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April 23, 1992

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PLANT HATCH - UNITS 1, 2
NRC DOCKETS 50-321, 50-366
OPERATING LICENSES DPR-57, NPF-5
1991 ANNUAL RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE REPORT

Gentlemen:

In accordance with Plant Hatch Units 1 and 2 Technical Specifications Sections 6.9.1.6 and 6.9.1.7, Georgia Power Company is submitting the enclosed Annual Radiological Environmental Surveillance Report for 1991.

If you have any questions in this regard, please contact this office at any time.

Sincerely,

W. G. Hairston, III

SRM/cr

Enclosure: 1991 Annual Radiological Environmental Surveillance Report

cc: (See next page.)

Georgia Power

cc: Georgia Power Company
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GEORGIA POWER COMPANY
EDWIN I. HATCH NUCLEAR PLANT
ANNUAL RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE REPORT
CALENDAR YEAR 1991

EDWIN I. HATCH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE REPORT

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1.0	INTRODUCTION	1-1
2.0	SUMMARY DESCRIPTION	2-1
3.0	RESULTS SUMMARY	3-1
4.0	DISCUSSION OF RESULTS	4-1
4.1	Airborne	4-3
4.2	Direct Radiation	4-5
4.3	Milk	4-7
4.4	Grass	4-9
4.5	River Water	4-10
4.6	Fish	4-11
4.7	Sediment	4-13
5.0	INTERLABORATORY COMPARISON PROGRAM	5-1
6.0	CONCLUSIONS	6-1

LIST OF TABLES

TABLE	TITLE	PAGE
2-1	SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM	2-2
2-2	RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS	2-5
3-1	RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY	3-2
4-1	LOCATION OF THE NEAREST PERMANENT RESIDENCE IN EACH SECTOR	4-2
5-1	CROSSCHECK PROGRAM RESULTS	5-3

LIST OF FIGURES

FIGURE	TITLE	PAGE
2-1	RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS ON SITE PERIPHERY	2-7
2-2	RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS BEYOND SITE PERIPHERY	2-8
2-3	LOCATION OF ADDITIONAL CONTROL STATION FOR MILK	2-11
2-4	LOCATION OF ADDITIONAL CONTROL STATION FOR TLDs AND VEGETATION	2-12

ACRONYMS

CL	Confidence Level
EL	Environmental Laboratory (Georgia Power Company)
EPA	Environmental Protection Agency
GPC	Georgia Power Company
HNP	Edwin I. Hatch Nuclear Plant
LLD	Lower Limit of Detection
MDA	Minimum Detectable Activity
MDD	Minimum Detectable Difference
NA	Not Applicable
NDM	No Detectable Measurement(s)
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
TLD	Thermoluminescent Dosimeter
TS	Technical Specifications

EDWIN I. HATCH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE REPORT

1.0 INTRODUCTION

The objectives of the Radiological Environmental Monitoring Program (REMP) are to ascertain the levels of radiation and concentrations of radioactivity in the environs of the Edwin I. Hatch Nuclear Plant (HNP) and to evaluate any radiological impact upon the environment due to plant operations. Reported herein are the program's activities for calendar year 1991.

The specifications for the REMP are provided in Section 3/4.16 of the Unit 1 Technical Specifications (TS) and in Section 3/4.12 of the Unit 2 TS. The Unit 2 TS simply reference the Unit 1 TS. A single program serves both units.

A summary description of the program is provided in Section 2. Maps showing the sampling locations are keyed to a table indicating the distance and direction of each sampling location from the main stack.

An annual summary of the main laboratory analysis results obtained from the samples utilized for environmental monitoring is presented in Section 3. A discussion of the results, including assessments of any radiological impacts upon the environment, is provided in Section 4.

The results of the Interlaboratory Comparison Program are presented in Section 5. Conclusions are stated in Section 6.

2.0 SUMMARY DESCRIPTION

A summary description of the REMP is provided in Table 2-1. This table portrays the program in the manner by which it is being regularly carried out. Table 2-1 is essentially a copy of Table 3.16.1-1 of the TS which delineates the program's requirements. Sampling locations required by Table 2-1 are described in Table 2-2 and are shown on maps in Figures 2-1 through 2-4. This description of the sample locations closely follows that found in the table and figures in Section 3.0 of the Offsite Dose Calculation Manual (ODCM).

It is stated in Section 3.16.1.a of the TS that deviations are permitted from the required sampling schedule, which is delineated in Table 2-1 herein, if samples are unobtainable due to hazardous conditions, unavailability, inclement weather, malfunction of equipment, or other just reasons. Any deviations are accounted for in the discussions for each particular sample type in Section 4.

During 1991, all the laboratory analyses, except for the reading of the thermoluminescent dosimeters (TLDs), were performed by Georgia Power Company's (GPC's) Environmental Laboratory (EL) in Smyrna, Georgia. The reading of the TLDs was provided by Teledyne Isotopes Midwest Laboratory in Northbrook, Illinois.

TABLE 2-1 (SHEET 1 OF 3)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Approximate Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis and Frequency
1. Airborne Radioiodine and Particulates	6	Continuous operation of sampler with sample collection weekly	Radioiodine canister: I-131 analysis weekly.
			Particulate sampler: analyze for gross beta radioactivity not less than 24 hours following filter change weekly; perform gamma isotopic analysis on affected sample when gross beta activity is 10 times the yearly mean of control samples; and composite (by location) for gamma isotopic analysis quarterly.
2. Direct Radiation	37	Quarterly	Gamma dose quarterly.
3. Ingestion			
Milk (a)	2	Biweekly	Gamma isotopic and I-131 analyses biweekly
Fish or Clams (b)	2	Semiannually	Gamma isotopic analysis on edible portions semiannually.
Grass or Leafy Vegetation	3	Monthly during growing season.	Gamma isotopic analysis monthly (c)

TABLE 2-1 (SHEET 2 OF 3)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Approximate Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis and Frequency
4. Waterborne			
Surface	2	Composite sample collected monthly (d).	Gamma isotopic analysis monthly. Composite (by location) for tritium analysis quarterly.
Sediment	2	Semiannually	Gamma isotopic analysis semiannually.
Drinking Water (e) (f)	One sample of river water near the intake and one sample of finished water from each of one to three of the nearest water supplies which could be affected by HNP discharges.	River water collected near the intake will be a composite sample; the finished water will be a grab sample. These samples will be collected monthly unless the calculated dose due to consumption of the water is greater than 1 mrem/year; then the collection will be biweekly. The collections may revert to monthly should the calculated doses become less than 1 mrem/year.	I-131 analysis on each sample when biweekly collections are required. Gross beta and gamma isotopic analyses on each sample; composite (by location) for tritium analysis quarterly.

TABLE 2-1 (SHEET 3 OF 3)

SUMMARY DESCRIPTION OF
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

NOTES

a. Up to three sampling locations within 5 miles and in different sectors will be used as available. In addition, one or more control locations beyond 10 miles will be used.

b. Commercially or recreationally important fish may be sampled. Clams may be sampled if difficulties are encountered in obtaining sufficient fish samples.

c. If gamma isotopic analysis is not sensitive enough to meet the Lower Limit of Detection (LLD), a separate analysis for I-131 may be performed.

d. Composite samples shall be collected by collecting an aliquot at intervals not exceeding a few hours.

e. If it is found that river water downstream of HNP is used for drinking, water samples will be collected and analyzed as specified herein.

f. A survey shall be conducted annually at least 50 river miles downstream of HNP to identify those who use Altamaha River water for drinking.

TABLE 2-2 (SHEET 1 OF 2)

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS

Station Number	Station Type (a)	Descriptive Location	Direction (b)	Distance (b) (miles)	Sample Type (c)
064	O	Roadside Park	WNW	0.8	D
101	I	Inner Ring	N	1.9	D
102	I	Inner Ring	NNE	2.5	D
103	I	Inner Ring	NE	1.8	AD
104	I	Inner Ring	ENE	1.6	D
105	I	Inner Ring	E	3.7	D
106	I	Inner Ring	ESE	1.1	DV
107	I	Inner Ring	SE	1.2	AD
108	I	Inner Ring	SSE	1.6	D
109	I	Inner Ring	S	0.9	D
110	I	Inner Ring	SSW	1.0	D
111	I	Inner Ring	SW	0.9	D
112	I	Inner Ring	WSW	1.0	ADV
113	I	Inner Ring	W	1.1	D
114	I	Inner Ring	WNW	1.2	D
115	I	Inner Ring	NW	1.1	D
116	I	Inner Ring	NNW	1.6	AD
170	C	Upriver	WNW	(d)	R
172	I	Downriver	E	(d)	R
201	O	Outer Ring	N	5.0	D
202	O	Outer Ring	NNE	4.9	D
203	O	Outer Ring	NE	5.0	D
204	O	Outer Ring	ENE	5.0	D
205	O	Outer Ring	E	7.2	D
206	O	Outer Ring	ESE	4.8	D
207	O	Outer Ring	SE	4.3	D
208	O	Outer Ring	SSE	4.8	D
209	O	Outer Ring	S	4.4	D
210	O	Outer Ring	SSW	4.3	D
211	O	Outer Ring	SW	4.7	D
212	O	Outer Ring	WSW	4.4	D
213	O	Outer Ring	W	4.3	D
214	O	Outer Ring	WNW	5.4	D
215	O	Outer Ring	NW	4.4	D
216	O	Outer Ring	NNW	4.8	D
301	O	Toombs Central	N	8.0	D
304	C	State Prison	ENE	11.2	AD
304	C	State Prison	ENE	10.8	M
309	C	Baxley Substation	S	10.0	AD
316	C	Thompson's Dairy	NNW	13.2	M
416	C	Emergency News Ctr	NNW	21.0	DV

TABLE 2-2 (SHEET 2 OF 2)

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS

NOTES

a. Station types:

C - Control
I - Indicator
O - Other

b. Direction and distance are reckoned from the main stack.

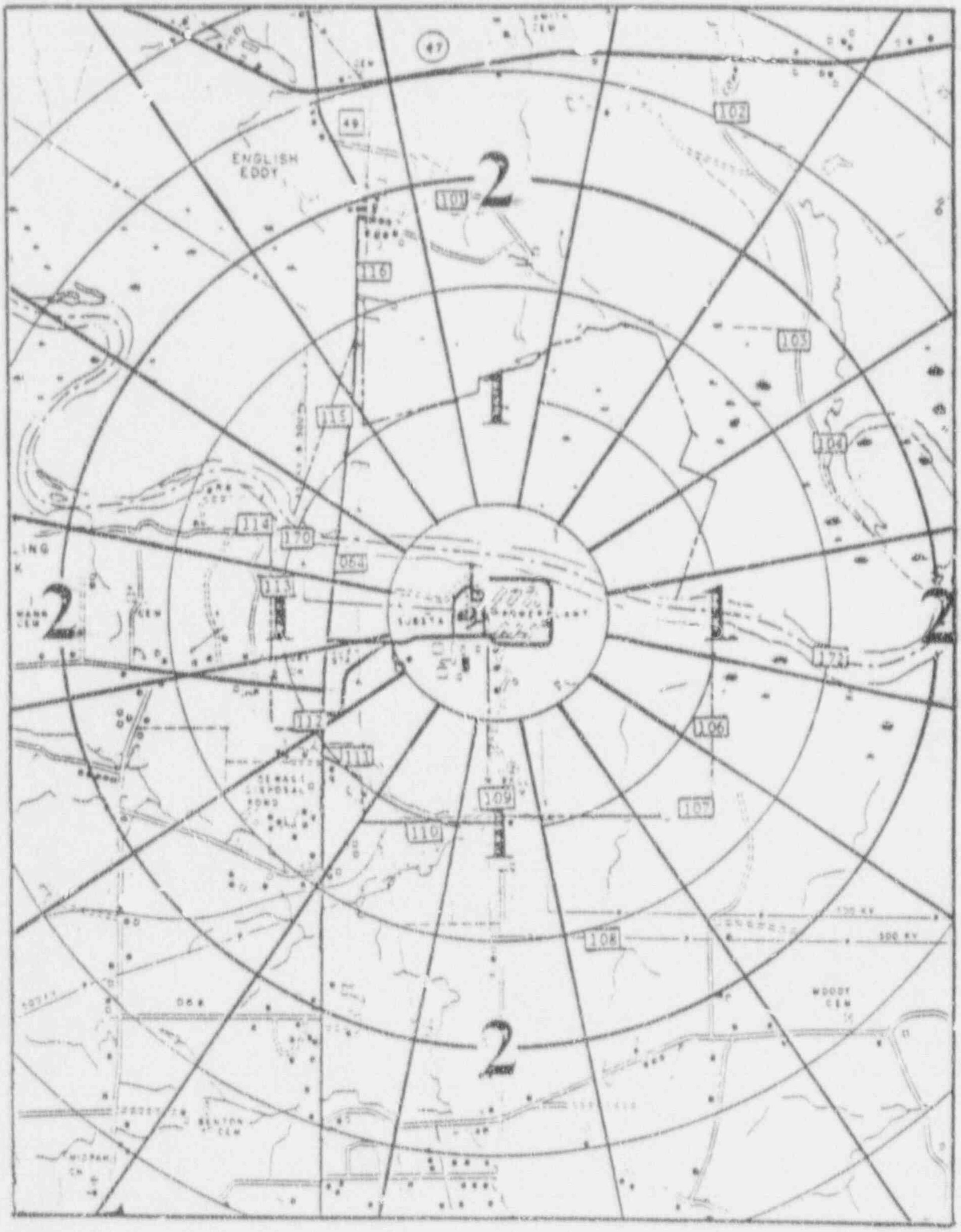
c. Sample types:

A - Airborne Radioactivity
D - Direct Radiation
M - Milk
R - River (fish or clams, shoreline sediment, and surface water)
V - Vegetation

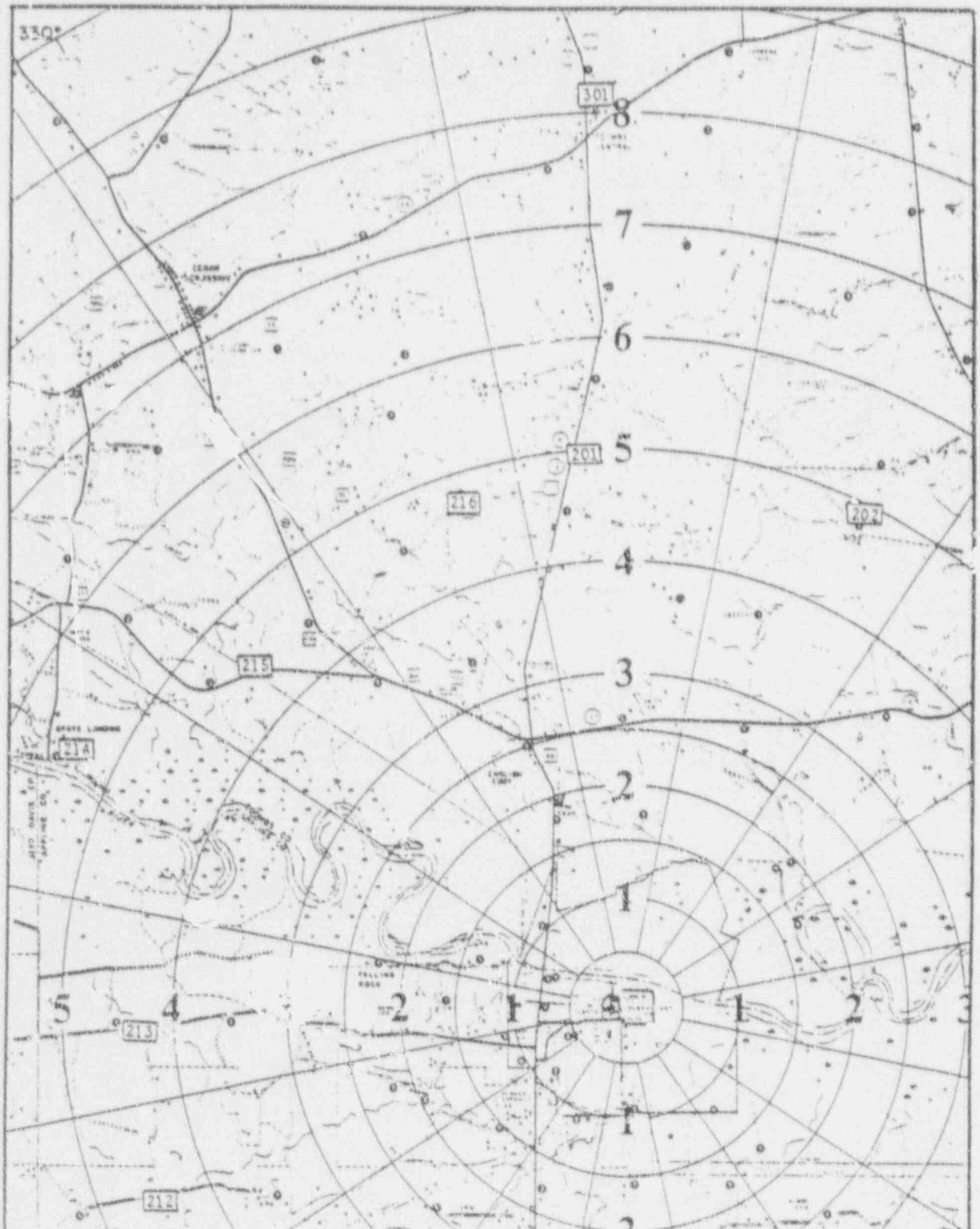
d. Station 170 is located approximately 0.6 river miles upstream of the intake structure for river water, 1.1 river miles for sediment and clams, and 1.5 river miles for fish.

Station 172 is located approximately 3.0 river miles downstream of the discharge structure for river water, sediment and clams, and 1.7 river miles for fish.

The location from which river water and sediment may be taken can be sharply defined. Often, the sampling locations for clams have to be extended over a wide area to obtain a sufficient quantity. High water adds to the difficulty in obtaining clam samples and may also make an otherwise suitable location for sediment sampling unavailable. A stretch of the river of a few miles or so is generally needed to obtain adequate fish samples. The mile locations given above represent approximations of the locations where the samples are collected.



Georgia Power — EDWIN I. HATCH NUCLEAR PLANT	RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATION MAP (SITE PERIPHERY)
	FIGURE 2-1



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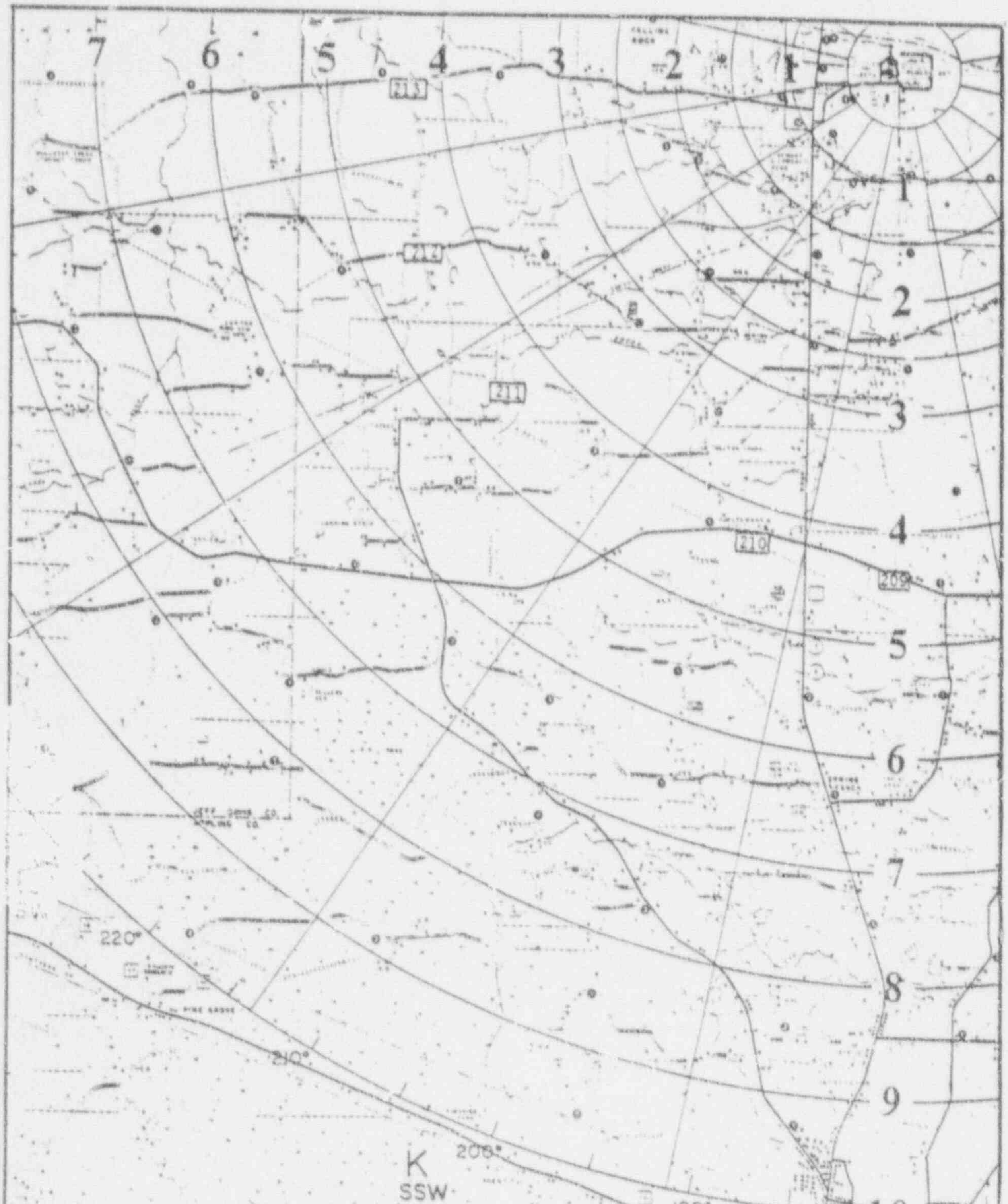
EDWIN I. HATCH NUCLEAR PLANT

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATION MAP (BEYOND SITE VICINITY)

FIGURE 2-2 (SHEET 1 OF 3)



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EDWIN I. HATCH NUCLEAR PLANT

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATION MAP (BEYOND SITE VICINITY)

FIGURE 2-2 (SHEET 2 OF 3)

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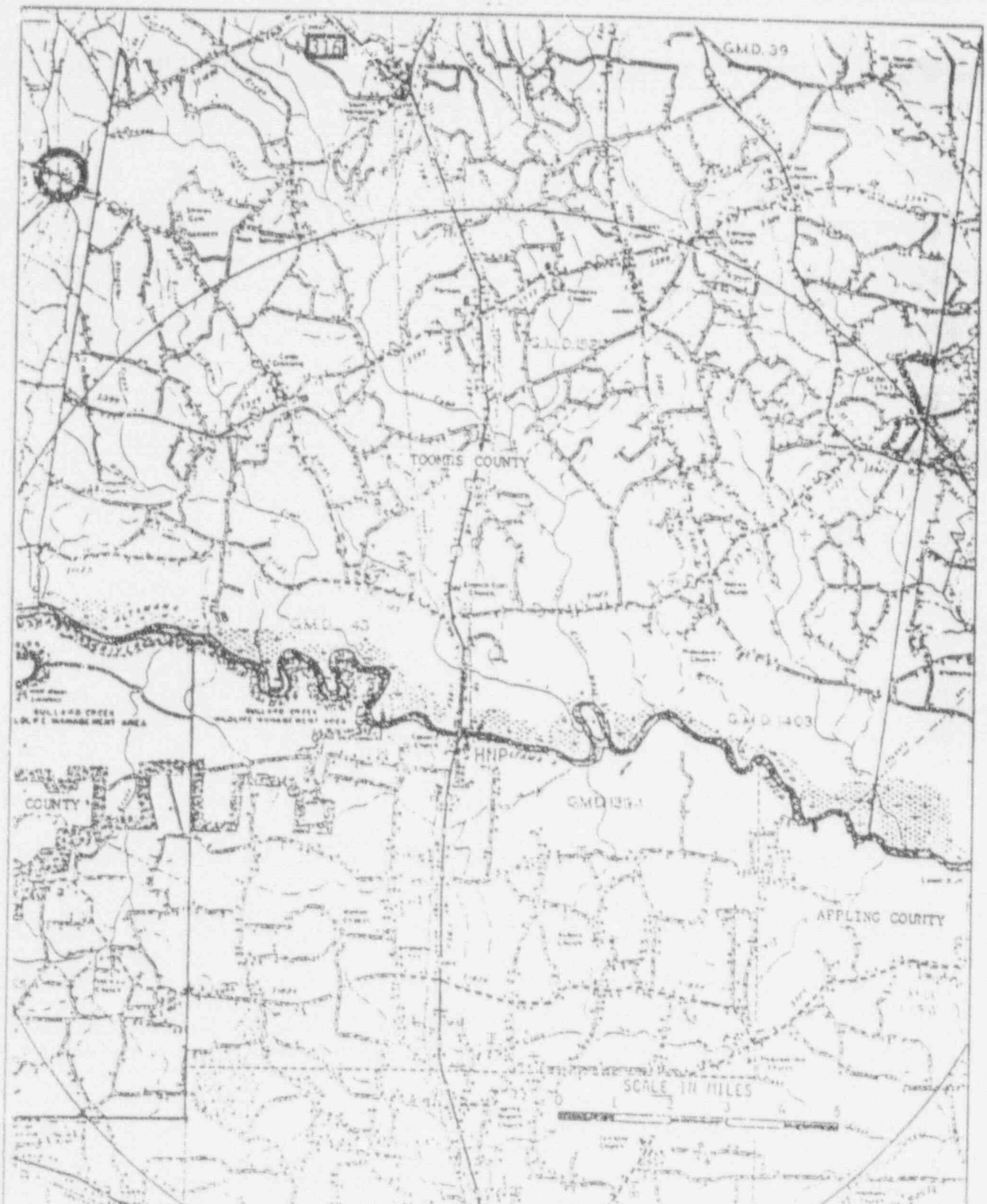
EDWIN I. HATCH NUCLEAR PLANT

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATION MAP (BEYOND SITE VICINITY)

FIGURE 2-2 (SHEET 3 OF 3)



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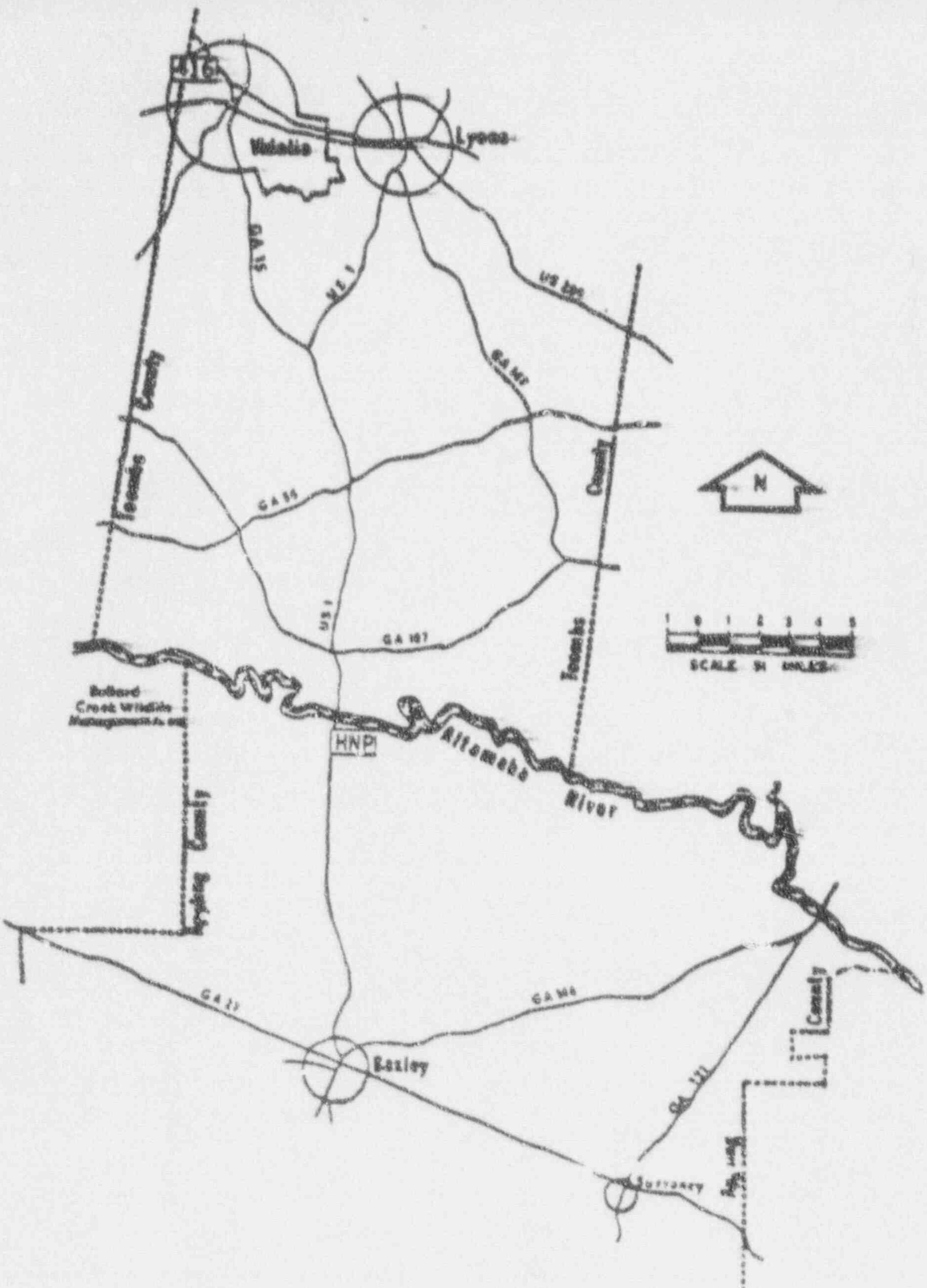
EDWIN I. HATCH NUCLEAR PLANT – UNIT 1

LOCATION OF ADDITIONAL CONTROL STATION FOR MILK

FIGURE 2-3



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EDWIN I. HATCH
NUCLEAR PLANT

LOCATION OF ADDITIONAL CONTROL
STATION FOR TLDs AND VEGETATION

FIGURE 2-4

3.0 RESULTS SUMMARY

In accordance with Section 6.9.1.7 of the TS, summarized and tabulated results for all of the regular samples collected for the year at the designated indicator and control stations are presented in Table 3-1 in the format of Table 6.9.1.7-1 of the TS. Only manmade radionuclides are reported. Results for samples collected at locations other than indicator or control stations or in addition to those stipulated by Table 2-1 are included in Section 4, the discussion of results section, for the type sample.

TABLE 3-1 (SHEET 1 OF 5)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366
Aopling County, Georgia, Calendar Year 1991

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (a) (LLD)	All Indicator Locations Mean (b) Range (Fraction)	Location with Highest Annual Mean Name Distance & Direction	Location with Highest Annual Mean Mean (b) Range (Fraction)	Control Locations Mean (b) Range (Fraction)	Number of Reportable Occurrences
Airborne Particulates (fCi/m^3)	Gross Beta 308	10	18.1 5-46 (206/206)	No. 116 Inner Ring 1.6 miles NNW	18.4 6-42 (52/52)	18.0 7-48 (102/102)	0
	Gamma Isotopic 24						
	Cs-134	50	NDM (c)		NDM	NDM	0
	Cs-137	60	NDM	No. 304 11.3 miles ENE	1.7 1.7-1.7 (1/4)	1.7 1.7-1.7 (1/8)	0
Airborne Radioiodine (fCi/m^3)	I-131 308	70	NDM		NDM	NDM	0
Direct Radiation (mR/91 days)	Gamma Dose 76	NA (d)	15.1 11-21 (64/64)	No. 104 Inner Ring 1.6 miles ENE	18.1 14-21 (4/4)	13.6 10-16 (12/12)	0
Milk (pCi/l)	Gamma Isotopic 27						
	Cs-134	20	NA		NDM	NDM	0
	Cs-137	20	NA		NDM	NDM	0

TABLE 3-1 (SHEET 2 OF 5)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366
Appling County, Georgia, Calendar Year 1991

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (a) (LLD)	All Indicator Locations Mean (b) Range (Fraction)	Location with Highest Annual Mean: Name Distance & Direction	Location with Highest Annual Mean: Mean (b) Range (Fraction)	Control Locations Mean (b) Range (Fraction)	Number of Reportable Occurrences
	Ba-140	60	NA		NDM	NDM	0
	La-140	20	NA		NDM	NDM	0
	I-131 27	1	NA		NDM	NDM	0
Grass (pCi/kg wet)	Gamma Isotopic 36						
	I-131	60	NDM		NDM	NDM	0
	Cs-134	60	NDM		NDM	NDM	0
	Cs-137	80	34.1 13-46 (8/24)	No. 112 Inner Ring 1.0 miles WSW	37.8 27-46 (4/4)	36.0 28-45 (2/12)	0
River Water (pCi/l)	Gamma Isotopic 24						
	Mn-54	20	NDM		NDM	NDM	0
	Fe-59	30	NDM		NDM	NDM	0
	Co-58	20	NDM		NDM	NDM	0
	Co-60	20	NDM		NDM	NDM	0

TABLE 3-1 (SHEET 3 OF 5)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366
Appling County, Georgia, Calendar Year 1991

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (a) (LLD)	All Indicator Locations Mean (b) Range (Fraction)	Location with Highest Annual Mean: Name Distance & Direction	Location with Highest Annual Mean: Mean (b) Range (Fraction)	Control Locations Mean (b) Range (Fraction)	Number of Reportable Occurrences
	Zn-65	30	NDM		NDM	NDM	0
	Zr-95	30	NDM		NDM	NDM	0
	Nb-95	20	NDM		NDM	NDM	0
	I-131	20 (e)	NDM		NDM	NDM	0
	Cs-134	20	NDM		NDM	NDM	0
	Cs-137	20	NDM		NDM	NDM	0
	Ba-140	60	NDM		NDM	NDM	0
	La-140	20	NDM		NDM	NDM	0
	Tritium 8	3000 (f)	NDM		NDM	NDM	0
Fish (pCi/kg wet)	Gamma Isotopic 10						
	Mn-54	100	NDM		NDM	NDM	0
	Fe-59	300	NDM		NDM	NDM	0
	Co-58	100	NDM		NDM	NDM	0
	Co-60	100	NDM		NDM	NDM	0

TABLE 3-1 (SHEET 4 OF 5)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366
Appling County, Georgia, Calendar Year 1991

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (a) (LLD)	All Indicator Locations Mean (b) Range (Fraction)	Location with Highest Annual Mean: Name Distance & Direction	Location with Highest Annual Mean: Mean (b) Range (Fraction)	Control Locations Mean (b) Range (Fraction)	Number of Reportable Occurrences
	Zn-65	300	NDM		NDM	NDM	0
	Cs-134	100	NDM		NDM	NDM	0
	Cs-137	200	32.9 22-53 (5/5)	No. 172 Downriver 1.7 miles	32.9 22-53 (5/5)	26.9 17-40 (5/5)	0
Sediment (pCi/kg dry)	Gamma Isotopic 4						
	Co-60	40 (g)	124.0 62-190 (2/2)	No. 172 Downriver 3.0 miles	124.0 62-190 (2/2)	NDM	0
	Cs-134	200	NDM		NDM	NDM	0
	Cs-137	200	43.1 37-49 (2/2)	No. 170 Upriver 1.1 miles	54.5 17-92 (2/2)	54.5 17-92 (2/2)	0
	Mn-54	10 (g)	57.2 57-57 (1/2)	No. 172 Downriver 3.0 miles	57.2 57-57 (1/2)	NDM	0
	Zn-65	20 (g)	250 250-250 (1/2)	No. 172 Downriver 3.0 miles	250 (250-250) (1/2)	NDM	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366
Appling County, Georgia, Calendar Year 1991

a. The LLD is defined in table notation a of Table 4.16.1-1, of the TS. Except as noted otherwise, the values listed in the column are those found in that table. In practice, the LLDs attained are generally much lower than the values listed.

b. Mean and range are based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses.

c. No Detectable Measurement(s).

d. Not Applicable.

e. Since no drinking water pathway exists, the LLD from the gamma isotopic analysis may be used (see notation c of Table 4.16.1-1 of the TS). The value listed is the objective LLD.

f. If a drinking water pathway existed, a LLD of 2000 pCi/l would have been used (see notation d of Table 4.16.1-1 of the TS).

g. The EL has determined that this value may be routinely attained. No value was provided in Table 4.16.1-1 of the TS.

4.0 DISCUSSION OF RESULTS

An interpretation and evaluation, as appropriate, of the laboratory results for each type sample are included in this section. Relevant comparisons are made between the difference in average values for indicator and control stations and the calculated Minimum Detectable Difference (MDD) between these two groups at the 99 percent Confidence Level (CL). The MDD is determined using the standard Student's t-test. A difference in the average values which is less than the MDD is considered to be statistically indiscernible. Pertinent results were also compared with past results including preoperations. The results were examined to perceive any trends. To provide perspective, a result might also be compared with its Reporting Level (RL) or Lower Limit of Detection (LLD), which are provided by Tables 3.16.1-2 and 4.16.1-1 of the TS, respectively. Attempts were made to explain any RLs or other high radiological levels found in the samples.

The annual land use survey as required by Section 3.16.2 of the TS was conducted on October 7, 1991. The location of the nearest permanent residence in each of the 16 meteorological sectors within a distance of 5 miles as required by the survey is listed in Table 4-1. The results of the milk animal component of the survey are presented in Subsection 4.3. The results of the annual river survey required by Note f in Table 2-1 are presented in Subsection 4.5.

To flag any result which differed from the others in its set by a relatively large amount, the practice of testing all results for conformance to Chauvenet's Criterion[1] was introduced in 1990. Identified outliers were investigated to determine reasons for deviating from the norm. If an equipment malfunction or other valid physical reason was found, the anomalous result was deemed non-representative and excluded from the data set. No datum was excluded for failing Chauvenet's Criterion only.

[1] G. D. Chase and J. L. Rabinowitz, Principles of Radioisotope Methodology (Burgess Publishing Company, 1962) 87-90.

TABLE 4-1

LOCATION OF THE NEAREST
PERMANENT RESIDENCE IN EACH SECTOR

SECTOR	DISTANCE (miles)
N	2.0
NNE	2.9
NE	3.2
ENE	4.2
E	*
ESE	3.7
SE	1.8
SSE	2.0
S	1.0
SSW	1.3
SW	1.1
WSW	1.1
W	1.1
WNW	1.1
NW	3.6
NNW	1.8

*None within 5 miles.

4.1 Airborne

As indicated by Table 2-2, airborne particulates and airborne radioiodine are collected at 4 indicator stations (Nos. 103, 107, 112, and 116) which encircle the site boundary and at 2 control stations (Nos. 304 and 309) which are at least 10 miles from the plant. At these locations air is continuously drawn through a Gelman Type A/E glass fiber filter and a SAI CP-200 charcoal canister in sequence to retain airborne particulates and airborne radioiodine, respectively. The filters and canisters are collected weekly.

As a consequence of equipment malfunctions, the gross beta results for four airborne particulate samples and the I-131 result for four airborne radioiodine samples were rejected. Each of the gross beta results had failed Chauvenet's Criterion. In 1990 there were two failures in obtaining adequate airborne particulate samples and one failure in obtaining adequate airborne radioiodine sample.

On March 18, the power to the air pump motor at Station 112 was disconnected while a new pole was installed. This resulted in a low sample volume with subsequent failure of Chauvenet's Criterion. Both the particulate and radioiodine samples were excluded.

At Station 107, on September 3, 1991, the air pump was discovered not running due to motor malfunction. Again low volume of sampled air led to failure of Chauvenet's Criterion. Both the particulate and radioiodine samples were excluded.

On October 28 and on December 9, 1991, at Station 304, the air pump was discovered not running due to motor malfunction. Uncertain sample volume led to failure of Chauvenet's Criterion. In both instances the particulate and radioiodine samples were excluded.

Each of the air particulate filters is counted for gross beta activity. As seen in Table 3-1, the annual average weekly activity of 18.1 fCi/m^3 for the indicator stations is 0.1 fCi/m^3 greater than that for the control stations. However, this difference is not discernible since it is less than the MDD, calculated as 2.1 fCi/m^3. During the 9 years prior to 1991, the absolute value of the difference between the average weekly activities for the indicator and control stations was never greater than about 2 fCi/m^3. The average activity for the control stations was greater than that for the indicator stations on three occasions. Although the differences fluctuated randomly, the average activity over the entire 9 year period for the control stations was about 0.2 fCi/m^3 greater than that for the indicator stations.

The average weekly gross beta activity for all stations during 1991 was less than that for 1990 by 1.0 fCi/m^3 (18.1 fCi/m^3 versus 19.1 fCi/m^3). In past years, it had been an order of magnitude higher. For example: the average weekly activity was 140 fCi/m^3 during preoperations, 242 fCi/m^3 during 1977, and 195 fCi/m^3 during 1981. Those high values were shown to be the result of fallout from numerous nuclear weapons tests conducted on mainland China in the early 1970s and from 1976 through 1980. With the termination of the weapons tests, the gross beta levels in recent years have become much lower. The annual average was 33 fCi/m^3 for 1982, and this steadily decreased to 22 fCi/m^3 for 1985. However, during 1986 as a consequence of the Chernobyl incident, the average activity increased to 37 fCi/m^3. The annual averages for 1987 and 1988 were 23 and 22 fCi/m^3, respectively.

During 1991, for the fifth consecutive year, no manmade radionuclides were detected in the gamma isotopic analyses of the quarterly composites of air particulate filters. During preoperations and each year of operations through 1986, numerous fission products and some activation products were detected. These were generally attributed to the nuclear weapons tests. With the cessation of the tests, the number of radionuclides detected became scant and their levels low. The positive results found during 1986 were attributed to the Chernobyl incident.

The charcoal canisters used for adsorbing iodine from the atmosphere were analyzed for I-131 by gamma spectroscopy. I-131 was not detected in any of the samples during the year. The maximum allowed LLD is 70 fCi/m^3; however, the activity usually attained was about a third of this value.

Positive results for airborne radioiodine are not normally obtained. However, during 1976, 1977, and 1978, positive levels of I-131 were found in nearly all of the samples collected for a period of a few weeks after the arrival of the cloud from each of the Chinese nuclear weapons tests conducted at that time; some of the levels were on the order of the maximum allowed LLD (that is, 70 fCi/m^3). In 1986, the same phenomenon occurred; however, in this case, the positive levels were attributed to the Chernobyl incident. The highest airborne I-131 level found to date was 217 fCi/m^3 in 1977. The RL called for in Table 3.16.1-2 of the TS is 900 fCi/m^3.

4.2 Direct Radiation

Direct (external) radiation is measured by TLDs. Two TLD badges are placed at each station; each badge contains four calcium sulfate TLD cards.

Two TLD stations are established in each of the 16 meteorological sectors about the plant. The inner ring of stations (Nos. 101 through 116) is located near the site boundary, while the outer ring (Nos. 201 through 216) is located at a distance of about 4 to 5 miles. These rings were installed at the beginning of 1980 to meet the requirements of Revision 1 to the Technical Position of the Radiological Assessment Branch of the Nuclear Regulatory Commission (NRC), dated November 1979. However, each of the stations in the East Sector is at a radius which is a few miles greater than the other stations in its ring; flood plains in this sector prevent easy access on a year-round basis to the site boundary and to the 4 to 5 mile annulus. The 16 stations forming the inner ring are designated as the indicator stations. The three control stations (Nos. 304, 309 and 416) are at least 10 miles from the plant. Stations 064 and 301 accommodate special interest areas. Station 064 is located in an onsite roadside park, while Station 301 is located adjacent to Toombs Central School. Station 210 in the outer ring is located adjacent to the Altamaha School, the only other nearby school.

As shown in Table 3-1, the average quarterly dose of 15.1 mR acquired at the indicator stations (inner ring) was 1.5 mR greater than that acquired at the control stations. This difference is barely discernible since it is greater than the calculated statistical difference of 1.47 mR. For the 11 year period, 1980 through 1990: 1) the absolute value of the difference between annual average quarterly doses acquired at these two station groups varied from 0 to 1.6 mR, 2) the average dose was greater at the indicator stations six times, and 3) the average dose at the indicator stations during this entire period was 0.1 mR greater than that at the control stations. No trends in the data for these station groups were recognized.

The quarterly doses acquired at outer ring stations ranged from 12.3 to 20.7 mR with an average of 15.6 mR for 1991, which is 0.5 mR greater than that found for the inner ring. There was no discernible difference between the averages for the inner and outer rings, since this difference is less than the calculated MDD of 0.87 mR. From 1980 through 1986, the average quarterly dose for the inner ring stations was greater than that for the outer ring stations by amounts ranging from 0.2 to 1.0 mR; the average difference was

0.6 mR. From 1987 through 1990, the average quarterly dose for the outer ring was greater than that for the inner ring by amounts ranging from 0.1 to 0.4 mR; the average difference was 0.2 mR.

The quarterly doses in units of mR acquired at the special interest areas were:

Location	Average	Minimum	Maximum
Roadside Park	14.4	14.1	14.8
Toombs Central School	15.2	13.5	16.9

These doses are seen to be on the order of those acquired at the other stations.

The average quarterly dose for all of the TLDs placed in the field varied very little from 1986 through 1988, when it was 14.7, 15.0, and 15.1 mR, respectively. For 1989, this overall average was 16.6 mR or about 11 percent greater than that for the previous 3 year period. For 1990, the overall average quarterly dose of 14.7 mR returned to that of the 3 year period prior to 1989. The overall average quarterly dose of 15.3 mR for 1991 is approximately one percent greater than the average for the previous five year period.

Not infrequently, TLDs are lost due to theft or vandalism. Near the middle of each quarter, the TLD stations are checked for missing or damaged badges; replacement badges are provided as needed. If both badges are missing at the end of the quarter, the dose for the quarter for that location cannot be assessed. At the end of the third quarter, at Station 104, TLD 104A was found lying on the ground, with a torn plastic cover, and subsequently failed Chauvenet's Criterion. However, TLD 104B which is also located at Station 104, was not damaged and was used to determine the dose for Station 104 for the third quarter. During 1991, one badge from one station was lost. In 1990, six badges from three different stations were lost.

4.3 Milk

Milk samples from cows were obtained biweekly at Station 304 (the state prison dairy) throughout the year. Since Thompson's Dairy ceased operations in 1990, there are no milk sampling locations other than the state prison dairy. This location is a control station. Gamma isotopic and I-131 analyses were performed on each sample.

The annual land use survey to identify the location of the nearest milk animal in each of the 16 meteorological sectors within a distance of 5 miles and the location of all milk animals within a distance of 3 miles was conducted on October 7, 1991. No milk animals were found. A milk animal is a cow or goat producing milk for human consumption.

During the year, no man-made radionuclide was detected from the gamma isotopic analyses of the milk samples. Each year since 1978, when gamma isotopic analysis of milk samples became a requirement, positive levels of Cs-137 were found in some of the samples, except for 1987 and 1990. No other man-made radionuclide has been detected in the milk samples by this type of analysis.

During preoperations, a chemical separation technique was employed to measure the Cs-137 levels in milk samples; the levels ranged from 2 to 60 pCi/l with an average value of 19.3 pCi/l. The frequency of occurrence, the range of values, and the average value in units of pCi/l in milk samples during each of the following periods indicate Cs-137 is being found less often and at lower levels.

Period	Frequency	Minimum	Maximum	Average
1978-1983	0.267	2.0	57.1	14.8
1984-1986	0.178	4.3	15.1	9.4
1988-1990	0.026	7.9	12.0	9.6

These positive values for Cs-137 are attributed to the nuclear weapons tests of the 1970s and before, and to the Chernobyl incident of 1986. During the latter half of 1986, milk became permanently unavailable at two stations. The lower levels after 1986 are believed, at least partially, to be due to changes in the location of the milk stations.

During 1991, I-131 was not detected in any of the milk samples. During preoperations, all readings for I-131 were less than 2 pCi/l, which was the allowed LLD at that time. Positive results were found during each year of the first 5 years of operations (1974 through 1978); these results ranged from 0.95 to 88 pCi/l. In 1980, positive results ranged from 0.7 to 1.8 pCi/l, while in 1986, positive results ranged from 0.6 to 20 pCi/l. In 1988, a single reading of 0.32 pCi/l, which was believed to have resulted from a procedural deficiency, was reported. The LLD and RL for I-131 are 1 and 2 pCi/l, respectively. All positive readings for I-131 have been generally attributed to fallout from the nuclear weapons tests and the Chernobyl incident.

4.4 Grass

The TS call for the gamma isotopic analysis of grass samples collected monthly at three locations. Two indicator stations (Nos. 106 and 112) and one control station (No. 416) have been designated for these collections. Gamma isotopic analysis has been performed on grass samples since 1978.

The results presented in Table 3-1 show that Cs-137 is the only manmade radionuclide detected; this has been the case since 1986. The levels of Cs-137 in grass reported in Table 3-1 are in the same range as those found in recent years. Positive results were found in about 28 percent of the samples collected. Since 1985 , positive results were found in approximately 25 to 50 percent of the samples collected at the indicator stations. The present control station was established in 1989; the first positive result was found there in 1990. For 1991, the Cs-137 levels at the control station was 1.9 pCi/kg wet greater than the average level at the indicator stations. However, this is not a discernible difference since it is less than the calculated MDD of 24.5 pCi/kg wet. The LLD and RL for Cs-137 are 80 and 2000 pCi/kg wet, respectively. The presence of Cs-137 in grass samples is attributed to fallout from the nuclear weapons tests of years past and to a lesser extent from the Chernobyl incident of 1986.

4.5 River Water

Surface water is composited from the Altamaha River at an upstream location (Station 170) and at a downstream location (Station 172) using ISCO automatic samplers. Small quantities are collected at intervals not exceeding a few hours. River water collected by these machines is picked up monthly; quarterly composites are composed of the monthly collections.

A gamma isotopic analysis is made on each monthly collection. As usual, no manmade radionuclides were detected. The occurrence of positive results for a manmade radionuclide has been infrequent. The only manmade radionuclides detected previously (by gamma isotopic analysis) were as follows:

Year	Quarter	Station	Radionuclide	Level (pCi/l)
1975	4th	172	Ce-141	78.2
1986	2nd	170	La-140	18.0
1986	2nd	172	Cs-137	12.0
1988	2nd	170	Cs-137	6.8

The positive results for 1986 were attributed to the Chernobyl incident.

Tritium analyses are performed on the quarterly composites. No positive results were found. Up until about five years ago, tritium was usually found in each composite, at levels of 200 to 300 pCi/l.

On September 23, the annual survey of the Altamaha River was conducted downstream of the plant for at least 50 river miles to identify anyone who may use river water for drinking purposes. As in all previous surveys, no intakes for drinking water or irrigation were observed. This was corroborated by information obtained from the State of Georgia that no new surface water permits for drinking water or irrigation purposes on the Altamaha River had been issued. If river water should become used for drinking, the TS requirements for its sampling and analysis will be implemented.

4.6 Fish

Gamma isotopic analyses were performed on the edible portion of the fish samples collected at the river stations on June 10 and October 14. The control station (No. 170) is located upstream of the plant, and the indicator station (No. 172) is located downstream of the plant. In June, largemouth bass, black crappie, and redear sunfish were collected at the control station, while largemouth bass, bluegill sunfish, and redear sunfish were collected at the indicator station. In October, largemouth bass and channel catfish were collected at the control station and at the indicator station. As shown in Table 3-1, Cs-137 was the only manmade radionuclide detected. The average level for all the samples with positive results was about 20 percent higher than that for 1990 but only 42 percent of that for the period of 1983 through 1988. The average level of 32.9 pCi/kg wet at the indicator station is seen to be 6.0 pCi/kg wet greater than that at the control station. This difference is not discernible, however, since it is less than the calculated MDD of 18.9 pCi/kg wet. The LLD and RL are 200 and 2000 pCi/kg wet, respectively.

In the past, the only other manmade radionuclide detected in fish samples by the gamma isotopic analysis were Co-60 and Cs-134. During preoperations, Co-60 was detected in one fish sample at a very low level. During the period of 1983 through 1988, Cs-134 was found in about half the samples at levels on the order of those found for Cs-137.

Fish samples are required to be collected semiannually which is defined by Table 1.1 of the TS as once per 184 days. A sampling interval may be extended up to 25 percent according to Section 1.0.II of the TS. Hence the maximum interval for a semiannual collection is 230 days. For the past few years fish samples have been collected during April and October. In 1990, fish samples were collected on April 16 and October 15. The first collection in 1991 should have been no later than June 9; the collection took place on June 10.

Fish collection had been scheduled for April 15, but was postponed due to high river elevation as a consequence of heavy rainfall. Collection was attempted on April 29 but no fish were caught. During this period, the river levels in feet above normal were found to be as follows:

April 10	12.2
April 22	8.2
April 29	8.6
May 3	8.5
May 14	9.8
May 28	6.8
June 4	6.0

At high elevations, the river overflows its banks and the fish tend to enter swamp areas which are not accessible to the boat used for fishing. The availability of fish in the river channel becomes scant. High river elevations also produce hazardous conditions. Unavailability of samples and hazardous conditions are two of the circumstances for which the TS permit deviations from the regular collection schedule.

4.7 Sediment

The semiannual collections of sediment took place on May 6 and November 4 at the river stations. Although the TS require only an annual collection, a second collection was added in 1989 to increase the statistical base.

A gamma isotopic analysis was performed on each sample. Positive results were obtained for Cs-137 in each sample. Positive results were also found for Co-60 in each sample collected at the downstream station (No. 172). In the samples collected at the downstream station (No. 172) in November, Mn-54 and Zn-65 were detected.

Positive readings for Cs-137 have been found in every sample since 1980 and in over 90 percent of all of the samples collected, including those during preoperations. As shown in Table 3-1, the average level of 43.1 pCi/kg dry found at the indicator (downstream) station is 11.4 pCi/kg dry less than that at the control (upstream) station. There is no discernible difference between these values since the difference is less than the calculated MDD of 264.2 pCi/kg dry. Typically, the Cs-137 levels have been several times greater than those found in 1990 and 1991.

The activation product Co-60 was found in regular samples on four previous occasions - twice at each station. As shown in Table 3-1, the levels found at the indicator station (124 pCi/kg dry) is 73 percent higher than those found in previous years (67.8, 108, and 33 pCi/kg dry). No Co-60 was found at the control station compared to 31, 33, and 19 pCi/kg dry in previous years. The assigned LLD for Co-60 is 40 pCi/kg dry.

The activation products Mn-54 and Zn-65 were found in the samples collected on November 4 at the downstream station (No. 172). As shown in Table 3-1, the levels for Mn-54 and Zn-65 were 57.2 pCi/kg dry and 250 pCi/kg dry, respectively. Since neither of these radionuclides was detected in samples collected at the upstream station (No. 170), both are assumed to be due to plant releases. No reporting levels nor required LLDs are specified for these radionuclides; calculated LLDs are shown in Table 3-1.

The potential radiological impact due to the presence of the levels of Co-60, Mn-54 and Zn-65 found in shoreline sediment was assessed by calculating the total body dose due to direct radiation (from the sediment) to an individual using the methodology and parameters presented in NRC Regulatory Guide 1.109, Revision 1, 1977. These calculated potential doses were then compared to the dose limits specified in Section 3.11.1.2.b of the TS (3 mrem in a year).

The potential doses were calculated to be 4.94 microrem per year due to Co-60, 0.78 microrem per year due to Mn-54 and 2.35 microrem per year due to Zn-65; these potential doses are 0.16, 0.03 and 0.08 percent of TS limits, respectively.

During the past 10 years, Cs-134 was detected in 40 percent of the regular samples collected at the indicator station. The levels ranged from 31 to 505 pCi/kg dry, with an average of 259 pCi/kg dry. As shown in Table 3-1, no Cs-134 was found this year at the indicator station nor at the control station. Positive levels of 40 and 50 pCi/kg dry were found in samples collected at the control station during preoperations and 1984, respectively.

In past years, various fission products and activation products were found in sediment samples; the levels were significant in some of the samples. Their presence was generally attributed to the nuclear weapons tests or to the Chernobyl incident.

5.0 INTERLABORATORY COMPARISON PROGRAM

Section 3.16.3 of the TS requires that analyses be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program approved by the NRC. The Environmental Protection Agency's (EPA's) Environmental Radioactivity Laboratory Intercomparison Studies (Crosscheck) Program conducted by the Environmental Monitoring and Support Laboratory in Las Vegas, Nevada, provides such a program. Reported herein, as required by Section 4.16.3 of the TS, are the results of the EL's participation in the EPA Crosscheck Program.

The Crosscheck Program was designed for laboratories involved with REMPs; it includes environmental media and a variety of radionuclides with activities at or near environmental levels. Participation in the program ensures that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed; REMP results can thereby be demonstrated to be reasonably valid.

Simulated environmental samples are distributed regularly to the participants who analyze the samples and return the results to the EPA for statistical analysis and comparisons with known values and results obtained from other participating laboratories. The Crosscheck Program provides each participant with documentation of its performance; this can be helpful in identifying any instrument or procedural problems.

The EL's participation in the program consists of the analyses on the radioactive materials supplied by the program that correspond with those required by Table 2-1. Analyses were performed in a normal manner. Each sample was analyzed in triplicate as required by the program. Results obtained from the gross beta and gamma isotopic analyses of air filters, the gamma isotopic and I-131 analyses of milk samples, and the tritium and gamma isotopic analyses of water samples are summarized in Table 5-1.

Delineated in Table 5-1 for each of the environmental media are the type analysis performed, EPA's collection date, the known value and expected precision (one standard deviation) provided by the EPA, the average result obtained by the EL, the standard deviation of the EL's result, the normalized deviation (from the known result), and the normalized range. The normalized deviation and normalized range were also provided by the EPA.

The normalized deviation from the known value provides a measure of the central tendency of the data (accuracy). The normalized range is a measure of the dispersion of the data (precision). An absolute value of three standard deviations was established by the EPA as the control limit. An absolute value of two standard deviations was established as the warning limit. The EL considers any value greater than the control limit as unacceptable. Investigations are undertaken whenever any value exceeds the warning limit or whenever a plot of the values indicates a trend.

As may be seen from Table 5-1, the normalized deviation and the normalized range in each case were within control limits but the warning limit was exceeded for the Cs-137 analysis on air filters on March 29 and August 30. The warning limit was exceeded for the Ru-106 analysis in water on February 8 and October 4. Also the warning limit was exceeded for the Co-60 analysis in water on October 4.

For Cs-137 on air filters, the investigation into the positive bias for normalized deviations led to the conclusion that this condition was the result of differences between the geometry of the calibration standard and the EPA Crosscheck sample. Geometry corrections are being developed.

For Ru-106 and Co-60 in water, the investigation led to the conclusion that the positive bias for normalized deviations probably resulted from changes in background count rate following relocation of the detectors. Computer software is being developed to evaluate background data to revise peak background correction values.

One sample, collected June 7, had a normalized range of 2.28 for Ba-133 in water. The sample analysis results were investigated, found to be correct, and no reason was found for the higher normalized range value. All other normalized range values for Ba-133 in water have been within the two standard deviations warning limit. The result was not investigated further since the result was within the three standard deviations control limit and no trend was indicated.

TABLE 5-1 (SHEET 1 OF 2)

CROSSCHECK PROGRAM RESULTS

Analysis	Date Collected	Known Value	Expected Precision	Reported Average	Standard Deviation	Normalized Deviation	Normalized Range
				Air Filters (pCi/filter)			
Gross Beta	03/29/91	124.0	6.0	122.67	1.53	-0.38	0.30
	03/30/91	92.0	10.0	92.67	0.58	0.12	0.06
Cs-137	03/29/91	40.0	5.0	46.67	4.51	2.31	1.12
	08/30/91	30.0	5.0	36.33	1.15	2.19	0.24
				Milk (pCi/l)			
I-131	04/26/91	60.0	6.0	59.67	3.79	-0.10	0.69
	09/27/91	108.0	11.0	104.33	3.79	-0.58	0.38
Cs-137	04/26/91	49.0	5.0	50.67	1.53	0.58	0.35
	09/27/91	30.0	5.0	31.67	4.51	0.58	1.12
				Water (pCi/l)			
H-3	02/22/91	4418.0	442.0	4726.67	75.06	1.21	0.17
	06/21/91	12480.0	1248.0	13200.00	173.20	1.00	0.12
	10/18/91	2454.0	352.0	2713.33	64.29	1.28	0.20
Co-60	02/08/91	40.0	5.0	39.33	3.21	-0.23	0.71
	06/07/91	10.0	5.0	13.67	2.52	1.27	0.59
	10/04/91	29.0	5.0	35.00	3.46	2.08	0.71
Zn-65	02/08/91	149.0	15.0	152.33	3.21	0.38	0.24
	06/07/91	108.0	11.0	115.67	14.05	1.21	1.96
	10/04/91	73.0	7.0	78.33	6.43	1.32	1.02

TABLE 5-1 (SHEET 2 OF 2)

CROSSCHECK PROGRAM RESULTS

Analysis	Date Collected	Known Value	Expected Precision	Reported Average	Standard Deviation	Normalized Deviation	Normalized Range
			Water (pCi/l) (Continued)				
Ru-106	02/08/91	186.0	19.0	217.00	6.24	2.83	0.37
	06/07/91	149.0	15.0	141.00	5.20	-0.92	0.35
	10/04/91	199.0	20.0	225.33	8.02	2.28	0.[illegible]7
Cs-134	02/08/91	8.0	5.0	11.00	0.00	1.04	0.00
	04/16/91	24.0	5.0	22.00	4.58	-0.69	1.12
	06/07/91	15.0	5.0	17.00	0.00	0.69	0.00
	10/04/91	10.0	5.0	11.33	1.15	0.46	0.24
Cs-137	02/08/91	8.0	5.0	9.33	0.58	0.46	0.12
	04/16/91	25.0	5.0	26.67	1.15	0.58	0.24
	06/07/91	14.0	5.0	18.67	4.62	1.62	0.95
	10/04/91	10.0	5.0	11.67	1.53	0.12	0.35
Ba-133	02/08/91	75.0	8.0	73.00	2.65	-0.43	0.37
	06/07/91	62.0	6.0	63.33	8.62	0.38	2.28
	10/04/91	98.0	10.0	98.00	2.65	0.00	0.30

6.0 CONCLUSIONS

This report confirms the licensee's conformance with Section 3/4.16 of the TS during the year. It shows that all data were carefully examined. A summary and a discussion of the results of the laboratory analyses for each type sample collected are presented. All results indicate no measurable adverse radiological impact to the environment as a result of plant discharges to the river or to the atmosphere.