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ENVIRONMENTAL RADIOACTIVITY LEVELS
BELLEFONTE NUCLEAR PLANT
ANNUAL REPORT - 1980
TVA/OMS/OHS - 81/6

June 1981

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Data were entered in computer storage for processing specific to the analysis conducted. A computer, employing an ALPHA-M least-squares code, using multimatrix techniques was used to estimate the activities of the gamma-emitting nuclides analyzed by NaI(Tℓ). The data obtained by Ge(Li) detectors were resolved by the ND-4420 software.

The detection capabilities for environmental sample analysis given as the nominal lower limits of detection (LLD) are listed in table 3. Samples processed by NaI(Tℓ) gamma spectroscopy were analyzed for 13 specific gamma-emitting radionuclides and radionuclide combinations[a]. For these analyses, radionuclide combinations such as $^{103,\ 106}$Ru and ^{95}Zr-Nb are analyzed as one radionuclide. All photopeaks found in Ge(Li) spectra were identified and quantified. Many of the isotopes identified by Ge(Li) spectral analysis are naturally occurring or naturally produced radioisotopes, such as ^{7}Be, ^{40}K, ^{212}Bi, ^{214}Bi, ^{212}Pb, ^{214}Pb, ^{226}Ra, etc. LLD's for the analysis of the radionuclides listed below[a] are given in table 3B. LLD's for additional radionuclides identified by Ge(Li) analysis were calculated for each analysis and nominal values are listed in the appropriate data tables. In the instance where an LLD has not been established, an LLD value of zero was assumed. A notation in a table of "__ values <LLD" for an isotope with no established LLD does not imply a value less than 0; rather it indicates that the isotope was not identified in that specific group of samples. For each sample type, only the radionuclides for which values greater than the LLD were reported are listed in the data tables.

TVA's radioanalytical laboratories participate in the Environmental Radioactivity Laboratory Intercomparison Studies Program conducted by EPA-Las Vegas. This program provides periodic cross-check samples of the type and radionuclide composition normally analyzed in an environmental monitoring program. Routine sample handling and analysis procedures were employed in the evaluation of these samples. The EARL began processing samples in May of 1980. Gamma spectral analyses were performed using NaI detectors. The results received during calendar year 1980 are shown in table 4. The $\pm 3\sigma$ limits based on one measurement were divided by the square root of 3 to correct for triplicate determinations.

---

[a]The following radionuclides and radionuclide combinations are quantified by the ALPHA-M least-squares computer code: $^{141,\ 144}$Ce; ^{51}Cr: ^{131}I; ^{103} ^{106}Ru; ^{134}Cs; ^{137}Cs; ^{95}Zr-Nb; ^{58}Co; ^{54}Mn; ^{65}Zn; ^{60}Co; ^{40}K; and ^{140}Ba-La.

ENVIRONMENTAL RADIOACTIVITY LEVELS

BELLEFONTE NUCLEAR PLANT

ANNUAL REPORT

1980

Introduction

The Bellefonte Nuclear Plant (BLN), being constructed by the Tennessee Valley Authority, is located in Jackson County, Alabama, on a peninsula bounded on the west by Town Creek embayment and on the east by Guntersville Reservoir at Tennessee River Mile (TRM) 391.5. (See figure 1). The site is approximately 6 miles (10 kilometers) northeast of Scottsboro, Alabama. The plant will consist of two pressurized water reactors; each unit is rated at 3,620 MWt and 1,271 MWe. Fuel load in unit 1 is scheduled for March 1983.

A preoperational environmental radiological monitoring program was implemented in August 1978. This program has the objective of establishing a baseline of data on the distribution of natural and manmade radioactivity in the environment near the plant site. This report presents the results obtained from that program during 1980.

Staffs in the Division of Occupational Health and Safety, the Division of Water Resources, and the Division of Natural Resource Operations, carried out the sampling program outlined in table 1. Sampling locations are shown in figures 2 and 3, and table 2 describes the locations of the atmospheric and terrestrial monitoring stations. All the radiochemical and instrumental analyses were conducted in TVA's Western Area Radiological Laboratory (WARL) located at Muscle Shoals, Alabama and Eastern Area Radiological Laboratory (EARL) at Vonore, Tennessee. Alpha and beta analyses were performed on Beckman Low Beta II, Beckman Wide Beta II, and Tennelec LB5100 low background proportional counters. Nuclear Data (ND) Model 100 multichannel analyzer systems employing sodium iodide, NaI(Tl) detectors and ND Model 4420 Systems in conjuction with germanium, Ge(Li) detection systems were used to analyze the samples for specific gamma-emitting radionuclides. At the EARL, an ND Model 6620 system is used with both types of detectors. Samples of water, vegetation, air particulates, food crops, and charcoal (specific analysis for ^{131}I) are routinely counted with NaI(Tl) detection systems. If significant concentrations of radioisotopes are identified, or if there is a reasonable expectation of increased radioactivity levels (such as during periods of increased fallout), these samples are counted on the Ge(Li) system. Identification of gamma-emitting radionuclides in all other types of samples is routinely performed by analysis on the Ge(Li) system. TVA fabricated and Tennelec beta-gamma coincidence counting systems are utilized for the determination of ^{131}I concentrations in milk. Tritium determinations are made with Beckman LS150, Beckman LS100C, and Packard Model 3250 liquid scintillation counting systems.

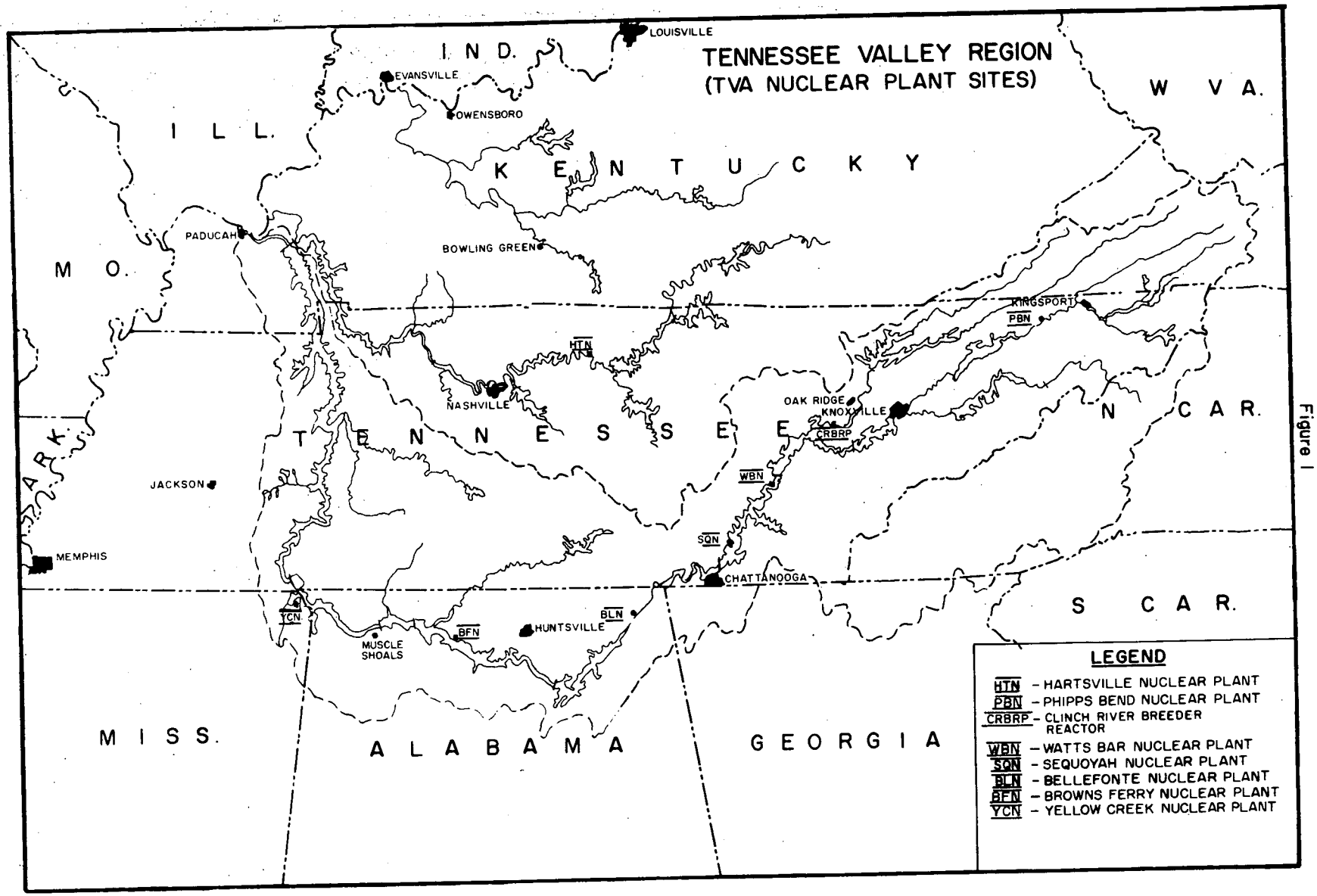

TENNESSEE VALLEY REGION
(TVA NUCLEAR PLANT SITES)
LOUISVILLE
IND.
EVANSVILLE
OWENSBORO
ILL.
KENTUCKY
W VA.
PADUCAH
BOWLING GREEN
MO.
KINGSPORT
PBN
HTN
NASHVILLE
OAK RIDGE
KNOXVILLE
CRBRP
N CAR.
ARK.
TENNESSEE
WBN
JACKSON
SQN
MEMPHIS
CHATTANOOGA
S CAR.
YCN
BLN
BFN
HUNTSVILLE
MUSCLE SHOALS
MISS.
ALABAMA
GEORGIA
LEGEND
HTN - HARTSVILLE NUCLEAR PLANT
PBN - PHIPPS BEND NUCLEAR PLANT
CRBRP - CLINCH RIVER BREEDER REACTOR
WBN - WATTS BAR NUCLEAR PLANT
SQN - SEQUOYAH NUCLEAR PLANT
BLN - BELLEFONTE NUCLEAR PLANT
BFN - BROWNS FERRY NUCLEAR PLANT
YCN - YELLOW CREEK NUCLEAR PLANT

Figure 1

Table 1

ENVIRONMENTAL RADIOACTIVITY SAMPLING SCHEDULE
BELLEFONTE NUCLEAR PLANT

Station Location	Air Filter	Charcoal Filter	Rain-water	Heavy Particle Fallout	Vegetation	Milk	Well Water	Public Water	Fish
Site SW	W	W	M	M	Q				
Site NE	W	W	M	M	Q				
Scottsboro	W	W	M	M	Q			M	
Hollywood	W	W	M	M	Q			M	
Fackler	W	W	M	M	Q				
Stevenson	W	W	M	M	Q				
Pisgah	W	W	M	M	Q				
Section	W	W	M	M	Q				
Lim Rock	W	W	M	M	Q				
Rainsville	W	W	M	M	Q				
Farm S					Q	M			
Farm G					Q				
Farm H					Q				
Farm D							M		
Farm C (Control)[a]						M	M		
Well A							M		
Onsite Wells (6)							M		
Sand Mountain Water & Fire Protection Authority								M	
Widows Creek Steam Plant								M	
Wheeler Reservoir									S[b]
Guntersville Reservoir									S[b]
Nickajack Reservoir									S[c]

W - Weekly M - Monthly Q - Quarterly S - Semiannually

[a]Sampling initiated in August, 1980.

[b]Samples collected as a part of the Browns Ferry Nuclear Plant monitoring program.

[c]Samples collected as a part of the Sequoyah Nuclear Plant monitoring program.

Table 2

Atmospheric and Terrestrial Monitoring Stations Locations
Bellefonte Nuclear Plant

Sample Station	Approximate Distance and Direction from Plant	
LM - 1 BL, Southwest	3/4 mile (1-1/4 kilometers)	SW
LM - 2 BL, Northeast	1 mile (1-1/2 kilometers)	NE
PM - 1 BL, Scottsboro, AL	5-3/4 miles (9-1/4 kilometers)	WSW
PM - 2 BL, Hollywood, AL	2 miles (3-1/4 kilometers)	WNW
PM - 3 BL, Fackler, AL	5-1/4 miles (8-1/2 kilometers)	N
PM - 4 BL, Stevenson, AL	11 miles (17-3/4 kilometers)	NNE
PM - 5 BL, Pisgah, AL	4 miles (6-1/2 kilometers)	ESE
PM - 6 BL, Section, AL	9 miles (14-1/2 kilometers)	SSW
RM - 1 BL, Lim Rock, AL (Control)	18 miles (29 kilometers)	W
RM - 2 BL, Rainsville, AL (Control)	14-1/2 miles (23-1/3 kilometers)	SSE
Farm S	5 miles (8 kilometers)	SW
Farm G	2-1/2 miles (4 kilometers)	NNE
Farm H	1 mile (1-2/3 kilometers)	NW
Farm D	1 mile (1-2/3 kilometers)	W
Well A	1-1/2 miles (2-1/2 kilometers)	NNE

Table 3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

A. Specific Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)*

	Air Particulates pCi/m^3	Charcoal pCi/m^3	Fallout mCi/km^2	Water pCi/l	Vegetation and grain pCi/g, dry	Soil and Sediment pCi/g, dry	Fish, clam flesh, plankton, pCi/g, dry	Clam shells pCi/g, dry	Foods, meat, poultry, pCi/kg, wet	Milk pCi/l
Total α			-	0.4	0.01				1.5	
Gross α	0.005			2.0	0.05	0.35	0.1	0.7		
Gross β	0.01		0.05	2.4	0.20	0.70	0.1	0.7	25	
^{3}H				330						
^{131}I		0.02								0.5
^{89}Sr	0.005			10	0.25	1.5	0.5	5.0	40	10
^{90}Sr	0.001			2	0.05	0.3	0.1	1.0	8	2

*All LLD values for isotopic separations are calculated by the method developed by Pasternack and Harley as described in HASL-300. Factors such as sample size, decay time, chemical yield, and counting efficiency may vary for a given sample; these variations may change the LLD value for the given sample. The assumption is made that all samples are analyzed within one week of the collection date. Conversion factors: 1 pCi = 3.7×10^{-2} Bq; 1 mCi = 3.7×10^{7} Bq.

Table 3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

B. Gamma Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)

	Air particulates pCi/m^3		Water and milk pCi/l		Vegetation and grain pCi/g, dry		Soil and sediment pCi/g, dry		Fish pCi/g, dry		Clam flesh and plankton pCi/g, dry	Clam shells pCi/g, dry		Foods, (tomatoes potatoes, etc.) pCi/kg, wet		Meat and poultry pCi/kg, wet	
	NaI*	Ge(Li)**	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)
^{141,144}Ce	0.03		38		0.55		0.35		0.35			0.35		38		90	
^{144}Ce		0.02		33		0.22		0.06		0.06	0.35		0.06		33		40
^{51}Cr	0.07	0.03	60	44	1.10	0.47	0.50	0.10	0.60	0.10	0.56	0.60	0.10	60	44	200	90
^{131}I	0.01	0.01	15	8	0.35	0.09	0.20	0.02	0.20	0.02	0.07	0.20	0.02	15	8	50	20
^{103,106}Ru	0.04		40		0.65		0.45		0.45			0.45		40		150	
^{106}Ru		0.03		40		0.51		0.11		0.11	0.74		0.11		40		90
^{134}Cs	0.01	0.02	10	26	0.20	0.33	0.12	0.08	0.12	0.08	0.48	0.12	0.08	10	26	40	50
^{137}Cs	0.01	0.01	10	5	0.20	0.06	0.12	0.02	0.12	0.02	0.08	0.12	0.02	10	5	40	15
^{95}Zr-Nb	0.01		10		0.20		0.12		0.12			0.12		10		40	
^{95}Zr		0.01		10		0.11		0.03		0.03	0.15		0.03		10		20
^{95}Nb		0.01		5		0.05		0.01		0.01	0.07		0.01		5		15
^{58}Co	0.02	0.01	15	5	0.23	0.05	0.20	0.01	0.20	0.01	0.07	0.20	0.01	15	5	55	15
^{54}Mn	0.02	0.01	10	5	0.20	0.05	0.15	0.01	0.15	0.01	0.08	0.15	0.01	10	5	40	15
^{65}Zn	0.02	0.01	15	9	0.25	0.11	0.23	0.02	0.23	0.02	0.17	0.23	0.02	15	9	70	20
^{60}Co	0.01	0.01	10	5	0.17	0.06	0.11	0.01	0.11	0.01	0.08	0.11	0.01	10	5	30	15
^{40}K	0.10		150		2.50		0.90		0.90			0.90		150		400	
^{140}Ba-La	0.02		15		0.68		0.15		0.15			0.15		15		50	
^{140}Ba		0.02		25		0.34		0.07		0.07	0.30		0.07		25		50
^{140}La		0.01		7		0.08		0.02		0.02	0.10		0.02		7		15

*The NaI(Tl) LLD values are calculated by the method developed by Pasternack and Harley as described in HASL-300 and Nucl. Instr. Methods 91, 533-40 (1971). These LLD values are expected to vary depending on the activities of the components in the samples. These figures do not represent the LLD values achievable on a given sample. Water is counted in a 3.5-L Marinelli beaker. Vegetation, fish, soil, and sediment are counted in a 1-pint container as dry weight. The average dry weight is 120 grams for vegetation and 400-500 grams for soil sediment and fish. Meat and poultry are counted in a 1-pint container as dry weight, then corrected to wet weight using an average moisture content of 70%. Average dry weight is 250 grams. Air particulates are counted in a well crystal. The counting system consists of a multichannel analyzer and either a 4" x 4" solid or 4" x 5" well NaI(Tl) crystal. The counting time is 4000 seconds. All calculations are performed by the least-squares computer program ALPHA-M. The assumption is made that all samples are analyzed within one week of the collection date.

**The Ge(Li) LLD values are calculated by the method developed by Pasternack and Harley as described in HASL-300. These LLD values are expected to vary depending on the activities of the components in the samples. These figures do not represent the LLD values achievable on given samples. Water is counted in either a 0.5-L or 3.5-L Marinelli beaker. Solid samples such as soil, sediment, and clam shells are counted in a 0.5-L Marinelli beaker as dry weight. The average dry weight is 400-500 grams. Air filters and very small volume samples are counted in petrie dishes centered on the detector endcap. The counting system consists of a ND-4420 multichannel analyzer and either a 25%, 14%, 16%, or 29% Ge(Li) detector. The counting time is normally 8 hours. All spectral analysis is performed using the software provided with the ND-4420. The assumption is made that all samples are analyzed within one week of the collection date.

Conversion factor: 1 pCi = 3.7×10^{-2} Bq.

Table 4

Results Obtained in Interlaboratory Comparison Program

A. Air Filter (pCi/filter)

Date	Gross Alpha EPA value (±3σ)	Gross Alpha TVA AVG. WARL[a]	Gross Alpha TVA AVG. EARL[b]	Gross Beta EPA value (±3σ)	Gross Beta TVA AVG. WARL	Gross Beta TVA AVG. EARL	Stontium-90 EPA value (±3σ)	Stontium-90 TVA AVG. WARL	Stontium-90 TVA AVG. EARL	Cesium-137 EPA value (±3σ)	Cesium-137 TVA AVG. WARL	Cesium-137 TVA AVG. EARL
12/79	10 ± 9	10		29 ± 9	33		9 ± 2.6	11		10 ± 9	10	
3/80	----------Equipment malfunction at EPA----------											
6/80	24 ± 10	26	25	28 ± 9	33	36	8 ± 2.6	9	8	12 ± 9	13	12
9/80	24 ± 9	24	24	10 ± 9	12	16	0	0	<1	10 ± 9	9	9
12/80	----------Results not received at this time----------											

B. Tritium in Urine (pCi/l)

Date	EPA VALUE (±3σ)	TVA AVERAGE WARL	TVA AVERAGE EARL
12/79	2060 ± 599	2100[c]	
3/80	2173 ± 603	2300	
6/80	2500 ± 610	1437[d]	2007
9/80	1700 ± 589	1723	1693
12/80	3150 ± 624	3287	3576

Table 4 (Contd)

Results Obtained in Interlaboratory Comparison Program

C. Radiochemical Analyses of Water (pCi/l)

Date	Gross Alpha			Gross Beta			Strontium - 89			Strontium - 90			Tritium			Iodine - 131[e]		
	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL
11/79	12±9	14		27±9	27													
12/79																		
1/80	30±14	25		45±9	47		10±9	9[g]		20±2.6	23[g]		2040±599	2128[f]		53±9	50	
2/80																		
3/80	13±9	12		22±9	25								1750±591	1920				
4/80																		
5/80	23±9	23	20	14±9	15	18	5±9	4	6	12±2.6	13	11	3400±624	3363		44±9	41	
6/80																		
7/80	36±16	31	19[h]	38±9	44	41							2000±598	1947	1960			
8/80																		
9/80	32±14	34	27	21±9	26	24	24±9	27	23	15±2.6	18	16	1210±570	1180	1223	36±9	33	26[h]
10/80																		
11/80	16±9	16	20	13±9	16	24[i]							3200±624	3207	3207			
12/80																		
													2240±606	2270	2213	22±10	21	19

D. Gamma-Spectral Analysis of Water (pCi/l)

Date	Chromium - 51			Colbalt - 60			Zinc - 65			Ruthenium - 106			Cesium - 134			Cesium - 137		
	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL
2/80	101±9	93		11±9	11		25±9	31		51±9	33[k]		10±9	16		30±9	31	
6/80	13±9[j]	0	0	5±9	7	5	23±9	25	21	37±9	36	40	11±9	15	10	17±9	19	18
10/80	86±9	74[k]	90	16±5	14	15	25±9	24	20	46±9	35[k]	42	20±9	22	19	12±9	12	13

Table 4 (Contd)

Results Obtained in Interlaboratory Comparison Program

E. Milk (pCi/l)[m]

Date	Strontium - 89			Strontium - 90			Iodine - 131			Cesium - 137			Barium - 140			Potassium		
	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL	EPA value (±3σ)	TVA WARL	AVG. EARL
1/80	10±9	11		25±2.6	28		0.01±0.2	0		40±9	39		0.01±0.2	0		1600±139	1577	
4/80	10±9	10		15±2.6	18		33±9	23[i]		28±9	30		0	0		1190±103	1117	
7/80	55±9	57	59	17±2.6	19	18	0	0	0	35±9	34	35	0	0	0	1550±135	1593	1533
10/80	23±9	25	25	0	1	<2	18±9	18	12	21±9	22	22	0	0	<15	1620±140	1447	1473

F. Foods (pCi/kg, Wet Weight)[n]

11/79	73±9	71		27±2.6	34[p]		127±11	127		22±9	24		0.001	0		1511±132	1372	
3/80	Sample spoiled in transit																	
7/80	94±9	113[p]	107[p]	13±2.6	22[p]	17[p]	54±9	47	49	27±9	27	27	0	0	0	2260±225	2737	2730
11/80	8±9	<10	<10	0	3	3	34±10	24	24	12±9	11	10	0	<15	<25	2520±208	2560	2723

a. Western Area Radiological Laboratory, Muscle Shoals, Alabama.
b. Eastern Area Radiological Laboratory, Vonore, Tennessee.
c. Not reported to EPA.
d. Low value result of deficiencies in analytical procedure. The procedure has been revised to correct these deficiencies.
e. Specific analysis for ^{131}I to test the procedures used for the analysis of ^{131}I in milk.
f. Results not returned by EPA.
g. ^{89}Sr and ^{90}Sr results reversed in report to EPA.
h. Laboratory in start up mode.
i. Investigation of the sample and procedures produced no indication for the cause of the discrepancy. Subsequent analyses have been satisfactory.
j. Below TVA LLD.
k. Analysis of these isotopes by NaI produce greater variation because of (1) the abundance of the main energy peaks (2) the broad shape of the peak, (3) relatively high background in the peak area, and (4) interference from radon peaks in the peak area.
m. Values for potassium reported as mg of potassium per ℓ of sample.
n. Values for potassium reported as mg of potassium per kg of sample.
p. Discrepancies in strontium values are believed to be due to (1) inhomogeneity of the sample ash and (2) magnification of slight errors in weight conversions. Efforts are being made to reduce the impacts of these variables.

Atmospheric Monitoring

The atmospheric monitoring network is divided into three subgroups. Two local air monitors are located within the plant boundary. Six perimeter air monitors are located at distances out to 9 miles (14.5 kilometers) from the plant in the towns of Scottsboro, Hollywood, Fackler, Stevenson, Pisgah, and Section. The remote air monitors are located at distances out to 18 miles (29 kilometers) from the plant in the Lim Rock community and the town of Rainsville. See table 2 and figures 2 and 3.

At each monitor, air is continuously pulled through a Hollingsworth and Vose HV-70 particulate filter at a regulated flow of 3 ft^3 /min (0.085 m^3/min). In series with, but downstream of, the particulate filter, is a charcoal filter used to collect iodine. Each monitor has a collection tray and storage container to collect rainwater on a continuous basis, and a horizontal platform covered with gummed acetate to catch and hold heavy particle fallout. Thermoluminescent dosimeters are used to record gamma radiation levels at each remote and perimeter station and at on-site locations as indicated in figure 3.

Each of the local and perimeter air monitors is fitted with a GM tube that continuously scans the particulate filter. The disintegration rate of the atmospheric radioactivity is continuously recorded at each station.

Air filters are collected weekly and analyzed for gross beta activity. During this period five samples were collected over a 2-week period, nineteen samples were not collected because of equipment malfunction, and one sample was accidently destroyed. No analyses are performed until 3 days after sample collection. The samples are composited monthly for analysis of specific gamma-emitting radionuclides and quarterly for ^{89}Sr, ^{90}Sr analysis. The results are presented in table 6.

With reference to table 5, which contains the maximum permissible concentrations (MPC) recommended by 10 CFR 20 for nonoccupational exposure, it is seen that the maximum beta concentration is 0.14 percent MPC.

Rainwater is collected and analyzed for specific gamma-emitting isotopes. A gamma scan is performed on a 3.5-liter monthly sample. The results are shown in table 7. During this period one sample was not obtained because of insufficient rainfall.

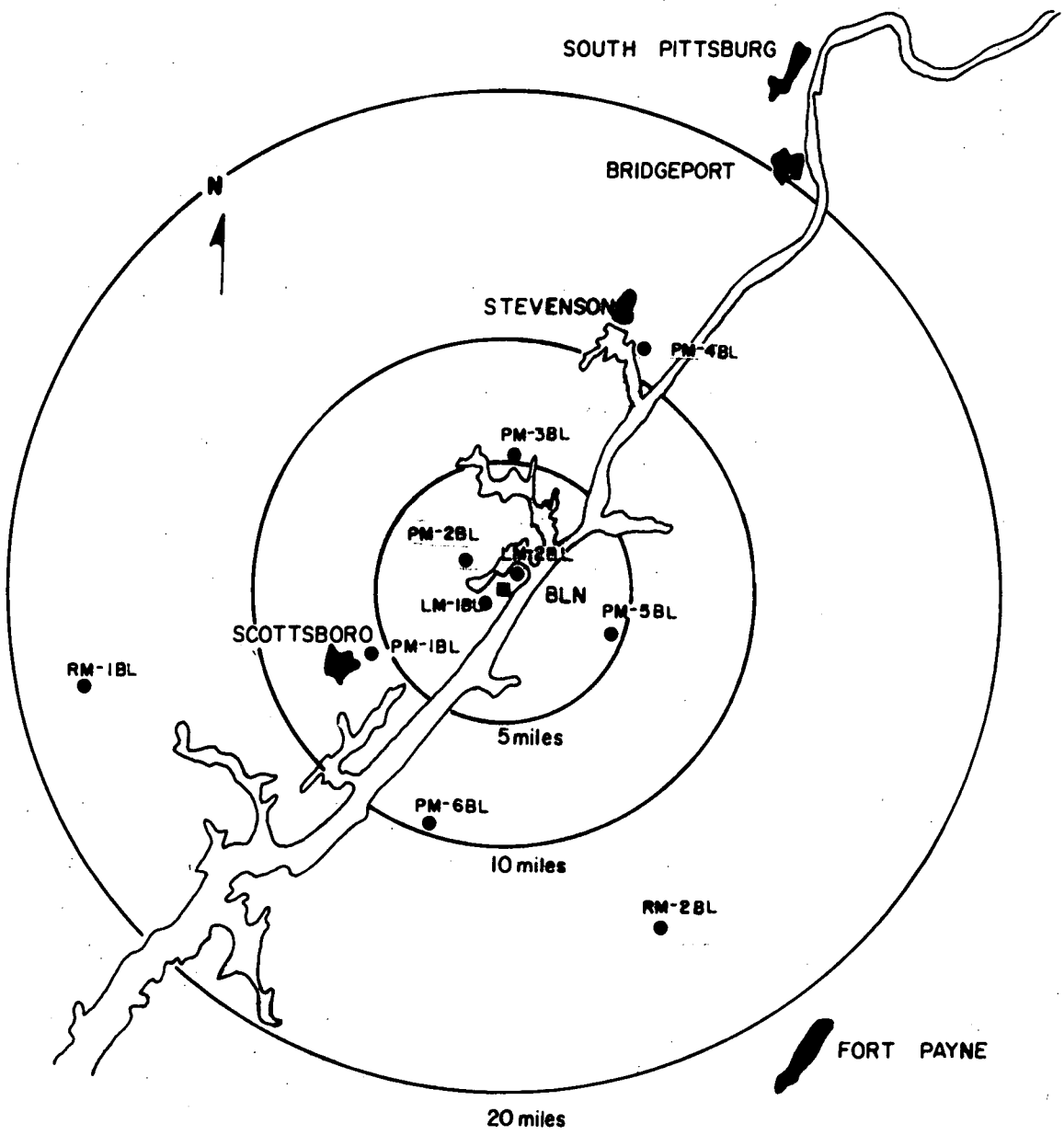
The gummed acetate that is used to collect heavy particle fallout is changed monthly. The sample is ashed and counted for gross beta activity. The results are given in table 8.

Charcoal filters are collected weekly and analyzed for radioiodine. During this period, eighteen samples were not collected because of equipment

malfunction and one sample was accidently destroyed. The filter is counted in a single channel analyzer system. The data are shown in table 9, where the highest value reported is 0.20 percent MPC for ^{131}I.

Figure 2

BELLEFONTE NUCLEAR PLANT
ATMOSPHERIC AND
TERRESTRIAL MONITORING NETWORK



NOTE: THE FOLLOWING SAMPLES ARE COLLECTED FROM EACH STATION:

AIR PARTICULATES	RAINWATER
RADIOIODINE	SOIL
HEAVY PARTICLE FALLOUT	VEGETATION

8-4-1977

Figure 3

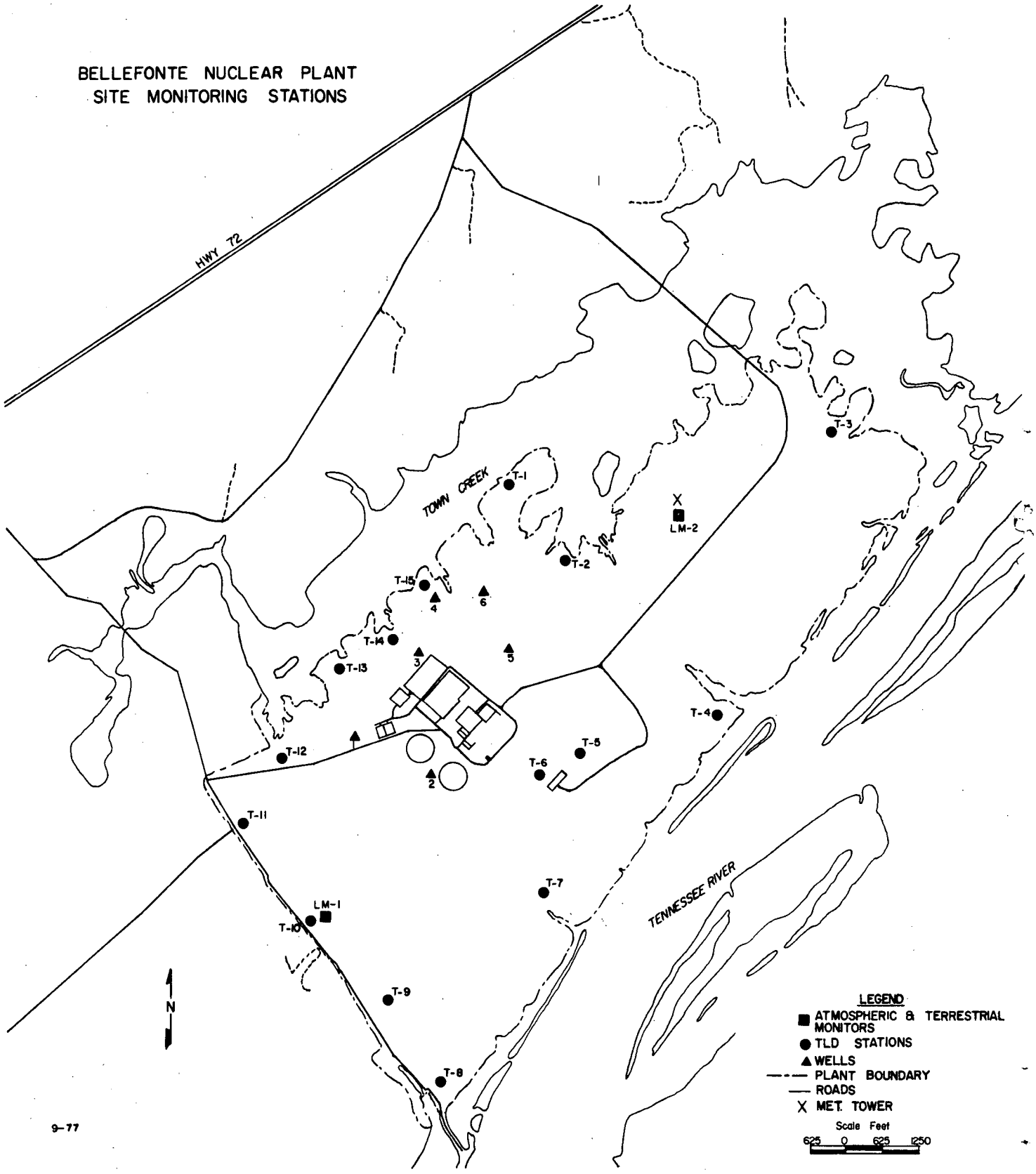

BELLEFONTE NUCLEAR PLANT
SITE MONITORING STATIONS
HWY 72
TOWN CREEK
TENNESSEE RIVER
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
T-11
T-12
T-13
T-14
T-15
LM-1
LM-2
2
3
4
5
6
N
9-77
LEGEND
ATMOSPHERIC & TERRESTRIAL MONITORS
TLD STATIONS
WELLS
PLANT BOUNDARY
ROADS
MET. TOWER
Scale Feet
625 0 625 1250

Table 5

MAXIMUM PERMISSABLE CONCENTRATIONS

FOR NONOCCUPATIONAL EXPOSURE

	MPC	
	In Water pCi/l*	In Air pCi/m^3*
Alpha	30	
Nonvolatile beta	3,000	100
Tritium	3,000,000	200,000
^{137}Cs	20,000	500
$^{103,106}Ru$	10,000	200
^{144}Ce	10,000	200
^{95}Zr-^{95}Nb	60,000	1,000
^{140}Ba-^{140}La	20,000	1,000
^{131}I	300	100
^{65}Zn	100,000	2,000
^{54}Mn	100,000	1,000
^{60}Co	30,000	300
^{89}Sr	3,000	300
^{90}Sr	300	30
^{51}Cr	2,000,000	80,000
^{134}Cs	9,000	400
^{58}Co	90,000	2,000

*1 pCi = 3.7×10^{-2} Bq.

TABLE 6

RADIOACTIVITY IN AIR FILTER

PCI/M(3) - 0.037 BQ/M(3)

NAME OF FACILITY BELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RH-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS[1]
GROSS BETA	0.010	0.03(395/ 399)	LM2 BL ENV DATA	0.04(51/ 51)	0.04(100/ 101)	
500		0.01- 0.14	1.0 MILE NE	0.01- 0.14	0.01- 0.11	
GAMMA (NAI)						
91						
I-131	0.010	0.02(8/ 72)	PM5 PISGAH,AL	0.02(1/ 10)	0.01(1/ 19)	
		0.01- 0.02	4.3 MILES ESE	0.02- 0.02	0.01- 0.01	
BE-7	NOT ESTAB	0.06(66/ 72)	PM4 STEVENSON,AL	0.07(7/ 8)	0.06(17/ 19)	
		0.02- 0.11	11.0 MILES NNE	0.04- 0.09	0.02- 0.09	
GAMMA (GELI)						
39						
CE-141	0.010	0.01(1/ 32)	PM1 SCOTTSBORO,A	0.01(1/ 4)	7 VALUES <LLD	
		0.01- 0.01	5.6 MILES WSW	0.01- 0.01		
RU-103	NOT ESTAB	0.01(6/ 32)	PM2 HOLLYWOOD,AL	0.01(1/ 6)	0.01(2/ 7)	
		0.01- 0.01	1.8 MILES WNW	0.01- 0.01	0.01- 0.01	
ZR-95	0.010	0.01(3/ 32)	PM6 SECTION,AL	0.01(1/ 3)	0.02(1/ 7)	
		0.01- 0.01	9.2 MILES SSW	0.01- 0.01	0.02- 0.02	
NB-95	0.010	0.01(2/ 32)	PM6 SECTION,AL	0.02(1/ 3)	0.02(1/ 7)	
		0.01- 0.02	9.2 MILES SSW	0.02- 0.02	0.02- 0.02	
K-40	NOT ESTAB	0.16(19/ 32)	PM4 STEVENSON,AL	0.29(5/ 5)	0.21(5/ 7)	
		0.06- 0.89	11.0 MILES NNE	0.07- 0.89	0.11- 0.50	
BI-214	0.020	0.03(15/ 32)	PM4 STEVENSON,AL	0.05(2/ 5)	0.05(3/ 7)	
		0.02- 0.08	11.0 MILES NNE	0.02- 0.08	0.03- 0.08	
PB-214	0.020	0.03(14/ 32)	PM4 STEVENSON,AL	0.05(2/ 5)	0.04(4/ 7)	
		0.02- 0.07	11.0 MILES NNE	0.03- 0.07	0.02- 0.08	
PB-212	NOT ESTAB	0.01(11/ 32)	PM1 SCOTTSBORO,A	0.02(1/ 4)	0.02(4/ 7)	
		0.00- 0.03	5.6 MILES WSW	0.02- 0.02	0.00- 0.02	
BE-7	0.050	0.08(21/ 32)	PM4 STEVENSON,AL	0.14(4/ 5)	0.07(4/ 7)	
		0.05- 0.35	11.0 MILES NNE	0.05- 0.35	0.06- 0.08	
TL-208	NOT ESTAB	0.01(4/ 32)	PM2 HOLLYWOOD,AL	0.01(1/ 6)	7 VALUES <LLD	
		0.00- 0.01	1.8 MILES WNW	0.01- 0.01		
SR 89	0.005	32 VALUES <LLD			8 VALUES <LLD	
40		ANALYSIS PERFORMED				
SR 90	0.001	32 VALUES <LLD			8 VALUES <LLD	
40		ANALYSIS PERFORMED				

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 7

RADIOACTIVITY IN RAINWATER

PCI/L - 0.037 BQ/L

NAME OF FACILITY SELLEFONTE — DOCKET NO. RH-81-8-BL1

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (NAI) 106						
I-131	15.000	16.10(1/ 85)	LM1 BL SOUTHWEST	16.10(1/ 11)	21 VALUES <LLD	
		16.10- 16.10	0.8 MILE SW	16.10- 16.10		
BE-7	NOT ESTAB	48.68(45/ 85)	LM1 BL SOUTHWEST	62.42(6/ 11)	45.84(14/ 21)	
		20.80- 97.70	0.8 MILE SW	33.80- 96.10	6.50- 90.80	
GAMMA (GELI) 23						
K-40	NOT ESTAB	72.15(6/ 18)	PM6 SECTION,AL	84.78(1/ 3)	191.97(3/ 5)	
		42.88- 104.90	9.2 MILES SSW	84.78- 84.78	100.20- 334.40	
BI-214	NOT ESTAB	19.39(14/ 18)	PM6 SECTION,AL	28.75(3/ 3)	13.81(1/ 5)	
		6.34- 44.44	9.2 MILES SSW	19.42- 44.44	13.81- 13.81	
PB-214	NOT ESTAB	22.31(2/ 18)	PM6 SECTION,AL	25.78(1/ 3)	5 VALUES <LLD	
		18.83- 25.78	9.2 MILES SSW	25.78- 25.78		
PB-212	NOT ESTAB	15.65(6/ 18)	LM1 BL SOUTHWEST	20.67(1/ 2)	15.65(2/ 5)	
		8.89- 20.67	0.8 MILE SW	20.67- 20.67	12.64- 18.66	
BE-7	NOT ESTAB	107.63(4/ 18)	PM5 PISGAH,AL	267.60(1/ 2)	5 VALUES <LLD	
		51.12- 267.60	4.3 MILES ESE	267.60- 267.60		

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 8

RADIOACTIVITY IN HEAVY PARTICLE FALLOUT

MCI/KM(2) - 37000000.00 BQ/KM(2)

NAME OF FACILITY BELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RM-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) [a]	ALL INDICATOR LOCATIONS MEAN (F) [b] RANGE [b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F) [b] RANGE [b]	CONTROL LOCATIONS MEAN (F) [b] RANGE [b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA	0.050	0.32(102/ 104)	PM6 SECTION,AL	0.78(13/ 13)	0.25(26/ 26)	
130		0.06- 8.33	9.2 MILES SSW	0.06- 8.33	0.05- 1.06	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 9

RADIOACTIVITY IN CHARCOAL FILTERS

PCI/M(3) - 0.037 BQ/M(3)

NAME OF FACILITY BELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RH-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION a (LLD)	ALL INDICATOR LOCATIONS MEAN (F) b RANGE b	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) b RANGE b	CONTROL LOCATIONS MEAN (F) b RANGE b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
IODINE IN AIR	0.020	0.03(40/ 400)	PM4 STEVENSON,AL	0.05(9/ 48)	0.03(13/ 101)	
501		0.02- 0.20	11.0 MILES NNE	0.02- 0.20	0.02- 0.06	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

Terrestrial Monitoring

Milk

Although there are no commercial dairy farms within five miles of the plant site, milk was collected, when available, from one farm producing milk for private consumption (See table 2). Sampling was initiated at a control dairy farm in August. Raw milk was analyzed monthly for ^{131}I, gamma-emitting radionuclides, and for radiostrontium. The results are shown in table 10.

As had been noted in earlier monitoring reports, the levels of ^{90}Sr in milk samples from farms producing milk for private consumption only, are up to six times the levels found in milk from commercial dairy farms. Samples of feed and water supplied to the animals were analyzed in 1979 in an effort to determine the source of the strontium. Analysis of dried hay samples indicated levels of ^{90}Sr slightly higher than those encountered in routine vegetation samples. Analysis of pond water indicated no significant strontium activity.

This phenomenon was also observed during preoperation monitoring at Sequoyah Nuclear Plant at a farm where only 1-2 cows were being milked for private consumption of the milk. It is postulated that the feeding practices of these small farmers differ from that of the larger dairy farmers to the extent that fallout from atmospheric nuclear weapons testing may be more concentrated in these instances.

Vegetation

Vegetation samples were collected quarterly from the farms from which milk was collected, from two additional farms, and from the vicinity of each atmospheric monitoring station and analyzed for gamma-emitting radionuclides. Approximately 1-2 kilograms of grass were broken or cut at ground level and returned for analysis. Efforts were made to sample vegetation that was representative of the pasturage where cattle graze. Table 11 gives the results obtained from the laboratory analyses.

Soil

Soil samples were collected semiannually near each monitoring station to provide an indication of any long-term buildup of radioactivity in the environment. An auger or "cookie cutter" type sampler was used to obtain samples of the top two inches (5 cm) of soil. These samples were analyzed for gamma-emitting radionuclides, ^{89}Sr and ^{90}Sr. The results are given in table 12.

Ground Water

Well water was obtained monthly from the two farms in the area and from six onsite wells. All samples were analyzed for gamma-emitting radionuclides and a quarterly composite was analyzed for tritium. The results are shown in table 13. During this period, samples were unavailable from two stations and two samples were not collected because the stations were inaccessible.

Public Water

Potable water supplies taken from the Tennessee River in the vicinity of Bellefonte Nuclear Plant are sampled and analyzed for gross beta, gamma-emitting radionuclides, ^{89}Sr, ^{90}Sr, and tritium. The results, shown in table 14, indicate that the maximum beta concentration is 0.22 percent MPC.

Environmental Gamma Radiation Levels

Bulb-type Victoreen Manganese-activated calcium fluoride (CaF_2: Mn) thermoluminescent dosimeters (TLD's) are placed at fifteen stations around the plant near the site boundary and at the perimeter and remote air monitors to determine the gamma exposure rates at these locations (see figures 2 and 3). The dosimeters, in approximate energy compensating shields are placed at approximately one meter above the ground, with three TLD's at each station. They are annealed and read with a Victoreen Model 2810 TLD reader. The values are corrected for gamma response, self-irradiation, and fading, with individual gamma response calibrations and self-irradiation factors determined for each TLD. The TLD's are exchanged every 3 months. The quarterly gamma radiation levels determined from these TLD's are given in table 15. It should be noted that even during the preoperational phase of the monitoring program, the average radiation levels onsite are generally 2-5 mR/quarter higher than the levels offsite. This is consistent with levels reported at TVA's other nonoperating nuclear power plant construction site where the average radiation levels onsite are generally 2-5 mR/quarter higher than levels offsite. This may be attributable to natural variations in environmental radiation levels, earth moving activities onsite, the mass of concrete employed in the construction of the plant, or other undetermined influences.

Poultry and Food Crops

Food crops and poultry raised in the vicinity of Bellefonte Nuclear Plant are sampled annually as they become available during the growing season. During this sampling period samples of corn, potatoes, tomatoes, and poultry were collected and analyzed for specific gamma-emitting radionuclides. The results are given in tables 16 and 17.

TABLE 10

RADIOACTIVITY IN MILK

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE — DOCKET NO. RH-81-8-BL1

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (NAI) 18						
CS-134	10.000	10.00(1/ 13)	SISK FARM	10.00(1/ 13)	5 VALUES <LLD	
		10.00- 10.00	4.9 MILES SW	10.00- 10.00		
K-40	150.000	1186.58(13/ 13)	SISK FARM	1186.58(13/ 13)	1223.92(5/ 5)	
		917.40- 1404.50	4.9 MILES SW	917.40- 1404.50	1144.70- 1280.60	
IODINE IN MILK 18	0.500	3.99(2/ 13)	SISK FARM	3.99(2/ 13)	2.37(1/ 5)	
		2.00- 5.98	4.9 MILES SW	2.00- 5.98	2.37- 2.37	
SR 89 18	10.000	13 VALUES <LLD			5 VALUES <LLD	
		ANALYSIS PERFORMED				
SR 90 18	2.000	21.53(13/ 13)	SISK FARM	21.53(13/ 13)	4.76(5/ 5)	
		11.68- 35.25	4.9 MILES SW	11.68- 35.25	3.72- 5.40	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 11

RADIOACTIVITY IN VEGETATION

PCI/G - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY BELLEFONTE — DOCKET NO. RM-81-8-BL1
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS[#]
GAMMA (GELI)						
^{54}CE-141	0.200	1.31(11/ 44)	PM4 STEVENSON,AL	2.53(1/ 4)	0.88(3/ 10)	
		0.70- 2.53	11.0 MILES NNE	2.53- 2.53	0.60- 1.09	
CE-144	0.220	0.42(9/ 44)	LM2 BL ENV DATA	0.54(1/ 4)	0.55(2/ 10)	
		0.24- 0.54	1.0 MILE NE	0.54- 0.54	0.53- 0.58	
BA-140	0.340	0.76(9/ 44)	PM2 HOLLYWOOD,AL	1.06(1/ 4)	0.37(1/ 10)	
		0.46- 1.06	1.8 MILES WNW	1.06- 1.06	0.37- 0.37	
LA-140	0.080	0.55(11/ 44)	PM2 HOLLYWOOD,AL	0.86(1/ 4)	0.46(3/ 10)	
		0.28- 0.86	1.8 MILES WNW	0.86- 0.86	0.37- 0.52	
CO-60	0.060	0.12(1/ 44)	HASS FARM	0.12(1/ 4)	10 VALUES <LLD	
		0.12- 0.12	1.0 MILE NW	0.12- 0.12		
RU-103	0.200	0.54(11/ 44)	PM2 HOLLYWOOD,AL	0.75(1/ 4)	0.50(3/ 10)	
		0.38- 0.75	1.8 MILES WNW	0.75- 0.75	0.35- 0.65	
CS-137	0.060	0.12(21/ 44)	PM1 SCOTTSBORO,A	0.24(1/ 4)	0.18(3/ 10)	
		0.06- 0.31	5.6 MILES WSW	0.24- 0.24	0.13- 0.27	
ZR-95	0.110	0.92(11/ 44)	GAMBLE FARM	1.78(1/ 4)	0.42(3/ 10)	
		0.38- 1.78	2.6 MILES NNE	1.78- 1.78	0.30- 0.57	
NB-95	0.050	1.03(11/ 44)	GAMBLE FARM	2.01(1/ 4)	0.58(3/ 10)	
		0.42- 2.01	2.6 MILES NNE	2.01- 2.01	0.37- 0.83	
K-40	NOT ESTAB	9.60(44/ 44)	PM4 STEVENSON,AL	16.00(4/ 4)	8.35(10/ 10)	
		1.83- 28.62	11.0 MILES NNE	2.77- 28.62	2.94- 18.30	
BI-214	0.100	0.33(15/ 44)	PM5 PISGAH,AL	0.51(2/ 4)	0.31(6/ 10)	
		0.15- 0.59	4.3 MILES ESE	0.43- 0.59	0.11- 0.48	
PB-214	NOT ESTAB	0.20(27/ 44)	PM5 PISGAH,AL	0.32(2/ 4)	0.24(7/ 10)	
		0.06- 0.33	4.3 MILES ESE	0.31- 0.32	0.07- 0.38	
PB-212	NOT ESTAB	0.12(24/ 44)	PM5 PISGAH,AL	0.16(3/ 4)	0.17(8/ 10)	
		0.04- 0.28	4.3 MILES ESE	0.08- 0.23	0.05- 0.28	
BE-7	NOT ESTAB	9.59(44/ 44)	PM5 PISGAH,AL	12.19(4/ 4)	9.11(10/ 10)	
		1.04- 26.47	4.3 MILES ESE	4.02- 21.48	2.51- 31.62	
TL-208	NOT ESTAB	0.06(9/ 44)	PM6 SECTION,AL	0.09(1/ 4)	0.08(3/ 10)	
		0.03- 0.09	9.2 MILES SSW	0.09- 0.09	0.06- 0.12	
AC-228	NOT ESTAB	0.24(10/ 44)	LM2 BL ENV DATA	0.42(1/ 4)	0.33(2/ 10)	
		0.16- 0.42	1.0 MILE NE	0.42- 0.42	0.14- 0.52	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 12

RADIOACTIVITY IN SOIL

PCI/G - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY BELLEFONTE — DOCKET NO. RH-81-8-BL1

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (GELI)						
20						
CS-137	0.020	0.39(16/ 16)	PM4 STEVENSON,AL	0.92(2/ 2)	0.18(4/ 4)	
		0.06- 1.18	11.0 MILES NNE	0.66- 1.18	0.14- 0.23	
K-40	0.250	5.28(16/ 16)	LM1 BL SOUTHWEST	10.77(2/ 2)	3.80(4/ 4)	
		2.84- 10.95	0.8 MILE SW	10.59- 10.95	3.19- 4.23	
BI-214	0.050	0.91(16/ 16)	LM2 BL ENV DATA	1.17(2/ 2)	0.59(4/ 4)	
		0.60- 1.20	1.0 MILE NE	1.14- 1.20	0.50- 0.70	
BI-212	0.100	0.66(16/ 16)	LM1 BL SOUTHWEST	0.97(2/ 2)	0.41(4/ 4)	
		0.19- 1.00	0.8 MILE SW	0.93- 1.00	0.26- 0.59	
PB-214	0.050	0.95(16/ 16)	LM2 BL ENV DATA	1.20(2/ 2)	0.63(4/ 4)	
		0.65- 1.25	1.0 MILE NE	1.16- 1.25	0.51- 0.78	
PB-212	NOT ESTAB	0.95(16/ 16)	LM1 BL SOUTHWEST	1.50(2/ 2)	0.63(4/ 4)	
		0.22- 1.57	0.8 MILE SW	1.44- 1.57	0.51- 0.88	
RA-226	0.050	0.91(16/ 16)	LM2 BL ENV DATA	1.17(2/ 2)	0.59(4/ 4)	
		0.60- 1.20	1.0 MILE NE	1.14- 1.20	0.50- 0.70	
RA-223	NOT ESTAB	0.38(3/ 16)	LM1 BL SOUTHWEST	0.49(1/ 2)	4 VALUES <LLD	
		0.28- 0.49	0.8 MILE SW	0.49- 0.49		
BE-7	0.160	16 VALUES <LLD			0.22(1/ 4)	
					0.22- 0.22	
TL-208	0.020	0.33(16/ 16)	LM1 BL SOUTHWEST	0.50(2/ 2)	0.21(4/ 4)	
		0.07- 0.51	0.8 MILE SW	0.50- 0.51	0.18- 0.27	
AC-228	0.060	1.00(16/ 16)	LM1 BL SOUTHWEST	1.57(2/ 2)	0.64(4/ 4)	
		0.25- 1.62	0.8 MILE SW	1.53- 1.62	0.56- 0.81	
PA-234M	NOT ESTAB	3.34(2/ 16)	LM2 BL ENV DATA	3.39(1/ 2)	4 VALUES <LLD	
		3.30- 3.39	1.0 MILE NE	3.39- 3.39		
SR 89	1.500	16 VALUES <LLD			4 VALUES <LLD	
20		ANALYSIS PERFORMED				
SR 90	0.300	16 VALUES <LLD			4 VALUES <LLD	
20		ANALYSIS PERFORMED				

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 13

RADIOACTIVITY IN WELL WATER

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE — DOCKET NO. RH-81-8-BL1

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (NAI) 89		67 VALUES <LLD ANALYSIS PERFORMED			22 VALUES <LLD	
GAMMA (GELI) 8						
K-40	NOT ESTAB	78.15(3/ 6)	WELL #6	84.84(1/ 2)	69.52(1/ 2)	
		68.23- 84.84	ONSITE N	84.84- 84.84	69.52- 69.52	
BI-214	NOT ESTAB	21.82(5/ 6)	WELL #6	27.95(2/ 2)	18.62(2/ 2)	
		15.55- 29.73	ONSITE N	26.16- 29.73	4.98- 32.26	
PB-214	NOT ESTAB	16.11(6/ 6)	WELL #6	21.02(2/ 2)	17.76(1/ 2)	
		10.34- 21.76	ONSITE N	20.27- 21.76	17.76- 17.76	
PB-212	NOT ESTAB	9.36(2/ 6)	WELL #5	12.33(1/ 1)	12.89(2/ 2)	
		6.38- 12.33	ONSITE NNE	12.33- 12.33	6.85- 18.94	
TRITIUM 32	330.000	331.45(3/ 24)	WELL #6	331.66(1/ 4)	357.88(1/ 8)	
		331.35- 331.66	ONSITE N	331.66- 331.66	357.88- 357.88	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 14

RADIOACTIVITY IN PUBLIC WATER SUPPLY

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RH-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 52	2.400	3.09(10/ 39) 2.41- 6.22	SCOTTSBORO,AL TRM 385.8	3.78(4/ 13) 2.45- 6.22	4.15(3/ 13) 2.86- 6.64	
GAMMA (NAI) 47						
I-131	15.000	16.70(1/ 34) 16.70- 16.70	SCOTTSBORO,AL TRM 385.8	16.70(1/ 12) 16.70- 16.70	13 VALUES <LLD	
GAMMA (GELI) 5						
K-40	NOT ESTAB	97.85(3/ 5) 63.14- 124.50	SCOTTSBORO,AL TRM 385.8	124.50(1/ 1) 124.50- 124.50		
BI-214	NOT ESTAB	22.35(4/ 5) 10.45- 39.90	SCOTTSBORO,AL TRM 385.8	39.90(1/ 1) 39.90- 39.90		
PB-214	NOT ESTAB	18.17(3/ 5) 13.81- 25.55	SCOTTSBORO,AL TRM 385.8	25.55(1/ 1) 25.55- 25.55		
PB-212	NOT ESTAB	11.09(3/ 5) 9.68- 12.29	SCOTTSBORO,AL TRM 385.8	12.29(1/ 1) 12.29- 12.29		
SR 89 16	10.000	12 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	
SR 90 16	2.000	12 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	
TRITIUM 16	330.000	12 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

Table 15

ENVIRONMENTAL GAMMA RADIATION LEVELS

Monitoring Period	Location	Environmental Gamma Radiation Levels	
		μR/Hour	mR/Quarter[a]
February-March 1980	On-Site (15)[b]		
	Maximum	11.4	25.0
	Minimum	6.3	13.7
	Average[c]	7.7±2.6	16.8±5.7
	Off-Site (8)		
	Maximum	7.6	16.6
	Minimum	5.8	12.6
	Average	6.6±1.2	14.4±2.7
April-June 1980	On-Site (14)		
	Maximum	11.3	24.7
	Minimum	7.6	16.6
	Average	9.5±2.2	20.9±4.9
	Off-Site (8)		
	Maximum	8.6	18.8
	Minimum	7.0	15.3
	Average	7.9±1.0	17.2±2.2
July-September 1980	On-Site (15)		
	Maximum	15.2	33.4
	Minimum	9.0	19.6
	Average	10.8±3.2	23.7±7.1
	Off-Site (8)		
	Maximum	10.0	21.8
	Minimum	6.9	15.2
	Average	8.3±2.0	18.2±4.4
October-December 1980	On-Site (15)		
	Maximum	13.6	29.7
	Minimum	9.0	19.6
	Average	10.5±2.5	23.0±5.5
	Off-Site (8)		
	Maximum	9.4	20.6
	Minimum	7.1	15.5
	Average	8.5±1.7	18.6±3.7

a. Data normalized to one quarter (2190 hours)
b. Number of stations (normally 3 TLD's at each station)
c. All averages reported ±2σ (95% confidence level)

TABLE 16

RADIOACTIVITY IN FOOD CROPS

PCI/KG - 0.037 BQ/KG (WET WEIGHT)

NAME OF FACILITY BELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RM-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		RADIOACTIVITY IN CORN				
GAMMA (GELI)						
K-40	NOT ESTAB	2073.00(1/ 1) 2073.00- 2073.00	1.5 MILES WNW	2073.00(1/ 1) 2073.00- 2073.00	2079.00(1/ 1) 2079.00- 2079.00	
		RADIOACTIVITY IN POTATOES				
GAMMA (GELI)						
K-40	NOT ESTAB	4280.00(1/ 1) 4280.00- 4280.00	1.5 MILES WNW	4280.00(1/ 1) 4280.00- 4280.00	4070.00(1/ 1) 4070.00- 4070.00	
PB-214	NOT ESTAB	10.68(1/ 1) 10.68- 10.68	1.5 MILES WNW	10.68(1/ 1) 10.68- 10.68	1 VALUES <LLD	
		RADIOACTIVITY IN TOMATOES				
GAMMA (GELI)						
K-40	NOT ESTAB	3165.00(1/ 1) 3165.00- 3165.00	1.5 MILES WNW	3165.00(1/ 1) 3165.00- 3165.00	3314.00(1/ 1) 3314.00- 3314.00	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 17

RADIOACTIVITY IN POULTRY

PCI/KG - 0.037 BQ/KG (WET WEIGHT)

NAME OF FACILITY HELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RH-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (GELI)						
K-40	NOT ESTAB	2152.00(1/ 1) 2152.00- 2152.00	SISK FARM 4.9 MILES SW	2152.00(1/ 1) 2152.00- 2152.00	1794.00(1/ 1) 1794.00- 1794.00	
BI-214	NOT ESTAB	19.76(1/ 1) 19.76- 19.76	SISK FARM 4.9 MILES SW	19.76(1/ 1) 19.76- 19.76	29.08(1/ 1) 29.08- 29.08	
PB-214	NOT ESTAB	11.81(1/ 1) 11.81- 11.81	SISK FARM 4.9 MILES SW	11.81(1/ 1) 11.81- 11.81	25.67(1/ 1) 25.67- 25.67	
PB-212	NOT ESTAB	I VALUES <LLD			13.02(1/ 1) 13.02- 13.02	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

Reservoir Monitoring

The reservoir monitoring program for Bellefonte Nuclear Plant is scheduled to be implemented in mid-1981, approximately two years prior to the projected fuel loading date. The program will include the collection and analysis of samples of surface water, sediment, Asiatic clams, plankton, aquatic macrophytes, and fish.

Fish

Radiological monitoring for fish is accomplished by analyses of composite samples of adult fish taken from each of three contiguous reservoirs--the reservoir on which the plant is located and the reservoirs immediately upstream and downstream. No permanent sampling stations are established within each reservoir; this reflects the movement of fish species within reservoirs as determined by TVA data from the Brown Ferry Nuclear Plant preoperational monitoring program. Sufficient fish are collected in each reservoir to yield 250-300 grams oven-dry material for analytical purposes. The composite samples contain approximately the same quantity of flesh from each fish. For each composite, a subsample of material is drawn for analysis.

Because of the location of Bellefonte Nuclear Plant, the reservoirs scheduled to be sampled are already being sampled in the Browns Ferry and Sequoyah Nuclear Plants' monitoring programs. Samples of white crappie and smallmouth buffalo are taken semiannually from Guntersville and Wheeler Reservoirs and analyzed for gamma-emitting radionuclides as a part of the Browns Ferry Nuclear Plant monitoring program. In addition, channel catfish samples were taken from Guntersville Reservoir. In the Sequoyah Nuclear Plant monitoring program, samples of white crappie, smallmouth buffalo, and channel catfish are taken semi-annually from Nickajack Reservoir and analyzed for gross alpha, gross beta, and gamma-emitting radionuclides. In addition, ^{89}Sr and ^{90}Sr concentrations are determined in smallmouth buffalo samples taken from Nickajack Reservoir. The data from the analysis of these samples are included herein in tables 18, 19, 20, and 21.

TABLE 18

RADIOACTIVITY IN WHITE CRAPPIE (FLESH)

PCI/G - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY BELLEFONTE
LOCATION OF FACILITY JACKSON ALABAMA

DOCKET NO. RM-81-8-BL1
REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA 2	0.100				1.27(2/ 2) 1.25- 1.29	
GROSS BETA 6	0.100	40.76(4/ 4) 33.89- 48.61	GUNTERSVILLE RES TRM 349-425	46.19(2/ 2) 43.78- 48.61	28.00(2/ 2) 27.46- 28.53	
GAMMA (GELI) 6						
CS-137	0.020	0.09(4/ 4) 0.08- 0.11	WHEELER RES TRM 275-349	0.10(2/ 2) 0.08- 0.11	0.11(2/ 2) 0.09- 0.14	
K-40	NOT ESTAB	16.29(4/ 4) 13.40- 18.10	GUNTERSVILLE RES TRM 349-425	17.45(2/ 2) 16.80- 18.10	15.94(2/ 2) 15.47- 16.40	
BI-214	0.020	0.06(2/ 4) 0.06- 0.06	WHEELER RES TRM 275-349	0.06(1/ 2) 0.06- 0.06	2 VALUES <LLD	
PB-214	NOT ESTAB	0.06(2/ 4) 0.05- 0.06	WHEELER RES TRM 275-349	0.06(1/ 2) 0.06- 0.06	0.02(1/ 2) 0.02- 0.02	
PB-212	NOT ESTAB	4 VALUES <LLD			0.05(2/ 2) 0.00- 0.09	
SR 89 2	0.500				0.56(1/ 2) 0.56- 0.56	
SR 90 2	0.100				2 VALUES <LLD	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 19

RADIOACTIVITY IN SMALLMOUTH BUFFALO (FLESH)

PCI/G - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY BELLEFONTE — DOCKET NO. RH-81-8-BL1
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS[4]
GROSS ALPHA 2	0.100				1.66(2/ 2) 0.86- 2.45	
GROSS BETA 6	0.100	31.04(4/ 4) 29.83- 32.52	GUNTERSVILLE RES TRM 349-425	31.17(2/ 2) 29.83- 32.52	23.15(2/ 2) 18.75- 27.56	
GAMMA (GELI) 6						
CS-137	0.020	0.05(3/ 4) 0.04- 0.05	WHEELER RES TRM 275-349	0.05(1/ 2) 0.05- 0.05	0.05(2/ 2) 0.04- 0.07	
K-40	NOT ESTAB	14.10(4/ 4) 12.41- 15.69	GUNTERSVILLE RES TRM 349-425	15.39(2/ 2) 15.08- 15.69	11.97(2/ 2) 8.60- 15.34	
BI-214	0.020	0.09(2/ 4) 0.04- 0.14	GUNTERSVILLE RES TRM 349-425	0.14(1/ 2) 0.14- 0.14	2 VALUES <LLD	
PB-214	NOT ESTAB	0.08(2/ 4) 0.06- 0.10	GUNTERSVILLE RES TRM 349-425	0.10(1/ 2) 0.10- 0.10	2 VALUES <LLD	
PB-212	NOT ESTAB	0.07(2/ 4) 0.04- 0.09	GUNTERSVILLE RES TRM 349-425	0.07(2/ 2) 0.04- 0.09	0.07(1/ 2) 0.07- 0.07	
TL-208	0.020	4 VALUES <LLD			0.03(1/ 2) 0.03- 0.03	
SR 89 2	0.500				1.56(1/ 2) 1.56- 1.56	
SR 90 2	0.100				2 VALUES <LLD	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 20

RADIOACTIVITY IN SMALLMOUTH BUFFALO (WHOLE)

PCI/G - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY BELLEFONTE — DOCKET NO. RH-81-8-BL1

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD)	ALL INDICATOR LOCATIONS MEAN (F) RANGE	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F) RANGE	CONTROL LOCATIONS MEAN (F) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS *
GROSS ALPHA 2	0.100				1.05(2/ 2) 0.56- 1.55	
GROSS BETA 6	0.100	16.33(4/ 4) 11.11- 20.92	WHEELER RES TRM 275-349	19.11(2/ 2) 17.30- 20.92	12.10(2/ 2) 8.50- 15.70	
GAMMA (GEL1) 6						
CS-137	0.020	0.03(3/ 4) 0.02- 0.03	GUNTERSVILLE RES TRM 349-425	0.03(1/ 2) 0.03- 0.03	0.03(1/ 2) 0.03- 0.03	
K-40	NOT ESTAB	8.59(4/ 4) 7.95- 9.67	WHEELER RES TRM 275-349	8.81(2/ 2) 7.95- 9.67	8.12(2/ 2) 6.39- 9.85	
BI-214	0.020	0.11(2/ 4) 0.07- 0.16	WHEELER RES TRM 275-349	0.16(1/ 2) 0.16- 0.16	0.05(1/ 2) 0.05- 0.05	
PB-214	NOT ESTAB	0.12(2/ 4) 0.03- 0.21	WHEELER RES TRM 275-349	0.21(1/ 2) 0.21- 0.21	2 VALUES <LLD	
PB-212	NOT ESTAB	0.03(1/ 4) 0.03- 0.03	GUNTERSVILLE RES TRM 349-425	0.03(1/ 2) 0.03- 0.03	0.06(2/ 2) 0.01- 0.12	
TL-208	0.020	4 VALUES <LLD			0.05(1/ 2) 0.05- 0.05	
SR 89 4	0.500	2 VALUES <LLD			1.00(1/ 2) 1.00- 1.00	
SR 90 4	0.100	0.12(2/ 2) 0.11- 0.13	WHEELER RES TRM 275-349	0.12(2/ 2) 0.11- 0.13	0.19(2/ 2) 0.12- 0.26	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 21

RADIOACTIVITY IN CHANNEL CATFISH (FLESH)

PCI/G = 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON, ALABAMA — REPORTING PERIOD 1980

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA 2	0.100				0.72 (2/2) 0.65 - 0.80	
GROSS BETA 4	0.100	28.33 (2/2) 28.11 - 28.54	GUNTERSVILLE RES TRM 349-425	28.33 (2/2) 28.11 - 28.54	22.68 (2/2) 16.84 - 28.52	
GAMMA (GELI) 4						
CS-137	0.020	0.05 (1/2) 0.05 - 0.05	GUNTERSVILLE RES TRM 349-425	0.05 (1/2) 0.05 - 0.05	0.03 (2/2) 0.03 - 0.04	
K-40	NOT ESTAB	15.60 (2/2) 15.19 - 16.01	GUNTERSVILLE RES TRM 349-425	15.60 (2/2) 15.19 - 16.01	12.09 (2/2) 11.76 - 12.42	
BI-214	0.020	0.21 (1/2) 0.21 - 0.21	GUNTERSVILLE RES TRM 349-425	0.21 (1/2) 0.21 - 0.21	2 VALUES <LLD	
PB-214	NOT ESTAB	0.14 (1/2) 0.14 - 0.14	GUNTERSVILLE RES TRM 349-425	0.14 (1/2) 0.14 - 0.14	0.00 (1/2) 0.00 - 0.00	
PB-212	NOT ESTAB	0.19 (1/2) 0.19 - 0.19	GUNTERSVILLE RES TRM 349-425	0.19 (1/2) 0.19 - 0.19	0.05 (1/2) 0.05 - 0.05	
TL-208	NOT ESTAB	2 VALUES <LLD			0.04 (1/2) 0.04 - 0.04	
SR 89 2	0.500	0 VALUES <LLD ANALYSIS PERFORMED			2 VALUES <LLD	
SR 90 2	0.100	0 VALUES <LLD ANALYSIS PERFORMED			2 VALUES <LLD	

a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

Quality Control

A quality control program has been established with the Alabama Department of Public Health Radiological Laboratory and the Eastern Environmental Radiation Facility, Environmental Protection Agency, Montgomery, Alabama. Samples of air, water, milk, fish, and soil collected around nuclear plants are forwarded to these laboratories for analysis, and results are exchanged for comparison.

Conclusions

Since Bellefonte Nuclear Plant has not achieved criticality, there has been no contribution of radioactivity to the environment from the operation of the plant. The levels of radioactivity being reported in this document are due to natural background radiation, fallout from nuclear weapons testing, or other nuclear operations in the area.