LASALLE COUNTY STATION

RADIOACTIVE WASTE AND ENVIRONMENTAL MONITORING

ANNUAL REPORT 1983

TELEDYNE ISOTOPES MIDWEST LABORATORY

Northbrook, Illinois

MARCH 1984

LASALLE COUNTY NUCLEAR POWER STATION

RADIOACTIVE WASTE AND ENVIRONMENTAL MONITORING

ANNUAL REPORT 1983

TELEDYNE ISOTOPES MIDWEST LABORATORY

Northbrook, Illinois

MARCH 1984

TABLE OF CONTENTS

INTRODUCTION

LaSalle Station, a two-unit BWR plant is located near Marseilles, Illinois, in Lasalle County, next to the Illinois River. Each reactor is designed to have a capacity of 1078 MW net. Unit No. 1 loaded fuel in March 1982. Unit No. 2 loaded fuel in late December 1983. The plant has been designed to keep releases to the environment at levels below those specified in the regulations.

Liquid effluents from LaSalle County Station are released to the Illinois 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 LaSalle County Station to measure changes in radiation or radioactivity levels that may be attributable to plant operations. If significant changes attributable to LaSalle County Station 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, Illinois 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 1.29E-05 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 1.98 curies of fission and activation gases was released with a maximum release rate of 5.0E+03 μCi/sec.

A total of 2.44E-04 curies of I-131 was released during the year, with an average release rate of 2.07E-04 μCi/sec for all iodines.

A total of 17.80 curies of beta-gamma emitters and less than 1.0E-08 curies of alpha emitters was released as airborne particulate matter, with an average release rate of 5.64E-04 μCi/sec.

A total of 5.25E-05 curies of tritium was released, with an average release rate of 3.30E-06 μCi/sec.

1.2 Liquids Released to the Illinois River

A total of 1.26E+06 liters of radioactive liquid waste (prior to dilution) containing 10.54 curies (excluding tritium, gases, and alpha) were discharged after dilution with a total of 2.56E+10 liters of water. These wastes were released at a monthly average concentration of 3.5E-07 μCi/ml, discharged on an unidentified nuclide basis, which is 87.5% of the Technical Specification release limits for unidentified radioactivity. A total of <7.8E-06 curies of alpha radioactivity and <2.08 curies of tritium were released. Monthly release estimates and principal radionuclides 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 meterological 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 1.29E-05 mrem for the year, with an occupancy or shielding factor of 0.7 included. The maximum gamma air dose was 4.26E-05 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 1.66E-05 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 5.16E-06 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 3.83E-06 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 4.56E-06 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 4.53E-05 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 2.43E-03 mrem and no organ dose exceeded 9.44E-03 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 375' level wind direction and wind speed class by atmospheric stability class determined from the temperature difference between the 375' and 33' levels. Data recovery for these measurements was about 98.4%.

5.0 ENVIRONMENTAL MONITORING

Table 5.0-1 provides an outline of the radiological environmental monitoring program as required in the Technical Specifications.

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.

5.1 Gamma Radiation

External radiation dose from on-site sources and noble gases released to the atmosphere was measured at ten indicator and four 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 48 were installed on June 1, 1980 such that each sector was covered at both five miles and the site boundary.

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

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 0.053 pCi/m^3 at indicator locations and 0.010 to 0.075 pCi/m^3 at control locations with an average concentration of 0.021 and 0.022 pCi/m^3 for the year at indicator and control locations, repectively. No radioactivity attributable to station operation was detected in any sample.

5.3 Terrestrial Radioactivity

Precipitation samples were collected monthly from four milk sampling locations and analyzed for gross beta, tritium, strontium-89 and -90, and gamma-emitting isotopes. Except for gross beta, all other radioactivity was below the limits of detection indicating that there was no measurable amount of radioactivity attributable to the station releases.

Annual mean gross beta concentration measured 23.6 pCi/l, which is the level expected in precipitation samples.

Vegetables were collected in July and August and analyzed for gross beta, strontium-89 and -90 , and gamma-emitting isotopes. In addition, green leafy vegetables were analyzed for iodine-131. Gross beta concentration ranged from 1.5 to 5.0 pCi/g wet weight and averaged 2.5 pCi/g wet weight. The range and mean values were those expected in the vegetation samples. All other isotopes were below the limits of detection indicating that there was no measurable amount of radioactivity attributable to the station releases.

Cattlefeed and grass samples were collected quarterly from milk sampling locations and analyzed for gross beta, strontium-89 and -90 and gamma-emitting isotopes. Except for gross beta, the level of radioactivity was below the detection limits. Gross beta concentrations were at the level usually encountered in these samples.

Well water from on-site well (L-27) was collected monthly and analyzed for gross beta activity. The annual mean gross beta concentration was 20.6 pCi/l. Monthly samples were also composited quarterly and analyzed for strontium-89 and -90, tritium, and gamma scanned. All results were below the lower limits of detection.

Well water was also collected quarterly from five off-site wells and analyzed for the same parameters as in well water from on-site. The results were similar to those obtained for the on-site well, indicating that there was no measurable amount of radioactivity due to the station releases.

5.4 Aquatic Radioactivity

Surface water samples were collected weekly from eight locations and analyzed for gross beta content. Weekly samples from the Illinois River near the intake and discharge pipes were composited monthly and analyzed for gamma emitters, tritium, and strontium-89 and -90. Samples from other locations were composited monthly for gamma isotopic analysis and quarterly for tritium, Sr-89 and Sr-90. None of the composite samples indicated the presence of other than naturally occurring gamma emitters at a sensitivity of 10 pCi/l. None of the samples contained Sr-89 or Sr-90 above respective detection sensitivities of 10 pCi/l and 2 pCi/l. Tritium concentrations were below the LLD level of 200 pCi/l in all samples.

Gross beta concentrations were similar to those obtained during the preoperational program indicating that there was no measurable amount of radioactivity due to station operation present.

Sediment samples were collected three times, from one indicator and two control locations, and analyzed for gross beta and gamma-emitters. Gamma emitters were below the detection limits. Mean gross beta activity in indicator samples measured 29.0 pCi/g and 27.3 pCi/g at control locations indicating the presence of no radioactivity due to station operation.

Collection sites, frequency, and analysis of aquatic vegetation were identical to those of sediments. As expected, the gross beta concentration was lower for aquatic vegetation than for sediments. All gamma emitters were below the detection levels.

Levels of gamma radioactivity in fish were measured and found in all cases to be below the lower limits of detection for the program. Gross beta concentration averaged 3.2 pCi/g wet weight and was at the level expected in fish.

5.5 Milk

Milk samples were collected monthly from November through April and weekly from May through October and analyzed for iodine-131, radiostrontium, and gamma emitters. Radioiodine was below the limits of detection, 0.5 pCi/l during the grazing period (May to October) and 5.0 pCi/l during the first part of the non-grazing period (January to April). Sr-90 concentrations were variable within the usual range for milk and Sr-89 and gamma emitters were below the limits of detection.

5.6 Special Collection

No special collections were made during the period.

5.7 Program Modifications

Following modifications were made to the program during 1983:

a. In November 1983, the LLD for I-131 in milk for non-grazing season was changed from 5.0 pCi/l to 0.5 pCi/l.

b. The frequency of collection of charcoal was changed from every two weeks to once a week beginning October 29, 1983.

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. The survey was conducted by "door-to door" canvas and by information from Illinois Agricultural Agents. The census was conducted by A. Lewis on August 27, 1983.

There are no dairy farms within a five mile radius of the LaSalle Nuclear Power Station.

8.0 NEAREST RESIDENT CENSUS

The census was conducted by A. Lewis on August 27, 1983. There were no changes from the previous census.

APPENDIX I

DATA TABLES AND FIGURES

Table 1.1-1

REPORT OF RADIOACTIVE EFFLUENTS

FACILITY: LASALLE COUNTY NPS UNIT 1 POCKET NOS.: 50-373 YEAR: 1983

I Gaseous Effluents	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6MO. TOTAL	TECH.SPEC. RE
1. Gross Radioactivity Releases a) Noble Gas Release Main Stack	Curies	4.60E-5	NONE RELEASED	NONE RELEASED	NONE RELEASED	NONE RELEASED	9.0E-01	9.0E-01	6.6.A.4.b.
b. Maximum Release Rate									3.11.2.1
(grab sample)	uCi/sec	4.60E+1	N/A	N/A	N/A	N/A	5.0E+03	5.0E+03	
c. Isotopes Released									3.11.2.2
Kr-85m	Curies	---	---	---	---	---	---	---	
Kr-87	Curies	---	---	---	---	---	---	---	
Kr-88	Curies	---	---	---	---	---	---	---	
Xe-133	Curies	---	---	---	---	---	9.0E-01	9.0E-01	
Xe-135	Curies	---	---	---	---	---	---	---	
Xe-135m	Curies	---	---	---	---	---	---	---	
Xe-138	Curies	---	---	---	---	---	---	---	
Kr-85	Curies	4.60E-5	---	---	---	---	---	4.60E-5	
d. Percent of Stack Limit	%	4.73E-10	N/A	N/A	N/A	N/A	8.77E-6	8.77E-6	
e. Average Release Rate	uCi/sec	1.72E-6	N/A	N/A	N/A	N/A	3.47E-1	5.76E-2	3.11.2.1.a
2. Main Stack Iodine Release		None	None	None	None	NONE			6.6.A.4.b
a. Isotopes Released		Released	Released	Released	Released	RELEASED			3.11.2.3
I-131	Curies	---	---	---	---	---	---	---	
I-133	Curies	---	---	---	---	--	4.85E-4	4.85E-4	
I-134	Curies	---	---	---	---	---	2.38E-4	2.38E-4	
b. Percent of Stack Limit	%	N/A	N/A	N/A	N/A	N/A	9.20E-5	9.20E-5	
c. Average Release Rate	uCi/sec	N/A	N/A	N/A	N/A	N/A	2.79E-4	4.62E-05	3.11.2.1.b.

Table 1.1-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

ATTACHMENT A

LRP 1110-3
Revision 0
March 24, 1983

FACILITY: LASALLE COUNTY NPS UNIT 1   DOCKET NOS.: 50-373, 50-374   YEAR: 1983

I. Gaseous Effluents	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	6MO. TOTAL	TECH.SPEC. REF
1. Gross Radioactivity Release a) Noble Gas Release Main Stack	Curies	9.88E0	9.26E-1	None Detected	None Detected	None Detected	None Detected	1.08E1	6.6.A.4.b.
b. Maximum Release Rate									3.11.2.1
(grab sample)	uCi/sec	1.0E1	2.30E0	N/A	N/A	N/A	N/A	1.0E1	
c. Isotopes Released									3.11.2.2
Kr-85m	Curies	<2.0E-8*	9.26E-1	<2.0E-8*	<2.0E-8*	<2.0E-8*	<2.0E-8*	9.26E-1	
Kr-87	Curies	<2.7E-8*	<2.7E-8*	<2.7E-8*	<2.7E-8*	<2.7E-8*	<2.7E-8*	<2.7E-1*	
Kr-88	Curies	<6.1E-8*	<6.1E-8*	<6.1E-8*	<6.1E-8*	<6.1E-8*	<6.1E-8*	<6.1E-8*	
Xe-133	Curies	7.0E0	<2.3E-7*	<2.3E-7*	<2.3E-7*	<2.3E-7*	<2.3E-7*	7.0E0	
Xe-135	Curies	2.88E0	<1.9E-8*	<1.9E-8*	<1.9E-8*	<1.9E-8*	<1.9E-8*	2.88E0	
Xe-135m	Curies	<2.8E-8*	<2.8E-8*	<2.8E-8*	<2.8E-8*	<2.8E-8*	<2.8E-8*	<2.8E-8*	
Xe-138	Curies	<4.6E-8*	<4.6E-8*	<4.6E-8*	<4.6E-8*	<4.6E-8*	<4.6E-8*	<4.6E-8*	
Kr-85	Curies	2.18E-3	-----	------	------	------	----	2.18E-3	
* Activity of each grab sample is less than LLD (uCi/cc)									
d. Percent of Stack Limit	%	3.15E-4	5.62E-5	N/A	N/A	N/A	N/A	3.15E-4	
e. Average Release Rate	uCi/sec	3.69E0	3.46E-1	N/A	N/A	N/A	N/A	6.79E-1	3.11.2.1.a
2. Main Stack Iodine Releases									6.6.A.4.b.
a. Isotopes I-135	Curies	<6.01E-12*	3.11E-4	<6.01E-12*	<6.01E-12*	<6.01E-12*	<6.01E-12*	3.11E-4	3.11.2.3.
I-131	Curies	6.99E-5	5.19E-5	<9.45E-13*	1.22E-4	<9.45E-13	<9.45E-13	2.44E-4	
I-133	Curies	3.94E-4	4.87E-4	<7.58E-13*	2.88E-4	<7.58E-13	<7.58E-13	1.17E-3	
I-132	Curies	3.7E-3	<1.74E-11*	6.48E-7	2.64E-4	1.64E-4	<1.74E-11	4.13E-3	
b. Percent of Stack Limit	%	1.33E-3	1.02E-3	7.53E-10	2.21E-5	1.91E-7	N/A	6.48E-5	
c. Average Release Rate	uCi/sec	1.55E-3	3.17E-4	2.50E-7	2.52E-4	6.33E-5	N/A	3.68E-4	3.11.2.1.b.

Table 1.1-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

ATTACHMENT A

LRP 1110-13
Revision 0
March 24, 1983
7

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373,50-374 YEAR: 1983

I. Gaseous Effluents (cont)	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	6 MO. TOTAL	TECH. SPEC.REF
3. Main Stack Particulate Release a. Gross Radioactivity (β-δ)	milli-curries	3.46E0	5.66E0	2.94E-1	4.14E-2	None Detected	None Detected	9.46E0	6.6.A.4.b
b. Gross Alpha Radioactivity	mCi	<1E-8+	<4E-9+	<8E-9 +	*	*	*	<1E-8 +	3.11.2.3
c. Isotopes Released									3.11.2.3
Cr-51	mCi	------	------	-------	------	-----	----	-----	
Mn-54	mCi	3.48E-2	1.49E-1	2.35E-1	9.96E-3	<2.1E-13+	<2.1E-13	3.94E-1	
Co-58	mCi	<4.7E-13+	<4.7E-13+	<4.7E-13+	<4.7E-13+	<4.7E-13+	<4.7E-13	<4.7E-13 +	
Fe-59	mCi	<4.9E13+	<4.9E-13+	<4.9E-13+	<4.9E-13+	<4.9E-13+	<4.9E-13	<4.9E-13 +	
Co-60	mCi	5.96E-3	1.12E-1	5.91E-2	3.14E-2	<3.3E-13+	<3.3E-13	2.08E-1	
Zn-65	mCi	2.55E-2	2.93E-2	<7.9E-13+	<7.9E-13+	<7.9E-13+	<7.9E-13	5.48E-2	
Sr-89	mCi	5.0E-9	<7.0E-9+	<3E-9 +	*	*	*	5.0E-9	
Sr-90	mCi	<3.0E-9+	<9.0E-9+	<4E-9 +	*	*	*	<9.0E-9 +	
Zr-95	mCi	------	-------	------	------	-------	----	----	
Nb-95	mCi	------	-------	-------	------	-------	----	----	
Ru-103	mCi	------	-------	-------	------	-------	----	----	
Ru-105	mCi	2.17E-1	-------	------	------	-------	----	2.17E-1	
As-76	mCi	------	7.40E-2	------	------	-------	----	7.40E-2	
Na-24	mCi	8.23E-1	3.86E0	-------	------	-------	----	4.68E0	
Cs-134	mCi	<3.4E-13+	<3.4E-13+	<3.4E-13+	<3.4E-13+	<3.4E-13+	<3.4E-13	<3.4E-13 +	
Cs-136	mCi	------	-------	-----	------	-------	----	---	
Cs-137	mCi	<5.8E-13+	<5.8E-13+	<5.8E-13+	<5.8E-13+	<5.8E-13+	<5.8E-13	<5.8E-13 +	
Tc-99m	mCi	------	1.27E-1	------	------	-------	----	1.27E-1	
Mn-56	mCi	2.36E-0	1.31E0	------	------	-------	----	3.62E0	
Rb-88	mCi	5.34E-6	-------	------	------	-------	----	5.34E-6	

* Data to be presented in an errata to this report.

Table 1.1-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373 YEAR: 1983

1. Gaseous Effluents(cont'd)	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6MO. TOTAL	TECH.SPEC. RE
3. Main Stack Particulate Release a. Gross Radioactivity(β-γ)	milli-curies	6.28E-3	NONE RELEASED	4.52E0	1.47E-02	NONE RELEASED	3.80E0	8.34E0	6.6.A.4.b.
b. Gross Alpha Radioactivity	mCi	<7.0E-09	<2.0E-09	<2.0E-09	*	*	☆	<7.0E-09	3.11.2.3
c. Isotopes Released									3.11.2.3.
Cr-51	mCi	---	---	---	---	---	---	---	
Mn-54	mCi	6.20E-3	---	1.07E-2	9.76E-03	---	5.35E-1	5.62E-1	
Co-58	mCi	---	---	---	---	---	5.83E-3	5.83E-3	
Fe-59	mCi	---	---	---	---	---	---	---	
Co-60	mCi	7.52E-5	---	---	4.96E-03	---	1.44E0	1.45E0	
Zn-65	mCi	---	---	---	---	---	---	---	
Sr-89	mCi	9.0E-09	<2.0E-09	<2.0E-09	*	*	*	9.0E-09	
Sr-90	mCi	<3.0E-09	<3.0E-09	<3.0E-09	*	*	*	<3.0E-9	
Sr-92	mCi	---	---	---	---	---	2.9E-2	2.9E-2	
Mn-56	mCi	---	---	3.21E0	---	---	6.65E-1	3.88E0	
Na-24	mCi	---	---	1.22E0	---	---	7.34E-1	1.95E0	
Ru-103	mCi	---	---	---	---	---	1.97E-1	1.97E-1	
Ru-105	mCi	---	---	---	---	---	1.47E-1	1.47E-1	
I-131	mCi	---	---	---	---	---	---	---	
Cs-134	mCi	---	---	---	---	---	---	---	
Cs-136	mCi	---	---	---	---	---	---	---	
Cs-137	mCi	---	---	---	---	---	9.64E-3	9.64E-3	
Ba-140/La-140	mCi	---	---	---	---	---	---	---	
As-76	mCi	---	---	4.05E-2	---	---	3.68E-2	7.73E-2	
W-187	mCi	---	---	3.73E-2	---	---	---	3.73E-2	

*Data to be presented in an errata to this report

Table 1.1-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS: 50-373 YEAR: 1983

I. Gaseous Effluents (cont)	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6 Mo. TOTAL	TECH SPEC REF
3. Main Stack Particulate Release									
d. Percent Main Stack limit	%	4.59E-8	N/A	1.69E-9	2.25E-10	N/A	5.21E-5	5.33E-5	6.6.A.4.b.
c. Average Release Rate	uCi/sec	2.34E-6	N/A	1.69E-3	5.67E-06	N/A	1.47E-3	5.33E-4	3.11.2.1.b
4. Sum of Iodine and Particulate	Curies	6.28E-6	NONE RELEASED	4.52E-3	1.47E-05	NONE RELEASED	4.52E-3	9.06E-3	6.6.A.4.b. 3.11.2.3
a. Percent Main Stack Limit	%	4.59E-8	N/A	1.69E-9	2.25E-10	N/A	9.20E-5	9.27E-5	
5. Gaseous Tritium									6.6.A.4.b
a. Release	Curies	None Released	NONE RELEASED	NONE RELEASED	None Released	NONE RELEASED	NONE RELEASED	NONE RELEASED	
b. Average Release Rate	uCi/sec	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
c. Percent Tech Spec Limit	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Table 1.1-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

ATTACHMENT A

LRP 1110-3
Revison 0
March 24, 1983
9

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS: 50-373, 50-374 YEAR: 1983

1. Gaseous Effluents(cont'd)	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	6MO. TOTAL	TECH.SPEC. REF.
3. Main Stack Particulate Release									
d. Percent Main Stack									6.6.A.4.b.
Limit	%	1.2E-5	1.51E-5	3.52E-6	1.07E-6	N/A	N/A	2.31E-5	
e. Average Release Rate	uCi/sec	1.29E-3	2.11E-3	1.13E-4	1.54E-5	N/A	N/A	5.95E-4	3.11.2.1.b.
4. Sum of Iodine and									6.6.A.4.b.
Particulate	Curies	7.62E-3	6.51E-3	2.95E-4	7.15E-4	1.64E-4	N/A	1.53E-2	3.11.2.3.
a. Percent Main Stack									
Limit	%	1.33E-3	1.02E-3	3.52E-6	2.21E-5	1.91E-7	N/A	6.51E-5	
5. Gaseous Tritium									6.6.A.4.b.
a. Release	Curies	5.25E-5	<3.8E-9*	<3.03E-9*	<2.84E-9*	<3.04E-9*	<1.20E-9*	5.25E-5	
b. Average Release Rate	uCi/sec	1.96E-5	N/A	NA	N/A	N/A	N/A	3.30E-6	
c. Percent Tech Spec									
Limit	%	3.51E-8	N/A	NA	N/A	N/A	N/A	3.51E-8	

* Activity of each grab sample is less than LLD (uCi/cc).

Table 1.2-1

REPORT OF RADIOACTIVE EFFLUENTS

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373 YEAR: 1983

II. Liquid Effluents	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6MO. TOTAL	TECH.SPEC. REF.
1. Gross Radioactivity (β-γ)									
a. Total Release	Curies	1.90E-01	1.20 E-01	6.28E0	2.62E0	5.19E-02	5.01E-03	9.27E0	6.6.A.4.b.
b. Avg. Conc. Released	uCi/ml	3.45E-07	1.5C E-07	7.44E-7	1.42E-6	1.84E-08	2.40E-09	5.60E-07	
c. Max. Conc. Released	uCi/ml	2.7E-04	1.7 E-04	4.4E-04	1.96E-6	7.10E-08	3.37E-08	4.4E-04	
d. Percent of Tech Spec									3.11.1.1
(based on Avg. Conc.									
Released)	%	9.24E-05	6.9C E-05	5.99E-02	2.82E-02	6.59E-04	8.13E-05	8.91E-02	
2. Tritium									6.6.A.4.b.
a. Total Release	Curies	1.82E-01	1.12 E-01	5.74E-01	*	*	*	8.68E-01	
b. Avg. Conc. Released	uCi/ml	2.7E-04	1.7 E-04	2.21E-04	*	*	*	2.21E-04	
c. Percent of Tech Spec	%	1.89E-05	1.16 E-05	5.97E-05	*	*	*	9.00E-05	
3. Dissolved Noble Gases		None	None	None	None	NONE			6.6.A.4.b.
a. Total Release	Curies	Released	Released	Released	Released	RELEASED	1.59E-5	1.59E-5	
b. Avg. Conc. Released	uCi/ml	N/A	N/A	N/A	N/A	N/A	7.60E-12	9.63E-13	
c. Percent of Tech Spec	%	N/A	N/A	N/A	N/A	N/A	≈ 0.0	≈ 0.0	3.11.1.1.
4. Gross Alpha Radioactivity									6.6.A.4.b.
a. Total Release	Curies	<3.37E-06	< 1.31 E-06	<7.8E-06	*	*	*	<7.8E-06	
b. Avg. Conc. Released	uCi/ml	<5.0E-09	<2.0 E-09	<3.0E-09	*	*	*	<5.0E-09	
5. Volume of Liquid Waste	Liters	6.73E05	6.57E5	2.60E06	1.41E06	1.75E06	1.03E+06	8.12E06	
6. Volume of Dilution Water	Liters	5.50E08	8.01E8	8.44E09	1.84E09	2.82E09	2.09E09	1.65E10	

Table 1.2-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

ATTACHMENT A

LRP 1110-3
Revision 0
March 24, 1983
11

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373, 50-374 YEAR: 1983

II. Liquids Effluents	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	6MO. TOTAL	TECH.SPEC. REF
1. Gross Radioactivity(β-γ)									
a. Total Release	Curies	1.80E-1	1.09E-1	9.77E-1	1.83E-3	4.32E-3	None Released	1.27E0	6.6.A.4.b.
b. Avg. Conc. Released	uCi/ml	1.96E-7	3.64E-7	2.38E-7	1.05E-9	2.11E-9	N/A	1.39E-7	
c. Max. Conc. Released	uCi/ml	3.35E-4	5.36E-4	4.55E-4	2.16E-9	4.73E-9	N/A	5.36E-4	
d. Percent of Tech Spec									3.11.1.1
(based on Avg. Conc.									
Released)	%	4.27E-5	1.94E-5	1.95E-4	1.68E-5	5.57E-5	N/A	1.98E-4	
2. Tritium							None		6.6.A.4.b.
a. Total Release	Curies	1.75E-1	1.08E-1	9.24E-1	*	*	Released	1.21E0	
b. Avg. Conc. Released	uCi/ml	3.35E-4	5.36E-4	4.55E-4	*	*	N/A	2.68E-4	
c. Percent of Tech Spec	%	1.82E-5	1.12E-5	9.60E-5	*	*	N/A	1.26E-4	
3. Dissolved Noble Gases		None		None			None		6.6.A.4.b.
a. Total Release	Curies	Detected	3.2E-5	Detected	9.1E-6	3.8E-6	Released	4.49E-5	
b. Avg. Conc. Released	uCi/ml	N/A	1.07E-10	N/A	5.20E-12	1.85E-12	N/A	4.92E-12	
c. Percent of Tech Spec	%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.11.1.1.
4. Gross Alpha Radioactivity							None		6.6.A.4.b.
a. Total Release	Curies	<5.23E-7	< 2.01E-7	4.06E-6	*	*	Released	4.06E-6	
b. Avg. Conc. Released	uCi/ml	<1E-9	<1E-9	2.0E-9	*	*	N/A	2.0E-9	
5. Volume of Liquid Waste	Liters	5.23E5	2.01E5	2.03E6	8.08E5	9.59E5	0.0	4.52E6	
[illegible]	[illegible]	9.16E8	2.99E8	[illegible]	1.75E9	2.05E9	0.0	9.12E9	

Table 1.2-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373 YEAR: 1983

II. Liquid Effluents (cont'd)	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6MO. TOTAL	TECH.SPEC. REF
7. Isotopes Released	milli-curies	7.50E+0	8.09E+0	5.71E03	2.62E03	5.19E01	5.01E00	8.40E03	
Cr-51	mCi	---	1.74E-1	1.43E03	6.77E02	9.63E00	1.45E00	2.12E03	
Mn-54	mCi	3.5E+0	3.15E+0	2.10E03	1.24E03	1.77E01	1.51E00	3.37E03	
Co-58	mCi	1.39E+0	7.01E-1	8.19E02	3.26E02	5.24E00	5.08E-01	1.15E03	
Fe-59	mCi	2.7E-02	2.17E-2	4.79E00	7.95E-01	3.98E00	---	9.61E00	
Co-60	mCi	7.55E-01	5.24E-1	4.86E02	1.63E02	9.25E00	6.22E-01	6.60E02	
Zn-65	mCi	5.33E-01	2.17E-1	5.29E02	1.93E02	5.24E00	8.53E-01	7.29E02	
Sr-89	mCi	8.8E-03	7.88E-02	5.73E-01	*	*	*	6.60E-01	
Sr-90	mCi	<6.73E-04	<1.31E-03	<7.8E-02	*	*	*	<8.00E-02	
Np-239	mCi	---	---	7.0E-01	4.1E-01	---	---	1.11E00	
Co-57	mCi	---	---	3.57E-01	---	---	---	3.57E-01	
Na-24	mCi	---	---	1.52E00	4.5E0	---	---	6.02E00	
I-131	mCi	---	---	3.1E+01	5.3E-01	---	---	8.4E-01	
Sb-122	mCi	---	---	---	6.6E-01	---	---	6.6E-01	
Sb-124	mCi	---	---	---	3.07E-01	2.74E-01	4.72E-02	6.28E-01	
Ba-140/La-140	mCi	---	---	2.7E-02	1.24E0	---	---	1.27E00	
Fe-55	mCi	1.28E+0	3.22E+0	2.56E+2	*	*	*	2.61E02	
Tc-99m	mCi	---	---	8.92E00	3.1E0	---	---	1.20E01	
Mo-99	mCi	--	---	1.60E00	1.5E0	---	---	3.10E00	
Mn-56	mCi	---	---	8.1E-02	---	---	---	8.1E-02	
As-76	mCi	---	---	---	2.8E0	---	---	2.8E00	
Br-82	mCi	---	---	---	3.7E-01	---	---	3.7E-01	
W-187	mCi	---	---	---	4.3E-01	---	---	4.3E-01	

*Data to be presented in an errata to this report.

Table 1.2-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

ATTACHMENT A

LRP 1110-3
Revision 0
March 24, 1983

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373, 50-374 13 YEAR: 1983

II. Liquid Effluents (cont'd)	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	6MO. TOTAL	TECH.SPEC. REF
7. Isotopes Released	milli-curies	4.52E0	5.63E-1	5.29E1	1.83E0	4.32E0	None Released	6.41E1	
Cr-51	mCi	2.39E0	5.00E-2	5.49E-1	7.31E-1	2.27E-1	-----	3.95E0	
Mn-54	mCi	4.72E-1	2.46E-1	2.74E0	4.86E-1	2.08E0	-----	6.02E0	
Co-58	mCi	1.37E-1	3.30E-2	3.60E-1	1.77E-1	8.72E-1	-----	1.58E0	
Fe-59	mCi	<6.17E-2	<2.37E-2	<2.39E-1	1.86E-2	5.84E-2	-----	7.7E-2	
Co-60	mCi	2.29E-1	8.30E-2	9.99E-1	2.42E-1	8.09E-1	-----	2.36E0	
Zn-65	mCi	2.49E-1	6.40E-2	5.38E-1	1.41E-1	2.64E-1	-----	1.26E0	
Sr-89	mCi	<2.09E-3	5.37E-4	<4.06E-3	*	*	-----	5.37E-4	
Sr-90	mCi	<2.67E-3	6.70E-4	3.18E-3	*	*	-----	3.85E-3	
Sr-91	mCi	------	------	1.10E-2	------	-------	-----	1.10E-2	
AS-76	mCi	------	------	-----	1.7E-2	-------	-----	1.7E-2	
Tc-99m	mCi	------	------	------	------	4.1E-3	-----	4.1E-3	
I-131	mCi	------	------	-----	------	-------	-----	-------	
I-132	mCi	1.9E-2	------	-----	------	-------	-----	1.9E-2	
I-135	mCi	1.3E-2	------	-----	------	-------	-----	1.3E-2	
Fe-55	mCi	4.56E-1	5.42E-2	4.77E1	*	*	-----	4.82E1	
Sb-122	mCi	2.49E-1	------	-----	------	-------	-----	2.49E-1	
Sb-124	mCi	2.37E-1	------	1.10E-2	6.2E-3	-------	-----	2.54E-1	
Ce-144	mCi	<1.57E-1	<6.41E-2	<6.48E-1	<2.58E-1	<3.06E-1	-----	<6.48E-1	
Br-82	mCi	6.3E-2	------	-----	------	-------	-----	6.3E-2	
Xe-133	mCi	------	2.00E-2	-----	------	-------	-----	2.00E-2	
Xe-133m	mCi	------	------	-----	------	-------	-----	------	
Xe-135	mCi	------	1.20E-2	-----	9.1E-3	3.8E-3	-----	2.49E-2	

* Data to be presented in an errata to this report.

Table 1.2-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

LRP 1110-3
Revision 0
March 24, 1983
12

ATTACHMENT A

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373 YEAR: 1983

II. Liquid Effluents (cont'd)	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6MO. TOTAL	TECH.SPEC. REF.
7. Isotopes Released	milli-curies								
CS-137	mCi	---	---	---	---	5.39E-01	---	5.39E-01	
Xe-135	mCi					---	1.59E-02	1.59E-02	

Table 2.0-1

REPORT OF RADIOAC IVE EFFLUENTS

FACILITY: LASALLE COUNTY NPS UNIT 1 DOCKET NOS.: 50-373 YEAR: 1983

III. Solid Waste Shipped Offsite for Burial or Disposal	UNITS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	6MO. TOTAL	TECH.SPEC. FLI
1. Spent Resins, Filter Sludges, Evaporator Bottoms, etc.		NONE SHIPPED	NONE SHIPPED						6.6.A.4.b.
a. Quantity Shipped	Cu. meters	N/A	N/A	3.38E+1	6.77E+1	7.93E+1	3.39E+01	2.15E+02	
b. Type of Waste		N/A	N/A	Evaporator Bottoms	Evaporator Bottoms	Evaporator Bottoms	Evaporator Bottoms	---	
c. Radioactivity - Total	curies	N/A	N/A	1.37E-1	2.87E-01	7.04E-1	6.60E-1	1.79E+0	
Measured or Estimated?		N/A	N/A	Measured	Measured	Measured	Measured	---	
d. Principle Radionuclides		N/A	N/A	Cr-51,Fe-59 Mn-54,Co-58	Cr-51,Mn-54 Co-58,Co-60	Cr-51,Mn-54 Co-58,Co-60	Cr-51,Mn-54 Co-58,Co-60	---	
Measured or Estimated?		N/A	N/A	Measured	Measured	Measured	Measured	---	
e. Type of Container (LSA, Type A,Type B,Lge Quantity)		N/A	N/A	LSA	LSA	LSA	LSA	---	
Container Volume	Cu. meters	N/A	N/A	2.12E-1	2.12E-1	2.12E-1 or 3.20E-1	2.12E-1 or 3.29E-1	---	
f. Solidification Agent		N/A	N/A	Cement	Cement	Cement	Cement	---	
2. Dry Compressible Waste, Contaminated Equipment, etc.				None Shipped		None Shipped			6.6.A.4.b.
a. Quantity Shipped	Cu. meters	1.76E+01	1.53E+01	N/A	1.56E+01	N/A	3.70E+01	8.55E+1	
b. Radioactivity - Total	Curies	1.73E-02	4.19E-02	N/A	3.98E-02	N/A	7.37E-02	1.73E-1	
Measured or Estimate?		Measured	Measured	N/A	Measured	N/A	Measured	---	
c. Principle Radionuclides		Cr-51,Fe-59 Mn-54,Co-60	Cr-51,Fe-59 Mn-54,Co-60	N/A	Cr-51,Mn-54 Co-58,Co-60	N/A	Cr-51,Mn-54 Co-58,Co-60	---	
Measured or Estimate?		Measured	Measured	N/A	Measured	N/A	Measured	---	
d. Type of Container (LSA, Type A,Type B,Lge.Quantity)		LSA	LSA	N/A	LSA	N/A	LSA	---	
Container Volume	Cu. meters	2.12E-1	2.12E-1	N/A	2.12E-01	N/A	2.12E-1 or 2.72E0	---	
e. Type of waste		DAW	DAW	N/A	DAW	N/A	DAW	---	

Table 2.0-1 (continued)

BSC - Barnwell, South Carolina
CN - Chem Nuclear Co.
HN - Hittman Nuclear & Development Co.

SOLID RADIOACTIVE WASTE SUMMARY
UNITS 1/2
LASALLE COUNTY NUCLEAR POWER STATION

DATE	DISPOSITION OF MATERIAL		Type of Waste	Type of Container	Solidification Agent	Principle Nuclides	Shipment Volume (ft^3)	Shipment Activity (mCi)	Volume per Month (ft^3)	Activity Per Month (mCi)
	TRANS CO.	BURIAL SITE								
21 January 83	Tri-State M.T.	RWA	DAW	LSA	N/A	Cr-51, Fe-59	622.5	17.29	622.5	17.29
18 February 83	Tri-State M.T.	RWA	DAW	LSA	N/A	Mn-54, Co-60	540.0	41.86	540.0	41.86
16 March 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Lement	Cr-51, Fe-59	397.5	47.8	397.5	47.8
23 March 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Mn-54 &	397.5	41.8	795.0	89.6
25 March 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-58	397.5	47.8	1192.5	137.4
01 April 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Cr-51	390.	34.7	390.	34.7
11 April 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	FE-59	397.5	18.6	787.5	53.3
14 April 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Mn-54	390	19.4	1177.5	72.7
15 April 83	Tri-State M.T.	RWA	DAW	LSA	N/A	Co-58	552 -	39.8	1729.5	112.5
20 April 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-60	397.5	61.2	2127	173.7
22 April 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Zn-65	397.5	88.9	2524.5	262.6
29 April 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	↓	416.9	64.3	2941.4	326.9
04 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Cr-51	393.9	84.8	393.9	84.8
06 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Fe-59	390.0	102.0	783.9	186.8
11 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Mn-54	397.5	27.0	1181.4	213.8
13 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-58	409.8	25.9	1591.2	239.7
19 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-60	397.5	6.36	1988.7	246.1
25 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Zn-65	420.0	6.72	2408.7	252.8
27 May 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	↓	390.0	450.7	2798.7	703.5
03 June 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Cr-51	418.0	327.7	418.0	327.7
10 June 83	Tri-State M.T.	RWA	DAW	LSA	N/A	Co-58	706.5	36.66	1124.5	364.4
16 June 83	Tri-State M.T.	RWA	DAW	LSA	N/A	Co-60	600.0	37.0	1724.5	401.4
21 June 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Mn-54	390.0	197.6	2114.5	599.0
24 June 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Zn-65	390.0	135.0	2504.5	734.0

Table 2.0-1 (continued)

REPORT OF RADIOACTIVE EFFLUENTS

ATTACHMENT A

LRP 1110-3
Revision 0
March 24, 1983

FACILITY: LASALLE COUNTY NPS UNIT 1

DOCKET NOS.: 50-373, 50-374

15 YEAR: 1983

III. Solid Waste Shipped Offsite for Burial or Disposal	UNITS	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	6MO. TOTAL	TECH.SPEC. REF
1. Spent Resins, Filter Sludges, Evaporator Bottoms, etc.									6.6.A.4.b.
a. Quantity Shipped	Cu. meters	1.04E2	3.08E1	5.37E1	5.10E1	3.33E1	4.81E1	3.21E2	
b. Type of Waste		Evap. Bottoms	Evap Bottoms	Evap Bottoms	Evap Bottoms	Evap. Bottoms	Evap Bottoms	N/A	
c. Radioactivity - Total	curies	1.876	2.650	3.845	3.420	5.399	9.522	2.671E1	
Measured or estimate?		Measured	Measured	Measured	Measured	Measured	Measured	N/A	
d. Principle Radionuclides		Cr-51,Fe-59 Co-58,Mn-54	Cr-51,Fe-59 Co-58,Mn-54	Cr-51,Fe-59 Co-58,Mn-54	Cr-51,Fe-59 Co-58,Mn-54	Same	Same	N/A	
Measured or estimate?		Measured	Measured	Measured	Measured	Measured	Measured	N/A	
e. Type of Container (LSA, Type A, Type B, Lge Quantity)		LSA	LSA	LSA	LSA	LSA	LSA	N/A	
Container Volume	Cu. meters	2.12E-1 or 3.29E-1	2.12E-1	2.12E-1 or 3.29E-1	2.12E-1	2.12E-1 or 3.29E-1	Same	N/A	
f. Solidification Agent		Cement	Cement	Cement	Cement	Cement	Cement	N/A	
2. Dry Compressible Waste, Contaminated Equipment, etc.		None Shipped		None Shipped					6.6.A.4.b.
a. Quantity Shipped	Cu. meters	N/A	2.09E1	N/A	1.99E1	1.87E1	1.60E0	6.11E1	
b. Radioactivity - Total	Curies	N/A	0.079	N/A	9.12E-2	2.55E-1	1.04E0	1.465	
Measured or estimate?		N/A	Measured	N/A	Measured	Measured	Measured	N/A	
c. Principle Radionuclides		N/A	Cr-51,Fe-59 Co-58,Mn-54	N/A	Cr51,Fe-59 Co58,Mn-54	Same	Same	N/A	
Measured or estimate?		N/A	Measured	N/A	Measured	Measured	Measured	N/A	
d. Type of Container (LSA, Type A, Type B, Lge. Quantity)		N/A	LSA	N/A	LSA	LSA	LSA	N/A	
Container Volume	Cu. meters	N/A	2.12E-1 or 2.72 Eo	N/A	2.12E-1 or 2.72E0	2.12E-1, 3.29E-1 or 2.72E0	2.12E-1 or 3.29E-1	N/A	
e. Type of Waste		N/A	DAW	N/A	DAW	DAW	DAW	N/A	

Table 2.0-1 (continued)

RWA - Richland, Washington
BSC - Barnwell, South Carolina
CN - Chem Nuclear Co.
HN - Hittman Nuclear & Development Co.

SOLID RADIOACTIVE WASTE SUMMARY
UNITS 1/2
LASALLE COUNTY NUCLEAR POWER STATION

LRP 1110-3
Revision 0
March 24, 1983
16

ATTACHMENT A

DATE	DISPOSITION OF MATERIAL		Type of Waste	Type of Container	Solidification Agent	Principle Nuclides	Shipment Volume (ft³)	Shipment Activity (mCi)	Volume per Month (ft3)	Activity Per Month (mCi)
	TRANS CO.	BURIAL SITE								
01JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Cr-51	442	142.0	442	142.0
05JULY83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Fe-59	413	34.2	855	176.2
08JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-58	405	46.6	1260	222.8
13JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-60	412.5	36.2	1672.5	259.0
15JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Mn-54	390.0	44.6	2062.5	303.6
20JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Zn-65	405.0	585.0	2467.5	888.6
22JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	↓	397.5	391.0	2865	1279.6
27JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	↓	327.5	312.0	3762.5	1591.6
29JULY83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	↓	408.0	284.0	3670.5	1875.6
03 AUG 83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Cr-51 Fe-59	405.0	736.0	405.0	736.0
12 AUG 83	Tri-State M.T.	RWA	Evap.	LSA	Cement	Co-58 Co-60	450.0	721.0	855.0	1457.0
24 AUG 83	Tri-State M.T.	RWA	Bottoms and	LSA	Cement	Mn-54 Zn-65	450.0	656.0	1305.0	2113.0
29 AUG 83	Tri-State M.T.	RWA	DAW	LSA	Cement		520.5	616.0	1825.5	2729.0
09SEP83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Cr-51	375.1	717.0	375.1	717.0
14SEP83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Fe-59	319.8	706.0	694.9	1423.0
16SEP83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-58	300.0	541.0	994.9	1964.0
23SEP83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-60	300.0	656.0	1294.9	2620.0
28SEP83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Mn-54	300.0	623.0	1594.9	3243.0
30SEP83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Zn-65	300.0	602.0	1894.9	3845.0
05OCT83	Tri-State M.T.	RWA	DAW	LSA	N/A	Cr-51 Fe-59	702.0	91.2	702.0	91.2
07 OCT83	Tri-State M.T.	RWA	Evap. Bottoms	LSA	Cement	Co-58	300.0	385.0	1002.0	476.2
14OCT83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Co-60	300.0	499.6	1302.0	975.8
19OCT83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Mn-54	300.0	366.0	1602.0	1341.8
21OCT83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Zn-65	300.0	618.0	1902.0	1959.8

Table 2.0-1 (continued)

RWA - Richland, Washington
BSC - Barnwell, South Carolina
CN - Chem Nuclear Co.
HN - Hittman Nuclear & Development Co.

SOLID RADIOACTIVE WASTE SUMMARY
UNITS 1/2
LASALLE COUNTY NUCLEAR POWER STATION

LRP 1110-3
Revision 0
March 24, 1983
16

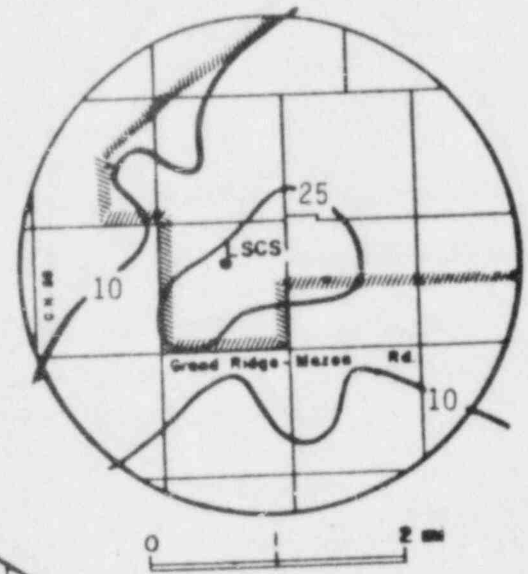
ATTACHMENT A

DATE	DISPOSITION OF MATERIAL		Type of Waste	Type of Container	Solidification Agent	Principle Nuclides	Shipment Volume (ft^3)	Shipment Activity (mCi)	Volume per Month (ft^3)	Activity Per Month (mCi)
	TRANS CO.	BURIAL SITE								
26OCT83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Same as Above	300.0	768.2	2202.0	2728.0
28OCT83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement		300.0	783.0	2502.0	3511.0
04NOV83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Cr-51	337.0	930.0	337.0	930.0
10NOV83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Co-58	300.0	1510.7	637.0	2440.7
11NOV83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Co-60	300.0	1773.0	937.0	4213.7
18NOV83	Tri-State M.T.	RWA	DAW	LSA	N/A	Mn-54	659.7	255.0	1596.7	4468.7
30NOV83	CN	RWA	Evap Bottoms	LSA	Cement	Zn-65	240.0	1185.0	1836.7	5653.7
02DEC83	Tri-State M.T.	RWA	DAW/EB	LSA	Cement	Cr-51	328.0	386.0	328.0	386.0
02DEC83	CN	RWA	Evap Bottoms	LSA	Cement	Fe-59	240.0	1479.7	568.0	1865.7
09DEC83	CN	RWA	Evap Bottoms	LSA	Cement	Co-58	240.0	2336.0	808.0	4201.7
13DEC83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Co-60	300.0	942.0	1108.0	5143.7
13DEC83	CN	RWA	DAW/EB	LSA	Cement	Mn-54	105.0	1909.0	1213.0	7052.7
15DEC83	CN	RWA	Evap Bottoms	LSA	Cement	Zn-65	240.0	1968.8	1453.0	9021.5
19DEC83	Tri-State M.T.	RWA	Evap Bottoms	LSA	Cement	Sb-124	300.0	1540.2	1753.0	10561.7

Figure 3.1-1

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

Isopleth Labels
Small figure - multiply by 10^{-6}
Large figure - multiply by 10^{-7}



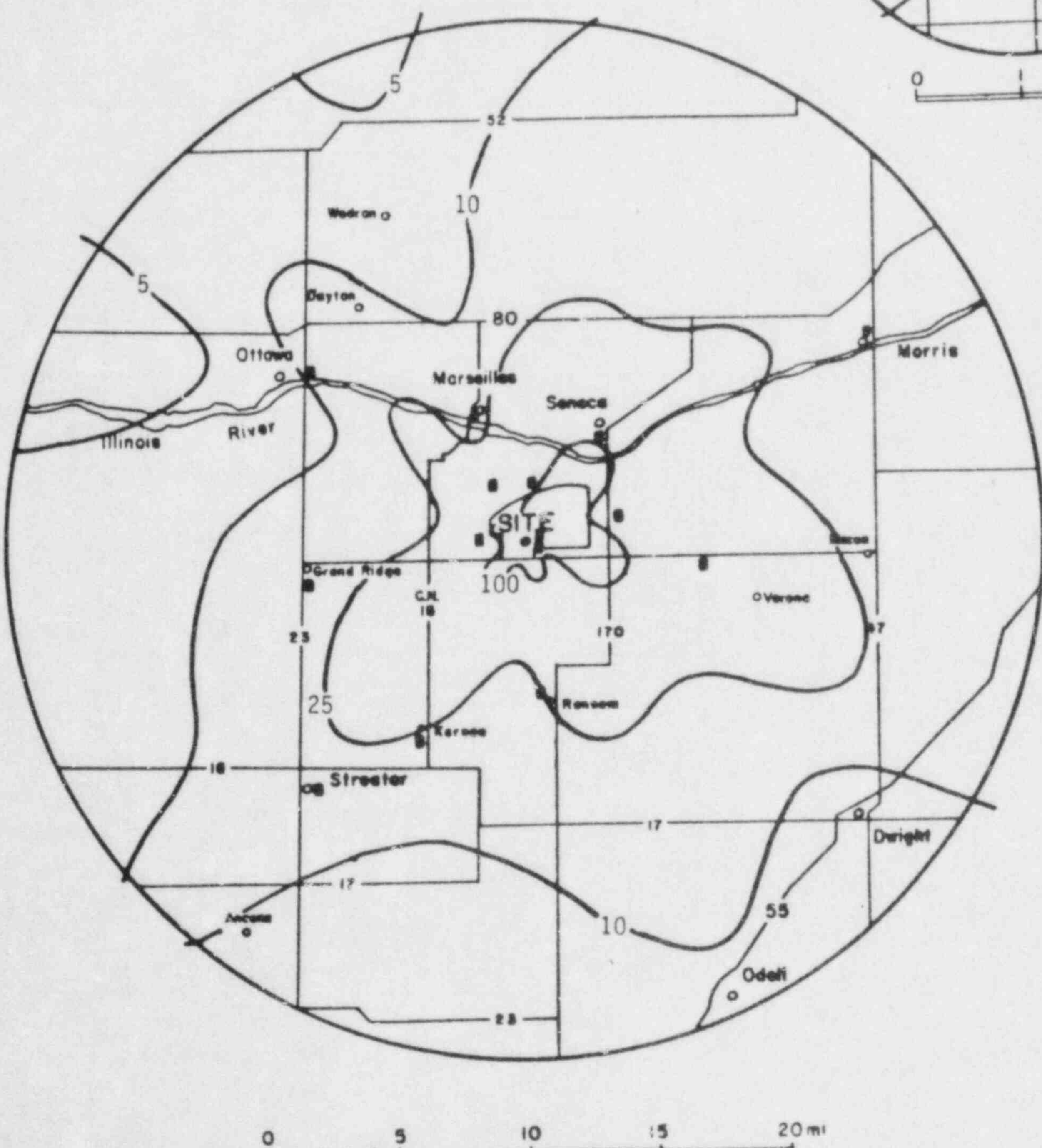
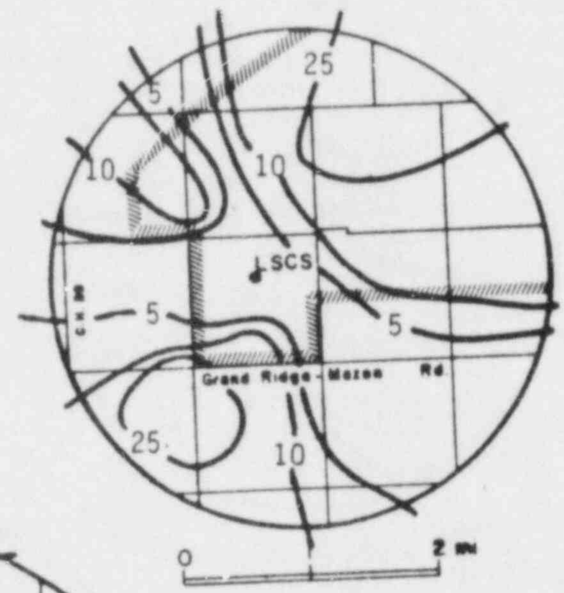


Figure 3.1-2

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

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



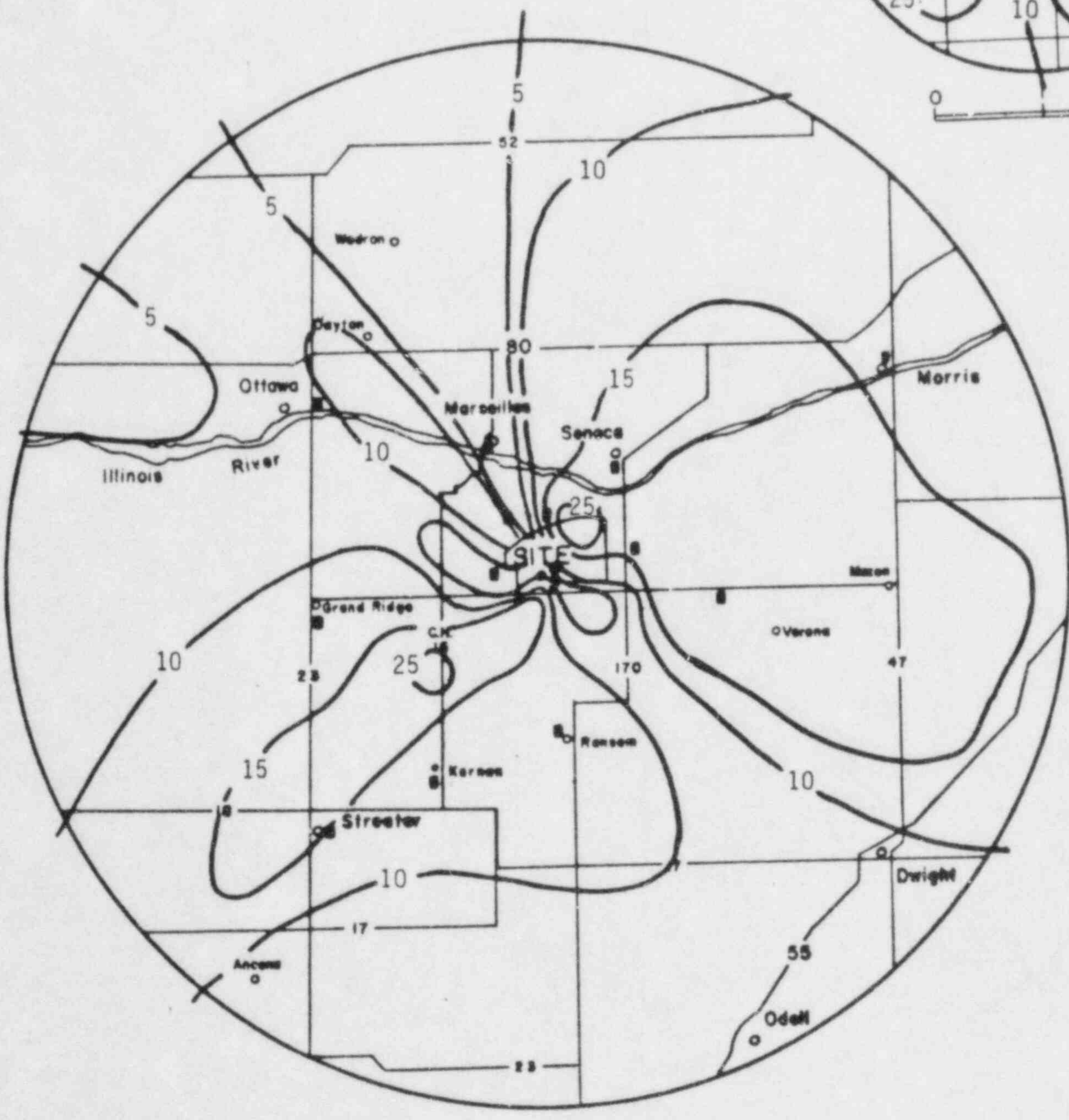
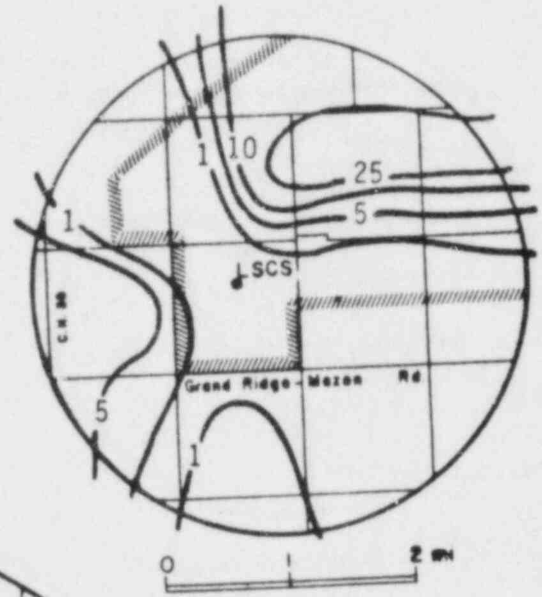


Figure 3.1-3

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

Isopleth Labels
Small figure - mutliply by 10^{-7}
Large figure - multiply by 10^{-7}



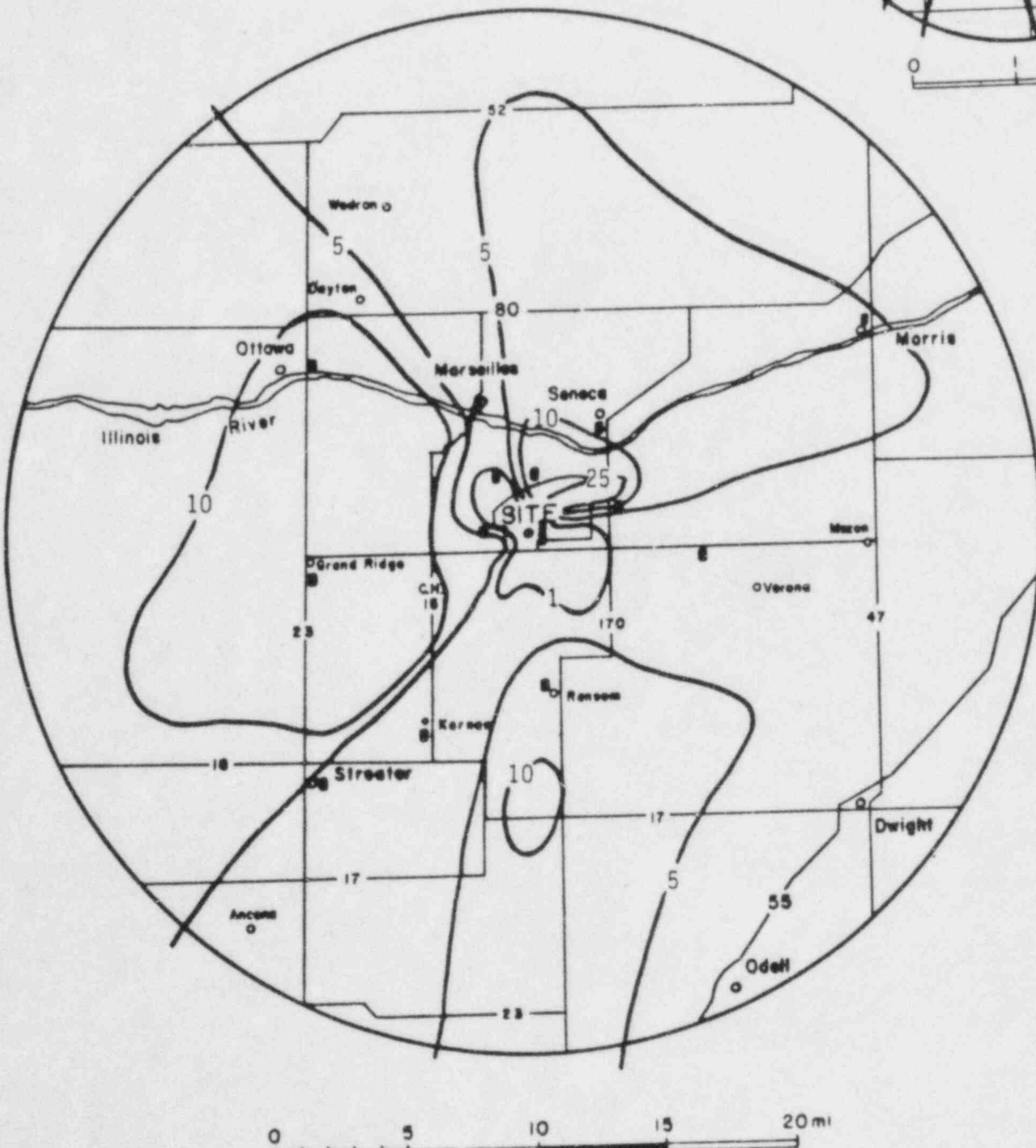


Figure 3.1-4

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

Isopleth Labels
Small figure - multiply by 10^{-6}
Large figure - multiply by 10^{-6}

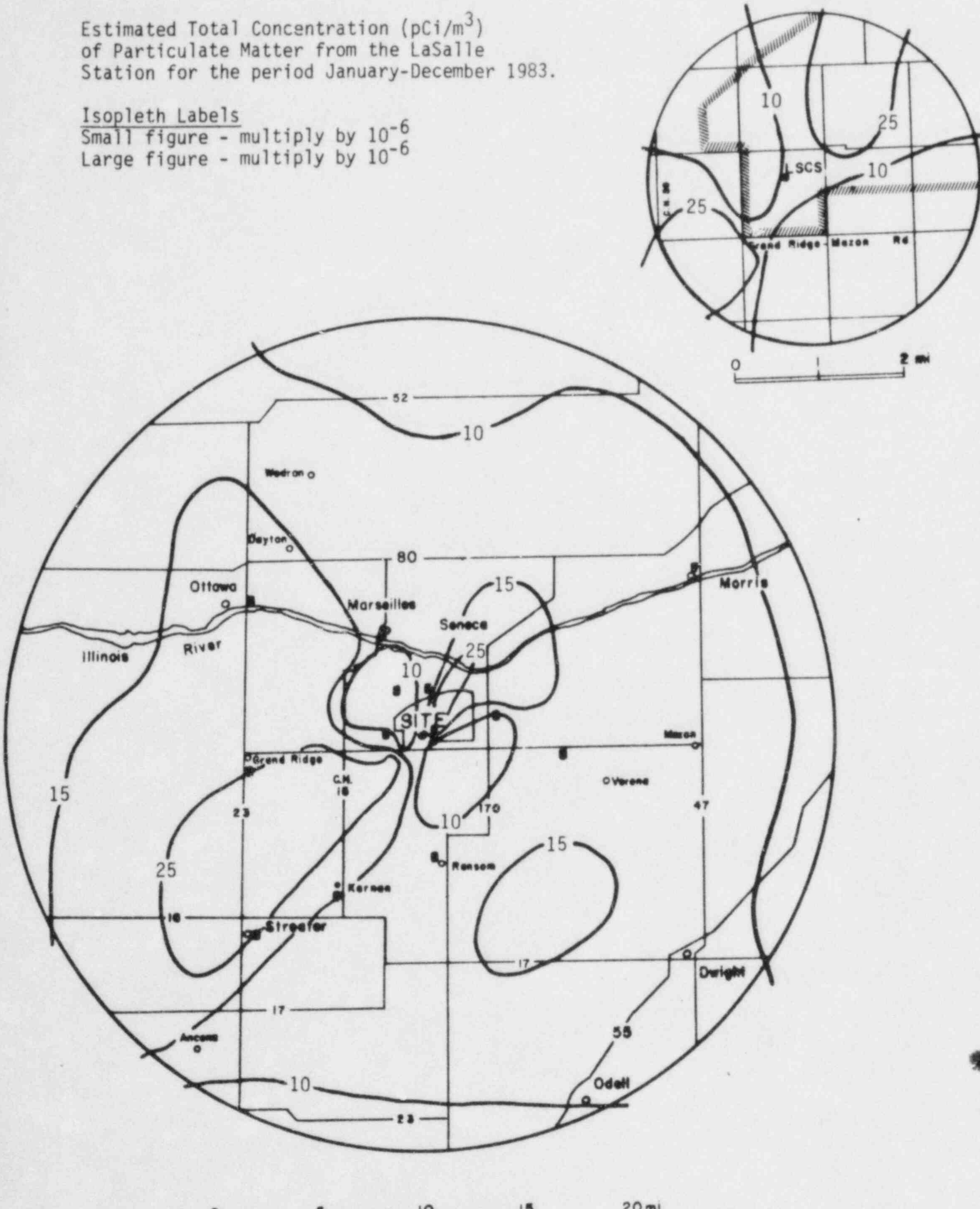


Table 3.1-1

LASALLE STATION - UNIT 1
MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES
PERIOD OF RELEASE DECEMBER 1, 1983 - DECEMBER 31, 1983   DATE OF CALCULATION 03/16/84

TYPE	CURRENT PERIOD	CURRENT QUARTER	THIRD QUARTER	SECOND QUARTER	FIRST QUARTER	ANNUAL
GAMMA AIR (MRAD)	0.000E 00(N)	0.000E 00(N)	0.420E-04(SW)	0.122E-05(WSW)	0.962E-12(ESE)	0.426E-04(SW)
BETA AIR (MRAD)	0.000E 00(N)	0.000E 00(N)	0.480E-05(NNE)	0.419E-06(NNE)	0.154E-10(ESE)	0.516E-05(NNE)
WHOLE BODY (MREM)	0.000E 00(N)	0.000E 00(N)	0.126E-04(SW)	0.440E-06(WSW)	0.196E-22(ESE)	0.129E-04(SW)
SKIN (MREM)	0.000E 00(N)	0.000E 00(N)	0.163E-04(SW)	0.596E-06(WSW)	0.522E-11(N)	0.166E-04(SW)
ORGAN (MREM)	0.000E 00(N)	0.345E-07(WSW)	0.444E-06(SW)	0.422E-05(NNE)	0.509E-07(SSE)	0.456E-05(NNE)
CRITICAL ORG-PERS	BN-AD	LN-AD	LN-AD	LN-AD	GI-IN	LN-AD

31

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	0.00	10.0	0.00
BETA AIR (MRAD)	10.0	0.00	20.0	0.00
WHOLE BODY (MREM)	2.5	0.00	5.0	0.00
SKIN (MREM)	7.5	0.00	15.0	0.00
ORGAN (MREM)	7.5	0.00	15.0	0.00
CRITICAL ORGAN-PERSON		(LN-AD)		(LN-AD)

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 3.2-1

LASALLE UNIT ONE
MAXIMUM DOSES (MREM) RESULTING FROM LIQUID EFFLUENTS
PERIOD OF RELEASE - 1/ 1/83 TO 12/31/83 CALCULATED 01/17/84 *

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	1.64E-03	7.78E-04	8.24E-06	0.0	2.43E-03
INTERNAL ORGAN	6.33E-03	3.05E-03	1.64E-05	0.0	9.44E-03
	GI-LLI	GI-LLI	GI-LLI	BONE	GI-LLI

* 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	0.11	0.05	0.00	0.0	3.0	0.08
CRIT. ORGAN(MREM)	5.0	0.13	0.06	0.00	0.0	10.0	0.09
		GI-LLI	GI-LLI	GI-LLI	BONE		GI-LLI

PROJECTED DOSE AT NEAREST COMMUNITY WATER SYSTEM *
PERIOD OF RELEASE - 11/22/83 TO 11/22/83 CALCULATED 12/09/83

DOSE TYPE	CURRENT PERIOD	CURRENT QUARTER 10/83-11/83	1ST PREV QUARTER 7/83- 9/83	2ND PREV QUARTER 4/83- 6/83	3RD PREV QUARTER 1/83- 3/83	ANNUAL
TOTAL BODY	3.87E-08	3.57E-07	5.73E-06	1.62E-04	2.69E-04	4.37E-04
INTERNAL ORGAN	3.41E-07	2.95E-06	9.2[illegible]E-0[illegible]	[illegible].74E-04	2.0[illegible]E-03	3.[illegible]7E-03
	GI-LLI	GI-LLI	GI-LLI	GI-LLI	GI-LLI	GI-LLI

* LAST PERIOD OF RELEASE - 11/14/83 TO 11/14/83 CALCULATED 12/09/8
THIS REPORT IS BASED ON CURRENT QUARTER RELEASES

COMPLIANCE STATUS - 40 CFR 141

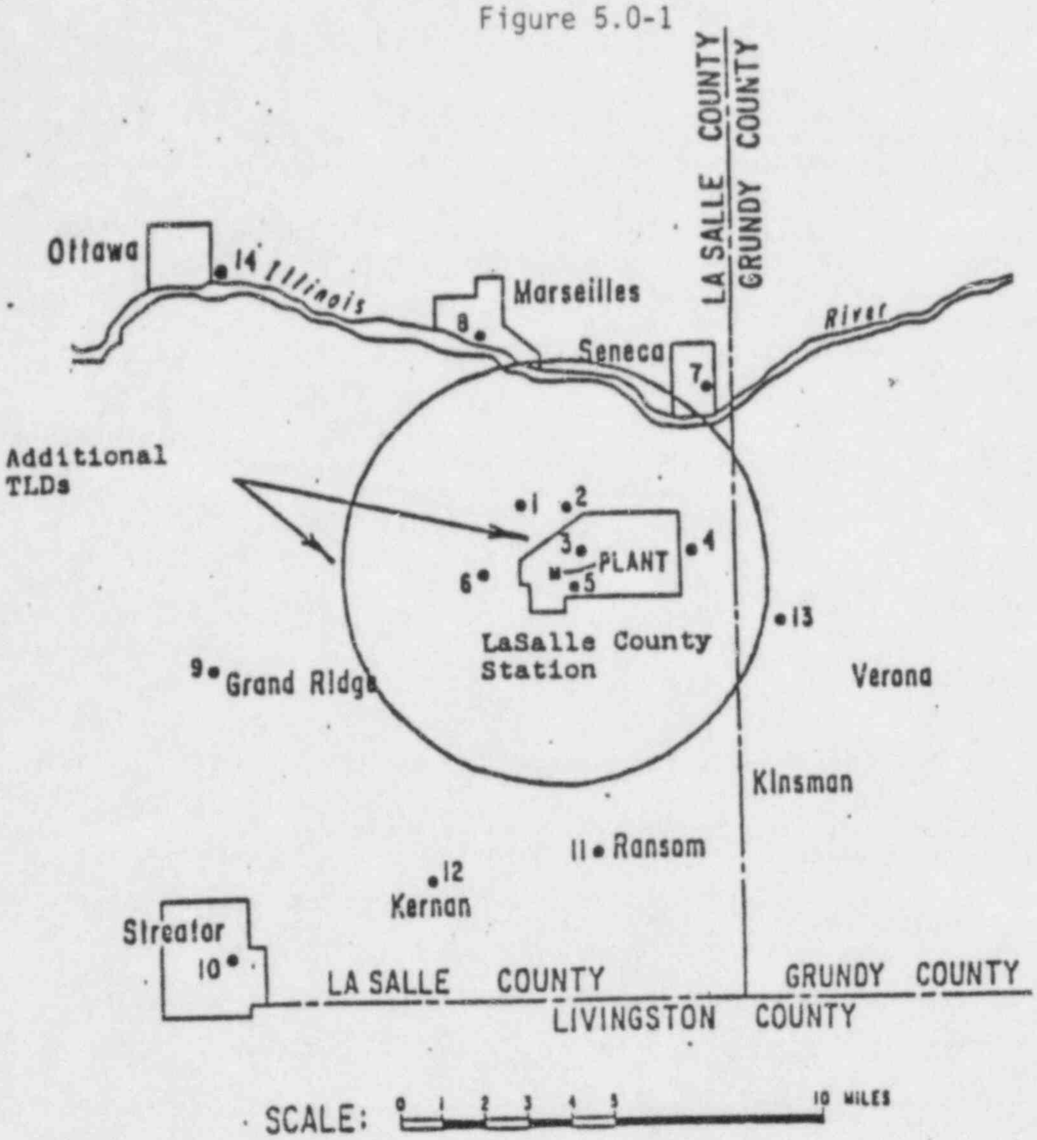
TYPE	ANNUAL LIMIT	% OF LIMIT
TOTAL BODY	4.0 (MREM)	0.011
INTERNAL ORGAN	4.0 (MREM)	0.077
	GI-LLI	

* THIS CALCULATION OF DOSE IS BASED ON TECHNIQUES DESCRIBED IN THE COMMONWEALTH EDISON OFFSITE DOSE CALCULATION MANUAL. THESE TECHNIQUES DIFFER FROM THOSE DESCRIBED IN 40 CFR 141. A PROJECTED DOSE OF 2 MREM USING CECO TECHNIQUES IS APPROXIMATELY 4 MREM USING EPA METHODS.

LASALLE COUNTY NUCLEAR POWER STATION

LOCATIONS OF FIXED ENVIRONMENTAL RADIOLOGICAL MONITORING STATIONS

Figure 5.0-1



<u>Air Samplers</u>

1 - Nearsite 1
2 - Onsite 2
3 - Onsite 3
4 - Nearsite 4
5 - Onsite 5
6 - Nearsite 6
7 - Seneca
8 - Marseilles
9 - Grand Ridge
10 - Streator
11 - Ransom
12 - Kernan
13 - Route 6 at Gonnam Road
14 - Ottawa

<u>TLD</u>

Same as air samplers <u>plus</u> a sufficient number of additional dosimeters placed near the site and near 5 miles to assure that one dosimeter is located at each range in each of the 16 meteorological sectors.

Standard Radiological Sampling Program

Loc. Code	Type[a]	Location Description	Air Samples	TLDs	Surface Water	Well Water	Fish	Aquatic Plants	Sediments	Milk	Precipitation	Feed & Grass	Vegetables
			Media										
L-01		Nearsite No. 1	X	X									
L-02		Onsite No. 2	X	X									
L-03		Onsite No. 3	X	X									
L-04		Nearsite No. 4	X	X									
L-05		Onsite No. 5	X	X									
L-06		Nearsite No. 6	X	X									
L-07		Seneca	X	X									
L-08		Marseilles	X	X									
L-09	C	Grand Ridge	X	X									
L-10	C	Streator	X	X									
L-11		Ransom	X	X									
L-12	C	Kernan	X	X									
L-13		Route 6 at Gonnam Road	X	X									
L-14	C	Ottawa	X	X									
L-15		Johnson Dairy								X	X	X	
L-16		Lowery Dairy								X	X	X	
L-17	C	Norsen Dairy								X	X	X	
L-18	C	Sunnyisle Dairy								X	X	X	
L-19		Illinois River at Marseilles			X								
L-20		Illinois River at Ottawa			X								
L-21	C	Illinois River at Seneca			X								
L-22		South Kickapoo Creek			X								
L-23		Illinois Nitrogen Corp.			X								
L-24		LSCS Cooling Lake near recreation area			X		X	X	X				
L-25	C	LSCS intake pipe/river			X								
L-26		LSCS discharge pipe/river			X								
L-27		LSCS onsite well				X							
L-28		Marseilles Well Water				X							
L-29	C	Seneca Well Water				X							
L-30		Ransom Well Water				X							
L-31		Ottawa Well Water				X							
L-32		Illinois State Park				X							
L-33	C	Just upstream of cooling lake inlet structure						X	X				
L-34		Just downstream of cooling lake discharge structure						X	X				
L-35		Marseilles Pool of Illinois River					X						
L-36		Farm A - vegetables											X
L-37		Farm B - vegetables											X

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

Table 5.0-1

LaSalle County Radiological Monitoring Program, Sample Collection and Analyses.

Sample Media	Location Code	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
1. Airborne Particulates	L-1	Nearsite No. 1	Weekly	Gross beta	Weekly	On all samples.
	L-2	Onsite No. 2		Gamma Isot	Quarterly	On quarterly composites from each location.
	L-3	Onsite No. 3		Sr-89,90	Quarterly	On quarterly composites from each location.
	L-4	Nearsite No. 4				
	L-5	Onsite No. 5				
	L-6	Nearsite No. 6				
	L-7	Seneca				
	L-8	Marseille				
	L-9	Grand Ridge				
	L-10	Streator				
	L-11	Ransom				
	L-12	Kernan				
	L-13	Route 6 at Gonnam Rd.				
	L-14	Ottawa				
2. Airborne Iodine	Same as 1.		Bi-weekly	I-131	Bi-weekly (weekly)*	Bi-weekly = every 2 weeks, on all samples.
3. TLD	Same as 1.		Quarterly	Gamma	Quarterly	Two sets at all AP locations. One set read quarterly. Second set read if required by Edison. At other locations, all sets read quarterly.
	L-101-07	Inner Ring				
	L-201-16	Outer Ring				
4. Milk	L-15	Johnson Dairy	Weekly: Apr to Sep	I-131	Weekly	May thru October only. LLD: 0.5 pCi/l
	L-16	Sunnyisle Farm	Monthly: Oct to Mar	Gamma Isot	Monthly	
	L-17	Norsen Dairy		Sr-89,90	Monthly	
	L-18	Rinker Dairy				
5. Surface Water	L-19	Illinois River at Marseilles	Weekly	Gross beta	Weekly	On all samples.
	L-20	Ill. River at Ottawa		Gamma Isot	Monthly	On monthly composites from each location.
	L-21	Ill. River at Seneca		Tritium	Quarterly	On quarterly composites from each location.
	L-22	South Kickapoo Creek		Sr-89,90	Quarterly	On quarterly composites from each location.
	L-23	Ill. River at Intake to Nitrogen Corp.				
	L-24	LSCS Cooling Lake near Rec. area				
6. Cooling Water	L-25	LSCS intake pipe/ river	Weekly	Gross beta	Weekly	On all samples.
	L-26	LSCS discharge pipe/ river		Gamma Isot	Monthly	On monthly composites from each location.
				Tritium	Monthly	On monthly composites from each location.
				Sr-89,90	Monthly	On monthly composites from each location.

* Beginning October 29, 1983, bi-weekly collections were changed to weekly.

Table 5.0-1 (continued)

LaSalle County Radiological Monitoring Program, Sample Collection and Analyses.

Sample Media	Location Code	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
7. Precipitation	Same as 4.		Monthly	Gross beta	Monthly	On all samples.
				Gamma Isot	Quarterly	On quarterly composites from each location.
				Tritium	Quarterly	On quarterly composites from each location.
				Sr-89,90	Quarterly	On quarterly composites from each location.
8. Well Water, Offsite	L-28	Marseilles Well	Quarterly	Gross beta	Quarterly	On all samples.
	L-29	Seneca Well		Gamma Isot		
	L-30	Ransom Well		Tritium		
	L-31	Ottawa Well		Sr-89,90		
	L-32	Illinois State Park Well				
9. Well Water, Onsite	L-27	LSCS Onsite Well	Monthly	Gross beta	Monthly	
				Gamma Isot	Quarterly	On quarterly composite.
				Tritium	Quarterly	On quarterly composite.
				Sr-89,90	Quarterly	On quarterly composite.
10. Vegetables	L-36	Farm A	Annually at harvest	Gross beta	Annually	Four varieties from each location.
	L-37	Farm B		Gamma Isot	Annually	
				Sr-89,90	Annually	
11. Green Leafy Vegetables	Same as 10.		Annually at harvest	I-131	Annually	
12. Cattle Feed and Grass	Same as 4.		Quarterly	Gross beta	Quarterly	Cattle Feed: winter
				Gamma Isot	Quarterly	Grass: summer
				Sr-89,90	Quarterly	
13. Fish	L-24	LSCS Cooling Lake	Three times a year	Gross beta	Three times a year	On edible portions only.
	L-35	Marseilles Pool		Gamma Isot	Three times a year	On edible portions only.
				Sr-89,90	Three times a year	On edible portions only.

Table 5.0-1 (continued)

LaSalle County Radiological Monitoring Program, Sample Collection and Analyses

Sample Media	Location Code	Location Site	Collection Frequency	Type of Analysis	Frequency of Analysis	Remarks
14. Aquatic Plants	L-24	LSCS cooling Lake	Three times a year, if available	Gross beta	Three times a year	
	L-33	Upstream of cooling lake		Gamma Isot	Three times a year	
	L-34	Downstream of cooling lake				
15. Bottom Sediments	Same as 14.		Three times a year	Gross beta	Three times a year	
				Gamma Isot	Three times a year	
16. Dairy Census	(a) Site boundary to 2 miles (b) 2 miles to 5 miles (c) At dairies listed in item 7				Annually	During grazing season
17. Nearest Residence Census	In all 16 sectors				Annually	

Table 5.0-2

Environmental Radiological Monitoring Program Quarterly Summary

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

Location of facility Marseilles, 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: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Air Particulates (pCi/m^3)	Gross Beta 182[b]	0.01	0.018 (120/130) (0.010-0.031)	L-09, Grand Ridge 10.4 mi @ 260°	0.020 (12/13) (0.010-0.049)	0.018 (45/52) (0.011-0.053)	0
				L-14, Ottawa 12.0 mi @ 315°	0.020 (12/13) (0.010-0.053)	<LLD	0
	Gamma Spec. 14	0.01	<LLD			<LLD	0
	Sr-89 14	0.01	<LLD	-	-	<LLD	0
	Sr-90 14	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131 98	0.10	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 14	3.0	15.8 (10/10) (14.5-16.9)	L-05, On-site # 5 0.3 mi @ 145°	16.9 (1/1) -	14.2 (4/4) (13.2-16.3)	0
Milk (pCi/l)	I-131 12	5.0	<LLD	-	-	<LLD	0
	Gamma Spec. 12						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Sr-89 12	10	<LLD	-	-	<LLD	0
	Sr-90 12	2	2.4 (1/6) -	L-15, Johnson Dairy 7.8 mi @ 258°	2.4 (1/6) -	<LLD	0
Precipitation	Gross Beta 12	13.4	15.1 (2/6) (14.7-15.4)	L-18, Sunnyisle Farm 8.8 mi @ 220°	30.3 (1/3) -	27.2 (2/6) (24.1-30.3)	0
	Gamma Spec. 4	20	<LLD	-	-	<LLD	0
	Tritium 4	200	<LLD	-	-	<LLD	0
	Sr-89 4	10	<LLD	-	-	<LLD	0
	Sr-90 4	2	<LLD	-	-	<LLD	0
Cooling Water (pCi/l)	Gross Beta 24	2.0	4.0 (12/12) (2.8-6.5)	L-26, LSCS Discharge Pipe - River at Station	6.3 (12/12) (4.5-8.0)	6.3 (12/12) (4.5-8.0)	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0

Table 5.0-2 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station Reporting Period 1st Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Surface Water (pCi/l)	Gross Beta 72	2.0	4.3 (60/60) (2.5-7.3)	L-24, Recreational Area Cooling Lake 0.3 mi @ 112°	5.6 (12/12) (3.9-6.2)	5.6 (12/12) (3.4-8.8)	0
				L-21, Illinois River at Seneca 4.0 mi @ 22°	5.6 (12/12) (3.4-8.8)		
	Gamma Spec. 18						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Well Water (pCi/l)	Gross Beta 8	5.6	20.6 (7/7) (11.8-27.4)	L-27, Onsite Well at Station	24.2 (3/3) -	18.1 (1/1) -	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Cattlefeed & Grass (pCi/g wet)	Gross Beta 11	1.0	9.7 (5/5) (4.4-17.4)	L-17, Norsen Dairy 9.0 mi @ 337°	12.2 (3/3) (3.1-28.0)	10.9 (6/6) (2.5-28.0)	0
	Gamma Spec. 11						
	Cs-134	0.1	<LLD	-	-	<LLD	0
	Cs-137	0.1	<LLD	-	-	<LLD	0
	Other gammas	0.2	<LLD	-	-	<LLD	0
	Sr-89 11	1.0	<LLD	-	-	<LLD	0
	Sr-90 11	1.0	<LLD	-	-	<LLD	0

[a] Mean and range based on detectable measurements only. Fraction indicated in parenthesis.
[b] One (1) higher LLD value due to a low volume caused by an electrical malfunction was excluded from determination of LLD.

Table 5.0-3

Environmental Radiological Monitoring Program Quarterly Summary

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

Location of facility Marseilles, 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: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Air Particulates (pCi/m³)	Gross Beta 182	0.01	0.015 (105/130) (0.010-0.034)	L-13, Rt. 6 at Gonnam Rd. 4.3 mi @ 100°	0.017 (12/13) (0.010-0.034)	0.014 (40/52) (0.010-0.023)	0
	Gamma Spec. 14	0.01	<LLD	-	-	<LLD	0
	Sr-89 14	0.01	<LLD	-	-	<LLD	0
	Sr-90 14	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m³)	I-131 84	0.10	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 14	3.0	12.5 (10/10) (11.8-13.8)	L-05, Onsite #5 0.3 mi @ 145°	16.9 (1/1) -	12.0 (4/4) (11.6-12.7)	0
Milk (pCi/l)	I-131 36	5.0/0.5*	<LLD	-	-	<LLD	0
	Gamma Spec. 12						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Sr-89 12	10	<LLD	-	-	<LLD	0
	Sr-90 12	2	<LLD			<LLD	0
Precipitation	Gross Beta 12	12.4	43.6 (2/6) (39.6-47.8)	L-16, Lowery Dairy 7.2 mi @ 120°	47.8 (1/3) -	12.9 (1/6) -	0
	Gamma Spec. 4	20	<LLD	-	-	<LLD	0
	Tritium 4	200	<LLD	-	-	<LLD	0
	Sr-89 4	10	<LLD	-	-	<LLD	0
	Sr-90 4	2	<LLD	-	-	<LLD	0
Cooling Water (pCi/l)	Gross Beta 26	1.0	3.6 (13/13) (2.2-5.4)	L-26, LSCS Discharge Pipe - River at Station	4.2 (13/13) (1.9-7.0)	4.2 (13/13) (1.9-7.0)	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-134	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0

*April, LLD = 5.0 pCi/l; May-June, LLD = 0.5 pCi/l.

Table 5.0-3 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station Reporting Period 2nd Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Surface Water (pCi/l)	Gross Beta 78	2.0	4.0 (65/65) (2.2-8.9)	L-21, Illinois River at Seneca 4.0 mi @ 22°	4.3 (13/13) (2.7-8.3)	4.3 (13/13) (2.7-8.3)	0
	Gamma Spec. 18			L-22, South Kickapoo Creek 4.7 mi @ 330°	4.3 (13/13) (2.4-8.7)		
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-		<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Well Water (pCi/l)	Gross Beta 8	5.0	19.0 (7/7) (11.8-25.5)	L-32, Ill. State Park Well 6.5 mi @ 326°	25.5 (1/1) -	18.3 (1/1) -	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Fish (pCi/g wet)	Gross Beta 10	2.0	3.1 (10/10) (2.4-4.3)	L-24, Recreational Area, Cooling Lake 0.3 mi @ 112°	3.5 (5/5) 2.5-4.3)	None	0
	Gamma Spec. 10						
	Cs-134	0.1	<LLD	-	-	None	0
	Cs-137	0.1	<LLD	-	-	None	0
	Other gammas	0.2	<LLD	-	-	None	0
	Sr-89 10	0.1	<LLD	-	-	None	0
	Sr-90 10	0.1	<LLD	-	-	None	0

Table 5.0-3 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station 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		
Cattlefeed & Grass (pCi/g wet)	Gross Beta 4	2.0	6.2 (2/2) (5.6-6.9)	L-17, Norsen Dairy 9.0 mi @ 337°	10.6 (1/1) -	8.3 (2/2) (6.0-10.6)	0
	Gamma Spec. 4						
	Cs-134	0.1	<LLD	-	-	<LLD	0
	Cs-137	0.1	<LLD	-	-	<LLD	0
	Other gammas	0.2	<LLD	-	-	<LLD	0
	Sr-89 4	1.0	<LLD	-	-	<LLD	0
	Sr-90 4	1.0	<LLD	-	-	<LLD	0
Aquatic Vegetation (pCi/g wet)	Gross Beta 3	1.0	3.8 (2/2) (3.7-3.9)	L-24, Cooling Pond 0.3 mi @ 112°	3.9 (1/1) -	3.7 (1/1) -	0
	Gamma Spec. 3						
	Cs-134	0.1	<LLD	-	-	<LLD	0
	Cs-137	0.1	<LLD	-	-	<LLD	0
	Other gammas	0.2	<LLD	-	-	<LLD	0
Bottom Sediments (pCi/g dry)	Gross Beta 3	10	27.8 (2/2) (25.1-30.5)	L-34, Downstream of cooling lake 4.8 mi @ 350°	30.5 (1/1) -	23.1 (1/1) -	0
	Gamma Spec. 3						
	Cs-134	0.1	<LLD	-	-	<LLD	0
	Cs-137	0.1	<LLD	-	-	<LLD	0
	Other gammas	0.2	<LLD	-	-	<LLD	0

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

Table 5.0-4

Environmental Radiological Monitoring Program Quarterly Summary

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

Location of facility Marseilles, 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: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Air Particulates (pCi/m^3)	Gross Beta	182	0.01	0.024 (129/130) (0.010-0.046)	L-12, Kernan 9.0 mi @ 214°	0.028 (10/13) (0.015-0.051)	0.026 (52/52) (0.010-0.055)	0
	Gamma Spec.	14	0.01	<LLD	-	-	<LLD	0
	Sr-89	14	0.01	<LLD	-	-	<LLD	0
	Sr-90	14	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131	84	0.10	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose	14	3.0	16.3 (10/10) (13.6-19.7)	L-07, Seneca #7 5.2 mi @ 18°	19.7 (1/1) -	14.3 (4/4) (12.7-16.8)	0
Milk (pCi/l)	I-131	52	0.5	<LLD	-	-	<LLD	0
	Gamma Spec.	12						
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other gammas		20	<LLD	-	-	<LLD	0
	Sr-89	12	10	<LLD	-	-	<LLD	0
	Sr-90	12	2	<LLD	L-17, Norsen Dairy 9.0 mi @ 337°	2.2 (1/6) -	2.2 (3/6) (2.1-2.2)	0
Precipitation (pCi/l)	Gross Beta	11	12.6	27.3 (4/6) (19.6-41.2)	L-15, Johnson Dairy 7.8 mi @ 258°	29.9 (3/3) (21.0-41.2)	17.6 (3/6) -	0
	Gamma Spec.	4	20	<LLD	-	-	<LLD	0
	Tritium	4	200	<LLD	-	-	<LLD	0
	Sr-89	4	10	<LLD	-	-	<LLD	0
	Sr-90	4	2	<LLD	-	-	<LLD	0
Cooling Water (pCi/l)	Gross Beta	26	1.0	7.3 (13/13) (4.4-10.5)	L-26, LCSC Discharge Pipe - River at Station	7.3 (13/13) (4.4-10.5)	3.5 (13/13) (2.0-5.4)	0
	Gamma Spec	6						
	Cs-134		10	<LLD	-	-	<LLD	0
	Cs-137		10	<LLD	-	-	<LLD	0
	Other gammas		20	<LLD	-	-	<LLD	0
	Tritium	6	200	<LLD	-	-	<LLD	0
	Sr-89	6	10	<LLD	-	-	<LLD	0
	Sr-90	6	2	<LLD	-	-	<LLD	0

Table 5.0-4 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station Reporting Period 3rd Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Surface Water (pCi/l)	Gross Beta 78	1.0	4.7 (65/65) (2.6-9.7)	L-24, Recreational Area Cooling Lake 0.3 mi @ 112°	5.2 (13/13) (4.3-6.2)	4.9 (13/13) (3.5-6.4)	0
	Gamma Spec. 18						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Well Water (pCi/l)	Gross Beta 8	1.0	19.4 (7/7) (12.7-27.3)	L-30, Ill. Ransom Well 6.0 mi @ 191°	27.3 (1/1) -	15.6 (1/1) -	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Fish (pCi/g wet)	Gross Beta 10	1.0	3.3 (10/10) (2.8-3.6)	L-35, Marseilles Pool - Illinois River 6.5 mi @ 326°	3.3 (6/6) (2.8-3.6)	None	0
	Gamma Spec. 10						
	Cs-134	0.1	<LLD	-	-	None	0
	Cs-137	0.1	<LLD	-	-	None	0
	Other gammas	0.2	<LLD	-	-	None	0
	Sr-89 10	0.1	<LLD	-	-	None	0
	Sr-90 10	0.1	<LLD	-	-	None	0

Table 5.0-4 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station 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		
Cattlefeed & Grass (pCi/g wet)	Gross Beta	4	1.0	7.4 (2/2) (6.9-7.9)	L-15, Johnson Dairy 7.8 mi @ 258°	7.9 (1/1) -	7.4 (2/2) (7.4-7.5)	0
	Gamma Spec.	4						
	Cs-134		0.1	<LLD	-	-	<LLD	0
	Cs-137		0.1	<LLD	-	-	<LLD	0
	Other gammas		0.2	<LLD	-	-	<LLD	0
	Sr-89	4	1.0	<LLD	-	-	<LLD	0
	Sr-90	4	1.0	<LLD	-	-	<LLD	0
Aquatic Vegetation (pCi/g wet)	Gross Beta	3	1.0	1.5 (2/2) (1.2-1.8)	L-24, Cooling Pond 0.3 mi @ 112°	1.8 (1/1) -	1.0 (1/1) -	0
	Gamma Spec.	3						
	Cs-134		0.1	<LLD	-	-	<LLD	0
	Cs-137		0.1	<LLD	-	-	<LLD	0
	Other gammas		0.2	<LLD	-	-	<LLD	0
Bottom Sediments (pCi/g dry)	Gross Beta	3	1.0	25.6 (2/2) (22.8-30.4)	L-34, Downstream of Cooling Lake 4.8 mi @ 350°	30.4 (1/1) -	27.4 (1/1) -	0
	Gamma Spec.	3						
	Cs-134		0.1	<LLD	-	-	<LLD	0
	Cs-137		0.1	<LLD	-	-	<LLD	0
	Other gammas		0.2	<LLD	-	-	<LLD	0
Vegetables (pCi/g wet)	Gross Beta	11	1.0	2.5 (11/11) (1.5-5.0)	L-36, Farm A	2.9 (5/5) (1.6-5.0)	None	0
	Gamma Spec.	12						
	Cs-134		0.1	<LLD	-	-	None	0
	Cs-137		0.1	<LLD	-	-	None	0
	Other Gammas		0.2	<LLD	-	-	None	0
	Sr-89	11	1.0	<LLD	-	-	None	0
	Sr-90	11	1.0	<LLD	-	-	None	0
	I-131	1	0.019	<LLD	-	-	None	0

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

Table 5.0-5

Environmental Radiological Monitoring Program Quarterly Summary

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

Location of facility Marseilles, 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: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean^a Range	Number of non-routine Results
Air Particulates (pCi/m^3)	Gross Beta 176	0.01	0.026 (124/124) (0.012-0.053)	L-09, Grand Ridge 10.4 mi @ 260°	0.030 (13/13) (0.013-0.058)	0.029 (52/52) (0.012-0.075)	0
	Gamma Spec. 14	0.01	<LLD	-	-	<LLD	0
	Sr-89 14	0.01	<LLD	-	-	<LLD	0
	Sr-90 14	0.01	<LLD	-	-	<LLD	0
Airborne Iodine (pCi/m^3)	I-131 162	0.10	<LLD	-	-	<LLD	0
Gamma Background (TLDs) (mR/Qtr.)	Gamma Dose 14	3.0	16.2 (10/10) (13.8-17.3)	L-05, Onsite #5 0.3 mi @ 145°	17.3 (1/1) -	15.3 (4/4) (13.9-16.2)	0
Milk (pCi/l)	I-131 28	0.5	<LLD	-	-	<LLD	0
	Gamma Spec. 12						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Sr-89 12	10	<LLD	-	-	<LLD	0
	Sr-90 12	2	2.9 (1/1) -	L-15, Johnson Dairy 7.8 mi @ 258°	2.9 (1/1) -	<LLD	0
Precipitation	Gross Beta 12	12.1	16.8 (1/6) -	L-18, Sunnyisle 8.8 mi @ 220°	20.2 (1/3) -	18.5 (2/6) (16.8-20.2)	0
	Gamma Spec. 4	20	<LLD	-	-	<LLD	0
	Tritium 4	200	<LLD	-	-	<LLD	0
	Sr-89 4	10	<LLD	-	-	<LLD	0
	Sr-90 4	2	<LLD	-	-	<LLD	0
Cooling Water (pCi/l)	Gross Beta 28	1.0	8.9 (14/14) (5.5-19.4)	L-26, LSCS Discharge Pipe - River at Station	8.9 (14/14) (5.5-19.4)	6.1 (14/14) (2.7-17.0)	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-134	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0

Table 5.0-5 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station Reporting Period 4th Quarter 1983

Sample Type (Units)	Type and Number of Analyses	LLD	Indicator Locations Mean[a] Range	Location with Highest Quarterly Mean: Location	Location with Highest Quarterly Mean: Mean Range	Control Locations Mean[a] Range	Number of non-routine Results
Surface Water (pCi/l)	Gross Beta 84	1.0	4.7 (70/70) (2.1-8.1)	L-19, Illinois River at Marseilles 6.5 mi @ 326°	4.3 (13/13) (2.7-8.3)	5.1 (14/14) (4.0-6.6)	0
	Gamma Spec. 18						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Well Water (pCi/l)	Gross Beta 8	5.0	19.0 (7/7) (12.3-27.9)	L-30, Ransom Well 6.0 mi @ 191°	27.9 (1/1) -	23.9 (1/1) -	0
	Gamma Spec. 6						
	Cs-134	10	<LLD	-	-	<LLD	0
	Cs-137	10	<LLD	-	-	<LLD	0
	Other gammas	20	<LLD	-	-	<LLD	0
	Tritium 6	200	<LLD	-	-	<LLD	0
	Sr-89 6	10	<LLD	-	-	<LLD	0
	Sr-90 6	2	<LLD	-	-	<LLD	0
Fish (pCi/g wet)	Gross Beta 9	2.0	28.3 (10/10) (2.0-3.6)	L-24, Recreational Area, Cooling Lake 0.3 mi @ 112°	3.0 (5/5) (2.0-3.6)	None	0
	Gamma Spec. 9						
	Cs-134	0.1	<LLD	-	-	None	0
	Cs-137	0.1	<LLD	-	-	None	0
	Other gammas	0.2	<LLD	-	-	None	0
	Sr-89 10	0.1	<LLD	-	-	None	0
	Sr-90 10	0.1	<LLD	-	-	None	0

Table 5.0-5 (continued)

Environmental Radiological Monitoring Program Quarterly Summary

Name of Facility LaSalle Nuclear Power Station 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		
Cattlefeed & Grass (pCi/g wet)	Gross Beta	4	1.0	8.2 (2/2) (8.0-8.3)	L-16, Lowery Dairy 7.2 mi @ 160°	8.3 (1/1) -	5.6 (2/2) (3.1-8.1)	0
	Gamma Spec.	4						
	Cs-134		0.1	<LLD	-	-	<LLD	0
	Cs-137		0.1	<LLD	-	-	<LLD	0
	Other gammas		0.2	<LLD	-	-	<LLD	0
	Sr-89	4	1.0	<LLD	-	-	<LLD	0
	Sr-90	4	1.0	<LLD	-	-	<LLD	0
Aquatic Vegetation (pCi/g wet)	Gross Beta	3	1.0	3.2 (2/2) (1.9-4.5)	L-33, Upstream of Cooling Lake 4.7 mi @ 354°	4.9 (1/1) -	4.9 (1/1) -	0
	Gamma Spec.	3						
	Cs-134		0.1	<LLD	-	-	<LLD	0
	Cs-137		0.1	<LLD	-	-	<LLD	0
	Other gammas		0.2	<LLD	-	-	<LLD	0
Bottom Sediments (pCi/g dry)	Gross Beta	3	1.0	32.6 (2/2) (30.2-35.1)	L-34, Downstream of cooling lake 4.8 mi @ 350°	35.1 (1/1) -	31.3 (1/1) -	0
	Gamma Spec.	3						
	Cs-134		0.1	<LLD	-	-	<LLD	0
	Cs-137		0.1	<LLD	-	-	<LLD	0
	Other gammas		0.2	<LLD	-	-	<LLD	0

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

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	4-02-83	7-01-83	10-01-83
Date Removed:		4-02-83	7-01-83	10-01-83	12-31-83
Days in the Field:		92	90	91	91
Location		Average mR/Qtr.			
On-Site and Near-Site Indicator Locations					
L-01	Near Site No. 1	16.4±1.2	13.2±0.3	16.4±0.5	16.6±0.9
L-02	On-Site No. 2	16.0±1.1	11.8±1.0	16.0±2.5	16.9±0.7
L-03	On-Site No. 3	15.6±1.3	12.7±0.6	17.0±2.1	15.8±0.6
L-04	Near-Site No. 4	14.8±0.9	12.3±0.6	17.3±0.6	16.3±1.1
L-05	On-Site No. 5	16.9±1.2	13.8±0.8	15.6±1.0	17.3±0.6
L-06	Near-Site No. 6	15.5±0.8	13.1±0.7	16.2±1.8	15.9±2.3
	Mean ± s.d.	15.9±0.7	12.8±0.7	16.4±0.6	16.5±0.6
Off-Site Indicator Locations					
L-07	Seneca	16.8±2.6	11.8±1.7	19.7±1.6	17.0±0.6
L-08	Marseilles	16.4±0.9	12.4±0.8	16.4±0.8	16.8±2.3
L-11	Ransom	14.5±0.8	11.7±0.7	13.6±0.7	13.8±2.3
L-13	Rt. 6/Gonnam Road	14.9±1.1	12.6±0.7	14.6±0.8	15.6±1.0
	Mean ± s.d.	15.6±1.1	12.1±0.4	16.1±2.7	15.8±1.5
Background Locations					
L-09	Grand Ridge	14.0±1.4	12.0±0.8	14.0±1.0	16.1±1.4
L-10	Streator	13.2±2.5	11.6±0.9	12.7±0.7	14.9±0.6
L-12	Kernan	13.3±0.8	11.7±0.6	13.6±0.3	13.9±0.9
L-14	Ottawa	16.3±1.0	12.7±0.5	16.8±2.2	16.2±1.0
	Mean ± s.d.	14.2±1.4	12.0±0.5	14.3±1.8	15.3±1.1

LASALLE

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	4-02-83	7-01-83	10-01-83
Date Removed:	4-02-83	7-01-83	10-01-83	12-31-83
Days in the Field:	92	90	92	91

Location	Average mR/Qtr.			
L-100-1	16.5±0.6	13.8±1.0	16.0±0.4	18.1±0.6
L-100-2	16.3±0.6	13.9±1.2	16.0±0.7	16.0±2.0
L-101-1	15.5±0.8	14.5±0.7	15.0±0.7	17.9±0.5
L-101-2	15.6±1.0	13.7±0.7	15.5±1.6	15.6±1.4
L-102-1	16.0±0.6	13.1±1.5	15.2±0.4	19.4±1.2
L-102-2	17.2±2.5	14.3±0.4	15.4±0.8	16.4±0.7
L-103-1	15.2±0.9	13.7±0.7	14.9±0.7	17.8±0.9
L-103-2	15.7±0.8	13.1±0.3	16.0±0.7	15.4±1.7
L-104-1	16.8±1.3	14.0±0.8	16.0±0.6	19.1±0.8
L-104-2	16.0±1.1	13.3±0.6	16.0±1.2	19.1±0.9
L-105-1	17.9±0.8	15.7±1.5	17.2±1.7	18.8±2.6
L-105-2	17.4±1.0	13.5±1.3	15.9±0.5	18.3±0.5
L-106-1	17.7±0.7	13.9±0.7	16.1±0.5	18.6±1.0
L-106-2	17.9±2.6	14.7±1.3	16.5±0.6	19.8±1.1
L-107-1	16.8±1.3	14.4±1.0	17.1±2.0	19.2±0.5
L-107-2	18.1±2.9	14.7±0.5	16.6±2.3	19.5±1.2
Mean ± s.d.	16.7±1.0	14.0±0.7	16.0±0.7	18.1±1.4

LASALLE

Table 5.1-1 (continued)

Gamma Radiation, as measured by TLDs (continued)

Special Program

Outer Ring, Near 5 Miles Radius, Indicator Locations

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Date Placed:	12-31-82	4-02-83	7-01-83	10-01-83
Date Removed:	4-02-83	7-01-83	10-01-83	12-31-83
Days in the Field:	92	90	92	91
Location	Average mR/Qtr.			
L-201-1	17.3±1.6	13.2±1.8	16.4±0.3	17.1±0.7
L-201-2	15.5±0.8	13.2±2.0	16.7±2.6	17.4±0.7
L-202-1	16.1±0.6	14.0±0.4	16.2±0.8	17.1±0.9
L-202-2	14.6±1.4	13.4±0.5	15.0±0.6	17.2±1.5
L-203-1	15.9±1.2	12.3±2.0	16.2±1.0	17.5±1.3
L-203-2	17.0±0.8	14.3±1.0	15.7±0.2	20.7±2.8
L-204-1	16.4±0.8	13.6±0.7	16.0±1.0	17.2±3.2
L-204-2	15.9±0.8	14.0±1.0	17.4±1.6	18.5±0.6
L-205-1	17.0±0.8	16.2±1.6	15.8±0.6	19.8±1.1
L-205-2	16.9±1.5	13.9±0.4	16.4±1.8	16.7±2.4
L-206-1	16.6±1.3	14.3±0.5	16.5±0.8	21.8±2.8
L-206-2	16.3±0.8	13.2±0.5	14.9±0.8	18.6±0.7
L-207-1	18.1±1.4	12.7±0.6	15.1±1.0	16.8±2.7
L-207-2	15.8±1.7	14.0±1.0	15.4±0.7	18.7±1.7
L-208-1	16.8±0.8	14.0±0.5	16.8±0.6	19.6±1.8
L-208-2	16.1±0.9	13.6±0.6	17.2±0.5	16.1±2.3
L-209-1	15.9±0.7	14.3±0.6	16.4±0.8	18.7±1.6
L-209-2	19.5±1.9	13.3±0.7	15.4±0.8	18.8±0.6
L-210-1	17.3±1.0	12.6±1.8	17.3±2.3	18.8±1.3
L-210-2	16.4±1.2	14.6±0.5	17.7±0.7	19.6±1.2
L-211-1	15.2±0.9	14.1±0.7	16.4±0.3	18.5±1.0
L-211-2	15.7±0.8	14.7±2.4	15.2±0.8	17.0±1.0
L-212-1	17.7±0.9	14.0±0.6	15.4±0.5	20.1±1.1
L-212-2	17.8±1.1	13.1±0.5	15.5±0.9	17.6±1.1
L-213-1	18.4±2.8	12.1±2.0	15.4±0.5	18.6±0.8
L-213-2	16.8±0.7	14.2±0.6	15.1±0.8	17.6±1.0
L-214-1	17.2±1.0	15.2±0.7	16.7±0.5	19.7±1.5
L-214-2	17.3±0.8	14.7±0.5	16.9±1.3	19.3±0.8
L-215-1	16.8±0.8	14.2±0.9	16.2±0.9	19.8±0.9
L-215-2	17.8±1.7	15.3±0.8	17.4±1.0	18.0±0.9
L-216-1	18.8±3.0	13.1±0.4	17.9±2.6	17.2±1.0
L-216-2	15.3±0.7	15.2±0.7	15.2±0.8	18.9±0.8
Mean ± s.d.	16.8±1.1	13.9±0.9	16.2±0.9	18.4±1.3

APPENDIX II

METEOROLOGICAL DATA

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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	2	0	2
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	2	0	2

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 - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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	1	4	0	5
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	1	0	0	0	1
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	1	1	4	0	6

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 - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	1	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	3	1	0	4
ENE	0	0	0	4	0	0	4
E	0	0	0	1	1	0	2
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	1	0	0	0	0	1
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	1	3	4
NNW	0	0	0	0	0	2	2
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	1	1	8	3	5	18

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 - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - NEUTRAL (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	7	37	28	22	2	97
NNE	0	19	22	28	2	0	71
NE	3	7	5	22	6	1	44
ENE	0	7	14	24	25	37	107
E	2	11	5	19	27	14	78
ESE	0	6	5	9	7	1	28
SE	0	8	14	14	3	2	41
SSE	1	9	19	23	4	9	65
S	2	10	25	40	14	6	97
SSW	2	14	10	14	2	12	54
SW	0	13	11	6	2	1	33
WSW	3	11	13	12	9	1	49
W	2	6	10	31	37	15	101
WNW	0	7	10	50	35	27	129
NW	1	6	22	36	26	10	101
NNW	0	6	11	24	73	23	137
VARIABLE	0	0	0	0	0	0	0
TOTAL	17	147	233	380	294	161	1232

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 86

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	.7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	3	5	3	0	12
NNE	1	5	10	1	0	0	17
NE	0	1	9	7	6	0	23
ENE	1	2	3	11	7	14	38
E	1	1	7	6	2	12	29
ESE	0	1	4	14	10	11	40
SE	1	4	7	14	9	17	52
SSE	1	6	16	21	6	10	60
S	2	4	5	8	18	36	73
SSW	0	7	1	7	13	12	40
SW	1	2	4	6	2	10	25
WSW	0	2	3	4	1	2	12
W	0	3	2	8	3	4	20
WNW	0	5	2	11	9	0	27
NW	1	0	5	12	8	3	29
NNW	1	0	2	4	1	0	8
VARIABLE	0	0	0	0	0	0	0
TOTAL	10	44	83	139	98	131	505

(WIND SPEED (IN MPH))

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 26

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	2	0	0	0	0	2
NNE	1	1	1	0	0	0	3
NE	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	1	0	2	1	2	6
ESE	2	1	1	2	0	0	6
SE	1	0	2	1	3	5	12
SSE	0	4	1	4	4	2	15
S	0	0	1	3	10	11	25
SSW	1	1	1	4	10	26	43
SW	0	1	1	0	3	4	9
WSW	1	2	3	2	3	1	12
W	1	1	2	1	4	2	11
WNW	2	1	1	0	4	0	8
NW	4	0	2	6	0	1	13
NNW	0	0	4	2	0	0	6
VARIABLE	0	0	0	0	0	0	0
TOTAL	14	15	20	27	42	54	172

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 - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JANUARY - MARCH 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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	1	0	0	0	0	1
E	0	0	1	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	0	3	0	0	5	8
SSE	0	0	4	4	5	5	18
S	0	0	1	2	4	9	16
SSW	0	0	0	1	7	13	21
SW	0	1	0	0	6	3	10
WSW	0	0	0	1	0	0	1
W	0	2	1	0	0	0	3
WNW	0	0	2	2	2	0	6
NW	0	0	3	0	0	0	3
NNW	0	0	1	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	4	16	10	24	35	90

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 - 22

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	1	1	0	2
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	1	1	0	2

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 - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	4	0	4
NNE	0	0	3	6	1	0	10
NE	0	0	1	2	0	1	4
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	3	2	5
SSW	0	0	0	6	5	2	13
SW	0	0	0	1	0	0	1
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	2	0	2
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	4	15	15	5	39

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 - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	1	3	6	1	11
NNE	0	0	2	7	2	0	11
NE	0	0	4	6	1	1	12
ENE	0	0	5	1	2	0	8
E	0	0	4	3	0	0	7
ESE	0	0	0	0	0	0	0
SE	0	0	0	1	0	0	1
SSE	0	0	0	0	0	0	0
S	0	0	0	5	5	2	12
SSW	0	0	2	4	4	1	11
SW	0	0	3	7	0	0	10
WSW	0	0	0	1	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	4	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	1	2	1	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	0	21	39	22	10	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 - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - NEUTRAL (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	.7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	2	19	15	15	23	20	94
NNE	2	11	17	8	9	1	48
NE	0	21	25	32	16	8	102
ENE	3	25	17	37	23	19	124
E	2	10	22	14	21	24	93
ESE	0	11	28	17	12	3	71
SE	1	7	22	23	2	9	64
SSE	1	2	8	17	5	10	43
S	2	5	15	14	18	8	62
SSW	0	5	4	14	13	16	52
SW	1	4	12	16	8	10	51
WSW	1	3	13	13	12	30	72
W	0	11	9	20	30	12	82
WNW	0	12	20	43	24	12	111
NW	0	1	16	33	8	11	69
NNW	1	13	16	24	13	1	68
VARIABLE	0	0	0	0	0	0	0
TOTAL	16	160	259	340	237	194	1206

(WIND SPEED (IN MPH))

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 9

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	2	1	0	0	4
NNE	1	1	0	0	0	0	2
NE	2	0	0	1	0	0	3
ENE	0	0	1	2	0	0	3
E	0	0	0	1	4	3	8
ESE	0	2	1	5	1	3	12
SE	0	1	1	9	9	9	29
SSE	0	0	1	8	10	1	20
S	1	0	2	4	5	9	21
SSW	1	0	1	4	5	16	27
SW	1	1	2	5	2	15	26
WSW	0	2	3	4	9	4	22
W	0	2	6	3	4	8	23
WNW	0	0	3	5	1	1	10
NW	0	0	3	8	6	0	17
NNW	0	0	0	2	0	2	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	6	10	26	62	56	71	231

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 - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	2	5	4	4	2	0	17
NNE	1	3	3	4	0	0	11
NE	3	4	8	6	0	1	22
ENE	1	3	7	10	4	0	25
E	1	0	8	21	12	11	53
ESE	0	4	7	16	13	9	49
SE	1	3	6	13	21	11	55
SSE	1	3	5	12	9	9	39
S	0	3	2	7	10	14	36
SSW	1	2	3	11	13	21	51
SW	0	2	6	6	3	6	23
WSW	2	1	2	5	6	4	20
W	0	3	7	11	12	10	43
WNW	0	3	1	2	10	3	19
NW	5	2	5	5	9	1	27
NNW	0	0	2	4	4	0	10
VARIABLE	0	0	0	0	0	0	0
TOTAL	18	41	76	137	128	100	500

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 - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - APRIL - JUNE 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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	1	1	0	0	2
SSE	0	0	1	2	4	3	10
S	0	0	1	1	2	8	12
SSW	0	0	3	0	5	5	13
SW	0	2	1	2	1	0	6
WSW	0	1	0	2	0	2	5
W	0	0	0	4	2	4	10
WNW	0	0	0	1	0	3	4
NW	0	1	0	0	0	1	2
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	4	7	13	14	26	64

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 - 25

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	1	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	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	1	0	0	0	1

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 - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	5	0	0	5
NNE	0	0	7	2	0	0	9
NE	0	1	4	0	0	0	5
ENE	0	0	3	3	0	0	6
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	2	1	1	0	0	4
SSW	0	1	1	6	2	1	11
SW	0	0	2	10	3	0	15
WSW	0	0	0	2	0	0	2
W	0	0	0	0	1	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	4	18	29	6	1	58

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 - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	2	6	0	0	0	9
NNE	0	4	10	3	0	0	17
NE	0	9	2	1	0	0	12
ENE	0	1	4	0	0	0	5
E	0	0	0	2	0	0	2
ESE	0	0	2	0	0	0	2
SE	0	2	4	0	0	0	6
SSE	0	3	1	0	0	0	4
S	0	3	6	2	1	0	12
SSW	0	4	4	4	2	0	14
SW	0	1	6	7	0	1	15
WSW	1	0	8	6	5	0	20
W	0	0	1	3	4	0	8
WNW	1	0	0	0	0	0	1
NW	0	0	0	1	0	0	1
NNW	0	1	2	0	1	0	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	3	30	56	29	13	1	132

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 4

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - NEUTRAL (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	11	10	12	6	1	41
NNE	3	9	16	10	6	0	44
NE	5	21	17	6	0	0	49
ENE	2	16	11	13	3	0	45
E	2	6	10	10	2	1	31
ESE	0	2	4	1	1	1	9
SE	1	12	14	5	3	0	35
SSE	2	15	24	8	3	0	52
S	1	11	7	6	10	11	46
SSW	0	7	8	17	15	7	54
SW	3	4	5	15	12	11	50
WSW	1	10	13	13	8	0	45
W	0	21	19	21	12	1	74
WNW	1	9	29	23	15	1	78
NW	0	6	15	12	8	2	43
NNW	4	8	12	6	11	4	45
VARIABLE	0	0	0	0	0	0	0
TOTAL	26	168	214	178	115	40	741

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

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	1	5	8	5	0	20
NNE	0	5	4	7	1	0	17
NE	5	8	19	9	1	0	42
ENE	0	4	11	11	0	1	27
E	0	6	5	11	7	1	30
ESE	1	7	4	8	9	3	32
SE	0	2	7	5	6	2	22
SSE	0	1	7	6	4	2	20
S	1	2	4	5	9	20	41
SSW	1	4	5	8	11	35	64
SW	1	2	3	11	10	5	32
WSW	0	1	5	9	5	2	22
W	0	0	4	8	3	2	17
WNW	2	4	3	14	13	6	42
NW	0	5	8	9	10	2	34
NNW	0	3	6	12	4	1	26
VARIABLE	0	0	0	0	0	0	0
TOTAL	12	55	100	141	98	82	488

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 18

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	1	1	0	2
NNE	1	3	0	5	0	0	9
NE	0	1	2	3	2	0	8
ENE	0	3	2	3	0	0	8
E	0	3	5	9	5	3	25
ESE	1	1	3	6	6	0	17
SE	0	5	6	27	3	1	42
SSE	0	4	5	14	2	0	25
S	0	7	5	7	6	17	42
SSW	1	0	11	8	6	17	43
SW	0	3	12	15	14	5	49
WSW	1	1	1	5	5	0	13
W	1	2	11	6	17	8	45
WNW	0	3	8	10	12	2	35
NW	1	2	6	6	16	3	34
NNW	0	3	3	4	3	0	13
VARIABLE	0	0	0	0	0	0	0
TOTAL	6	41	80	129	98	56	410

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 6

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - JULY - SEPTEMBER 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	1	1	0	2
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	1	5	0	6
ESE	0	0	0	4	0	0	4
SE	0	1	1	5	2	1	10
SSE	0	0	12	6	6	7	31
S	0	1	4	12	24	13	54
SSW	0	1	8	18	4	6	37
SW	0	0	1	4	2	4	11
WSW	0	0	1	7	7	3	18
W	0	0	2	0	10	1	13
WNW	0	1	1	1	5	8	16
NW	0	0	0	1	4	0	5
NNW	0	0	0	1	1	0	2
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	4	30	61	71	43	209

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 9

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 117

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - EXTREMELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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 - 28

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - MODERATELY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 3[illegible] FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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	2	0	0	3
ENE	0	0	0	1	1	0	2
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	1	1
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	1	3	1	1	6

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 - 28

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - SLIGHTLY UNSTABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	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	1	4	0	5
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	2	1	1	3	7
SW	0	1	0	1	0	2	4
WSW	0	0	0	0	3	0	3
W	0	0	0	0	0	0	0
WNW	0	0	0	0	1	0	1
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	0	1	4	3	9	5	22

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 - 28

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - NEUTRAL (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	.7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	1	1	9	34	5	9	59
NNE	1	2	7	14	1	7	32
NE	2	2	5	31	17	0	57
ENE	1	4	2	5	19	27	58
E	0	1	3	8	20	35	67
ESE	2	5	13	6	2	0	28
SE	0	0	5	5	0	1	11
SSE	1	0	9	3	9	19	41
S	3	1	13	9	8	8	42
SSW	1	3	10	21	15	18	68
SW	0	5	12	8	16	18	59
WSW	1	7	10	18	17	44	97
W	1	2	14	16	20	20	73
WNW	2	13	21	27	30	39	132
NW	1	6	21	35	23	25	111
NNW	1	2	17	13	16	34	83
VARIABLE	0	0	0	0	0	0	0
TOTAL	18	54	171	253	218	304	1018

HOURS OF CALM IN THIS STABILITY CLASS - 0
HOURS OF MISSING WIND MEASUREMENTS IN THIS STABILITY CLASS - 27

HOURS OF MISSING STABILITY MEASUREMENTS IN ALL STABILITY CLASSES - 28

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - SLIGHTLY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	7	18	13	2	41
NNE	2	4	15	14	7	0	42
NE	2	4	6	13	2	0	27
ENE	0	0	6	21	8	9	44
E	0	4	9	19	18	15	65
ESE	0	6	5	15	10	4	40
SE	1	7	6	12	13	10	49
SSE	0	4	17	13	18	7	59
S	1	1	9	14	23	20	68
SSW	1	4	8	14	14	34	75
SW	1	5	10	6	4	26	52
WSW	2	4	8	12	9	30	65
W	0	3	5	2	17	23	50
WNW	0	2	8	10	12	32	64
NW	0	4	14	16	12	7	53
NNW	0	1	9	12	4	1	27
VARIABLE	0	0	0	0	0	0	0
TOTAL	10	54	142	211	184	220	821

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 - 28

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - MODERATELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	0	1	3	0	0	4
NNE	1	0	2	1	0	0	4
NE	0	0	1	4	1	0	6
ENE	0	0	0	5	3	0	8
E	0	0	1	0	0	0	1
ESE	0	1	1	0	3	4	9
SE	0	2	0	0	1	3	6
SSE	0	0	2	0	1	5	8
S	0	0	9	5	6	17	37
SSW	0	1	2	5	7	23	38
SW	0	2	2	1	7	8	20
WSW	0	0	2	7	5	8	22
W	0	1	0	3	8	6	18
WNW	0	0	1	0	4	9	14
NW	0	0	1	0	5	0	6
NNW	0	0	0	0	3	1	4
VARIABLE	0	0	0	0	0	0	0
TOTAL	1	7	25	34	54	84	205

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 - 28

LASALLE NUCLEAR POWER STATION
PERIOD OF RECORD - OCTOBER - DECEMBER 1983
STABILITY CLASS - EXTREMELY STABLE (DELTA T 375-33 FT)
WINDS MEASURED AT 375 FEET

WIND DIRECTION	WIND SPEED (IN MPH) .7-3	4- 7	8-12	13-18	19-24	GT 24	TOTAL
N	0	1	2	0	0	0	3
NNE	0	2	0	0	0	0	2
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	2	0	0	2
SSE	0	0	0	2	2	3	7
S	0	0	6	5	7	13	31
SSW	0	0	0	0	1	5	6
SW	0	0	0	0	3	1	4
WSW	0	0	0	3	8	2	13
W	0	0	0	0	0	0	0
WNW	0	0	0	0	2	0	2
NW	0	0	0	0	0	0	0
NNW	0	0	1	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
TOTAL	0	3	9	12	23	24	71

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 - 28

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.

Section 2.2.2.(continued)

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:

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

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

Section 3.7 (continued)

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:

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

6. Sample Activity:

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

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)

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.

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)

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):

Section 8.1

8.1 Strontium-89 and Strontium-90 in Milk by Ion Exchange

Principle of Method

A citrate complex of yttrium, strontium, and barium carriers at the pH of milk is added to the milk sample. The mixture is then passed successively through cation- and anion-exchange resin columns. Strontium, barium, and calcium are absorbed on the cation-exchange resin, and the yttrium carrier with the yttrium 90 daughter of strontium 90 is retained on the anion-exchange resin.

The yttrium is eluted from the anion resin with hydrochloric acid and precipitated as the oxalate. Lanthanum 140, which may be a contaminant, is removed by dissolving yttrium oxalate in concentrated nitric acid and extracting yttrium from the solution into an equal volume of pre-equilibated tributyl phosphate. The lanthanum 140 remains in the concentrated nitric acid to be discarded. Yttrium is re-extracted from the organic phase with dilute nitric acid and precipitated as the oxalate. The precipitate is weighed to determine recovery of yttrium carrier, then counted for yttrium 90 activity.

Strontium, barium, and calcium are eluted from the cation-exchange resin with sodium chloride solution. Following dilution of the eluate, the alkaline earths are precipitated as carbonates. The carbonates are then converted to nitrates, and strontium and barium nitrate are precipitated. The nitrate precipitate is dissolved, and barium is precipitated as the chromate, purified as the chloride, and then counted to determine the barium 140. From the supernate, strontium is precipitated as the nitrate, dissolved in water, and reprecipitated as strontium nitrate. The nitrate is converted to the carbonate, which is filtered, weighed to determine strontium carrier recovery, and counted for "total radiostrontium".

The concentration of strontium-89 is calculated as the difference between the activity for "total radiostrontium" and the activity due to strontium-90.

Reagents

Ammonium acetate buffer: pH 5.0

Ammonium hydroxide, NH_4OH: concentrated (15N)

Ammonium oxalate, $(NH_4)_2C_2O_4.H_2O$: 1N

Anion-exchange resin: Dowex 1-X8 (Cl^- form, 50-100 mesh)

Carrier solutions:

- Ba^{+2} as barium nitrate, $Ba(NO_3)2$: 20 mg Ba^{+2} per ml
- Sr^{+2} as strontium nitrate, $Sr(NO_3)_2$: 20 mg Sr^{+2} per ml
- Y^{+3} as yttrium nitrate, $Y(NO_3)$: 10 mg Y^{+3} per ml

Cation-exchange resin: Dowex 50W-X8 (Na^+ form, 50-100 mesh)

Citrate solution: 3N (pH 6.5)

Section 8.1 (Continuea)

Diethyl ether, $(C_2H_5)_2$:anhydrous

Ethyl alcohol, C_2H_5OH: absolute (100%), 95%

Hydrochloric acid, HCl: concentrated (12N, 6N*, 2N*)

Hydrochloric acid-diethyl ether, HCl-$(C_2H_5)_2O$:5.1 v/v

Nitric acid, HNO_3:fuming (90%), concentrated (16N)*, 14N, 6N, 0.1 N*

Oxalic acid, $H_2C_2O_4.2H_2O$:2N*

Sodium carbonate, Na_2CO_3:3N, 0.1 N

Sodium chloride, NaCl:4N

Sodium chromate, Na_2CrO_4:3N

Tri-n-butyl phosphate (TBP), $(C_4H_9)_3PO_4$:pre-equilibrated with 14N HNO_3*

* Starred reagents are used only in processing the anion column effluent to determine strontium-90 concentration (Part A).

Apparatus

Ion-exchange system: The apparatus for this system is illustrated in Figure 8.1-1. It consists of three glass components connected one above the other for gravity flow. At the top is a graduated, 1-liter glass separatory funnel which serves as the reservoir. Below it is connected a 250 ml glass column, 5 cm in diameter and 25 cm long, which services as the cation column. Below this is connected the anion column, a 30-ml glass column, 1.9 cm in diameter and 10.5 cm long. Both columns have extra coarse, fritted glass disks at the bottom.

Five milliliters of distilled water are placed in the 30-ml column, and 15 ml Dowex 1 resin are poured into it. The cation column is filled by adding 170 ml Dowex 50W resin in the same way.

Millipore filtering apparatus (Pyrex Hydrosol Microanalysis Filter Holder)

Millipore type OH membrane filter, 1.5-μ pore size, 2.5-cm diameter low-background beta counter.

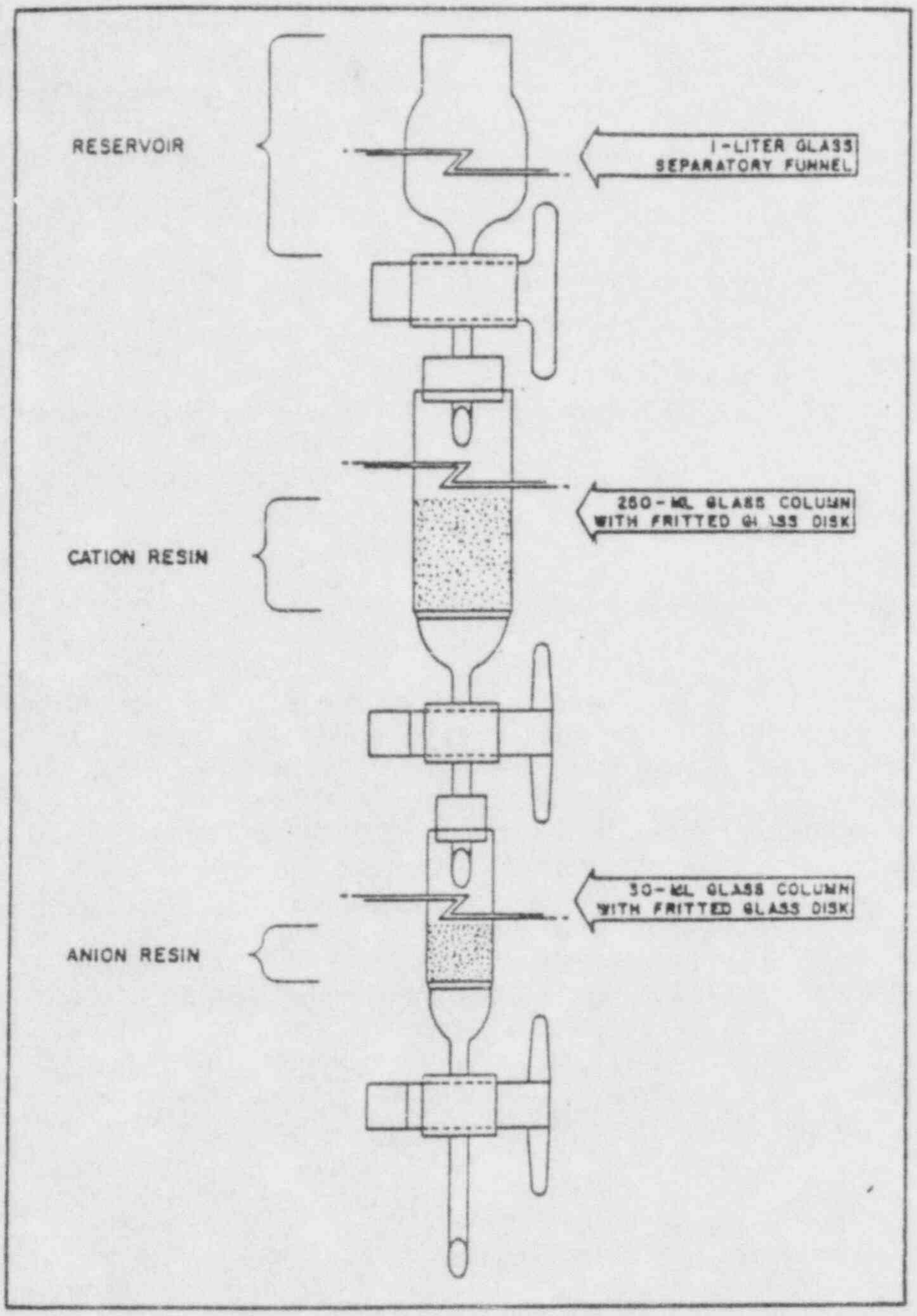


Figure 8-4 Ion-exchange system

Part A. Strontium-90

Procedure

1. Place 1 liter of milk into the graduated reservoir. Pipette 1.0 ml each of yttrium, strontium, and barium carrier solutions into 10 ml of citrate solution: swirl to mix and dissolve the barium citrate which forms. Transfer this mixture quantitatively to the milk with 5 ml of distilled water, and mix well.

2. Open the stopcocks of the reservior, anion column, and cation column, in that order. NOTE THE TIME. Control the flow rate at 10 milliliters per minute (ml/min) with the anion column stop-cock. Check occasionally by collecting effluent for 1 minute in a graduated cylinder. Stop flow when just enough milk remains in the columns to cover resin. NOTE THE TIME. Discard the effluent milk. RECORD THE MIDPOINT OF THE ELUTION PERIOD AS THE BEGINNING OF YTTRIUM 90 DECAY.

3. Replace the milk reservoir with a separatory funnel containing 300 ml of warm distilled water, and let the water flow through the columns at approximately 10 ml/min to displace the milk. Stop the flow when just enough water remains in the columns to cover the resin. Discard the effluent water.

4. Separate the columns.

   In order to collect eluate for "total radio-strontium", barium, and calcium determinations, and to regenerate the cation column for subsequent use, follow Step 5, Part B.

5. Gradually add 75-100 ml of 2N HCl to the anion colum. Control the effluent flow at 2 ml/min. Collect eluate in a 250-ml centrifuge bottle.

6. Add 5 ml of 2N oxalic acid to the eluate and adjust the pH to 1.5 with 6N NH_4OH using a pH meter.

7. Stir and heat to near boiling in a water bath (approx. 20 min).

8. Cool in an ice bath and centrifuge. Decant and discard the supernatant. Proceed as in (a) or (b) depending on whether Ba-La-140 is absent or present from the gamma analysis of the sample.

   (a) If fresh fission products are known to be absent:

   Dissolve the ppt in 10 ml of HNO_3, filter solution through Whatman No. 541 paper into a 40 ml centrifuge tube. Wash paper, collecting the washing in tube and continue as in Step A-9.

Section 8.1 - Part A (Continued)

(b) If fresh fission products are present:

Dissolve the ppt in 10 ml of HNO_3, transfer the solution to a 60 ml separatory funnel, washing the tube with additional 10 ml of HNO_3. Add 10 ml of equilibrated TBP, shake 2-3 min, and when separated drain and discard the lower acid phase. Add 15 ml of 14N HNO_3 to the separatory funnel, shake 2-3 min, drain and discard the lower acid phase. Repeat the 14N HNO_3 treatment to remove eight lanthanide elements and La-140. Add 15 ml of H_2O to the separator and shake. Drain the lower phase into a 125-ml centrifuge tube. Repeat the wash, using 15 ml of 0.1N HNO_3, adding it to the centrifuge tube.

9. Add 5 ml of 2N oxalic acid to the purified yttrium solution from (a) or (b). Adjust to a pH of 1.5 with NH_4OH, using a pH meter.

10. Digest the solution in a hot H_2O bath for 10 min. with occasional stirring. Cool in an ice bath (20 min).

11. Filter on a weighed Whatman No. 42 (2.1 cm) filter paper. Wash with H_2O, ethyl alcohol and ether and dry at room temperature and weigh.

12. Mount and count in a proportional counter.

13. If analysis for Sr-89 is not required, disregard Section 8.1-Part B. Use the computer program SR8990 to calculate (Sr-90) activity.

Part B

Total Radiostrontium (Sr-89 separation)

Procedure

Continue following columns separation (Step A-4).

5. Connect 1 l separator funnel containing 1 l of 4N NaCl to the cation column. Allow the solution to flow at ~10 ml/min to elute the alkali metal and alkaline earth ions and to recharge the column. Collect 1 l of eluate into a 2 l beaker, but leave the resin covered with 2-3 ml of solution.

6. Wash the column with 500 ml of H_2O or more to remove excess NaCl. Discard the wash.

7. Remove 20 ml of the NaCl eluate into a small bottle for the determination of stable calcium. (See section 6.1).

8. Dilute the eluate to 1500 ml with distilled water.

9. Heat the solution to 85°-90° C (near boiling on a hot plate) and add, with constant stirring, 100 ml of 3N Na_2CO_3. Stir gently while on hot plate to prevent bumping. Let stand overnight.

10. Decant most of the supernate. Transfer the precipitate to a 250 ml centrifuge bottle.

11. Wash the precipitate twice with 50 ml portions of H_2O. Dry it in an oven at 110° C for 1-2 hours.

12. Dissolve the ppt slowly with vigorous stirring in 10 ml of 6N HNO_3 (with magnetic stirrer). Filter through Whatman No. 541 paper into a 40 ml centrifuge tube. Rinse the bottle with little 6N HNO_3 and pour the washings through the paper. To the filtrate, add slowly 30 ml of 21N HNO_3 (fuming). Stir well and cool in an ice bath. Centrifuge and discard supernatant.

13. Carefully add 30 ml of conc. HNO_3 to the precipitate. Heat in a H_2O bath with stirring for about 30 minutes. Cool the solution in an ice water bath for about 5 minutes. Centrifuge and discard supernatant.

14. Repeat step No. 13.

15. Dissolve the ppt. in 10 ml. of H_2O and 5 ml. of NH_4AC buffer and heat in a water bath: Adjust pH to 5.5 using a pH meter and add immediately 1 ml. of 3N Na_2CrO_4 and mix well. Digest in a water bath for 5 min., centrifuge and decant the supernatant into another 40 ml. centrifuge tube.

16. Heat the supernate in a water bath. Adjust the pH to 8-8.5 with NH_4OH. With continuous stirring, cautiously add 5 ml of 3N Na_2CO_3 solution. Heat gently for 10 minutes. Centrifuge and decant the supernate. Wash the strontium carbonate precipitate with 0.1 N Na_2CO_3. Centrifuge again, and decant the supernate.

17. Dissolve the carbonate precipitate in 5 ml of 6N HNO_3. With continuous stirring, cautiously add 30 ml of fuming HNO_3 to the solution. (Stirring the solution longer helps in the precipitation of the strontium nitrate.) Cool in ice bath, centrifuge and decant the supernate.

18. Dissolve the strontium nitrate precipitate in 3 ml of H_2O and 5 ml of 6N HNO_3. Add cautiously, with continuous stirring, 20 ml of fuming HNO_3. Cool in an ice bath, centrifuge and discard supernatant. RECORD TIME AS BEGINNING OF Y-90 INGROWTH.

19. Dissolve the precipitate in 10 ml of H_2O. Heat in a water bath. Adjust the pH to 8-8.5. With continuous stirring, add 5 ml of 3 N Na_2CO_3 solution. Heat gently for 10 minutes.

20. Cool and filter on a weighed No. 42 Whatman (2.1 cm) filter paper. Wash thoroughly with water and alcohol.

21. Dry the precipitate in an oven at 105° C or under the lamp for 30 minutes. Cool and weigh.

22. Mount and count without delay in a proportional counter as total strontium.

23. Calculate Sr-89 and Sr-90 activity (pCi/l) using computer program SR8990.

Section 8.1 (Continued)

Calculations

Part A.

$$\text{Strontium 90 activity (pCi/liter)} = \frac{A}{2.22 \times B \times C \times D \times E \times F}$$

Where:

A = net beta count rate of yttrium 90 (cpm)
B = recovery of yttrium carrier
C = counter efficiency for counting yttrium-90 or yttrium oxalate mounted on a 2.1-cm diameter membrane filter (cpm/pCi)
D = sample volume (liters)
E = Correction factor $e^{-\lambda t}$ for yttrium-90 decay, where t is the time from midpoint of the elution time of milk (Step A-2) to the time of counting.
F = Correction factor $1-e^{-\lambda t}$ for the degree of equilibrium attained during the yttrium-90 ingrowth period, where t is the time from collection of the milk sample to the time of passage through the column (Step A-2)

Part B.

$$\text{Strontium 89 activity (pCi/liter)} = \frac{1}{2.22 x B x C} \left(\frac{A}{D x E} - F\ (G x H + I x J) \right)$$

Where:

A = net beta count rate of "Total radiostrontium" (cpm)
B = counter efficiency for counting strontium-89 as strontium oxalate mounted on a 2.1-cm diameter membrane filter (cpm/pCi)
C = correction factor $e^{-\lambda t}$ for strontium-89 decay, where t is the time for sample collection to the time of counting
D = recovery of strontium carrier
E = volume of milk sample (liters)
F = strontium 90 concentration (pCi/liter) from Part A
G = self-absorption factor for strontium-90 as strontium oxalate mounted on a 2.1-cm diameter filter, obtained from a self-absorption curve prepared by plotting the fraction of a standard activity absorbed against density thickness of the sample (mg/cm^2)
H = counter efficiency for counting strontium-90 as strontium oxalate mounted on a 2.1-cm diameter membrane filter (cpm/pCi)
I = counter efficiency for counting yttrium-90 as yttrium oxalate mounted on a 2.1-cm diameter membrane filter (cpm/pCi)

Section 8.1 (Continued)

J = correction factor $1-e^{-\lambda t}$ for yttrium-90 ingrowth, where it is the time from the last decantation of the nitric acid (Step B-18).

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

Section 8.4

8.4 Strontium 89 and Strontium 90 in Water Samples

A. Principle of Method

The acidified sample of clear water with stable strontium, barium and calcium carriers is treated with oxalic acid at a pH of 3.0 to precipitate insoluble oxalates. The oxalates are dissolved in nitric acid and strontium nitrate is separated from calcium as a precipitate in 70% nitric acid. The residue is purified by adding iron and rare earth carriers and precipitating them as hydroxides. After a second strontium nitrate precipitation from 70% nitric acid, the nitrates are dissolved in water and with added yttrium carrier, are stored for ingrowth of yttrium-90. The strontium is again precipitated and separated from 70% nitric acid with the yttrium nitrate being in the supernate. Each fraction is precipitated separately as an oxalate and collected on No. 42 (2.1 cm) Whatman filter or planchet for counting either total radiostrontium or yttrium-90 or both.

Reagents

Acetic acid, CH_3COOH: 1.5N

Ammonium acetate, $NH_4C_2H_3O_2$: 3N

Ammonium acetate buffer: pH 5.0

Ammonium hydroxide, NH_4OH: concentrated (15 N), 6 N, 1 N

Ammonium oxalate, $(NH_4)_2C_2O_4.H_2O$: 0.5% w/v

Carrier solutions:

- Ba^{+2} as barium nitrate, $Ba(NO_3)_2$: 20 mg Ba^{+2} per ml
- Ca^{+2} as calcium nitrate, $Ca(NO_3)_24H_2O$: 40 mg Ca^{+2} per ml
- Sr^{+2} as strontium nitrate, $Sr(NO_2)$: 20 mg Sr^{+3} per ml
- Y^{+3} as yttrium nitrate, $Y(NO_3)_3$: 10 mg Y^{+3} per ml

Hydrochloric acid, HCl: concentrated (12 N), 0.5 N

Hydrogen peroxide, H_2O_2: 30% solution

Nitric acid, HNO_3: fuming (90%), concentrated (16 N), 6 N, 3 N

Oxalic acid, $H_2C_2O_2$. $2H_2O$: Saturated at room temperature

Scavenger solutions: 20 mg Fe^{+3} per ml, 10 mg each Ce^{+3} and Zr^{+4} per ml

- Fe^{+} as ferric chloride, $FeCl_3.6H_2O$
- Ce^{+3} as cerous nitrate, $Ce(NO_3)_3.6H_2O$
- Zr^{+4} as zirconyl chloride, $ZrOCl_2.8H_2O$

Sodium Carbonate, Na_2CO_3:3N, 0.1N

Sodium Chromate, Na_2CrO_4:3N

Apparatus

Analytical balance
Low background beta counter
Medium - porosity filter stick
pH meter

Section 8.4 A

Part A. Strontium 89

Procedure

1. Filter 1 liter of an acidified water sample using millipore filter paper.

2. Digest the filter paper with the residue with concentrated nitric acid (HNO_3) until all the organic matter is removed.

3. Evaporate to dryness and dissolve the residue with hot water and filter using No. 541 Whatman filter paper.

4. Combine the filtrates in a 2 liter beaker.

5. Add 1 ml of strontium carrier solution, 1 ml barium carrier solution, and if necessary, 1 ml of calcium carrier solution. (Improved precipitation may be obtained by adding calcium to soft waters.) Stir thoroughly and while stirring add 125 ml of saturated oxalic acid solution.

6. Using a pH meter, adjust the pH to 3.0 with 15 N NH_4OH, and allow the precipitate to settle for 5-6 hours.

7. Decant most of the supernate (liquid) and transfer the precipitate to a 250 ml centrifuge bottle. Wash the precipitate and the beaker wall with 0.5% ammonium oxalate and centrifuge. Discard the supernate.

8. Dissolve the precipitate with 10 ml of 6 N HNO_3 and transfer to a 250 ml beaker. Then use 20 ml of 16 N HNO_3 to rinse the centrifuge tube and combine it to the solution in the 250 ml beaker.

9. Evaporate the solution to dryness. Cool; then add 50 ml 16 N HNO_3 and repeat the acid addition and evaporation until the residue is colorless.

10. Transfer the residue to a 40-ml centrifuge tube, rinsing with a minimum volume of 16 N HNO_3. Cool in a refrigerator overnight. Centrifuge at 1500-1800 rpm for 10 minutes, and discard the supernate.

11. Dissolve the precipitate in 5 ml of 6N HNO_3 and then add 30 ml of fuming nitric acid. Centrifuge, and discard the supernate.

12. Dissolve the nitrate precipitate in about 10 ml of distilled water. Add 1 ml of scavenger solution. Adjust the pH of the mixture to 7 with 6 N HN_4OH. Heat, stir, and filter through a Whatman No. 541 filter. Discard the mixed hydroxide precipitate.

Part A. Strontium 89

Procedure (continued)

13. To the filtrate, add 5 ml of ammonium acetate buffer. Adjust the pH with 3N HNO_3 or NH_4OH to pH 5.5. (Note: the pH of the solution at this point is critical.) Add dropwise with stirring 1 ml of 3N Na_2CrO_4 solution. Heat in a water bath.

14. Cool and centrifuge. Decant the supernate into another centrifuge tube. Save the precipitate for Ba analysis if needed.

15. Heat the supernate in a water bath. Adjust the pH to 8-8.5 with NH_4OH. With continuous stirring, cautiously add 5 ml of 3N Na_2CO_3 solution. Heat gently for 10 minutes. Cool, centrifuge, and decant the supernate. Wash the precipitate with 0.1N Na_2CO_3. Centrifuge again and decant the supernate.

16. Dissolve the precipitate in no more than 4 ml of 3N HNO_3. Then add 20-30 ml of fuming HNO_3, cool in a water bath, and centrifuge. Decant and discard the supernate.

17. Repeat step 16. Then, RECORD THE TIME AND DATE AS THE BEGINNING OF YTTRIUM 90 INGROWTH. If no immediate count of total radiostrontium is desired add to the precipitate 1 ml of yttrium carrier solution and 4 ml of 6N HNO_3 and store 7-14 days to allow the yttrium 90 to grow in.

18. To determine total radiostrontium, dissolve the precipitate in 10 ml of water. Heat in water bath. Adjust the pH to 8-8.5. With continuous stirring add 5 ml of 3N Na_2CO_3 solution. Heat gently for 10 minutes.

19. Cool and filter on a weighed No. 42 (2.1 cm) Whatman filter paper. Wash thoroughly with water and alcohol.

20. Dry the precipitate under the lamp for 30 min. Cool and weigh.

21. Mount and count without delay its beta activity as "total radiostrontium" in a proportional counter.

Part B. Strontium 90

Procedure

1. After counting total radiostrontium dissolve the precipitate on the filter in 6 N HNO_3 and transfer the solution to a 40 ml centrifuge tube. The total volume of dissolution and rinsing should be about 4 ml.

2. Add 1 ml of yttrium carrier solution and store until 7 to 14 days have elapsed since step 17 was completed.

3. Heat the equilibrated strontium-yttrium sample in a water bath at approximately 90°C. Adjust the pH to 8 with NH_4OH, stirring continuously.

4. Cool to room temperature in a cold water bath and centrifuge for 5 minutes. Record the hour and date of decantation as the end of the yttrium-90 ingrowth and the beginning of its decay in the yttrium fraction.

5. Dissolve by adding about 4 drops of HCl with stirring. Add 15-20 ml of water. Heat in a water bath and adjust the pH to 8 with NH_4OH, stirring continuously.

6. Cool to room temperature in a cold water bath and centrifuge for 5 minutes.

7. Repeat steps 5 and 6.

8. Add 3 drops of HCl to dissolve the precipitate, then add 20 ml of water. Filter using No. 541 filter paper. Heat in a water bath at approximately 90° C. Add 1 ml of saturated oxalic acid solution dropwise with vigorous stirring. Adjust to a pH of 2-3 with NH_4OH. Allow the precipitate to digest for about an hour.

9. Cool to room temperature in a cold water bath. Centrifuge for 10 minutes and decant most of the supernate. Filter by suction on a weighed filter paper. Wash the precipitate with water and alcohol.

10. Dry the precipitate under the lamp for 30 minutes. Cool and weigh. Mount and count without delay in a proportional counter.

11. Calculate Sr-89 and Sr-90 activity in pCi/l using the computer program for Sr-89,90.

Part B. Strontium 90

Calculations

For formulas used refer to Section 8.1.

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

8.6 Strontium-89 and Strontium-90 in Milk (Ash), Vegetation, Fish, Wildlife, Soil and Bottom Sediment Samples - Sodium Carbonate Fusion.

Principle of Method

Strontium is separated from calcium, other fission products, and other natural radioactive elements. Fuming nitric acid separations remove the calcium and most of the other interfering ions. Radium, lead, and barium are removed with barium chromate. Traces of other fission products are scavenged with yttrium hydroxide. After the Sr-90 and Y-90 equilibrium has been attained, the Y-90 is precipitated as the hydroxide and converted to the oxalate for counting. Strontium is precipitated as the carbonate and counted for total activity. Strontium-89 activity is computed as the difference between the total radiostrontium and the strontium-90 (as yttrium-90) activity.

Reagents

Ammonium acetate buffer, $(NH_4)_2$ Ac:pH = 5.0, 6M
Ammonium hydroxide, NH_4OH:6N
Carrier Solutions:
- Ba^{+2}, $Ba(No_3)_2$:20 mg/ml of Ba^{+2}
- Fe^{+3}, $Fe(NO_3)_3$, scavenger:5 mg/ml of Fe^{+3}
- Sr^{+2}, $Sr(NO_3)_2$:20 mg/ml of Sr^{+3}
- Y^{+3}, $Y(NO_3)_3$:10 mg/ml of Y^{+3}

Ethyl alcohol, C_2H_5OH:absolute
Hydrochloric acid, HCl:12N (conc.)
Nitric acid, HNO_3:16N (conc.), 6N, 3N, fuming
Oxalic acid, $H_2C_2O_4$:saturated
Potassium nitrate, KNO_3:powdered
Sodium carbonate, Na_2CO_3:powdered, 3N, 0.1N
Sodium chromate, Na_2CrO_4:3N
Sodium hydroxide, NaOH:pellets

Apparatus

Teflon filter holder, or filter funnel and sample mount rings and discs
Magnetic stirrers with Teflon-Coated magnet bars
Mylar film
Glass fiber filters
Fisher filtrator
Brinkman dispenser - pipettor

Part A. Sample Preparation - Sodium Carbonate Fusion

Procedure

1. Weigh out 3 g of ashed sample or silted soil and set aside.

2. Sift into a 250 ml nickel crucible enough Na_2CO_3 to very lightly cover the bottom.

3. Add 30 g of NaOH pellets and 5 g of KNO_3.

4. Add the weighed ash sample and tap the crucible gently to shake the ash down among the pellets.

5. Sift from 10 to 20 grams of Na_2CO_3 over the ash so it is completely covered.

6. Place in a muffle furnace at 600°C for 20 to 30 minutes to melt and fuse the mixture.

   NOTE: If carbon materials remain floating on the surface of the melt, cautiously add a few grains of KNO_3 and heat for another 5 to 10 minutes.

   Decomposition of organic matter is complete when no further reaction is noticed on addition of KNO_3.

7. Using a long-handled tongs, remove the crucible from the muffle furnace and immediately, <u>but very cautiously</u>, cool in an ice bath until the melt is completely solidified and cool enough to handle without gloves.

   NOTE: It is very important that no moisture come in contact with the melt at this time. One drop of water in the crucible could render the melt very difficult, if not impossible, to remove.

8. Transfer the melt to a 250 ml centrifuge bottle using distilled water and stir until completely dispersed.

   NOTE: Rotating the crucible in the palm of one's hand and very gently applying pressure should be sufficient to loosen the melt from the sides of the crucible.

9. Add 2 ml of strontium and 1 ml of barium carriers.

10. Bring to a gentle boil, cool, centrifuge and discard the supernatant.

Part A. Sample Preparation - Sodium Carbonate Fusion

Procedure (continued)

11. To the residue add 50 ml 3N Na_2CO_3 as a wash, swirl and disperse the residue, heat for 10 minutes in a hot water bath, centrifuge and discard the supernatant.

12. Repeat step (11) three times to put the precipitate in a suitable form for further analysis.

13. Dissolve the precipitate in 50 ml of concentrated HNO_3, transfer to a 250 ml beaker, and take to dryness on a hot plate.

    NOTE: Evaporation may be done rapidly at first, and then very slowly to prevent spattering.

    A jelly-like substance may form at this point, due to hydrated silicic acid formed from the soluble silicates and will be removed in the following steps.

14. Bake the remaining residue for at least 1 hour at 120° to 130° C, cool, moisten the salts with 5 ml of HNO_3 and allow to stand at room temperature for 10 minutes. Then place on a hot plate, bring to a boil and add 45 ml of boiling water. DISPERSE ANY REMAINING RESIDUE WITH A GLASS STIRRING ROD AND FILTER IMMEDIATELY into a 250 ml beaker. Use Whatman No. 541 hardened filter paper.

    NOTE: To separate the silicic acid the hydrated acid must be changed to a less hydrated and less soluble acid by baking at 100° to 130°C.

    It is important at this point that evaporation be to complete dryness. (There should no longer be a smell of acid).

    Addition of 5 ml of HNO_3 converts any metal oxides which may have been formed back to nitrates so they will be dissolved and not removed with the silicates.

    Filtering must be done immediately as some of the silicates will tend to go back into solution. Also, due to this fact, removal of silicates by dehydration is not 100% efficient and the process must be repeated at least once and more often if necessary.

15. Evaporate and repeat step (14) at least once, and again as often as necessary.

Part A. Sample Preparation - Sodium Carbonate Fusion

Procedure (continued)

16. Evaporate the solution in a beaker to dryness on a hot plate. Cool, then add 40 ml of concentrated HNO_3 and evaporate to 20-25 ml. Then add another 40 ml HNO_3 and repeat the procedure.

    NOTE: The liquid portion of the sample at this point will be yellow. Should the color toward the end of the first evaporation be red-brown, or black, add more nitric acid and repeat the above procedure as often as necessary to obtain a clear yellow solution.

    The dark samples described above have been known to explode if evaporated to dryness without adding additional portions of nitric acid. These samples should be handled in a hood with the window down as far as possible to prevent possible personal injury to the operator.

    This step is to destroy any remaining organic materials. The darker colored solutions contain large amounts of organic matter.

17. Complete the analyses as described under Determination.

References: The basis for this procedure was presented by J.J. Bolan in the Public Health Service Manual, titled "Chemical Analysis of Environmental Radionuclides, Determination of radio-strontium in food" (1.11.3.A(8.65)). Modifications to this procedure were made by the North Dakota State Department of Health.

Part B. Determination

I. Strontium - 89

Procedure

1. Transfer the solution to a 40 ml conical, heavy-duty centrifuge tube using a minimum of conc. HNO_3. Cool the centrifuge tube in an ice bath for about 10 minutes. Centrifuge and discard the supernatant.

   NOTE: The precipitate consists of calcium, strontium and barium-radium nitrates. The supernatant contains part of the sample's calcium and phosphate content.

2. Add 30 ml of conc. HNO_3 to the precipitate. Heat in a hot water bath with stirring for about 10 minutes. Cool the solution in an ice bath with stirring for about 5 minutes. Centrifuge and discard the supernatant.

   NOTE: Additional calcium is removed from the sample. Nitrate precipitations with 70% HNO_3 will afford a partial decontamination from soluble calcium while strontium, barium, and radium are completely precipitated.

   The separation of calcium is best at 60% HNO_3, however at 60% the precipitation of strontium is not complete. Therefore, it is common practice to precipitate $Sr(NO_3)_2$ with 70% HNO_3 which is the concentration of commercially available 16 $\underline{N}$ HNO_3.

   Most of the other fission products, induced activities and actinides are soluble in concentrated HNO_3 affording a good "gross" decontamination step from a wide spectrum of radionuclides. The precipitation is usually repeated several times.

3. Repeat step (2) two more times.

4. Dissolve the nitrate precipitate in about 10 ml distilled water. Add 1 ml of scavenger solution. Adjust the pH of the mixture to 7 with 6 $\underline{N}$ NH_4OH. Heat, stir, and filter through a Whatman No. 541 filter. Discard the mixed hydroxide precipitate.

Part B Determination

1. Strontium-89

Procedure (continued)

5. To the filtrate add 5 ml of ammonium acetate buffer (pH 5.0). Adjust the pH to 5.5 with 3N HNO_3 or 6N NH_4OH. (Note: The pH of the solution at this point is critical. Barium chromate will not precipitate completely in more acidic solution and strontium will partially precipitate in more basic solutions.) Add dropwise with stirring 1 ml of 3N Na_2CrO_4 solution. Heat in a water bath to about 90°C and centrifuge. Decant the supernate into another centrifuge tube. Save the precipitate for Ba analysis if needed.

6. Heat the supernate in a water bath. Adjust the pH to 8-8.5 with NH_4OH. With continuous stirring, cautiously add 5 ml of 3N Na_2CO_3 solution. Heat gently for 10 minutes. Centrifuge, and when completeness of precipitation has been verified by adding a few drops of Na_2CO_3, centrifuge and decant the supernate. Wash the strontium carbonate precipitate with 0.1N Na_2CO_3. Centrifuge again, and decant the supernate.

7. Dissolve the carbonate precipitate in 5 ml 6N HNO_3. With continuous stirring, cautiously add 20 ml fuming HNO_3 to the solution. (Stirring the solution longer helps in the precipitation of strontium nitrate). Cool in an ice bath, centrifuge and decant the supernate.

8. Dissolve the strontium nitrate precipitate in 3 ml H_2O and 5 ml 6N HNO_3. Add cautiously, with continuous stirring, 20 ml fuming HNO_3. Cool in ice bath, centrifuge and discard supernatant. RECORD TIME AS BEGINNING OF Y-90 INGROWTH.

9. Dissolve the precipitate in 10 ml of H_2O. Heat in a water bath. Adjust the pH to 8-8.5. With continuous stirring, add 5 ml of 3N Na_2CO_3 solution. Heat gently for 10 minutes.

10. Cool and filter on a weighed No. 42 (2.1 cm) Whatman filter paper. Wash thoroughly with water and alcohol.

11. Dry the precipitate under the lamp for 30 minutes. Cool and weigh.

12. Mount and count without delay in a proportional counter as total radiostrontium.

Part B Determination

II. Strontium-90

Procedure

1. After counting total radiostrontium, dissolve the strontium carbonate precipitate on the filter in 6N HNO_3 and transfer the solution to a 40 ml centrifuge tube. The total volume of dissolution and rinsing should be about 4 ml.

2. Add 1 ml of yttrium carrier solution and store until 7 to 14 days have elapsed since Step B-I-8 was completed.

3. Heat the equilibrated strontium-yttrium sample in a water bath at approximately 90° C. Adjust the pH to 8 with NH_4OH, stirring continuously.

4. Cool to room temperature in a cold water bath and centrifuge for 5 minutes. Discard the supernate, record the time and date of the decantation as the end of the yttrium-90 ingrowth and the beginning of its decay in the yttrium fraction.

5. Dissolve precipitate by adding about 4 drops of HCl with stirring. Add 15-20 ml of water. Heat in a water bath and adjust the pH to 8 with NH_4OH, stirring continuously.

6. Cool to room temperature in a cold water bath and centrifuge for 5 minutes. Discard supernate.

7. Repeat steps 5 and 6.

8. Add 3 drops of HCl to dissolve the precipitate, then add 20 ml of water. Filter the solution using No. 541 Whatman hardened filter paper. Heat in a water bath at approximately 90° C. Add 1 ml of saturated oxalic acid solution dropwise with vigorous stirring. Adjust to a pH of 2-3 with NH_4OH. Allow the precipitate to digest for about an hour.

9. Cool to room temperature in a cold water bath. Centrifuge for 10 minutes and decant most of the supernate. Filter by suction on a weighed filter paper. Wash the precipitate with water and absolute ethyl alcohol.

10. Dry the precipitate under the lamp for 30 minutes. Cool and weigh. Mount and count without delay in a proportional counter as Y-90 (Sr-90).

11. Calculate Sr-89 and Sr-90 activity using the computer program for Sr-89,-90.

Part B Determination

II. Strontium-90

Calculations

a. Strontium-90 activity (pCi/g) = $\frac{A}{2.22 \times B \times C \times D \times E \times F}$

Where:

A = net beta count rate of yttrium-90 (cpm)
B = recovery of strontium carrier
C = efficiency for counting yttrium-90 as yttrium oxalate (cpm/dpm)
D = sample size (in grams)
E = correction factor $e^{-\lambda t}$ for yttrium-90 decay, where t is the time from decantation of the strontium supernate (Step B-II-4) to the time of counting (Step B-II-10)
F = correction factor $1 - e^{-\lambda t}$ for the degree of equilibrium attained during the yttrium-90 ingrowth period, where t is the time from strontium separation (Step B-I-8) to the time of strontium removal (Step B-II-4).

b. Strontium-89 activity (pCi/g) = $\frac{1}{2.22 \times B \times C} \left(\frac{A}{D \times E} - F(G \times H + I \times J) \right)$

Where:

A = net beta count rate of "total radiostrontium": (cpm)
B = counter efficiency for counting strontium-89 as strontium oxalate mounted on a 2.1 cm diameter membrane filter (cpm/pCi)
C = correction factor $e^{-\lambda t}$ for strontium-89 decay, where t is the time from sample collection to the time of counting
D = recovery of strontium carrier
E = sample size (in grams)
F = strontium-90 concentration (pCi/g)
G = self-absorption factor for strontium-90 as strontium oxalate mounted on a 2.1 cm diameter membrane filter
H = counter efficiency for counting strontium-90 as strontium oxalate mounted on a 2.1 cm diameter membrane filter (cpm/dpm)
I = counter efficiency for counting yttrium-90 as yttrium oxalate mounted on a 2.1 cm diameter membrane
J = correction factor $1 - e^{-\lambda t}$ for yttrium-90 ingrowth, where t is the time from the last decantation of the nitric acid supernate from the strontium nitrate precipitate to the time of counting (Step B-I-8).

References: Radioassay Procedures for Environmental Samples. U.S. Department of Health, Education and Welfare Environmental Health Series, January 1967. HASL Procedure Manual edited by John H. Harley, 1972.