TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

June 20, 1983

IE HQ FILE COPY

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

In the Matter of the	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

Enclosed are 20 copies of the following report prepared by the Tennessee Valley Authority pertaining to environmental monitoring at the Watts Bar Nuclear Plant.

Environmental Radioactivity Levels
Watts Bar Nuclear Plant - Annual Report 1982

Very truly yours

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 20th day of June 1983

Bryant M. Lowery
Notary Public
My Commission Expires 4/8/86

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

IE25

ENVIRONMENTAL RADIOACTIVITY LEVELS
WATTS BAR NUCLEAR PLANT
Annual Report 1982
TVA/POWER/RHS

May 1983

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ENVIRONMENTAL RADIOACTIVITY LEVELS

WATTS BAR NUCLEAR PLANT

1982

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 1983.

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 man-made radioactivity in the environment near the plant site. This report presents the results obtained from that program during 1982.

The Radiological Health Staff (Office of Power) and the Office of Natural Resources carried out the sampling program outlined in tables 1 and 27. 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, and Eastern Area Radiological Laboratory (EARL) at Vonore, Tennessee, with EARL being the primary laboratory for samples from WBN. Alpha and beta analyses were performed on Beckman Low Beta II, Beckman Wide Beta II, and Tennelec LB5100 low-background proportional counters. Nuclear Data (ND) Model 100 multichannel analyzer systems employing sodium iodide, NaI(Tℓ), detectors and ND Model 4420 Systems in conjunction with germanium, Ge(Li), detection systems were used to analyze the samples for specific gamma-emitting radionuclides. At EARL, an ND Model 6620 system is used with both types of detectors. Samples of water, vegetation, air particulates, food crops, and charcoal (specific analysis for ^{131}I) are routinely counted with NaI(Tℓ) detection systems. If significant concentrations of radioisotopes are identified, or if there is a reasonable expectation of increased radioactivity levels (such as during periods of increased fallout), these samples are counted on the Ge(Li) systems. Identification of gamma-emitting radionuclides in all other types of samples is routinely performed by analysis on the Ge(Li) system. TVA-fabricated and Tennelec beta-gamma coincidence counting systems are utilized for the determination of ^{131}I concentrations in milk. Tritium determinations are made with Beckman LS150, Beckman LS100C, and Packard Model 3250 liquid scintillation counting systems.

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

The detection capabilities for environmental sample analysis given as the nominal lower limits of detection (LLD) are listed in table 3. Samples processed by NaI(Tℓ) gamma spectroscopy were analyzed for 14 specific gamma-emitting radionuclides and radionuclide combinations[a]. For these analyses, radionuclide combinations such as ^{103,106}Ru and ^{95}Zr-Nb are analyzed as one radionuclide. All photopeaks found in Ge(Li) spectra were identified and quantified. Many of the isotopes identified by Ge(Li) spectral analysis are naturally occurring or naturally produced radioisotopes, such as ^{7}Be, ^{40}K, ^{212}Bi, ^{214}Bi, ^{212}Pb, ^{214}Pb, ^{226}Ra, etc. LLDs for the analysis of the radionuclides listed below[a] are given in table 3B. LLDs for additional radionuclides identified by Ge(Li) analysis were calculated for each analysis and nominal values are listed in the appropriate data tables. In the instance where an LLD has not been established, an LLD value of zero was assumed. A notation in a table of "__ values <LLD" for an isotope with no established LLD does not imply a value less than 0; rather, it indicates that the isotope was not identified in that specific group of samples. For each sample type, only the radionuclides for which values greater than the LLD were reported are listed in the data tables.

TVA's radioanalytical laboratories participate in the Environmental Radioactivity Laboratory Intercomparison Studies Program conducted by EPA-Las Vegas. This program provides periodic cross-check samples of the type and radionuclide composition normally analyzed in an environmental monitoring program. Routine sample handling and analysis procedures were employed in the evaluation of these samples. The results received during calendar year 1982 are shown in table 4. The ±3σ limits based on one measurement were divided by the square root of 3 to correct for triplicate determinations.

---

[a]The following radionuclides and radionuclide combinations are quantified by the ALPHA-M least-squares computer code: ^{141,144}Ce; ^{51}Cr; ^{131}I; ^{103,106}Ru; ^{134}Cs; ^{137}Cs; ^{95}Zr-Nb; ^{58}Co; ^{54}Mn; ^{65}Zn; ^{59}Fe; ^{60}Co; ^{40}K; and ^{140}Ba-La.

Table 1
ENVIRONMENTAL RADIOACTIVITY SAMPLING SCHEDULE

Station Location	Air Filter	Charcoal Filter	Rain-water	Heavy Particle Fallout	Atmospheric Moisture	Soil	Vegetation	Milk	Well Water	Public Water	Aquatic Life and Sediment
Site SSW	W	W	M	M	BW	S					
Site N	W	W	M	M	BW	S					
Smith Bend	W	W	M	M		S	Q		M		
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	W	W	M	M		S					
Rockwood	W	W	M	M		S					
Dayton	W	W	M	M	BW	S				M	
Farm H							Q	M	M[a]		
Farm L							Q	M	M[a]		
Farm Mo							Q	M	M[a]		
Control Farms							Q	M[b]	M[b]		
Onsite Wells (7)									M		
Watts Bar Reservation									M	M	
C. F. Industries										M	
Chickamauga/Watts Bar Reservoirs											Q[c]

W - Weekly BW - Biweekly M - Monthly (every 4 weeks) Q - Quarterly S - Semiannually a. Considered as controls for well water. b. Control farms are also part of SQN program and some locations are sampled weekly. c. Some control samples are part of the SQN program and are collected semiannually.

Table 2

ENVIRONMENTAL MONITORING STATION LOCATIONS

WATTS BAR NUCLEAR PLANT

Sample Station	Approximate Distance and Direction from Plant		
Indicator Stations			
LM-1 WB	1/2 mile	(3/4 kilometers)	SSW
LM-2 WB	1/2 mile	(3/4 kilometers)	N
PM-1 WB, Smith Bend	3-1/2 miles	(5-1/2 kilometers)	SW
PM-2 WB, Spring City, TN	7 miles	(11-1/4 kilometers)	NW
PM-3 WB, Cedine Camp	11-1/2 miles	(18-1/2 kilometers)	NNE
PM-4 WB, Ten Mile, TN	7-3/4 miles	(12-1/2 kilometers)	NE
PM-5 WB, Decatur, TN	6-1/4 miles	(10 kilometers)	S
PM-6 WB, Goodfield, TN	9 miles	(14-1/2 kilometers)	SSW
Farm H[a]	4-3/4 miles	(7-3/4 kilometers)	W
Farm L[a]	1-1/2 miles	(2 kilometers)	SSW
Farm Mo[a]	4-1/2 miles	(7-1/4 kilometers)	NW
Control Stations			
RM-1 WB, Rockwood, TN	17-1/4 miles	(27-3/4 kilometers)	NNE
RM-2 WB, Dayton, TN (Identical with RM-2 SQ, Sequoyah Nuclear Plant)	15 miles	(24-1/4 kilometers)	SW
Farm S	19-1/2 miles	(31-1/3 kilometers)	SW
Farm B	15 miles	(24-1/4 kilometers)	E
Farm C	16 miles	(25-3/4 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	Vegetation and grain pCi/g, dry	Soil and Sediment pCi/g, dry	Fish, clam flesh, plankton, pCi/g, dry	Clam shells pCi/g, dry	Foods, meat, poultry, pCi/kg, wet	Milk pCi/l
Total α			-	0.4	0.01				1.5	
Gross α	0.005			2.0	0.05	0.35	0.1	0.7		
Gross β	0.01		0.05	2.4	0.20	0.70	0.1	0.7	25	
^{3}H				330						
^{131}I		0.02								0.5
^{89}Sr	0.005			10	0.25	1.5	0.5	5.0	40	10
^{90}Sr	0.001			2	0.05	0.3	0.1	1.0	8	2

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

Table 3

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

B. Gamma Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)

	Air particulates pCi/m³		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 petrie dishes centered on the detector endcap. The counting system consists of a ND-4420 multichannel analyzer and either a 25%, 14%, 16%, or 29% Ge(Li) detector. The counting time is normally 8 hours. All spectral analysis is performed using the software provided with the ND-4420. The assumption is made that all samples are analyzed within one week of the collection date.

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

Table 4

Results Obtained in Interlaboratory Comparison Program

A. Air Filter (pCi/filter)

Date	Gross Alpha			Gross Beta			Strontium-90			Cesium-137		
	EPA value (±3σ)	TVA AVG. WARL[a]	TVA AVG. EARL[b]	EPA value (±3σ)	TVA AVG. WARL	TVA AVG. EARL	EPA value (±3σ)	TVA AVG. WARL	TVA AVG. EARL	EPA value (±3σ)	TVA AVG. WARL	TVA AVG. EARL
3/82	27±12	23	28	55±9	63	56	16±2.6	16	15	23±9	24	24
9/82	32±14	28	28	67±9	57[c]	52[c]	20±2.6	17[d,g]	14[g]	27±9	22	22

B. Tritium in Urine (pCi/L)

Date	EPA Value (±3σ)	TVA AVERAGE	
		WARL	EARL
5/82	1300±575	1793	1650[e]
12/82	3830±641	3510	4023

Table 4 (Continued)

Results Obtained in Interlaboratory Comparison Program

C. Radiochemical Analysis of Water (pCi/L)

Date	Gross Alpha EPA value (±3σ)	Gross Alpha TVA WARL	Gross Alpha AVG. EARL	Gross Beta EPA value (±3σ)	Gross Beta TVA WARL	Gross Beta AVG. EARL	Strontium - 89 EPA value (±3σ)	Strontium - 89 TVA WARL	Strontium - 89 AVG. EARL	Strontium - 90 EPA value (±3σ)	Strontium - 90 TVA WARL	Strontium - 90 AVG. EARL	Tritium EPA value (±3σ)	Tritium TVA WARL	Tritium AVG. EARL	Iodine -131 EPA value (±3σ)	Iodine -131 TVA WARL	Iodine -131 AVG. EARL
1/82	24±10	20	19	32±9	33	28	21±9	20	22	12±2.6	13	12				8.4±2.6[h]	8.7	7.3
2/82													1820±592	2007	1793			
3/82	19±9	19	20	19±9	19	20												
4/82													2860±624	2907	2923	62±11	61	61
5/82	27.5±12	27	38.3	29±9	26	33	22±9	24	22	13±2.6	11	8[g]						
6/82													1830±589	1620	1810	4.4±1.2[h]	5.3	3.6
7/82	16±9	13	32[f]	23±9	20	21												
8/82													2890±624	2903	2793			
9/82	29±13	26	--[f]	40±9	38	--[f]	24.5±9	30	21	14.5±2.6	13.8	14.8				87±15	93	79
10/82													2560±606	2690	2510			
11/82	19±9	19	15[f]	24±9	22	23												
12/82													1990±598	1943	1993	37±10	37	39

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

Date	Chromium - 51 EPA value (±3σ)	Chromium - 51 TVA WARL	Chromium - 51 AVG. EARL	Cobalt - 60 EPA value (±3σ)	Cobalt - 60 TVA WARL	Cobalt - 60 AVG. EARL	Zinc - 65 EPA value (±3σ)	Zinc - 65 TVA WARL	Zinc - 65 AVG. EARL	Ruthenium - 106 EPA value (±3σ)	Ruthenium - 106 TVA WARL	Ruthenium - 106 AVG. EARL	Cesium - 134 EPA value (±3σ)	Cesium - 134 TVA WARL	Cesium - 134 AVG. EARL	Cesium - 137 EPA value (±3σ)	Cesium - 137 TVA WARL	Cesium - 137 AVG. EARL
2/82	0	<44	<35	20±9	21	22	15±9	16	16	20±9	<40	<30	22±9	21	19	23±9	24	22
6/82	23±9	<44	<35	29±9	32	34	26±9	29	26	0	<40	<30	35±9	31	32	25±9	24	27
10/82	51±9	55[d]	<35[i]	20±9	18[d]	21	24±9	25[d]	25	30±9	39[d]	<36	19±9	19[d]	17	20±9	20[d]	22

Table 4 (Continued)

Results Obtained in Interlaboratory Comparison Program

E. Milk (pCi/L)

Date	Strontium - 89 EPA value (±3σ)	Strontium - 89 TVA WARL	Strontium - 89 AVG. EARL	Strontium - 90 EPA value (±3σ)	Strontium - 90 TVA WARL	Strontium - 90 AVG. EARL	Iodine - 131 EPA value (±3σ)	Iodine - 131 TVA WARL	Iodine - 131 AVG. EARL	Cesium - 137 EPA value (±3σ)	Cesium - 137 TVA WARL	Cesium - 137 AVG. EARL	Barium - 140 EPA value (±3σ)	Barium - 140 TVA WARL	Barium - 140 AVG. EARL	Potassium[j] EPA value (±3σ)	Potassium[j] TVA WARL	Potassium[j] AVG. EARL	Cobalt - 60 EPA value (±3σ)	Cobalt - 60 TVA WARL	Cobalt - 60 AVG. EARL
4/82	25±9	29	28	16±2.6	16	13[k]				28±9	31	30	0	<25	<15	1500±130	1590	1413	30±6	32	29
7/82							5.4±1.4[h]	6.7	5.1												
10/82	0	<10	<10	18.6±2.6	19.5	19.2[k]	42±10	43	42	34±9	34	35	0	<25	<20	1560±135	1563	1639			

F. Foods (pCi/kg, Wet Weight)

Date	Strontium - 89 EPA value (±3σ)	Strontium - 89 TVA WARL	Strontium - 89 AVG. EARL	Strontium - 90 EPA value (±3σ)	Strontium - 90 TVA WARL	Strontium - 90 AVG. EARL	Iodine - 131 EPA value (±3σ)	Iodine - 131 TVA WARL	Iodine - 131 AVG. EARL	Cesium 137 EPA value (±3σ)	Cesium 137 TVA WARL	Cesium 137 AVG. EARL	Barium - 140 EPA value (±3σ)	Barium - 140 TVA WARL	Barium - 140 AVG. EARL	Potassium[j] EPA value (±3σ)	Potassium[j] TVA WARL	Potassium[j] AVG. EARL
7/82	26±9	30	28	20±2.6	26[g,k]	27[k]	94±15	98	98	20±9	24	26	0	<25	<14	2400±208	2810[g]	2733[g]
11/82	0	<10	<40[d]	27.8±2.6	30.6[k]	24[d,k]	25±10	20	29	27±9	28	27	0	<25	<14	2780±242	2670	2903

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

[b] Eastern Area Radiological Laboratory, Vonore, Tennessee

[c] No known explanation. Investigation underway.

[d] Analysis completed after report date

[e] Equipment malfunction, analysis completed after report date

[f] Poor analysis. Equipment taken out of service for recalibration. Further results satisfactory.

[g] Previous and Subsequent results satisfactory. No known explanation.

[h] NRC/EPA Low-level ^{131}I study.

[i] Experimental detection limit is being reviewed.

[j] Potassium values are mg/l or mg/kg.

[k] Review of procedure is in progress.

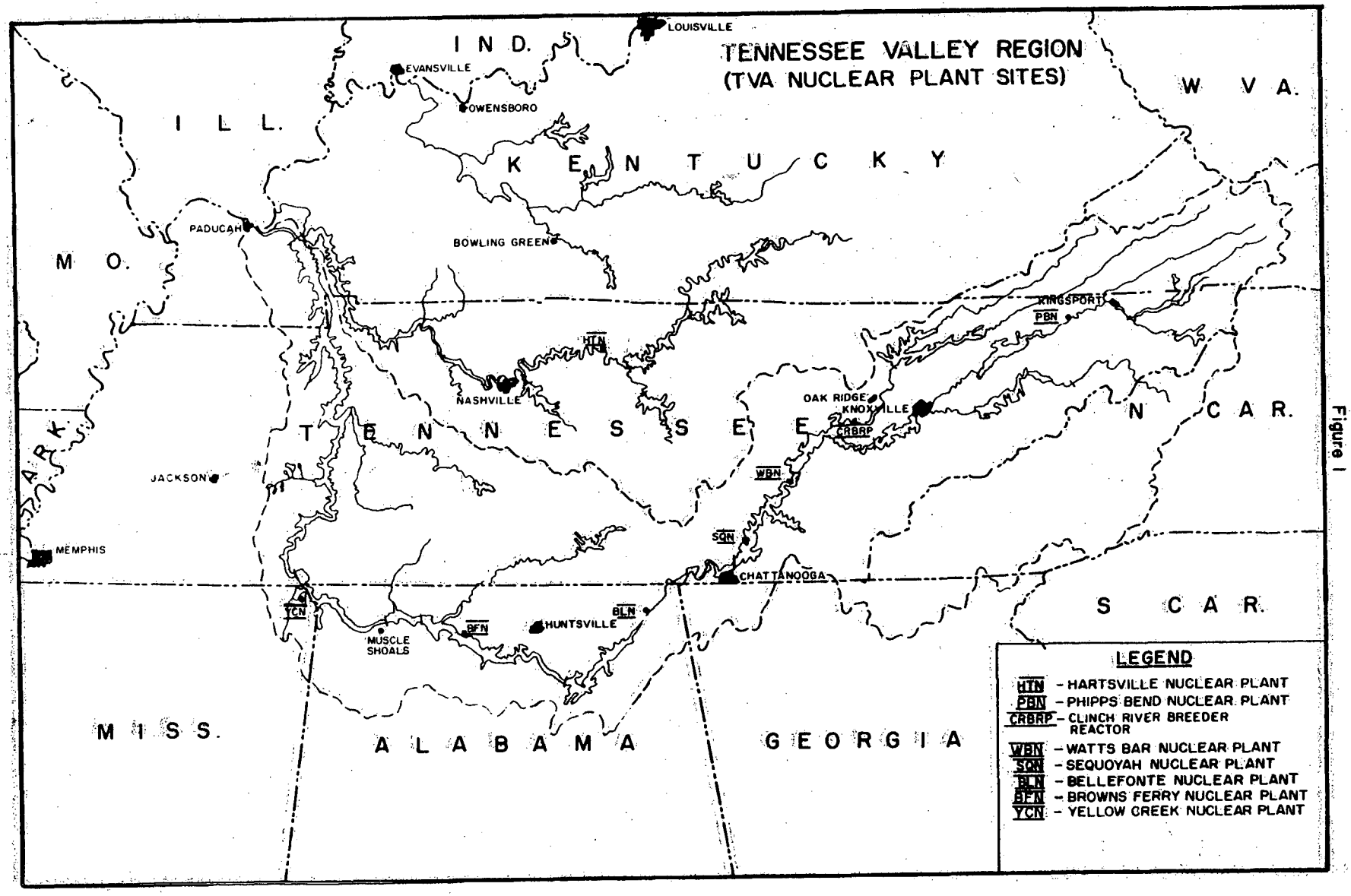

TENNESSEE VALLEY REGION
(TVA NUCLEAR PLANT SITES)
LOUISVILLE
I N D.
EVANSVILLE
OWENSBORO
W V A.
I L L.
K E N T U C K Y
PADUCAH
BOWLING GREEN
M O.
KINGSPORT
PBN
HTN
NASHVILLE
OAK RIDGE
KNOXVILLE
CRBRP
T E N N E S S E E
N C A R.
ARK.
JACKSON
WBN
SQN
MEMPHIS
CHATTANOOGA
S C A R.
YCN
BLN
BFN
HUNTSVILLE
MUSCLE SHOALS
M I S S.
A L A B A M A
G E O R G I A
LEGEND
HTN - HARTSVILLE NUCLEAR PLANT
PBN - PHIPPS BEND NUCLEAR PLANT
CRBRP - CLINCH RIVER BREEDER REACTOR
WBN - WATTS BAR NUCLEAR PLANT
SQN - SEQUOYAH NUCLEAR PLANT
BLN - BELLEFONTE NUCLEAR PLANT
BFN - BROWNS FERRY NUCLEAR PLANT
YCN - YELLOW CREEK NUCLEAR PLANT

Figure I

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 11 miles (18 kilometers) from the plant in the towns of Spring City and Decatur, and in four other populated areas. The remote air monitors are located at distances out to 17 miles (27 kilometers) from the plant in the towns of Dayton and Rockwood. See table 2 and figures 2, 3, and 7.

At each monitor, air is continuously pulled through a Hollingsworth and Vose LB 5211 glass fiber filter at a flow rate of 3 ft^3/min (0.085 m^3/min). In series with, but downstream of, the particulate filter, is a charcoal filter used to collect iodine. Each monitor has a collection tray and storage container to collect rainwater on a continuous basis, and a horizontal platform covered with gummed acetate to catch and hold heavy particle fallout. Moisture is collected from the atmosphere at each local monitor and at one remote monitor and analyzed for tritium.

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. The data from the two local monitors and from perimeter monitors (PM) 1, 2, 4, and 5 are radiotelemetered into the plant control room.

Air filters are collected weekly and analyzed for gross beta activity. During this period, six samples were not obtained because of equipment malfunction. No analyses are performed until three days after sample collection. The samples are composited monthly for analysis of specific gamma-emitting radionuclides and quarterly for ^{89}Sr, ^{90}Sr analysis. Five samples were lost or destroyed during strontium analysis. The results are presented in table 6.

The annual averages of the gross beta activity in the air particulate filters at the indicator stations (local and perimeter monitors) and at the control stations (remote monitors) for the years 1977 through 1982 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 is collected and analyzed 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 analyzed for gross beta and tritium activity. During this period, one sample contained insufficient volume for any analyses. Another sample was missed due to equipment malfunction. 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.

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.

Charcoal filters are collected and analyzed for radioiodine. During this period, six samples were not obtained because of equipment malfunction. The filter is counted in a single channel analyzer system. The data are shown in table 9.

An atmospheric moisture collection device containing molecular sieve is located at each local monitor and at one remote monitor. Samples are taken every other week, the moisture 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, four samples were not obtained because of equipment malfunction, one sample was lost during analysis, and one sample contained insufficient volume for analysis.

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
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

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 514	0.010	0.03(407/ 411) 0.01- 0.14	PM1 PETTY FARM 3.75 MILES WSW	0.04(51/ 51) 0.01- 0.14	0.02(100/ 103) 0.01- 0.07	
GAMMA (GELI) 130						
K-40	NOT ESTAB	0.02(93/ 104) 0.00- 0.07	PM5 DECATUR 6.25 MILES S	0.02(11/ 13) 0.01- 0.05	0.02(25/ 26) 0.00- 0.07	
BI-214	0.020	0.03(9/ 104) 0.02- 0.04	PM6 GOODFIELD 9.0 MILES SSW	0.03(2/ 13) 0.03- 0.03	0.03(3/ 26) 0.02- 0.05	
PB-214	0.020	0.03(8/ 104) 0.02- 0.04	PM4 TEN MILE 7.75 MILES NE	0.04(1/ 13) 0.04- 0.04	0.03(3/ 26) 0.02- 0.04	
PB-212	NOT ESTAB	0.00(56/ 104) 0.00- 0.00	PM4 TEN MILE 7.75 MILES NE	0.00(10/ 13) 0.00- 0.00	0.00(16/ 26) 0.00- 0.00	
BE-7	0.050	0.06(59/ 104) 0.05- 0.08	PM6 GOODFIELD 9.0 MILES SSW	0.07(8/ 13) 0.06- 0.08	0.06(15/ 26) 0.05- 0.07	
TL-208	NOT ESTAB	0.00(50/ 104) 0.00- 0.00	PM2 SPRING CITY 7.0 MILES NW	0.00(5/ 13) 0.00- 0.00	0.00(11/ 26) 0.00- 0.00	
AC-228	NOT ESTAB	0.00(25/ 104) 0.00- 0.01	PM6 GOODFIELD 9.0 MILES SSW	0.00(4/ 13) 0.00- 0.01	0.00(2/ 26) 0.00- 0.00	
PA-234M	NOT ESTAB	104 VALUES <LLD			0.35(2/ 26) 0.18- 0.53	
SR 89 35	0.005	31 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	
SR 90 35	0.001	31 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	

a. Nominal Lower Limit of Detection (LLD) as described in Table 3.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements 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 RHEA TENNESSEE — REPORTING PERIOD 1982

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 12	2.400				3.75(8/ 12) 2.75- 7.53	
GAMMA (GELI) 128						
K-40	NOT ESTAB	16.71(49/ 103) 0.01- 51.99	PM3 CEDINE BIBLE CAMP 11.5 M. NNE	31.12(9/ 13) 16.48- 43.47	17.92(16/ 25) 1.88- 44.54	
BI-214	NOT ESTAB	6.69(48/ 103) 0.00- 18.35	PM1 PETTY FARM 3.75 MILES WSW	10.12(4/ 13) 2.79- 14.61	4.63(13/ 25) 0.52- 23.16	
PB-214	NOT ESTAB	4.46(32/ 103) 0.26- 13.65	PM2 SPRING CITY 7.0 MILES NW	6.95(2/ 13) 0.26- 13.65	4.55(4/ 25) 0.77- 11.60	
PB-212	NOT ESTAB	2.05(30/ 103) 0.02- 6.65	LM2 N. WBSP GATE 0.5 MILES N	2.92(4/ 13) 0.25- 6.32	2.08(14/ 25) 0.11- 4.70	
BE-7	NOT ESTAB	48.21(39/ 103) 35.13- 119.20	PM6 GOODFIELD 9.0 MILES SSW	58.72(6/ 13) 42.37- 119.20	45.27(14/ 25) 30.48- 73.46	
SR 89 128	10.000	103 VALUES <LLD ANALYSIS PERFORMED			25 VALUES <LLD	
SR 90 128	2.000	2.79(1/ 103) 2.79- 2.79	PM3 CEDINE BIBLE CAMP 11.5 M. NNE	2.79(1/ 13) 2.79- 2.79	3.49(1/ 25) 3.49- 3.49	
TRITIUM 12	330.000	0 VALUES <LLD ANALYSIS PERFORMED			12 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 RHEA TENNESSEE — REPORTING PERIOD 1982

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	0.050	0.14(101/ 104)	LM2 N. WBSP GATE	0.33(13/ 13)	0.11(26/ 26)	
130		0.05- 0.48	0.5 MILES N	0.20- 0.48	0.06- 0.22	

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 9

RADIOACTIVITY IN CHARCOAL FILTERS

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 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
IODINE IN AIR	0.020	0.02(9/ 411)	PM5 DECATUR	0.02(2/ 51)	0.02(4/ 103)	
514		0.02- 0.02	6.25 MILES S	0.02- 0.02	0.02- 0.02	

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

TABLE 10

RADIOACTIVITY IN ATMOSPHERIC MOISTURE

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

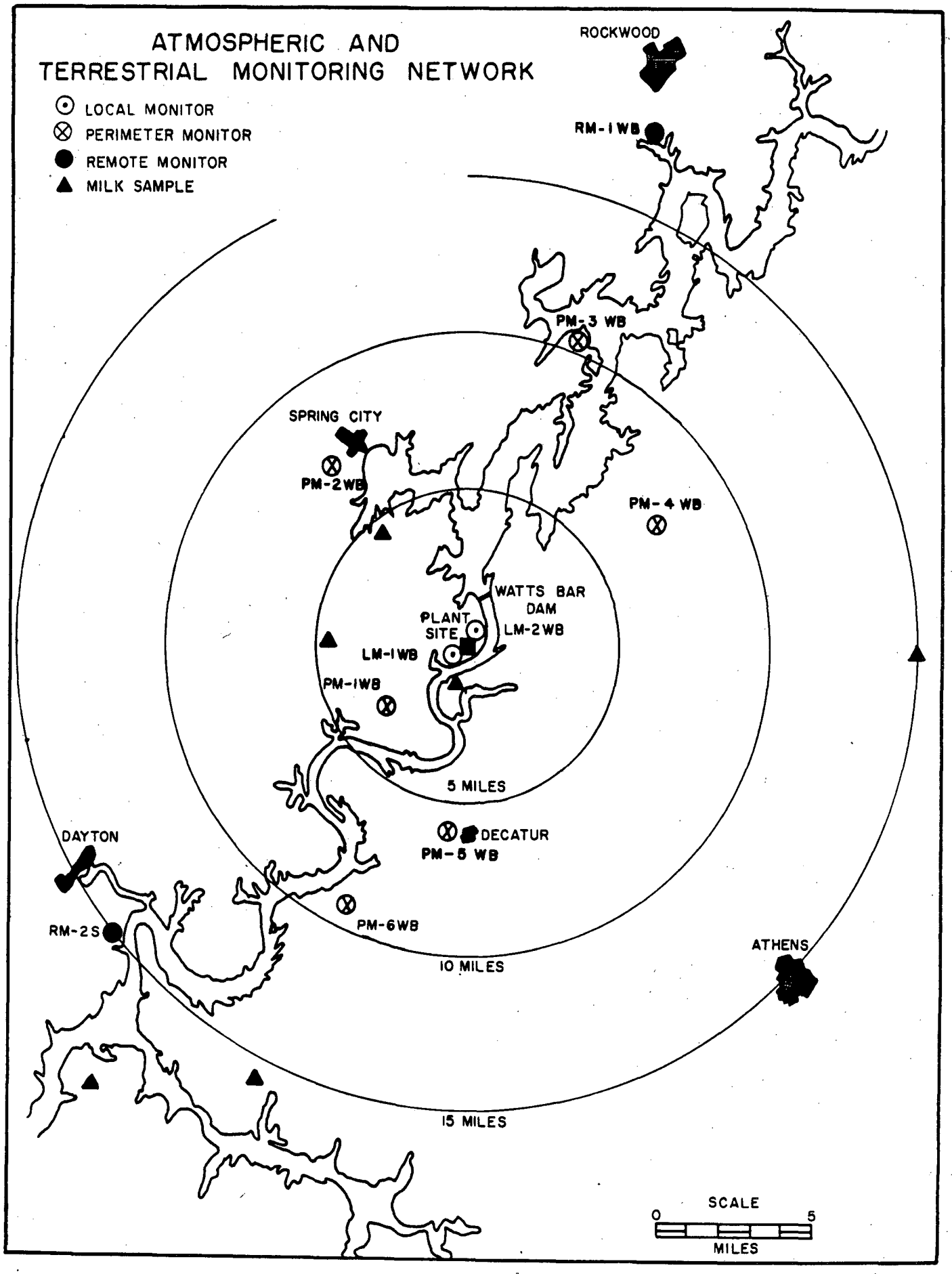
NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

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
TRITIUM 72	NOT ESTAB	5.82(46/ 46) 1.02- 16.88	LM2 N. WBSP GATE 0.5 MILES N	5.88(23/ 23) 1.02- 16.88	7.28(26/ 26) 1.33- 20.32	

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

Figure 2



(1 mile - 1.6 kilometers)

Figure 3

WATTS BAR NUCLEAR PLANT
SITE MONITORING STATIONS

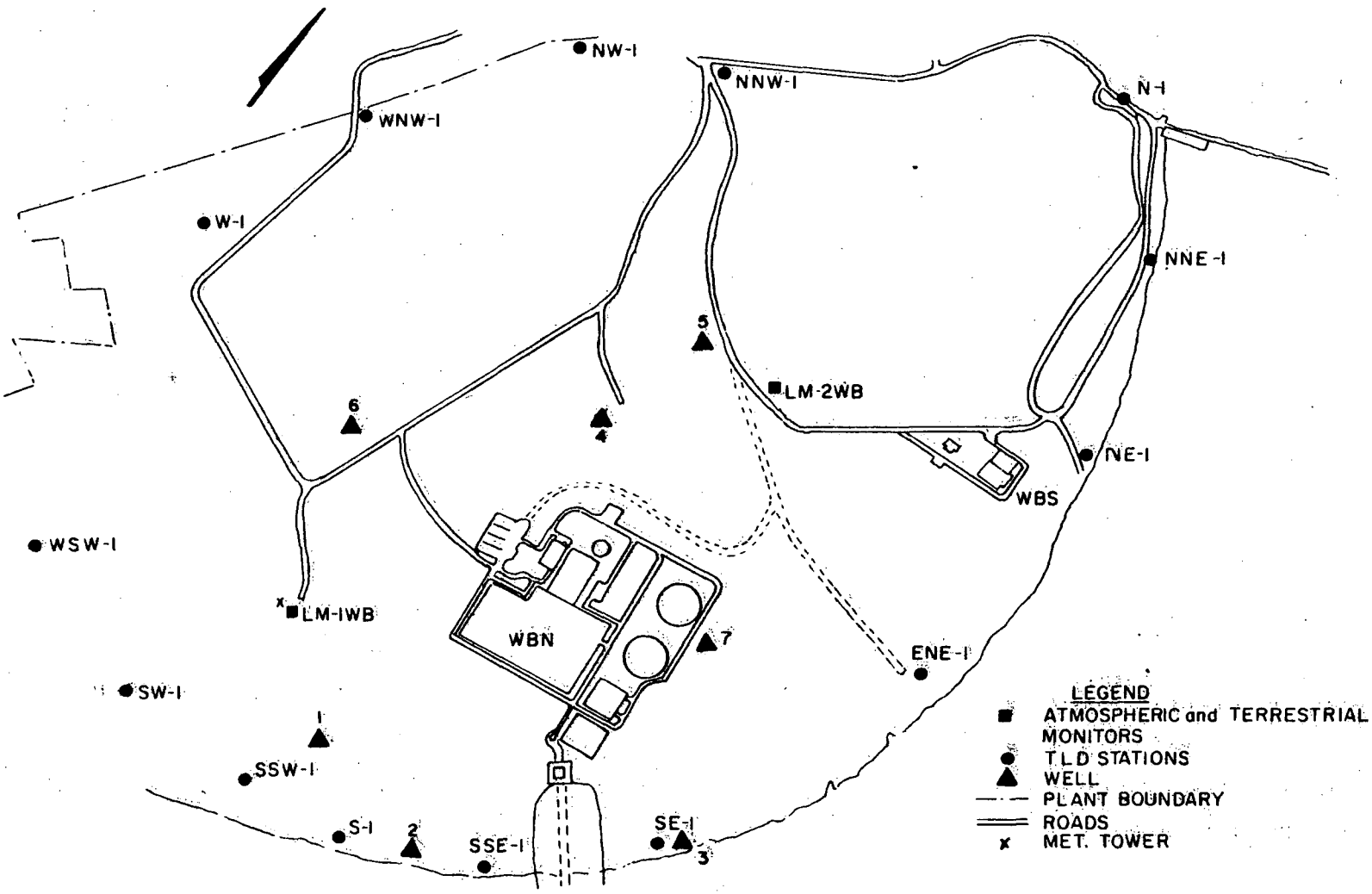
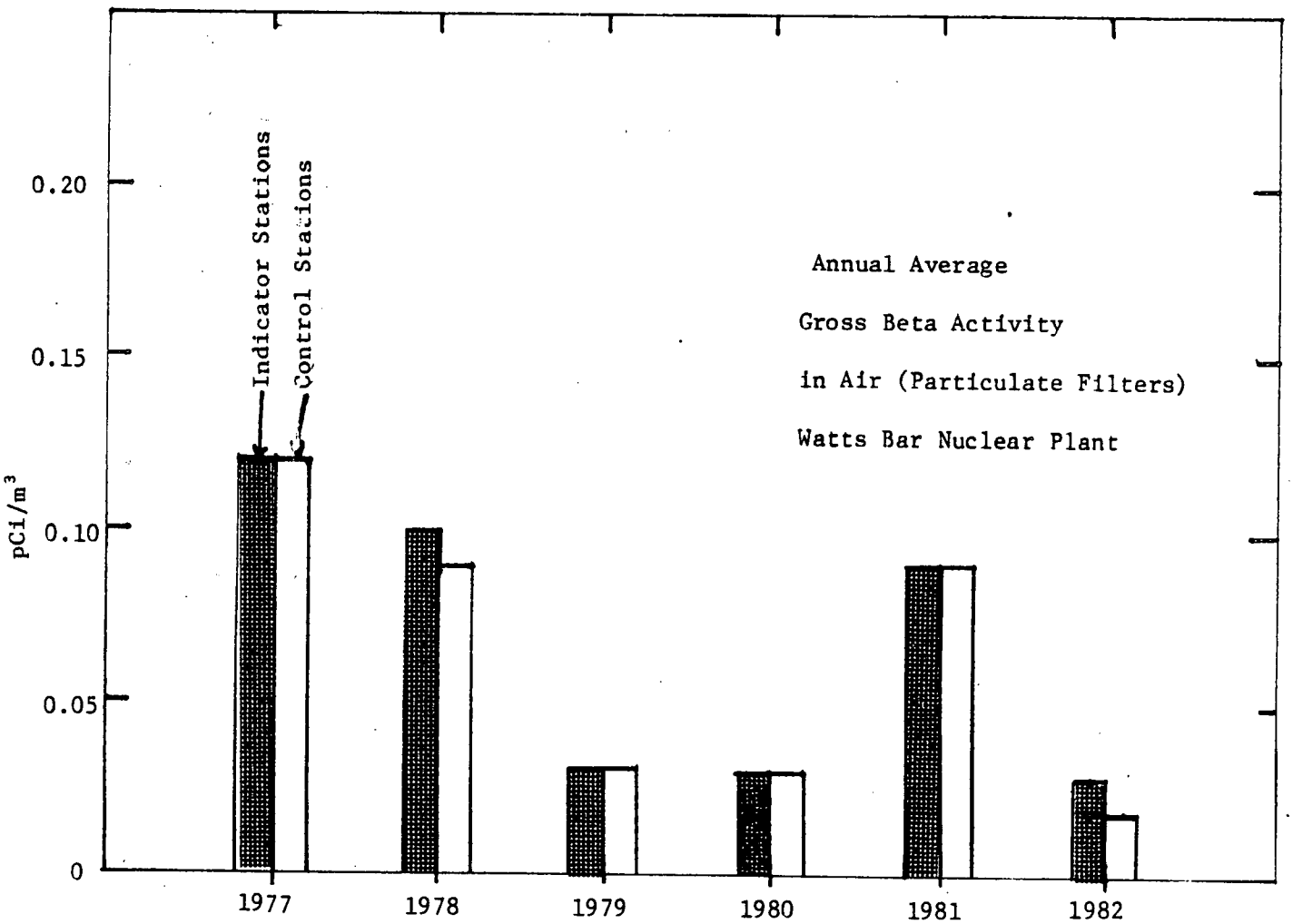


Figure 4


Indicator Stations
Control Stations
Annual Average
Gross Beta Activity
in Air (Particulate Filters)
Watts Bar Nuclear Plant
pCi/m³
0.20
0.15
0.10
0.05
0
1977
1978
1979
1980
1981
1982

Terrestrial Monitoring

Milk

Milk samples were collected monthly from one indicator station until February 1982, when two additional stations were added. Weekly samples were taken at three control stations (these control stations are part of an ongoing SQN sampling program). All monthly and weekly samples and composites are analyzed for I-131. Monthly samples are also analyzed for gamma-emitting radionuclides and strontium. Only four samples for I-131 analysis were lost or destroyed; therefore, results for these samples are not available. Table 11 gives the results of laboratory analysis.

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

This phenomenon was observed during preoperation 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 was observed at a small dairy farm near the Watts Bar Nuclear Plant. 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 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. 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 gives the results obtained from the laboratory analyses.

Soil

Soil samples were collected semiannually near each monitoring station to provide an indication of any long-term buildup of radioactivity in the environment. One additional sample was taken at the control station

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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. 999-R-6, May 1964.

used in the SQN monitoring program. An auger or "cookie cutter" type sampler was used to obtain samples of the top two inches (5 cm) of soil. These samples were analyzed for gross beta, gamma-emitting radionuclides, ^{89}Sr, and ^{90}Sr. In addition, one sample from each station and two samples from the SQN control station were analyzed for gross beta. The results are given in table 13.

Ground Water

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, three samples were not taken because the stations were inaccessible, and one sample was not available for tritium analysis.

An automatic sequential-type sampling device was operating on a seventh well located downgradient from WBN.

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. One sample was lost during strontium analysis. Results of laboratory analysis are shown in table 15.

Figure 5 shows the trends in gross beta activity in drinking water from 1977 through 1982. The annual averages 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 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 1982. 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 Crops, Poultry, and/or Beef

Food crops, poultry, and/or beef raised in the vicinity of WBN are sampled annually as they become available during the growing season. During this sampling period, samples of apples, cabbage, corn, green beans, lettuce, potatoes, tomatoes, and turnip greens were collected and analyzed for gross beta and specific gamma-emitting radionuclides. The results are given in tables 17 through 24. Beef and poultry samples were collected and analyzed for gamma-emitting radionuclides. Analytical results are given in tables 25 and 26. No sample of poultry was taken from a control location.

TABLE 11

RADIOACTIVITY IN MILK

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (NAI)						
32						
K-40	150.000	1256.16(15/ 15) 1021.50- 1459.90	MOFFETT FARM 4.5 MILES NW	1325.82(5/ 5) 1205.40- 1459.90	1263.55(17/ 17) 1175.60- 1347.70	
IODINE-131	0.500	34 VALUES <LLD			155 VALUES <LLD	
189		ANALYSIS PERFORMED				
GAMMA (GELI)						
44						
CS-137	5.000	5.94(1/ 22) 5.94- 5.94	HOUSLEY FARM 4.75 MILES W	5.94(1/ 8) 5.94- 5.94	5.36(1/ 22) 5.36- 5.36	
K-40	NOT ESTAB	1320.93(22/ 22) 978.03- 1501.55	LAYMAN FARM 1.5 MILES SSW	1407.00(7/ 7) 1314.60- 1501.55	1313.53(22/ 22) 844.40- 1476.74	
BI-214	NOT ESTAB	6.96(11/ 22) 0.60- 14.65	LAYMAN FARM 1.5 MILES SSW	7.51(3/ 7) 0.60- 13.52	9.71(12/ 22) 2.30- 30.53	
PB-214	NOT ESTAB	4.41(6/ 22) 0.94- 7.15	LAYMAN FARM 1.5 MILES SSW	6.44(2/ 7) 6.18- 6.71	7.41(8/ 22) 1.13- 13.93	
PB-212	NOT ESTAB	2.27(11/ 22) 0.03- 5.57	LAYMAN FARM 1.5 MILES SSW	5.48(2/ 7) 5.40- 5.57	2.39(6/ 22) 0.98- 5.05	
TL-208	NOT ESTAB	1.61(3/ 22) 0.78- 2.91	LAYMAN FARM 1.5 MILES SSW	2.91(1/ 7) 2.91- 2.91	2.24(4/ 22) 0.67- 4.15	
AC-228	NOT ESTAB	0.19(1/ 22) 0.19- 0.19	MOFFETT FARM 4.5 MILES NW	0.19(1/ 7) 0.19- 0.19	22 VALUES <LLD	
SR 89	10.000	37 VALUES <LLD			39 VALUES <LLD	
76		ANALYSIS PERFORMED				
SR 90	2.000	8.40(33/ 37) 2.21- 19.55	HOUSLEY FARM 4.75 MILES W	12.19(11/ 12) 8.63- 19.55	3.11(32/ 39) 2.18- 5.79	
76						

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 1982

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						
CE-144	0.220	0.40(3/ 12)	HOUSLEY FARM	0.51(1/ 4)	0.67(6/ 39)	
		0.27- 0.51	4.75 MILES W	0.51- 0.51	0.34- 1.09	
CS-137	0.060	0.07(3/ 12)	MOFFETT FARM	0.09(1/ 4)	0.10(8/ 39)	
		0.06- 0.09	4.5 MILES NW	0.09- 0.09	0.08- 0.14	
NB-95	0.050	12 VALUES <LLD			0.09(6/ 39)	
					0.05- 0.12	
K-40	NOT ESTAB	19.93(12/ 12)	LAYMAN FARM	29.66(4/ 4)	22.29(39/ 39)	
		4.66- 34.57	1.5 MILES SSW	24.08- 34.57	3.67- 69.92	
BI-214	0.100	12 VALUES <LLD			0.24(3/ 39)	
					0.16- 0.37	
PB-214	NOT ESTAB	0.04(6/ 12)	MOFFETT FARM	0.05(2/ 4)	0.07(27/ 39)	
		0.02- 0.08	4.5 MILES NW	0.04- 0.07	0.01- 0.27	
PB-212	NOT ESTAB	0.02(10/ 12)	HOUSLEY FARM	0.03(2/ 4)	0.06(30/ 39)	
		0.00- 0.05	4.75 MILES W	0.00- 0.05	0.00- 0.17	
BE-7	NOT ESTAB	8.62(12/ 12)	MOFFETT FARM	11.00(4/ 4)	6.14(39/ 39)	
		2.01- 20.33	4.5 MILES NW	2.01- 20.33	1.32- 19.03	
TL-208	NOT ESTAB	0.02(6/ 12)	LAYMAN FARM	0.03(3/ 4)	0.02(25/ 39)	
		0.00- 0.04	1.5 MILES SSW	0.02- 0.04	0.00- 0.08	
AC-228	NOT ESTAB	0.10(3/ 12)	LAYMAN FARM	0.13(2/ 4)	0.14(19/ 39)	
		0.05- 0.16	1.5 MILES SSW	0.10- 0.16	0.04- 0.46	
SR 89	0.250	0.49(2/ 12)	HOUSLEY FARM	0.73(1/ 4)	0.38(4/ 12)	
24		0.25- 0.73	4.75 MILES W	0.73- 0.73	0.31- 0.47	
SR 90	0.050	0.22(11/ 12)	HOUSLEY FARM	0.27(4/ 4)	0.14(10/ 12)	
24		0.08- 0.51	4.75 MILES W	0.12- 0.51	0.05- 0.22	

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 1982

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 21	0.700	20.08(16/ 16) 11.87- 40.11	PM2 SPRING CITY 7.0 MILES NW	30.31(2/ 2) 20.51- 40.11	14.23(5/ 5) 9.19- 21.60	
GAMMA (GELI) 21						
CS-134	0.080	0.16(1/ 16) 0.16- 0.16	LM1 ENV DATA STA 0.5 MILES SSW	0.16(1/ 2) 0.16- 0.16	0.18(1/ 5) 0.18- 0.18	
CS-137	0.020	0.63(16/ 16) 0.15- 2.97	PM2 SPRING CITY 7.0 MILES NW	1.78(2/ 2) 0.59- 2.97	0.36(5/ 5) 0.24- 0.47	
K-40	0.250	8.22(16/ 16) 2.80- 21.28	PM2 SPRING CITY 7.0 MILES NW	14.53(2/ 2) 7.78- 21.28	3.98(5/ 5) 2.53- 6.31	
BI-214	0.050	0.88(16/ 16) 0.68- 1.07	PM1 PETTY FARM 3.75 MILES WSW	1.04(2/ 2) 1.02- 1.07	0.95(5/ 5) 0.58- 1.52	
BI-212	0.100	1.23(16/ 16) 0.71- 1.55	PM1 PETTY FARM 3.75 MILES WSW	1.42(2/ 2) 1.37- 1.46	0.94(5/ 5) 0.49- 1.61	
PB-214	0.050	0.98(16/ 16) 0.71- 1.17	PM1 PETTY FARM 3.75 MILES WSW	1.15(2/ 2) 1.14- 1.16	1.04(5/ 5) 0.63- 1.66	
PB-212	NOT ESTAB	1.17(16/ 16) 0.72- 1.38	LM2 N. WBSP GATE 0.5 MILES N	1.37(2/ 2) 1.35- 1.38	0.89(5/ 5) 0.51- 1.49	
RA-226	0.050	0.88(16/ 16) 0.68- 1.07	PM1 PETTY FARM 3.75 MILES WSW	1.04(2/ 2) 1.02- 1.07	0.95(5/ 5) 0.58- 1.52	
RA-224	NOT ESTAB	1.33(16/ 16) 0.79- 1.69	LM1 ENV DATA STA 0.5 MILES SSW	1.58(2/ 2) 1.47- 1.69	1.01(5/ 5) 0.66- 1.66	
TL-208	0.020	0.36(16/ 16) 0.21- 0.45	LM1 ENV DATA STA 0.5 MILES SSW	0.43(2/ 2) 0.40- 0.45	0.26(5/ 5) 0.16- 0.44	
AC-228	0.060	1.13(16/ 16) 0.64- 1.45	LM1 ENV DATA STA 0.5 MILES SSW	1.30(2/ 2) 1.27- 1.32	0.86(5/ 5) 0.49- 1.45	
PA-234M	NOT ESTAB	2.54(8/ 16) 1.93- 3.19	PM1 PETTY FARM 3.75 MILES WSW	2.97(1/ 2) 2.97- 2.97	3.21(2/ 5) 2.66- 3.75	
SR 89 21	1.500	2.97(3/ 16) 1.68- 3.80	PM4 TEN MILE 7.75 MILES NE	3.80(1/ 2) 3.80- 3.80	1.70(1/ 5) 1.70- 1.70	
SR 90 21	0.300	0.41(5/ 16) 0.30- 0.66	LM1 ENV DATA STA 0.5 MILES SSW	0.48(2/ 2) 0.30- 0.66	5 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 14

RADIOACTIVITY IN WELL WATER

PCI/L - 0.037 BQ/L

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

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

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) 127						
K-40	NOT ESTAB	15.55(45/ 91)	WBN WELL #4	27.73(7/ 13)	18.50(22/ 36)	
		0.12- 47.92	ONSITE NNW	6.01- 44.84	2.05- 50.37	
BI-214	NOT ESTAB	6.68(48/ 91)	WBN WELL #5	12.45(7/ 13)	10.90(22/ 36)	
		0.02- 30.34	ONSITE N	0.16- 27.31	0.05- 29.36	
PB-214	NOT ESTAB	7.39(25/ 91)	WBN WELL #2	9.99(4/ 13)	6.52(15/ 36)	
		0.18- 26.15	ONSITE SSE	0.31- 26.15	0.23- 18.90	
PB-212	NOT ESTAB	2.29(35/ 91)	WBN WELL #5	12.41(1/ 13)	1.26(15/ 36)	
		0.24- 12.41	ONSITE N	12.41- 12.41	0.05- 2.65	
TL-208	NOT ESTAB	0.94(15/ 91)	WBN WELL #1	1.18(1/ 13)	1.06(8/ 36)	
		0.21- 2.49	ONSITE S	1.18- 1.18	0.02- 3.39	
AC-228	NOT ESTAB	4.57(1/ 91)	WBN WELL #4	4.57(1/ 13)	1.00(1/ 36)	
		4.57- 4.57	ONSITE NNW	4.57- 4.57	1.00- 1.00	
TRITIUM 39	330.00	27 VALUES <LLD ANALYSIS PERFORMED			12 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 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 RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME / DISTANCE AND DIRECTION	MEAN (F)[b]	RANGE[b]	CONTROL LOCATIONS MEAN (F)[b]	RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 52	2.400	3.84(21/ 26)	CF INDUSTRIES	4.16(	9/ 13)	4.54(	1/ 26)	
		2.42- 6.66	TRM 473.0	2.42-	6.66	4.54-	4.54	
GAMMA (GELI) 52								
K-40	NOT ESTAB	20.04(10/ 26)	CF INDUSTRIES	22.70(	8/ 13)	17.45(	10/ 26)	
		0.34- 39.78	TRM 473.0	0.34-	39.78	0.31-	41.93	
BI-214	NOT ESTAB	4.35(12/ 26)	CF INDUSTRIES	6.98(	5/ 13)	7.88(	17/ 26)	
		0.04- 21.57	TRM 473.0	0.04-	21.57	0.01-	46.10	
PB-214	NOT ESTAB	4.19(7/ 26)	CF INDUSTRIES	5.69(	4/ 13)	8.56(	12/ 26)	
		0.12- 9.09	TRM 473.0	0.12-	9.09	0.98-	34.35	
PB-212	NOT ESTAB	1.73(8/ 26)	CF INDUSTRIES	1.74(	3/ 13)	0.75(	3/ 26)	
		0.06- 3.49	TRM 473.0	1.21-	2.06	0.34-	0.99	
TL-208	NOT ESTAB	1.26(6/ 26)	DAYTON, TN	1.46(	3/ 13)	1.10(	7/ 26)	
		0.12- 3.13	17.75 MILES NNE	0.26-	3.13	0.08-	2.15	
AC-228	NOT ESTAB	4.05(1/ 26)	CF INDUSTRIES	4.05(	1/ 13)	26 VALUES <LLD		
		4.05- 4.05	TRM 473.0	4.05-	4.05			
SR 89 15	10.000	7 VALUES <LLD ANALYSIS PERFORMED				8 VALUES <LLD		
SR 90 15	2.000	7 VALUES <LLD ANALYSIS PERFORMED				8 VALUES <LLD		
TRITIUM 16	330.000	397.43(3/ 8)	CF INDUSTRIES	397.60(	2/ 4)	8 VALUES <LLD		
		378.77- 416.42	TRM 473.0	378.77-	416.42			

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 - 1982
mR/Quarter[a]

Distance miles	Average External Gamma Radiation Levels[b]			
	1st Quarter (Dec 81-Feb 82)	2nd Quarter (Mar-May 82)	3rd Quarter (Jun-Aug 82)	4th Quarter (Sep-Nov 82)
0-1	19.6 ± 2.1	19.5 ± 1.7	19.4 ± 2.4	19.3 ± 2.0
1-2	20.0 ± 1.1	19.6 ± 1.2	20.2 ± 1.8	19.5 ± 1.1
2-4	16.5 ± 0.2	15.7 ± 0.1	17.2 ± 0.5	16.5 ± 0.9
4-6	17.7 ± 2.3	17.6 ± 2.4	17.7 ± 2.4	17.4 ± 2.6
>6	16.2 ± 2.3	16.2 ± 2.7	15.3 ± 2.1	15.7 ± 2.9
Average, 0-2 miles (Onsite)	19.7 ± 1.8	19.5 ± 1.5	19.7 ± 2.2	19.4 ± 1.7
Average, >2 miles (Offsite)	17.1 ± 2.3	16.9 ± 2.5	16.8 ± 2.4	16.7 ± 2.7

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

TABLE 17

RADIOACTIVITY IN APPLES

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

NAME OF FACILITY WATTS BAR — DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	NOT ESTAB	1845.14(1/ 1) 1845.14- 1845.14	4.5 MILES NW	1845.14(1/ 1) 1845.14- 1845.14	2612.80(1/ 1) 2612.80- 2612.80	
GAMMA (GELI) 2						
K-40	NOT ESTAB	915.26(1/ 1) 915.26- 915.26	4.5 MILES NW	915.26(1/ 1) 915.26- 915.26	1521.08(1/ 1) 1521.08- 1521.08	
PB-212	NOT ESTAB	1 VALUES <LLD			2.92(1/ 1) 2.92- 2.92	
TL-208	NOT ESTAB	1.91(1/ 1) 1.91- 1.91	4.5 MILES NW	1.91(1/ 1) 1.91- 1.91	0.92(1/ 1) 0.92- 0.92	

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 CABBAGE

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

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

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PEREORMED	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	25.000	3356.18(1/ 1) 3356.18- 3356.18	4.5 MILES NW	3356.18(1/ 1) 3356.18- 3356.18	4138.29(1/ 1) 4138.29- 4138.29	
GAMMA (GELI) 2						
K-40	NOT ESTAB	1584.23(1/ 1) 1584.23- 1584.23	4.5 MILES NW	1584.23(1/ 1) 1584.23- 1584.23	1986.04(1/ 1) 1986.04- 1986.04	
BI-214	NOT ESTAB	1 VALUES <LLD			3.68(1/ 1) 3.68- 3.68	

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 at specified locations is indicated in parentheses (F).

TABLE 19

RADIOACTIVITY IN CORN

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

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

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	25.000	3228.49(1/ 1) 3228.49- 3228.49	4.5 MILES NW	3228.49(1/ 1) 3228.49- 3228.49	3982.90(1/ 1) 3982.90- 3982.90	
GAMMA (GELI) 2						
K-40	NOT ESTAB	2192.27(1/ 1) 2192.27- 2192.27	4.5 MILES NW	2192.27(1/ 1) 2192.27- 2192.27	2398.11(1/ 1) 2398.11- 2398.11	
BI-214	NOT ESTAB	1 VALUES <LLD			6.19(1/ 1) 6.19- 6.19 1 VALUES <LLD	
PB-214	NOT ESTAB	1.59(1/ 1) 1.59- 1.59 1 VALUES <LLD	4.5 MILES NW	1.59(1/ 1) 1.59- 1.59		
PB-212	NOT ESTAB				1.00(1/ 1) 1.00- 1.00	

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 at specified locations is indicated in parentheses (F).

TABLE 20

RADIOACTIVITY IN GREEN BEANS

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

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

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	25.000	3426.01(1/ 1) 3426.01- 3426.01	4.5 MILES NW	3426.01(1/ 1) 3426.01- 3426.01	3230.09(1/ 1) 3230.09- 3230.09	
GAMMA (GELI) 2						
K-40	NOT ESTAB	1726.90(1/ 1) 1726.90- 1726.90	4.5 MILES NW	1726.90(1/ 1) 1726.90- 1726.90	1711.86(1/ 1) 1711.86- 1711.86	
BI-214	NOT ESTAB	9.18(1/ 1) 9.18- 9.18	4.5 MILES NW	9.18(1/ 1) 9.18- 9.18	1 VALUES <LLD	
PB-214	NOT ESTAB	6.57(1/ 1) 6.57- 6.57	4.5 MILES NW	6.57(1/ 1) 6.57- 6.57	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 21

RADIOACTIVITY IN LETTUCE

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

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	25.000	2476.45(1/ 1) 2476.45- 2476.45	4.5 MILES NW	2476.45(1/ 1) 2476.45- 2476.45	1618.87(1/ 1) 1618.87- 1618.87	
GAMMA (GELI) 2						
K-40	NOT ESTAB	2744.05(1/ 1) 2744.05- 2744.05	4.5 MILES NW	2744.05(1/ 1) 2744.05- 2744.05	1340.14(1/ 1) 1340.14- 1340.14	
BI-214	NOT ESTAB	0.65(1/ 1) 0.65- 0.65	4.5 MILES NW	0.65(1/ 1) 0.65- 0.65	0.23(1/ 1) 0.23- 0.23	
BE-7	NOT ESTAB	69.47(1/ 1) 69.47- 69.47	4.5 MILES NW	69.47(1/ 1) 69.47- 69.47	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 22

RADIOACTIVITY IN POTATOES

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

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

LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PEREORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	25.000	7683.52(1/ 1) 7683.52- 7683.52	4.5 MILES NW	7683.52(1/ 1) 7683.52- 7683.52	7013.91(1/ 1) 7013.91- 7013.91	
GAMMA (GELI) 2						
K-40	NOT ESTAB	4115.36(1/ 1) 4115.36- 4115.36	4.5 MILES NW	4115.36(1/ 1) 4115.36- 4115.36	4677.61(1/ 1) 4677.61- 4677.61	
BI-214	NOT ESTAB	3.84(1/ 1) 3.84- 3.84	4.5 MILES NW	3.84(1/ 1) 3.84- 3.84	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 23

RADIOACTIVITY IN TOMATOES

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

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	25.000	4142.27(1/ 1) 4142.27- 4142.27	4.5 MILES NW	4142.27(1/ 1) 4142.27- 4142.27	4325.58(1/ 1) 4325.58- 4325.58	
GAMMA (GELI) 2						
K-40	NOT ESTAB	2628.85(1/ 1) 2628.85- 2628.85	4.5 MILES NW	2628.85(1/ 1) 2628.85- 2628.85	2557.51(1/ 1) 2557.51- 2557.51	
PB-212	NOT ESTAB	0.79(1/ 1) 0.79- 0.79	4.5 MILES NW	0.79(1/ 1) 0.79- 0.79	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 24

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 RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	25.000	3346.33(1/ 1) 3346.33- 3346.33	4.5 MILES NW	3346.33(1/ 1) 3346.33- 3346.33	3673.23(1/ 1) 3673.23- 3673.23	
GAMMA (GELI) 2						
K-40	NOT ESTAB	1772.07(1/ 1) 1772.07- 1772.07	4.5 MILES NW	1772.07(1/ 1) 1772.07- 1772.07	1490.29(1/ 1) 1490.29- 1490.29	
PB-212	NOT ESTAB	1.98(1/ 1) 1.98- 1.98	4.5 MILES NW	1.98(1/ 1) 1.98- 1.98	5.55(1/ 1) 5.55- 5.55	
TL-208	NOT ESTAB	1 VALUES <LLD			0.79(1/ 1) 0.79- 0.79	
AC-228	NOT ESTAB	11.29(1/ 1) 11.29- 11.29	4.5 MILES NW	11.29(1/ 1) 11.29- 11.29	1.92(1/ 1) 1.92- 1.92	

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 BEEF

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

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (GELI)						
K-40	NOT ESTAB	2481.81(1/ 1) 2481.81- 2481.81	HOUSLEY FARM 4.75 MILES W	2481.81(1/ 1) 2481.81- 2481.81	1183.95(1/ 1) 1183.95- 1183.95	
BI-214	NOT ESTAB	6.83(1/ 1) 6.83- 6.83	HOUSLEY FARM 4.75 MILES W	6.83(1/ 1) 6.83- 6.83	1.97(1/ 1) 1.97- 1.97	
PB-214	NOT ESTAB	2.60(1/ 1) 2.60- 2.60	HOUSLEY FARM 4.75 MILES W	2.60(1/ 1) 2.60- 2.60	4.68(1/ 1) 4.68- 4.68	
PB-212	NOT ESTAB	2.81(1/ 1) 2.81- 2.81	HOUSLEY FARM 4.75 MILES W	2.81(1/ 1) 2.81- 2.81	1 VALUES <LLD	
RA-226	NOT ESTAB	6.83(1/ 1) 6.83- 6.83	HOUSLEY FARM 4.75 MILES W	6.83(1/ 1) 6.83- 6.83	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 26

RADIOACTIVITY IN POULTRY

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

NAME OF FACILITY WATTS BAR DOCKET NO. 50-390,391
LOCATION OF FACILITY RHEA TENNESSEE REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA (GELI)						
K-40	NOT ESTAB	1868.07(2/ 2) 1392.21- 2343.92	HOUSLEY FARM 4.75 MILES W	2343.92(1/ 1) 2343.92- 2343.92		

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

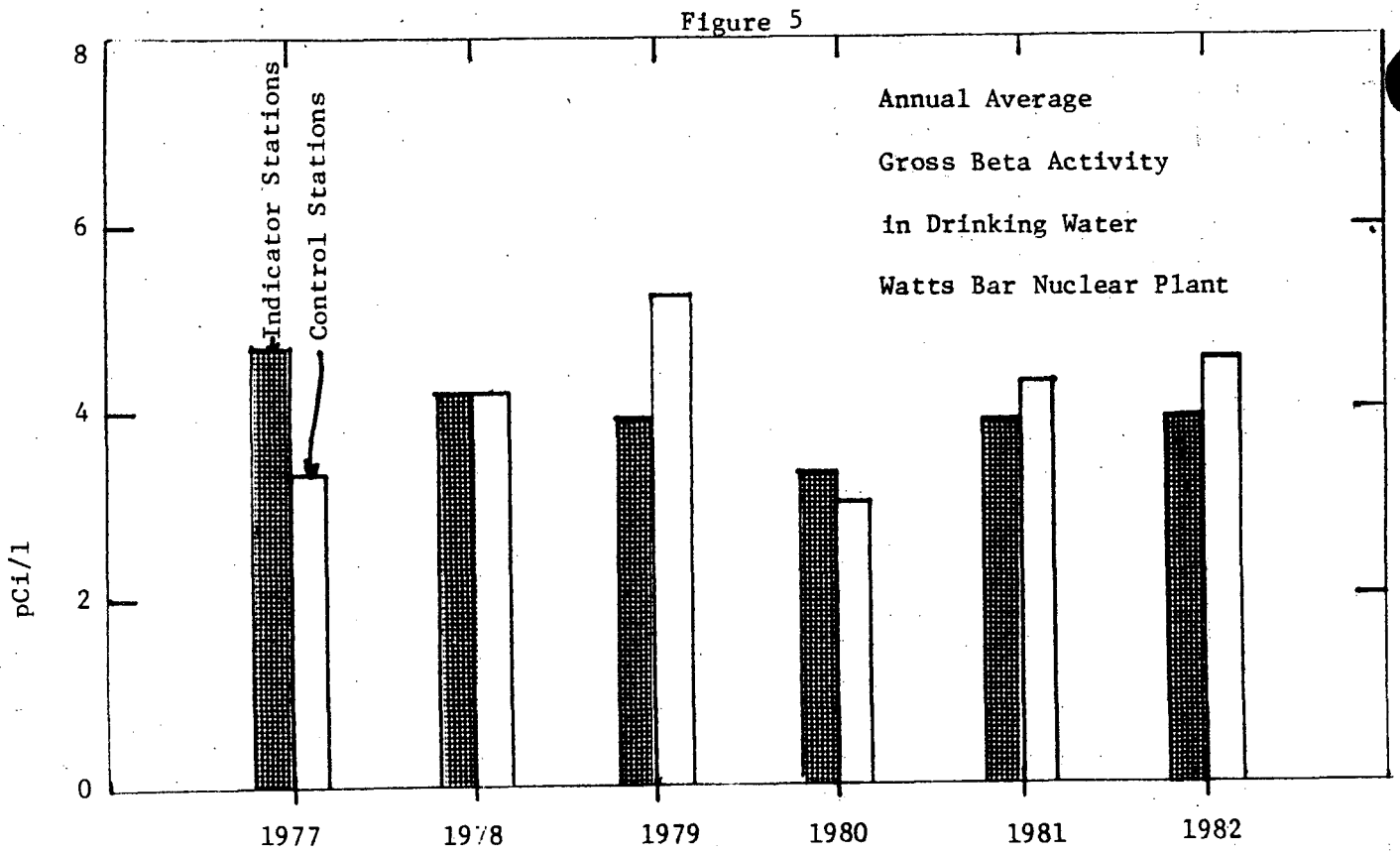


Figure 6

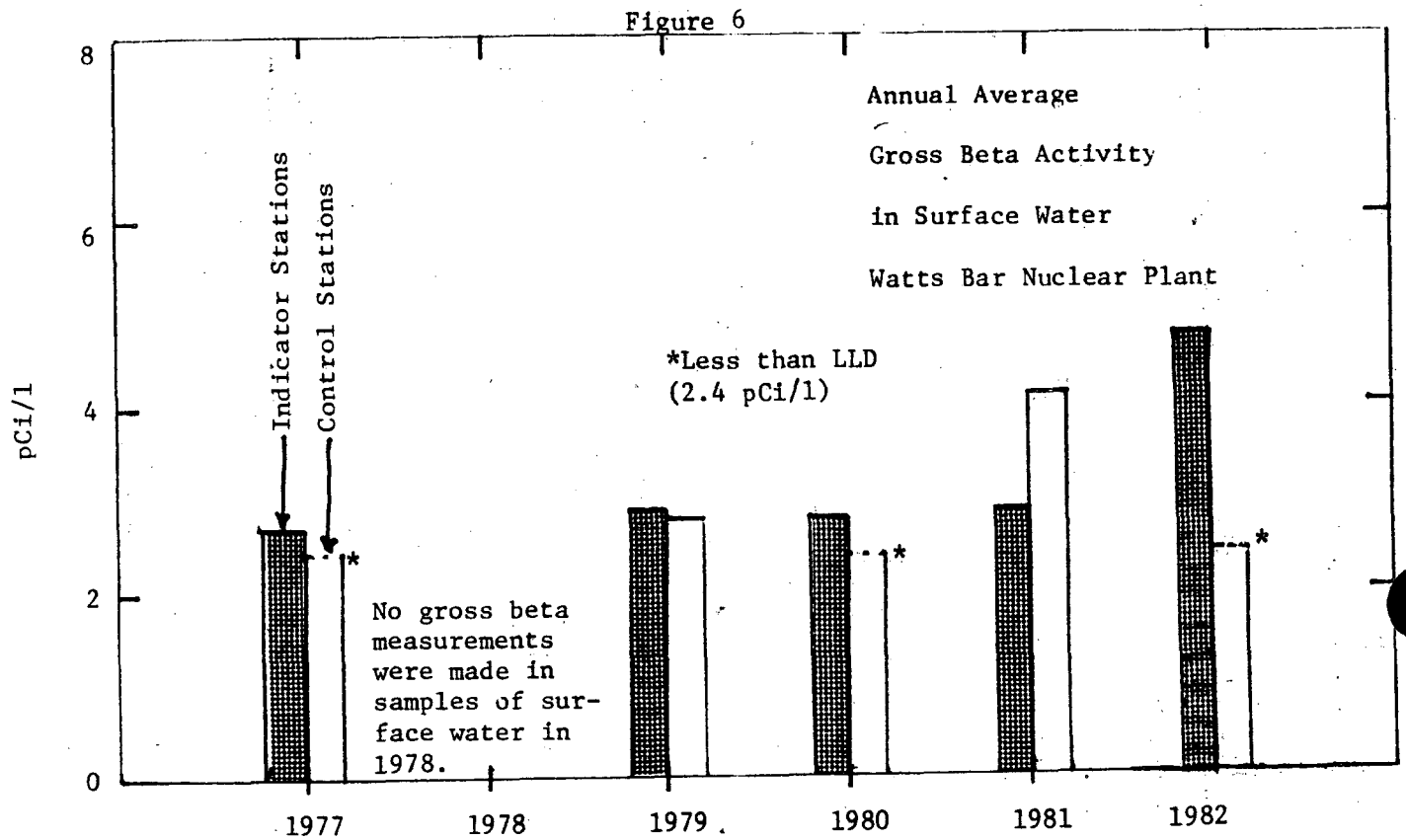


Figure 7

Figure 8

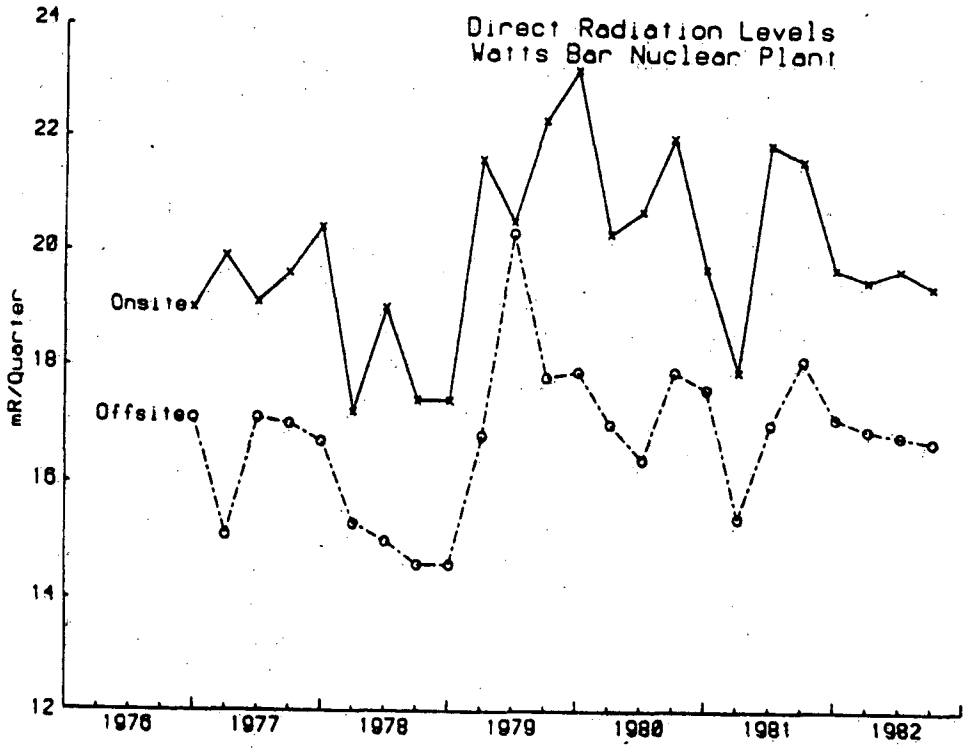
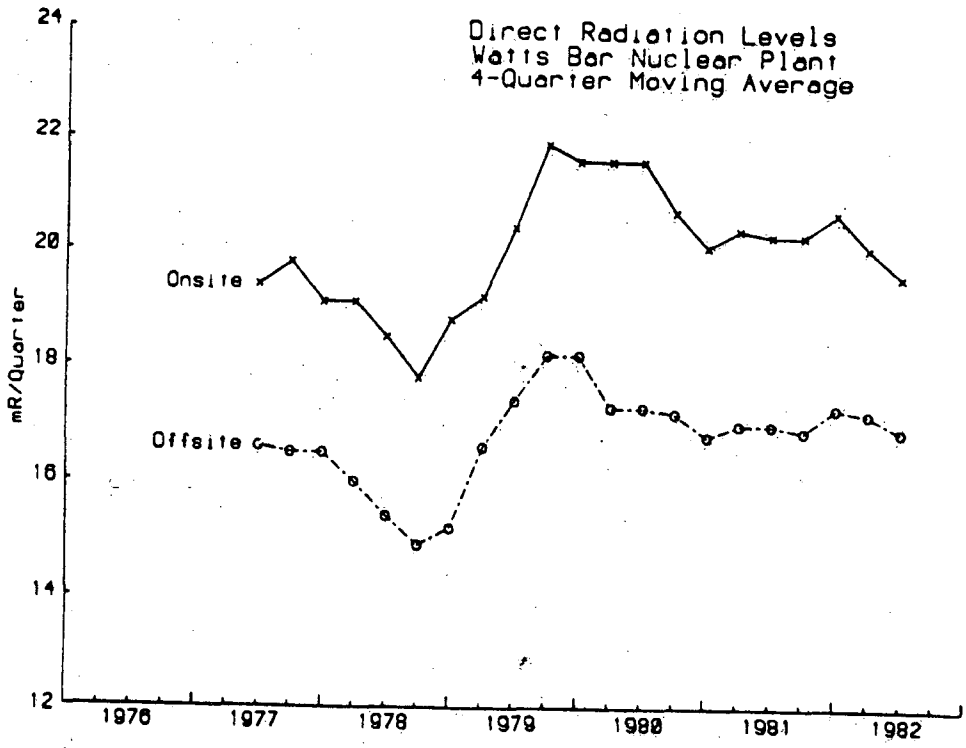


Figure 9



Reservoir Monitoring

Samples of water and aquatic media are collected quarterly along five river stations in Chickamauga and Watts Bar Reservoirs--at Tennessee River miles (TRM) 496.5, 518.0, 527.4. 529.9, and 532.1. The station at TRM 496.5 is also a part of the Sequoyah Nuclear Plant monitoring. 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 27). The locations of these stations are shown on the accompanying map (figure 10) and conform to sediment ranges established and surveyed by TVA.

Samples of water, net plankton, sediment, and Asiatic clams were collected quarterly and analyzed for radioactivity. In addition, samples of the flesh of two commercial and one game species of fish and the whole body of one commercial fish species were collected and analyzed semiannually.

Water

Grab water samples were collected quarterly from three locations in the Tennessee River; one upstream from the plant discharge area, one immediately downstream from the discharge area, and one approximately nine miles downstream. The samples were analyzed for gamma-emitting radionuclides, ^{89}Sr, ^{90}Sr, and ^{3}H. Results are displayed in table 28.

Figure 6 presents a plot of the gross beta activity in surface water from 1977 through 1982. 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 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 29, 30, 31, and 32.

Plankton

As indicated in table 27, 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 were analyzed for gross beta activity. Quantities collected were not sufficient for eight gross beta, twelve gamma-emitting radionuclides, and ten strontium analyses. Analytical results of collected samples are given in table 33.

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 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 34.

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 35.

Figures 11 and 12 respectively present the trends in ^{137}Cs and ^{60}Co 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 36 and 37.

Table 27

Sampling Schedule - Reservoir Monitoring

Tennessee River (Mile	Biological Samples				Water Samples	
	Plankton	Benthic Fauna	Sediment	Fish*	Distance from Left Bank, %	Depths (Meters)
Indicator Stations						
496.5	X	X	X			
518.0	X	X	X		67	0
527.4	X	X	X		67	1
Control Stations						
529.9					90	1
532.1	X	X	X			

*Fish samples are taken from Watts Bar, Chickamauga, and Nickajack Reservoirs.

TABLE 28

RADIOACTIVITY IN SURFACE WATER TOTAL

PCI/L - 0.037 BQ/L

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

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 12	2.400	4.65(2/ 8) 3.50- 5.80	TRM 518.0-67-0	5.80(1/ 4) 5.80- 5.80	4 VALUES <LLD	
GAMMA (GELI) 12						
K-40	NOT ESTAB	39.28(2/ 8) 10.64- 67.92	TRM 518.0-67-0	39.28(2/ 4) 10.64- 67.92	33.98(1/ 4) 33.98- 33.98	
BI-214	NOT ESTAB	10.10(2/ 8) 9.21- 10.99	TRM 518.0-67-0	10.99(1/ 4) 10.99- 10.99	1.26(1/ 4) 1.26- 1.26	
PB-214	NOT ESTAB	2.93(2/ 8) 2.45- 3.40	TRM 527.4-67-1	3.40(1/ 4) 3.40- 3.40	4 VALUES <LLD	
PB-212	NOT ESTAB	2.01(5/ 8) 0.32- 4.70	TRM 518.0-67-0	2.77(3/ 4) 1.47- 4.70	0.54(1/ 4) 0.54- 0.54	
SR 89 12	10.000	8 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	
SR 90 12	2.000	8 VALUES <LLD ANALYSIS PERFORMED			4 VALUES <LLD	
TRITIUM 12	330.000	389.84(5/ 8) 333.73- 481.15	TRM 527.4-67-1	413.48(3/ 4) 358.45- 481.15	455.82(1/ 4) 455.82- 455.82	

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 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 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA	0.100	1.76(4/ 4)	NICKAJACK RES	2.63(2/ 2)	1.10(2/ 2)	
6		0.57- 2.72	TRM 425-471	2.54- 2.72	0.58- 1.62	
GROSS BETA	0.100	23.62(4/ 4)	NICKAJACK RES	28.03(2/ 2)	18.37(2/ 2)	
6		17.94- 30.43	TRM 425-471	25.63- 30.43	18.22- 18.52	
GAMMA (GELI)						
6						
CO-60	0.010	4 VALUES <LLD			0.03(1/ 2)	
					0.03- 0.03	
CS-137	0.020	0.06(4/ 4)	NICKAJACK RES	0.06(2/ 2)	0.09(2/ 2)	
		0.04- 0.06	TRM 425-471	0.06- 0.06	0.03- 0.15	
K-40	NOT ESTAB	11.44(4/ 4)	NICKAJACK RES	12.43(2/ 2)	10.61(2/ 2)	
		9.71- 12.66	TRM 425-471	12.19- 12.66	7.87- 13.35	
BI-214	0.020	0.04(2/ 4)	NICKAJACK RES	0.05(1/ 2)	2 VALUES <LLD	
		0.02- 0.05	TRM 425-471	0.05- 0.05		
PB-214	NOT ESTAB	0.02(1/ 4)	NICKAJACK RES	0.02(1/ 2)	2 VALUES <LLD	
		0.02- 0.02	TRM 425-471	0.02- 0.02		
RA-226	NOT ESTAB	0.00(1/ 4)	CHICKAMAUGA RES	0.00(1/ 2)	2 VALUES <LLD	
		0.00- 0.00	TRM 471-530	0.00- 0.00		
TL-208	NOT ESTAB	0.01(1/ 4)	NICKAJACK RES	0.01(1/ 2)	0.00(1/ 2)	
		0.01- 0.01	TRM 425-471	0.01- 0.01	0.00- 0.00	
SR 89	0.500	0.94(2/ 4)	NICKAJACK RES	0.94(2/ 2)	0.78(1/ 2)	
6		0.74- 1.14	TRM 425-471	0.74- 1.14	0.78- 0.78	
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 30

RADIOACTIVITY IN WHITE CRAPPIE (FLESH)

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

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

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 6	0.100	2.01(4/ 4) 0.31- 2.68	CHICKAMAUGA RES TRM 471-530	2.64(2/ 2) 2.60- 2.68	3.05(2/ 2) 2.32- 3.78	
GROSS BETA 6	0.100	31.31(4/ 4) 30.64- 32.27	NICKAJACK RES TRM 425-471	31.69(2/ 2) 31.11- 32.27	29.55(2/ 2) 28.04- 31.05	
GAMMA (GELI) 6						
CS-137	0.020	0.14(4/ 4) 0.09- 0.18	CHICKAMAUGA RES TRM 471-530	0.17(2/ 2) 0.17- 0.18	0.13(2/ 2) 0.10- 0.16	
K-40	NOT ESTAB	17.63(4/ 4) 16.54- 19.60	NICKAJACK RES TRM 425-471	18.62(2/ 2) 17.63- 19.60	15.46(2/ 2) 14.27- 16.66	
BI-214	0.020	0.03(1/ 4) 0.03- 0.03	CHICKAMAUGA RES TRM 471-530	0.03(1/ 2) 0.03- 0.03	0.15(1/ 2) 0.15- 0.15	
PB-214	NOT ESTAB	0.01(2/ 4) 0.00- 0.01	NICKAJACK RES TRM 425-471	0.01(2/ 2) 0.00- 0.01	0.11(2/ 2) 0.04- 0.19	
RA-226	NOT ESTAB	0.00(1/ 4) 0.00- 0.00	NICKAJACK RES TRM 425-471	0.00(1/ 2) 0.00- 0.00	0.15(1/ 2) 0.15- 0.15	
PA-234M	NOT ESTAB	2.82(1/ 4) 2.82- 2.82	NICKAJACK RES TRM 425-471	2.82(1/ 2) 2.82- 2.82	2 VALUES <LLD	
SR 89 6	0.500	1.51(3/ 4) 0.80- 2.27	CHICKAMAUGA RES TRM 471-530	2.27(1/ 2) 2.27- 2.27	1.07(1/ 2) 1.07- 1.07	
SR 90 6	0.100	4 VALUES <LLD			0.20(1/ 2) 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 at specified locations is indicated in parentheses (F).

TABLE 31

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 RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA	0.100	0.97(4/ 4)	NICKAJACK RES	1.07(2/ 2)	0.82(2/ 2)	
6		0.24- 1.50	TRM 425-471	0.81- 1.34	0.80- 0.84	
GROSS BETA	0.100	24.12(4/ 4)	NICKAJACK RES	25.21(2/ 2)	17.50(2/ 2)	
6		16.96- 33.45	TRM 425-471	16.96- 33.45	10.93- 24.07	
GAMMA (GELI)						
6						
CS-137	0.020	0.04(4/ 4)	CHICKAMAUGA RES	0.05(2/ 2)	0.10(1/ 2)	
		0.02- 0.07	TRM 471-530	0.03- 0.06	0.10- 0.10	
K-40	NOT ESTAB	12.02(4/ 4)	CHICKAMAUGA RES	12.99(2/ 2)	9.64(2/ 2)	
		8.46- 16.82	TRM 471-530	9.17- 16.82	4.60- 14.67	
BI-214	0.020	0.02(1/ 4)	NICKAJACK RES	0.02(1/ 2)	0.04(1/ 2)	
		0.02- 0.02	TRM 425-471	0.02- 0.02	0.04- 0.04	
PB-214	NOT ESTAB	0.01(2/ 4)	CHICKAMAUGA RES	0.01(1/ 2)	0.01(2/ 2)	
		0.01- 0.01	TRM 471-530	0.01- 0.01	0.00- 0.03	
PB-212	NOT ESTAB	4 VALUES <LLD			0.01(1/ 2)	
					0.01- 0.01	
SR 89	0.500	1.48(2/ 4)	CHICKAMAUGA RES	1.82(1/ 2)	2 VALUES <LLD	
6		1.13- 1.82	TRM 471-530	1.82- 1.82		
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 32

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 RHEA TENNESSEE — REPORTING PERIOD 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]		LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]		CONTROL LOCATIONS MEAN (F)[b] RANGE[b]		NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA	0.100	0.98(	2/ 4)	CHICKAMAUGA RES	1.07(	1/ 2)	1.63(	2/ 2)	
6		0.90-	1.07	TRM 471-530	1.07-	1.07	1.07-	2.20	
GROSS BETA	0.100	20.46(	4/ 4)	CHICKAMAUGA RES	26.62(	2/ 2)	14.96(	2/ 2)	
6		14.17-	39.06	TRM 471-530	14.17-	39.06	13.88-	16.05	
GAMMA (GELI)									
6									
CS-137	0.020	0.04(	4/ 4)	CHICKAMAUGA RES	0.05(	2/ 2)	0.09(	1/ 2)	
		0.03-	0.06	TRM 471-530	0.03-	0.06	0.09-	0.09	
K-40	NOT ESTAB	8.05(	4/ 4)	NICKAJACK RES	8.08(	2/ 2)	7.34(	2/ 2)	
		6.66-	9.44	TRM 425-471	6.72-	9.44	6.24-	8.44	
BI-214	0.020	0.06(	3/ 4)	CHICKAMAUGA RES	0.07(	2/ 2)	0.07(	1/ 2)	
		0.02-	0.12	TRM 471-530	0.02-	0.12	0.07-	0.07	
PB-214	NOT ESTAB	0.05(	3/ 4)	CHICKAMAUGA RES	0.05(	2/ 2)	0.04(	2/ 2)	
		0.02-	0.09	TRM 471-530	0.02-	0.09	0.02-	0.07	
PB-212	NOT ESTAB	0.00(	1/ 4)	CHICKAMAUGA RES	0.00(	1/ 2)	0.02(	1/ 2)	
		0.00-	0.00	TRM 471-530	0.00-	0.00	0.02-	0.02	
RA-226	NOT ESTAB	0.02(	2/ 4)	NICKAJACK RES	0.02(	1/ 2)	0.07(	1/ 2)	
		0.02-	0.02	TRM 425-471	0.02-	0.02	0.07-	0.07	
SR 89	0.500	1.60(	3/ 4)	CHICKAMAUGA RES	3.18(	1/ 2)	2 VALUES <LLD		
6		0.68-	3.18	TRM 471-530	3.18-	3.18			
SR 90	0.100	0.16(	2/ 4)	CHICKAMAUGA RES	0.16(	2/ 2)	0.13(	2/ 2)	
6		0.15-	0.18	TRM 471-530	0.15-	0.18	0.10-	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 at specified locations is indicated in parentheses (F).

TABLE 33

RADIOACTIVITY IN PLANKTON

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 1982

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	0.100	17.16(6/ 6)	TRM 496.50	20.93(2/ 2)	11.13(2/ 2)	
8		9.33- 32.50		9.36- 32.50	7.39- 14.87	
GAMMA (GELI)						
4						
CS-137	0.080	0.41(3/ 3)	TRM 496.50	0.60(1/ 1)	1 VALUES <LLD	
		0.27- 0.60		0.60- 0.60		
K-40	NOT ESTAB	13.31(3/ 3)	TRM 496.50	15.30(1/ 1)	10.39(1/ 1)	
		9.94- 15.30		15.30- 15.30	10.39- 10.39	
BI-214	NOT ESTAB	0.62(3/ 3)	TRM 496.50	0.91(1/ 1)	1.78(1/ 1)	
		0.41- 0.91		0.91- 0.91	1.78- 1.78	
PB-214	NOT ESTAB	0.76(3/ 3)	TRM 527.4	0.80(1/ 1)	1.84(1/ 1)	
		0.70- 0.80		0.80- 0.80	1.84- 1.84	
PB-212	NOT ESTAB	0.40(3/ 3)	TRM 518.0	0.53(1/ 1)	0.33(1/ 1)	
		0.18- 0.53		0.53- 0.53	0.33- 0.33	
RA-226	NOT ESTAB	0.55(1/ 3)	TRM 518.0	0.55(1/ 1)	1 VALUES <LLD	
		0.55- 0.55		0.55- 0.55		
TL-208	NOT ESTAB	0.09(2/ 3)	TRM 518.0	0.11(1/ 1)	0.15(1/ 1)	
		0.07- 0.11		0.11- 0.11	0.15- 0.15	
AC-228	NOT ESTAB	0.63(3/ 3)	TRM 496.50	1.11(1/ 1)	1 VALUES <LLD	
		0.22- 1.11		1.11- 1.11		
PA-234M	NOT ESTAB	23.80(1/ 3)	TRM 518.0	23.80(1/ 1)	1 VALUES <LLD	
		23.80- 23.80		23.80- 23.80		
SR 89	0.500	2.21(4/ 4)	TRM 527.4	2.80(2/ 2)	3.97(2/ 2)	
6		0.65- 4.26		1.35- 4.26	1.16- 6.78	
SR 90	0.100	0.16(4/ 4)	TRM 527.4	0.18(2/ 2)	0.17(2/ 2)	
6		0.11- 0.25		0.11- 0.25	0.17- 0.18	

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

TABLE 34

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 1982

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION[a] (LLD)	ALL INDICATOR LOCATIONS MEAN (F)[b] RANGE[b]	LOCATION WITH HIGHEST ANNUAL MEAN: NAME, DISTANCE AND DIRECTION	MEAN (F)[b] RANGE[b]	CONTROL LOCATIONS MEAN (F)[b] RANGE[b]	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS ALPHA	0.350	3.47(2/ 2)	TRM 496.50	3.47(2/ 2)		
2		3.37- 3.57		3.37- 3.57		
GROSS BETA	0.700	30.85(10/ 10)	TRM 496.50	32.07(2/ 2)	32.34(4/ 4)	
14		22.61- 38.10		30.60- 33.54	26.93- 38.31	
GAMMA (GELI)						
14						
CE-144	0.060	0.12(1/ 10)	TRM 496.50	0.12(1/ 2)	4 VALUES <LLD	
		0.12- 0.12		0.12- 0.12		
CO-60	0.010	0.15(3/ 10)	TRM 496.50	0.20(2/ 2)	0.37(4/ 4)	
		0.06- 0.21		0.20- 0.21	0.21- 0.52	
CS-137	0.020	0.56(7/ 10)	TRM 496.50	1.74(2/ 2)	3.46(4/ 4)	
		0.02- 1.83		1.66- 1.83	1.56- 5.54	
K-40	NOT ESTAB	16.93(10/ 10)	TRM 527.4	17.75(4/ 4)	16.23(4/ 4)	
		12.85- 27.39		13.68- 27.39	13.91- 18.84	
BI-214	0.020	1.07(10/ 10)	TRM 527.4	1.25(4/ 4)	1.09(4/ 4)	
		0.70- 1.45		1.16- 1.45	0.76- 1.45	
BI-212	0.100	1.90(9/ 10)	TRM 496.50	2.37(2/ 2)	1.88(4/ 4)	
		1.07- 3.17		1.57- 3.17	1.21- 2.52	
PB-214	NOT ESTAB	1.19(10/ 10)	TRM 527.4	1.44(4/ 4)	1.22(4/ 4)	
		0.78- 1.61		1.26- 1.61	0.84- 1.50	
PB-212	NOT ESTAB	1.57(10/ 10)	TRM 527.4	1.82(4/ 4)	1.65(4/ 4)	
		0.94- 2.52		1.06- 2.52	1.08- 2.19	
RA-226	NOT ESTAB	1.07(10/ 10)	TRM 527.4	1.25(4/ 4)	1.09(4/ 4)	
		0.70- 1.45		1.16- 1.45	0.76- 1.45	
RA-224	NOT ESTAB	1.92(7/ 10)	TRM 527.4	2.46(2/ 4)	1.65(3/ 4)	
		1.40- 2.94		1.98- 2.94	1.22- 2.37	
TL-208	0.020	0.47(10/ 10)	TRM 527.4	0.55(4/ 4)	0.52(4/ 4)	
		0.30- 0.71		0.40- 0.71	0.33- 0.64	
AC-228	0.060	1.53(10/ 10)	TRM 527.4	1.80(4/ 4)	1.54(4/ 4)	
		0.96- 2.30		1.31- 2.30	1.04- 2.00	
PA-234M	NOT ESTAB	2.74(2/ 10)	TRM 496.50	3.15(1/ 2)	4 VALUES <LLD	
		2.34- 3.15		3.15- 3.15		
SR 89	1.500	2.27(3/ 10)	TRM 496.50	2.59(1/ 2)	3.59(2/ 4)	
14		2.03- 2.59		2.59- 2.59	2.04- 5.15	
SR 90	0.300	10 VALUES <LLD			4 VALUES <LLD	
14		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 35

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 1982

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	0.700	18.08(4/ 4)	COTTON PORT MARI	27.84(2/ 2)	14.13(2/ 2)	
6		6.03- 29.53	TRM 513	26.14- 29.53	4.19- 24.08	
GAMMA (GELI)						
6						
CO-60	0.010	0.03(2/ 4)	COTTON PORT MARI	0.03(2/ 2)	2 VALUES <LLD	
		0.01- 0.04	TRM 513	0.01- 0.04		
CS-137	0.020	0.32(3/ 4)	COTTON PORT MARI	0.45(2/ 2)	2 VALUES <LLD	
		0.06- 0.52	TRM 513	0.38- 0.52		
K-40	NOT ESTAB	9.84(4/ 4)	COTTON PORT MARI	16.92(2/ 2)	6.37(2/ 2)	
		2.38- 19.79	TRM 513	14.04- 19.79	1.35- 11.39	
BI-214	0.020	0.74(4/ 4)	COTTON PORT MARI	0.90(2/ 2)	0.66(2/ 2)	
		0.26- 1.06	TRM 513	0.74- 1.06	0.29- 1.03	
BI-212	0.100	1.00(4/ 4)	COTTON PORT MARI	1.41(2/ 2)	1.12(2/ 2)	
		0.27- 1.46	TRM 513	1.37- 1.46	0.38- 1.87	
PB-214	NOT ESTAB	0.86(4/ 4)	COTTON PORT MARI	1.04(2/ 2)	0.71(2/ 2)	
		0.30- 1.24	TRM 513	0.84- 1.24	0.31- 1.12	
PB-212	0.020	0.99(4/ 4)	COTTON PORT MARI	1.39(2/ 2)	1.05(2/ 2)	
		0.25- 1.57	TRM 513	1.21- 1.57	0.39- 1.70	
RA-226	NOT ESTAB	0.74(4/ 4)	COTTON PORT MARI	0.90(2/ 2)	0.66(2/ 2)	
		0.26- 1.06	TRM 513	0.74- 1.06	0.29- 1.03	
RA-224	NOT ESTAB	1.12(4/ 4)	COTTON PORT MARI	1.65(2/ 2)	1.80(1/ 2)	
		0.26- 2.07	TRM 513	1.23- 2.07	1.80- 1.80	
TL-208	0.020	0.30(4/ 4)	COTTON PORT MARI	0.42(2/ 2)	0.34(2/ 2)	
		0.08- 0.49	TRM 513	0.34- 0.49	0.12- 0.56	
AC-228	0.060	0.95(4/ 4)	COTTON PORT MARI	1.33(2/ 2)	1.07(2/ 2)	
		0.22- 1.53	TRM 513	1.13- 1.53	0.39- 1.74	
PA-234M	NOT ESTAB	4 VALUES <LLD			3.18(1/ 2)	
					3.18- 3.18	
SR 89	1.500	5.04(1/ 4)	COTTON PORT MARI	5.04(1/ 2)	2 VALUES <LLD	
6		5.04- 5.04	TRM 513	5.04- 5.04		
SR 90	0.300	4 VALUES <LLD			2 VALUES <LLD	
6		ANALYSIS PERFORMED				

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

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

TABLE 36

RADIOACTIVITY IN CLAM FLESH

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

NAME OF FACILITY WATTS BAR
LOCATION OF FACILITY RHEA TENNESSEE

DOCKET NO. 50-390,391
REPORTING PERIOD 1982

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	2.69(2/ 2) 1.42- 3.96	TRM 496.50	2.69(2/ 2) 1.42- 3.96		
GROSS BETA 2	0.100	6.62(2/ 2) 4.66- 8.58	TRM 496.50	6.62(2/ 2) 4.66- 8.58		
GAMMA (GELI) 14						
CO-60	0.080	0.17(3/ 10) 0.13- 0.21	TRM 496.50	0.21(1/ 2) 0.21- 0.21	4 VALUES <LLD	
CS-137	0.080	0.17(2/ 10) 0.13- 0.20	TRM 496.50	0.20(1/ 2) 0.20- 0.20	0.22(1/ 4) 0.22- 0.22	
K-40	NOT ESTAB	2.62(10/ 10) 1.03- 4.47	TRM 496.50	3.70(2/ 2) 2.94- 4.47	3.25(4/ 4) 2.09- 4.27	
BI-214	NOT ESTAB	0.32(10/ 10) 0.05- 0.78	TRM 496.50	0.55(2/ 2) 0.32- 0.78	0.28(4/ 4) 0.20- 0.46	
PB-214	NOT ESTAB	0.35(10/ 10) 0.01- 0.77	TRM 496.50	0.48(2/ 2) 0.20- 0.77	0.25(4/ 4) 0.11- 0.49	
PB-212	NOT ESTAB	0.08(5/ 10) 0.03- 0.11	TRM 527.4	0.11(1/ 4) 0.11- 0.11	0.06(3/ 4) 0.04- 0.07	
TL-208	NOT ESTAB	0.03(7/ 10) 0.00- 0.08	TRM 496.50	0.04(1/ 2) 0.04- 0.04	0.08(2/ 4) 0.04- 0.12	
AC-228	NOT ESTAB	0.21(4/ 10) 0.06- 0.33	TRM 518.0	0.33(1/ 4) 0.33- 0.33	0.36(1/ 4) 0.36- 0.36	

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 37

RADIOACTIVITY IN CLAM SHELL

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

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

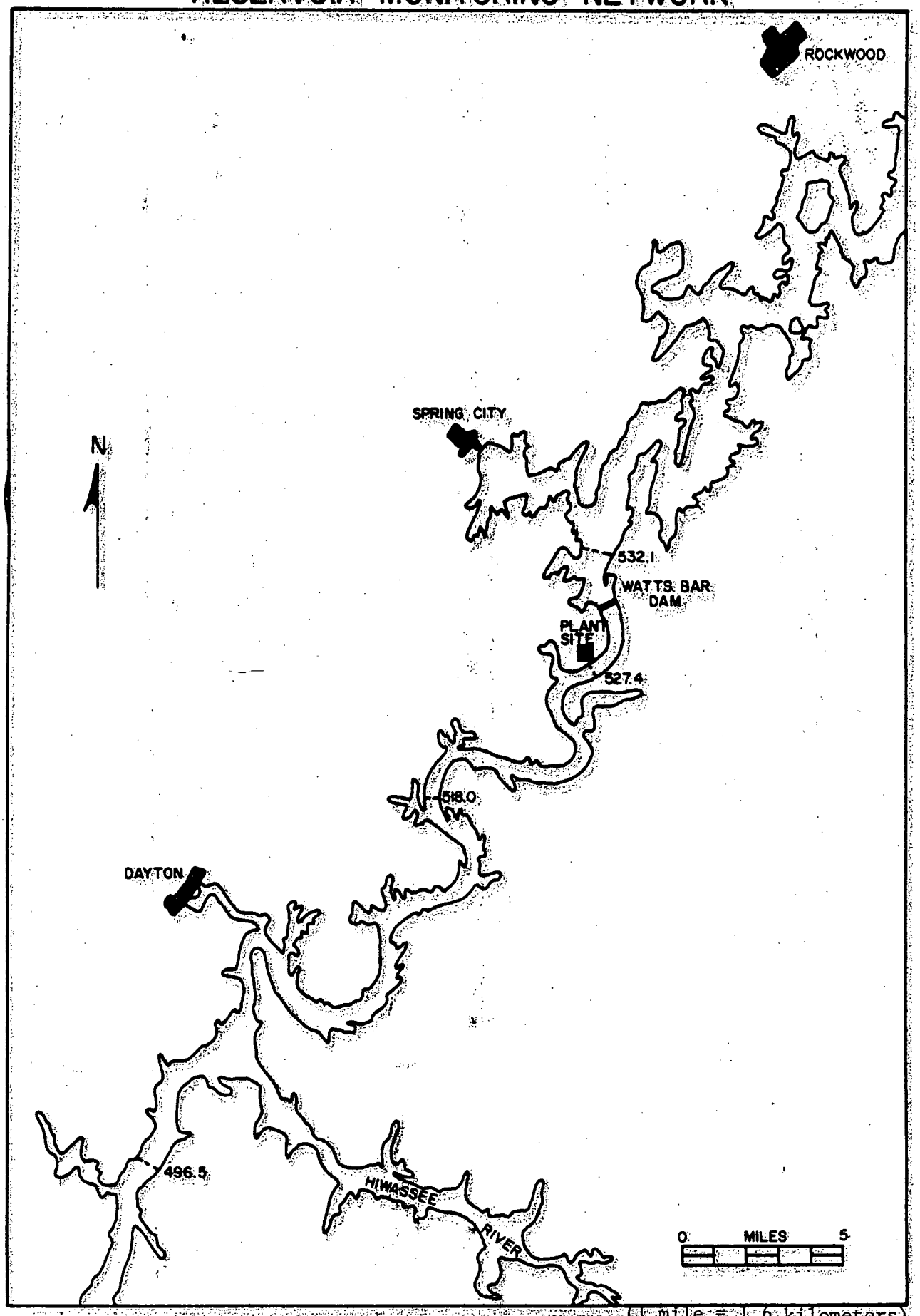
LOCATION OF FACILITY RHEA TENNESSEE — REPORTING PERIOD 1982

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	0.700	2 VALUES <LLD ANALYSIS PERFORMED			0 VALUES <LLD	
GROSS BETA 2	0.700	3.65(2/ 2) 3.31- 3.99	TRM 496.50	3.65(2/ 2) 3.31- 3.99		
GAMMA (GELI) 14						
CO-60	0.010	0.02(9/ 10) 0.01- 0.02	TRM 518.0	0.02(4/ 4) 0.02- 0.02	0.02(1/ 4) 0.02- 0.02	
K-40	NOT ESTAB	0.12(10/ 10) 0.03- 0.26	TRM 496.50	0.15(2/ 2) 0.10- 0.21	0.05(2/ 4) 0.03- 0.06	
BI-214	0.050	0.10(9/ 10) 0.06- 0.14	TRM 518.0	0.11(4/ 4) 0.09- 0.14	0.46(1/ 4) 0.46- 0.46	
BI-212	0.100	0.15(5/ 10) 0.10- 0.19	TRM 496.50	0.19(1/ 2) 0.19- 0.19	4 VALUES <LLD	
PB-214	0.050	0.11(9/ 10) 0.06- 0.16	TRM 518.0	0.13(4/ 4) 0.10- 0.16	0.55(1/ 4) 0.55- 0.55	
PB-212	NOT ESTAB	0.08(10/ 10) 0.03- 0.13	TRM 496.50	0.10(2/ 2) 0.10- 0.10	0.04(4/ 4) 0.02- 0.08	
RA-226	0.050	0.11(8/ 10) 0.08- 0.14	TRM 518.0	0.11(4/ 4) 0.09- 0.14	4 VALUES <LLD	
TL-208	0.020	0.03(7/ 10) 0.02- 0.04	TRM 496.50	0.03(2/ 2) 0.03- 0.03	4 VALUES <LLD	
AC-228	0.060	0.16(10/ 10) 0.06- 0.25	TRM 518.0	0.20(4/ 4) 0.18- 0.25	0.07(1/ 4) 0.07- 0.07	
SR 89 2	5.000	12.98(1/ 2) 12.98- 12.98	TRM 496.50	12.98(1/ 2) 12.98- 12.98		
SR 90 2	1.000	2 VALUES <LLD ANALYSIS PERFORMED			0 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 10

RESERVOIR MONITORING NETWORK



(1 mile = 1.6 kilometers)

Figure 11

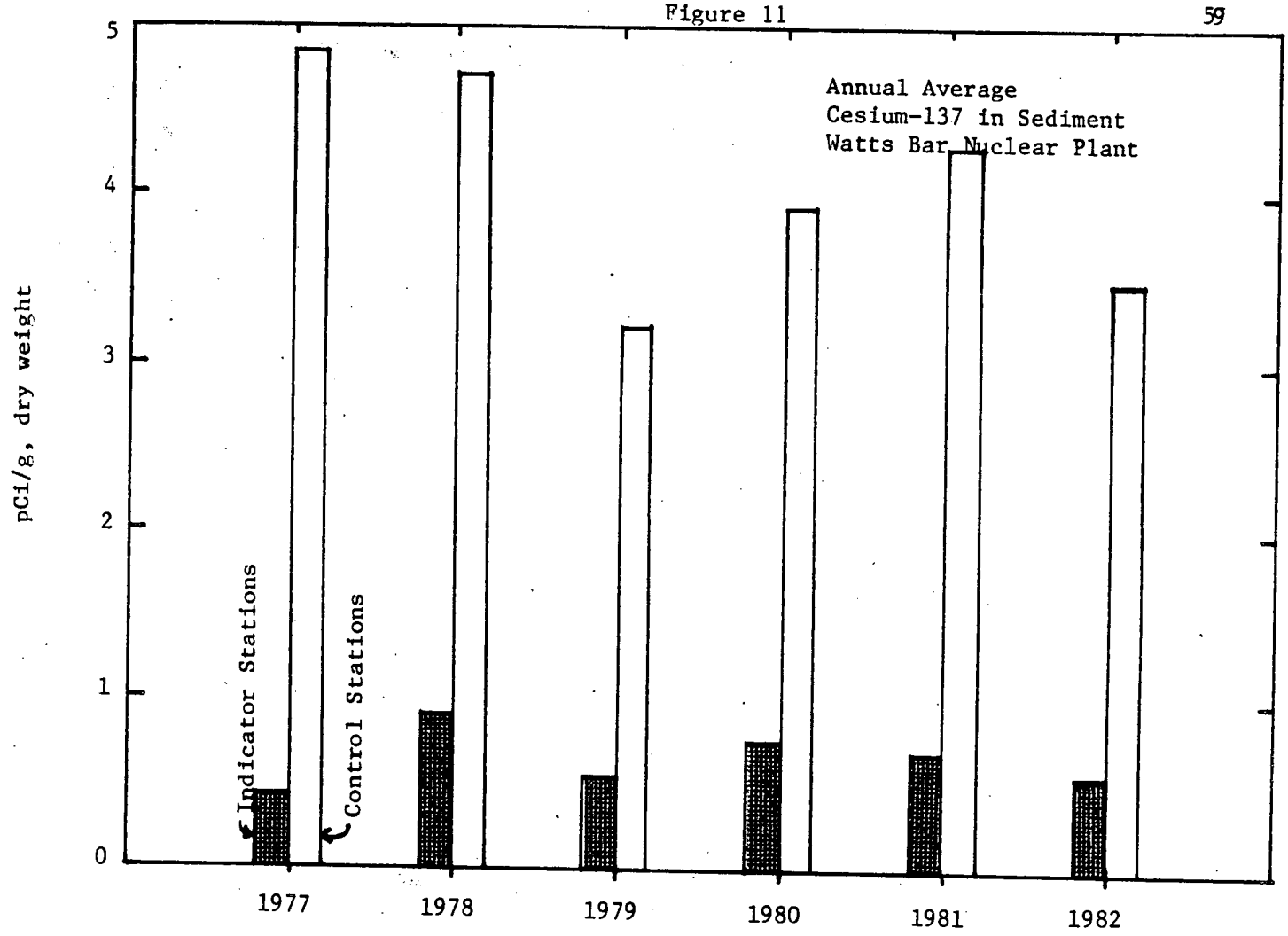
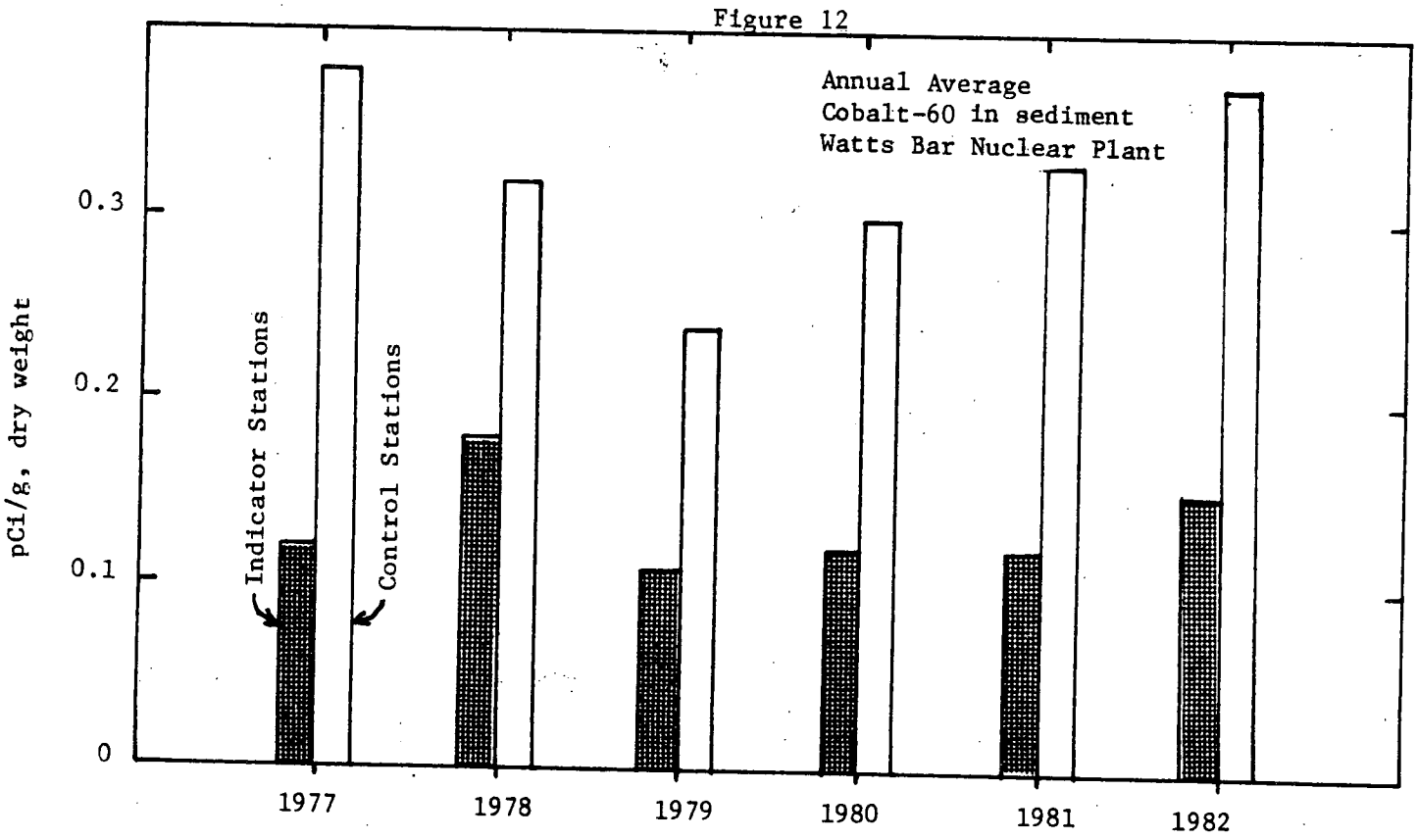


Figure 12



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.