standard solution

Apparatus

Condenser
Distillation flask, 250-ml capacity
Liquid scintillation counter
Liquid scintillation counting vials

Procedure

1. Distill a 30 ml aliquot of the sample in a 250-ml distillation flask. Add a boiling chip to the flask. Connect a side arm adapter and a condenser to the outlet of the flask. Place a glass vial at the outlet of the condenser. Heat the sample to 100 - 150° C to distill, just to dryness. Collect the distillate for tritium analysis.

2. Dispense 13 ml of the distillate to a low potassium glass vial.

3. Prepare background and standard tritium-water solutions for counting, using the same amount as the sample. Use low tritium background distilled water for these preparations (distillate of most deep well water sources is acceptable, but each source should be checked for tritium activity before using).

4. Dark-adapt all samples, backgrounds, and standards. Add 10 ml of insta-gel scintillator. Count the samples, backgrounds and standards. Count samples containing less than 200 pCi/l for 300 minutes and samples containing more than 200 pCi/l for 200 minutes.

Section 3.8 (continued)

5. Counting efficiency:

$$Eff = \frac{\text{cpm of Standard-cpm of background}}{\text{dpm Standard}}$$

6. Sample Activity:

$$pCi/ml = \frac{A}{2.22 \times E \times V}$$

Where:

A = net count rate (cpm)
E = efficiency (cpm/dpm)
V = volume (ml)

7. Calculate tritium activity using computer program H3.

3.9 Iodine-131 Milk by Ion Exchange on Anion Exchange Column

After samples have been treated to convert all iodine in the sample to a common oxidation state, the iodine is isolated by solvent extraction or a combination of ion exchange and solvent extraction steps.

Iodine, as the iodide, is concentrated by adsorption on an anion exchanged column. Following a NaCl wash, the iodine is eluted with sodium hypochlorite. Iodine in the iodate form is reduced to I_2 and the elemental iodine extracted into CCl_4, back-extracted into water then finally precipitated as palladium iodide.

Chemical recovery of the added carrier is determined gravimetrically from the PdI_2 precipitate. I-131 is determined by beta counting the PdI_2.

Reagents

Anion exchange resin, Dowex 1-X8 (50-100 mesh) chloride form.

Carbon tetrachloride, CCl_4 - reagent grade.

Hydrochloric acid, HCl, 1N.

Hydrochloric acid, HCl, 3N.

H_2O - HNO_3 - HN_2OH HCL wash solution: 50 ml H_2O; 10 ml 1M - NH_2OH-HCl; 10 ml conc. HNO_3.

Hydroxylamine hydrochloride, NH_2OH HCl - 1 M.

Nitric acid, HNO_3 - concentrated.

Palladium chloride, PdI_2, 20 mg Pd^{++}/ml. 1.2 g $PdCl_2$/100 ml

6N HCl).

Sodium bisulfite, $NaHSO_3$ - 1 M

Sodium chloride, NaCl - 2M

Sodium hypochlorite, NaOCl - 5% (Clorox).

Section 3.9 (continued)

Special Apparatus

Chromatographic column, 20 mm x 150 mm (Reliance Glass Cat.#R2725T).

Vacuum filter holder, 2.5 cm^2 filter area

Filter paper, Whatman #42, 21 mm

Mylar

Polyester gummed tape, 1 1/2", Scotch #853

Drying oven

A. Ion Exchange Procedure

1. Set up an ion exchange column of 20 mm diameter and 150 mm length.

2. Pour 20 ml of a slurry of Dowex 1-X8, Cl^- form (50-100 mesh) into the column and wash down sides with water. Add 2 ml of I^- carrier to 2 liters milk, stir for 20 minutes.

3. Pass the sample through the ion exchange column at a flow rate of 20 ml/min. Save the effluent for other analyses and label it "iodine effluent".

4. Wash column with 500 ml of hot distilled water for milk samples or 200 ml of distilled water for water samples. Discard wash.

5. Wash column with 100 ml of 2 M NaCl at a flow rate of 4 ml/min. Discard wash.

6. Drain the solution from the column.

7. Measure 50 ml 5% sodium hypochlorite in a graduated cylinder. Add sodium hypochlorite to column in 10-20 ml increments, stirring resin as needed to eliminate gas bubbles and maintain flow rate of 2 ml/min. Collect eluate in 250-ml beaker and discard the resin.

B. Iodine Extraction Procedure

1. Acidify the eluate from step 7 using concentrated HNO_3 to make the sample 2-3 N in HNO_3, and transfer to 250 ml separatory funnel. (Add the acid slowly with stirring until the vigorous reaction subsides.) Volume of concetrated HNO_3 required will depend on eluate volume as follows):

B. Iodine Extraction Procedure (continued)

eluate volume (ml)	concentrated HNO_3 (ml)
50-60	10
60-70	12
70-80	14
80-90	16

2. Add 50 ml of CCl_4 and 10 ml of 1 M hydroxylamine hydrochloride (freshly prepared). Extract iodine into organic phase (about 2 minutes equilibration). Draw off the organic phase (lower phase) into another separatory funnel.

3. Add 25 ml of CCl_4 and 5 ml of 1 M hydroxylamine hydrochloride to the first separatory funnel and again equilibrate for 2 minutes. Combine the organic phases. Discard the aqueous phase (Upper phase) if no other analyses are required. If Pu, U or Sr is required on the same sample aliquot, submit the aqueous phase and data sheet to the approprate laboratory section.

4. Add 20 ml H_2O-HNO_3-NH_2OH HCl wash solution to the separatory funnel containing the CCl_4. Equilibrate 2 minutes. Allow phases to separate and transfer CCl_4 (lower phase) to a clean separatory funnel. Discard the wash solution.

5. Add 25 ml H_2O and 10 drops of 1 M sodium bisulfite (freshly prepared) to the separatory funnel containing the CCl_4. Equilibrate for 2 minutes. Discard the organic phase (lower phase). Drain aqueous phase (upper phase) into a 100-ml beaker. Proceed to the Precipitation of PdI_2.

C. Precipitation of Palladium Iodide

CAUTION: AMMONIUM HYDROXIDE INTERFERES WITH THIS PROCEDURE

1. Add 10 ml of 3 N HCl to the aqueous phase from the iodine extraction procedure in step 5.

2. Place the beaker on a stirrer-hot plate. Using the magnetic stirrer, boil and stir the sample until it evaporates to 30 ml or begins to turn yellow.

3. Add 1.0 ml of 20 mg Pd^{++}/ml palladium chloride per liter of milk used dropwise, to the solution.

Section 3.9 (continued)

C. Precipitation of Palladium Iodide (continued)

4. Turn the heat off, but continue to stir the sample until it cools to room temperature. Place the beaker in a stainless steel tray and put in the refrigerator overnight.

5. Weigh a clean 21 mm Whatman #42 filter which has been stored over silica gel in a desiccator.

6. Place the weighed filter in the filter holder. Filter the sample and wash the residue with water and then with absolute alcohol.

7. Remove filter from filter holder and place it on a stainless steel planchet.

8. Dry under the lamp for 20 minutes.

9. Cut a 1 1/2" strip of polyester tape and lay it on a clean surface, gummed side up. Place the filter, precipitate side up, in the center of the tape.

10. Cut a 1 1/2" wide piece of mylar. Using a spatula to press it in place, put it directly over the precipitate and seal the edges to the polyester tape. Trim to about 5 mm from the edge of the filter with scissors.

11. Mount the sample on the plastic disc and write the sample number on the back side of the disc.

12. Count the sample on a proportional beta counter.

Calculations

Calculate the sample activity using computer program I131.

Reference: "Determination of 1-131 by Beta-Gamma coincidence Counting of PdI_2". Radiological Science Laboratory. Division of Laboratories and Research, New York State Department of Health, March 1975, Revised February 1977.