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1978

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2. RADIOLOGICAL MONITORING

2.1 INTRODUCTION

The results of the radiological environmental monitoring program for the calendar year 19[illegible] are reported herein. An assessment of the radiological impact [illegible]lant's operation upon the environment is provided. Reports on various related activities are also included.

An Operating License for Unit 2 was issued on June 13, 1978; the Unit 2 reactor achieved initial criticality on July 4, 1978. The NRC Branch Technical Position (issued April 11, 1978) on radiological environmental monitoring was used as a guideline in writing that portion of the proposed Environmental Technical Specifications (ETS) for Unit 2. Furthermore, these ETS were written and reviewed to be site specific rather than applicable only to Unit 2. However, approval to delete the old Unit 1 ETS and to accept the new ETS was not obtained until November 16, 1978. Now with identical ETS for each unit we have in effect one site specific ETS. Sampling and analysis to satisfy the radiological environmental monitoring requirements of the new ETS were implemented prior to the issuance of the Unit 2 Operating License. Sampling and analysis necessary to satisfy the radiological environmental monitoring requirements of the old Unit 1 ETS continued, however, until the end of 1978. Only the requirements of the new ETS are expected to be followed subsequently. Specific changes in the requirements of the radiological environmental monitoring program are pointed out in appropriate sections of this chapter.

A summary, interpretation, and evaluation of the analytical results obtained from the samples utilized to monitor discharges to the atmosphere, river, and ground are provided as feasible in Sections 2.2, 2.3, and 2.4, respectively. As practical, the data tabulated for each station consist of: the maximum, minimum, and average values of the radiological level; the number of samples (n); and the standard deviation (s). Nominally, summaries are provided for the control (background) and indicator stations on an annual basis; they may also be provided for other periods of exposure as feasible; the calculated minimum detectable difference (MDD) at the 99% confidence level between these two groups is provided for comparison with the difference in their average values, $L_i - L_c$. Any significant deviations from the required sampling schedule are noted in the discussions for those particular samples. Any laboratory analyses performed on the environmental samples in addition to those required are also reported.

The interpretation of results includes, as warranted and as practical, a comparison with the results found in the preoperational surveillance report and in previous operational surveillance reports. In some cases, an attempt was made to provide a perspective of the results within the framework of regulatory limits, background levels, and plant releases coupled with dilution, dispersion and/or concentration factors; where feasible, attempts were also made to correlate the plant releases with the radiological levels found in the environmental samples. Efforts were made to recognize any data trends; plausible explanations are offered for any such trends considered to be significant.

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Any confirmed measured radiological concentrations in an environmental sampling medium averaged over any quarterly sampling period which exceeds the reporting levels given in Table 3.2-3 of the new ETS are discussed. Also, as required by Section 5.6.1 of the old ETS for Unit 1, individual samples that showed higher than normal levels (25% above control station value for external dose or twice control station value for radionuclide content) are noted; the average value of the positive readings for each radiological level at the control stations during the collection period is considered as the control station value. Explanations are postulated to account for any exceptionally high radiological levels.

In recent years there has been a series of detonations of nuclear devices in weapons tests on mainland China; there were also tests conducted at the time when preoperations began. These occurred as follows:

January 7, 1972
March 13, 1972
September 26, 1976
November 17, 1976
September 17, 1977
March 14, 1978
December 14, 1978

About a week after each of these tests a marked increase in the radiological level in many of the samples collected in the Hatch environs was noted giving abundant evidence of the appearance of fallout of radioactive material from the cloud created by the test. These were generally collaborated with widespread reports of similar step increases occurring elsewhere. The early years of operation was a period without significant weapons tests being conducted in the atmosphere, a time when there was a general decline in the radiological level for most of the environmental samples. The effects of each of the 1976 and 1977 weapons tests have been noted in the past two annual environmental surveillance reports. The effects of the nuclear weapons tests conducted by the Peoples Republic of China in 1978 are described separately herein for each of the affected samples.

Miscellaneous related activities are injected either where appropriately related to a particular sampling medium or in Section 2.5. Included in this section on miscellaneous activities are the results of the participation in the EPA Environmental Radioactivity Laboratory Intercomparison Studies (Crosscheck Program) by two contract laboratories as well as the plant's radiochemistry laboratory; also included are the results of any investigation to determine the cause of crosscheck program results not in agreement with NRC criteria for comparing analytical results and any consequent corrective actions. In Section 2.6 the chief conclusions drawn from the radiological environmental monitoring activities including the assessment of any radiological impact of the plant's operation upon the environment are presented.

2.2 DISCHARGES TO THE ATMOSPHERE

The media or pathways sampled to monitor discharges to the atmosphere consisted of: airborne dust, airborne iodine, precipitation, external radiation, milk and vegetation. Airborne dust, airborne iodine, and precipitation were collected at air monitoring stations. The air stations also served as locations for some of the thermoluminescent dosimeters (TLDs) for measuring external radiation; the TLD control badges were placed at the control air stations and some of the TLD indicator badges were located at indicator air stations. Under the old Unit 1 ETS there were 14 air stations - six control stations (Nos. 1 through 6) and eight indicator stations (Nos. 7 through 9, 15 and 17 through 20); each of these were in operation throughout the entire year. On January 3, 1978, a new indicator air station (No. 21) was added to accommodate the new ETS requirements; precipitation was not collected at this air station as precipitation is not required by these new ETS.

The numbers of stations required by the new ETS is generally much less than those required by the old Unit 1 ETS, for example, 2 rather than 6 control air and TLD stations, 4 rather than 8 indicator air stations, and 7 rather than 30 indicator TLD stations. The sector location and distance to each of these stations (required by the new ETS) as reckoned from the main stack are as follows:

Air Stations

No. 1	State Prison	ENE	11 miles
No. 5	Baxley	S	10 miles
No. 9	Dead River Road	NE	1.9 miles
No. 15	Roadside Park	WNW	0.8 miles
No. 17	Site Boundary	SE	1.2 miles
No. 21	Site Boundary	WSW	1.0 miles

TLD Stations
(same as air stations plus)

No. 119	East Boundary	ESE	1.1 miles
No. 126	South Boundary	S	0.9 miles
No. 133	West Boundary	W	1.0 miles

The old Unit 1 ETS required radiostrontium analyses of weekly milk samples, of the quarterly composites of airborne dust samples, and of the quarterly composites of precipitation samples, should measurable quantities of radioactive strontium be discharged to the atmosphere during the affected period. The concentrations for either Sr-89 or Sr-90 at the point of discharge must be equal to or exeed 10^{-11} μCi/ml as listed in Table 2.4-2 of the old Unit 1 ETS in order to be considered detectable. Any gaseous discharges of Sr-89 or Sr-90 during 1978 were below this level. Hence no radiostrontium analyses were required on atmospheric samples collected during 1978 although some were made. The new ETS do not require radiostrontium analyses.

2.2.1 AIRBORNE DUST

The annual summary of the gross beta activity for the airborne dust samples which are collected weekly is presented in Tables 2.2-1A and 2.2-1B. Table 2.2-1A provides a summary of the data for the stations required by the old Unit 1 ETS and Table 2.2-1B provides a summary of the data for the stations required by the new ETS. In Table 2.2-1A the average activity of the indicator stations is seen to be a little less than that of the control stations. However, in Table 2.2-1B the opposite is true but to a much lesser degree. The absolute value of the difference between these averages in each table was less than the MDD.

The past two annual reports have clearly pointed out the effects of nuclear weapons tests on mainland China to the levels of gross beta activity in airborne dust samples collected in the environs of Plant Hatch. The detonation of two such tests during 1978, however, seems to have had less impact than those of the two previous years. This may be seen by comparing the average activity (for the 14 stations required by the old Unit 1 ETS) for each year of operations and for the period of preoperations; these are given below in units of fCi/m^3.

Period	Average Activity
Preoperations	133
1974	87
1975	87
1976	137
1977	242
1978	133

The fairly high level of average activity for the few year period of preoperations is attributed to the weapons tests in the early seventies. The lower levels of average activity for 1974 and 1975 show the depletion of these levels due to decay or physical removal during a period without significant weapons tests. The level continued to drop into 1976; the average level for the first three quarters of 1976 was 42 fCi/m^3, then the average jumped to 412 fCi/m^3 for the 4th quarter of 1976 as a consequence of the detonations on September 26 and November 17, 1976. The higher level for 1977 shows the carry over of debris from the 1976 tests as well as the effects of the detonation on September 17, 1977. Despite the detonation on March 14 and December 14, 1978, the annual average level for 1978 dropped to a little over half of that for 1977.

A better understanding of the average activity level in airborne dust for 1978 might be provided by a look at the average activity (for these same stations) for each quarter; these are given below in units of fCi/m^3.

TABLE 2.2-1A
ANNUAL SUMMARY OF GROSS BETA ACTIVITY IN AIRBORNE DUST
FOR STATIONS REQUIRED BY OLD UNIT 1 ETS

fCi/m^3

Station No.	n	Maximum	Minimum	Average	s
		Data for Control Stations			
1	52	1275	26	129	177
2	52	1624	22	140	223
3	52	1707	25	143	233
4	51	1511	20	145	216
5	52	1077	19	126	153
6	52	1011	19	137	154
Summary	6	145	126	137	8
		Data for Indicator Stations			
7	52	1394	21	136	194
8	52	908	28	126	134
9	52	1080	30	124	149
15	51	1092	32	135	158
17	50	1004	19	123	147
18	52	1119	25	130	157
19	52	1255	20	132	174
20	51	1237	24	134	176
Summary	8	136	123	130	5

$L_i - L_c = -7$ MDD = 11

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TABLE 2.2-1B
ANNUAL SUMMARY OF GROSS BETA ACTIVITY IN AIRBORNE DUST
FOR STATIONS REQUIRED BY NEW ETS

fCi/m^3

Station No.	n	Maximum	Minimum	Average	s
		Data for Control Stations			
1	52	1275	26	129	177
5	50	1077	19	126	153
Summary	2	129	126	128	2
		Data for Indicator Stations			
9	52	1080	30	124	149
15	51	1092	32	135	158
17	50	1004	19	123	147
21	51	1441	24	135	202
Summary	4	135	123	129	11

$L_i - L_c = 1$ MDD = 38

Quarter	Average Activity
1st	226
2nd	185
3rd	61
4th	58

For the first 12 weeks of the 1st quarter the average activity was 142 fCi/m^3 which is quite a drop from the average activity of 448 fCi/m^3 for the 4th quarter of 1977. Then in the 13th week (of the 1st quarter of 1978) the activity at each station jumped by about a factor 8 due to the arrival of the cloud of radioactive debris from the detonation on March 14, 1978. The maximum for the year occurred at each station for that week; these values are listed in Tables 2.2-1A and 2.2-1B. The activities then dropped off rather rapidly returning to the predetonation level by early May. The rather high levels in the 2nd quarter can also be partially attributed to the usual spring mixing of air from higher to lower levels. This consequently renders an influx of long lived debris from the weapons tests of previous years to ground level. The levels fell greatly in the latter half of the year; then at year's end the levels at most stations increased by about 50% for a week or two; these increases might be attributed to the detonation on December 14, 1979. When levels are as low as they were in December, however, a 50% variation from week to week is not uncommon.

The activities of specific radionuclides detected in quarterly composites of airborne dust filters by gamma spectral analyses are summarized in Table 2.2-2 for the entire year. The activity levels and the frequency of positive values were in general considerably greater in the earlier quarters of the year. It is seen from this table that there is little difference in the average levels between the control and the indicator stations; in no case was there a detectable difference. Except for I-131, the activities for each of these radionuclides are typical of or within the range of those found previously.

The radionuclide, I-131, has not been found previously by the gamma isotopic analyses of air dust composites. The levels were a bit higher at the control stations. Positive values were found only in the 1st quarter and they were found at all stations. These levels can indeed be attributed to the weapons tests. As seen in the next section, the levels found in the charcoal air filters at these same stations in the last week of the 1st quarter are roughly 4 to 10 times higher than the levels found in the air dust filters. Although the air dust filters take out much of the iodine in particulate form, they do not hold up the more plentiful elemental iodine.

The following radionuclides were identified in quarterly composites at the indicator stations, but were not found at control stations during the same collection period.

TABLE 2.2-2
SPECIFIC RADIONUCLIDES DETECTED IN AIRBORNE DUST COMPOSITES
SUMMARY FOR 1978

fCi/m^3

Radionuclide	n	Max	Min	Avg	s	L_i-L_b	MDD
Control Stations							
Be-7	24	99.1	43.7	66.1	15.9		
K-40	0						
Mn-54	1	0.5	0.5	0.5			
Zr-95	14	6.3	0.4	3.3	1.9		
Ru-103	12	19.0	0.7	6.4	6.2		
Ru-106	20	20.9	2.8	10.5	6.2		
I-131	6	26.4	11.7	17.2	5.1		
Cs-137	24	9.3	0.6	2.6	2.0		
Ba-140	6	25.7	9.4	17.5	7.5		
Ce-141	8	13.4	0.4	6.2	4.3		
Ce-144	24	44.6	2.9	18.3	14.9		
Indicator Stations							
Be-7	36	98.7	35.1	63.2	14.9	-2.9	10.7
K-40	2	17.2	16.7	17.0	0.4		
Mn-54	1	0.4	0.4	0.4		-0.1	
Zr-95	17	5.8	1.3	3.8	1.4	0.5	1.6
Ru-103	16	13.3	0.6	6.1	5.0	-0.3	5.9
Ru-106	27	17.9	2.2	10.5	5.7	0.0	4.7
I-131	9	19.5	8.8	14.6	3.5	-2.6	6.6
Cs-137	36	5.3	0.5	2.3	1.6	-0.3	1.3
Ba-140	9	19.4	11.4	16.0	2.5	-1.5	11.8
Ce-141	9	8.9	3.9	6.7	1.4	0.5	5.3
Ce-144	34	38.7	2.0	18.6	13.4	0.3	10.0

Quarter	Station	Radionuclide	Activity (fCi/m^3)	LLD Range (fCi/m^3)
1st	19	K-40	17.2	5-10
4th	20	K-40	16.7	4-10
4th	21	Mn-54	0.4	0.3-0.6

The LLD range given is that reported for the control stations during the collection period. Hence each of these levels may be considered as marginally detectable.

Of the radionuclides listed in Table 2.2-2, Be-9 and K-40 occur abundantly in nature. The weapons test may also have had some effect on their level. Recent and past nuclear weapons test are believed to be the cause of all or nearly all of the activity for the other radionuclides listed. The only radionuclides which were reported as gaseous effluent releases during 1978 and which are listed in Table 2.2-2 are I-131, Cs-137 and Ba-140. The release levels would have to be a few orders of magnitude greater, however, before they could be detected at the environmental stations.

2.2.2 AIRBORNE IODINE

The charcoal cartridges used for filtering iodine from the atmosphere at the air monitoring stations were collected weekly and analyzed for I-131 by Ge(Li) spectroscopy. Except for two consecutive weeks marked by the arrival of the radioactive cloud from the weapons test of March 14, 1978, the activity found in each sample for the entire year was below the LLD which ranged from 5 to 60 fCi/m^3. The new ETS require that the LLD for the devices measuring airborne I-131 not exceed 70 fCi/m^3. Higher levels were found for the first week for which collections were made on March 27 and 28; as stated in the previous section, the air dust samples showing the high gross beta activity were collected on these same dates. No detectable levels of I-131 were found following the weapons test of December 14. The only previous occasions where airborne I-131 was detected in the HNP environs occurred in 1976 for a 4 week period and in 1977 for a 3 week period both of which followed weapons tests.

All of the cartridges collected for the first week showed positive indications of I-131. The activities ranged from 37 to 132 fCi/m^3 while the average activity was 70 fCi/m^3. The average reading at the indicator stations was 18% higher than that at the control stations. It is noted that Indicator Station No. 15 had the maximum reading of 132 fCi/m^3; this reading is more than twice the average reading of 63 fCi/m^3 for the control stations. No significance is seen to this higher reading. The maximum and average readings in fCi/m^3 for all stations for the week of maximum response to a weapons test during the past few years was as follows.

Year	Maximum	Average
1976	97	75
1977	217	126
1978	132	70

For the second week (that is for the collections on April 3 and 4), the levels dropped significantly. The activities for the 13 out of 15 stations which showed positive results ranged from 15 to 38 fCi/l while the average activity was 25 fCi/l. The average reading at the indicator stations was 7% lower than at the control stations.

A summary of the positive results in units of fCi/m^3 obtained for this 2 week period is presented below for the control and the indicator stations, respectively.

n	Max	Min	Avg	s	L_i-L_c	MDD
12	100	20	45	26		
16	132	15	53	32	8	32

Although the indicator stations show slightly higher levels than the control stations, there is no discernable difference between the average levels for the two type stations.

Since the releases of gaseous I-131 were more or less normal during this period when positive levels of airborne I-131 were detected in the HNP environs, it is concluded that virtually none of the I-131 detected is due to plant operations; it is all attributed to the weapons tests.

2.2.3 PRECIPITATION

The annual summary of the gross beta activity found in monthly precipitation samples is presented in Table 2.2-3. It is seen that the average value for the indicator stations was less than the average for the control stations; the difference between these average values was less than the MDD. All values and their variations are typical and well within the range of that reported in previous years. Since the levels found in March, April and December were not significantly different from those of other months during 1978 or from those in these months during previous years, any impact of the weapons tests of 1978 upon the level of beta activity in precipitation was not apparent.

Four of the samples collected at indicator stations on November 21 had gross beta activities which were more than twice the average activity for the samples collected that month at the control stations. These were as follows:

Indicator Station No.	Activity (nCi/m^2 month)	Control Station Average Activity (nCi/m^2 month)
7	0.65	0.17
8	0.47	0.17
15	0.46	0.17
18	0.36	0.17

None of these readings are considered to have any significance.

Gamma spectral analyses were performed on quarterly composites of precipitation samples as required by the old Unit 1 ETS. The results for 1978 were scant as they have consistently been in the past. Only one positive result was found for 1978. In the 2nd quarter composite for Station No. 1 naturally occurring Be-7 was found at a level of 176 pCi/l. This level is only marginally detectable as its LLD ranges from 50 to 200 pCi/l. In 1976 and 1977, Be-7 was also detected a total of 3 times when its level ranged from 32 to 262 pCi/l.

Precipitation was phased out as an environmental sampling medium at the close of 1978. Definitive data trends were never established as the measured activity levels were generally inconsistent. A relationship between releases and activity levels was never established. However, in 1976 and 1977 the activity levels did clearly show an impact from the weapons test. In short, precipitation did not prove to be an effective sampling medium.

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TABLE 2.2-3

SUMMARY OF GROSS BETA ACTIVITY IN
PRECIPITATION FOR THE YEAR 1978

nCi/m^2 month

Station	n	Max.	Min.	Avg.	s
	Background Data				
1	12	2.05	0.16	0.89	0.56
2	12	1.66	0.16	0.76	0.48
3	12	2.52	0.17	0.99	0.80
4	12	2.02	0.07	0.93	0.56
5	12	2.46	0.12	1.08	0.74
6	12	2.01	0.14	0.93	0.64
Summary	6	1.08	0.76	0.93	0.11
	Indicator Data				
7	12	2.29	0.26	0.91	0.55
8	12	2.06	0.34	0.99	0.59
9	12	1.94	0.15	0.66	0.47
15	12	1.72	0.23	0.82	0.48
17	12	1.65	0.09	0.78	0.49
18	12	2.01	0.20	0.93	0.66
19	12	2.70	0.27	0.91	0.75
20	12	2.61	0.18	0.96	0.76
Summary	8	0.99	0.66	0.87	0.11

$L_i - L_b = -0.06$ MDD = 0.18

2.2.4 THERMOLUMINESCENT DOSIMETERS

External radiation is monitored by thermoluminescent dosimeters (TLDs). The total dose acquired by the TLD badges consist of that received when on-station and that received when off-station (that is, in transit, in storage and in handling). It is assumed that a fair estimate of the off-station component may be provided by the average dose acquired by the extra badges which accompany each batch of badges during shipment and temporary periods of storage, and which are kept in a Pb cave at the plant while the regular badges are on-station or in transit to their respective stations in the field. The on-station dose is approximated by subtracting the average dose of these "nonirradiated" extra badges from the total dose reading of each regular field badge before normalizing to the desired exposure period. The validity of this method may indeed by questioned, however, it was shown in the 1975 report that generally the on-station doses were more consistent throughout the year and provided better correlation between the doses acquired over various periods of exposure than the total doses.

The on-station dose is fundamentally of more interest than the total dose because it is closer to what is being sought, which is, the dose that might be acquired by external radiation as a consequence of gaseous releases from the plant. Each badge in the field is subjected to local background radiations consisting of terrestrial radiations from naturally occurring radionuclides, cosmic radiations and fallout. The large variability of each of these components of the local background radiations in both space and time makes it difficult to discern any part of the on-station dose which can be attributed to plant releases, which part is generally anticipated as being much smaller.

The annual summary of the on-station dose acquired by the TLDs is presented in Tables 2.2-4A and 2.2-4B. Table 2.2-4A provides a summary of the data for the stations required by the old Unit 1 ETS; these were phased out at the end of the year. Table 2.2-1B provides a summary of the data for the stations required by the new ETS. In Table 2.2-4A the average dose of the indicator stations is seen to be a little greater than that of the control stations. However, in Table 2.2-4B the opposite is true. The absolute value of the difference between these values in each table is less than the MDD. These values are typical of and well within the range of those found in prior years.

Individual badges that showed an on-station dose at one of the indicator stations required by the old Unit 1 ETS and which was 25% or greater than the average on-station dose of the TLDs placed at the control stations (required by the old Unit 1 ETS) during the same quarter are noted in Table 2.2-5. Many of the badges would be struck from this listing if total dose were the basis of the table. Little, if any, significance is attributed to any of these readings.

TABLE 2.2-4A
ANNUAL SUMMARY OF ON-STATION DOSE ACQUIRED BY TLDs
AT STATIONS REQUIRED BY OLD UNIT 1 ETS

mrem/13 weeks

Station No.	n	Maximum	Minimum	Average	s
	Data for Control Stations				
101	8	8.56	5.62	7.08	0.88
102	8	6.46	4.76	5.59	0.65
103	8	7.86	3.99	6.12	1.45
104	6	10.25	1.84	5.30	2.19
105	8	8.00	4.68	5.62	1.14
106	8	8.46	4.36	6.37	1.38
Summary	6	7.08	5.30	6.01	0.65
	Data for Indicator Stations				
111	4	13.18	4.13	9.23	4.37
112	3	11.06	6.50	8.95	2.30
113	4	11.88	0.98	7.43	4.62
114	4	8.86	5.48	7.13	1.40
115	4	11.51	8.14	10.00	1.41
116	4	5.96	3.44	4.96	1.08
117	4	10.70	7.86	9.70	1.29
118	3	7.76	2.55	5.91	2.91
119	4	6.56	2.52	5.38	1.91
120	4	6.45	5.66	6.08	0.42
121	4	6.65	5.17	6.08	0.64
122	3	5.96	4.15	4.98	0.91
123	4	6.05	4.56	5.13	0.64
124	4	7.06	5.17	6.35	0.87
125	3	8.47	6.09	7.21	1.20
126	3	8.76	4.97	7.40	2.11
127	2	8.07	6.61	7.34	1.03
128	4	6.78	5.17	5.97	0.70
129	4	8.37	5.66	6.72	1.29
130	4	5.40	3.80	4.83	0.74
131	4	7.53	4.76	6.19	1.24
132	3	7.14	4.21	5.90	1.52
133	1	5.62	5.62	5.62	
134	4	5.95	4.26	5.15	0.89
135	4	6.08	4.16	5.12	0.82
136	3	10.15	5.66	8.05	2.26
137	4	8.89	1.16	5.58	3.26
138	4	8.50	4.71	6.76	1.82
139	4	10.25	5.28	8.37	2.37
140	4	7.14	5.75	6.54	0.64
Summary	30	10.00	4.83	6.67	1.46

$L_i - L_c = 0.66$

MDD = 1.67 (3.5) 150

TABLE 2.2-4B
ANNUAL SUMMARY OF ON-STATION DOSE ACQUIRED BY TLDs
AT STATIONS REQUIRED BY NEW ETS

mrem/13 weeks

Station No.	n	Maximum	Minimum	Average	s
	Data for Control Stations				
1	4	7.36	5.01	6.52	1.10
5	4	6.73	6.28	6.58	0.21
Summary	2	6.58	6.52	6.55	0.04
	Data for Indicator Stations				
9	4	5.81	4.01	5.02	0.85
15	4	6.58	3.71	4.95	1.22
17	3	6.31	3.96	5.48	1.32
21	3	6.21	1.36	4.42	2.67
119	4	17.11	5.16	8.69	5.66
126	4	9.83	4.76	7.03	2.19
133	2	7.40	5.05	6.22	1.66
Summary	7	8.69	4.42	5.98	1.48

$L_i - L_c = -0.57$ MDD = 2.08

TABLE 2.2-5

INDIVIDUAL TLDs WHOSE ON-STATION DOSE EXCEEDED
THE AVERAGE ON-STATION DOSE OF TLDs PLACED AT BACKGROUND
STATIONS BY 25% DURING THE SAME QUARTER*

mrem/13 weeks

Quarter	Indicator Station No.	Indicator Station Dose	Reference Dose**
1st	112	11.06	8.54
1st	114	8.86	8.54
1st	115+	9.86	8.54
1st	126	8.76	8.54
2nd	112	9.28	7.76
2nd	113+	8.98	7.76
2nd	115+	11.51	7.76
2nd	117+	10.70	7.76
2nd	125	8.47	7.76
2nd	126	8.47	7.76
2nd	127	8.07	7.76
2nd	129	8.37	7.76
2nd	138	3.07	7.76
2nd	139+	10.19	7.76
3rd	111+	12.54	6.20
3rd	112	6.50	6.20
3rd	115+	8.14	6.20
3rd	117+	9.77	6.20
3rd	127	6.61	6.20
3rd	136+	8.35	6.20
3rd	137+	6.73	6.20
4th	111+	13.18	7.76
4th	113+	11.88	7.76
4th	115+	10.48	7.76
4th	117+	10.48	7.76
4th	136+	10.15	7.76
4th	137+	8.89	7.76
4th	138	8.50	7.76
4th	139+	10.25	7.76

*This table is applicable only to the stations required by the old Unit 1 ETS.

**The reference dose is 25% more than the average dose acquired by the TLDs at the control stations during the same quarter.

+Riverbank group

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Well over half of these higher readings listed in Table 2.2-5 occurred at one of the stations located along or near the river bank, namely, Stations Nos. 111, 113, 115, 117, 136, 137 and 139. It was shown in the 1976 report that generally doses are significantly higher at these stations. This is probably due to a greater content of naturally occurring radioactivity in the soil at these locations. This terrestrial component of the dose acquired by the badges at these locations seems to vary greatly over the year due to flooding.

2.2.5 MILK

Milk samples were collected weekly as available from four locations as follows:

Station	Type	Azimuth (degrees)	Distance (miles)	Weeks (number)
Prison	Control	067	11.2	51
Heads	Control	218	14.1	51
Stones	Indicator	229	6.5	52
Williamsons	Indicator	029	3.2	50

The numbers in the last column refer to the number of weeks for which samples were both collected and analyzed for I-131. Samples were lost in shipment to a laboratory (for analysis), 2 or 3 times and no sample was available at the dairy once or twice. It is seen that milk samples were available nearly every week throughout the year at each of these stations.

The old Unit 1 ETS require weekly collections as available from one indicator and two control stations. A further requirement is the performance of an I-131 analysis on each sample; radiostrontium analyses were also performed on a few of the samples although this was not an ETS requirement.

The new ETS require collections every two weeks from one control station and from one to four indicator stations depending upon the availability of milk animals near the plant. The prison was specified as the control station and Stones was designated as an indicator station since it is the closest reliable station from the plant. Up to three additional sampling stations within 5 miles and in different sectors are also specified if available; Williamsons was the only location during 1978 to meet this specification.

The new ETS requires a gamma isotopic analysis as well as an I-131 analysis on each of these biweekly samples. Gamma spectral analyses were intiated in early May; by the time the Operating License for Unit 2 was obtained this analysis was being performed on each of the samples collected every other week; this schedule was adhered to for the remainder of the year except for the collections on July 24 and August 21 when the samples were discarded before performing the gamma analyses.

Since May 1975 the laboratory analyses on milk samples have been performed by Eberline Instrument Corporation's Southeastern Facility in West Columbia, South Carolina. In the latter part of March 1978 this facility was closed. Samples were subsequently sent to Eberline's Midwestern Facility in West Chicago, Illinois.

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The LLD for the I-131 analyses was generally reported as 0.5 pCi/l by Eberline's Midwestern Facility; there was a small number of times, however, when their reported value was greater than 0.5 pCi/l but it never exceeded 0.8 pCi/l which is the maximum value permitted by Table 3.2-2 of the new ETS. The LLD reported by the Southeastern Facility was generally lower; the average reported value was about 0.3 pCi/l.

There were 16 positive indications of I-131 during the year; these are tabulated below in units of pCi/l.

Collection Date	Control Stations		Indicator Stations	
	Prison	Heads	Stones	Williamsons
1/09				0.16
1/23			0.15	
3/27		17.3	7.3	0.5
4/03	2.6	2.4	5.2	9.8
4/10	0.7	0.6	1.1	2.2
4/17	1.5			0.1
5/01				0.7

The readings occurred in two distinct time periods - the early weeks of the year and a 5 week stretch beginning in late March.

The two very low levels of I-131 found during the early months of 1978 which are barely detectable appear to be residuals from the weapons test which occurred on September 17, 1977. It is noted that each of these samples was collected at an indicator station when there was no positive reading for the control stations. On Janury 9 the reading was 0.16 pCi/l at Williamsons while each of the control stations had an LLD of 0.12 pCi/l. On January 23 the reading was 0.15 pCi/l at Stones while the LLDs at the control stations were 0.17 and 0.36 pCi/l.

The second group of positive readings began with the collections on the same date for which positive readings of I-131 in the charcoal air filters commenced and for which there was a step increase in the gross beta readings on the air dust filters. The occurrence of the maximum readings for the dairies in the SW quadrant (Heads and Stones) a week earlier than in the NE quadrant (Williamsons and the Prison) indicates an earlier arrival of the cloud of radioactive debris for the March weapons test to these locations. This could be expected since the weather patterns in this area generally move in a northeasterly direction. The sample collected at the Prison on March 27 was lost in its shipment to the laboratory.

These I-131 levels showing the peak of the impact from the weapons test of March 1978 are lower than those from the weapons test occurring in the falls of 1976 and 1977 by about a factor of 5. The average reading of the

control stations for this second group of positive readings was 4.18 pCi/l while that of the indicator stations was 3.36 pCi/l. There was no discernable difference between these two groups of stations as the MDD was 10 times the difference in their average values.

It is noted that the readings at individual indicator stations exceeded the average positive readings at the control stations (for this second group of positive readings) in units of pCi/l for the same collection period as follows:

Collection Date	Indicator Station Name	Indicator Station Level	Control Stations Average Level
4/03	Stones	5.2	2.5
4/03	Williamsons	9.8	2.5
4/10	Williamsons	2.2	.7

On May 1 a positive reading of 0.7 pCi/l was found at Williamsons and the level at both control stations was below the LLD reported as 0.5 pCi/l. There is no significance to any of these readings.

Radiostrontium analyses were performed on a total of 12 milk samples. All samples but one showed a positive indication of Sr-90 while none showed a positive indication for Sr-89. The Sr-90 levels in units of pCi/l were as follows:

Station	Type	5/15	8/14	11/13
Prison	Control	9	<1	2
Heads	Control	2	2	3
Stones	Indicator	2	3	3
Williamsons	Indicator	10	4	6

These readings are about the same as those which have been found previously. It is noted that the levels at Williamsons on August 14 and November 13 are at least twice the average positive level for the control stations. There is no significance to these higher readings at Williamsons.

Gamma isotopic analyses were performed on a total of 59 samples. There have been no previous gamma scans performed on milk. Positive levels of Cs-137 were found in 17 of these samples. All other gamma emitters were reported as <15 pCi/l. The positive results found for Cs-137 in units of pCi/l are provided in the following tabulation.

Collection Date	Control Stations		Indicator Stations	
	Prison	Heads	Stones	Williamsons
6/12		25	10	10
6/26		16	10	
7/10		20		
8/07		14	8	
9/04		18	10	
9/18				14
10/02		14		
10/30		21	14	
11/13				17
11/27			13	
12/26			15	

It is rather surprizing that no positive values were found at the Prison. It is noted that on September 18, November 13 and 27, and on December 26, positive readings ranging from 13 to 17 pCi/l were found at indicator stations while at the control stations the level was below the LLD which was reported as 15 pCi/l. It should be noted that all of the positive levels may be considered as only marginally detectable.

A summary of these positive results in units of pCi/l is listed below for the control and indicator stations, respectively.

n	Max	Min	Avg	s	L_1-L_c	MDD
7	25	14	18.3	4.0		
10	17	8	12.1	2.9	-6.2	4.9

The control stations are seen to be higher than the indicator stations. There is a discernable difference between the average values for the two type stations.

The only previous measurements of Cs-137 in milk were done by a chemical separation technique during preoperations. The levels ran from 2 to 60 pCi/l with an average value of 19.3 pCi/l. The levels during preoperation and the levels during 1978 are attributed to the weapons tests, although miniscule quantities of Cs-137 are released.

On September 4 and October 23 the samples at the prison were split and sent to Teledyne Isotopes Laboratory in Westwood, New Jersey as well as to Eberline in West Chicago Illinois. On September 4 a gamma isotopic analysis as well as an I-131 analysis were performed. Eberline reported <0.5 pCi/l for I-131 and <15 pCi/l for all gamma isotopes. Teledyne found <0.7 pCi/l for I-131. Teledyne found a positive level for only one radionuclide, the naturally occurring K-40; the level was 1.01 nCi/l. In 1975 K-40 levels of this order were found in precipitation. Teledyne listed 17 other radionuclides whose LLD ranged from 6 pCi/l for

Cs-137 to 100 pCi/l for Ra-226. On October 23 two samples were taken and split; only I-131 analyses were performed. Eberline reported <0.5 pCi/l for each sample while Teledyne reported <0.5 pCi/l for one sample and <0.3 pCi/l for the other. The comparison of the analysis reports for these two laboratories shows they are within reasonable agreement.

The principal pathway of human exposure resulting from gaseous releases from the plant is apt to be the ingestion of milk. An annual survey is conducted within a 5 mile radius of the plant to locate cows and goats which are producing milk for human consumption. The results of the survey conducted on April 26 are presented in Figure 2.2-1 which is a map of the area which shows the location of each milk producing cow by an "A"; no milk producing goats were found.

A total of 3 milk-producing cows were found. The locations of the cows were reported as follows:

Azimuth (Degrees)	Distance (miles)
029	3.1
177	2.3
254	4.4

The first cow on the above list is Williamsons which has been sampled regularly since June 1977. The pasture is actually about 3.2 miles from the main stack; the barn is 3.1 miles. The milk from the second cow on the above list, it was subsequently learned, was not being used for human consumption. The third cow on the above list died in the first part of June before arrangements could be made for sampling.

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2.2.6 VEGETATION

Green leafy vegetable samples were collected weekly as available from four locations as follows:

Station (name)	Azimuth (degrees)	Distance (miles)	Weeks (number)
Prison	067	11.2	28
Sharpes	209	4.9	2
Phillips	031	2.9	31
Hatch	210	0.6	30

The numbers in the last column refer to the number of weeks for which samples were both collected and analyzed for I-131. At least one sample was available in 38 weeks of the year. Samples began to become scarce in the latter part of April and after mid-July, none were available until the latter part of October. This is the usual occurrence as a consequence of the hot and dry summer.

Detectable levels of I-131 were found in 11 samples over a three week period which coincided with the arrival of the radioactive cloud from the weapons test of March 14. These positive levels in units of fCi/gm (wet) are tabulated as follows:

Station	5/23	3/30	4/07
Prison	120	160	
Phillips	100	130	32
Hatch	52	99	29

The LLD varied from 6 to 20 fCi/gm (wet) during the year. The levels on April 7 are considered as only marginally detectable. There has been a total of nine occurrences of a positive indication of I-131 in green leafy vegetables since sampling began in October 1974 (about a month following initial criticality of Unit 1). These previous readings ranged from 54 to 490 fCi/gm (wet).

The sampling and I-131 analysis of green leafy vegetables was phased out at the end of 1978 since this is not required by the new ETS. The new ETS specify gamma isotopic analyses of grab samples collected monthly from Air Stations Nos. 5, 17 and 21. These laboratory analyses are performed by the University of Georgia's Center for Applied Isotopic Studies in Athens, Georgia. Starting in March, samples were collected monthly as available from these three locations:

Station	Months
No. 5	7
No. 17	6
No. 21	9

At least one sample was available each month over these 10 sampling periods.

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Positive levels of I-131 were found only for the collections on March 27. They were found at all three stations ranging in value from 110 to 148 fCi/gm (wet). These levels are about the same as those found in the green leafy vegetables collected on March 23 and 30. Since the Operating License for Unit 2 was obtained, the LLD has ranged from 15 to 26 fCi/gm (wet). On only one instance did it exceed 25 fCi/gm (wet) which is the maximum permitted by Table 3.2-2 of the new ETS.

In addition to I-131, a number of other radionuclides were identified by the gamma scans. These have been separated into 4 groups as follows:

(1) Be-7 and K-40;
(2) Tl-208, Pb-212, Pb-214, Bi-214 and Ac-228;
(3) Nb-95, Ru-103, Ba-140, La-140, and Ce-141; and
(4) Cs-137 and Ce-144

The first two groups occur in nature and the last two are man-made.

Both Be-7 and K-40 were detected in most samples. The number of times detected and the range of values in units of pCi/kg (wet) are as follows:

Radionuclide	n	Max	Min
Be-7	18	1790	296
K-40	22	9520	2850

These levels are not related to plant operations.

Each of the radionuclides in the second group is a primordinal nuclide. Each was identified in only a few samples and at levels considered as only marginally detectable. Each of these radionuclides had been found in soil samples taken from each of these grass stations on November 10, 1977.

The appearance in the grass samples of the radionuclides in the third group is believed to be due almost entirely to the weapons test of March 14 since all of these appearances with only two exceptions occurred in the three grass samples collected on March 27. The exceptions were for Nb-95 where a positive level was found in both a June and a July sample. Tabulated below for each radionuclide are the number of times detected, the range of levels in units of pCi/kg (wet) and a typical LLD.

Radionuclide	n	Max	Min	LLD
Nb-95	4	40	20	30
Ru-103	3	116	79	30
Ba-140	2	216	123	100
La-140	3	190	139	60
Ce-141	3	71	55	40

Of these radionuclides, there were gaseous releases only for Ba-La-140; these releases during the 1st quarter, however, were lower than usual.

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The fission products, Cs-137 and Ce-144, composing the last group were found in many of the samples. There was not a correlation to the March weapons test since the levels for Cs-137 in the grass samples were relatively low in March and Ce-144 was not detected at all in the March samples. The gaseous releases of Cs-137 has not been high and there has been no releases of Ce-144. These levels are attributed to the weapons tests, but largely to the tests prior to 1978.

A summary of the positive results for Cs-137 in units of pCi/kg (wet) is presented below for the control and the indicator stations, respectively.

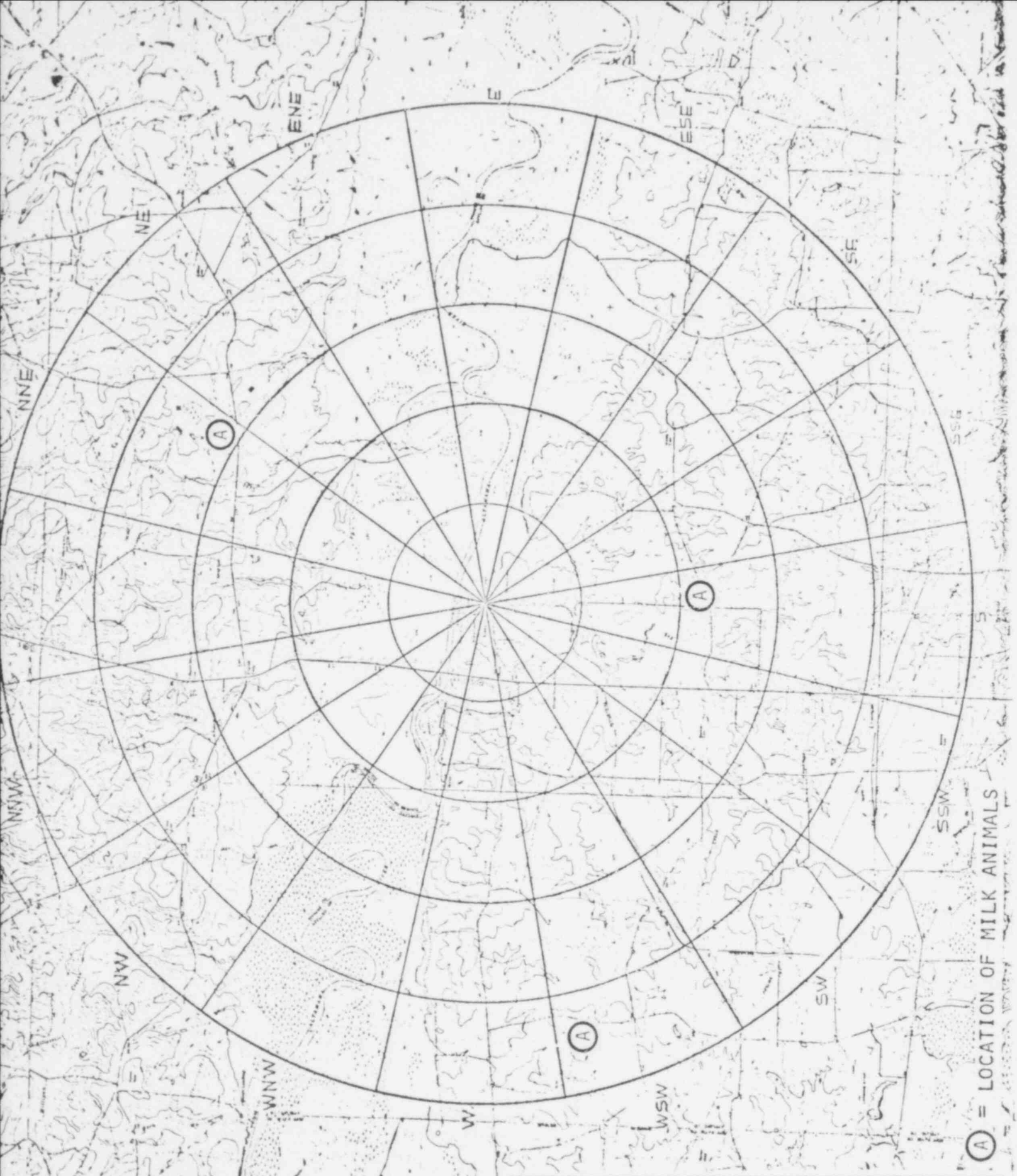
n	Max	Min	Avg	s	L_i-L_c	MDD
7	1500	647	1089	325		
10	410	21	112	116	-997	442

The control stations show higher levels than the indicator stations; there is a discernable difference between the average values for these two type stations. The LLD for Cs-137 (and Cs-134) ranged from 16 to 33 pCi/kg (wet) which is well below the maximum permitted value of 80 pCi/kg (wet) specified in Table 3.2-2 of the new ETS.

A summary of the positive results for Ce-144 in units of pCi/kg (wet) is presented below for the control and indicator stations, respectively.

n	Max	Min	Avg	s	L_i-L_c
1	202	202	202		
7	443	113	233	117	31

The average value for the indicator stations is a little higher than the single result for the control station.



GEORGIA POWER COMPANY

EDWIN I. HATCH NUCLEAR PLANT

ANNUAL REPORT 1978

5-MILE SURVEY

2.3 DISCHARGES TO THE RIVER

The media or pathways sampled from one background station (No. 170) and two indicator stations (Nos. 171 and 172) in the river were: water, benthos (clams), fish, and sediment. In addition to these, benthos (oysters) and sediment were taken from two estuary sampling stations; the background station was in St. Catherine's Sound, about 30 miles up (north-northeasterly) the coast from the indicator station in the Altamaha Sound, which is roughly 120 miles downstream of the plant. The new ETS require sampling of water, clams and shorline sediment only from River Stations Nos. 170 and 172 which are approximately 1 mile upstream and 3 miles downstream from the discharge structure; Station No. 171 which was discontinued at the end of 1978 is about 500 feet downstream of the discharge structure. The new ETS also require the sampling of American Shad from the area of the discharge structure during the spring spawning period. The new ETS do not require estuary sampling.

Under the old Unit 1 ETS all samples collected in the river except water required analyses for radiostrontium if there should be measurable quantities discharged to the river during the affected period. In the instances where the concentration of Sr-89 or of Sr-90 in the tank to be discharged was found to be greater than 5×10^{-8} μCi/ml, which is the concentration listed in Table 2.4-1 of the old Unit 1 ETS as detectable, the dilution afforded in the process of discharging reduced these concentrations at the point of discharge to levels below this detectable concentration. Hence, the radionuclides of strontium discharged were not considered to be at measurable levels. No radiostrontium analyses were thus required for aquatic samples during 1978, although a few such analyses were done. The new ETS do not require radiostrontium analyses.

2.3.1 RIVER WATER

Grab samples were taken at each of the river stations in the first part of the year. On June 21, automatic sampling equipment was installed at Station No. 172 to collect around an ounce of river water every hour or two. This equipment was installed at Station No. 170 at a later date. Grab samples continued to be taken at Station No. 171 until the end of the year when this station was phased out.

The old Unit 1 ETS require a gross beta count on the suspended portion of the monthly composite of each station. In practice, a gross beta count is generally taken on both the suspended and dissolved portions. The new ETS do not require gross beta analyses; consequently, these analyses stopped at the end of 1978.

On only six occasions during the year was the gross beta count on the suspended portion of the monthly components greater than the LLD, which ranged from 0.8 to 1.0 pCi/l. The positive results ranged from 1.0 to 3.3 pCi/l with an average of 1.64 pCi/l. The values are typical of those found previously.

The positive results of the gross beta counts taken on the dissolved portion of the river water in units of pCi/l is summarized as follows for the control and the indicator stations, respectively.

n	Max	Min	Avg	s	L_i-L_c	MDD
12	3.1	1.7	2.48	.53	-	-
24	7.5	1.5	2.95	1.30	.47	.84

The average reading for the control station was a little greater than that for the indicator stations. The LLD was reported as 1.0 pCi/l. These readings are also typical of those found previously. The only occasions during the year when the reading at an indicator station was at least twice that of the control station occurred for the June and July collections at Station No. 172 where the levels were respectively 3.5 and 7.5 pCi/l as compared to 1.7 and 2.3 pCi/l at the background station.

A gamma spectral analysis was performed on the clear filtrate of each quarterly composite as required by the old Unit 1 ETS and on each monthly composite beginning in June as required by the new ETS. There were no positive results. Only scant results have been obtained in the past with this analysis. During preoperation traces of K-40 and radon daughter products were detected occasionally. Since operation began, K-40 and Th-228 were detected in the 3rd quarter of 1974, and Ce-141 was detected during the 4th quarter of 1975.

The positive results in units of pCi/l for the tritium analyses of the quarterly composites is summarized as follows for the control and the indicator stations, respectively.

n	Max	Min	Avg	s	L_i-L_c	MDD
4	270	130	193	61	-	-
8	390	100	224	124	31	211.49

Although the average reading for the indicator stations was greater than that for the background station, the difference was far from discernal . Analyses were alsc performed on the monthly composite for July; the readings were 150, 150, and 120 pCi/l for Stations 170, 171, and 172, respectively. These values are typical and within the range of those found previously.

As required by the new ETS a survey was conducted downstream of HNP on October 10 and 24, 1978 to identify users of the Altamaha River for drinking purposes. No intakes for drinking water were observed. The same results were obtained from previous surveys taken during preoperations and in the early years of operations. If river water downstream of HNP should become used for drinking, the new ETS require certain sampling and analyses of that drinking water.

2.3.2 BENTHOS

Gamma spectral analyses were performed on benthos samples gathered quarterly. Asiatic clams were collected at the three river stations and oysters were collected at the two estuary stations.

Positive results were more scant than had been found in previous years. No positive results were found for the samples collected in the river. Half of the samples collected in the estuaries showed some positive results, but only for the naturally occurring and very abundant K-40, and only at barely detectable levels. Positive results in pCi/gm (wet) were as follows:

Quarter	St. Catherines Sound	Altamaha Sound
1st	1.09	-
2nd	1.18	1.03
3rd	-	1.04
4th	-	-

The LLD for K-40 was 1.0 pCi/gm (wet).

In past years, the naturally occurring radionuclides Ra-226 and Th-228 and the man-made radionuclide Cs-137 have been occasionally but infrequently found in benthos samples. The man-made radionucludes Zr-95 and Sb-125 have each also been identified on one occasion in the past.

The collection of oysters in the Altamaha Sound and in St. Catherines Sound was phased out at the end of the year. The new ETS require the collection of clams semiannually from two river stations.

2.3.3 FISH

The old Unit 1 ETS required gamma spectral analyses of the catfish and redbreasted sunfish samples which were collected quarterly at each of the three river stations. Collections of these species of fish were phased out at the close of 1978. Adequate samples of each species were gathered in each quarter except the first when redbreasted sunfish were not gathered at any of the stations and catfish were not obtained at Station No. 171. At times of high water when the river's current is swift, fish are more difficult to catch; this is especially true for the smaller redbreasted sunfish. The average river water flow during the 1st quarter was 126% higher than the annual average flow.

The new ETS require the gamma spectral analysis of American Shad collected from the area of the discharge structure during the spring spawning period. No other fish sampling is required by the new ETS. On February 16, 1978, American Shad samples were collected at Station No. 171 which is about 500 feet downstream of the discharge structure.

The gamma spectral analyses showed naturally occurring K-40 in each fish sample except one, man-made Cs-137 in four of the 11 catfish samples but in only one of the sunfish samples, and naturally occurring Ra-226 in one of the catfish samples. The positive results for all of the fish samples in units of pCi/gm (wet) is summarized as follows for the control and the indicator stations, respectively:

Radionuclide	n	Max	Min	Avg	s	L_i-L_c	MDD
K-40	6	3.02	1.42	2.08	0.53		
K-40	14	2.85	1.23	1.94	0.48	-0.14	0.69
Cs-137	2	0.052	0.043	0.047	0.006		
Cs-137	3	0.129	0.046	0.088	0.043	0.041	0.186

It is seen that there was no discernable differences between the average levels at the indicator and the control stations. These levels are within the range and typical of those found in previous years.

It is noted that during the 1st quarter the K-40 level at the control station in the catfish sample was below its LLD of 0.9 pCi/gm (wet), while the level in catfish at Station 172 was 2.21 pCi/gm (wet). In the 2nd quarter at Station No. 172 the Cs-137 level in a catfish sample was 0.129 pCi/gm (wet) which is more than twice the positive level of 0.0427 pCi/gm (wet) found at the control station. In the 4th quarter at Station No. 171 the positive level of Ra-226 in a catfish sample was 0.385 pCi/gm (wet) while the level at the control station was below the LLD of 1.0 pCi/gm (wet).

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2.3.4 SEDIMENT

As in past years gamma spectral analyses of both river and estuary sediment samples which are collected quarterly have shown that (1) the naturally occurring radionuclides K-40, Ra-226 and Th-228 were virtually always present at detectable levels; (2) the naturally occurring Be-7 was sometimes detected; and (3) the fission product Cs-137 was nearly always found. In addition to these, a handful of fission or activation products were occasionally or infrequently detected. The levels of each of these radionuclides are within the range or typical of those found previously. No trends in the data were noticed. The annual summaries of the specific radionuclides detected in sediment samples taken at river and estuary stations are presented in Tables 2.3-1 and 2.3-2, respectively.

Samples from indicator stations which showed an activity for a specific radionuclide at a level of more than twice that of control station for the same collection period are noted as follows:

Radionuclide	Quarter in Which Collected	Indicator Station Name	Indicator Station Activity pCi/gm(dry)	Background Station Name	Background Station Activity pCi/gm(dry)
Be-7	4th	No. 172	1.42	No. 170	<0.8
Zr-95	1st	No. 171	0.16	No. 170	<0.08
Zr-95	4th	No. 171	0.17	No. 170	<0.09
Cs-137	1st	No. 171	0.20	No. 170	<0.06
Cs-137	1st	No. 172	0.23	No. 170	<0.06
Cs-137	4th	No. 172	0.36	No. 170	<0.17
Ce-144	2nd	No. 171	1.02	No. 170	<0.40
Ce-144	4th	No. 171	0.50	No. 170	<0.50
Ce-144	4th	No. 172	0.58	No. 170	<0.50
Ra-226	1st	No. 172	3.23	No. 170	1.56
Be-7	3rd	Altamaha	1.27	St. Catherines	<1.00
Zr-95	4th	Altamaha	0.102	St. Catherines	<0.07
Cs-134	1st	Altamaha	0.097	St. Catherines	<0.09
Cs-137	3rd	Altamaha	0.18	St. Catherines	<0.07
Cs-137	4th	Altamaha	0.07	St. Catherines	<0.05
Ce-144	3rd	Altamaha	0.52	St. Catherines	<0.40
Ra-266	1st	Altamaha	2.59	St. Catherines	<1.00
Ra-226	3rd	Altamaha	1.94	St. Catherines	<1.00

No significance is attributed to any of these levels of activity.

The collection of sediment samples in St. Catherines Sound and in the Altamaha Sound were phased out at the end of 1978. The new ETS require an annual collection of sediment at the two river stations.

TABLE 2.3-1

ANNUAL SUMMARY OF SPECIFIC RADIONUCLIDES DETECTED IN
SEDIMENT SAMPLES TAKEN QUARTERLY AT RIVER STATIONS

pCi/gm (dry)

Radionuclide	n	Maximum	Minimum	Average	s	L_i-L_b	MDD
Background Station (No. 170)							
Be-7	1			1.79			
K-40	4	10.20	7.08	8.58	1.28		
Zr-95	1			0.23			
Cs-137	3	0.38	0.17	0.26	0.11		
Ce-144	0						
Ra-226	4	3.54	1.56	2.48	0.87		
Th-228	4	2.17	0.97	1.68	0.51		
Indicator Stations (Nos. 171 and 172)							
Be-7	2	2.03	1.42	1.73	0.43	-0.06	
K-40	8	15.50	8.03	10.00	2.38	1.42	4.10
Zr-95	4	0.32	0.16	0.22	0.07	-0.01	
Cs-137	8	0.50	0.20	0.33	0.11	0.07	0.24
Ce-144	3	1.02	0.50	0.70	0.28		
Ra-226	8	4.17	1.98	3.21	0.76	0.73	1.54
Th-228	8	2.29	1.74	2.01	0.24	0.33	0.67

TABLE 2.3-2

ANNUAL SUMMARY OF SPECIFIC RADIONUCLIDES DETECTED IN SEDIMENT SAMPLES TAKEN QUARTERLY AT ESTUARY STATIONS

pCi/gm (dry)

Radionuclide	n	Maximum	Minimum	Average	s	L_i-L_b	MDD
Background Station (St. Catherine's Sound)							
Be-7	1			2.42			
K-40	4	12.30	5.04	9.94	3.34		
Co-58	1			0.18			
Zr-95	0						
Cs-134	0						
Cs-137	2	0.43	0.34	0.38	0.06		
Ce-144	2	1.28	1.25	1.27	0.02		
Ra-226	2	2.22	1.16	1.69	0.75		
Th-228	4	1.58	1.03	1.33	0.23		
Indicator Station (Altamaha Sound)							
Be-7	1			1.27		-1.15	
K-40	4	14.6	8.79	11.51	2.97	1.57	8.28
Co-58	0						
Zr-95	1			0.10			
Cs-134	1			0.10			
Cs-137	4	0.38	0.07	0.20	0.13	-0.18	0.46
Ce-144	2	0.59	0.52	0.56	0.05	-0.71	0.10
Ra-226	4	2.59	1.96	2.11	0.33	0.42	1.88
Th-228	4	2.62	1.53	2.01	0.46	0.68	0.95

2.5 MISCELLANEOUS

This section contains topics or activities related to the radiological environmental monitoring program but which do not seem appropriate to a particular sampling medium or to a particular category of discharge. The results from participation in EPA's Crosscheck Program by laboratories analyzing the radiological environmental samples are discussed. A synoposis of an independent assessment of Georgia Power Company's (GPC's) radiological environmental monitoring program by the Environmental Protection Division of the State of Georgia is provided.

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2.5.1 CROSSCHECK PROGRAM

Participation by two control laboratories in the EPA Environmental Radioactivity Laboratory Intercomparison Studies (Crosscheck Program) began several years ago. Such participation is a requirement of the new ETS. The results obtained from participation since the date on which the Unit 2 Operating License was obtained are included in Tables 2.5-1, 2.5-2A and 2.5-2B. Because of the time lag involved in obtaining results from the EPA and the subsequent reporting of these results to GPC by the contract laboratories, it is not possible to obtain all results from the previous calendar year in time for submission in the Annual Environmental Surveillance Report. In fact, results for the latter part of each year are routinely reported to GPC in July of the next year. The results for the latter part of 1978 will be reported in the 1979 report.

Table 2.5-1 gives results of participation in the Crosscheck Program by Teledyne Isotope, Inc. Results are reported for those sample types which are specified in Table 3.2-1 of the new ETS, which are routinely analyzed by Teledyne and which are part of the EPA program. (Not all sample types and nuclides listed in the ETS are provided by the EPA). As can be seen in Table 2.5-1, all Teledyne measurements were in agreement with the EPA known values. Agreement is calculated by using the NRC's "Criteria for Comparing Analytical Measurements" as described in Attachment 1.

Tables 2.5-2A and 2.5-2B give results of participation in the Crosscheck Program by Eberline Instrument Corporation who routinely analyze only the milk and the TLDs. The milk samples were provided by EPA, whereas the TLDs were dosed to known values by Battelle Pacific Northwest Laboratory which Eberline informs us is approved by EPA for this program. For all but one milk sample sufficient information was not provided by EPA to calculate agreement. For that one sample there was agreement. In the case of the TLDs all of Eberline's reported values plus or minus two standard deviations bracket the known values (Battelle's values).

The radiochemistry laboratory at HNP analyzes air particulate filters for gross beta only. Due to a change in the Crosscheck Program air particulate filters were not sent out by EPA in September 1978. Also filters were not sent to Plant Hatch in December 1978 due to a misunderstanding by EPA of our request to participate in the Crosscheck Program. This problem has now been clarified with EPA and filters are being received. Prior to the date of required participation in the Crosscheck Program, the HNP laboratory had analyzed two EPA filters for gross beta and results were in agreement with the EPA known values.

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TABLE 2.5-1

PARTICIPATION BY TELEDYNE ISOTOPES (TI) IN CROSSCHECK PROGRAM

Date	6/78	6/78	6/78
Radionuclide	Cs-137	Ra-226	Ra-228
Units	pCi/filter	pCi/l	pCi/l
Media	Air Filter	Water	Water
EPA Known Value	18 $\pm$ 5	3.7 $\pm$ 0.6	3.6 $\pm$ 0.8
TI Results	17 $\pm$ 4	3.9 $\pm$ 0.1	4.4 $\pm$ 1.3
EPA Resolution	3.6	6.2	7.0
TI/EPA Ratio	0.94	1.1	0.79
Evaluation	Agreement	Agreement	Agreement

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TABLE 2.5-2A

PARTICIPATION BY EBERLINE INSTRUMENT CORPORATION (EIC)
IN CROSSCHECK PROGRAM FOR MILK

pCi/l

Date	7/78	7/78	7/78
Radionuclide	Cs-137	I-131	Ba-140
EPA Known Value	53 ± 5		
EIC Results	55 ± 6	<10	<20
EPA Resolution	10.6		
EIC/EPA Ratio	1.0		
Evaluation	Agreement		

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TABLE 2.5-2B

PARTICIPATION BY EBERLINE INSTRUMENT CORPORATION (EIC)
IN CROSSCHECK PROGRAM WITH TLDs

mrem

Date	Battelle Known Values	EIC Results
3rd qtr, 1978	37	35 ± 2
	43	42 ± 3
	69	67 ± 5
	75	77 ± 6
	30	29 ± 3
	37	36 ± 2
	50	53 ± 6
	69	70 ± 8
	98	95 ± 8
	98	105 ± 8
4th qtr, 1978	41	41 ± 2
	36	35 ± 2
	29	29 ± 2
	56	58 ± 2
	88	88 ± 3
	45	45 ± 2
	67	67 ± 2
	17	17 ± 2
	82	86 ± 7
	11	11 ± 1

ATTACHMENT 1

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgment limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated one sigma uncertainty. As the ratio, referred to in this program as "Resolution", increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement should be considered acceptable as the resolution decreases. The values in the ratio criteria may be rounded to fewer significant figures to maintain statistical consistency with the number of significant figures reported by the NRC Reference Laboratory, unless such rounding will result in a narrowed category of acceptance. The acceptance category reported will be the narrowest into which the ratio fits for the resolution being used.

RESOLUTION	RATIO = LICENSEE VALUE/NRC REFERENCE VALUE		
	Agreement	Possible Agreement "A"	Possible Agreeable "B"
<3	No Comparison	No Comparison	No Comparison
≥3 and <4	0.4 - 2.5	0.3 - 3.0	No Comparison
≥4 and <8	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0
≥8 and <16	0.6 - 1.67	0.5 - 2.0	0.4 - 2.5
≥16 and <51	0.75 - 1.33	0.6 - 1.67	0.5 - 2.0
≥51 and <200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.67
≥200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33

"A" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is greater than 250 keV.

Tritium analyses of liquid samples.

"B" criteria are applied to the following analyses:

Gamma spectrometry, where principal gamma energy used for identification is less than 250 keV.

Sr-89 and Sr-90 determinations.

Gross beta, where samples are counted on the same date using the same reference nuclide.

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2.5.2 INDEPENDENT ASSESSMENT

Beginning in the 4th quarter of 1978 the Environmental Protection Division (EPD) of the State of Georgia initiated a limited radiological monitoring program in the vicinity of HNP. This program was proposed by the NRC as a means of obtaining independent environmental radiological assessment around NRC licensed facilities. Consequently, this program, in reality, serves as a crosscheck of GPC's monitoring results.

Throughout 1978 GPC cooperated with EPD in establishing this program. The essence of the EPD program involves sample splitting with GPC and the use of several of GPC's sampling locations. Sample media collected by EPD include airborne particulates, radioiodine, TLDs, river water, fish, milk, and vegetation. Analytical results obtained by the program will be sent to NRC by EPD with copies forwarded to GPC. The first report on this program is presently being prepared.

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2.6 CONCLUSIONS

This chapter has shown the licensee's conformance with the radiological portions of both the old Unit 1 ETS and the new ETS. It has been shown that all data were carefully examined. A summary, an interpretation and an evaluation (where warranted) of the results of the laboratory analyses for each type sample collected have been presented.

A measurable radiological impact upon the environment as a consequence of discharges to the atmosphere and to the river was not established. The radiological impact upon the environment due to nuclear weapons tests conducted by the Peoples Republic of China was strong and clear in many of the samples collected to monitor discharges to the atmosphere. The impacts from the weapons tests of 1978 were generally less pronounced than those found from the tests in 1976 and 1977.

The environmental impact of the high tritium levels found in ground water samples during 1977 and the first part of 1978 is miniscule. Resolution of the ground water problem is progressing satisfactorily.

5.0 Administrative Controls

5.1 Specification

In accordance with Section 5.7.1 of the HNP-ETS, Units I and II, the HNP Annual Environmental Surveillance Report will include a summary of: all instances of ETS non-compliance, changes in Federal and State permits and certificates, changes in the EPDD, changes in station design or operation which could involve an environmental impact, changes to the ETS, and copies of all reports regarding station discharges made in accordance with NPDES Permit No. GA-0004120.

5.2 Discussion

As noted in Section 4.3.2, aerial surveys of transmission lines should be conducted on a semi-annual basis. Surveys were flown in August and December, 1978, therefore, this requirement was in non-compliance. Future surveys will be conducted on a semi-annual basis until this requirement is deleted.

Section 5.6.2, of the E.T.S. states in part, that procedures shall be established to assure the quality of ETS program results including analytical measures. In addition, these quality assurance procedures shall provide for systems to identify and correct deficiencies in technical monitoring programs or related administrative activities, to investigate anomalous or suspect results and to review and evaluate program results.

Contrary to the above, an NRC inspection disclosed that quality assurance procedures for program results were not established. A deficiency was issued for this non-compliance. Procedures to correct this deficiency were issued in April 1979.

Section 5.5.1 of the E.T.S. requires that detailed written procedures be prepared and followed for all activities involved in carrying out the E.T.S.

Contrary to the above, an NRC inspection revealed that the procedure for performing air flow measurements at environmental air cabinets was not strictly adhered to. The inspection also revealed that the procedure for collecting, treating, and shipping milk samples was not strictly adhered to. The deviations did not affect the analytical results of the samples; however, a deficiency was issued against this deviation. Both procedures are now being strictly adhered to by plant personnel.

There were no changes in the EPDD or station design or operation during 1978.

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A change was made in the NPDES Permit No. GA-0004120 in March, 1978, to eliminate the free available chlorine monitoring requirement for the cooling tower blowdown discharge from outfall 001 (b) as per letter from J. L. Ledbetter, director of Department of Natural Resources to T. E. Byerley, Manager of Environmental Affairs, GPC.

On November 16, 1978, amendment No. 61 to Facility License No. DPR-57 for Edwin I. Hatch Nuclear Plant Unit I was issued to replace the existing ETS with the ETS approved for Hatch Unit II.

Copies of all reports regarding station discharges in accordance with NPDES Permit No. GA-0004120 are included in Appendix A.

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