ENV-83

TENNESSEE VALLEY AUTHORITY

RADIOLOGICAL HEALTH STAFF

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8405310181 DOC.DATE: 83/12/31 NOTARIZED: NO DOCKET #
FACIL:50-438 Bellefonte Nuclear Plant, Unit 1, Tennessee Valley Au 05000438
50-439 Bellefonte Nuclear Plant, Unit 2, Tennessee Valley Au 05000439
AUTH.NAME AUTHOR AFFILIATION
MILLS,L.M. Tennessee Valley Authority
RECIP.NAME RECIPIENT AFFILIATION

ADENSAM,E. Licensing Branch 4

SUBJECT: "Environ Radioactivity Levels,Bellefonte Nuclear Plant, Annual Rept - 1983," W/840525 ltr.

DISTRIBUTION CODE: IE25S COPIES RECEIVED:LTR 1 ENCL 20 SIZE: 60
TITLE: Periodic Environ Monitoring Rept (50 DKT)-Annual/Semiannual/Effluent/

NOTES:

	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL
	NRR LB4 BC	04	7	7				
INTERNAL:	AEOD		1	1	IE FILE	01	1	1
	NRR/DE/EEB	06	1	1	NRR/DL/ORAB	09	1	1
	NRR/DSI/METB		2	2	NRR/DSI/RAB	10	1	1
	RM/DOAMI/MIB		1	1				
EXTERNAL:	ACRS	11	1	1	LPDR	03	1	1
	NRC PDR	02	1	1	NTIS	05	1	1

TOTAL NUMBER OF COPIES REQUIRED: LTTR 19 ENCL 19

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

May 25, 1984

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket No. 50-438
Tennessee Valley Authority) 50-439

Enclosed for your information are 20 copies of the report:

Environmental Radioactivity Levels
Bellefonte Nuclear Plant
Annual Report - 1983

The report presents the results obtained from TVA's preoperational environmental radiological monitoring program during 1983.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Enclosure (20)
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

IE25
1/20

ENVIRONMENTAL RADIOACTIVITY LEVELS
BELLEFONTE NUCLEAR PLANT
ANNUAL REPORT - 1983
TVA/POWER/RHS

May 1984

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ENVIRONMENTAL RADIOACTIVITY LEVELS

BELLEFONTE NUCLEAR PLANT

ANNUAL REPORT

1983

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 no earlier than 1987.

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 1983.

The Radiological Health Staff (Office of Power) and the Office of Natural Resources and Economic Development carried out the sampling program outlined in table 1 and 21. Sampling locations are shown in figures 2, 3, and 9 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, until its closing in October 1983, the Eastern Area Radiological Laboratory (EARL) at Vonore, Tennessee, with WARL being the primary laboratory for processing samples from BLN. 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 6620 Systems in conjunction with germanium detection systems were used to analyze the samples for specific gamma-emitting radionuclides. At EARL an ND Model 6620 system was 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 germanium system. Identification of gamma-emitting radionuclides in all other types of samples is routinely performed by analysis on the germanium 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.

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 germanium detectors were resolved by the appropriate analyzer software and the software program routine HYPERMET.

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 14 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 germanium spectra were identified and quantified. Many of the isotopes identified by germanium 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. LLDs for the analysis of the radionuclides listed below[a] are given in table 3B. LLDs for additional radionuclides identified by germanium 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. An isotope may be identified and a valid result obtained and yet a mean and a range of 0 can be shown if the activity is between 0 and 0.01 since the output program displays results to two decimal places. 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 WARL, as did EARL until its closing, participates in the Environmental Radioactivity Laboratory Intercomparison Studies Program conducted by EPA-Las Vegas. This program provides periodic cross-checks on 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 results received during calendar year 1983 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; ^{59}Fe; ^{60}Co; ^{40}K; and ^{140}Ba-La.

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	Surface 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 (Control)	W	W	M	M	Q					
Rainsville (Control)	W	W	M	M	Q					
Farm S					Q	M				
Farm D (Control)							M			
Farm C (Control)					Q	M				
Well A (Control)							M			
Onsite Wells (6)							M			
Sand Mountain Water & & Fire Protection Authority								M		
Widows Creek Steam Plant (Control)								M		
Wheeler Reservoir										S[a]
Guntersville Reservoir									Q	S[a]
Nickajack Reservoir (Control)										S[b]

W - Weekly M - Monthly (every four weeks) Q - Quarterly S - Semiannually

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

[b]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	
Indicator Stations		
LM - 1 BL, Southwest	0.75 mile (1.2 kilometers)	SW
LM - 2 BL, Northeast	1 mile (1.6 kilometers)	NE
PM - 1 BL, Scottsboro, AL	5.75 miles (9.3 kilometers)	WSW
PM - 2 BL, Hollywood, AL	2 miles (3.2 kilometers)	WNW
PM - 3 BL, Fackler, AL	5.25 miles (8.5 kilometers)	N
PM - 4 BL, Stevenson, AL	11 miles (17.1 kilometers)	NNE
PM - 5 BL, Pisgah, AL	4 miles (6.4 kilometers)	ESE
PM - 6 BL, Section, AL	9 miles (14.5 kilometers)	SSW
Farm S	5 miles (8.1 kilometers)	SW
Control Stations		
RM - 1 BL, Lim Rock, AL	18 miles (29 kilometers)	W
RM - 2 BL, Rainsville, AL	14.5 miles (23.4 kilometers)	SSE
Farm C	11.5 miles (18.5 kilometers)	SSW
Farm D	1 mile (1.6 kilometers)	W
Well A	1.5 miles (2.4 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/Kgm, 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						0.5
^{131}I		0.02								10
^{89}Sr	0.005			10	0.25	1.5	0.5	5.0	40	2
^{90}Sr	0.001			2	0.05	0.3	0.1	1.0	8	

*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)	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	0.60	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 petri dishes centered on the detector endcap. The counting system consists of a ND-6620 multichannel analyzer and germanium detector having an efficiency of at least 20 percent. The counting time is normally 4-8 hours. All spectral analysis is performed using the software program HYPERMET. The assumption is made that all samples are analyzed within one week of the collection date.

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

Table 4

Results Obtained in Interlaboratory Comparison Program

A. Air Filter (pCi/filter)

Date	Gross Alpha			Gross Beta			Strontium-90			Cesium-137		
	EPA value (±3σ)	TVA AVG. WARL[a]	EARL[b]	EPA value (±3σ)	TVA AVG. WARL	EARL	EPA value (±3σ)	TVA AVG. WARL	EARL	EPA value (±3σ)	TVA AVG. WARL	EARL
3/83	26±11	25	25	68±9	69	63	20±3	21	17	29±9	30	25
8/83	13±9	14		36±9	38		10±3	11		15±9	17	

B. Tritium in Urine (pCi/L)

Date	EPA Value (±3σ)	TVA AVERAGE	
		WARL	EARL
3/83	2470±610	2420	2540
5/83	1330±575	1793	1650[c]
6/83	1589±585	1753	1580
11/83	1008±585	1053	

[a] Western Area Radiological Laboratory, Muscle Shoals, Alabama

[b] Eastern Area Radiological Laboratory, Vonore, Tennessee, closed 10/83

[c] Equipment failure, values determined after report date

Table 4 (continued)

Results Obtained in Interlaboratory Comparison Program

C. Radiochemical Analysis of Water (pCi/L)

Date	Gross Alpha			Gross Beta			Strontium - 89			Strontium - 90			Tritium			Iodine -131		
	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
1/83	29±13	27	25	31±9	29	28	29.2±8.7	33.0	16±10.6[ef]	17.2±2.6	17.7	15.9±3.2[e]						
2/83													2560±611	2510	2627			
3/83	31±14	27	35	28±9	28	32												
4/83													3330±627	3733	3373	26.8±10.4	28.0	25.3
5/83[d]	11±9	10	11	57±9	53	43	57.1±8.7	63.7	71.3[f]	37.7±3.3	38.3	29.3[f]						
5/83[d]	64±28	47	60	149±13	133[g]	136	24±9	29	31	13±3	13	10						
6/83													1529±584	1573	1577			
7/83	7±9	7	6	22±9	22	20												
8/83													1836±592	1930	1807	14±10	14	14
9/83	5±9	5		9±9	10		15±9	13		10±3	12							
10/83													1210±570	720				
11/83[d]	14±9	13		16±9	18													
11/83[d]	22±9	19		63±9	61		17±9	14		8±3	6							
12/83													2389±608	2390		20±10	18	

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

Date	Chromium - 51			Cobalt - 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
2/83[d]	45±9	45	<35[f]	22±9	24	24	21±9	22	25	48±9	55	50	20±9	20	20	19±9	18	18
5/83[d]				30±9	33	33							33±9	32	33	27±9	27	28
6/83	60±9	67	<72	13±9	14	16	36±9	38	36	40±9	42	<36	47±9	46	47	26±9	27	27
10/83[d]	51±9	47		19±9	20		40±9	41		52±9	53		15±9	17		22±9	25	
11/83[d]				11±9	11								15±9	15		15±9	15	

[d] Laboratory Performance Evaluation Study

[e] Only 2 values reported, calculated error terms increase

[f] Previous and subsequent results satisfactory. No known explanation.

[g] Calibration of beta detectors is done with Cs-137. Nine isotopes and their daughters were present in this sample. Average value reported nationwide was 136 pCi/L.

Table 4 (continued)

Results Obtained in Interlaboratory Comparison Program

E. Foods (pCi/kg, Wet Weight)

Date	Strontium - 89			Strontium - 90			Iodine - 131			Cesium - 137			Barium - 140			Potassium - 40		
	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
3/83	34.6±8.7	40.0	31.7	27.8±2.6	28.3	31.3[h]	36.9±10.4	33.3	37.7	31.3±8.7	29.7	30.0	0	<25	<15	2592±225	2533	2887[h]

F. Milk (pCi/L)

Date	Strontium - 89			Strontium - 90			Iodine - 131			Cesium - 137			Barium - 140			Potassium - 40		
	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
2/83	37.4±8.7	[i]	42.3	17.8±2.6	[i]	18	54.5±10.4	52.7	56.0	25.6±8.7	22.3	26.7	0	<25	<20	1512±132	1497	1613
6/83	25±9	27	29	16±3	17	18	30±10	30	38	47±9	48	47				1486±128	1520	1480
10/83	15±9	16		14±3	13		40±10	39		33±9	34					1550±135	1563	

[h] A history of sporadic difficulty with this sample type for all participants nationwide is probably due to sample inhomogeneity.

[i] Sample spoiled before analysis

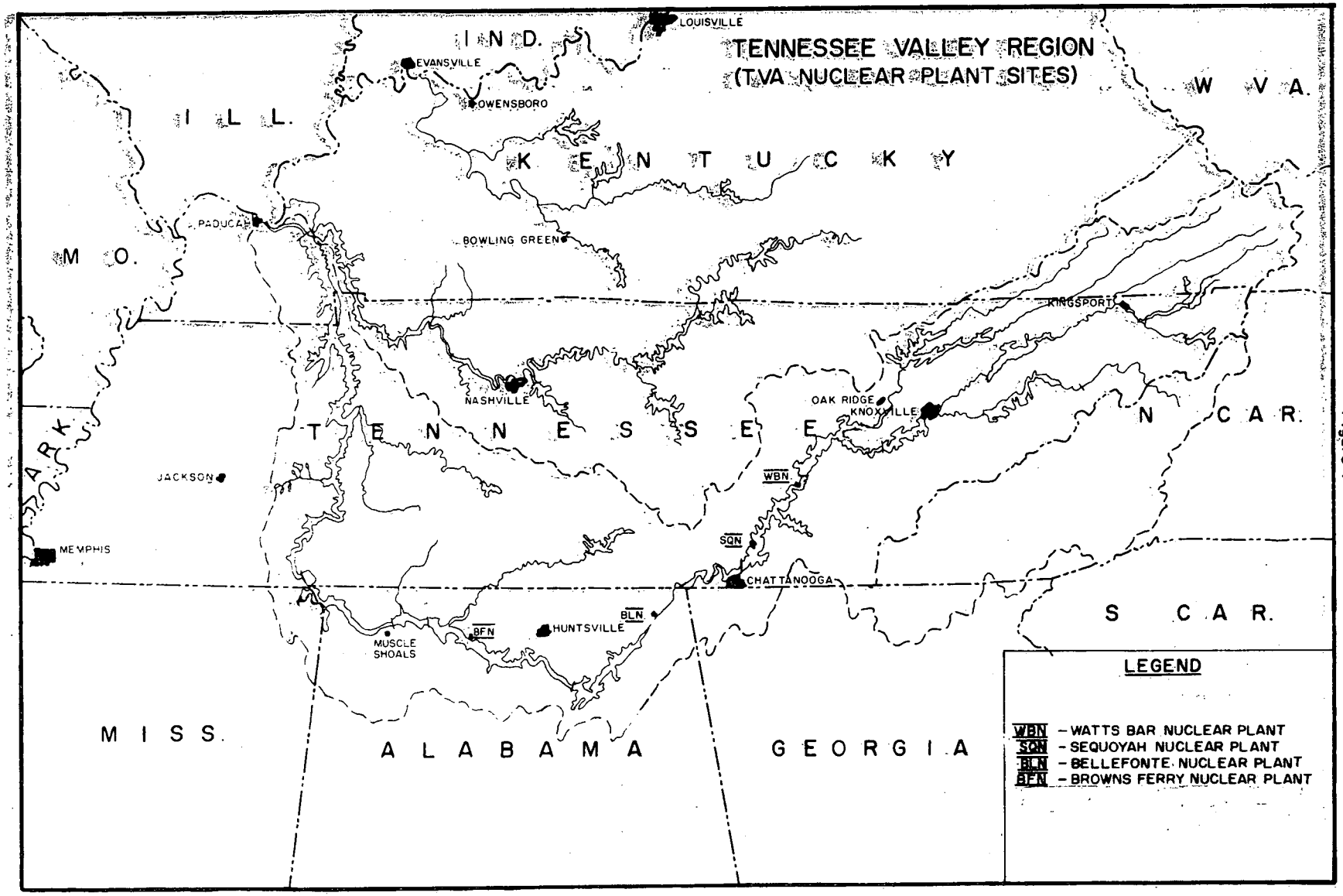

TENNESSEE VALLEY REGION
(TVA NUCLEAR PLANT SITES)
LOUISVILLE
IND.
EVANSVILLE
OWENSBORO
ILL.
KENTUCKY
W VA.
PADUCAH
BOWLING GREEN
MO.
KINGSPORT
NASHVILLE
OAK RIDGE
KNOXVILLE
N CAR.
ARK
TENNESSEE
JACKSON
WBN
MEMPHIS
SQN
CHATTANOOGA
S CAR.
BLN
BFN
HUNTSVILLE
MUSCLE SHOALS
MISS.
ALABAMA
GEORGIA
LEGEND
WBN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

Figure 1

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. Two 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 LB5211 glass fiber particulate filter at a regulated flow rate 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.

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 nine samples were not collected because of equipment malfunction. Two samples were not usable because air flow start time had not been recorded after equipment repair (also accounted for one gamma monthly composite). One filter was lost during transportation to the laboratory. Another filter had no air flow and was unusable. No analyses are performed until three 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.

The annual averages of the gross beta activity in the air particulate filters at the indicator stations (local and perimeter monitors) and at the control stations (remote monitors) for the years 1978-1983 are presented in figure 4. Increased levels due to fallout from atmospheric nuclear weapons testing are evident in 1981. These fluctuations are consistent with data from monitoring programs conducted by TVA at other nuclear power plant sites.

Table 5 presents the maximum permissible concentrations (MPC) recommended by 10 CFR 20 for nonoccupational exposure.

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. One sample was not collected because of equipment problems.

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, nine samples were not collected because of equipment malfunction. Two samples were not usable because air flow start time had not

been recorded after equipment repair. One filter was lost during transportation to the laboratory. Another sample was lost when a retaining "O" ring broke during sampling. The filter is counted in a single channel analyzer system. The data for collected samples are shown in table 9.

Table 5

MAXIMUM PERMISSIBLE CONCENTRATIONS

FOR NONOCCUPATIONAL EXPOSURE

	MPC	
	In Water pCi/l*	In Air pCi/m3*
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
^{59}Fe	50,000	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 — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION [a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F) [b] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) [b] RANGE	CONTROL LOCATIONS MEAN (F) [b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 517	0.010	0.02 (391/ 411) 0.01- 0.05	LM2 BL ENV DATA 1.0 MILE NE	0.02 (49/ 51) 0.01- 0.05	0.02 (103/ 106) 0.01- 0.06	
GAMMA (GELI) 139						
K-40	NOT ESTAB	0.02 (50/ 111) 0.00- 0.05	LM2 BL ENV DATA 1.0 MILE NE	0.02 (8/ 14) 0.01- 0.05	0.02 (12/ 28) 0.01- 0.03	
BI-214	0.020	0.03 (2/ 111) 0.02- 0.03	LM1 BL SOUTHWEST 0.8 MILE SW	0.03 (1/ 13) 0.03- 0.03	0.02 (1/ 28) 0.02- 0.02	
BI-212	NOT ESTAB	111 VALUES <LLD			0.01 (1/ 28) 0.01- 0.01	
PB-214	0.020	0.03 (2/ 111) 0.02- 0.03	LM1 BL SOUTHWEST 0.8 MILE SW	0.03 (1/ 13) 0.03- 0.03	28 VALUES <LLD	
PB-212	NOT ESTAB	0.00 (41/ 111) 0.00- 0.00	PM6 SECTION/AL 9.2 MILES SSW	0.00 (7/ 14) 0.00- 0.00	0.00 (12/ 28) 0.00- 0.00	
BE-7	0.050	0.06 (54/ 111) 0.05- 0.09	PM2 HOLLYWOOD/AL 1.8 MILES WNW	0.07 (5/ 14) 0.06- 0.09	0.06 (14/ 28) 0.05- 0.09	
TL-208	NOT ESTAB	0.00 (23/ 111) 0.00- 0.00	PM6 SECTION/AL 9.2 MILES SSW	0.00 (3/ 14) 0.00- 0.00	0.00 (7/ 28) 0.00- 0.00	
AC-228	NOT ESTAB	0.00 (3/ 111) 0.00- 0.01	PM5 PISGAH/AL 4.3 MILES ESE	0.01 (1/ 14) 0.01- 0.01	0.00 (2/ 28) 0.00- 0.00	
PA-234M	NOT ESTAB	0.09 (1/ 111) 0.09- 0.09	PM6 SECTION/AL 9.2 MILES SSW	0.09 (1/ 14) 0.09- 0.09	28 VALUES <LLD	
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				

. Nominal Lower Limit of Detection (LLD) as described in Table 3.

. Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).

TABLE 7

RADIOACTIVITY IN RAINWATER

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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)						
4						
FE-59	NOT ESTAB	3.50(1/ 3)	PM1 SCOTTSBORO,A	3.50(1/ 1)	1 VALUES <LLD	
		3.50- 3.50	5.6 MILES WSW	3.50- 3.50		
BE-7	NOT ESTAB	52.00(3/ 3)	LM1 BL SOUTHWEST	71.90(1/ 1)	36.70(1/ 1)	
		29.50- 71.90	0.8 MILE SW	71.90- 71.90	36.70- 36.70	
RN-222	NOT ESTAB	0.35(2/ 3)	LM1 BL SOUTHWEST	0.50(1/ 1)	0.60(1/ 1)	
		0.20- 0.50	0.8 MILE SW	0.50- 0.50	0.60- 0.60	
GAMMA (GELI)						
135						
K-40	NOT ESTAB	27.85(2/ 108)	PM5 PISGAH,AL	31.54(1/ 14)	29.13(4/ 27)	
		24.17- 31.54	4.3 MILES ESE	31.54- 31.54	0.30- 77.80	
BI-214	NOT ESTAB	4.17(35/ 108)	PM2 HOLLYWOOD,AL	8.21(4/ 14)	7.81(8/ 27)	
		0.20- 15.25	1.8 MILES WNW	1.51- 14.31	0.90- 32.21	
PB-214	NOT ESTAB	4.37(12/ 108)	LM2 BL ENV DATA	6.74(3/ 13)	7.20(4/ 27)	
		1.75- 9.47	1.0 MILE NE	1.75- 9.47	0.99- 14.81	
PB-212	NOT ESTAB	2.04(47/ 108)	PM1 SCOTTSBORO,A	3.88(5/ 13)	2.64(16/ 27)	
		0.04- 6.58	5.6 MILES WSW	0.90- 6.56	0.16- 21.69	
BE-7	NOT ESTAB	49.87(24/ 108)	LM1 BL SOUTHWEST	58.15(2/ 13)	56.55(9/ 27)	
		30.35- 84.77	0.8 MILE SW	55.04- 61.27	31.50- 155.70	
					15.09(1/ 27)	
TL-208	10.000	108 VALUES <LLD			15.09- 15.09	

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 at specified location is indicated in parentheses (F).

TABLE 8

RADIOACTIVITY IN HEAVY PARTICLE FALLOUT

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

NAME OF FACILITY BELLEFONTE DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1983

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	0.14 (104/ 104)	PM4 STEVENSON, AL	0.19 (13/ 13)	0.13 (25/ 26)	
130		0.05 - 0.48	11.0 MILES NNE	0.11 - 0.48	0.06 - 0.32	

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 at specified location is indicated in parentheses (F).

TABLE 9

RADIOACTIVITY IN CHARCOAL FILTERS

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

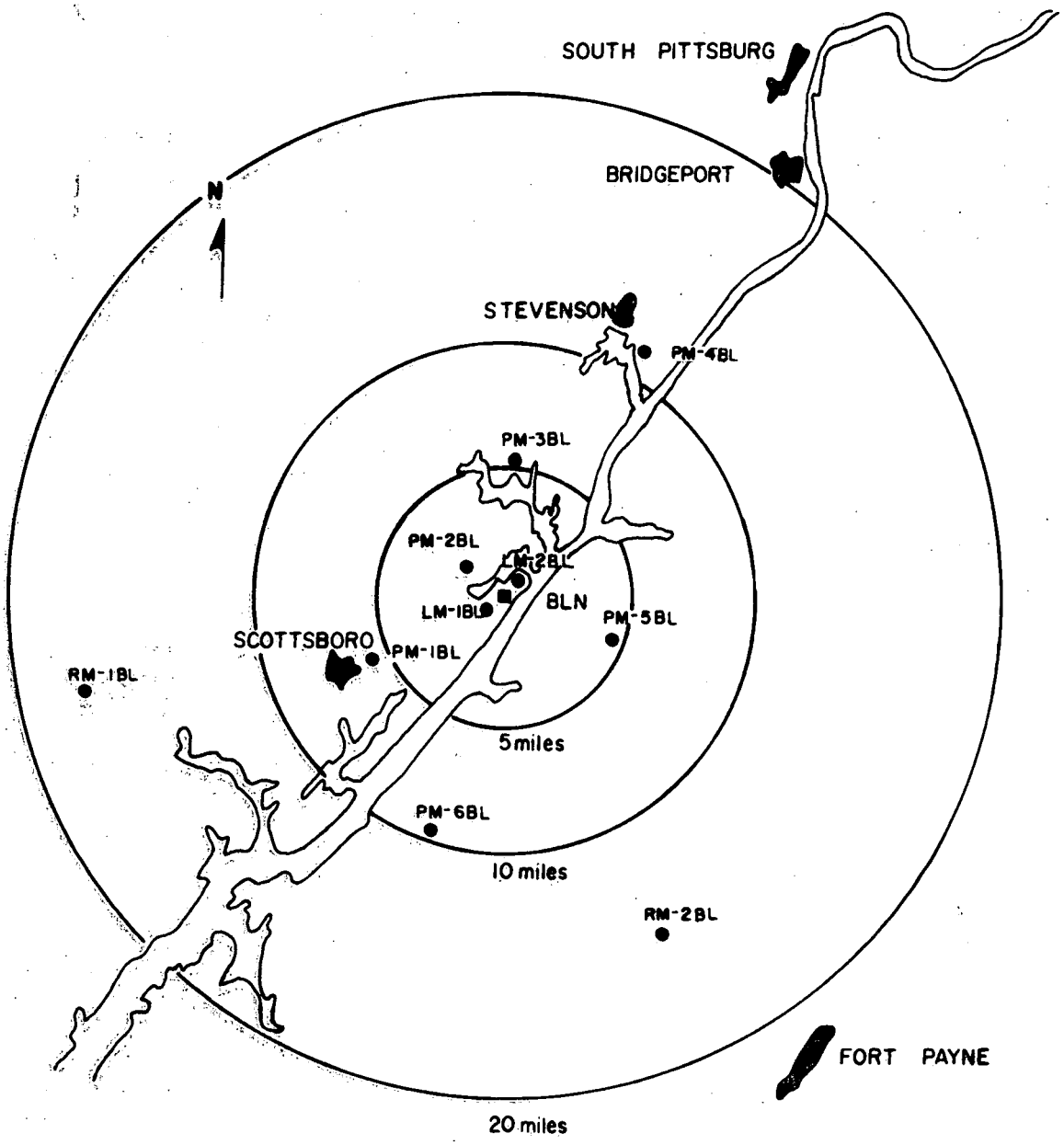
NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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-131	0.020	0.04(23/ 411)	PM2 HOLLYWOOD,AL	0.09(4/ 51)		0.03(8/ 106)	
517		0.02- 0.26	1.8 MILES WNW	0.02- 0.26		0.02- 0.04	

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 at specified location is indicated in parentheses (F).

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

Figure 3

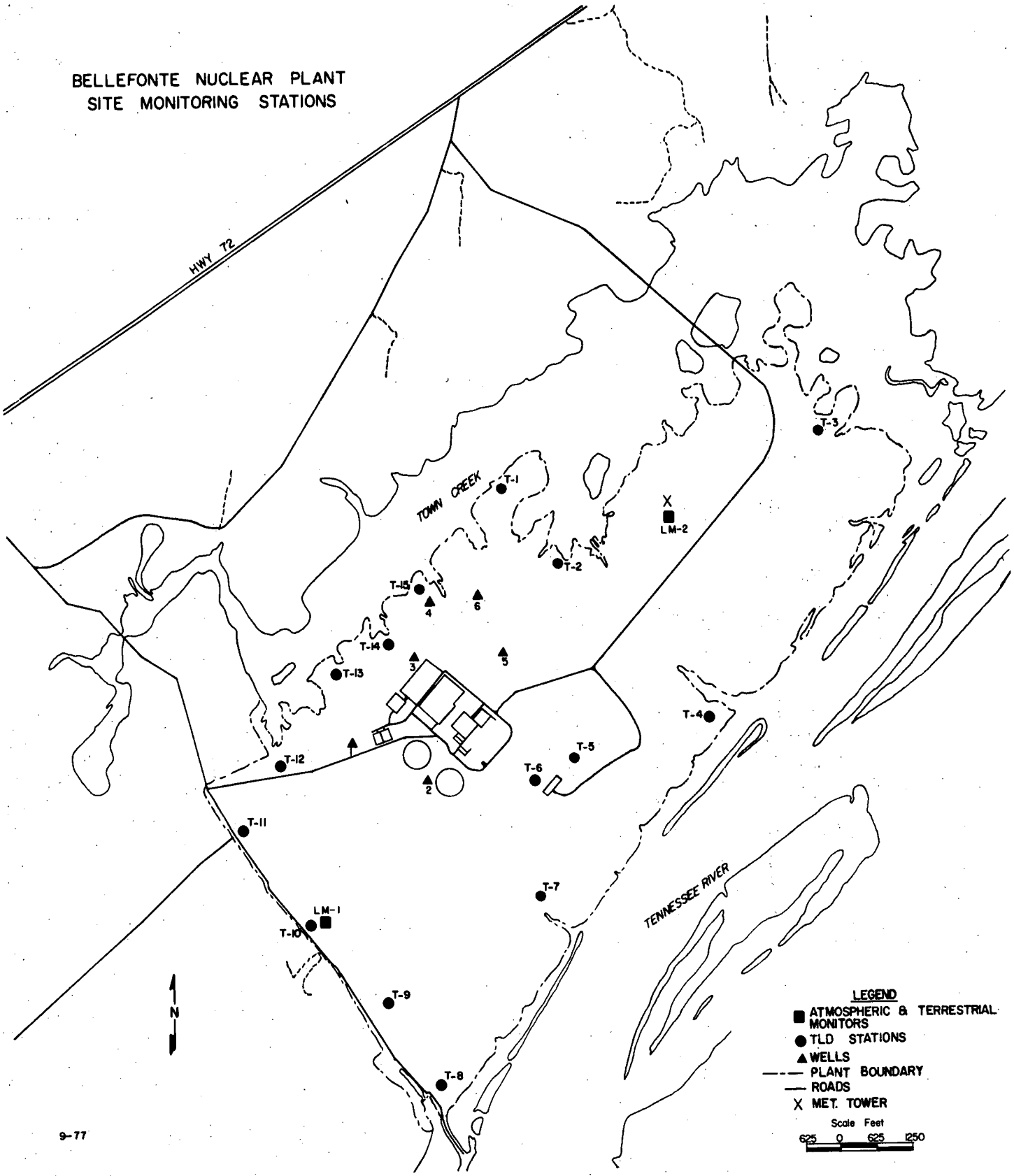
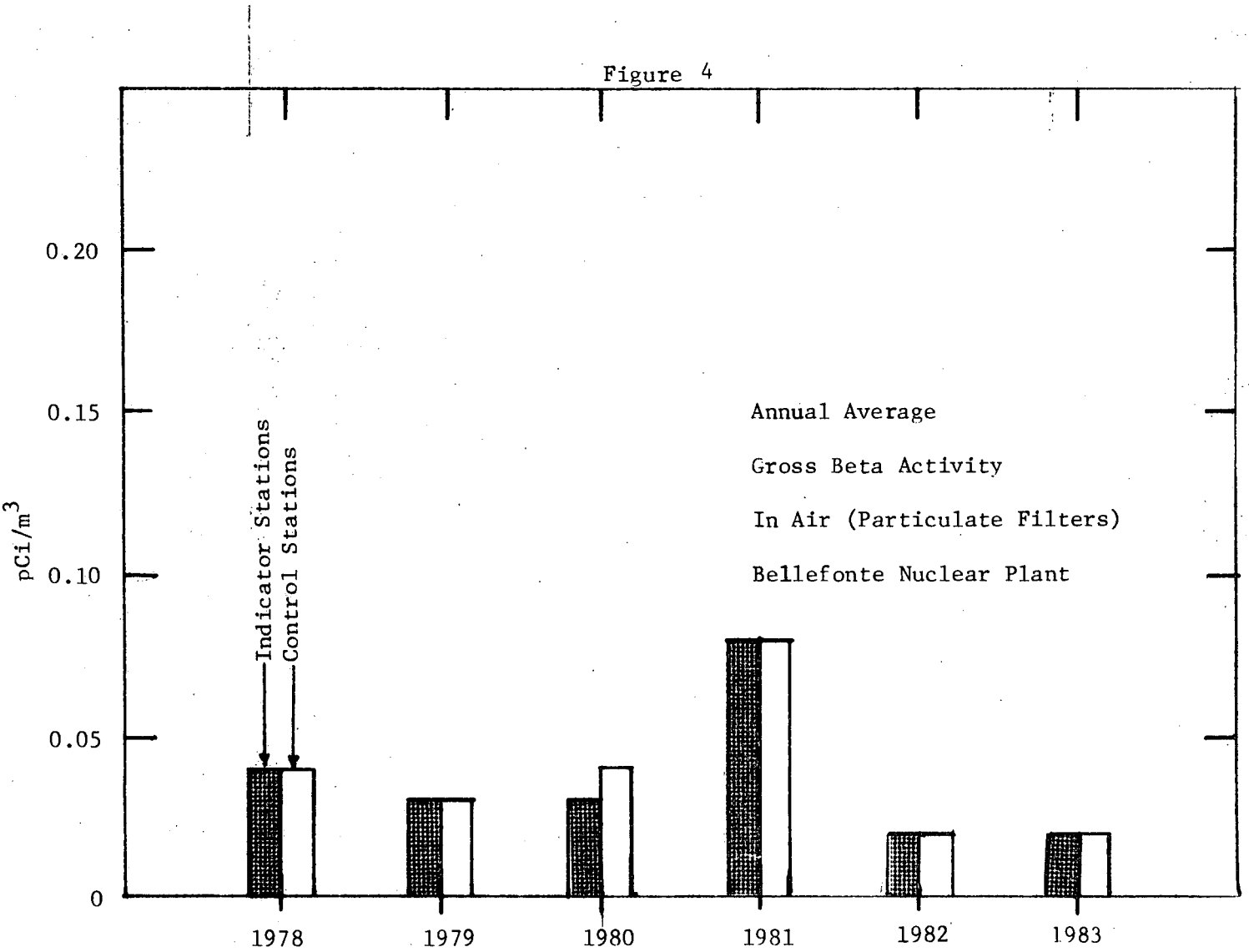

BELLEFONTE NUCLEAR PLANT
SITE MONITORING STATIONS
HWY 72
TOWN CREEK
TENNESSEE RIVER
T-1
T-2
T-3
T-4
T-5
T-6
T-7
T-8
T-9
T-10
T-11
T-12
T-13
T-14
T-15
LM-1
LM-2
1
2
3
4
5
6
N
9-77
LEGEND
ATMOSPHERIC & TERRESTRIAL MONITORS
TLD STATIONS
WELLS
PLANT BOUNDARY
ROADS
MET. TOWER
Scale Feet
625 0 625 1250

Figure 4


0.20
0.15
0.10
0.05
0
pCi/m3
Indicator Stations
Control Stations
Annual Average
Gross Beta Activity
In Air (Particulate Filters)
Bellefonte Nuclear Plant
1978
1979
1980
1981
1982
1983

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), and from one control dairy farm. Raw milk was analyzed monthly for ^{131}I, gamma-emitting radionuclides, and for radiostrontium. The results are shown in table 10. During this reporting period, one sample spoiled and was not available for iodine and strontium analysis.

As had been noted in earlier radiological 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 preoperational monitoring at Sequoyah Nuclear Plant in samples taken from a farm where only one to two cows were being milked for private consumption of the milk. It is postulated that the feeding practices of these small farmers differ from those of the larger dairy farmers to the extent that fallout from atmospheric nuclear weapons testing may be more concentrated in these instances. Similarly, Hansen, et al., reported an inverse relationship between the levels of ^{90}Sr in milk and the quality of fertilization and land management.[a]

Vegetation

Vegetation samples were collected quarterly from the farms from which milk was collected, and from the vicinity of each atmospheric monitoring station and analyzed for gamma-emitting radionuclides. Approximately 1-2 kilograms of grass was 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 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. During this report period one sample was spilled during ashing and was unusable.

---

[a]Hansen, W.G., et al., Farming Practices and Concentrations of Emission Products in Milk, U.S. Department of Health, Education, and Welfare; Public Health Service Publication No. 999-R-6, May 1964.

Ground Water

Well water was obtained monthly from two farms in the area and from six onsite wells. All samples collected were analyzed for gamma-emitting radionuclides and a quarterly composite was analyzed for tritium. The results are shown in table 13. During this period 11 samples were not collected because the stations were inaccessible due to construction activities and one was unavailable because of equipment malfunction.

Public Water

Potable water supplies taken from the Tennessee River in the vicinity of BLN are sampled and analyzed monthly for gross beta, gamma-emitting radionuclides, ^{89}Sr, ^{90}Sr, and tritium. The results are shown in table 14. Figure 5 shows the trends in gross beta activity in drinking water from 1978 through 1983.

Environmental Gamma Radiation Levels

Bulb-type Victoreen Manganese-activated calcium fluoride (CaF_2: Mn) thermoluminescent dosimeters (TLDs) are placed at 18 stations around the plant near the site boundary, at the perimeter and remote air monitors, and at 18 additional stations approximately 5 miles from the site to determine the gamma exposure rates at these locations (see figures 2, 3, and 6). The dosimeters, located inside energy compensating shields, are placed at approximately one meter above the ground, with two to three TLDs 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 TLDs are exchanged every three months. The quarterly gamma radiation levels determined from these TLDs 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 2-4 mR/quarter higher than the levels offsite. This is consistent with levels reported in other preoperational monitoring programs conducted by TVA where the average radiation levels onsite are generally 2-6 mR/quarter higher than levels offsite. The causes of these differences have not been completely isolated; however, it is postulated that the differences are probably attributable to combinations of influences, such as natural variations in environmental radiation levels, earth moving activities onsite, the mass of concrete employed in the construction of the plant, and other undetermined influences.

Figure 7 compares plots of the data from the onsite or site boundary stations with those from the offsite stations over the period from 1978 through 1983. To reduce the variations present in the data sets, a four-quarter moving average was constructed for each set. Figure 8 presents a trend plot of the direct radiation levels as defined by the moving averages. The data follow the same general trend as the raw data, but the curves are smoothed considerably.

Food Crops and Poultry

Food crops and poultry raised in the vicinity of BLN are sampled annually as they become available during the growing season. During this sampling period samples of cabbage, corn, potatoes, tomatoes, and poultry were collected and analyzed for specific gamma-emitting radionuclides. The results are given in tables 16 through 19. During this reporting period a control sample for corn was not collected.

TABLE 10

RADIOACTIVITY IN MILK

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1983

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)						
4						
CS-137	10.000	13.00(1/ 2)	SISK FARM	13.00(1/ 2)	2 VALUES <LLD	
		13.00- 13.00	4.9 MILES SW	13.00- 13.00		
K-40	150.000	1119.70(2/ 2)	SISK FARM	1119.70(2/ 2)	1344.80(2/ 2)	
		1104.80- 1134.60	4.9 MILES SW	1104.80- 1134.60	1296.70- 1392.90	
IODINE-131	0.500	12 VALUES <LLD			13 VALUES <LLD	
25		ANALYSIS PERFORMED				
GAMMA (GELI)						
22						
CS-137	5.000	10.07(9/ 11)	SISK FARM	10.07(9/ 11)	10.08(1/ 11)	
		6.85- 13.56	4.9 MILES SW	6.85- 13.56	10.08- 10.08	
K-40	NOT ESTAB	1232.12(11/ 11)	SISK FARM	1232.12(11/ 11)	1283.85(11/ 11)	
		1035.08- 1604.34	4.9 MILES SW	1035.08- 1604.34	1129.38- 1429.44	
BI-214	NOT ESTAB	5.94(7/ 11)	SISK FARM	5.94(7/ 11)	3.66(5/ 11)	
		1.96- 13.30	4.9 MILES SW	1.96- 13.30	0.29- 7.94	
PB-214	NOT ESTAB	4.17(4/ 11)	SISK FARM	4.17(4/ 11)	3.56(1/ 11)	
		0.15- 10.80	4.9 MILES SW	0.15- 10.80	3.56- 3.56	
PB-212	NOT ESTAB	1.78(5/ 11)	SISK FARM	1.78(5/ 11)	2.87(7/ 11)	
		0.45- 3.46	4.9 MILES SW	0.45- 3.46	0.39- 6.74	
TL-208	NOT ESTAB	2.25(2/ 11)	SISK FARM	2.25(2/ 11)	3.21(1/ 11)	
		1.18- 3.31	4.9 MILES SW	1.18- 3.31	3.21- 3.21	
SR 89	10.000	12 VALUES <LLD			13 VALUES <LLD	
25		ANALYSIS PERFORMED				
SR 90	2.000	12.72(12/ 12)	SISK FARM	12.72(12/ 12)	3.52(13/ 13)	
25		8.73- 20.11	4.9 MILES SW	8.73- 20.11	2.28- 5.30	

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 at specified location is indicated in parentheses (F).

TABLE 11

RADIOACTIVITY IN VEGETATION

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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) 48						
CS-137	0.060	0.08(4/ 36)	PM2 HOLLYWOOD,AL	0.13(1/ 4)	12 VALUES <LLD	
		0.06- 0.13	1.8 MILES WNW	0.13- 0.13		
K-40	NOT ESTAB	11.55(36/ 36)	SISK FARM	18.90(4/ 4)	11.76(11/ 12)	
		2.00- 33.65	4.9 MILES SW	5.39- 33.65	2.70- 26.65	
BI-214	0.100	0.14(6/ 36)	LM2 BL ENV DATA	0.20(1/ 4)	12 VALUES <LLD	
		0.10- 0.20	1.0 MILE NE	0.20- 0.20		
PB-214	NOT ESTAB	0.10(17/ 36)	LM2 BL ENV DATA	0.18(1/ 4)	0.06(4/ 12)	
		0.03- 0.18	1.0 MILE NE	0.18- 0.18	0.04- 0.09	
PB-212	NOT ESTAB	0.05(22/ 36)	LM2 BL ENV DATA	0.10(2/ 4)	0.04(5/ 12)	
		0.00- 0.18	1.0 MILE NE	0.03- 0.18	0.02- 0.06	
BE-7	NOT ESTAB	8.84(36/ 36)	PM5 PISGAH,AL	10.69(4/ 4)	9.24(12/ 12)	
		1.65- 16.93	4.3 MILES ESE	6.57- 13.28	2.97- 20.00	
TL-208	NOT ESTAB	0.03(19/ 36)	PM4 STEVENSON,AL	0.06(1/ 4)	0.02(3/ 12)	
		0.00- 0.07	11.0 MILES NNE	0.06- 0.06	0.01- 0.03	
AC-228	NOT ESTAB	0.15(8/ 36)	PM4 STEVENSON,AL	0.19(3/ 4)	12 VALUES <LLD	
		0.03- 0.27	11.0 MILES NNE	0.17- 0.20		

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 at specified location is indicated in parentheses (F).

TABLE 12

RADIOACTIVITY IN SOIL

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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
GAMMA (GELI)						
20						
CS-137	0.020	0.27(16/ 16)	PM6 SECTION,AL	0.58(2/ 2)	0.15(4/ 4)	
		0.05- 0.72	9.2 MILES SSW	0.43- 0.72	0.05- 0.24	
K-40	0.250	4.92(16/ 16)	LM2 BL ENV DATA	7.45(2/ 2)	3.37(4/ 4)	
		2.21- 10.27	1.0 MILE NE	4.63- 10.27	2.43- 3.78	
MN-54	0.010	0.02(1/ 16)	PM2 HOLLYWOOD,AL	0.02(1/ 2)	4 VALUES <LLD	
		0.02- 0.02	1.8 MILES WNW	0.02- 0.02		
BI-214	0.050	0.86(16/ 16)	PM2 HOLLYWOOD,AL	1.02(2/ 2)	0.51(4/ 4)	
		0.60- 1.03	1.8 MILES WNW	1.02- 1.02	0.39- 0.62	
BI-212	0.100	1.18(16/ 16)	PM2 HOLLYWOOD,AL	1.49(2/ 2)	0.65(4/ 4)	
		0.57- 1.54	1.8 MILES WNW	1.43- 1.54	0.43- 0.85	
PB-214	0.050	0.96(16/ 16)	PM2 HOLLYWOOD,AL	1.16(2/ 2)	0.57(4/ 4)	
		0.65- 1.17	1.8 MILES WNW	1.16- 1.17	0.41- 0.71	
PB-212	NOT ESTAB	1.05(16/ 16)	PM2 HOLLYWOOD,AL	1.35(2/ 2)	0.61(4/ 4)	
		0.52- 1.46	1.8 MILES WNW	1.33- 1.38	0.45- 0.79	
RA-226	0.050	0.86(16/ 16)	PM2 HOLLYWOOD,AL	1.02(2/ 2)	0.51(4/ 4)	
		0.60- 1.03	1.8 MILES WNW	1.02- 1.02	0.39- 0.62	
RA-223	NOT ESTAB	0.37(4/ 16)	LM2 BL ENV DATA	0.52(1/ 2)	4 VALUES <LLD	
		0.25- 0.52	1.0 MILE NE	0.52- 0.52		
RA-224	NOT ESTAB	1.08(6/ 16)	PM2 HOLLYWOOD,AL	1.55(1/ 2)	0.53(1/ 4)	
		0.71- 1.55	1.8 MILES WNW	1.55- 1.55	0.53- 0.53	
BE-7	0.160	16 VALUES <LLD			0.16(1/ 4)	
					0.16- 0.16	
TL-208	0.020	0.37(16/ 16)	PM2 HOLLYWOOD,AL	0.47(2/ 2)	0.21(4/ 4)	
		0.18- 0.51	1.8 MILES WNW	0.46- 0.48	0.15- 0.26	
AC-228	0.060	1.10(16/ 16)	PM2 HOLLYWOOD,AL	1.39(2/ 2)	0.59(4/ 4)	
		0.57- 1.46	1.8 MILES WNW	1.36- 1.41	0.43- 0.75	
PA-234M	NOT ESTAB	2.76(6/ 16)	PM4 STEVENSON,AL	3.08(1/ 2)	4 VALUES <LLD	
		1.71- 3.64	11.0 MILES NNE	3.08- 3.08		
SR 89	1.500	15 VALUES <LLD			1.52(1/ 4)	
19					1.52- 1.52	
SR 90	0.300	15 VALUES <LLD			4 VALUES <LLD	
19		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 at specified location is indicated in parentheses (F).

TABLE 13

RADIOACTIVITY IN WELL WATER

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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
GAMMA (NAI)						
5		3 VALUES <LLD ANALYSIS PERFORMED			2 VALUES <LLD	
GAMMA (GELI)						
87						
K-40	NOT ESTAB	16.84(9/ 63)	WELL #3	51.02(1/ 12)	11.72(4/ 24)	
		0.40- 51.02	ONSITE NW	51.02- 51.02	2.83- 20.17	
BI-214	NOT ESTAB	28.97(41/ 63)	WELL #1	70.40(4/ 7)	44.83(21/ 24)	
		0.01- 170.55	ONSITE W	1.06- 153.94	1.79- 350.79	
PB-214	NOT ESTAB	39.11(30/ 63)	WELL #1	92.73(3/ 7)	47.70(19/ 24)	
		2.37- 170.10	ONSITE W	7.97- 170.10	2.30- 340.50	
PB-212	NOT ESTAB	1.52(20/ 63)	WELL #6	2.54(4/ 12)	0.94(10/ 24)	
		0.01- 4.66	ONSITE N	0.66- 4.66	0.14- 1.72	
TL-208	NOT ESTAB	1.05(18/ 63)	WELL #2	1.82(3/ 13)	0.81(7/ 24)	
		0.08- 3.35	ONSITE WSW	0.91- 3.35	0.41- 1.21	
TRITIUM	330.000	23 VALUES <LLD			8 VALUES <LLD	
31		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 at specified location is indicated in parentheses (F).

TABLE 14

RADIOACTIVITY IN PUBLIC WATER SUPPLY

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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	2.400	2.91(12/ 39)	SCOTTSBORO,AL	3.36(4/ 13)	3.04(7/ 13)	
52		2.40- 5.87	TRM 385.8	2.45- 5.87	2.49- 4.05	
GAMMA (NAI)						
8						
FE-59	NOT ESTAB	4.90(3/ 6)	SAND MT. WFPA	5.50(2/ 2)	2 VALUES <LLD	
		3.20- 7.80	TRM 382.1	3.20- 7.80		
GAMMA (GELI)						
44						
K-40	NOT ESTAB	7.54(2/ 33)	SCOTTSBORO,AL	10.98(1/ 11)	25.11(1/ 11)	
		4.09- 10.98	TRM 385.8	10.98- 10.98	25.11- 25.11	
BI-214	NOT ESTAB	29.21(19/ 33)	HOLLYWOOD,AL	50.85(10/ 11)	12.99(3/ 11)	
		0.96- 218.82	3.4 MILES WNW	3.24- 218.82	1.07- 21.70	
PB-214	NOT ESTAB	39.05(13/ 33)	HOLLYWOOD,AL	48.66(10/ 11)	19.20(1/ 11)	
		2.21- 203.88	3.4 MILES WNW	5.33- 203.88	19.20- 19.20	
PB-212	NOT ESTAB	2.36(9/ 33)	HOLLYWOOD,AL	2.64(4/ 11)	0.86(6/ 11)	
		0.63- 3.92	3.4 MILES WNW	1.77- 3.92	0.02- 2.06	
TL-208	NOT ESTAB	0.57(8/ 33)	HOLLYWOOD,AL	0.82(3/ 11)	11 VALUES <LLD	
		0.16- 1.54	3.4 MILES WNW	0.19- 1.54		
SR 89	10.000	12 VALUES <LLD			4 VALUES <LLD	
16		ANALYSIS PERFORMED				
SR 90	2.000	12 VALUES <LLD			4 VALUES <LLD	
16		ANALYSIS PERFORMED				
TRITIUM	330.000	352.40(1/ 12)	SCOTTSBORO,AL	352.40(1/ 4)	4 VALUES <LLD	
16		352.40- 352.40	TRM 385.8	352.40- 352.40		

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 at specified location is indicated in parentheses (F).

Table 15

ENVIRONMENTAL GAMMA RADIATION LEVELS

Average External Gamma Radiation Levels at Various Distances from Bellefonte Nuclear Plant for Each Quarter - 1983
mR/Quarter[a]

Distance miles	Average External Gamma Radiation Levels[b]			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
0-1	15.3 ± 1.5	18.5 ± 1.4	20.6 ± 2.0	21.4 ± 2.0
1-2	18.2 ± 5.7	21.9 ± 6.1	23.6 ± 6.6	24.3 ± 6.3
2-4	12.8 ± 0.9	15.3 ± 1.4	16.5 ± 1.4	16.7 ± 1.1
4-6	13.7 ± 1.3	16.7 ± 1.5	17.9 ± 2.1	18.9 ± 1.5
>6	12.3 ± 1.5	15.3 ± 1.1	15.9 ± 1.5	17.0 ± 1.1
Average, 0-2 miles (Onsite)	15.8 ± 2.7	19.1 ± 2.8	21.2 ± 3.2	21.9 ± 3.1
Average, >2 miles (Offsite)	13.2 ± 1.4	16.1 ± 1.5	17.1 ± 2.0	18.0 ± 1.6

a. Data normalized to one quarter (2190 hours).
b. All averages reported ±1σ (68 percent confidence level).

TABLE 16

RADIOACTIVITY IN CABBAGE

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED GAMMA (GELI)	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
2						
K-40	NOT ESTAB	1716.45 (1/ 1) 1716.45- 1716.45	2 MILES WNW	1716.45 (1/ 1) 1716.45- 1716.45	1702.43 (1/ 1) 1702.43- 1702.43	

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 at specified location is indicated in parentheses (F).

TABLE 17

RADIOACTIVITY IN CORN

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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) 1						
K-40	NOT ESTAB	2121.52(1/ 1) 2121.52- 2121.52	2 MILES WNW 2 MILES WNW	2121.52(1/ 1) 2121.52- 2121.52		

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 at specified location is indicated in parentheses (F).

TABLE 18

RADIOACTIVITY IN POTATOES

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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) 2						
CS-137	5.000	1 VALUES <LLD			6.16(1/ 1) 6.16- 6.16	
K-40	NOT ESTAB	3579.92(1/ 1) 3579.92- 3579.92	2 MILES WNW	3579.92(1/ 1) 3579.92- 3579.92	2518.37(1/ 1) 2518.37- 2518.37	
PB-212	NOT ESTAB	1.09(1/ 1) 1.09- 1.09	2 MILES WNW 2 MILES WNW	1.09(1/ 1) 1.09- 1.09	1 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 at specified location is indicated in parentheses (F).

TABLE 19

RADIOACTIVITY IN TOMATOES

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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) 2						
K-40	NOT ESTAB	2331.75(1/ 1) 2331.75- 2331.75	2 MILES WNW 2 MILES WNW	2331.75(1/ 1) 2331.75- 2331.75	2252.60(1/ 1) 2252.60- 2252.60	

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 at specified location is indicated in parentheses (F).

TABLE 20

RADIOACTIVITY IN POULTRY

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON — ALABAMA — REPORTING PERIOD 1983

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	2255.31 (1/ 1) 2255.31 - 2255.31	SISK FARM 4.9 MILES SW	2255.31 (1/ 1) 2255.31 - 2255.31	2148.30 (1/ 1) 2148.30 - 2148.30	
PB-212	NOT ESTAB	1 VALUES <LLD			0.37 (1/ 1) 0.37 - 0.37	

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 at specified location is indicated in parentheses (F).

Figure 5

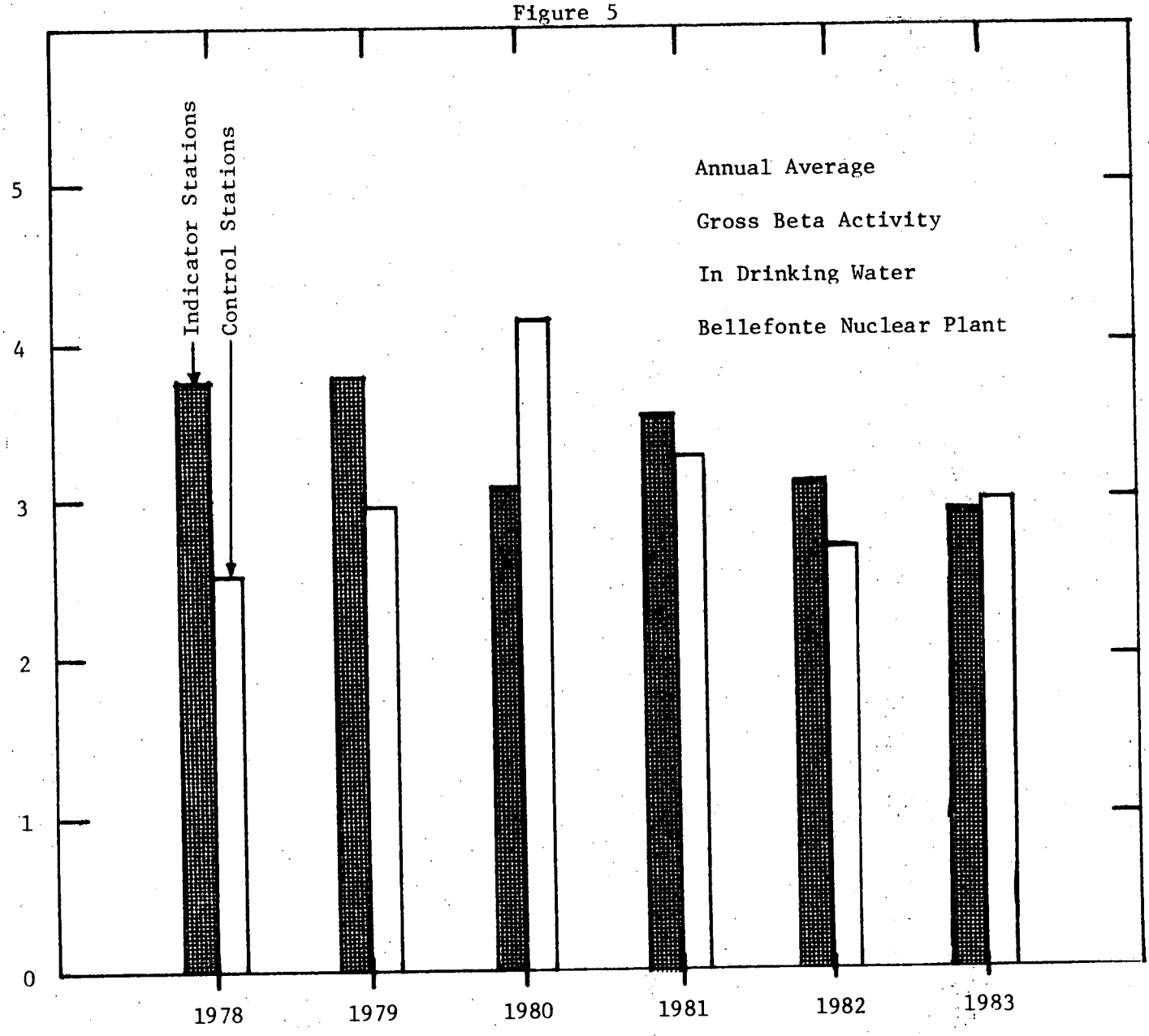

Indicator Stations
Control Stations
Annual Average
Gross Beta Activity
In Drinking Water
Bellefonte Nuclear Plant
pCi/l
0
1
2
3
4
5
1978
1979
1980
1981
1982
1983

Figure 6

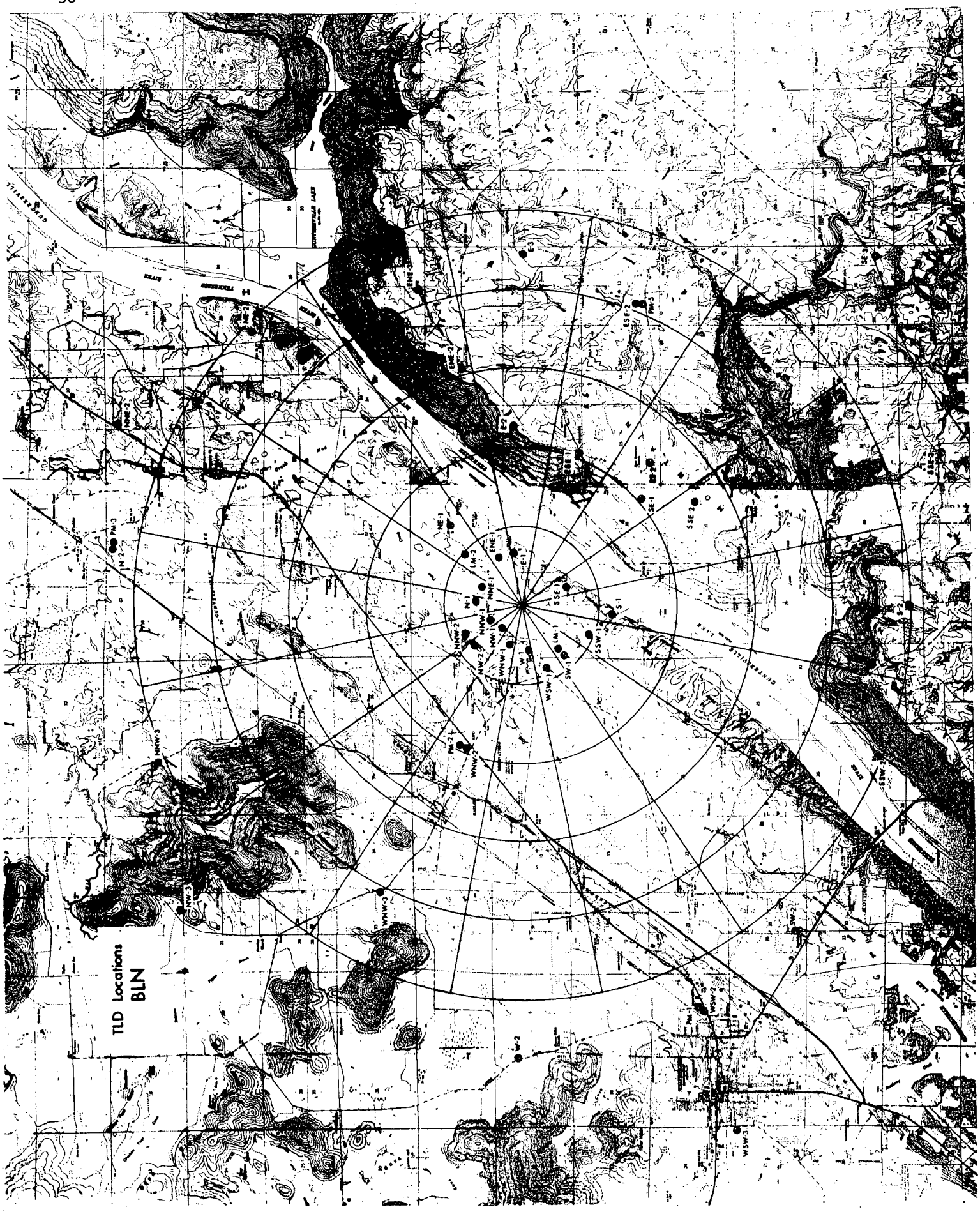


Figure 7

Direct Radiation Levels
Bellefonte Nuclear Plant

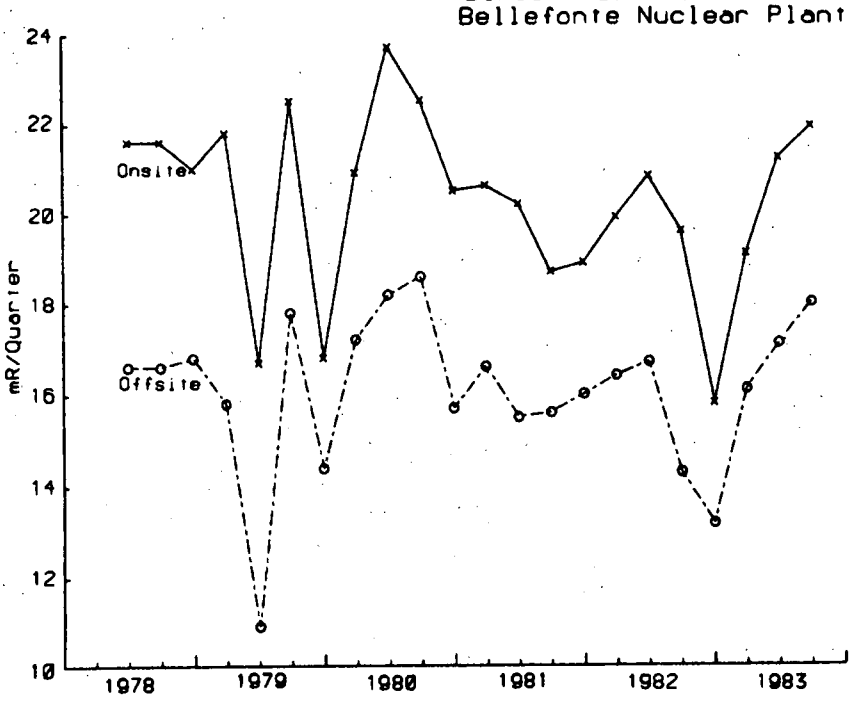
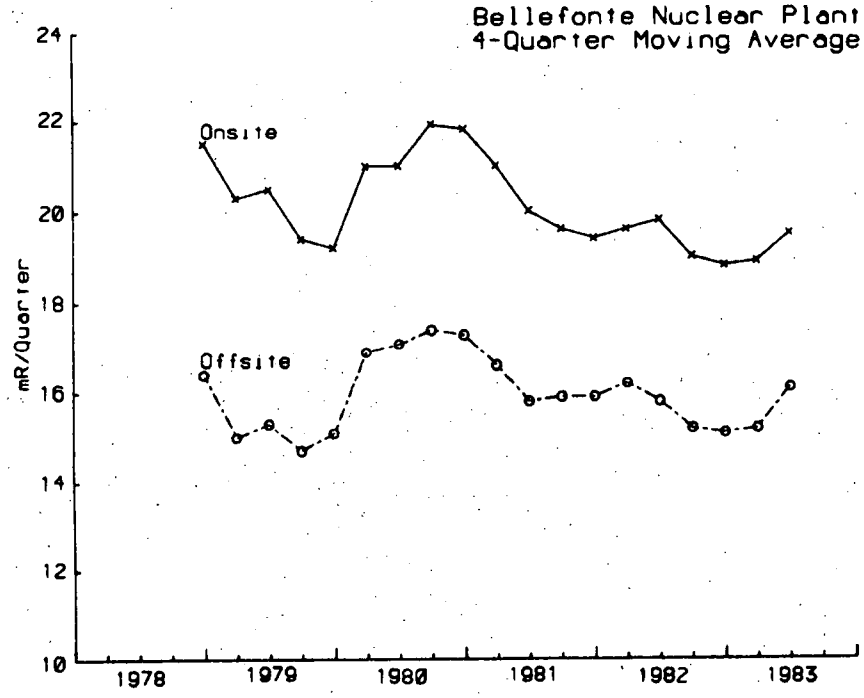


Figure 8

Direct Radiation Levels
Bellefonte Nuclear Plant
4-Quarter Moving Average



THIS PAGE

INTENTIONALLY LEFT

BLANK

Reservoir Monitoring

Reservoir sampling at BLN was initiated in November 1981 with the collection of surface water. Surface water samples were collected quarterly and samples of sediment, Asiatic clams, plankton, and aquatic macrophytes were collected semiannually at locations listed in table 21. Because of the location of BLN between Browns Ferry Nuclear Plant (BFN) and Sequoyah Nuclear Plant (SQN), the reservoirs scheduled to be sampled for fish were being sampled in the BFN and SQN monitoring programs.

Water

Grab samples of surface water are taken quarterly at TRMs 388.0, 391.2, and 396.8 (figure 9) and analyzed for gamma-emitting radionuclides strontium, and for tritium. The results are shown in table 22.

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.

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 BFN monitoring program. In the SQN monitoring program, samples of white crappie and smallmouth buffalo are taken semiannually from Nickajack Reservoir and analyzed for gross alpha, gross beta, gamma-emitting radionuclides, and strontium. In addition, ^{89}Sr and ^{90}Sr concentrations were determined in two smallmouth buffalo flesh samples taken in connunction with the BFN monitoring program. During this reporting period one sample was of insufficient size to permit a representative "whole" analysis. The data from the analysis of these samples are included herein in tables 23, 24, and 25.

Sediment

Sediment samples are collected from Ponar dredge hauls made for bottom fauna. Gamma radioactivity and ^{89}Sr and ^{90}Sr content are determined semiannually in composite samples collected from each of three stations. Locations of these stations are shown in table 21. Results are shown in table 26.

Bottom Fauna

Asiatic clams are collected semiannually from cross sections of the Tennessee River at three stations (table 21). The clam flesh was analyzed for gross beta activity and for gamma-emitting radionuclides. The shells were analyzed for gamma-emitting radionuclides and for strontium content. A 50-gram (wet weight) sample provides sufficient activity for counting. Results are given in tables 27 and 28.

Plankton

Net plankton (all phytoplankton and zooplankton caught with a 100 μ mesh net) are collected for radiological analyses at each of three stations by vertical tows with a 1/2-meter net. At least 50 grams (wet weight) of material is necessary for analytical accuracy. Samples are collected semiannually and submitted for gross beta analysis, and when quantities are sufficient, for gamma activity and ^{89}Sr and ^{90}Sr content. The results are shown in table 29. During this reporting period, only three samples contained sufficient volume of material for gross beta analysis. There were insufficient volumes for strontium and gamma analysis.

Aquatic Macrophytes

Samples of aquatic macrophytes are collected semiannually from three locations (table 21) and analyzed for gross beta, gamma-emitting radionuclides, and levels of ^{89}Sr and ^{90}Sr. Results are given in table 30.

Table 21

Sampling Schedule - Reservoir Monitoring

Tennessee River (Mile)	Biological Samples					Surface Water
	Plankton	Benthic Fauna	Sediment	Fish*	Aquatic Macrophytes	
396.8 (control)	X	X	X		X	X
391.2	X	X	X		X	X
388.0	X	X	X		X	X

*Fish samples are taken from Guntersville, Wheeler, and Nickajack Reservoirs.

TABLE 22

RADIOACTIVITY IN SURFACE WATER TOTAL

PCI/L - 0.037 BQ/L

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439
LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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)						
3		2 VALUES <LLD ANALYSIS PERFORMED			1 VALUES <LLD	
GAMMA (GELI)						
9						
BI-214	NOT ESTAB	3.72(3/ 6) 0.86- 6.20	TRM 388.0	5.15(2/ 3) 4.10- 6.20	3 VALUES <LLD	
PB-212	NOT ESTAB	2.02(3/ 6) 0.47- 2.94	TRM 388.0	2.80(2/ 3) 2.67- 2.94	2.22(1/ 3) 2.22- 2.22	
SR 89	10.000	8 VALUES <LLD			4 VALUES <LLD	
12		ANALYSIS PERFORMED				
SR 90	2.000	8 VALUES <LLD			4 VALUES <LLD	
12		ANALYSIS PERFORMED				
TRITIUM	330.000	8 VALUES <LLD			4 VALUES <LLD	
12		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 at specified location is indicated in parentheses (F).

TABLE 23

RADIOACTIVITY IN WHITE CRAPPIE (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 1983

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 VALUES <LLD ANALYSIS PERFORMED				2 VALUES <LLD	
GROSS BETA 6	0.100	31.11(4/ 4) 23.00- 34.34	WHEELER RES TRM 275-349	33.97(2/ 2) 33.60-	34.34	35.10(2/ 2) 31.76- 38.45	
GAMMA (GELI) 6							
CS-137	0.020	0.13(4/ 4) 0.07- 0.16	WHEELER RES TRM 275-349	0.14(2/ 2) 0.11-	0.16	0.10(2/ 2) 0.06- 0.13	
K-40	NOT ESTAB	15.55(4/ 4) 10.12- 18.57	WHEELER RES TRM 275-349	17.26(2/ 2) 15.95-	18.57	16.13(2/ 2) 15.72- 16.53	
PB-212	NOT ESTAB	4 VALUES <LLD				0.00(1/ 2) 0.00- 0.00	
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 at specified location is indicated in parentheses (F).

TABLE 24

RADIOACTIVITY IN SMALLMOUTH BUFFALO (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 1983

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 ALPHA	0.100	0 VALUES <LLD				2 VALUES <LLD	
2		ANALYSIS PERFORMED					
GROSS BETA	0.100	21.62 (4/ 4)	WHEELER RES	23.00 (2/ 2)		21.19 (2/ 2)	
6		19.21 - 25.49	TRM 275-349	20.51 - 25.49		18.94 - 23.44	
GAMMA (GELI)							
6							
CS-137	0.020	0.05 (2/ 4)	GUNTERSVILLE RES	0.05 (2/ 2)		0.07 (1/ 2)	
		0.04 - 0.05	TRM 349-425	0.04 - 0.05		0.07 - 0.07	
K-40	NOT ESTAB	10.92 (4/ 4)	WHEELER RES	12.19 (2/ 2)		10.82 (2/ 2)	
		9.51 - 13.70	TRM 275-349	10.67 - 13.70		10.27 - 11.37	
PB-214	NOT ESTAB	0.00 (1/ 4)	GUNTERSVILLE RES	0.00 (1/ 2)		2 VALUES <LLD	
		0.00 - 0.00	TRM 349-425	0.00 - 0.00			
PB-212	NOT ESTAB	4 VALUES <LLD				0.00 (1/ 2)	
						0.00 - 0.00	
SR 89	0.500	2 VALUES <LLD				2 VALUES <LLD	
4		ANALYSIS PERFORMED					
SR 90	0.100	2 VALUES <LLD				2 VALUES <LLD	
4		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 at specified is indicated in parentheses (F).

TABLE 25

RADIOACTIVITY IN SMALLMOUTH BUFFALO (WHOLE)

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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	0.100	0 VALUES <LLD				1 VALUES <LLD	
1		ANALYSIS PERFORMED					
GROSS BETA	0.100	16.82(4/ 4)	WHEELER RES	18.17(2/ 2)		13.46(1/ 1)	
5		12.04- 18.92	TRM 275-349	17.73-	18.60	13.46- 13.46	
GAMMA (GELI)							
5							
CS-137	0.020	0.03(1/ 4)	GUNTERSVILLE RES	0.03(1/ 2)		1 VALUES <LLD	
		0.03- 0.03	TRM 349-425	0.03-	0.03		
K-40	NOT ESTAB	7.34(4/ 4)	WHEELER RES	8.04(2/ 2)		4.84(1/ 1)	
		5.13- 8.18	TRM 275-349	7.90-	8.17	4.84- 4.84	
BI-214	0.020	0.04(2/ 4)	WHEELER RES	0.04(2/ 2)		1 VALUES <LLD	
		0.02- 0.05	TRM 275-349	0.02-	0.05		
PB-214	NOT ESTAB	0.03(1/ 4)	WHEELER RES	0.03(1/ 2)		1 VALUES <LLD	
		0.03- 0.03	TRM 275-349	0.03-	0.03		
PB-212	NOT ESTAB	0.02(2/ 4)	WHEELER RES	0.02(2/ 2)		0.00(1/ 1)	
		0.01- 0.03	TRM 275-349	0.01-	0.03	0.00- 0.00	
SR 89	0.500	0 VALUES <LLD				1 VALUES <LLD	
1		ANALYSIS PERFORMED					
SR 90	0.100					0.12(1/ 1)	
1						0.12- 0.12	

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 at specified location is indicated in parentheses (F).

TABLE 26

RADIOACTIVITY IN SEDIMENT

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

NAME OF FACILITY BELLEFONTE DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1983

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)						
6						
CO-60	0.010	0.11(2/ 4) 0.11- 0.12	TRM 391.2	0.12(1/ 2) 0.12- 0.12	0.08(1/ 2) 0.08- 0.08	
CS-137	0.020	1.32(4/ 4) 0.30- 2.58	TRM 388.0	1.95(2/ 2) 1.33- 2.58	0.62(2/ 2) 0.21- 1.03	
K-40	NOT ESTAB	14.20(4/ 4) 11.66- 15.62	TRM 388.0	15.18(2/ 2) 14.73- 15.62	14.29(2/ 2) 13.35- 15.23	
MN-54	0.010	0.03(2/ 4) 0.03- 0.04	TRM 391.2	0.04(1/ 2) 0.04- 0.04	2 VALUES <LLD	
BI-214	0.020	1.10(4/ 4) 0.95- 1.23	TRM 388.0	1.13(2/ 2) 1.04- 1.23	0.99(2/ 2) 0.87- 1.10	
BI-212	0.100	1.75(2/ 4) 1.74- 1.76	TRM 391.2	1.76(1/ 2) 1.76- 1.76	1.40(1/ 2) 1.40- 1.40	
PB-214	NOT ESTAB	1.25(4/ 4) 0.95- 1.39	TRM 388.0	1.36(2/ 2) 1.33- 1.39	1.17(2/ 2) 1.12- 1.23	
PB-212	NOT ESTAB	1.25(4/ 4) 0.93- 1.52	TRM 388.0	1.33(2/ 2) 1.13- 1.52	1.33(2/ 2) 1.24- 1.43	
RA-226	NOT ESTAB	1.10(4/ 4) 0.95- 1.23	TRM 388.0	1.13(2/ 2) 1.04- 1.23	1.10(1/ 2) 1.10- 1.10	
RA-224	NOT ESTAB	1.35(1/ 4) 1.35- 1.35	TRM 388.0	1.35(1/ 2) 1.35- 1.35	1.78(1/ 2) 1.78- 1.78	
TL-208	0.020	0.45(4/ 4) 0.33- 0.52	TRM 388.0	0.48(2/ 2) 0.44- 0.52	0.45(2/ 2) 0.41- 0.49	
AC-228	0.060	1.28(4/ 4) 1.03- 1.47	TRM 391.2	1.31(2/ 2) 1.20- 1.43	1.27(2/ 2) 1.06- 1.47	
PA-234M	NOT ESTAB	4 VALUES <LLD			3.61(1/ 2) 3.61- 3.61	
SR 89	1.500	4 VALUES <LLD			2 VALUES <LLD	
6		ANALYSIS PERFORMED				
SR 90	0.300	4 VALUES <LLD			2 VALUES <LLD	
6		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 at specified location is indicated in parentheses (F).

TABLE 27

RADIOACTIVITY IN CLAM 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 1983

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 6	0.100	9.45(4/ 4) 6.19- 15.28	TRM 391.2	11.98(2/ 2) 8.67- 15.28	4.63(2/ 2) 4.04- 5.22	
GAMMA (GELI) 6						
BI-214	NOT ESTAB	2.04(1/ 4) 2.04- 2.04	TRM 391.2	2.04(1/ 2) 2.04- 2.04	2 VALUES <LLD	
PB-214	NOT ESTAB	2.38(1/ 4) 2.38- 2.38	TRM 391.2	2.38(1/ 2) 2.38- 2.38	2 VALUES <LLD	
PB-212	NOT ESTAB	0.04(1/ 4) 0.04- 0.04	TRM 388.0	0.04(1/ 2) 0.04- 0.04	0.20(2/ 2) 0.16- 0.23	
AC-228	NOT ESTAB	1.72(1/ 4) 1.72- 1.72	TRM 391.2	1.72(1/ 2) 1.72- 1.72	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 at specified location is indicated in parentheses (F).

TABLE 28

RADIOACTIVITY IN CLAM SHELL

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

NAME OF FACILITY BELLEFONTE DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1983

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)							
6							
CS-137	0.020	4 VALUES <LLD				0.15 (1/ 2)	
						0.15 - 0.15	
K-40	NOT ESTAB	2.52 (1/ 4)	TRM 388.0	2.52 (1/ 2)		2 VALUES <LLD	
		2.52 - 2.52		2.52 - 2.52			
BI-214	0.050	0.25 (1/ 4)	TRM 388.0	0.25 (1/ 2)		0.42 (1/ 2)	
		0.25 - 0.25		0.25 - 0.25		0.42 - 0.42	
PB-214	0.050	0.25 (1/ 4)	TRM 388.0	0.25 (1/ 2)		0.53 (1/ 2)	
		0.25 - 0.25		0.25 - 0.25		0.53 - 0.53	
PB-212	NOT ESTAB	0.09 (1/ 4)	TRM 388.0	0.09 (1/ 2)		0.19 (2/ 2)	
		0.09 - 0.09		0.09 - 0.09		0.05 - 0.34	
RA-226	0.050	0.25 (1/ 4)	TRM 388.0	0.25 (1/ 2)		2 VALUES <LLD	
		0.25 - 0.25		0.25 - 0.25			
SR 89	5.000	4 VALUES <LLD				2 VALUES <LLD	
6		ANALYSIS PERFORMED					
SR 90	1.000	1.27 (2/ 4)	TRM 391.2	1.33 (1/ 2)		1.38 (1/ 2)	
6		1.21 - 1.33		1.33 - 1.33		1.38 - 1.38	

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 at specified location is indicated in parentheses (F).

TABLE 29

RADIOACTIVITY IN PLANKTON

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

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON ALABAMA — REPORTING PERIOD 1983

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 3	0.100	40.51(2/ 2) 39.10- 41.92	TRM 388.0	41.92(1/ 1) 41.92- 41.92	41.43(1/ 1) 41.43- 41.43	

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 at specified location is indicated in parentheses (F).

TABLE 30

RADIOACTIVITY IN AQUATIC MACROPHYTES

PCI/GM - 0.037 BQ/GM

NAME OF FACILITY BELLEFONTE — DOCKET NO. 50-438,439

LOCATION OF FACILITY JACKSON — ALABAMA — REPORTING PERIOD 1983

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE	CONTROL LOCATIONS MEAN (F)[b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA	NOT ESTAB	33.26(4/ 4)	TRM 391.2	33.73(2/ 2)	34.13(2/ 2)	
6		24.46- 41.11		32.44- 35.03	29.12- 39.13	
GAMMA (GELI)						
6						
CO-60	NOT ESTAB	0.13(4/ 4)	TRM 388.0	0.15(2/ 2)	0.12(2/ 2)	
		0.07- 0.17		0.13- 0.17	0.12- 0.13	
CS-137	NOT ESTAB	0.27(4/ 4)	TRM 388.0	0.32(2/ 2)	0.25(2/ 2)	
		0.17- 0.38		0.26- 0.38	0.23- 0.28	
CO-58	NOT ESTAB	0.04(1/ 4)	TRM 388.0	0.04(1/ 2)	0.04(1/ 2)	
		0.04- 0.04		0.04- 0.04	0.04- 0.04	
K-40	NOT ESTAB	17.12(4/ 4)	TRM 391.2	17.70(2/ 2)	19.80(2/ 2)	
		16.29- 18.09		17.32- 18.09	19.54- 20.06	
MN-54	NOT ESTAB	0.03(3/ 4)	TRM 388.0	0.03(2/ 2)	2 VALUES <LLD	
		0.02- 0.04		0.02- 0.04		
BI-214	NOT ESTAB	0.40(4/ 4)	TRM 388.0	0.43(2/ 2)	0.42(2/ 2)	
		0.20- 0.60		0.26- 0.60	0.37- 0.47	
BI-212	NOT ESTAB	0.59(3/ 4)	TRM 388.0	0.66(2/ 2)	0.59(2/ 2)	
		0.42- 0.90		0.42- 0.90	0.44- 0.73	
PB-214	NOT ESTAB	0.43(4/ 4)	TRM 388.0	0.47(2/ 2)	0.47(2/ 2)	
		0.22- 0.64		0.30- 0.64	0.42- 0.51	
PB-212	NOT ESTAB	0.41(4/ 4)	TRM 388.0	0.49(2/ 2)	0.43(2/ 2)	
		0.22- 0.59		0.40- 0.59	0.39- 0.47	
BE-7	NOT ESTAB	2.52(4/ 4)	TRM 388.0	3.00(2/ 2)	2.24(2/ 2)	
		1.69- 3.28		2.72- 3.28	1.72- 2.76	
TL-208	NOT ESTAB	0.16(4/ 4)	TRM 388.0	0.19(2/ 2)	0.15(2/ 2)	
		0.09- 0.25		0.13- 0.25	0.13- 0.17	
AC-228	NOT ESTAB	0.66(4/ 4)	TRM 391.2	0.67(2/ 2)	0.66(2/ 2)	
		0.43- 0.92		0.43- 0.92	0.64- 0.67	
SR 89	NOT ESTAB	0.60(3/ 4)	TRM 391.2	0.64(1/ 2)	0.45(2/ 2)	
6		0.13- 1.04		0.64- 0.64	0.22- 0.69	
SR 90	NOT ESTAB	0.14(4/ 4)	TRM 391.2	0.18(2/ 2)	0.14(2/ 2)	
6		0.02- 0.27		0.10- 0.27	0.05- 0.23	

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 at specified is indicated in parentheses (F).

RESERVOIR MONITORING NETWORK

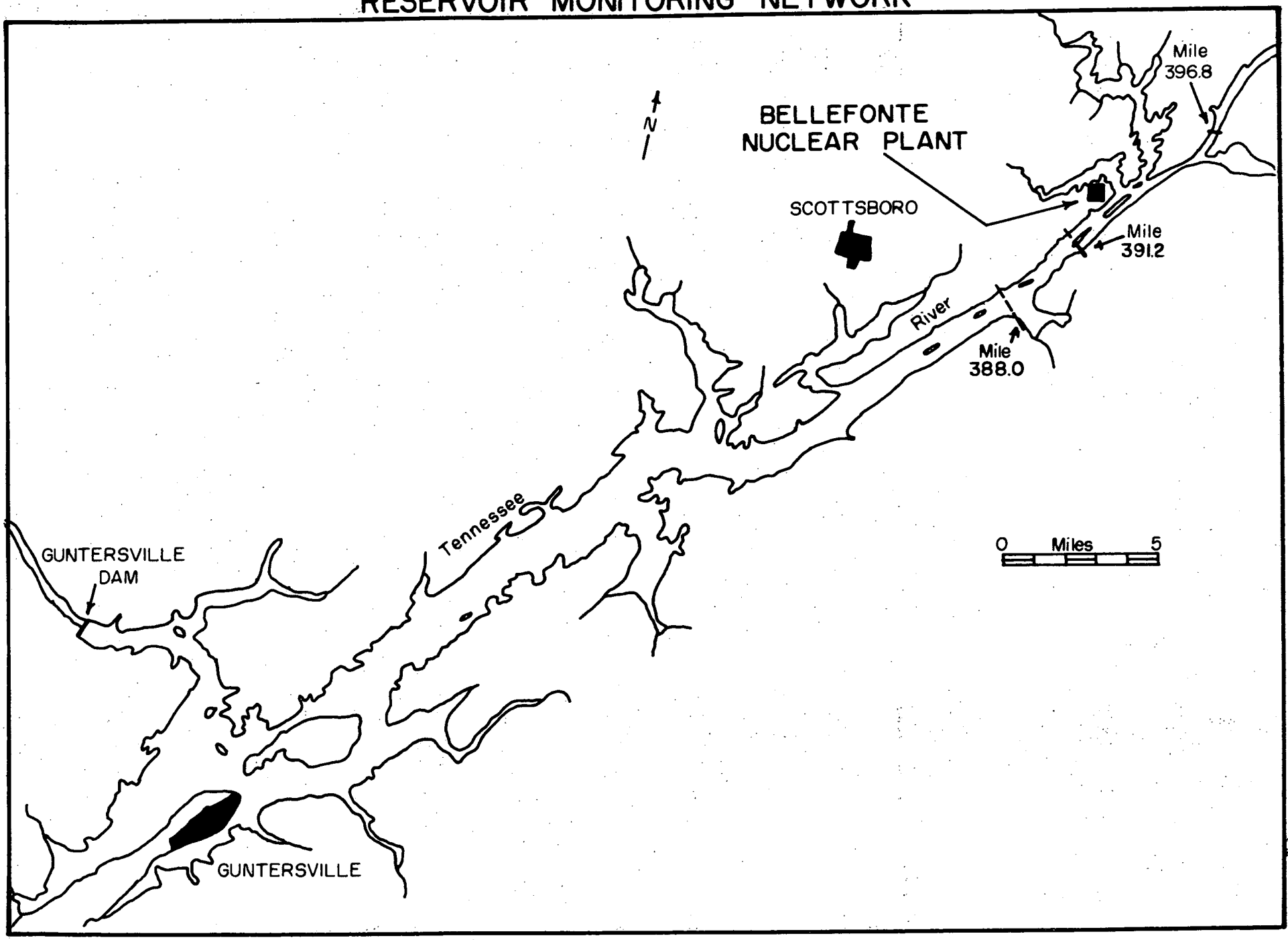


Figure 9

THIS PAGE

INTENTIONALLY LEFT

BLANK

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 BLN 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.