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TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

January 29, 1980

Director of Nuclear Reactor Regulation
Attention: Mr. Daniel R. Muller
Acting Director, Division of Site Safety
and Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Muller:

In the Matter of the Application of) Docket Nos. 50-438
Tennessee Valley Authority) 50-439

Enclosed for your information are three copies of the report,
"Environmental Radioactivity Levels - Bellefonte Nuclear Plant
1978." This report presents the results obtained from TVA's
preoperational environmental radiological monitoring program
during 1978.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosures (3)

cc (Enclosures 2):

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*Cool
E/S
1/31*

RH-79-8-BL1

ENVIRONMENTAL RADIOACTIVITY LEVELS
BELLEFONTE NUCLEAR PLANT
1978

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ENVIRONMENTAL RADIOACTIVITY LEVELS

BELLEFONTE NUCLEAR PLANT

1978

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 September 1982.

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 1978.

Field staffs in the Division of Occupational Health and Safety, the Division of Water Resources, and the Division of Natural Resources Services carried out the sampling program outlined in Table 1. Sampling locations are shown in Figures 2, and 3. All the radiochemical and instrumental analyses were conducted in a central laboratory at Muscle Shoals, Alabama. Alpha and beta analyses were performed on Beckman Low Beta II and Beckman Wide Beta II low-background proportional counters. Two Nuclear Data Model 100 multichannel analyzer systems employing sodium iodide, NaI(Tl) detectors and one Nuclear Data Model 4420 in conjunction with Germanium, Ge(Li), detection systems were used to analyze the samples for specific gamma-emitting radionuclides. 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 fall-out), 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. A TVA fabricated beta-gamma coincidence counting system is utilized for the determination of ^{131}I concentration in milk.

Data were entered in computer storage for processing specific to the analysis conducted. A computer, employing an ALPHA-M least-squares code, was used to solve multimatrix problems associated with estimating 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*. For these analyses, radionuclide combinations such as $^{103,106}\text{Ru}$ and $^{95}\text{Zr-Nb}$ 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 ^7Be , ^{40}K , ^{212}Bi , ^{214}Bi , ^{212}Pb , ^{214}Pb , ^{226}Ra , etc. LLD's for the analysis of the radionuclides listed below* 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.

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

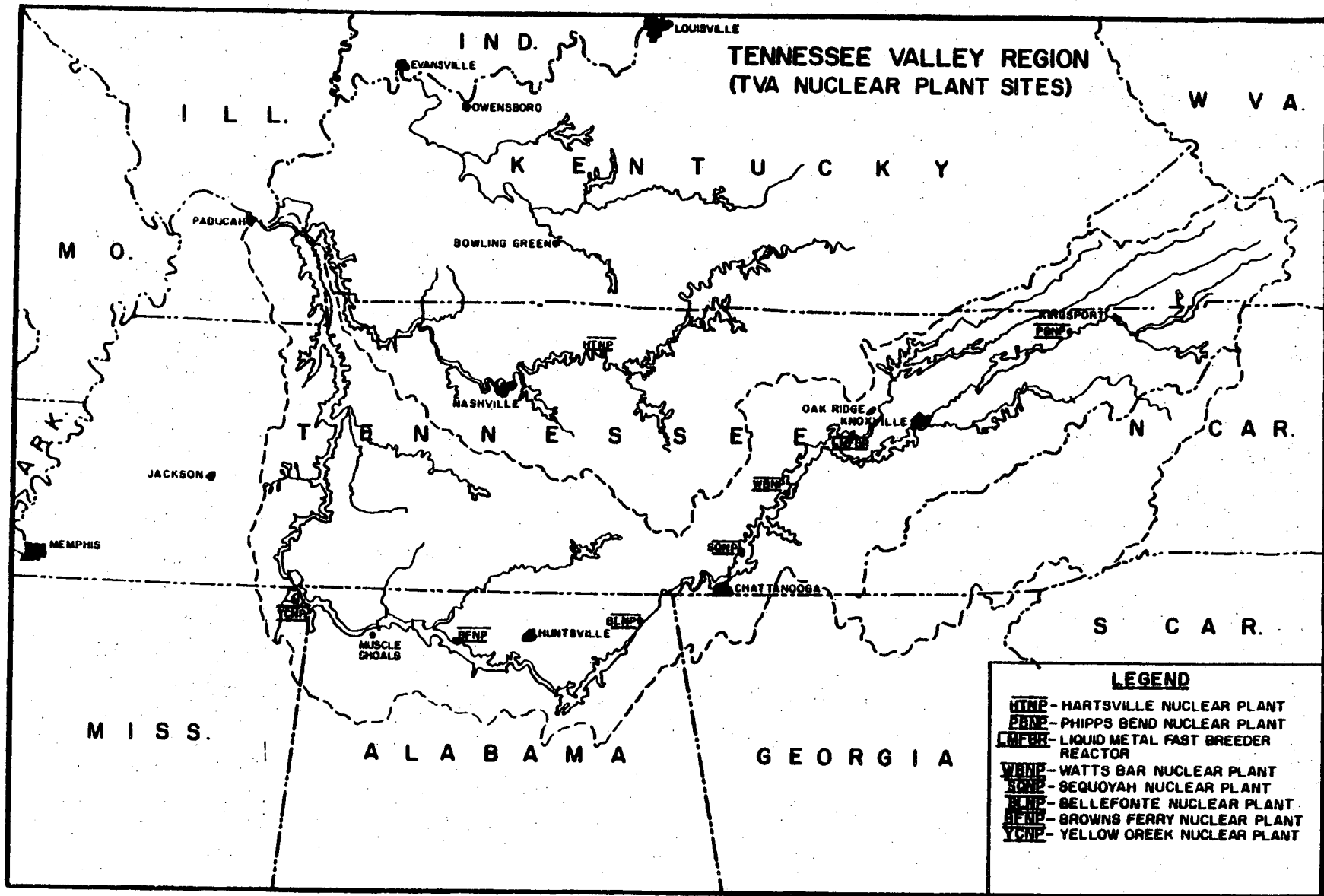


Figure 1

Table 1

ENVIRONMENTAL RADIOACTIVITY SAMPLING SCHEDULE
BELLEFONTE NUCLEAR PLANT

<u>Station Location</u>	<u>Air Filter</u>	<u>Charcoal Filter</u>	<u>Rain-water</u>	<u>Heavy Particle Fallout</u>	<u>Vegetation</u>	<u>Milk</u>	<u>Well Water</u>	<u>Public Water</u>	<u>Fish</u>
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 D							M		
Well A							M		
Onsite Wells (6)							M		
Sand Mountain Water & Fire Protection Authority								M	
Widows Creek Steam Plant								M	
Wheeler Reservoir									S*
Guntersville Reservoir									S*
Nickajack Reservoir									S**

W - Weekly M - Monthly Q - Quarterly S - Semiannually
 *Samples collected as a part of the Browns Ferry Nuclear Plant monitoring program.
 **Samples collected as a part of the Sequoyah Nuclear Plant monitoring program.

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 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 15 miles (24 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 ft³/min (0.085 m³/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.

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. These stations will detect significant airborne release from BLN.

Air filters are collected weekly and analyzed for gross beta activity. 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 ⁸⁹Sr, ⁹⁰Sr analysis. The results are presented in Table 5.

With reference to Table 4, which contains the maximum permissible concentrations (MPC) recommended by 10 CFR 20 for nonoccupational exposure, it is seen that the maximum beta concentration is 0.12 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 6.

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 7.

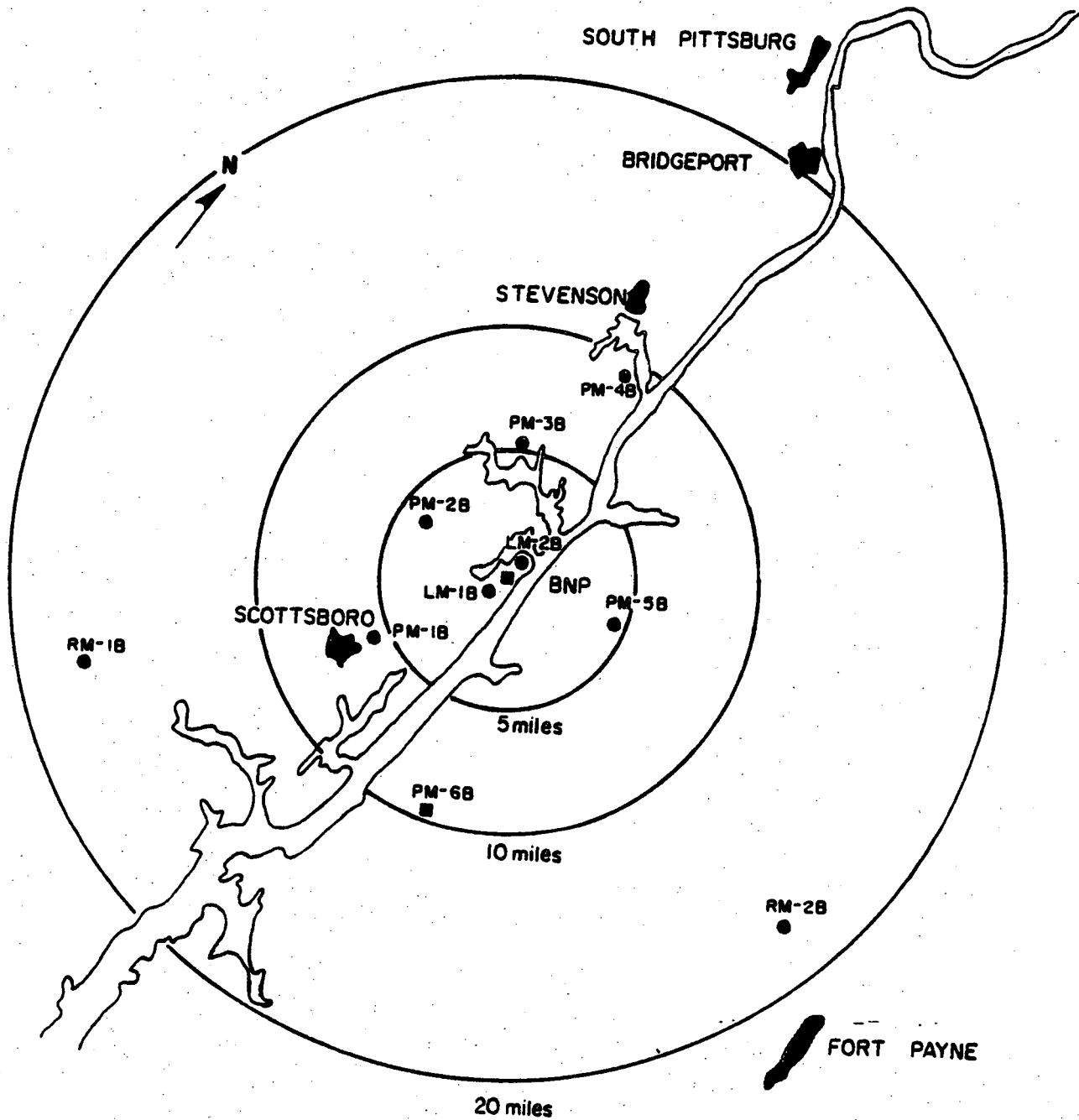
Charcoal filters are collected and analyzed for radioiodine. The filter is counted in a single channel analyzer system. The data are shown in Table 8, where the highest value reported is 0.04 percent MPC for ¹³¹I.

Table 2

Atmospheric and Terrestrial Monitoring Stations Locations
Bellefonte Nuclear Plant

<u>Sample Station</u>	<u>Approximate Distance and Direction from Plant</u>
LM - 1 BL	3/4 mile SW (1-1/4 kilometers)
LM - 2 BL	1 mile NE (1-1/2 kilometers)
PM - 1 BL (Scottsboro)	5-1/2 miles WSW (9 kilometers)
PM - 2 BL (Hollywood)	1-3/4 miles WNW (3 kilometers)
PM - 3 BL (Fackler)	5-1/4 miles N (8-1/2 kilometers)
PM - 4 BL (Stevenson)	11 miles NNE (17-3/4 kilometers)
PM - 5 BL (Pisgah)	4-1/4 miles ESE (7 kilometers)
PM - 6 BL (Section)	9-1/4 miles SSW (14-3/4 kilometers)
RM - 1 BL (Lim Rock)	15 miles W (24-1/4 kilometers)
RM - 2 BL (Rainsville)	15 miles SSE (24-1/4 kilometers)
Farm S	5 miles SW (8 kilometers)

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

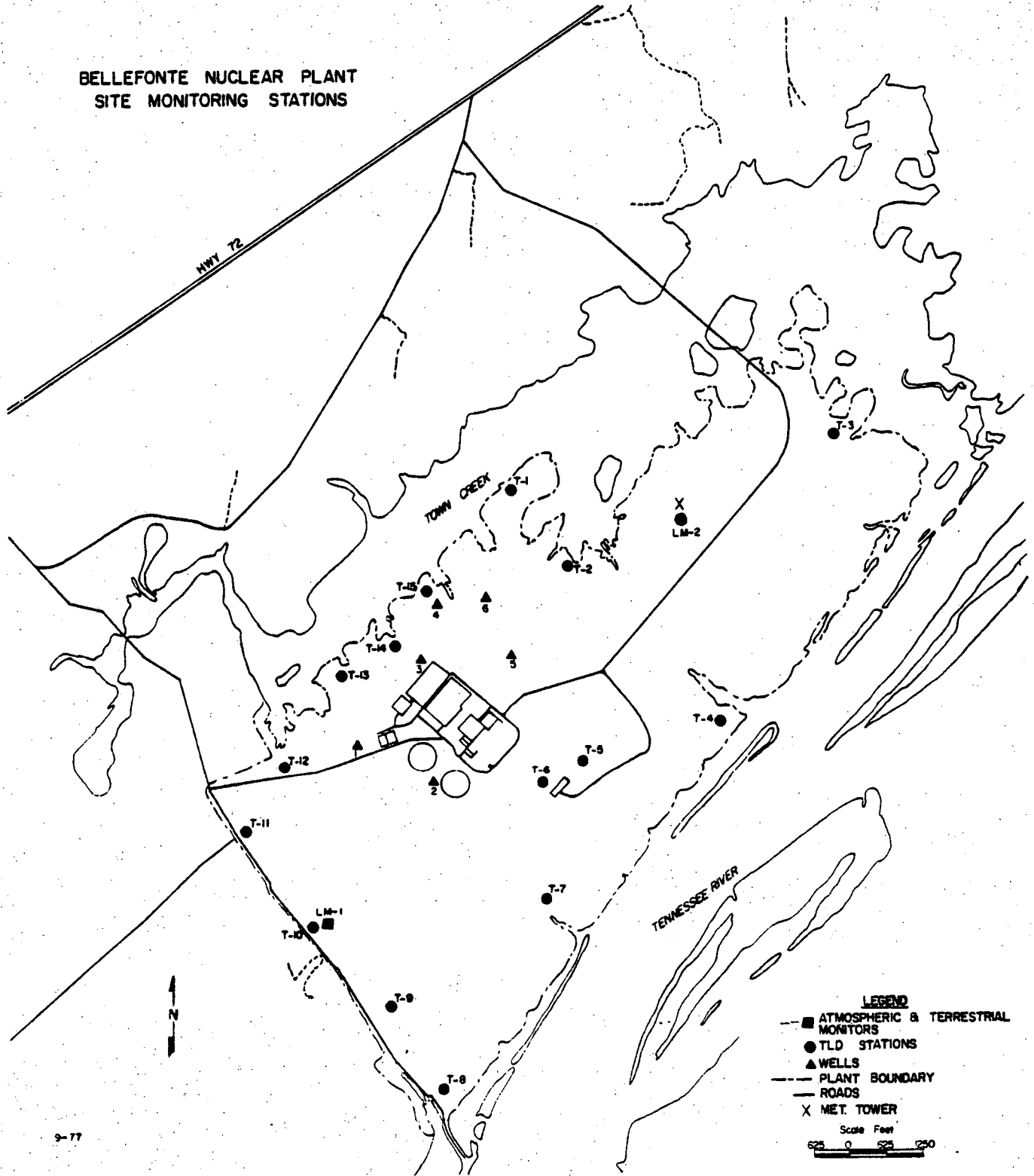


Table 3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSISA. Specific AnalysesNOMINAL LOWER LIMIT OF DETECTION (LLD)*

	<u>Air Particulates pCi/m³</u>	<u>Charcoal pCi/m³</u>	<u>Fallout mCi/km²</u>	<u>Water pCi/l</u>	<u>Vegetation and grain pCi/g, dry</u>	<u>Soil and Sediment pCi/g, dry</u>	<u>Fish, clam flesh, plankton, pCi/g, dry</u>	<u>Clam shells pCi/g, dry</u>	<u>Foods, meat, poultry, pCi/kg, wet</u>	<u>Milk pCi/l</u>
Total α				0.4	0.01				1.5	
Gross α	0.005		0.05	2.0	0.05	0.35	0.1	0.7		
Gross β	0.01			2.4	0.20	0.70	0.1	0.7	25	
³ H				330						
¹³¹ I		0.01								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		Water and milk		Vegetation and grain		Soil and sediment		Fish		Clam flesh and plankton		Clam shells		Foods, tomatoes, potatoes, etc.)		Meat and poultry	
	pCi/m ³		pCi/l		pCi/g, dry		pCi/g, dry		pCi/g, dry		pCi/g, dry		pCi/g, dry		pCi/kg, wet		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)
¹³⁷ Cs	0.03		38		0.55		0.35		0.35		0.35	0.06	0.35		38		90	
¹⁴⁴ Ce		0.02		33		0.22	0.06		0.06		0.06	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	0.45		40		150		
¹⁰⁶ Ru		0.03		40		0.51	0.11		0.11		0.11	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	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	0.90		150		400		
¹⁴⁰ Ba-La	0.02		15		0.68		0.15		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

MAXIMUM PERMISSIBLE CONCENTRATIONS
FOR NONOCCUPATIONAL EXPOSURE

	MPC	
	<u>In Water</u> <u>pCi/l*</u>	<u>In Air</u> <u>pCi/m³ *</u>
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 5
 RADIOACTIVITY IN AIR FILTER
 PCI/M(3) - 0.037 BQ/M(3)

5

		NAME OF FACILITY	BELLEFONTE	DOCKET NO.	RH-79-8-BL1		
		LOCATION OF FACILITY	JACKSON ALABAMA	REPORTING PERIOD	1978		
TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS ^b MEAN (F) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) ^b RANGE		NAME DISTANCE AND DIRECTION	MEAN (F) ^b RANGE		
GROSS BETA 177	0.010	0.04(139/ 139)		LM1 BL SOUTHWEST	0.05(17/ 17)	0.04(38/ 38)	
GAMMA (NAI) 45		0.02- 0.12		0.8 MILE SW	0.02- 0.12	0.02- 0.09	
CE-141,144	0.030	0.03(1/ 35)		PM5 PISGAH,AL	0.03(1/ 5)	10 VALUES < LLD	
BE-7	NOT ESTAB	0.03- 0.03		4.3 MILES ESE	0.03 0.03		
GAMMA (GELI) 5		0.10(34/ 35)		PM1 SCOTTSBORO,A	0.11(4/ 4)	0.09(10/ 10)	
K-40	NOT ESTAB	0.06- 0.19		5.6 MILES WSW	0.08- 0.14	0.07- 0.13	
BI-214	0.020	0.10(1/ 5)		PM2 HOLLYWOOD,AL	0.10(1/ 1)		
PB-214	0.020	0.10- 0.10		1.8 MILES WNW	0.10- 0.10		
BE-7	0.050	0.03(4/ 5)		PM6 SECTION,A	0.04(1/ 1)		
SR-89	0.005	0.02- 0.04		9.2 MILES SSW	0.04- 0.04		
SR-90	0.001	0.03(3/ 5)		PM6 SECTION,A	0.04(1/ 1)		
		0.02- 0.04		9.2 MILES SSW	0.04- 0.04		
		0.07(4/ 5)		PM1 SCOTTSBORO,A	0.08(1/ 1)		
		0.06- 0.08		5.6 MILES WSW	0.08- 0.08		
		16 VALUES < LLD				4 VALUES < LLD	
		ANALYSIS PERFORMED				4 VALUES < LLD	
		16 VALUES < LLD					
		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 parenthesis (F).

TABLE 6

RADIOACTIVITY IN AIRWATER

PC/L - 0.031 D/L

NAME OF FACILITY BELLEFONTE PROJECT NO. 44-72-3-311
 LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1972

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS MEAN (F) ^b		LOCATION AND HIGHEST ANNUAL MEAN NAME MEAN (F) ^b	CONTROL LOCATIONS MEAN (F) ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		RANGE ^b				
GAMMA (YAI)						
20						
BA-140, A-140	15.000	17.39 (1 / 16)	17.39 (17.39	PM5 PISCATAWAY 4.3 MILES ESE	17.39 (17.39	4 VALUES <LLD
I-131	15.000	35.04 (1 / 16)	35.04 (35.04	PM2 HOLLYWOOD AL 1.4 MILES SW	35.04 (35.04	4 VALUES <LLD
BE-7	NOT ESTAB	54.63 (11 / 16)	54.63 (54.63	PM5 PISCATAWAY 4.3 MILES ESE	54.63 (54.63	47.98 (47.98
GAMMA (GELI)						
13						
K-40	NOT ESTAB	209.34 (7 / 10)	209.34 (209.34	PM4 STEVENSON AL 11.0 MILES NNE	209.34 (209.34	275.20 (275.20
BI-214	NOT ESTAB	23.00 (1 / 10)	23.00 (23.00	PM4 STEVENSON AL 11.0 MILES NNE	23.00 (23.00	3 VALUES <LLD
PH-214	NOT ESTAB	17.82 (4 / 10)	17.82 (17.82	LM2 BL ENV DATA 1.0 MILE NE	17.82 (17.82	11.11 (11.11
PB-212	NOT ESTAB	16.00 (19.79	16.00 (16.00		16.00 (16.00	16.88 (16.88
AC-226	15.000	10 VALUES <LLD	10 VALUES <LLD		17.08 (17.08	17.68 (17.68

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 HEAVY PARTICLE FALLOUT

MC1/KM(2) - 37000000.00 MC2/KM(2)

NAME OF FACILITY HELLEFONTE JOCKET NO. 44-72-8-311
 LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1978

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS MEAN (F) ^b RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) ^b RANGE ^b		NAME DISTANCE AND DIRECTION	MEAN (F) ^b RANGE ^b		
GROSS BETA 39	0.050	0.17 (30 / 31) 0.06 - 0.27		LM2 BL ENV DATA 1.0 MILE NE	0.28 (4 / 4) 0.16 - 0.27	0.10 (7 / 8) 0.06 - 0.15	

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 CHARCOAL FILTERS

PCI/4(3) - 0.037 30/4(3)

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS MEAN (F) ^b RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) ^b RANGE ^b	FRACTION OF DETECTABLE MEASUREMENTS (F)	NAME	DISTANCE AND DIRECTION		
IODINE IN AIR 174	0.010	0.021 (69/ 139)	0.01- 0.04	PM3 FACKLER ^{AL}	5.2 MILES N	0.021 (10/ 19) 0.01- 0.03	0.021 (18/ 35) 0.01- 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 of specified locations is indicated in parentheses (F).

Terrestrial Monitoring

Milk

Although there are no commercial dairy farms within 5 miles of the plant site, milk was collected, when available, from a farm producing milk for private consumption (See Table 2). Raw milk was analyzed monthly for ^{131}I , gamma-emitting radionuclides, and for radiostrontium. The results are shown in Table 9.

It was noted that the levels of ^{90}Sr in milk samples from this farm were up to six times the levels found in milk from commercial dairy farms in other areas. A second analysis was performed on one sample, confirming the observed level. These levels are suspected to be the result of stored feed containing residual radiostrontium from atmospheric nuclear weapons testing. The results obtained from further investigation performed in 1979 will be included in the report for that year.

Vegetation

Vegetation samples were collected near each dairy farm and near each of the atmospheric monitoring stations. Table 10 gives the results obtained from the laboratory analyses.

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 11.

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, $^{89,90}\text{Sr}$, and tritium. The results, shown in Table 12, indicate that the maximum beta concentration is 0.24 percent MPC.

Environmental Gamma Radiation Levels

Thermoluminescent dosimeters (TLD's) are placed at fifteen stations around the plant near the site boundary (see Figure 3) and at the perimeter and remote monitors to determine the gamma exposure rates at these locations. The TLD's are normally changed every 3 months. The quarterly gamma radiation levels determined from these TLD's are given in Table 13. It should be noted that, even though the plant has not achieved criticality, the average radiation levels onsite appear to be approximately 5 mR/quarter higher than the 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 influences.

TABLE 9
RADIOACTIVITY IN MILK

MCI/L = 0.037 Bq/L

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS MEAN (FP) RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (FP) ^b	RANGE ^b	NAME	MEAN (FP) RANGE ^b		
NAME OF FACILITY <u>BELLEFOUNTE</u> DOCKET NO. <u>44-79-8-211</u>							
LOCATION OF FACILITY <u>JACKSON</u> <u>ALABAMA</u> REPORTING PERIOD <u>1978</u>							
GAMMA (NAI)							
CS-137	10.000	12.48 (2 / 4)		SISK FARM	12.48 (2 / 4)		
		11.77- 13.18		4.9 MILES SW	11.77- 13.18		
K-40	150.000	1229.13 (4 / 4)		SISK FARM	1229.13 (4 / 4)		
		1159.02- 1286.97		4.9 MILES SW	1159.02- 1286.97		
IODINE IN MILK	0.500	4 VALUES <LLD				0 VALUES <LLD	
		ANALYSIS PERFORMED				0 VALUES <LLD	
SR 89	10.000	4 VALUES <LLD					
		ANALYSIS PERFORMED					
SR 90	2.000	23.10 (4 / 4)		SISK FARM	23.10 (4 / 4)		
		19.37- 29.45		4.9 MILES SW	19.37- 29.45		

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 10

RADIOACTIVITY IN VEGETATION

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

NAME OF FACILITY HELLEFONTE DUCKET NO. SN-79-d-011
 LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1979

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED GAMMA (SELI)	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS ^b		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS		NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) ^b RANGE	(F) ^b RANGE	NAME DISTANCE AND DIRECTION	MEAN (F) ^b RANGE	MEAN (F) ^b RANGE		
12								
CE-144	0.220	0.70 (3/ 10)		PM6 SECTION, AL	1.05 (1/ 1)	4.80 (1/ 2)		
		0.22- 1.05		9.2 MILES SSW	1.05- 1.05	4.80- 4.80		
KU-106	0.510	10 VALUES <LLD				1.47 (1/ 2)		
						1.47- 1.47		
CS-137	0.060	0.21 (5/ 10)		SISK FARM	0.60 (1/ 1)	0.76 (1/ 2)		
		0.09- 0.60		4.9 MILES SW	0.60- 0.60	0.76- 0.76		
K-40	NOT ESTAB	14.00 (10/ 10)		PM3 FACKLE, AL	19.80 (1/ 1)	7.41 (2/ 2)		
		4.52- 19.80		5.2 MILES N	19.80- 19.80	3.86- 10.95		
BI-214	0.100	0.20 (7/ 10)		LM2 BL ENV DATA	0.29 (1/ 1)	0.27 (2/ 2)		
		0.11- 0.29		1.0 MILE NE	0.29- 0.29	0.24- 0.30		
PB-214	NOT ESTAB	0.15 (8/ 10)		LM2 BL ENV DATA	0.23 (1/ 1)	0.24 (2/ 2)		
		0.00- 0.23		1.0 MILE NE	0.23- 0.23	0.17- 0.41		
PB-212	NOT ESTAB	0.10 (5/ 10)		PM6 SECTION, AL	0.14 (1/ 1)	0.20 (1/ 2)		
		0.07- 0.14		9.2 MILES SSW	0.14- 0.14	0.20- 0.20		
RA-226	NOT ESTAB	0.20 (7/ 10)		LM2 BL ENV DATA	0.29 (1/ 1)	0.27 (2/ 2)		
		0.11- 0.29		1.0 MILE NE	0.29- 0.29	0.24- 0.30		
BE-7	NOT ESTAB	3.13 (10/ 10)		PM6 SECTION, AL	5.92 (1/ 1)	4.74 (2/ 2)		
		1.55- 5.92		9.2 MILES SSW	5.92- 5.92	2.67- 6.80		
IL-208	NOT ESTAB	10 VALUES <LLD				0.06 (1/ 2)		
						0.06- 0.06		
AC-228	NOT ESTAB	0.17 (2/ 10)		SISK FARM	0.20 (1/ 1)	2 VALUES <LLD		
		0.13- 0.20		4.9 MILES SW	0.20- 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 of specified locations is indicated in parentheses (F).

TABLE II
 RADIOACTIVITY IN WELL WATER
 PCI/L = 0.037 dpm/L

NAME OF FACILITY BELLEFOUNTE DOCKET NO. 44-72-B-211
 LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1976

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS - MEAN (F) RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) RANGE ^b	DISTANCE AND DIRECTION	MEAN (F) RANGE ^b			
GAMMA (NAI)	31	23 VALUES <LLD ANALYSIS PERFORMED				4 VALUES <LLD	
GAMMA (GELI)	1						
K-40	NOT ESTAB	45.33(1/ 1)	WELL #4	45.33(1/ 1)			
		45.33- 45.33	ONSITE NNW	45.33- 45.33			
BI-214	NOT ESTAB	19.04(1/ 1)	WELL #9	19.04(1/ 1)			
		19.04- 19.04	ONSITE NNW	19.04- 19.04			
PB-214	NOT ESTAB	16.10(1/ 1)	WELL #9	16.10(1/ 1)			
		16.10- 16.10	ONSITE NNW	16.10- 16.10			
TRITIUM	330.000	447.00(1/ 1)	WELL #9	447.00(1/ 2)	4 VALUES <LLD		
	15	447.00- 447.00	ONSITE NNW	447.00- 447.00			

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 12

RADIOACTIVITY IN PUBLIC WATER SUPPLY

PCI/L = 0.037 HQ/L

		NAME OF FACILITY <u>HELLEFONTE</u>		LOCATION OF FACILITY <u>JACKSON ALABAMA</u>		POCKET NO. <u>44-72-d-811</u>		REPORTING PERIOD <u>1974</u>	
TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS		NUMBER OF NONROUTINE REPORTED MEASUREMENTS	
		MEAN (F) ^b	RANGE ^b	NAME	MEAN (F) ^b	RANGE ^b	MEAN (F) ^b		RANGE ^b
GROSS BETA	16	2.400	3.761 6/ 12)	SCOTTSDONOAL	5.121 2/ 4)	2.521 1/ 4)			
			2.57- 7.05	TRM 385.d	3.18- 7.05	2.52- 2.52			
GAMMA (NAI)	16		12 VALUES <LLD			4 VALUES <LLD			
			ANALYSIS PERFORMED						
SR 89	8	10.000	0 VALUES <LLD			2 VALUES <LLD			
			ANALYSIS PERFORMED						
SR 90	8	2.000	0 VALUES <LLD			2 VALUES <LLD			
			ANALYSIS PERFORMED						
TRITIUM	8	330.000	391.501 2/ 6)	SCOTTSDONOAL	424.001 1/ 2)	2 VALUES <LLD			
			359.00- 424.00	TRM 385.d	424.00- 424.00				

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 13

ENVIRONMENTAL GAMMA RADIATION LEVELS

<u>Monitoring Period</u>	<u>Location</u>	<u>Environmental Gamma Radiation Levels</u>	
		<u>μR/Hour</u>	<u>mR/Quarter^a</u>
August-December 1978	On-Site (14) ^b		
	Maximum	14.5	31.7
	Minimum	7.8	17.0
	Average ^c	9.9 \pm 3.4	21.6 \pm 7.4
	Off-Site (8)		
	Maximum	8.6	18.9
	Minimum	6.2	13.5
	Average	7.6 \pm 1.6	16.6 \pm 3.6

a. 2190 hours

b. Number of stations (normally three TLD's at each station)

c. All averages reported $\pm 2\sigma$

Reservoir Monitoring

The reservoir monitoring program for Bellefonte Nuclear Plant is scheduled to be implemented in mid-1980, 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.

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 Browns 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 Gunterville and Wheeler Reservoirs and analyzed for gamma-emitting radionuclides as a part of the Browns Ferry Nuclear Plant monitoring program. In the Sequoyah Nuclear Plant monitoring program, samples of white crappie, smallmouth buffalo, and channel catfish are taken semiannually 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 14, 15, 16, and 17.

TABLE 14

RADIOACTIVITY IN WHITE CHAPPIE (FLESH)

PC1/G - 0.037 JJ/G (DRY WEIGHT)

24

NAME OF FACILITY BELLEFONTIE DOCKET NO. MM-79-8-311
 LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1978

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS		NUMBER OF NONROUTINE REPORTED MEASUREMENTS ⁴
		MEAN (F) ^b	RANGE	NAME	MEAN (F) ^b	MEAN (F) ^b	RANGE	
GROSS ALPHA	0.100						0.14 (1/ 2)	
GROSS BETA	0.100						0.13- 0.18	
GAMMA (NAI)							33.62 (2/ 2)	
							31.22- 36.14	
CS-137	0.120	0.20 (1/ 2)	0.20-	GUNTERVILLE RES	0.20 (1/ 1)		0.13 (1/ 1)	
			0.20-	TRM 349-425	0.20-	0.20	0.13-	0.13
K-40	0.900	14.05 (2/ 2)	13.92-	WHEELER RES	14.14 (1/ 1)		14.86 (1/ 1)	
			14.18	TRM 275-349	14.18-	14.18	14.86-	14.86
GAMMA (GELI)								
CS-137	0.020	0.16 (2/ 2)	0.11-	GUNTERVILLE RES	0.21 (1/ 1)		0.10 (1/ 1)	
			0.21	TRM 349-425	0.21-	0.21	0.10-	0.10
K-40	NOT ESTAB	16.25 (2/ 2)	15.96-	GUNTERVILLE RES	16.53 (1/ 1)		17.12 (1/ 1)	
			16.53	TRM 349-425	16.53-	16.53	17.12-	17.12
B1-214	0.020	0.06 (1/ 2)	0.06-	WHEELER RES	0.06 (1/ 1)		0.07 (1/ 1)	
			0.06	TRM 275-349	0.06-	0.06	0.07-	0.07
PB-214	NOT ESTAB	0.05 (2/ 2)	0.05-	WHEELER RES	0.06 (1/ 1)		0.06 (1/ 1)	
			0.06	TRM 275-349	0.06-	0.06	0.06-	0.06
SR 89	0.500	0 VALUES <LLD				1 VALUES <LLD		
SR 90	0.100	ANALYSIS PERFORMED				1 VALUES <LLD		
		0 VALUES <LLD				1 VALUES <LLD		
		ANALYSIS PERFORMED				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 of specified locations is indicated in parentheses (F).

TABLE 15

RADIOACTIVITY IN SMALLMOUTH BUFFALO (FLESH)

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

NAME OF FACILITY BELLEFONTE DOCKET NO. 44-79-8-211
 LOCATION OF FACILITY JACKSON ALABAMA REPORTING PERIOD 1978

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS		NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) ^b	RANGE ^b	NAME	MEAN (F) ^b	MEAN (F) ^b	RANGE ^b	
			DISTANCE AND DIRECTION					
GROSS ALPHA	0.100	0 VALUES <LLD ANALYSIS PERFORMED				1 VALUES <LLD		
GROSS BETA	0.100					28.78(1/ 1)		
GAMMA (NAI)						28.78-	28.78	
K-40	0.900	9.29(2/ 2)	WHEELER RES	10.17(1/ 1)				
GAMMA (GELI)		8.42- 10.17	TRM 275-349	10.17- 10.17				
CS-137	0.020	0.11(2/ 2)	GUNTERSVILLE RES	0.13(1/ 1)		0.09(1/ 1)		
		0.08- 0.13	TRM 349-425	0.13- 0.13		0.09-	0.09	
K-40	NOT ESTAB	12.89(2/ 2)	GUNTERSVILLE RES	13.36(1/ 1)		13.37(1/ 1)		
		12.41- 13.36	TRM 349-425	13.36- 13.36		13.37-	13.37	
BI-214	0.020	2 VALUES <LLD				0.06(1/ 1)		
						0.06-	0.06	
PB-214	NOT ESTAB	0.12(1/ 2)	WHEELER RES	0.12(1/ 1)		0.03(1/ 1)		
		0.12-	TRM 275-349	0.12-	0.12	0.03-	0.03	
SR 89	0.500	0 VALUES <LLD ANALYSIS PERFORMED				1 VALUES <LLD		
SR 90	0.100	0 VALUES <LLD ANALYSIS PERFORMED				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 of specified locations is indicated in parentheses (F).

TABLE 16

RADIOACTIVITY IN SMALLMOUTH BUFFALO (WHOLE)

26

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

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN ^b		CONTROL LOCATIONS MEAN (F) RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) RANGE		NAME DISTANCE AND DIRECTION	MEAN (F) RANGE		
GROSS ALPHA	0.100					0.10(1/ 2) 0.10- 0.10	
GROSS BETA	0.100					17.12(2/ 2) 10.72- 17.52	
GAMMA (NAI)							
K-40	0.900	6.76(2/ 2) 6.26- 7.25		WHEELER RES TRM 275-349	7.25(1/ 1) 7.25- 7.25	5.89(1/ 1) 5.89- 5.89	
GAMMA (GEL)							
CS-137	0.020	0.05(2/ 2) 0.05- 0.06		GUNTERVILLE RES TRM 349-425	0.06(1/ 1) 0.06- 0.06	0.06(1/ 1) 0.06- 0.06	
K-40	NOT ESTAB	7.83(2/ 2) 6.44- 9.21		WHEELER RES TRM 275-349	9.21(1/ 1) 9.21- 9.21	8.75(1/ 1) 8.75- 8.75	
B1-214	0.020	0.06(2/ 2) 0.05- 0.06		WHEELER RES TRM 275-349	0.06(1/ 1) 0.06- 0.06	0.08(1/ 1) 0.08- 0.08	
PB-214	NOT ESTAB	0.04(2/ 2) 0.04- 0.04		WHEELER RES TRM 275-349	0.04(1/ 1) 0.04- 0.04	0.06(1/ 1) 0.06- 0.06	
PB-212	NOT ESTAB	0.02(2/ 2) 0.02- 0.02		WHEELER RES TRM 275-349	0.02(1/ 1) 0.02- 0.02	0.03(1/ 1) 0.03- 0.03	
SR 89	0.500					2 VALUES <LLD	
SR 90	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 17

RADIOACTIVITY IN CHANNEL CATFISH (FLESH)

PCI/6 - 0.017 43/6 (DRY WEIGHT)

		NAME OF FACILITY <u>HELLEFONTE</u>		BUCKET NO. <u>44-74-1-211</u>		
		LOCATION OF FACILITY <u>JACKSON ALABAMA</u>		REPORTING PERIOD <u>1973</u>		
TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		CONTROL LOCATIONS		NUMBER OF NONROUTINE REPORTED MEASUREMENTS
		MEAN (F) ^b RANGE ^b	LOCATION #111 NAME DISTANCE AND DIRECTION	HIGHEST ANNUAL MEAN (F) ^b RANGE ^b	MEAN (F) ^b RANGE ^b	
GROSS ALPHA	0.100			0.10 (1/ 2)		
GROSS BETA	0.100			0.10- 0.10		
GAMMA (NAI)				28.31 (2/ 2)		
				29.43- 29.79		
K-40	0.900			14.39 (1/ 1)		
GAMMA (SELI)				14.39- 14.39		
CS-137	0.020			0.05 (1/ 1)		
K-40	NOT ESTAB			0.05- 0.05		
BI-214	0.020			12.77 (1/ 1)		
PB-214	NOT ESTAB			12.77- 12.77		
				0.13 (1/ 1)		
				0.13- 0.13		
SR 89	0.500			0.06 (1/ 1)		
				0.06- 0.06		
SR 90	0.100			1 VALUES <LLD		
				1 VALUES <LLD		
		0 VALUES <LLD ANALYSIS PERFORMED				
		0 VALUES <LLD 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).

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 from the plant to the environment. The levels of radioactivity being reported in this document are due to natural background radiation, nuclear weapons testing, or other nuclear operations in the area.