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ENVIRONMENTAL RADIOACTIVITY LEVELS
WATTS BAR NUCLEAR PLANT
ANNUAL REPORT - 1984

TVA/NUC PR/RH

April 1985

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WATTS BAR NUCLEAR PLANT

1984

Introduction

The Watts Bar Nuclear Plant (WBN), being constructed by the Tennessee Valley Authority, is located on a site owned by TVA containing 1770 acres of land in Rhea County, Tennessee, bounded on the east by Chickamauga Reservoir (see figure 1). The site is approximately 50 miles (80 kilometers) northeast of Chattanooga, Tennessee, and 8 miles (13 kilometers) southeast of Spring City, Tennessee. The plant will consist of two pressurized water reactors; each unit is rated at 3,411 MWt and 1,160 MWe. Fuel load in unit 1 is scheduled for 1985.

A preoperational environmental radiological monitoring program was implemented in December 1976. 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 1984.

Radiological Health (Office of Nuclear Power) and the Office of Natural Resources and Economic Development carried out the sampling program outlined in tables 1 and 21. Sampling locations are shown in figures 2, 3, 7, and 10, 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. Alpha and beta analyses were performed on Beckman Low Beta II, Beckman Wide Beta II, and Tennelec LB5100 low-background proportional counters. A Nuclear Data (ND) Model 6700 system, in conjunction with germanium detection systems was used to analyze the samples for specific gamma-emitting radionuclides. Specific analysis for ^{131}I in charcoal filters are routinely counted with NaI(Tℓ) detection systems. TVA-fabricated beta-gamma coincidence counting systems are utilized for the determination of ^{131}I concentrations in milk. Tritium determinations are made with Packard Tri-carb 3255 or 4000 series liquid scintillation counting systems.

Data were entered in computer storage for processing specific to the analysis conducted. 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. 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 additional radionuclides identified by germanium analysis were calculated for each analysis and nominal values are listed in table 3. In the instance where an LLD has not been established, an LLD value of zero is 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 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 radiological monitoring program. Routine sample handling and analysis procedures were employed in the evaluation of these samples. The results received during calendar year 1984 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.

Table 1

ENVIRONMENTAL RADIOACTIVITY SAMPLING SCHEDULE

Station Locations	Air Filter	Charcoal Filter	Rain-water	Heavy Particle Fallout	Atmospheric Moisture	Soil	Vegatation	Milk	Well Water	Public Water	Aquatic Life and Sediment
Site SSW	W	W	M	M	BW	S					
Site SE[a]	W	W	M	M		S					
Site N	W	W	M	M	BW	S					
Site NNE[a]	W	W	M	M		S					
Smith Bend[b]	W	W	M	M		S	Q				
Spring City	W	W	M	M		S				M	
Cedine	W	W	M	M		S					
Ten Mile	W	W	M	M		S					
Decatur	W	W	M	M		S					
Goodfield[b]	W	W	M	M		S					
Rockwood[b]	W	W	M	M		S					
Dayton	W	W	M	M	BW	S				M	
Alloway[a]	W	W	M	M		S					
Farm H							Q	M	M[c]		
Farm L							Q	M	M[c]		
Farm Mo							Q	M	M[c]		
Control Farms							Q	M[d]	M[d]		
Onsite Wells (6)									M		
Watts Bar Reserv.										M	
C. F. Industries										M	
Nickajack/ Chickamauga/Watts Bar Reservoirs											Q[e]

W - Weekly BW - Biweekly M - Monthly (every 4 weeks) Q - Quarterly S - Semiannually

[a]Operational in March 1984. [b]Deactivated in March 1984. [c]Considered as controls for well water. [d]Control farms are also part of SQN program and some locations are sampled weekly. [e]Some samples are part of the SQN program and are collected semiannually.

Table 2

4

ENVIRONMENTAL MONITORING STATION LOCATIONS

WATTS BAR NUCLEAR PLANT

Sample Station	Approximate Distance From Plant		Approximate Direction From Plant
Indicator Stations			
LM-1 WB	0.5 Mile	(0.8 kilometers)	SSW
LM-2 WB	0.5 Mile	(0.8 kilometers)	N
LM-3 WB	2.0 Miles	(3.2 kilometers)	NNE
LM-4 WB	0.9 Miles	(1.4 kilometers)	SE
PM-1 WB, Smith Bend	3.75 Miles	(6.0 kilometers)	SW
PM-2 WB, Spring City, TN	7 Miles	(11.3 kilometers)	NW
PM-3 WB, Cedine Camp	11.5 Miles	(18.5 kilometers)	NNE
PM-4 WB, Ten Mile, TN	7.75 Miles	(12.5 kilometers)	NE
PM-5 WB, Decatur, TN	6.25 Miles	(10.1 kilometers)	S
PM-6 WB, Goodfield, TN	9 Miles	(14.5 kilometers)	SSW
Farm H[a]	4.75 Miles	(7.6 kilometers)	W
Farm L[a]	1.5 Miles	(2.4 kilometers)	SSW
Farm Mo[a]	4.5 Miles	(7.2 kilometers)	NW
Control Stations			
RM-1 WB, Rockwood, TN	17.25 Miles	(27.8 kilometers)	NNE
RM-2 WB, Dayton, TN (Identical with RM-2 SQ, Sequoyah Nuclear Plant)	15 Miles	(24.1 kilometers)	SW
RM-3 WB, Alloway, TN	14.9 Miles	(23.8 kilometers)	NNW
Farm S	19.5 Miles	(31.4 kilometers)	SW
Farm B	15 Miles	(24.1 kilometers)	E
Farm C	16 Miles	(25.7 kilometers)	SSW

[a]Considered as controls for well water.

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	Vegegation 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
Gross α	0.005			2.0	0.05	0.35	0.1	0.7		
Gross β	0.01		0.05	2.3	0.20	0.70	0.1	0.7	25	
^{3}H				330						
^{131}I		0.01								0.05
^{89}Sr	0.005			10	0.25	1.5	0.5	5.0	40	10
^{90}Sr	0.001			2	0.05	0.3	0.1	1.0	8	2

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

Table 3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

B. Gamma Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)

	Air particulates pCi/m^3		Water and milk pCi/l		Vegetation and grain pCi/g, dry		Soil and sediment pCi/g, dry		Fish pCi/g, dry		Clam flesh and plankton pCi/g, dry	Clam shells pCi/g, dry		Foods,(tomatoes potatoes, etc.) pCi/Kg, wet		Meat and poultry pCi/Kg, wet	
	NaI*	Ge(Li)**	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)
^{141,144}Ce	0.03		38		0.55		0.35		0.35			0.35		38		90	
^{144}Ce		0.02		33		0.22		0.06		0.06	0.35		0.06		33		40
^{51}Cr	0.07	0.03	60	44	1.10	0.47	0.60	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 20 percent. The counting time is normally 4-15 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.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.
11/83	19±9	<1[a]	50±9	40[a]	15±3	16	21±9	20
3/84	15±9	18	51±9	60	21±3	20	11±9	10
8/84	17±9	17	51±9	60	18±3	N/A[b]	15±9	15

B. Tritum in Urine (pCi/1)

Date	EPA value (±3σ)	TVA Avg.
2/84	2383±608	2466
11/84	2012±598	2047

a. Sample fouled in preparation. Procedure modified to prevent recurrence.
b. Lost in analysis.

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 Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.
1/84	10±9	10	12±9	15	36±9	39	24±3	23				
3/84	5±9	6	20±9	20								
4/84									3508±630	3580	6±0.8	6
5/84	3±9	4	6±9	6	25±9	32	5±3	5				
6/84									3081±622	2770		
7/84	6±9	6	13±9	16								
8/84									2817±617	2607	34±10	36
9/84	5±9	5	16±9	12	34±9	41	19±3	18				
10/84									2810±617	2517		
10/84[c]	14±9	11	64±9	60	11±9	12	12±3	13				
11/84	7±9	8	20±9	22								
12/84									3182±624	3400	36±10	33

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 Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.	EPA value (±3σ)	TVA Avg.
2/84	40±9	<44	10±9	11	50±9	50	61±9	53	31±9	29	16±9	15
6/84	66±9	72	31±9	32	63±9	66	29±9	<40	47±9	44	37±9	37
10/84	40±9	43	20±9	22	147±9	151	47±9	48	31±9	29	24±9	26
10/84[c]			14±9	17					2±9	<5	14±9	16

c. Laboratory performance evaluation study

TABLE 4 (Continued)

RESULTS OBTAINED IN INTERLABORATORY COMPARISON PROGRAM

E. Foods (pCi/kg, Wet Weight)

Date	Strontium-89 EPA value (±3σ)	Strontium-89 TVA Avg.	Strontium-90 EPA value (±3σ)	Strontium-90 TVA Avg.	Iodine-131 EPA value (±3σ)	Iodine-131 TVA Avg.	Cesium-137 EPA value (±3σ)	Cesium-137 TVA Avg.	Potassium-40[d] EPA value (±3σ)	Potassium-40[d] TVA Avg.
1/84	34±9	40	20±3	19	20±10	20	20±9	21	2730±236	2670
7/84	25±9	N/A[e]	20±3	N/A[e]	39±10	40	25±9	26	2605±226	2624

F. Milk (pCi/l)

Date	Strontium-89 EPA value (±3σ)	Strontium-89 TVA Avg.	Strontium-90 EPA value (±3σ)	Strontium-90 TVA Avg.	Iodine-131 EPA value (±3σ)	Iodine-131 TVA Avg.	Cesium-137 EPA value (±3σ)	Cesium-137 TVA Avg.	Potassium-40[f] EPA value (±3σ)	Potassium-40[f] TVA Avg.
3/84					6±0.9	6				
6/84	25±9	24	17±3	18	43±10	39	35±9	34	1496±130	1483
10/84	22±9	26	16±3	15	42±10	40	32±9	30	1517±132	1563

d. Values reported as mg K/kg.
e. Lost in sample preparation.
f. Values reported as mg K/l.

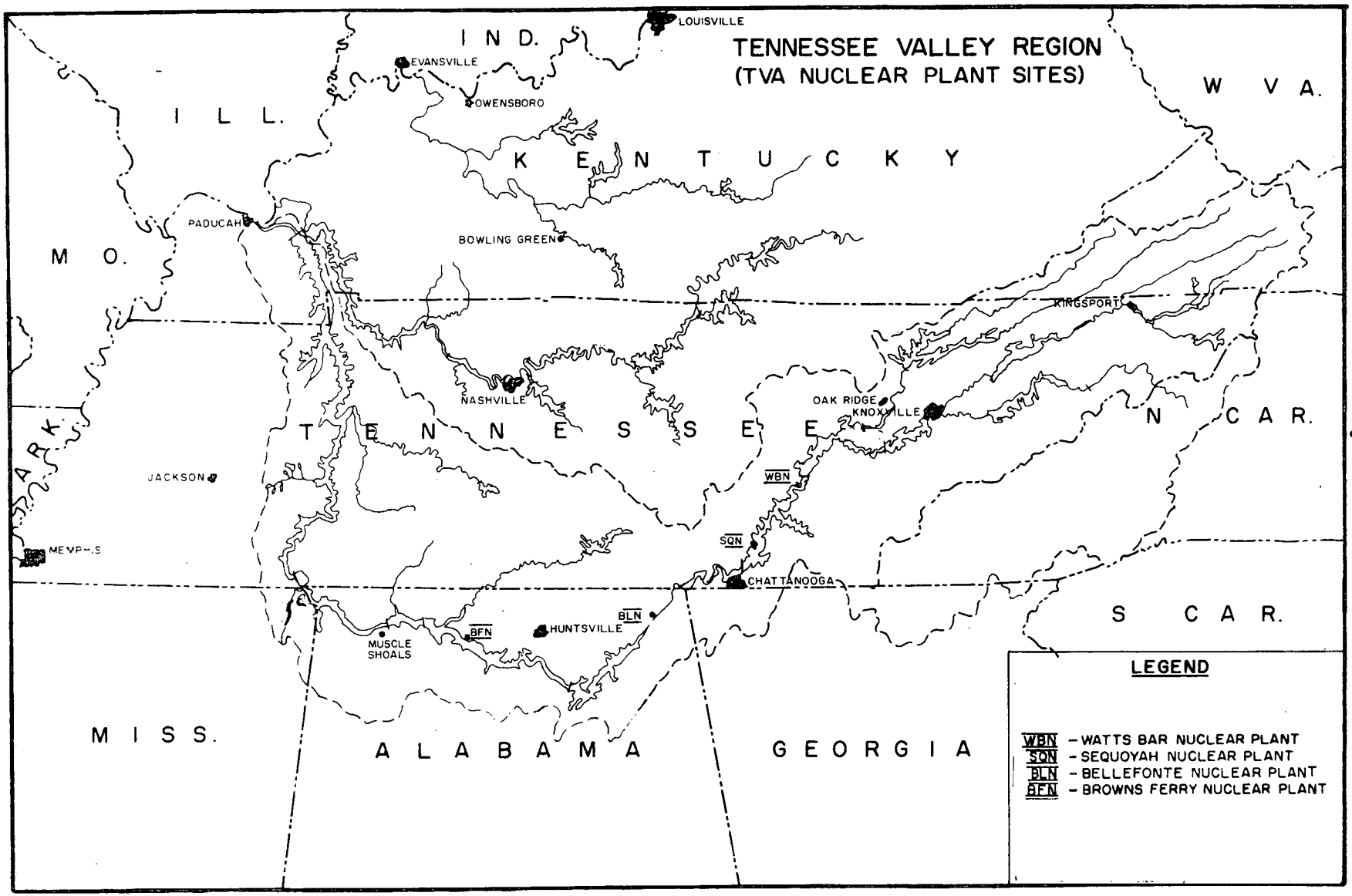

TENNESSEE VALLEY REGION
(TVA NUCLEAR PLANT SITES)
LOUISVILLE
IND.
EVANSVILLE
OWENSBORO
ILL.
W VA.
KENTUCKY
PADUCAH
BOWLING GREEN
MO.
KINGSPORT
NASHVILLE
OAK RIDGE
KNOXVILLE
ARK.
TENNESSEE
N CAR.
JACKSON
WBN
SQN
MEMPHIS
CHATTANOOGA
S CAR.
BLN
BFN
HUNTSVILLE
MUSCLE SHOALS
MISS.
ALABAMA
GEORGIA
LEGEND
WBN - 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; local monitors, perimeter monitors, and remote monitors. Four local monitors are located within or near the plant boundry (two of these local monitors were installed during March 1984). There were six perimeter monitors until March 1984, when two were deactivated and the equipment used to establish two additional local monitors. The present perimeter monitors are located at distances out to 11 miles (18 kilometers) from the plant in the towns of Spring City and Decatur and two other populated areas. One remote monitor was discontinued in March 1984 and the equipment used to establish another remote station in Alloway, 14.9 miles (23.8 kilometers) NNW of the plant. The other remote monitor is located in Dayton, 17 miles (27 kilometers) from the plant. For location information see table 2 and figures 2, 3, and 7.

Each monitoring station has air sampling filters, a collection tray and storage container to continuously collect rainwater, a horizontal platform covered with gummed acetate to catch and hold heavy particle fallout, and at selected stations a GM tube with a recorder to continuously monitor and record gamma radiation levels. Additionally, at two local and one remote monitors moisture is collected from the atmosphere and analyzed for tritium.

During 1984, the air particulate and charcoal filter system was modified at seven of the ten monitoring stations. The modified system uses a 1 7/8-inch diameter glass fiber particulate filter. The charcoal filter used to sample airborne radioiodine is a 2 1/4-inch diameter, 1 inch thick filter filled with TEDA-impregnated charcoal. The particulate and charcoal filter is contained in a round cone-shaped filter holder located on the outside of the monitoring station and protected from rain by a metal overhang housing the gum paper filter. Air is continuously drawn in through the particulate and charcoal filter by an air pump at a flow rate of approximately 2 CFM. The total flow through the system is measured with a domestic type LPG meter.

At each of the three unmodified monitors, air is continuously pulled through a Hollingsworth and Voss LB5211 glass fiber filter at a flow rate of 3 CFM. In series with, but downstream of the particulate filter, is a charcoal filter used to collect iodine. The monitors are scheduled for modification in 1985.

Each of the local and perimeter air monitors is fitted with a GM tube that continuously monitors the gamma activity levels at the stations. The disintegration rate of the atmospheric radioactivity is continuously recorded at each station. The data from the four local monitors and from three perimeter monitors (PM-2, PM-4, and PM-5) are radiotelemetered into the plant control room.

Air Filters

Air filters are collected weekly and analyzed for gross beta activity. The samples are composited monthly for analysis for specific gamma-emitting radionuclides and quarterly for ^{89}Sr and ^{90}Sr content. No analyses are performed until three days after collection. Analytical results are presented in table 6. During this reporting period, relocation of equipment from three monitoring stations resulted in three weekly samples not being collected and one monthly composite for gamma-emitting radionuclides not being done. Nine additional weekly air filters were not collected because of equipment malfunction. Hazardous conditions and inaccessibility prevented collection of two weekly air filters and on four occasions air filters were inadvertently damaged or destroyed during processing and were unusable for analysis. Seven filters were off or damaged and unusable, and on one occasion an air filter was misplaced or lost.

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 1977 through 1984 are presented in figure 4. Increased levels due to fallout from atmospheric nuclear weapons testing are evident, especially in 1977, 1978, and 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) specified in 10 CFR 20 for nonoccupational exposure.

Rainwater

Rainwater is collected and analyzed monthly for specific gamma-emitting isotopes and strontium. In addition, samples from one of the control stations, which is also a part of the Sequoyah Nuclear Plant (SQN) monitoring program, were also analyzed for gross beta and tritium activity. For the gross beta analysis, a maximum of 500 ml of the sample is boiled to dryness and counted. A gamma scan is performed on a 3.5-liter monthly sample. The strontium isotopes are separated chemically and counted in a low background system. The results are shown in table 7. During this report period one sample was not available for analysis because of equipment malfunction. Three samples were not collected because of monitoring equipment relocation.

Heavy Particle Fallout

The gummed acetate that is used to collect heavy particle fallout is changed monthly. The samples are ashed and counted for gross beta activity. The results are given in table 8. During this reporting period, three samples were not collected because of equipment relocation.

Charcoal Filters

Charcoal filters are collected weekly and analyzed for radioiodine. The filter is counted in a single channel analyzer system. The data are shown in table 9. During this reporting period, equipment relocation from three monitoring stations resulted in three samples not being collected for analysis. Nine samples were not collected because of equipment malfunction, seven filters were damaged and unusable, another was destroyed inadvertently during processing, two samples were unsuitable for analysis, and two filters were not collected because of hazardous conditions and station inaccessibility.

Atmospheric Moisture

An atmospheric moisture collection device containing molecular sieve is located at two local monitors and at one remote monitor. Samples are taken every other week, the moisture is driven off the molecular sieve, collected in a cold trap, distilled, and counted for tritium content. The results are shown in table 10. During this reporting period, ten samples were not obtained because of equipment malfunction, one sample was lost during analysis, ten samples contained insufficient volume for analysis, and nine samples were not available through personnel errors. Training and revised procedures were instituted to prevent reoccurrence.

Table 5

MAXIMUM PERMISSIBLE CONCENTRATIONS

FOR NONOCCUPATIONAL EXPOSURE

	MPC	
	In Water pCi/l*	In Air pCi/m^3*
Alpha	30	
Nonvolatile beta	3,000	100
Tritium	3,000,000	200,000
^{137}Cs	20,000	500
$^{103,106}Ru$	10,000	200
^{144}Ce	10,000	200
^{95}Zr-^{95}Nb	60,000	1,000
^{140}Ba-^{140}La	20,000	1,000
^{131}I	300	100
^{65}Zn	100,000	2,000
^{54}Mn	100,000	1,000
^{60}Co	30,000	300
^{89}Sr	3,000	300
^{90}Sr	300	30
^{51}Cr	2,000,000	80,000
^{134}Cs	9,000	400
^{58}Co	90,000	2,000
^{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 WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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) RANGE	CONTROL LOCATIONS MEAN (F)[b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA	0.010	0.02(387/ 396)	PM4 TEN MILE	0.03(51/ 51)	0.02(94/ 98)	
494		0.01- 0.05	7.75 MILES NE	0.01- 0.05	0.01- 0.04	
GAMMA (GELI)						
129						
K-40	NOT ESTAB	0.01(35/ 104)	LM-4 WB	0.02(4/ 10)	0.02(14/ 25)	
		0.00- 0.03	0.9 MILES SE	0.02- 0.03	0.00- 0.04	
PB-212	NOT ESTAB	0.00(21/ 104)	PM4 TEN MILE	0.00(1/ 13)	0.00(7/ 25)	
		0.00- 0.00	7.75 MILES NE	0.00- 0.00	0.00- 0.00	
BE-7	0.050	0.09(96/ 104)	LM-3 WB	0.10(9/ 10)	0.07(17/ 25)	
		0.05- 0.17	2.1 MILES NNE	0.07- 0.11	0.05- 0.10	
TL-208	NOT ESTAB	0.00(16/ 104)	LM1 ENV DATA STA	0.00(3/ 13)	0.00(4/ 25)	
		0.00- 0.00	0.5 MILES SSW	0.00- 0.00	0.00- 0.00	
AC-228	NOT ESTAB	0.00(11/ 104)	PM4 TEN MILE	0.00(1/ 13)	0.01(5/ 25)	
		0.00- 0.00	7.75 MILES NE	0.00- 0.00	0.00- 0.01	
SR 89	0.005	32 VALUES <LLD			8 VALUES <LLD	
40		ANALYSIS PERFORMED				
SR 90	0.001	32 VALUES <LLD			8 VALUES <LLD	
40		ANALYSIS PERFORMED				

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

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

TABLE 7

RADIOACTIVITY IN RAINWATER

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY AREA TENNESSEE — REPORTING PERIOD 1984

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 [b] NAME DISTANCE AND DIRECTION	MEAN (F) [b] RANGE	CONTROL LOCATIONS MEAN (F) [b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 13	2.300				3.71(8/ 13) 2.48- 6.36	
GAMMA (GELI) 126						
K-40	NOT ESTAB	19.32(7/ 101) 0.78- 32.49	PM5 DECATUR 6.25 MILES S	32.49(1/ 13) 32.49- 32.49	7.38(2/ 25) 6.11- 8.65	
BI-214	NOT ESTAB	5.58(39/ 101) 0.09- 18.85	PM5 DECATUR 6.25 MILES S	8.95(4/ 13) 3.63- 17.74	6.34(13/ 25) 0.04- 21.29	
PB-214	NOT ESTAB	4.55(22/ 101) 0.43- 16.33	LM-3 WB 2.1 MILES NNE	9.39(2/ 10) 2.46- 16.33	6.34(8/ 25) 2.66- 12.30	
PB-212	NOT ESTAB	1.68(27/ 101) 0.00- 4.94	PM6 GOODFIELD 9.0 MILES SSW	3.91(1/ 2) 3.91- 3.91	1.03(10/ 25) 0.16- 3.29	
BE-7	NOT ESTAB	47.36(41/ 101) 24.16- 89.95	PM4 TEN MILE 7.75 MILES NE	52.21(6/ 13) 24.16- 89.95	40.17(8/ 25) 25.35- 61.27	
SR 89 126	10.000	101 VALUES <LLD ANALYSIS PERFORMED			25 VALUES <LLD	
SR 90 126	2.000	101 VALUES <LLD ANALYSIS PERFORMED			25 VALUES <LLD	
TRITIUM 13	330.000	0 VALUES <LLD ANALYSIS PERFORMED			13 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 locations is indicated in parentheses (F).

TABLE 8

RADIOACTIVITY IN HEAVY PARTICLE FALLOUT

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

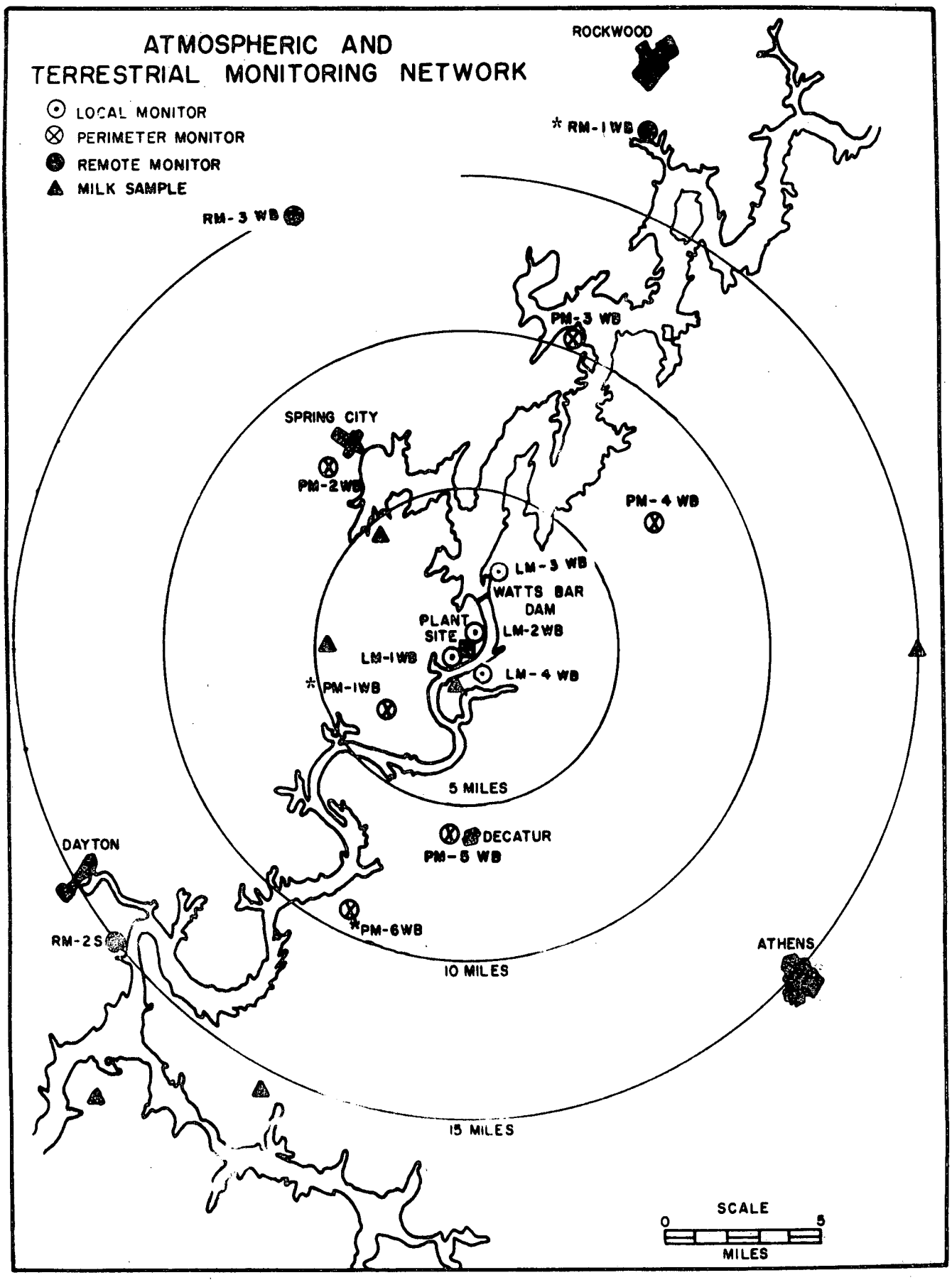
LOCATION OF FACILITY DAYTON TENNESSEE — REPORTING PERIOD 1984

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[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA	0.050	0.17(99/ 102)	LM2 N. WBSP GATE	0.36(13/ 13)	0.13(24/ 25)	
127		0.06- 1.00	0.5 MILES N	0.13- 1.00	0.05- 0.44	

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 locations is indicated in parentheses (F).

Figure 2



(1 mile - 1.6 kilometers)

*Discontinued March 1984.

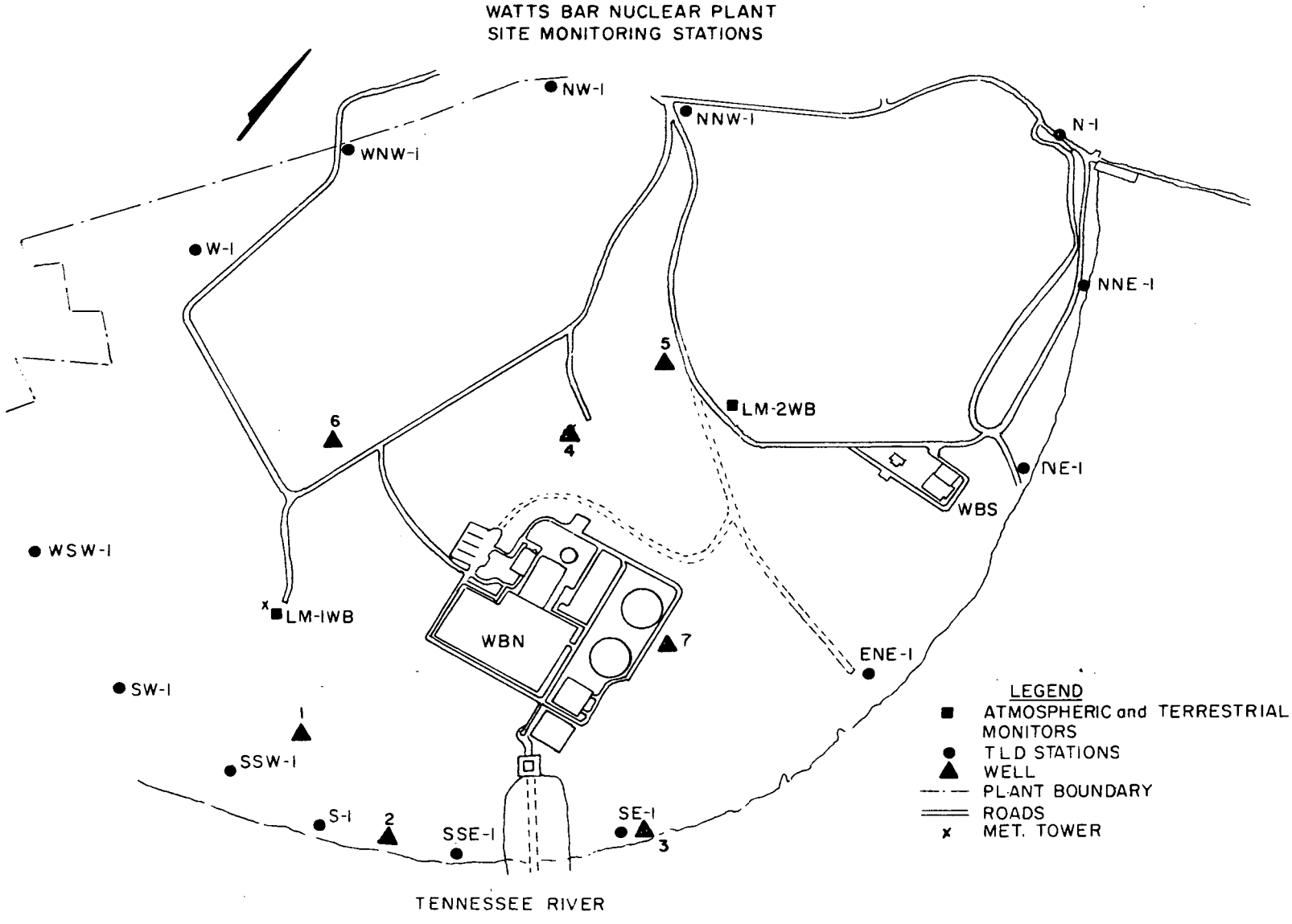

WATTS BAR NUCLEAR PLANT
SITE MONITORING STATIONS
NW-1
NNW-1
N-1
WNW-1
W-1
NNE-1
5
LM-2WB
6
4
NE-1
WBS
WSW-1
LM-1WB
WBN
7
ENE-1
SW-1
1
SSW-1
S-1
2
SSE-1
SE-1
3
TENNESSEE RIVER
LEGEND
ATMOSPHERIC and TERRESTRIAL MONITORS
TLD STATIONS
WELL
PLANT BOUNDARY
ROADS
MET. TOWER

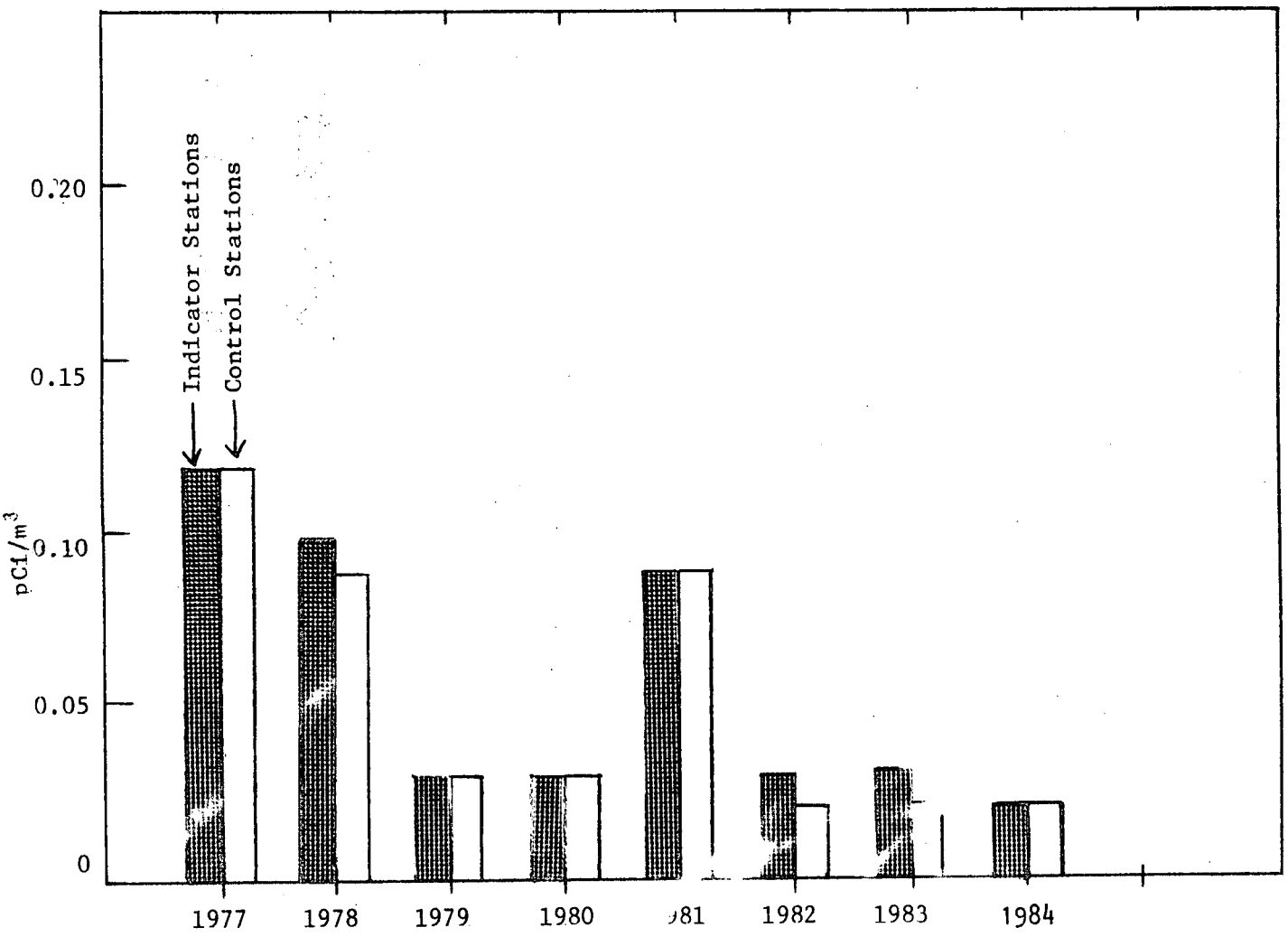
Figure 3

Figure 4

Annual Average

Gross Beta Activity in Air (Particulate Filters)

Watts Bar Nuclear Plant



Terrestrial Monitoring

Terrestrial monitoring is accomplished by collecting samples of environmental media that provide a pathway to humans. Samples of milk, vegetation, soil, groundwater, public water, gamma radiation levels, and food products are taken on routine schedules at indicator stations (at or near the plant) and control stations (remote to the plant). Once each year, a land use survey is performed to determine census and location of milk-producing animals within a five-mile radius of the plant. Significant changes identified by the survey may be reflected by modifying milk/vegetation sampling locations.

Land Use Survey

The annual land use survey was conducted during the summer of 1984. Results of the survey identified two locations, each with one milk-producing animal, from which samples were desirable. TVA representatives contacted the residents at these two locations and obtained their willingness to participate in the sampling program. However, since sufficient quantities of milk would not be available, vegetation samples will be collected monthly at these locations.

Milk

Milk samples were collected monthly from three indicator stations. Weekly samples were taken at three control stations (these control stations are part of an ongoing SQN sampling program). All monthly and weekly samples are analyzed for gamma-emitting radionuclides and iodine-131. Monthly samples are also analyzed for strontium. Table 11 summarizes the results of laboratory analysis. During this reporting period, five samples were not available for collection, resulting in the loss of five iodine-131 analyses, two gamma analyses, and one strontium analysis. In addition, two samples for strontium content were destroyed during analysis.

As has been noted in previous radiological monitoring reports, the levels of ^{90}Sr in milk samples from farms producing milk for private consumption only were 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 observed during preoperational radiological monitoring near Sequoyah and Bellefonte Plants at farms where only one or two cows were being milked for private consumption of the milk. A similar phenomenon has been observed at two small dairy farms near the Watts Bar Nuclear Plant. Levels reported for 1984 are about three times above the levels measured at larger dairy farms. 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 were analyzed for gamma-emitting radionuclides, ^{89}Sr, and ^{90}Sr content. The sampling frequency was monthly at the three control stations in support of the SQN monitoring program. These monthly samples were analyzed for gamma-emitting radionuclides. The monthly samples collected at the end of each quarter were also analyzed for strontium content. 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 12 summarizes the results obtained from the laboratory analyses.

Soil

Soil samples were collected semiannually near each monitoring station and from one control station used in the Sequoyah monitoring program. An additional sample was taken at the Sequoyah monitoring station. Soil samples are taken to provide an indication of any long-term buildup of radioactivity in the environment. An auger, or "cookie cutter" type of sampler, was used to obtain samples of the top two inches (5 cm) of soil. All samples were analyzed for gross beta activity, gamma-emitting radionuclides, and strontium content. The analytical results are given in table 13.

Groundwater

Well water was obtained monthly from three 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 14. During this reporting period, two samples were not taken because two of the stations were inaccessible for a period of time due to ground conditions.

Public Water

Potable water supplies taken from the Tennessee River in the vicinity of WBN were sampled and analyzed monthly for gross beta and gamma-emitting radionuclides. Tritium, ^{89}Sr, and ^{90}Sr concentrations are determined in quarterly composite samples. The potable water sampling locations downstream from the plant are equipped with automatic samplers with composite samples analyzed monthly. Results of laboratory analysis are shown in Table 15. During this reporting period, one sample was not collected because of equipment malfunction.

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[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. 999R6, May 1964.

Figure 5 shows the trends in gross beta activity in drinking water from 1977 through 1984. The annual averages for the indicator stations reported herein are slightly higher than the levels reported in surface water samples (figure 6).

Environmental Gamma Radiation Levels

Bulb-type Victoreen manganese-activated calcium fluoride (CaF_2: Mn) thermoluminescent dosimeters (TLDs) are placed at 16 stations around the plant near the site boundary, at the perimeter and remote air monitors, and at 22 additional stations approximately 5 miles from the site to determine the gamma exposure rates at these locations. The dosimeters, in energy compensating shields to correct energy dependence, are placed at approximately one meter above the ground, with 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 16, which indicates that average levels at onsite stations are approximately 2-3 mR/quarter higher than levels at offsite stations. This is consistent with levels reported in other preoperational radiological 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, or other undetermined influences.

Figure 8 compares plots of the data from the onsite or site boundary stations with those from the offsite stations over the period from 1977 through 1984. To reduce the variations present in the data sets, a four-quarter moving average was constructed for each set. Figure 9 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 Products

Food products raised in the vicinity of WBN are sampled annually as they become available during the growing season. During this sampling period, samples of pears, tomatoes, turnip greens, and beef were collected and analyzed for gross beta and specific gamma-emitting radionuclides. The results are given in tables 17 through 20.

RADIOACTIVITY IN MILK

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DECATUR TENNESSEE — REPORTING PERIOD 1984

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD)[a]	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
IODINE-131	0.500	39 VALUES <LLD			151 VALUES <LLD	
190		ANALYSIS PERFORMED				
GAMMA (GELI)						
103						
CS-137	5.000	7.26(3/ 39)	HOUSLEY FARM	8.98(1/ 13)	64 VALUES <LLD	
		5.46- 8.98	4.75 MILES W	8.98- 8.98		
K-40	NOT ESTAB	1240.60(39/ 39)	MOFFETT FARM	1280.26(13/ 13)	1228.69(63/ 64)	
		729.57- 1766.79	4.5 MILES NW	1081.02- 1616.39	782.09- 1513.56	
BI-214	NOT ESTAB	27.24(23/ 39)	LAYMAN FARM	57.24(10/ 13)	46.56(45/ 64)	
		0.49- 268.63	1.5 MILES SSW	1.47- 268.63	1.62- 186.32	
PB-214	NOT ESTAB	42.74(14/ 39)	LAYMAN FARM	79.68(7/ 13)	54.11(38/ 64)	
		0.28- 272.84	1.5 MILES SSW	0.28- 272.84	0.33- 189.55	
PB-212	NOT ESTAB	2.53(10/ 39)	LAYMAN FARM	5.60(3/ 13)	1.91(17/ 64)	
		0.39- 10.78	1.5 MILES SSW	2.02- 10.78	0.65- 5.43	
TL-208	NOT ESTAB	1.17(5/ 39)	LAYMAN FARM	2.29(2/ 13)	1.23(8/ 64)	
		0.14- 3.54	1.5 MILES SSW	1.04- 3.54	0.33- 2.78	
AC-228	NOT ESTAB	10.36(2/ 39)	HOUSLEY FARM	10.36(2/ 13)	4.99(5/ 64)	
		10.13- 10.60	4.75 MILES W	10.13- 10.60	2.09- 10.40	
SR 89	10.000	39 VALUES <LLD			36 VALUES <LLD	
75		ANALYSIS PERFORMED				
SR 90	2.000	6.20(34/ 39)	MOFFETT FARM	8.07(13/ 13)	2.55(26/ 36)	
75		2.14- 10.61	4.5 MILES NW	6.65- 10.61	2.01- 3.47	

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 locations is indicated in parentheses (F).

TABLE 12

RADIOACTIVITY IN VEGETATION

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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) 51						
CS-137	0.060	0.11(2/ 12) 0.07- 0.15	HOUSLEY FARM 4.75 MILES W	0.15(1/ 4) 0.15- 0.15	0.08(3/ 39) 0.07- 0.11	
K-40	NOT ESTAB	12.76(12/ 12) 2.97- 28.07	LAYMAN FARM 1.5 MILES SSW	14.00(4/ 4) 2.97- 28.07	19.87(39/ 39) 2.96- 42.35	
BI-214	0.100	0.21(4/ 12) 0.10- 0.36	MOFFETT FARM 4.5 MILES NW	0.36(1/ 4) 0.36- 0.36	0.18(15/ 39) 0.10- 0.37	
PB-214	NOT ESTAB	0.12(9/ 12) 0.02- 0.30	LAYMAN FARM 1.5 MILES SSW	0.18(2/ 4) 0.14- 0.21	0.12(27/ 39) 0.02- 0.38	
PB-212	NOT ESTAB	0.04(10/ 12) 0.00- 0.13	HOUSLEY FARM 4.75 MILES W	0.07(4/ 4) 0.02- 0.13	0.07(28/ 39) 0.01- 0.35	
BE-7	NOT ESTAB	6.45(12/ 12) 1.54- 17.45	LAYMAN FARM 1.5 MILES SSW	8.29(4/ 4) 1.54- 17.45	7.58(39/ 39) 1.50- 29.14	
TL-208	NOT ESTAB	0.03(5/ 12) 0.01- 0.08	HOUSLEY FARM 4.75 MILES W	0.06(2/ 4) 0.04- 0.08	0.04(18/ 39) 0.00- 0.11	
AC-228	NOT ESTAB	0.15(4/ 12) 0.04- 0.29	HOUSLEY FARM 4.75 MILES W	0.29(1/ 4) 0.29- 0.29	0.16(12/ 39) 0.01- 0.36	
PA-234M	NOT ESTAB	12 VALUES <LLD			6.18(1/ 39) 6.18- 6.18	
SR 89	0.250	12 VALUES <LLD			0.27(3/ 12) 0.26- 0.28	
SR 90 24	0.050	0.29(10/ 12) 0.06- 1.32	MOFFETT FARM 4.5 MILES NW	0.53(3/ 4) 0.09- 1.32	0.09(11/ 12) 0.05- 0.13	
24						

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 locations is indicated in parentheses (F).

TABLE 13

RADIOACTIVITY IN SOIL

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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 21	0.700	25.59(16/ 16) 14.02- 53.57	LM-4 WB 0.9 MILES SE	51.22(2/ 2) 48.88- 53.57	17.84(5/ 5) 11.38- 34.63	
GAMMA (GELI) 21						
CS-137	0.020	0.53(16/ 16) 0.02- 1.51	PM5 DECATUR 6.25 MILES S	1.09(2/ 2) 0.75- 1.44	0.44(5/ 5) 0.28- 0.69	
K-40	0.250	9.54(16/ 16) 0.67- 28.66	LM-4 WB 0.9 MILES SE	27.31(2/ 2) 25.96- 28.66	5.83(5/ 5) 2.53- 17.07	
MN-54	0.010	0.02(1/ 16) 0.02- 0.02	LM2 N. WBSP GATE 0.5 MILES N	0.02(1/ 2) 0.02- 0.02	5 VALUES <LLD	
BI-214	0.050	0.83(16/ 16) 0.16- 1.02	LM-3 WB 2.1 MILES NNE	0.99(2/ 2) 0.97- 1.02	0.67(5/ 5) 0.55- 0.73	
BI-212	0.100	1.14(15/ 16) 0.78- 1.52	LM-4 WB 0.9 MILES SE	1.50(2/ 2) 1.48- 1.52	0.75(5/ 5) 0.63- 1.14	
PB-214	0.050	0.92(16/ 16) 0.18- 1.14	LM-3 WB 2.1 MILES NNE	1.11(2/ 2) 1.09- 1.12	0.75(5/ 5) 0.66- 0.84	
PB-212	NOT ESTAB	0.94(16/ 16) 0.14- 1.29	LM-4 WB 0.9 MILES SE	1.27(2/ 2) 1.26- 1.29	0.66(5/ 5) 0.51- 1.15	
RA-226	0.050	0.83(16/ 16) 0.16- 1.02	LM-3 WB 2.1 MILES NNE	0.99(2/ 2) 0.97- 1.02	0.67(5/ 5) 0.55- 0.73	
RA-223	NOT ESTAB	0.32(3/ 16) 0.25- 0.45	PM5 DECATUR 6.25 MILES S	0.45(1/ 2) 0.45- 0.45	5 VALUES <LLD	
RA-224	NOT ESTAB	1.01(10/ 16) 0.69- 1.42	LM-4 WB 0.9 MILES SE	1.40(2/ 2) 1.39- 1.42	0.86(3/ 5) 0.53- 1.41	
BE-7	0.160	0.47(1/ 16) 0.47- 0.47	PM2 SPRING CITY 7.0 MILES NW	0.47(1/ 2) 0.47- 0.47	5 VALUES <LLD	
TL-208	0.020	0.33(16/ 16) 0.04- 0.45	LM-4 WB 0.9 MILES SE	0.45(2/ 2) 0.45- 0.45	0.23(5/ 5) 0.18- 0.40	
AC-228	0.060	0.98(16/ 16) 0.15- 1.33	LM-4 WB 0.9 MILES SE	1.33(2/ 2) 1.32- 1.33	0.68(5/ 5) 0.54- 1.15	
PA-234M	NOT ESTAB	2.33(7/ 16) 1.52- 3.25	PM5 DECATUR 6.25 MILES S	3.25(1/ 2) 3.25- 3.25	2.00(1/ 5) 2.00- 2.00	
SR 89 21	1.500	3.44(2/ 16) 1.65- 5.23	PM5 DECATUR 6.25 MILES S	5.23(1/ 2) 5.23- 5.23	5.07(1/ 5) 5.07- 5.07	
SR 90 21	0.300	0.46(2/ 16) 0.31- 0.61	PM5 DECATUR 6.25 MILES S	0.61(1/ 2) 0.61- 0.61	0.35(1/ 5) 0.35- 0.35	

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 locations is indicated in parentheses (F).

TABLE 14

RADIOACTIVITY IN WELL WATER

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY ROANE TENNESSEE — REPORTING PERIOD 1984

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) 115						
K-40	NOT ESTAB	11.38(9/ 76) 2.99- 30.42	WBN WELL #2 ONSITE SSE	21.00(2/ 12) 11.58- 30.42	21.61(10/ 39) 6.33- 69.22	
BI-214	NOT ESTAB	12.20(63/ 76) 0.36- 70.71	WBN WELL #6 ONSITE WSW	21.62(12/ 13) 2.68- 70.71	201.73(39/ 39) 4.64- 646.80	
PB-214	NOT ESTAB	13.49(47/ 76) 0.51- 70.30	WBN WELL #6 ONSITE WSW	25.42(10/ 13) 9.39- 70.30	205.15(38/ 39) 14.93- 652.52	
PB-212	NOT ESTAB	1.44(14/ 76) 0.01- 4.37	WBN WELL #2 ONSITE SSE	2.58(2/ 12) 0.79- 4.37	1.55(9/ 39) 0.32- 3.28	
TL-208	NOT ESTAB	0.99(13/ 76) 0.19- 1.88	WBN WELL #1 ONSITE S	1.31(2/ 11) 0.75- 1.88	0.81(7/ 39) 0.18- 1.58	
AC-228	NOT ESTAB	4.94(4/ 76) 0.39- 9.24	WBN WELL #3 ONSITE SE	9.24(1/ 12) 9.24- 9.24	4.74(2/ 39) 2.83- 6.65	
TRITIUM 36	330.000	24 VALUES <LLD ANALYSIS PERFORMED			12 VALUES <LLD	

a. Nominal and 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 locations is indicated in parentheses (F).

TABLE 15

RADIOACTIVITY IN PUBLIC WATER SUPPLY

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DECATUR TENNESSEE — REPORTING PERIOD 1984

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD)[a]	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 51	2.300	3.23(18/ 25) 2.37- 6.67	DAYTON, TN 17.75 MILES NNE	3.51(10/ 12) 2.37- 6.67	3.16(7/ 26) 2.46- 5.67	
GAMMA (GELI) 51						
K-40	NOT ESTAB	20.50(3/ 25) 2.37- 40.32	CF INDUSTRIES TRM 473.0	21.34(2/ 13) 2.37- 40.32	12.64(7/ 26) 6.01- 20.03	
BI-214	NOT ESTAB	5.54(14/ 25) 0.99- 16.16	DAYTON, TN 17.75 MILES NNE	7.27(5/ 12) 1.93- 16.16	11.43(21/ 26) 2.51- 32.16	
PB-214	NOT ESTAB	4.40(5/ 25) 2.29- 8.45	CF INDUSTRIES TRM 473.0	4.41(4/ 13) 2.29- 8.45	9.13(18/ 26) 1.46- 23.73	
PB-212	NOT ESTAB	0.90(7/ 25) 0.24- 2.33	DAYTON, TN 17.75 MILES NNE	1.54(3/ 12) 1.01- 2.33	1.52(2/ 26) 1.21- 1.83	
TL-208	NOT ESTAB	0.54(7/ 25) 0.11- 1.80	CF INDUSTRIES TRM 473.0	0.84(4/ 13) 0.34- 1.80	0.85(10/ 26) 0.18- 1.68	
AC-228	NOT ESTAB	3.07(4/ 25) 0.85- 8.16	DAYTON, TN 17.75 MILES NNE	3.72(3/ 12) 0.85- 8.16	9.77(2/ 26) 6.62- 12.92	
SR 89 16	10.000	8 VALUES <LLD ANALYSIS PERFORMED			8 VALUES <LLD	
SR 90 16	2.000	8 VALUES <LLD ANALYSIS PERFORMED			8 VALUES <LLD	
TRITIUM 16	330.000	446.53(1/ 8) 446.53- 446.53	CF INDUSTRIES TRM 473.0	446.53(1/ 4) 446.53- 446.53	8 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 locations is indicated in parentheses (F).

Table 16

ENVIRONMENTAL GAMMA RADIATION LEVELS

Average External Gamma Radiation Levels at Various Distances from Watts Bar Nuclear Plant for Each Quarter - 1984
mR/Quarter[a]

Distance Miles	Average External Gamma Radiation Levels[b]			
	1st Quarter (Dec 83-Feb 84)	2nd Quarter (Mar-May 84)	3rd Quarter (Jun-Aug 84)	4th Quarter (Sep-Nov 84)
0-1	20.1±1.9	20.1±2.3	20.4±2.2	20.8±2.2
1-2	19.0±3.1	21.1±1.7	21.3±0.7	20.7±1.6
2-4	16.6±0.4	18.0±0.5	17.4±1.3	17.9±1.4
4-6	18.2±1.8	18.9±2.0	18.5±2.8	18.5±2.9
>6	17.0±2.5	18.2±2.9	17.4±3.4	16.7±3.3
Average, 0-2 miles (Onsite)	19.7±2.4	20.5±2.1	20.7±1.8	20.8±2.0
Average, >2 miles (Offsite)	17.6±2.1	18.6±2.3	18.0±2.9	17.8±3.0

[a]Date normalized to one quarter (2190 hours)

[b]All averages reported ±1σ (68% confidence level)

TABLE 17

RADIOACTIVITY IN PEARS

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY DECATUR TENNESSEE — REPORTING PERIOD 1984

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 2	25.000	2240.98(1/ 1) 2240.98- 2240.98	2.5 MILES NE	2240.98(1/ 1) 2240.98- 2240.98	2718.49(1/ 1) 2718.49- 2718.49	
GAMMA (GELI) 2						
K-40	NOT ESTAB	1111.96(1/ 1) 1111.96- 1111.96	2.5 MILES NE	1111.96(1/ 1) 1111.96- 1111.96	1215.04(1/ 1) 1215.04- 1215.04	
BI-214	NOT ESTAB	8.22(1/ 1) 8.22- 8.22	2.5 MILES NE	8.22(1/ 1) 8.22- 8.22	1 VALUES <LLD	
PB-212	NOT ESTAB	1.42(1/ 1) 1.42- 1.42 1.42- 1.42	2.5 MILES NE	1.42(1/ 1) 1.42- 1.42 1.42- 1.42	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 locations is indicated in parentheses (F).

TABLE 18

RADIOACTIVITY IN TOMATOES

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DAYTON TENNESSEE — REPORTING PERIOD 1984

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	25.000	2079.01(1/ 1)	PM2 SPRING CITY	2079.01(1/ 1)	4348.84(1/ 1)	
2		2079.01- 2079.01	7.0 MILES NW	2079.01- 2079.01	4348.84- 4348.84	
GAMMA (GELI)						
2						
K-40	NOT ESTAB	2541.67(1/ 1)	PM2 SPRING CITY	2541.67(1/ 1)	2120.08(1/ 1)	
		2541.67- 2541.67	7.0 MILES NW	2541.67- 2541.67	2120.08- 2120.08	
PB-212	NOT ESTAB	0.50(1/ 1)	PM2 SPRING CITY	0.50(1/ 1)	1 VALUES <LLD	
		0.50- 0.50	7.0 MILES NW	0.50- 0.50		

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 locations is indicated in parentheses (F).

RADIOACTIVITY IN TURNIP GREENS

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DAYTON TENNESSEE — REPORTING PERIOD 1984

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[b] NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE	CONTROL LOCATIONS MEAN (F)[b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA[2]	25.000	5477.94(1/ 1) 5477.94- 5477.94	2.5 MILES NE	5477.94(1/ 1) 5477.94- 5477.94	7395.17(1/ 1) 7395.17- 7395.17	
GAMMA (GELI)[2]						
K-40	NOT ESTAB	2340.56(1/ 1) 2340.56- 2340.56	2.5 MILES NE	2340.56(1/ 1) 2340.56- 2340.56	2979.16(1/ 1) 2979.16- 2979.16	
BI-214	NOT ESTAB	11.66(1/ 1) 11.66- 11.66	2.5 MILES NE	11.66(1/ 1) 11.66- 11.66	12.71(1/ 1) 12.71- 12.71	
PB-214	NOT ESTAB	5.53(1/ 1) 5.53- 5.53	2.5 MILES NE	5.53(1/ 1) 5.53- 5.53	5.11(1/ 1) 5.11- 5.11	
PB-212	NOT ESTAB	4.01(1/ 1) 4.01- 4.01	2.5 MILES NE	4.01(1/ 1) 4.01- 4.01	9.94(1/ 1) 9.94- 9.94	
BE-7	NOT ESTAB	82.72(1/ 1) 82.72- 82.72	2.5 MILES NE	82.72(1/ 1) 82.72- 82.72	146.42(1/ 1) 146.42- 146.42	
TL-208	NOT ESTAB	3.51(1/ 1) 3.51- 3.51	2.5 MILES NE	3.51(1/ 1) 3.51- 3.51	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 locations is indicated in parentheses (F).

TABLE 20

RADIOACTIVITY IN BEEF

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DECATUR TENNESSEE — REPORTING PERIOD 1984

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 2	25.000	4081.34(1/ 1) 4081.34- 4081.34	2.5 MILES NE	4081.34(1/ 1) 4081.34- 4081.34	3540.77(1/ 1) 3540.77- 3540.77	
GAMMA (GELI) 2						
K-40	NOT ESTAB	1418.23(1/ 1) 1418.23- 1418.23	2.5 MILES NE	1418.23(1/ 1) 1418.23- 1418.23	1290.82(1/ 1) 1290.82- 1290.82	
BI-214	NOT ESTAB	5.05(1/ 1) 5.05- 5.05	2.5 MILES NE	5.05(1/ 1) 5.05- 5.05	0.77(1/ 1) 0.77- 0.77	
AC-228	NOT ESTAB	0.35(1/ 1) 0.35- 0.35	2.5 MILES NE	0.35(1/ 1) 0.35- 0.35	1 VALUES <LLD	

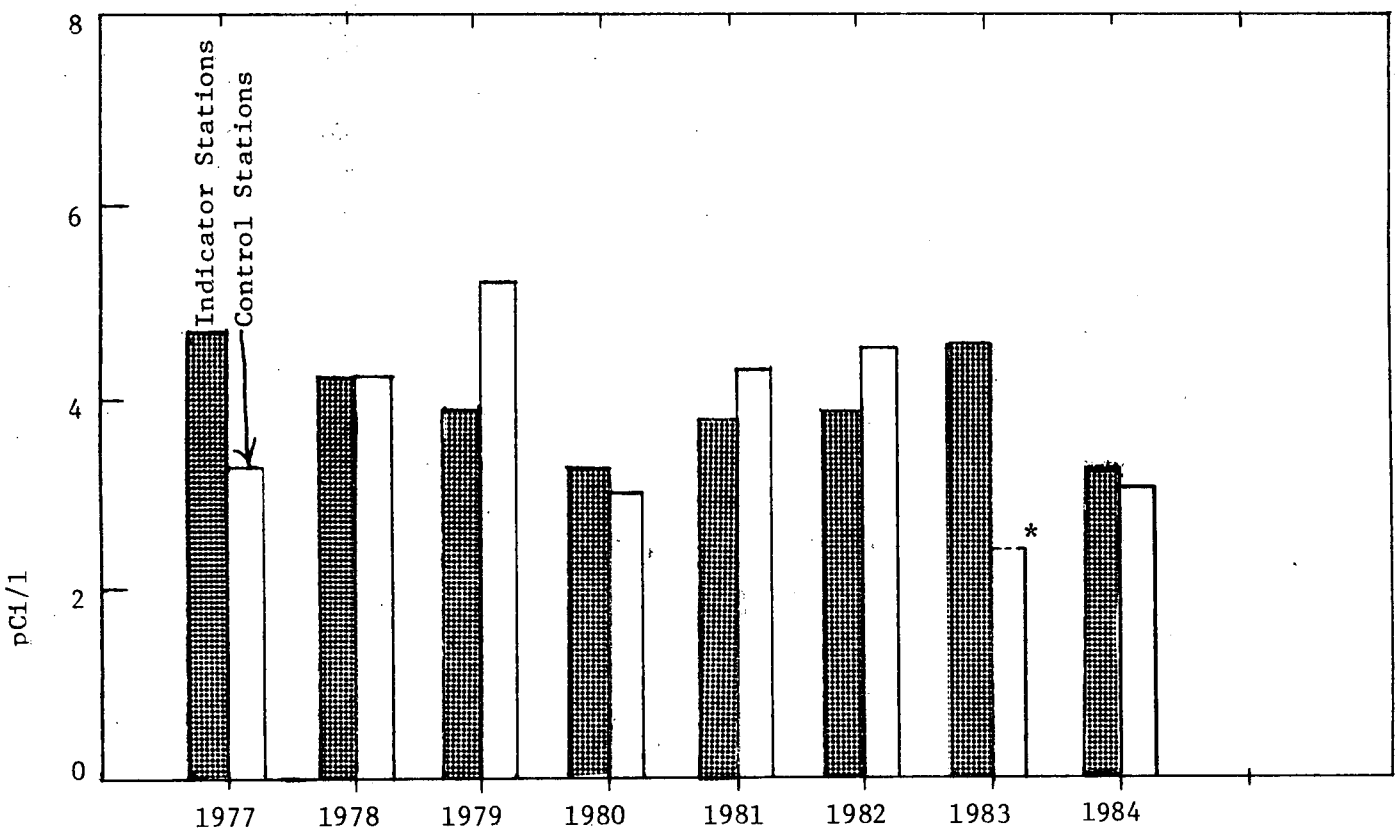
a. Nominal Lower Limit of Detection (LLD) as described in table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses (F).

Figure 5

Annual Average

Gross Beta Activity in Drinking Water

Watts Bar Nuclear Plant



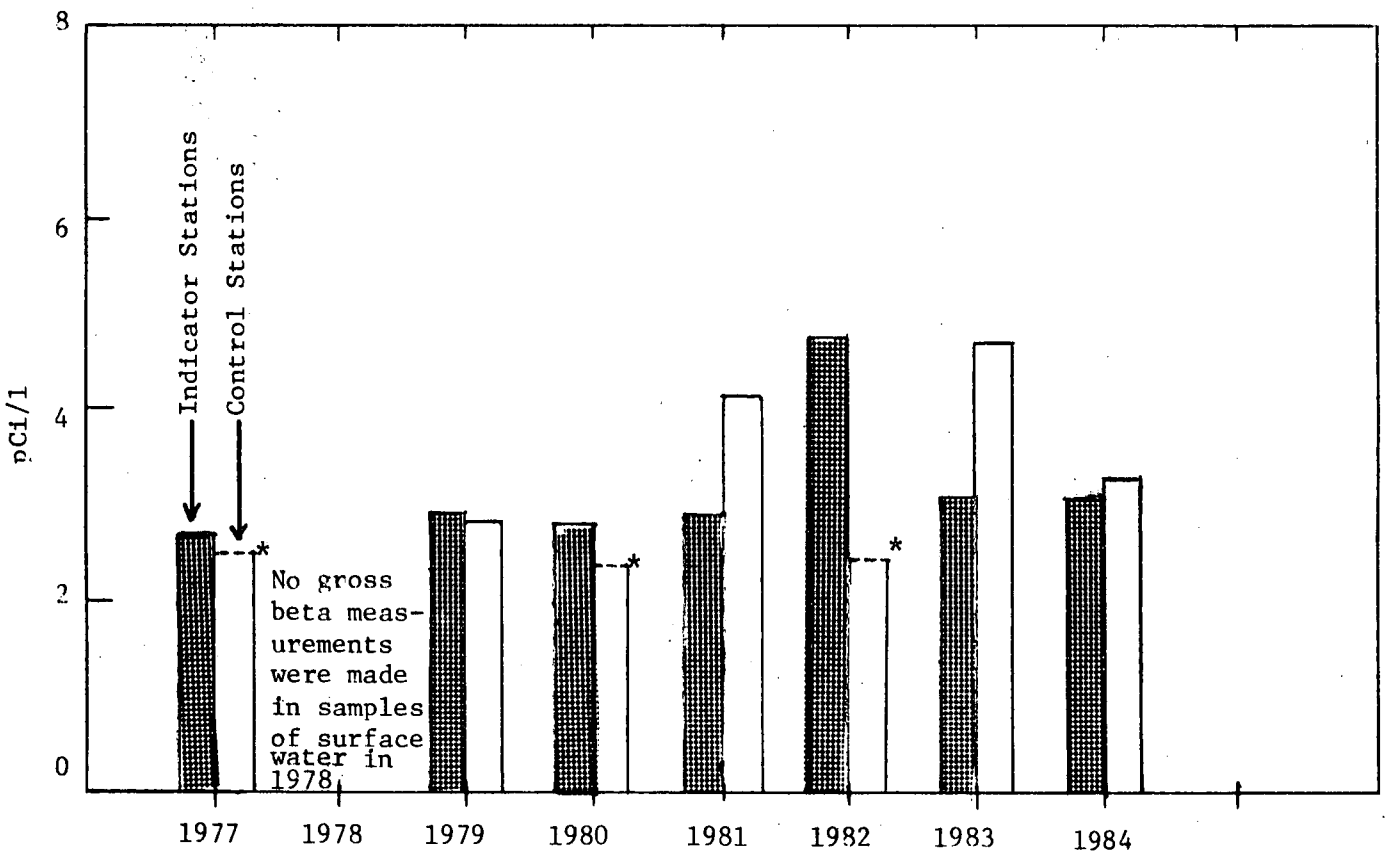
*Less than LLD (2.4 pCi/l).

Figure 6

Annual Average

Gross Beta Activity in Surface Water

Watts Bar Nuclear Plant



*Less than LLD (2.4 pCi/1).

Figure 7

TLD LOCATIONS - WBN

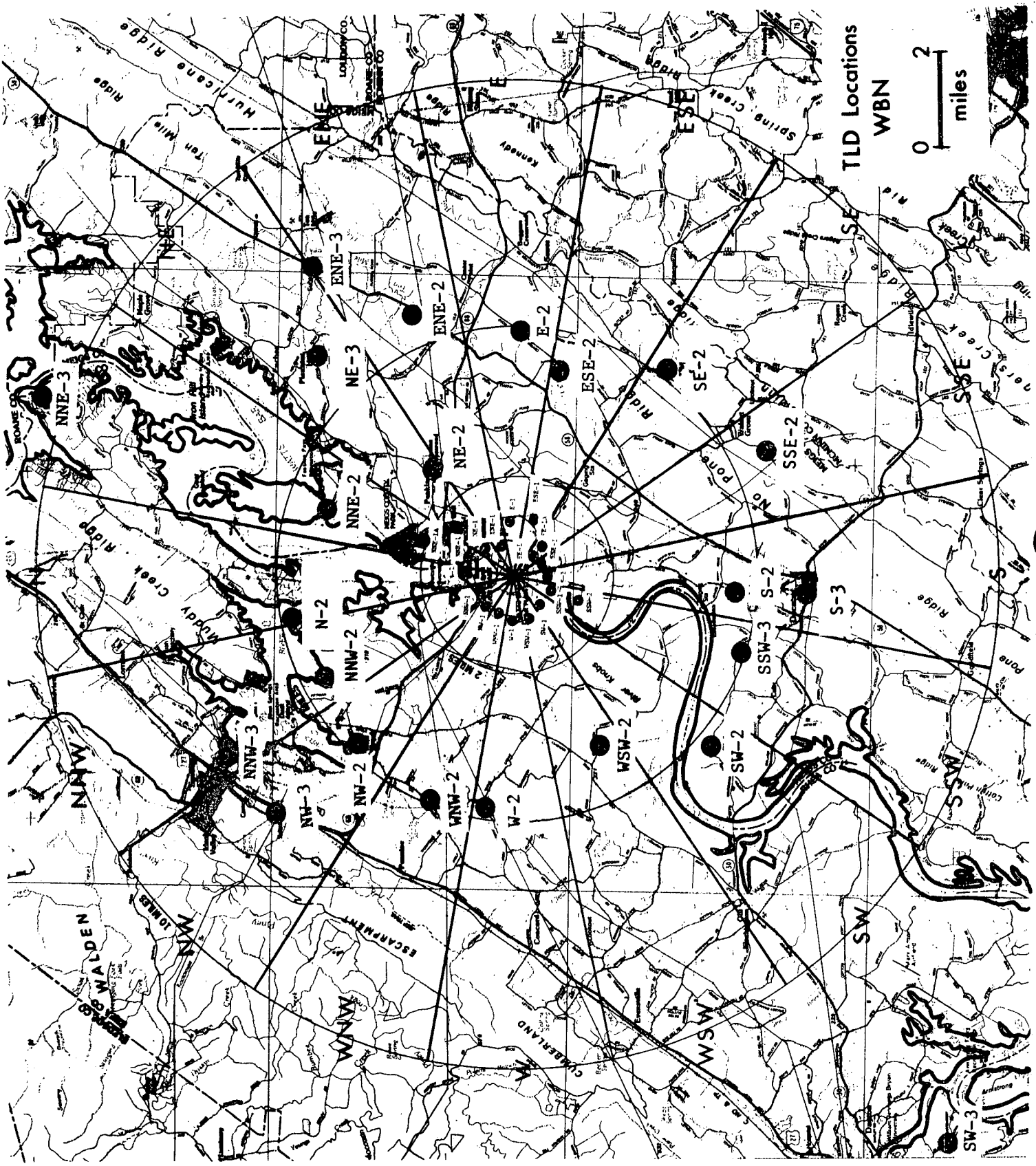


Figure 8

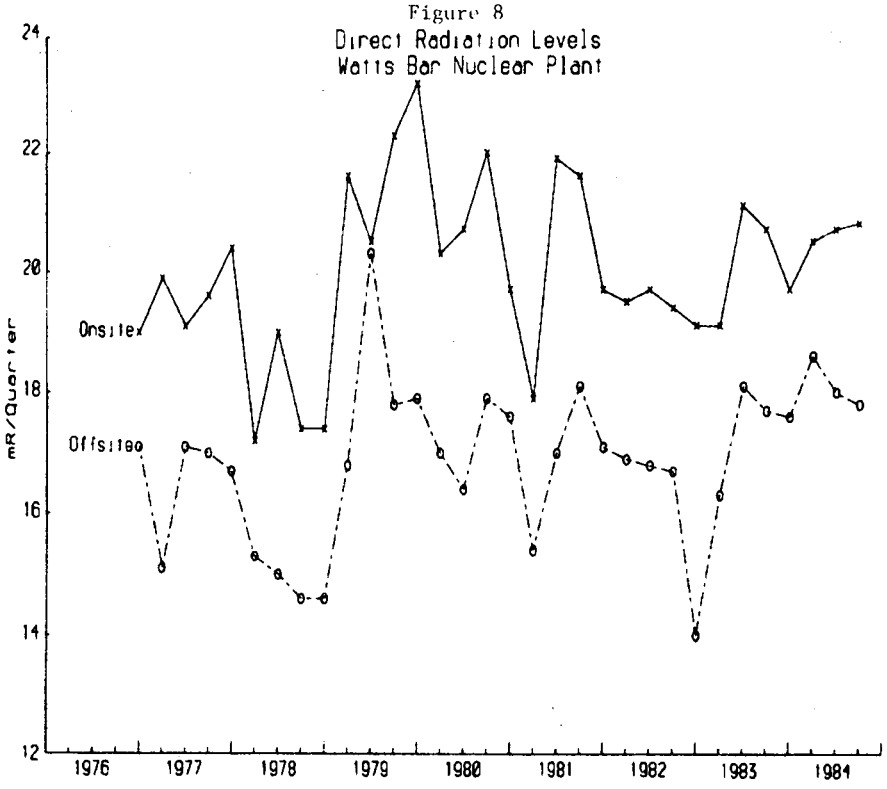
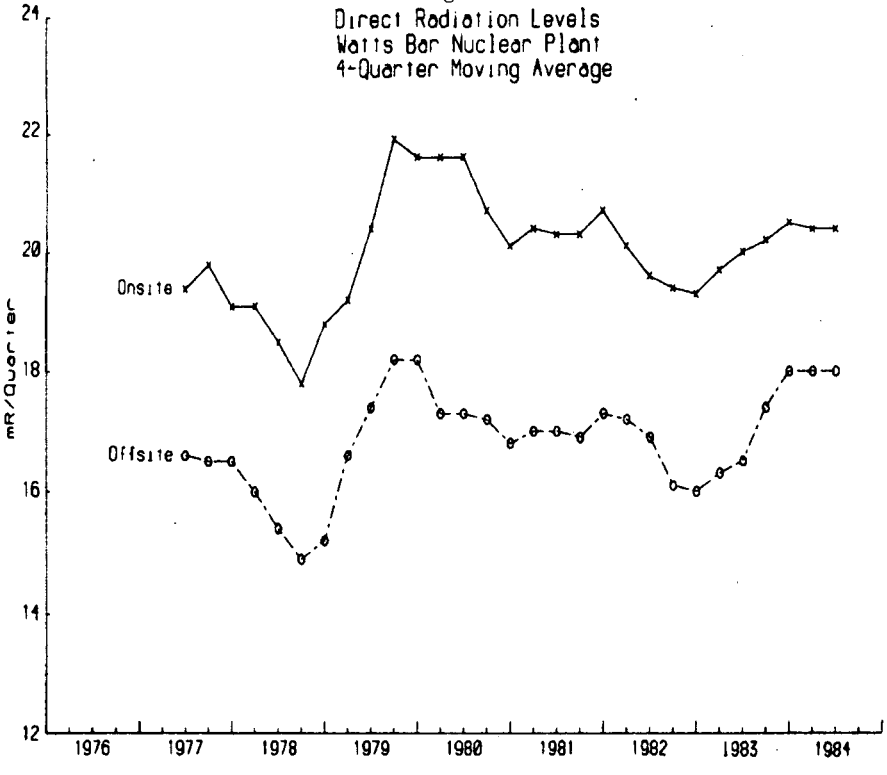


Figure 9



Reservoir Monitoring

Samples of water and aquatic media are collected along the Tennessee River in Chickamauga and Watts Bar Reservoirs. One station is also a part of the Sequoyah Nuclear Plant monitoring program. In conjunction with that program, additional analyses are conducted on some samples. Samples collected for radiological analyses include sediment, plankton, and Asiatic clams from four stations; water from three stations; and fish from Watts Bar, Chickamauga and Nickajack Reservoirs (see table 21). The locations of these stations are shown on the accompanying map (figure 10) and conform to sediment ranges established and surveyed by TVA.

Water

To provide a more representative sample, automatic surface water sampling devices were installed at three locations near grab sampling sites (one upstream from the plant discharge area, one immediately downstream from the plant discharge, and one approximately nine miles downstream). Two of the automatic samplers were operational in January of 1984, and the other one was operational in June of 1984. The surface water samples are collected monthly and analyzed for gross beta and for gamma-emitting radionuclides. These monthly samples are composited quarterly for strontium and tritium determination.

With the installation and operation of automatic samplers, routine quarterly grab sampling was discontinued October 1, 1984. The quarterly samples collected were analyzed for gross beta, gamma-emitting radionuclides, ^{89}Sr, ^{90}Sr, and tritium.

During this reporting period, three quarterly grab samples were not collected because of hazardous flood conditions, and three other quarterly grab samples were inadvertently discarded before gross beta could be determined.

Analytical results of collected surface water samples are summarized in table 22.

Figure 6 presents a plot of the gross beta activity in surface water from 1977 through 1984. Indicator stations are those located downstream from the plant and controls are located upstream. The levels reported are consistent with gross beta levels measured in surface water samples taken from the Tennessee River in preoperational radiological monitoring programs conducted by TVA at other sites.

Fish

Radiological monitoring for fish was accomplished by analyses of composite samples of adult fish taken semiannually from each of three contiguous reservoirs--Watts Bar, Chickamauga, and Nickajack. No permanent sampling stations have been 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. Three species, white crappie, channel catfish, and smallmouth buffalo, are collected representing both commercial and game species. Sufficient fish are collected in each reservoir to yield 250 or 300 grams oven-dry weight for analytical purposes. All samples were analyzed for gamma, gross alpha, and gross beta activity. In addition, samples of each species were analyzed for ^{89}Sr and ^{90}Sr. The composite samples contained approximately the same quantity of flesh from each fish. For each composite, a subsample of material was drawn for counting. Results are given in tables 23 through 26.

Plankton

As indicated in table 21, net plankton was collected for radiological analyses at four stations by vertical tows with a one-half meter, 100 micro-mesh net. For analytical accuracy, at least 50 grams (wet weight) of material is required; and collection of such amounts is usually practical only during the period April to September because of seasonal variability in plankton abundance. All samples collected were analyzed for gross beta activity. When quantities collected are sufficient, analyses for gamma-emitting radionuclides and strontium are performed. Analytical results of collected samples are given in table 27. During this reporting period, four samples were not available for collection, and four samples collected contained insufficient volume for analysis. This resulted in the loss of 8 gross beta, 9 gamma-emitting radionuclides identification, and 16 strontium determinations.

Sediment

Sediment samples were collected from dredge hauls made for bottom fauna quarterly from three stations and semiannually from one station. Gross beta, gamma activity, ^{89}Sr, and ^{90}Sr content were determined in samples collected from points in four cross sections. In addition, gross alpha activity was determined in samples from Tennessee River Mile (TRM) 496.5. Each sample was a composite obtained by combining equal volumes of sediment from each of three dredge hauls at a point in the cross section. Results are given in table 28. During this reporting period, one sample from each location was not collected because of hazardous flood conditions.

Shoreline sediment samples were collected semiannually at three recreation-use areas (two downstream from the plant and one upstream) in the vicinity of WBN. Samples were analyzed for gross beta, gamma-emitting radionuclides, ^{89}Sr, and ^{90}Sr. Results are given in table 29.

Figures 11 and 12 respectively present the trends in cesium-137 and cobalt-60 levels in sediment during the operation of the monitoring program. The upstream (control) station is located above Watts Bar Dam.

Asiatic Clams

Samples of Asiatic clams were collected with a Ponar dredge quarterly from three stations and semiannually from one station and analyzed for gamma activity. Gross alpha and gross beta analyses were also conducted on samples from TRM 496.5 and strontium activity was determined in samples of clam shells taken at that location. Results are given in tables 30 and 31. During this reporting period, because of equipment problems and scarcity of clams, samples from one indicator and one control location were taken during the first week of January 1985. The analytical results of these two "late" samples are included in tables 30 and 31.

Table 21

Sampling Schedule - Reservoir Monitoring

Tennessee River Mile	Biological Samples					Surface Water
	Plankton	Fauna	Sediment	Shoreline Sediment	Fish[a]	
Indicator Stations						
494.0				X		
496.5	X		X			
513.0				X		
517.9						X[b]
518.0	X	X	X			X[c]
523.1						X[d]
527.4	X	X	X			X[c]
Control Stations						
529.3						X[b]
529.9						X[c]
530.2				X		
532.1	X	X	X			

[a]Fish samples taken from Watts Bar, Chickamauga, and Nickajack Reservoirs.

[b]Automatic surface water sampler operational January 1984.

[c]Grab surface water sampling discontinued October 1984.

[d]Automatic surface water sampler operational June 1984.

TABLE 22

RADIOACTIVITY IN SURFACE WATER TOTAL

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DAYTON TENNESSEE — REPORTING PERIOD 1984

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	2.300	3.10(16/ 23)	TRM 523.1	3.45(7/ 8)	3.31(9/ 14)	
37		2.33- 4.69	5.2 MILE DOWNSTR	2.78- 4.69	2.39- 6.48	
GAMMA (GELI)						
40						
K-40	NOT ESTAB	15.77(2/ 25)	TRM 517.9	15.77(2/ 13)	27.07(3/ 15)	
		3.54- 27.99	10.3 MILE DOWNST	3.54- 27.99	3.05- 45.13	
BI-214	NOT ESTAB	6.80(15/ 25)	TRM 523.1	8.30(6/ 8)	4.34(7/ 15)	
		0.47- 18.33	5.2 MILE DOWNSTR	0.47- 18.33	0.39- 8.50	
PB-214	NOT ESTAB	5.87(11/ 25)	TRM 518.0-67-0	10.76(1/ 2)	4.74(3/ 15)	
		0.31- 14.39		10.76- 10.76	0.96- 6.70	
PB-212	NOT ESTAB	1.08(8/ 25)	TRM 517.9	1.33(5/ 13)	0.98(3/ 15)	
		0.36- 1.98	10.3 MILE DOWNST	0.91- 1.98	0.17- 1.68	
SR 89	10.000	11 VALUES <LLD			6 VALUES <LLD	
17		ANALYSIS PERFORMED				
SR 90	2.000	11 VALUES <LLD			6 VALUES <LLD	
17		ANALYSIS PERFORMED				
TRITIUM	330.000	365.69(2/ 11)	TRM 517.9	365.69(2/ 4)	426.18(1/ 6)	
17		336.79- 394.60	10.3 MILE DOWNST	336.79- 394.60	426.18- 426.18	

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 locations is indicated in parentheses (F).

TABLE 23

RADIOACTIVITY IN CHANNEL CATFISH (FLESH)

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1986

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[b] 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	0.18(	2/	4)	NICKAJACK RES	0.21(	1/	2)	0.16(	1/	2)	
6		0.14-	0.21		TRM 425-471	0.21-	0.21		0.16-	0.16		
GROSS BETA	0.100	21.99(	4/	4)	NICKAJACK RES	25.70(	2/	2)	21.11(	2/	2)	
6		13.24-	34.67		TRM 425-471	16.73-	34.67		11.83-	30.38		
GAMMA (GELI)												
6												
CS-137	0.020	0.06(	4/	4)	CHICKAMAUGA RES	0.06(	2/	2)	0.04(	2/	2)	
		0.05-	0.08		TRM 471-530	0.05-	0.08		0.04-	0.04		
K-40	NOT ESTAB	13.71(	4/	4)	NICKAJACK RES	15.43(	2/	2)	10.52(	2/	2)	
		11.78-	17.91		TRM 425-471	12.95-	17.91		7.75-	13.28		
BI-214	0.020	0.06(	3/	4)	CHICKAMAUGA RES	0.08(	1/	2)	0.03(	2/	2)	
		0.03-	0.08		TRM 471-530	0.08-	0.08		0.02-	0.04		
PB-214	NOT ESTAB	0.04(	3/	4)	CHICKAMAUGA RES	0.05(	1/	2)	0.04(	2/	2)	
		0.04-	0.05		TRM 471-530	0.05-	0.05		0.02-	0.06		
TL-208	NOT ESTAB	0.00(	1/	4)	NICKAJACK RES	0.00(	1/	2)	2 VALUES <LLD			
		0.00-	0.00		TRM 425-471	0.00-	0.00					
AC-228	NOT ESTAB	4 VALUES <LLD							0.01(	1/	2)	
									0.01-	0.01		
SR 89	0.500	4 VALUES <LLD							2 VALUES <LLD			
6		ANALYSIS PERFORMED										
SR 90	0.100	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 locations is indicated in parentheses (F).

TABLE 24

RADIOACTIVITY IN WHITE CRAPPIE (FLESH)

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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[b] NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE	CONTROL LOCATIONS MEAN (F)[b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA	0.100	0.16(3/ 4)	CHICKAMAUGA RES	0.17(1/ 2)	0.22(1/ 2)	
6		0.11- 0.21	TRM 471-530	0.17- 0.17	0.22- 0.22	
GROSS BETA	0.100	30.23(4/ 4)	NICKAJACK RES	32.25(2/ 2)	26.92(2/ 2)	
6		18.89- 40.62	TRM 425-471	23.88- 40.62	15.86- 37.97	
GAMMA (GELI)						
6						
CS-137	0.020	0.07(4/ 4)	NICKAJACK RES	0.07(2/ 2)	0.12(2/ 2)	
		0.04- 0.08	TRM 425-471	0.07- 0.08	0.10- 0.13	
K-40	NOT ESTAB	15.48(4/ 4)	NICKAJACK RES	16.59(2/ 2)	13.08(2/ 2)	
		11.88- 17.60	TRM 425-471	15.58- 17.60	9.87- 16.29	
BI-214	0.020	0.31(2/ 4)	CHICKAMAUGA RES	0.34(1/ 2)	0.24(1/ 2)	
		0.28- 0.34	TRM 471-530	0.34- 0.34	0.24- 0.24	
PB-214	NOT ESTAB	0.24(2/ 4)	CHICKAMAUGA RES	0.33(1/ 2)	0.21(1/ 2)	
		0.14- 0.33	TRM 471-530	0.33- 0.33	0.21- 0.21	
SR 89	0.500	4 VALUES <LLD			2 VALUES <LLD	
6		ANALYSIS PERFORMED				
SR 90	0.100	0.13(1/ 4)	NICKAJACK RES	0.13(1/ 2)	2 VALUES <LLD	
6		0.13- 0.13	TRM 425-471	0.13- 0.13		

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 locations is indicated in parentheses (F).

TABLE 25

RADIOACTIVITY IN SMALLMOUTH BUFFALO (FLESH)

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY DAYTON TENNESSEE — REPORTING PERIOD 1984

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 ALPHA	0.100	0.20(2/ 4)	CHICKAMAUGA RES	0.22(1/ 2)	0.17(1/ 2)	
6		0.18- 0.22	TRM 471-530	0.22- 0.22	0.17- 0.17	
GROSS BETA	0.100	19.50(4/ 4)	NICKAJACK RES	20.63(2/ 2)	28.01(2/ 2)	
6		13.06- 23.67	TRM 425-471	20.46- 20.81	25.75- 30.26	
GAMMA (GELI)						
6						
CS-137	0.020	0.06(4/ 4)	CHICKAMAUGA RES	0.06(2/ 2)	0.18(2/ 2)	
		0.04- 0.07	TRM 471-530	0.06- 0.07	0.05- 0.30	
K-40	NOT ESTAB	12.22(4/ 4)	NICKAJACK RES	13.26(2/ 2)	12.67(2/ 2)	
		9.21- 17.32	TRM 425-471	9.21- 17.32	12.20- 13.15	
BI-214	0.020	0.07(3/ 4)	NICKAJACK RES	0.09(1/ 2)	0.06(1/ 2)	
		0.03- 0.09	TRM 425-471	0.09- 0.09	0.06- 0.06	
PB-214	NOT ESTAB	0.06(3/ 4)	CHICKAMAUGA RES	0.07(2/ 2)	0.05(1/ 2)	
		0.04- 0.09	TRM 471-530	0.04- 0.09	0.05- 0.05	
PB-212	NOT ESTAB	0.00(1/ 4)	CHICKAMAUGA RES	0.00(1/ 2)	0.01(2/ 2)	
		0.00- 0.00	TRM 471-530	0.00- 0.00	0.00- 0.01	
SR 89	0.500	4 VALUES <LLD			2 VALUES <LLD	
6		ANALYSIS PERFORMED				
SR 90	0.100	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 locations is indicated in parentheses (F).

TABLE 26

RADIOACTIVITY IN SMALLMOUTH BUFFALO (WHOLE)

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY DECATUR TENNESSEE — REPORTING PERIOD 1984

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[b] NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE	CONTROL LOCATIONS MEAN (F)[b] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA	0.100	0.17(1/ 4)	NICKAJACK RES	0.17(1/ 2)	2 VALUES <LLD	
6		0.17- 0.17	TRM 425-471	0.17- 0.17		
GROSS BETA	0.100	16.83(4/ 4)	CHICKAMAUGA RES	17.14(2/ 2)	17.45(2/ 2)	
6		12.83- 20.19	TRM 471-530	16.63- 17.65	17.25- 17.66	
GAMMA (GELI)						
6						
CS-137	0.020	0.05(1/ 4)	CHICKAMAUGA RES	0.05(1/ 2)	0.05(2/ 2)	
		0.05- 0.05	TRM 471-530	0.05- 0.05	0.03- 0.08	
K-40	NOT ESTAB	7.57(4/ 4)	CHICKAMAUGA RES	7.84(2/ 2)	8.05(2/ 2)	
		6.44- 8.15	TRM 471-530	7.72- 7.96	7.95- 8.15	
BI-214	0.020	0.04(3/ 4)	CHICKAMAUGA RES	0.05(1/ 2)	0.04(1/ 2)	
		0.03- 0.05	TRM 471-530	0.05- 0.05	0.04- 0.04	
PB-214	NOT ESTAB	0.06(3/ 4)	CHICKAMAUGA RES	0.06(1/ 2)	0.03(2/ 2)	
		0.03- 0.08	TRM 471-530	0.06- 0.06	0.02- 0.03	
PB-212	NOT ESTAB	0.00(2/ 4)	NICKAJACK RES	0.00(1/ 2)	0.01(1/ 2)	
		0.00- 0.00	TRM 425-471	0.00- 0.00	0.01- 0.01	
SR 89	0.500	0.67(2/ 4)	NICKAJACK RES	0.73(1/ 2)	2 VALUES <LLD	
6		0.61- 0.73	TRM 425-471	0.73- 0.73		
SR 90	0.100	0.18(1/ 4)	NICKAJACK RES	0.18(1/ 2)	0.16(1/ 2)	
6		0.18- 0.18	TRM 425-471	0.18- 0.18	0.16- 0.16	

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 locations is indicated in parentheses (F).

TABLE 27

RADIOACTIVITY IN PLANKTON

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY DECATUR TENNESSEE — REPORTING PERIOD 1984

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 8	0.100	25.48(6/ 6) 16.30- 34.80	TRM 518.0	33.66(2/ 2) 32.53- 34.80	10.23(2/ 2) 9.35- 11.11	
GAMMA (GELI) 7						
CS-137	0.080	0.85(2/ 5) 0.60- 1.10	TRM 527.4	1.10(1/ 2) 1.10- 1.10	2 VALUES <LLD	
K-40	NOT ESTAB	8.56(2/ 5) 3.69- 13.43	TRM 518.0	13.43(1/ 2) 13.43- 13.43	21.70(1/ 2) 21.70- 21.70	
BI-214	NOT ESTAB	7.05(5/ 5) 3.90- 12.76	TRM 527.4	8.33(2/ 2) 3.90- 12.76	9.66(2/ 2) 4.30- 15.03	
PB-214	NOT ESTAB	6.96(5/ 5) 3.99- 13.18	TRM 527.4	8.58(2/ 2) 3.99- 13.18	14.67(2/ 2) 3.26- 26.09	
PB-212	NOT ESTAB	0.64(2/ 5) 0.39- 0.90	TRM 518.0	0.90(1/ 2) 0.90- 0.90	0.33(1/ 2) 0.33- 0.33	
BE-7	NOT ESTAB	8.15(2/ 5) 5.91- 10.38	TRM 527.4	10.38(1/ 2) 10.38- 10.38	10.73(1/ 2) 10.73- 10.73	
TL-208	NOT ESTAB	5 VALUES <LLD			1.01(2/ 2) 0.43- 1.60	

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 locations is indicated in parentheses (F).

TABLE 28

RADIOACTIVITY IN SEDIMENT

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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 ALPHA 1	0.350	3.42(1/ 1) 3.42- 3.42	TRM 496.5C	3.42(1/ 1) 3.42- 3.42		
GROSS BETA 10	0.700	39.45(7/ 7) 33.12- 54.52	TRM 518.0	42.97(3/ 3) 35.98- 54.52	43.30(3/ 3) 37.78- 48.10	
GAMMA (GELI) 10						
CO-60	0.010	7 VALUES <LLD			0.21(3/ 3) 0.17- 0.28	
CS-137	0.020	0.27(7/ 7) 0.03- 1.45	TRM 496.50	1.45(1/ 1) 1.45- 1.45	2.70(3/ 3) 2.27- 3.10	
K-40	NOT ESTAB	15.16(7/ 7) 11.08- 19.39	TRM 518.0	17.44(3/ 3) 15.93- 19.39	14.96(3/ 3) 14.23- 15.67	
BI-214	0.020	1.11(7/ 7) 0.86- 1.89	TRM 496.50	1.89(1/ 1) 1.89- 1.89	1.36(3/ 3) 0.99- 1.91	
BI-212	0.100	1.49(6/ 7) 1.28- 1.86	TRM 527.4	1.60(3/ 3) 1.36- 1.86	1.55(2/ 3) 1.52- 1.58	
PB-214	NOT ESTAB	1.17(7/ 7) 0.93- 1.75	TRM 496.50	1.75(1/ 1) 1.75- 1.75	1.54(3/ 3) 1.10- 2.20	
PB-212	NOT ESTAB	1.33(7/ 7) 1.01- 1.76	TRM 496.50	1.55(1/ 1) 1.55- 1.55	1.37(3/ 3) 1.25- 1.48	
RA-226	NOT ESTAB	0.98(6/ 7) 0.86- 1.20	TRM 527.4	1.05(3/ 3) 0.91- 1.20	1.08(2/ 3) 0.99- 1.16	
RA-224	NOT ESTAB	1.36(5/ 7) 1.13- 1.68	TRM 527.4	1.51(3/ 3) 1.27- 1.68	1.43(2/ 3) 1.36- 1.51	
BE-7	NOT ESTAB	0.18(2/ 7) 0.15- 0.21	TRM 527.4	0.18(2/ 3) 0.15- 0.21	3 VALUES <LLD	
TH-234	NOT ESTAB	1.95(1/ 7) 1.95- 1.95	TRM 527.4	1.95(1/ 3) 1.95- 1.95	3 VALUES <LLD	
TL-208	0.020	0.44(7/ 7) 0.35- 0.60	TRM 527.4	0.51(3/ 3) 0.39- 0.60	0.48(3/ 3) 0.45- 0.54	
AC-228	0.060	1.36(7/ 7) 1.08- 1.75	TRM 496.50	1.49(1/ 1) 1.49- 1.49	1.42(3/ 3) 1.35- 1.53	
SR 89 10	1.500	7 VALUES <LLD			1.66(1/ 3) 1.66- 1.66	
SR 90 10	0.300	0.49(1/ 7) 0.49- 0.49	TRM 518.0	0.49(1/ 3) 0.49- 0.49	0.41(1/ 3) 0.41- 0.41	

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 locations is indicated in parentheses (F).

TABLE 29

RADIOACTIVITY IN SHORE LINE SEDIMENT

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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	0.700	18.76(4/ 4) 11.54- 37.82	COTTON PORT MARI TRM 513	25.44(2/ 2) 13.05- 37.82	13.03(2/ 2) 4.45- 21.61	
GAMMA (GELI) 6						
CO-60	0.010	0.08(1/ 4) 0.08- 0.08	COTTON PORT MARI TRM 513	0.08(1/ 2) 0.08- 0.08	2 VALUES <LLD	
CS-137	0.020	0.44(4/ 4) 0.03- 1.60	COTTON PORT MARI TRM 513	0.85(2/ 2) 0.09- 1.60	2 VALUES <LLD	
K-40	NOT ESTAB	10.38(4/ 4) 2.89- 17.91	COTTON PORT MARI TRM 513	17.22(2/ 2) 16.53- 17.91	4.28(2/ 2) 1.36- 7.20	
BI-214	0.020	0.72(4/ 4) 0.40- 1.05	COTTON PORT MARI TRM 513	1.00(2/ 2) 0.94- 1.05	0.60(2/ 2) 0.28- 0.92	
BI-212	0.100	1.02(4/ 4) 0.42- 1.65	COTTON PORT MARI TRM 513	1.57(2/ 2) 1.48- 1.65	0.83(2/ 2) 0.40- 1.25	
PB-214	NOT ESTAB	0.77(4/ 4) 0.43- 1.18	COTTON PORT MARI TRM 513	1.07(2/ 2) 0.96- 1.18	0.68(2/ 2) 0.32- 1.04	
PB-212	0.020	0.89(4/ 4) 0.39- 1.37	COTTON PORT MARI TRM 513	1.35(2/ 2) 1.33- 1.37	0.77(2/ 2) 0.34- 1.20	
RA-226	NOT ESTAB	0.72(4/ 4) 0.40- 1.05	COTTON PORT MARI TRM 513	1.00(2/ 2) 0.94- 1.05	0.60(2/ 2) 0.28- 0.92	
RA-224	NOT ESTAB	1.03(3/ 4) 0.55- 1.31	COTTON PORT MARI TRM 513	1.28(2/ 2) 1.24- 1.31	1.43(1/ 2) 1.43- 1.43	
BE-7	0.020	0.13(2/ 4) 0.11- 0.14	GRASSHOPPER CREE TRM 494	0.13(2/ 2) 0.11- 0.14	0.10(1/ 2) 0.10- 0.10	
TL-208	0.020	0.30(4/ 4) 0.14- 0.48	COTTON PORT MARI TRM 513	0.47(2/ 2) 0.46- 0.48	0.27(2/ 2) 0.12- 0.43	
AC-228	0.060	0.88(4/ 4) 0.38- 1.43	COTTON PORT MARI TRM 513	1.35(2/ 2) 1.26- 1.43	0.82(2/ 2) 0.35- 1.30	
PA-234M	NOT ESTAB	2.28(3/ 4) 1.59- 3.63	COTTON PORT MARI TRM 513	3.63(1/ 2) 3.63- 3.63	2 VALUES <LLD	
SR 89 6	1.500	4 VALUES <LLD ANALYSIS PERFORMED			2 VALUES <LLD	
SR 90 6	0.300	4 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 locations is indicated in parentheses (F).

TABLE 30

RADIOACTIVITY IN CLAM FLESH

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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	0.29(2/ 2) 0.16- 0.42	TRM 496.50	0.29(2/ 2) 0.16- 0.42		
GROSS BETA 2	0.100	5.16(2/ 2) 2.26- 8.05	TRM 496.50	5.16(2/ 2) 2.26- 8.05		
GAMMA (GELI) 14						
CS-137	0.080	0.13(1/ 10) 0.13- 0.13	TRM 518.0	0.13(1/ 4) 0.13- 0.13	4 VALUES <LLD	
K-40	NOT ESTAB	3.30(2/ 10) 1.50- 5.09	TRM 496.50	5.09(1/ 2) 5.09- 5.09	1.82(4/ 4) 0.83- 3.71	
BI-214	NOT ESTAB	0.66(8/ 10) 0.01- 1.54	TRM 518.0	0.84(3/ 4) 0.01- 1.54	0.61(4/ 4) 0.01- 1.34	
PB-214	NOT ESTAB	0.75(8/ 10) 0.05- 1.75	TRM 518.0	1.00(3/ 4) 0.27- 1.75	0.66(4/ 4) 0.08- 1.47	
PB-212	NOT ESTAB	0.09(4/ 10) 0.04- 0.13	TRM 496.50	0.13(1/ 2) 0.13- 0.13	0.03(2/ 4) 0.01- 0.04	
TL-208	NOT ESTAB	0.04(4/ 10) 0.03- 0.05	TRM 496.50	0.04(2/ 2) 0.04- 0.05	0.02(1/ 4) 0.02- 0.02	
AC-228	NOT ESTAB	0.18(2/ 10) 0.13- 0.22	TRM 518.0	0.22(1/ 4) 0.22- 0.22	0.71(2/ 4) 0.05- 1.37	

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 specific locations is indicated in parentheses (F).

TABLE 31

RADIOACTIVITY IN CLAM SHELL

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1984

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[b] NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA 2	0.700	0.81(2/ 2) 0.76- 0.85	TRM 496.50	0.81(2/ 2) 0.76- 0.85		
GROSS BETA 2	0.700	5.44(2/ 2) 5.22- 5.66	TRM 496.50	5.44(2/ 2) 5.22- 5.66		
GAMMA (GELI) 14						
CO-60	0.010	0.01(5/ 10) 0.01- 0.02	TRM 496.50	0.02(2/ 2) 0.01- 0.02	4 VALUES <LLD	
CS-137	0.020	0.02(1/ 10) 0.02- 0.02	TRM 496.50	0.02(1/ 2) 0.02- 0.02	4 VALUES <LLD	
K-40	NOT ESTAB	0.13(9/ 10) 0.07- 0.23	TRM 496.50	0.22(2/ 2) 0.22- 0.23	0.10(2/ 4) 0.07- 0.13	
BI-214	0.050	0.16(10/ 10) 0.09- 0.27	TRM 496.50	0.22(2/ 2) 0.18- 0.27	0.10(4/ 4) 0.05- 0.19	
BI-212	0.100	0.18(5/ 10) 0.13- 0.25	TRM 496.50	0.23(2/ 2) 0.22- 0.25	4 VALUES <LLD	
PB-214	0.050	0.18(10/ 10) 0.09- 0.32	TRM 496.50	0.26(2/ 2) 0.19- 0.32	0.10(4/ 4) 0.05- 0.21	
PB-212	NOT ESTAB	0.11(10/ 10) 0.06- 0.16	TRM 496.50	0.16(2/ 2) 0.16- 0.16	0.03(3/ 4) 0.02- 0.03	
RA-226	0.050	0.16(10/ 10) 0.09- 0.27	TRM 496.50	0.22(2/ 2) 0.18- 0.27	0.06(3/ 4) 0.05- 0.08	
TL-208	0.020	0.04(10/ 10) 0.02- 0.07	TRM 496.50	0.06(2/ 2) 0.05- 0.07	4 VALUES <LLD	
AC-228	0.060	0.23(10/ 10) 0.12- 0.37	TRM 496.50	0.32(2/ 2) 0.27- 0.37	0.07(3/ 4) 0.07- 0.08	
SR 89 2	5.000	15.34(1/ 2) 15.34- 15.34	TRM 496.50	15.34(1/ 2) 15.34- 15.34		
SR 90 2	1.000	1.20(2/ 2) 1.14- 1.25	TRM 496.50	1.20(2/ 2) 1.14- 1.25		

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 locations is indicated in parentheses (F).

Figure 10

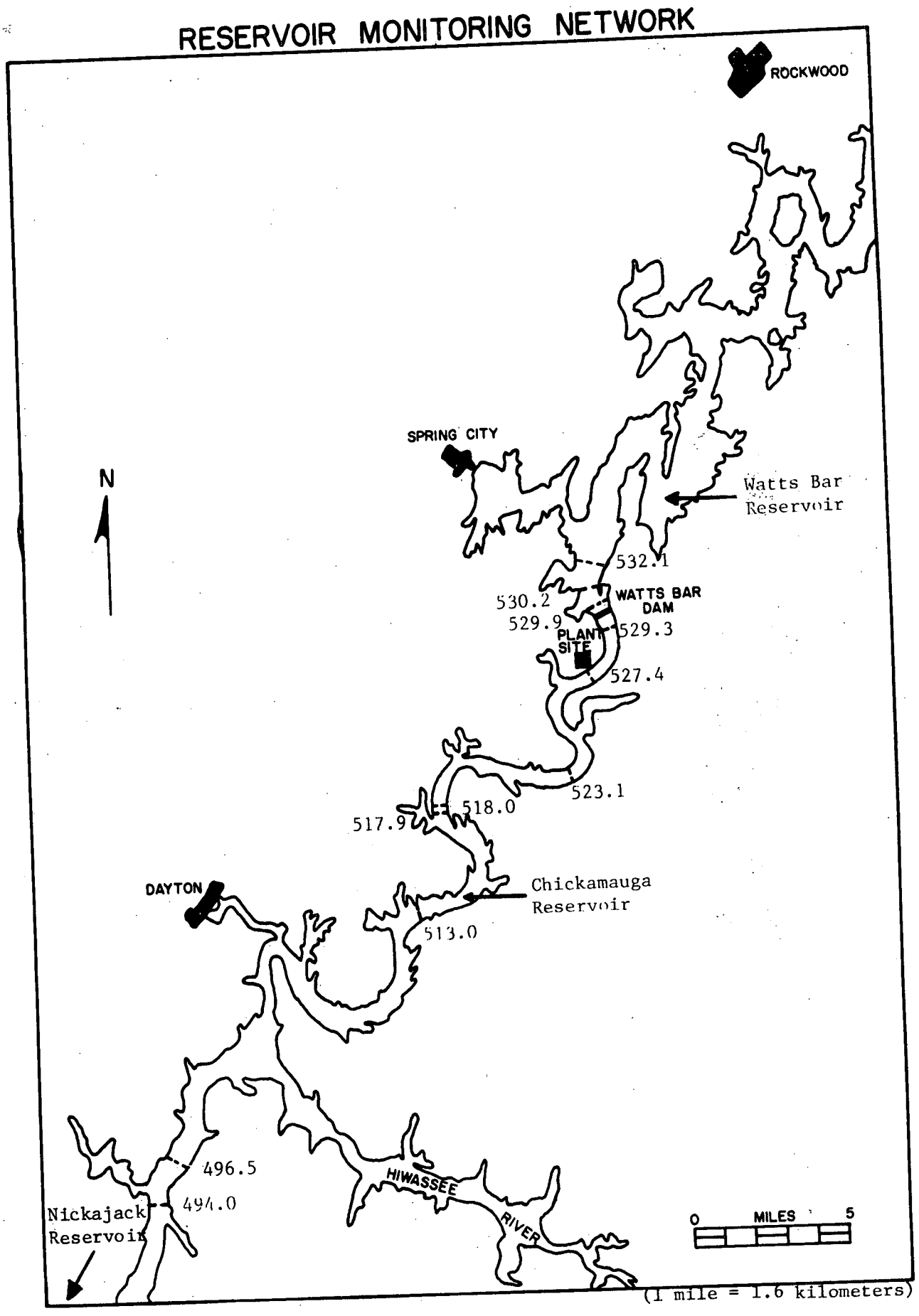

RESERVOIR MONITORING NETWORK
ROCKWOOD
SPRING CITY
N
Watts Bar
Reservoir
532.1
530.2
529.9
WATTS BAR
DAM
PLANT
SITE
529.3
527.4
523.1
518.0
517.9
DAYTON
Chickamauga
Reservoir
513.0
496.5
494.0
Nickajack
Reservoir
HIWASSEE
RIVER
0
MILES
5
(1 mile = 1.6 kilometers)

Figure 11

Annual Average

Cesium-137 in Sediment

Watts Bar Nuclear Plant

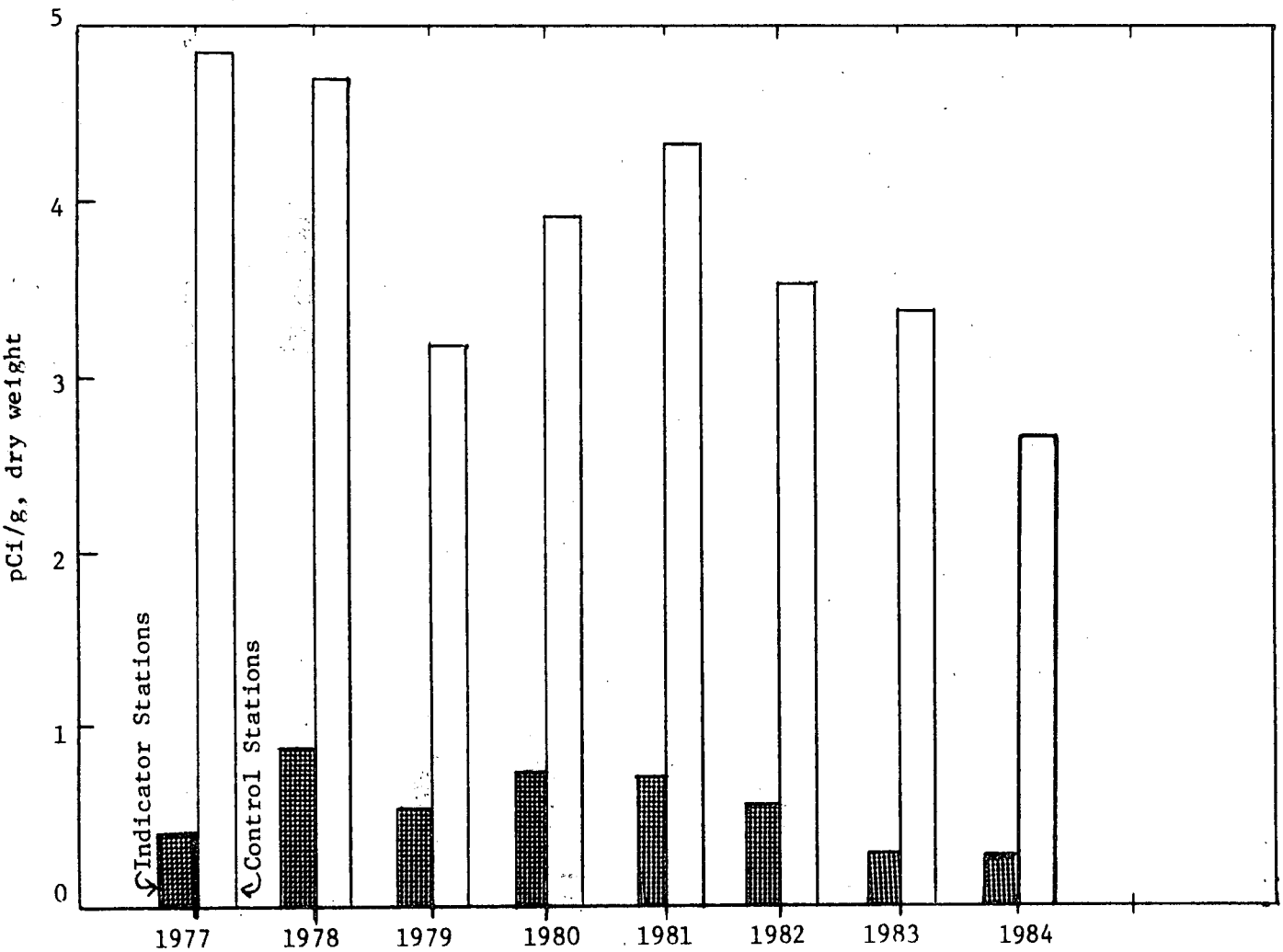
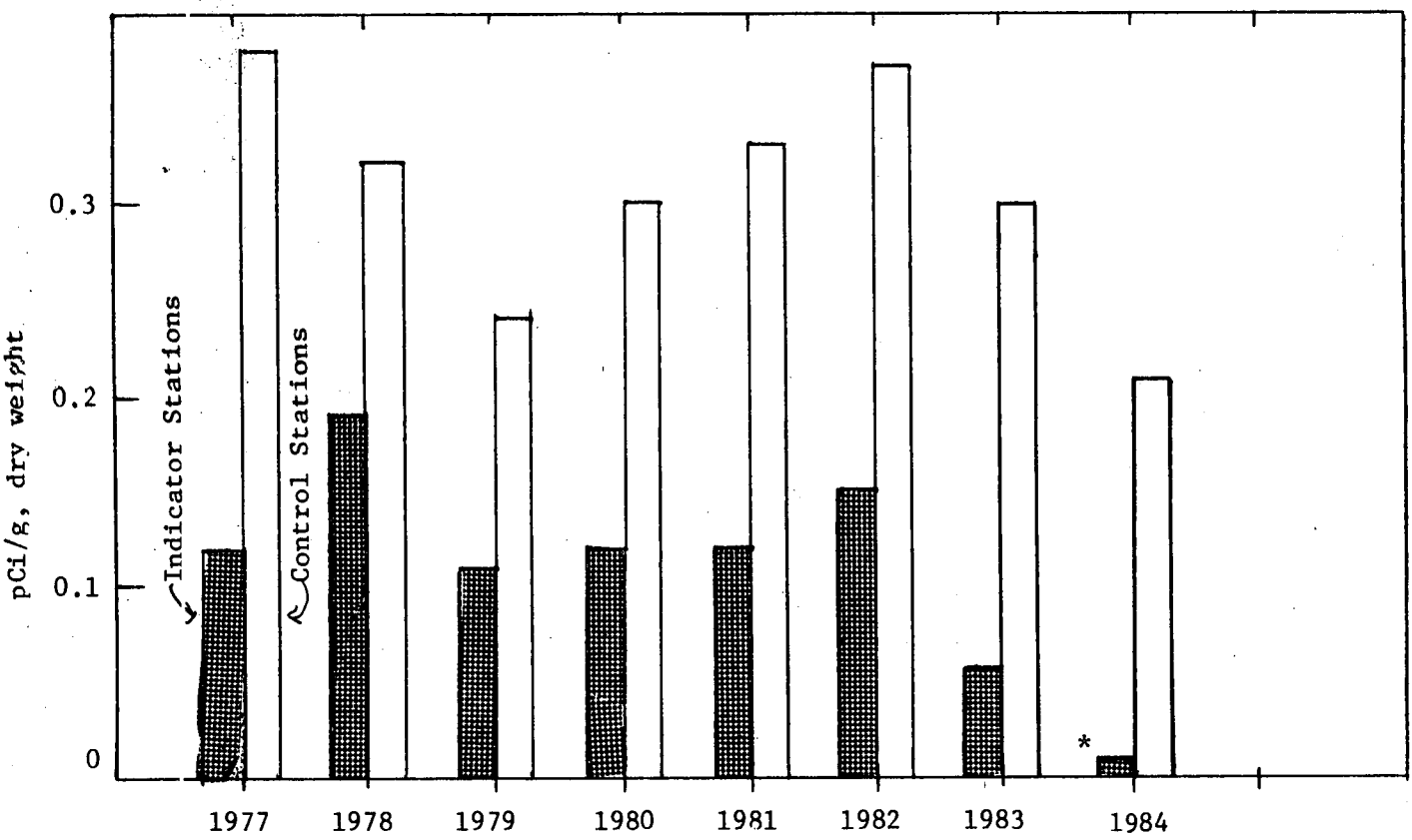


Figure 12
Annual Average
Cobalt-60 in Sediment
Watts Bar Nuclear Plant



*Less than LLD (0.01 pCi/g).

Quality Control

A quality control program has been established with the Tennessee 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 WBN 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, fallout from nuclear weapons testing, or other nuclear operations in the area.