

TENNESSEE VALLEY AUTHORITY

2/11
10/19/90
50-327A

50-327
328

DIVISION OF ENVIRONMENTAL PLANNING

ENVIRONMENTAL RADIOACTIVITY LEVELS
SEQUOYAH NUCLEAR PLANT

1977

September 1978

CONTENTS

Introduction	1
Figure 1 - Tennessee Valley Region	3
Table 1 - Environmental Radioactivity Sampling Schedule	4
Atmospheric Monitoring	5
Figure 2 - Atmospheric and Terrestrial Monitoring Network	7
Figure 3 - Local Monitoring Stations	8
Table 2 - Detection Capabilities for Environmental Sample Analysis	9
Table 3 - Maximum Permissible Concentrations for Nonoccupational Exposure.	11
Table 4 - Radioactivity in Air	12
Table 5 - Radioactivity in Rain	13
Table 6 - Radioactivity in Heavy Particle Fallout	15
Table 7 - Radioactivity in Charcoal Filters	16
Table 8 - Radioactivity in Atmospheric Moisture	17
Terrestrial Monitoring	19
Table 9 - Radioactivity in Milk	21
Table 10 - Radioactivity in Vegetation	22
Table 11 - Radioactivity in Soil	24
Table 12 - Radioactivity in Well Water	25
Table 13 - Radioactivity in Public Water Supply	26
Table 14 - Environmental Gamma Radiation Levels	27
Table 15 - Radioactivity in Food Crops	28
Reservoir Monitoring	31
Table 16 - Sampling Schedule - Reservoir Monitoring	33
Figure 4 - Reservoir Monitoring Network	34
Table 17 - Radioactivity in Reservoir Water (Total)	35
Table 18 - Radioactivity in Fish (Channel Catfish, Flesh)	36
Table 19 - Radioactivity in Fish (White Crappie, Flesh)	37
Table 20 - Radioactivity in Fish (Smallmouth Buffalo, Flesh)	38
Table 21 - Radioactivity in Fish (Smallmouth Buffalo, Whole)	39
Table 22 - Radioactivity in Plankton	40
Table 23 - Radioactivity in Sediment	41
Table 24 - Radioactivity in Clam Flesh	42
Table 25 - Radioactivity in Clam Shell	43
Quality Control	45
Conclusions	45

ENVIRONMENTAL RADIOACTIVITY LEVELS

SEQUOYAH NUCLEAR PLANT

1977

Introduction

The Sequoyah Nuclear Plant (SQNP), being constructed by the Tennessee Valley Authority, is located on a site owned by TVA containing 525 acres of land in Hamilton County, Tennessee, bounded on the east by Chickamauga Reservoir. See Figure 1. The site is 12 miles (19.3 kilometers) northeast of Chattanooga, Tennessee, and 11 miles (17.7 kilometers) west-northwest of Cleveland, Tennessee. The plant will consist of two pressurized water reactors; each unit is rated at 3,423 MWt and 1,171 MWe. Fuel load in unit 1 is scheduled for March 1978.

The preoperational environmental monitoring 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.

TVA has collected data in this preoperational environmental monitoring program since 1971. Since the operation of the plant has been delayed, the program was reduced as of November 1, 1973. All continuous collections (air and charcoal filters) were discontinued as were milk and monthly river water samples. Only quarterly samples of soil, vegetation, well water, public water, river water, plankton, Asiatic clams, sediment, and fish, and annual samples of food products were collected. The full sampling program was reinstated in February 1976. The program outlined herein describes the sampling program as conducted in 1977.

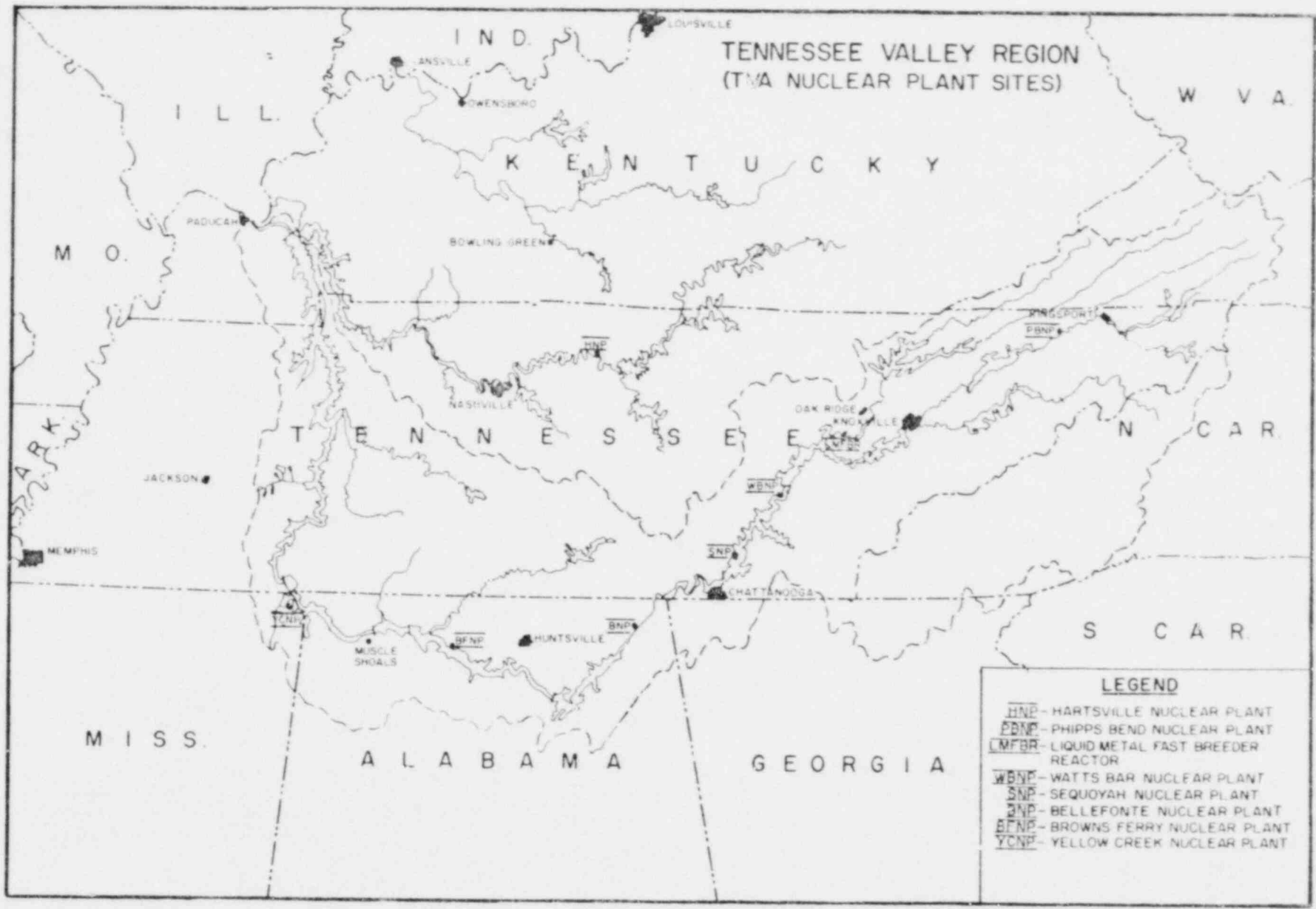
Field staffs in the Division of Environmental Planning and the Division of Forestry, Fisheries, and Wildlife Development carried out the sampling program outlined in tables 1 and 16. Sampling locations are shown in figures 2, 3, and 4. All the radiochemical and instrumental analyses were conducted in a central laboratory at Muscle Shoals, Alabama. Alpha and beta analyses were performed on Beckman Low Beta II and Beckman Wide Beta II low-background proportional counters. Two Nuclear Data Model 100 multi-channel analyzer systems employing sodium iodide, NaI(Tl) detectors and one Nuclear Data Model 4420 in conjunction with Germanium, Ge(Li) detection systems, were used to analyze the samples for specific gamma-emitting radionuclides. Samples of water, vegetation, air particulates, food crops, and charcoal (specific analysis for ^{131}I) are routinely counted with NaI(Tl) detection systems. If significant concentrations of radioisotopes are identified, or if there is a reasonable expectation of increased radioactivity levels (such as during periods of increased fallout), these samples are

counted on the Ge(Li) system. Identification of gamma-emitting radionuclides in all other types of samples is routinely performed by analysis on the Ge(Li) system. A TVA fabricated beta-gamma coincidence counting system is utilized for the determination of ^{131}I concentration in milk.

Data were entered in computer storage for processing specific to the analysis conducted. An IBM 370 Model 165 computer, employing an ALPHA-M least-squares code, was used to solve multimatrix problems associated with estimating the activities of the gamma-emitting nuclides analyzed by NaI(Tl). The data obtained by Ge(Li) detectors were resolved by the ND-4420 software.

The detection capabilities for environmental sample analysis given as the nominal lower limits of detection (LLD) are listed in Table 2. Samples processed by NaI(Tl) gamma spectroscopy were analyzed for 13 specific gamma-emitting radionuclides and radionuclide combinations*. All photopeaks found in Ge(Li) spectra were identified and quantified. LLD's for the analysis of the radionuclides listed below* are given in Table 2-B. LLD's for additional radionuclides identified by Ge(Li) analysis were calculated for each analysis and nominal values are listed in the appropriate data tables. In the instance where an LLD has not been established, an LLD value of zero was assumed. For each sample type, only the radionuclides for which values greater than the LLD were reported are listed in the data tables.

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



E. J. BENTLEY

Table 1

ENVIRONMENTAL RADIOACTIVITY SAMPLING SCHEDULE

Station Location	Air Filter	Charcoal Filter	Rain-water	Heavy Particle Fallout	Soil	Vegetation	Milk	River Water	Well Water	Public Water	Aquatic Life and Sediment
Chattanooga	W	W	M	M	S	Q				M	
Dayton	W	W	M	M	S	Q				M	
Sale Creek	W	W	M	M	S	Q					
Daisy	W	W	M	M	S	Q				Q	
Red Bank	W	W	M	M	S	Q					
Volunteer Ordnance Works (Harrison)	W	W	M	M	S	Q					
Harrison Bay	W	W	M	M	S	Q					
Georgetown	W	W	M	M	S	Q					
Hamilton County Park	W	W	M	M	S	Q					
Jork	W	W	M	M	S	Q					
Site N	W	W	M	M	S	Q					
Site S	W	W	M	M	S	Q					
Farm L						Q	M		M		
Farm N						Q	M		M		
Control Farm						Q	M		M		
Sequoyah Discharge TRM #83.7								M			
Hiwassee River								M			
South Chickamauga Creek								M			
Chickamauga Reservoir								M			Q
E. I. DuPont											Q
Cleveland, TN											Q
C. E. Industries											M
On Site Wells (3)									M		
Hays Farm									Q		
Barris Farm									Q		
Kilmer Farm									Q		
McGarish Farm									Q		

W - Weekly

M - Monthly

Q - Quarterly

S - Semiannually

Atmospheric Monitoring

The atmospheric monitoring network is divided into three subgroups. Two local air monitors are located within the plant boundary. Eight perimeter air monitors are located at distances out to 11 miles (17.7 kilometers) from the plant in the towns of Sale Creek, Daisy, Red Bank, Harrison, and four other densely populated areas. The remote air monitors are located at distances out to 19 miles (30.6 kilometers) from the plant in the town of Dayton and the city of Chattanooga. See Figures 2 and 3.

At each monitor, air is continuously pulled through a Hollingsworth and Voss HV-70 particulate filter at a regulated flow of 3 ft³/min (0.085 m³/min). In series with, but downstream of, the particulate filter, is a charcoal filter used to collect iodine. Each monitor has a collection tray and storage container to collect rainwater on a continuous basis, and a horizontal platform covered with gummed acetate to catch and hold heavy particle fallout. Moisture is collected from the atmosphere at each local monitor and at one remote monitor and analyzed for tritium. Thermoluminescent dosimeters are used to record gamma radiation levels at each remote and perimeter station.

Each of the local and perimeter air monitors is fitted with a GM tube that continuously scans the particulate filter. The disintegration rate of the atmospheric radioactivity is continuously recorded at each station. These stations will detect any significant airborne release from SQNP.

Air filters are collected weekly and analyzed for gross beta activity. No analyses are performed until 3 days after sample collection. The samples are composited monthly for analysis of specific gamma-emitting radionuclides and quarterly for ⁸⁹Sr, ⁹⁰Sr analysis. The results are presented in Table 4.

With reference to table 3, which contains the maximum permissible concentrations (MPC) recommended by 10 CFR 20 for nonoccupational exposure, it is seen that the maximum beta concentration is 0.70 percent MPC.

Rainwater is collected and analyzed for gross beta activity, specific gamma-emitting isotopes, and radiostrontium. 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. An aliquot of the quarterly composite is distilled and analyzed by liquid scintillation for tritium. The results are shown in Table 5. The highest value reported for beta activity is 3.72 percent of the MPC for drinking water.

The gummed acetate that is used to collect heavy particle fallout is changed monthly. The sample is ashed and counted for gross beta activity. The results are given in Table 6.

Charcoal filters are collected and analyzed for radioiodine. The filter is counted in a single channel analyzer system. The data are shown in Table 7, where the highest value reported is 0.12 percent MPC for ^{131}I .

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 8, where the highest value reported is 0.02 percent MPC for ^3H in air.

ATMOSPHERIC AND TERRESTRIAL MONITORING NETWORK

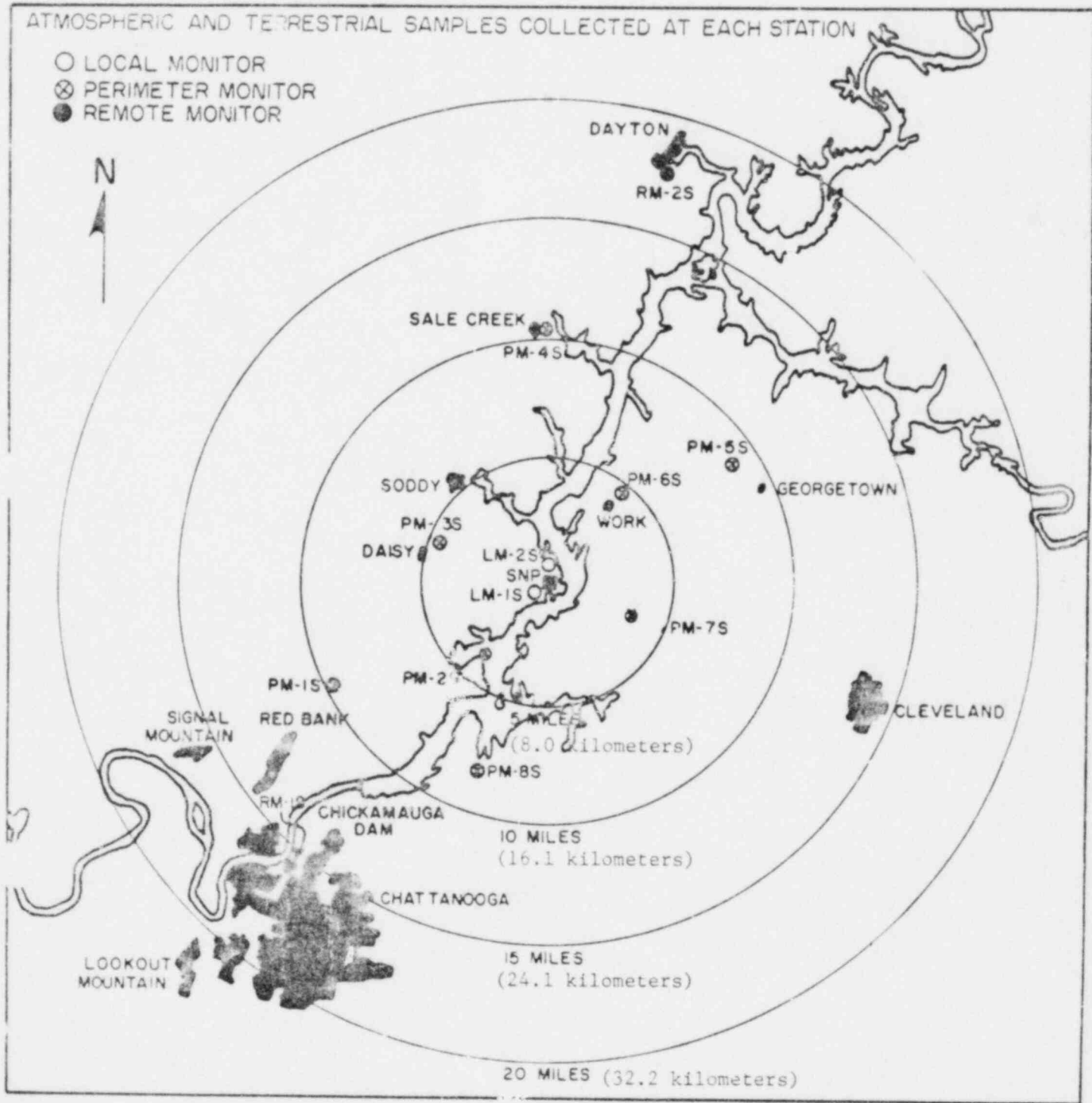


Figure 3

LOCAL MONITORING STATIONS SEQUOYAH NUCLEAR PLANT

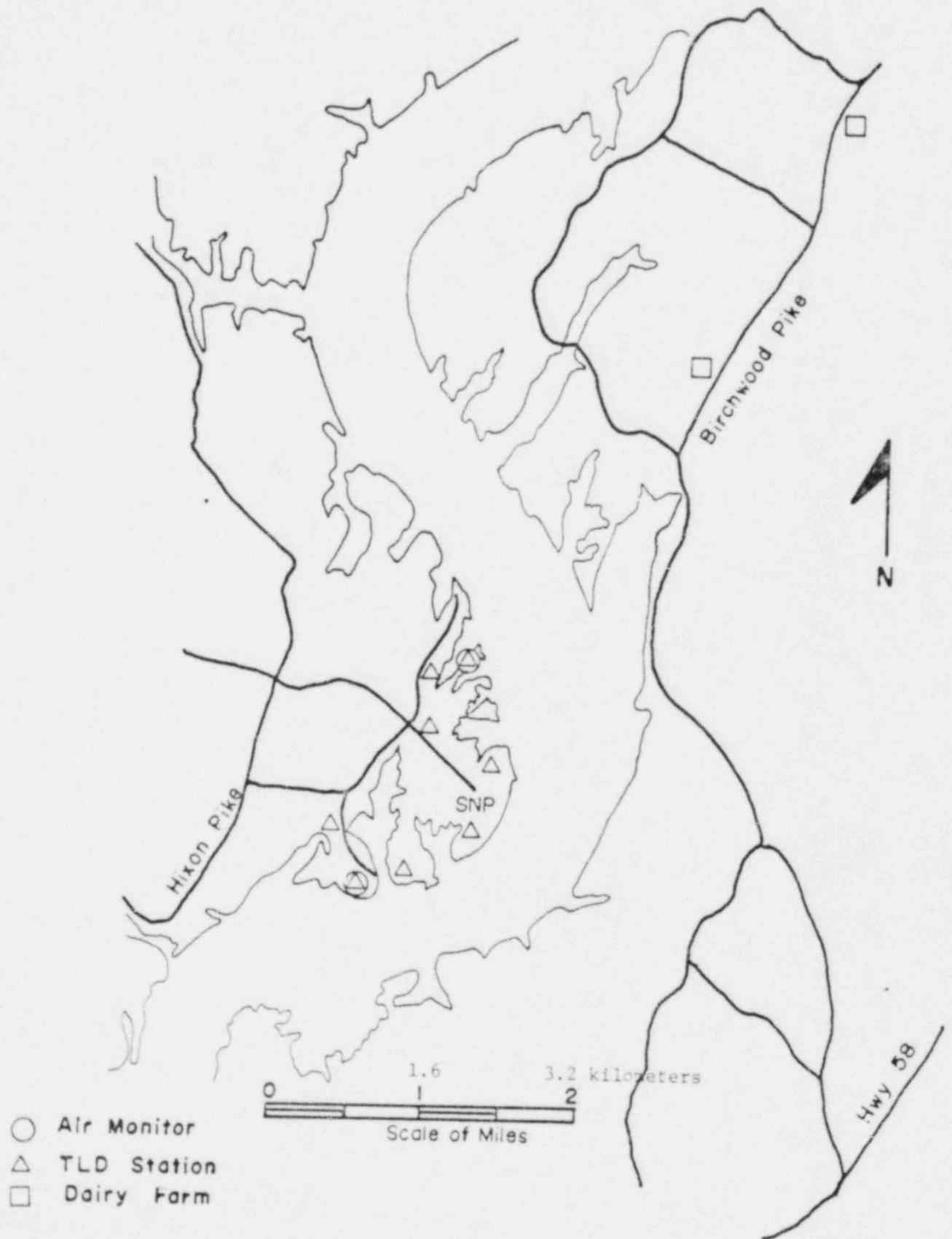


Table 2

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, wet pCi/Kgm, wet	Milk pCi/l
Total α				0.4	0.01				1.5	
Gross α	0.005		0.05	2.0	0.05	0.35	0.1	0.7		
Gross β	0.01			2.3	0.20	0.70	0.1	0.7	25	
³ H				330						
¹³¹ I		0.01								
⁸⁹ Sr	0.005			10	0.25	1.5	0.5	5.0	40	0.5
⁹⁰ Sr	0.001			2	0.05	0.3	0.1	1.0	8	10
										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 7
B. count analyses

NORMATIVE LOWER LEVEL OF DETECTION (LLD)

	Air particulates μCi/m ³ Soil (μCi/g)	Water and soils μCi/g Soil (μCi/g)	Vegetation and shells μCi/g Soil (μCi/g)	Soil and sediment μCi/g Soil (μCi/g)	Fish μCi/g Soil (μCi/g)	Clam, fish and plantain μCi/g Soil (μCi/g)	Clam shells μCi/g Soil (μCi/g)	Beats, clam-shells potatoes, etc.) μCi/g Soil (μCi/g)	Heat and pottery μCi/g Soil (μCi/g)
¹³⁷ Cs	0.03	5	0.33	0.33	0.33	0.33	0.33	40	90
¹³⁴ Cs	0.02	14	0.27	0.35	0.46	0.06	0.15	43	40
¹³⁷ La	0.01	46	1.19	0.17	0.60	0.10	0.36	44	200
¹³⁷ La	0.01	75	0.35	0.09	0.20	0.02	0.07	13	50
¹³⁷ La	0.02	10	0.67	0.31	0.45	0.11	0.43	10	150
¹³⁷ La	0.01	20	0.31	0.31	0.13	0.13	0.13	40	90
¹³⁷ La	0.01	10	0.20	0.13	0.12	0.08	0.12	10	40
¹³⁷ La	0.01	10	0.20	0.06	0.12	0.02	0.08	16	46
¹³⁷ La	0.01	10	0.11	0.11	0.03	0.03	0.15	10	40
¹³⁷ La	0.01	5	0.05	0.05	0.01	0.01	0.07	7	15
¹³⁷ La	0.01	15	0.23	0.05	0.20	0.01	0.07	15	55
¹³⁷ La	0.01	10	0.20	0.09	0.15	0.01	0.08	10	5
¹³⁷ La	0.01	14	0.25	0.11	0.23	0.02	0.17	15	40
¹³⁷ La	0.01	10	0.12	0.06	0.11	0.01	0.08	10	30
¹³⁷ La	0.01	100	2.30	0.90	0.90	0.90	0.90	100	400
¹³⁷ La	0.01	15	0.68	0.15	0.15	0.07	0.15	15	50
¹³⁷ La	0.01	5	0.08	0.07	0.07	0.07	0.10	7	15

*The NaCl-110 values are calculated by the method described by Pasternack and Bartlett (1961) as described in BNSI-100 and No. 1. Inset. Methods 91, 100 and 101. These LLD values are applied to all components of 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 200-300 grams for soil, sediment and fish. Heat and pottery are counted in a 1-pint container as dry weight, then corrected to wet weight using an average moisture content of 50%. Average dry weight is 200 grams. Air particulates are counted in a well-cristal. The counting system consists of a multi-channel analyzer and either a ²²Na or ¹³⁷La well NaCl-110 crystal. The counting time is 5000 seconds. All calculations are performed by the best-squares computer program BPPROB. 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 Bartlett as described in BNSI-100. 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. Marine shells are counted in either a 0.5-l or 1.5-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 500-500 grams. Air filters and very small volume samples are counted in plastic dishes referred to the detector end up. The counting system consists of a MCA-420 multi-channel analyzer and either a 3", 15", or 16.5 Ge(Li) detector. The counting time is normally 8 hours. All spectral analysis is performed using the software provided with the 30-4420. The assumption is made that all samples are analyzed within one week of the collection date. Conversion factor: 1 pCi = 3.7 x 10⁷ Bq.

Table 3
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

*1 pCi = 3.7×10^{-2} Bq.

TABLE 5
ENVIRONMENTAL MONITORING SUMMARY
RADIONUCLIDES IN AIR

STATION	DATE	TIME	WIND DIRECTION	WIND SPEED (MPH)	PRECIPITATION (IN)	DETECTABLE LOCATIONS		HIGHEST AMBIENT MEAN (CPM/100)	CONTROL LOCATIONS (CPM/100)	NUMBER OF MONITORING LOCATIONS		
						LOCATIONS	MEAN (CPM/100)					
A1 - FIELDS PULVERILL SITE	6-25-56	1:00 P	E	1-16	0.00	5117	5133	0.12	527	521	0.02	0.41
						227	227	0.06	0.06	167	241	
						227	227	0.06	0.06	0.10		
						227	227	0.06	0.06	67	241	
						227	227	0.06	0.06	0.02	0.04	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.06	0.06	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.01	0.01	
A2 - FIELDS (3.7 x 10 ¹⁰ Bq/cubic meter)	6-25-56	1:00 P	E	1-16	0.00	5117	5133	0.12	527	521	0.02	0.41
						227	227	0.06	0.06	167	241	
						227	227	0.06	0.06	0.10		
						227	227	0.06	0.06	67	241	
						227	227	0.06	0.06	0.02	0.04	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.06	0.06	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.01	0.01	
A3 - FIELDS PULVERILL SITE	6-25-56	1:00 P	E	1-16	0.00	5117	5133	0.12	527	521	0.02	0.41
						227	227	0.06	0.06	167	241	
						227	227	0.06	0.06	0.10		
						227	227	0.06	0.06	67	241	
						227	227	0.06	0.06	0.02	0.04	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.06	0.06	
						227	227	0.06	0.06	0.01	0.01	
						227	227	0.06	0.06	0.01	0.01	

a. Non-detectable levels of detectable (LLD) as described in Table 2.
 b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 5 (CONT'D)
 ENVIRONMENTAL MONITORING SUMMARY
 RADIOACTIVITY IN RAIN

NAME OF FACILITY, SUMMARY		DOCKET NO. RU-78-4-501				
LOCATION OF FACILITY, PARISH		REPORTING PERIOD 77				
TENNESSEE						
MEDIUM OR PATHWAY SAMPLED	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION ^a	ALL INDICATOR ISOTOPIES MEAN (F) ^b RANGE ^b	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (F) ^b RANGE ^b	CONTROL LOCATIONS MEAN (F) ^b RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
PRECIPITATION	NE-239	NOT ESTAB	10.100 17 191	PM-870 HARRISON, TN 10.100 17 11	<LLD	
	I-132	NOT ESTAB	10.100- 10.10	0.75 MILE SW 10.10- 10.10		
	TE-132	NOT ESTAB	12.290 37 191	PM-850 HARRISON, TN 13.720 17 11	<LLD	
	TE-132	NOT ESTAB	11.310- 13.72	0.75 MILE SW 13.72- 13.72		
	TE-132	NOT ESTAB	4.890 67 191	PM-150 NORTHWOODS, TN 11.420 17 21	<LLD	
	TE-99	NOT ESTAB	2.960- 11.42	10.25 MILE WSW 11.42- 11.42		
	TE-99	NOT ESTAB	4.360 37 191	PM-150 NORTHWOODS, TN 17.730 17 21	3.550 17 21	
	TE-99	10.000	3.000- 17.73	10.25 MILE WSW 17.73- 17.73	3.550- 3.55	
	SR-90	129	13.330 297 1071	PM-850 HARRISON, TN 18.660 37 111	13.520 67 221	
	SR-90	2.000	10.010- 21.50	0.75 MILE SW 17.030- 21.50	10.960- 19.09	
	SR-90	129	2.560 67 1071	PM-150 NORTHWOODS, TN 3.100 17 111	<LLD	
	TRITIUM	>>10,000	2.000- 3.10	10.25 MILE WSW 3.10- 3.10		
	TRITIUM	62	421.000 17 301	EM-150 SOUTHWEST 421.000 17 111	<LLD	
	TRITIUM		421.000- 421.00	0.75 MILE SW 421.000- 421.00		

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

TABLE 6
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN HEAVY PARTICLE FALLOUT

FACILITY OR PATHWAY SOURCE	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	DATE OF ANALYSIS	TYPE AND DATE OF FACILITY OPERATION	INDICATOR LOCATIONS		LOCATIONS WITH HIGHEST ANNUAL MEAN FALLOUT		CONTROL LOCATIONS		NUMBER OF ROUTINE REPORTS
				MEAN (F) ^a	RANGE	MEAN (F) ^b	RANGE	MEAN (F) ^b	RANGE	
DOCKET NO. RB-28-6-501 REPORTING PERIOD 77				ALL INDICATOR LOCATIONS	LOCATIONS WITH HIGHEST ANNUAL MEAN FALLOUT	CONTROL LOCATIONS				
				MEAN (F) ^a	MEAN (F) ^b	MEAN (F) ^b				
				RANGE	RANGE	RANGE				
GM TYPE MCI/50.8M	CLASS FIVE 134	5.3%	7.24E 1107 1107 0.13- 15.68	1M-25.0 MERTHERS) 0.75 MILES N	3.154 117 111 0.15- 15.68	2.20(227 22)	0.14-	9.54		

(3.7 x 10⁷ Bq/sq. km)

a. Nominal lower limit of detection (LLD) as described in Table 2.

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

TABLE 8
 ENVIRONMENTAL MONITORING SUMMARY
 RADIOACTIVITY IN ATMOSPHERIC MOISTURE

NAME OF FACILITY, SECURE		DUCKET NO. RE-28-6-501					
LOCATION OF FACILITY, BARTON		REPORTING PERIOD 77					
ILLINOIS							
MEDIUM OR PATHWAY SAMPLED	TYPE AND TOTAL NUMBER OF ANALYSIS	LOWER LIMIT OF DETECTION ^a	ALL INDICATED LOCATIONS MEAN (F) ^b RANGE ^b	LOCATIONS WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION RANGE	ANNUAL MEAN MEAN (F) RANGE	CONTROL LOCATIONS MEAN (F) ^b RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
ATMOSPHERIC TRITIUM PC1/COLIC METER	TRITIUM 67	N.F. STAR	3.81E 287 263 2.00-25.00	1.8-11.0 SOUTHWEST 0.75 MILES SW	4.16E 147 141 0.00-23.00	5.28E 147 151 1.00-42.00	

(3.7 x 10¹² Bq/cubic meter)

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

Terrestrial Monitoring

Milk

Milk is collected from two farms within a 10-mile radius of the plant (see figure 3), and from one control farm. Raw milk is analyzed monthly for ^{131}I , gamma-emitting isotopes, and for radiostrontium. The results are shown in Table 9.

Vegetation

Vegetation samples were collected near each monitoring station in the network and from each dairy farm to determine possible plant uptake of radioactive materials from the soil or from foliar deposition. Table 10 gives the results obtained from the laboratory analyses.

Soil

Soil samples were collected near each monitoring station in order that any relationship between the amount of radioactive material found in vegetation and that in soil might be established. The results are given in Table 11.

Ground Water

Well water was obtained monthly from the dairy farms from which milk was sampled and from four onsite wells. In addition, samples were taken quarterly from four other farms located within 5 miles of the plant. All samples were analyzed for gross beta and for gamma-emitting radionuclides. A quarterly composite was analyzed for tritium. The results are shown in Table 12 and indicate the maximum beta concentration with reference to Table 3, is 0.34 percent MPC.

Public Water

Potable water supplies taken from the Tennessee River in the vicinity of Sequoyah Nuclear Plant are sampled and analyzed for gross beta, gamma-emitting radionuclides, $^{89,90}\text{Sr}$, and tritium. The first potable water supply downstream from the plant is equipped with an automatic sampler with composite samples analyzed monthly. Two additional water supplies are sampled monthly and three other potable water supplies are sampled quarterly. The results, shown in Table 13, indicate that the maximum beta concentration is 0.27 percent MPC.

Environmental Gamma Radiation Levels

Thermoluminescent dosimeters (TLD's) are placed at eight stations around the plant near the site boundary (see Figure 3) and at the perimeter

and remote monitors to determine the gamma exposure rates at these locations. The TLD's are changed every 3 months. The quarterly gamma radiation levels determined from these TLD's are given in Table 14.

Food Crops

Food crops raised in the vicinity of Sequoyah Nuclear Plant are sampled annually as they become available during the growing season. During this sampling period, samples of cabbage, corn, green beans, potatoes, and tomatoes were collected and analyzed for gross beta, specific gamma-emitting radionuclides, ^{89}Sr , and ^{90}Sr . The results are given in Table 15.

TABLE 10 (CONT'D)

ENVIRONMENTAL MONITORING SUMMARY

RADIOACTIVITY IN VEGETATION

MEDIUM OR PATHWAY SAMPLED	TYPE AND DATE OF ANALYSIS PERFORMED	LIFE LIMIT OF DETECTION	INDICATOR	LOCATION		DISTANCE, MILES	DIRECTION	ANNUAL MEAN MEAN (F) ^b	RANGE ^b	CONTROL LOCATIONS MEAN (F) ^b	RANGE ^b	NUMBER OF NONROUTINE REPORTS RECEIVED
				STATE	COUNTY							
7H-95	0.050	3.511	3/ 31	PM-850 HARRISON, TN	3.911	1/ 11	<LLD					
8H-214	0.100	2.590	3.91	8.75 MILL SW	3.91	3-91	<LLD					
5K-89	0.250	0.561	2/ 31	PM-150 NORTHWOODS, TN	0.701	1/ 11						
5K-90	0.050	0.42	0.70	10.25 PILE SW	0.70	0.70						
		1.201	36/ 361	LM-250 NORTHEAST	2.601	3/ 31	1.261	7/ 81				
		0.38	5.08	0.75 MILLS N	0.47	5.98	0.47	2.29				
		0.211	36/ 361	PM-250 COUNTY PK, TN	2.101	3/ 31	0.751	7/ 81				
		0.11	4.65	3.75 MILLS SW	0.76	4.66	0.11	2.62				

a. Minimum Lower Limit of Detection (LLD) as described in Table 27.

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

TABLE 11
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN SOIL

SITE	DATE	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	UPPER LIMIT OF DETECTION	INDICATED RECEPTIONS	ALLEGED SOURCE	DIRECTION	DISTANCE AND DIRECTION	ANNUAL MEAN RANGE ^b	CONTROL MEAN (F) ^b RANGE	NUMBER OF RECEPTIONS REPORTED
PC1758 (URY WEGOT)	6-55, 7-76	26	1.700	20/ 201	PM-550 GEORGETOWN, TN	52-831	27/ 21	32.791	87/ 41	
(3.7 x 10 ⁻² Bq/gm)	6-55-6 (6-11)	26	20.246- 60.10	20/ 201	9.20 WILLES FNE	45.56-	60.10	17.80-	52.02	
CE-141	NOT ESTAB		SLUD							
CE-162	0.660		0.151	3/ 201	PM-250 COUNTY PR, TN		1/ 21	0.054	1/ 41	
KU-103	NOT ESTAB		0.14-	0.16	3.75 WILLES SW		1/ 21	0.05-	0.05	
CS-137	0.020		0.041	6/ 201	PM-250 COUNTY PR, TN		1/ 21	0.15-	0.15	
ZF-95	0.030		0.02-	0.05	3.75 WILLES SW		0.05-	0.04-	3/ 41	
91-95	0.010		0.051	20/ 201	PM-250 COUNTY PR, TN		0.03-	0.03-	0.05	
91-21a	0.020		0.28-	1.72	3.75 WILLES SW		1.31-	1.43-	4/ 41	
91-21c	0.100		0.091	5/ 201	PM-350 DEFSY, TN		0.50-	0.51-	2.83	
9A-223	NOT ESTAB		0.07-	0.10	5.50 WILLES N		0.10-	0.10-	0.10	
11-20c	0.020		0.131	16/ 201	PM-650 SALT CREEK, TN		0.211	0.191	3/ 41	
AC-221	0.660		0.03-	0.21	10.5 WILLES N		0.21-	0.06-	0.25	
PA-22b	NOT ESTAB		1.021	20/ 201	PM-650 PARKSIDE, TN		1.261	0.921	4/ 41	
			0.74-	1.28	8.25 WILLES SW		1.25-	0.80-	1.13	
			1.241	20/ 201	PM-250 COUNTY PR, TN		1.721	0.971	4/ 41	
			0.66-	2.38	3.75 WILLES SW		1.05-	0.54-	1.65	
			0.361	3/ 201	PM-550 GEORGETOWN, TN		0.421	0.681	1/ 41	
			0.361	0.42	9.00 WILLES FNE		0.42-	0.42-	0.48	
			0.24-	0.57	PM-550 GEORGETOWN, TN		0.541	0.301	4/ 41	
			1.321	19/ 201	PM-550 GEORGETOWN, TN		2.011	1.131	4/ 41	
			0.95-	2.09	9.00 WILLES FNE		1.94-	0.64-	1.10	
			0.171	11/ 201	PM-650 HARRISON, TN		0.671	0.041	2/ 41	
			0.04-	1.10	8.25 WILLES SW		0.05-	0.02-	0.07	

a. Nominal lower limit of detection (LLD) as described in Table 2.

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

TABLE 12
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN WELL WATER

MEDIUM OR PATHWAY SAMPLED	NAME OF FACILITY	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION ^a	INDICATION	LOCATION	WELL NO. 1 UNSITE, NW	ANNUAL MEAN (F) ^b		CONTROL LOCATIONS MEAN (F) ^b	NUMBER OF REPORTS RECEIVED		
							MEAN (F) ^b	RANGE ^b				
WELL WATER	NAME OF FACILITY	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION ^a	INDICATION	LOCATION	WELL NO. 1 UNSITE, NW	ANNUAL MEAN (F) ^b	RANGE ^b	CONTROL LOCATIONS MEAN (F) ^b	NUMBER OF REPORTS RECEIVED		
PC17A	68-55	117	2.300	4.891	307	633	6.631	127-127	3.411	247	311	
	GARPA	(5,11)		2.36-	10.15		4.87-	10.15	2.37-	5.71		
	CF-141	146	10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	PA-146	146	15.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	C-60		10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	RU-10	3,106	10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	CS-135		10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	CS-137		10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	ZK-95	83-95	10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	CO-58		15.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	CR-51		10.000	<LLD					0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	ZK-65		15.000	15.081	17	603	15.081	17	101	64.661	17	311
				ANALYSIS PERFORMED	--	WELL NO. 1 UNSITE, NW	15.08-	15.08-	64.06-	64.06		
	PK-54		10.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	I-131		15.000	0.001	07	603			0.001	07	311	
				ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	GA-96	11111		ANALYSIS PERFORMED	--	ALL BELOW LLD			0.001	07	311	
	W-276		NOT ESTAB	2.691	37	31	2.691	27	27	<LLD		
				ANALYSIS PERFORMED	--	WELL NO. 1 UNSITE, NW	16.59-	31.14	16.59-	31.14		
	AC-226		NOT ESTAB	12.661	17	31	12.661	17	27	<LLD		
				ANALYSIS PERFORMED	--	WELL NO. 1 UNSITE, NW	12.06-	12.06	12.06-	12.06		
	TRITIUM		330.000	392.001	17	241	392.001	17	31	<LLD		
				ANALYSIS PERFORMED	--	FARM # 1.0 WELLS N	392.00-	392.00	392.00-	392.00		

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

Table 14

ENVIRONMENTAL GAMMA RADIATION LEVELS

<u>Quarter</u>	<u>Location</u>	<u>Environmental Gamma Radiation Levels</u>	
		<u>mR/Hour</u>	<u>mR/Quarter</u>
November 1976 - January 1977	On-Site (8)*		
	Maximum	0.010	21.3
	Minimum	0.009	18.7
	Average**	0.009±0.001	19.7±2.0
	Off-Site (10)		
	Maximum	0.009	20.8
Minimum	0.005	11.2	
Average	0.007±0.002	15.5±4.8	
February-April 1977	On-Site (8)		
	Maximum	0.019	42.3
	Minimum	0.007	15.5
	Average	0.012±0.008	25.5±17.6
	Off-Site (10)		
	Maximum	0.010	19.6
Minimum	0.006	14.1	
Average	0.008±0.002	16.6±3.6	
May-July 1977	On-Site (7)		
	Maximum	0.010	22.1
	Minimum	0.008	17.1
	Average	0.009±0.002	19.9±3.8
	Off-Site (10)		
	Maximum	0.008	17.7
Minimum	0.005	11.8	
Average	0.007±0.002	16.0±3.4	
August-October 1977	On-Site (8)		
	Maximum	0.013	27.5
	Minimum	0.006	13.1
	Average	0.009±0.004	19.4±9.6
	Off-Site (10)		
	Maximum	0.009	20.0
Minimum	0.005	11.7	
Average	0.007±0.002	16.0±4.8	

*Number of stations (three TLD's at each station)

**All averages reported ±2σ.

Reservoir Monitoring

Samples of aquatic media are collected quarterly along four river stations in Chickamauga Reservoir--at Tennessee River miles (TRM) 496.5, 483.4, 480.8, and 472.8. In addition, water samples were collected by automatic samplers installed at TRM's 473.2, 483.4, and 497.0. Samples collected for radiological analyses include sediment from four stations; water, plankton, and Asiatic clams from three of these stations; and fish from Watts Bar, Chickamauga and Nickajack Reservoirs (see Table 16). The locations of these stations are shown on the accompanying map (Figure 4) and conform to sediment and special ranges established and surveyed by the Data Services Branch, TVA. River station 496.5, the control station, is 12.7 miles (20.4 kilometers) upstream from the Sequoyah plant outfall diffuser.

Samples of water, net plankton, sediment, Asiatic clams, and three species of fish were collected quarterly (plankton only during the two quarters of maximum abundance) and analyzed for radioactivity. Gamma, gross alpha, and gross beta activity were determined in water, net plankton, sediment, shells, and flesh of clams, flesh of two commercial and one game fish species, and the whole body of one commercial fish species. In addition to the above, tritium concentrations were determined in river water samples. Except in the flesh of clams, white crappie, and channel catfish, ^{89}Sr and ^{90}Sr content was determined in all samples by appropriate radiochemical techniques. The activity of 12 gamma-emitting radionuclides was determined with a multichannel gamma spectrometer.

Water

Automatic sequential-type water samplers were installed at the three cross sections indicated above and shown in Table 16, with composite samples analyzed monthly. Grab water samples were also collected monthly at the point of plant discharge to the Tennessee River (TRM 483.7), at a point on the Hiwassee River, and at a point on Chickamauga Creek. Results are displayed in Table 17.

Fish

Radiological monitoring for fish was accomplished by analyses of composite samples of adult fish taken 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. Concentrations of ^{89}Sr and ^{90}Sr were determined on the whole fish and flesh of the buffalo only. 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 18, 19, 20, and 21.

Plankton

As indicated in Table 16, net plankton was collected for radiological analyses at three 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 will probably be practical only during the period April to September because of seasonal variability in plankton abundance. Samples were analyzed for gross alpha and gross beta activity. Sample quantities were not sufficient for the analysis of specific gamma-emitting radionuclides, ^{89}Sr and ^{90}Sr . Sample results are given in Table 22.

Sediment

Sediment samples were collected from dredge hauls made for bottom fauna. Gamma, gross alpha, and gross beta activity and ^{89}Sr and ^{90}Sr content were determined in samples collected from points in four cross sections. 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 23.

Asiatic Clams

Samples of Asiatic clams were collected with a Ponar dredge from three stations and analyzed for gamma, gross alpha, and gross beta activity. The ^{89}Sr and ^{90}Sr content was determined in the shells. Results are given in Tables 24 and 25.

Table 16

SAMPLING SCHEDULE - RESERVOIR MONITORING

Tennessee River (Mile)	Biological Samples				Water Samples			
	Zooplankton, Chlorophyll, Phytoplankton*	Benthic Fauna*	Sediment*	Fish**	Distance From Left Bank		Depths (Meters)	
					Feet	Percent		
472.8			2		4442	89	1, 9	
473.2								Automatic sampler***
480.8	1	1	2					
483.4	1	1	2		266 435	11 17	1 1, 12	Automatic sampler***
496.5	1	1	2		2500	57	1, 9	
497.0								Automatic sampler***

*Replicate samples.

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

***Composite sample analyzed monthly.

Figure 4

RESERVOIR MONITORING NETWORK SEQUOYAH NUCLEAR PLANT

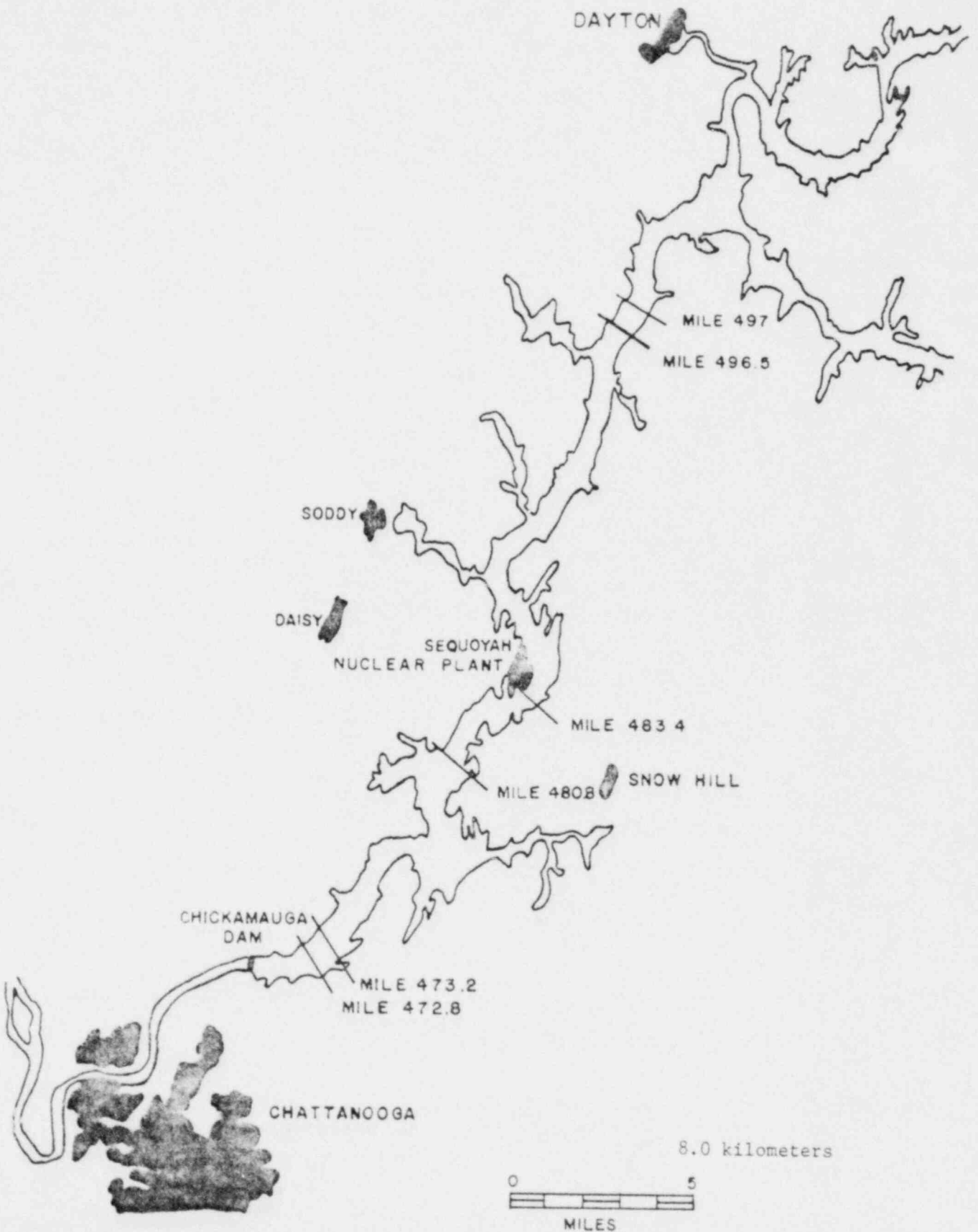


TABLE 1B
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN FISH (CHANNEL CATFISH, FLESH)

NAME OF FACILITY LOCATION OF FACILITY	TYPE OF FISH TURAL NUMBER OF SAMPLES --RECORDED--	CENTER LIMIT OF EFFECTIVE --LLD--	INDICATOR LOCATIONS MEAN (F) ^a --BASED--	LOCATION WITH HIGHEST AMPI --DISTANCE--	ACTUAL MEAN MEAN (F) ^b --RANGE--	CONTROL LOCATIONS MEAN (F) ^b --BASED--	NUMBER OF ANALYSES REPORTED MEASUREMENTS
PELUM TR F-2342Z SAMPLER LADDER-CLASS-BREWER	GR-55 ALFA GR-55 FFB CAAMA (L-41)	0.100 0.100	ALL ANALYSIS PERFORMED -- 24.371 2/ 21 17.97- 30.76	ALL PELUM LLD CHICKAPOUGA RES. TRM 471-530	24.371 2/ 21 17.97- 30.76	0.001 0/ 4) 0.361 4/ 4) 21.94- 34.94	
CHANNEL CATFISH (FL) PELUM (DYE WEIGHT)	GR-55 ALFA GR-55 FFB CAAMA (L-41)	0.150 0.110 0.650	ALL ANALYSIS PERFORMED -- 0.171 1/ 21 0.17- 0.17 0.001 0/ 21	CHICKAPOUGA RES. TRM 471-530	0.171 1/ 21 0.17- 0.17	0.311 3/ 4) 0.18- 0.39 0.001 0/ 4)	
(3.7 x 10 ⁻² Bq/gm)	GR-55 ALFA GR-55 FFB CAAMA (L-41)	0.120 0.120 0.120	ALL ANALYSIS PERFORMED -- 0.121 1/ 21 0.12- 0.12 0.001 0/ 21	ALL PELUM LLD ALL PELUM LLD CHICKAPOUGA RES. TRM 471-530	0.121 1/ 21 0.12- 0.12	0.001 0/ 4) 0.001 0/ 4) 0.241 3/ 4) 0.17- 0.32 0.001 0/ 4)	
	GR-55 ALFA GR-55 FFB CAAMA (L-41)	0.200 0.600 0.230	ALL ANALYSIS PERFORMED -- 1.821 1/ 21 1.82- 1.82 0.241 1/ 21	ALL PELUM LLD ALL PELUM LLD CHICKAPOUGA RES. TRM 471-530	1.821 1/ 21 1.82- 1.82 0.241 1/ 21	0.001 0/ 4) 0.001 0/ 4) 0.001 0/ 4) 0.001 0/ 4)	
	GR-55 ALFA GR-55 FFB CAAMA (L-41)	0.150	ALL ANALYSIS PERFORMED -- 0.061 0/ 21	ALL PELUM LLD	0.061 0/ 21	0.001 0/ 4)	

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.
b. Mean and range based upon detectable measurements only. Fraction of detectable measurements of specified locations is indicated in parentheses (F).

TABLE 19
 ENVIRONMENTAL MONITORING SUMMARY
 RADIOACTIVITY IN FISH (WHITE CRAPPIE, FLESH)

NAME OF FACILITY: COOBYA DOCKET NO. BB-78-4-501
 LOCATION OF FACILITY: BRILLICE TENNESSEE REPORTING PERIOD: 72

MEDIUM OR PATHWAY SAMPLED UNIT OF MEASUREMENT	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a LLD	ALL INDICATOR LOCATIONS MEAN (F) ^b RANGE ^b	LOCATION WITH HIGHEST NAME DISTANCE AND DIRECTION	ANNUAL MEAN MEAN (F) ^b RANGE ^b	CONTROL LOCATIONS MEAN (F) ^b RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
WHITE CRAPPIE (FF) PCI/GM DRY WEIGHT (1.7×10^{-2} Bq/gm)	GROSS ALPHA b	0.100	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 41	
	GROSS BETA f	0.100	37.711 2/ 21 36.15- 39.24	CHICKAMAUGA RES. TRM 471-530	37.711 2/ 21 36.15- 39.26	39.791 4/ 41 33.96- 46.22	
	GAMMA INAIR s						
	GA-140, LA-140	0.150	0.281 1/ 21 0.28- 0.28	CHICKAMAUGA RES. TRM 471-530	0.281 1/ 21 0.28- 0.28	0.381 3/ 41 0.26- 0.48	
	CO-60	0.110	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 41	
	CS-137	0.120	0.141 2/ 21 0.14- 0.14	CHICKAMAUGA RES. TRM 471-530	0.141 2/ 21 0.14- 0.14	0.211 4/ 41 0.15- 0.27	
	ZK-95, NE-95	0.120	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 41	
	CD-58	0.290	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 41	
	CE-51	0.800	0.721 1/ 21 0.72- 0.72	CHICKAMAUGA RES. TRM 471-530	0.721 1/ 21 0.72- 0.72	0.951 1/ 41 0.95- 0.95	
	RE-54	0.150	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 41	
I-131	0.200	0.551 1/ 21 0.55- 0.55	CHICKAMAUGA RES. TRM 471-530	0.551 1/ 21 0.55- 0.55	0.721 1/ 41 0.72- 0.72		

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

TABLE 20
 ENVIRONMENTAL MONITORING SUMMARY
 RADIOACTIVITY IN FISH (SMALLMOUTH BUFFALO, FLESH)

NAME OF FACILITY, SEWQUAN		DOCKET NO. RB-18-6-501					
LOCATION OF FACILITY, HAMMOND		REPORTING PERIOD, 71					
MEDIA OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL	LOCATION WITH HIGHEST	ANNUAL MEAN	CONTROL	NUMBER OF
			INDICATOR LOCATIONS MEAN (F) ^b RANGE ^b	NAME DISTANCE AND DIRECTION	MEAN (F) ^b RANGE ^b	LOCATIONS MEAN (F) ^b RANGE ^b	NONROUTINE REPORTED MEASUREMENTS
SMALLMOUTH BUFF (F) PERCENT (DRY WEIGHT) (1.7×10^{-6} Bq/gw)	GROSS ALPHA	0.100	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	GROSS BETA	0.100	26.431 2/ 21 25.05- 27.10	CHICKAMAUGA RES. TRM 471-530	26.431 2/ 21 25.05- 27.80	29.951 3/ 31 20.75- 39.15	
	GAMMA (RAI)						
	BA-140, LA-140	0.150	0.421 1/ 21 0.42- 0.42	CHICKAMAUGA RES. TRM 471-530	0.421 1/ 21 0.42- 0.42	0.441 2/ 31 0.29- 0.60	
	Co-60	0.110	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	CS-134	0.120	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	CS-137	0.120	0.141 1/ 21 0.14- 0.14	CHICKAMAUGA RES. TRM 471-530	0.141 1/ 21 0.14- 0.14	0.161 1/ 31 0.16- 0.16	
	Zr-95, Nb-95	0.120	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	CU-64	0.200	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	CR-51	0.600	<LLD			0.761 1/ 31 0.76- 0.76	
	Zr-95	0.230	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	Nb-94	0.150	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
	Sr-89	0.500	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31	
Sr-90	0.100	0.001 0/ 21 ANALYSIS PERFORMED	-- ALL BELOW LLD		0.001 0/ 31		

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

TABLE 1

ENVIRONMENTAL MONITORING SUMMARY

RADIOACTIVITY IN FISH (SMALLMOUTH BUFFALO, WHOLE)

NAME OF FACILITY, SEDUCYAL ----- DOCKET NO. KB-28-4-501 -----
 LOCATION OF FACILITY, BASILION ----- TENNESSEE ----- REPORTING PERIOD 77 -----

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a (LLD)	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ANNUAL MEAN MEAN (F) ^b RANGE ^b	CONTROL LOCATIONS MEAN (F) ^b RANGE ^b	NUMBER OF NONROUTINE REPORTS MEASUREMENTS
			MEAN (F) ^b	RANGE ^b			
SMALLMOUTH BUFF (WHOLE FISH (DRY WEIGHT)) (3.7 x 10 ⁻² Bq/gm)	GROSS ALPHA K	0.100	0.100	17 21	CHICKAMAUGA RES. TRM 471-530	0.100- 0.10	0.330 17 31
	GROSS BETA K	0.100	19.730	27 21	CHICKAMAUGA RES. TRM 471-530	19.730- 24.02	26.790 37 31
GAMMA (WHOLE) S	Cs-137,144	0.350	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
	Ba-140,La-140	0.150	<LLD			0.260 17 31	
Ce-60		0.110	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
	Ru-106,106	0.450	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
Cs-137		0.120	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
	Zr-95,Ni-95	0.120	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
Co-58		0.200	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
	Ck-51	0.600	<LLD			0.940 17 31	
Zn-65		0.230	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
	Mn-54	0.150	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
I-131		0.200	0.270	17 21	CHICKAMAUGA RES. TRM 471-530	0.270- 0.27	0.310 17 31
	Sr-89	0.500	0.000	07 21	ANALYSIS PERFORMED -- ALL BELOW LLD	0.000 07 31	
Sr-90		0.100	0.300	17 21	CHICKAMAUGA RES. TRM 471-530	0.300- 0.30	0.280 37 31
			0.300	0.30		0.100- 0.51	

a. Nominal lower limit of detection (LLD) as described in Table 2.

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

TABLE 22
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN PLANKTON

NAME OF FACILITY	TYPE AND TOTAL AMOUNTS OF ANALYSIS PERFORMED	TYPE AND NUMBER OF SAMPLES	LOCATION OF FACILITY	STATE	DCKET NO.	REPORTING PERIOD	ALL INDICATOR LOCATIONS		LOCATION WITH HIGHEST ACTIVITY		CONTROL LOCATIONS	
							MEAN (CP)	RANGE	NAME	DISTANCE	MEAN (CP)	RANGE
LOCATION OF FACILITY	TYPE AND TOTAL AMOUNTS OF ANALYSIS PERFORMED	TYPE AND NUMBER OF SAMPLES	LOCATION OF FACILITY	STATE	DCKET NO.	REPORTING PERIOD	MEAN (CP)	RANGE	NAME	DISTANCE	MEAN (CP)	RANGE
PLANT	CR-55 ALPHA	0.100		ILLINOIS	74-28-6-SOL	3/ 31	6.324	6/ 61	ANNURL-REPH	158	7.654	3/ 31
(3.7 x 10 ⁻⁷ Bq/gm)	CR-55 ALPHA	0.100		ILLINOIS		6/ 61	1.03	13.19			1.93	13.19
						6/ 61	3.216	6/ 61			31.254	3/ 31
							16.25	69.54			18.45	49.94

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

TABLE 23
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN SEDIMENT

NAME OF FACILITY, SURVEY LOCATION OF FACILITY, SURVEY		TYPE AND TOTAL NUMBER OF ANALYSES		LOCATIONS WITH HIGHEST ANNUAL MEAN		CONTROL LOCATIONS		NUMBER OF NONROUTINE REPORTS	
MEDIUM OR METHOD SAMPLED		CONCENTRATION		MEAN (FP)		MEAN (FP)		RANGE	
LUBRICATION MEASUREMENTS		LIMIT		DIRECTION AND DIRECTION		RANGE		RANGE	
STUDENT AVG		OF		DIRECTION		RANGE		RANGE	
PCITUM (MGY METHOD)		OF		DIRECTION		RANGE		RANGE	
GRUSS TAPP	0.350	11/ 121	18M 480.82	17.811	4/ 41	9.954	4/ 41		
68055 TETA	0.700	5/ 121	18M 472.80	14.56-	23.84	8.01-	12.41		
LAPPA (LFA)		12/ 121	18M 472.80	64.361	4/ 41	44.521	4/ 41		
		69.09		59.55-	69.09	40.26-	48.68		
0-149	0.260	1/ 121	18M 480.82	0.391	1/ 41	<LLD			
0-161	0.010	0.49	18M 480.82	0.39-	0.38				
0-171	0.020	8/ 121	18M 480.82	0.361	4/ 41	0.121	3/ 41		
0-181	0.030	0.46	18M 472.80	0.28-	0.45	0.09-	0.18		
0-191	0.040	12/ 121	18M 472.80	0.191	4/ 41	1.011	4/ 41		
0-201	0.050	6.02		0.15-	6.02	0.42-	2.05		
0-211	0.060	0/ 121		0.001	0/ 121	0.001	0/ 41		
0-221	0.070	ANALYSES PERFORMED -- ALL RESULTS LLD		0.201	2/ 121	18M 480.82			
0-231	0.080	0.25	18M 472.80	0.15-	0.25	0.251	1/ 41		
0-241	0.090	1.83	18M 472.80	1.471	12/ 121	1.671	4/ 41		
0-251	0.100	1.83	18M 480.82	1.911	12/ 121	1.66-	1.70		
0-261	0.110	2.52	18M 480.82	1.911	12/ 121	2.251	4/ 41		
0-271	0.120	0.65	18M 480.82	1.20-	2.52	1.75-	2.52		
0-281	0.130	0.65	18M 472.80	0.651	1/ 41	0.851	1/ 41		
0-291	0.140	0.65	18M 472.80	0.63-	0.65	0.65-	0.65		
0-301	0.150	0.72	18M 480.82	0.571	12/ 121	0.64	4/ 41		
0-311	0.160	0.72	18M 480.82	0.34-	0.72	0.60-	0.71		
0-321	0.170	2.061	18M 480.82	2.061	12/ 121	2.361	4/ 41		
0-331	0.180	2.49	18M 480.82	1.36-	2.49	2.26-	2.42		
0-341	0.190	0.39	18M 472.80	0.39-	0.39	0.09-	0.09		
0-351	0.200	2.53	18M 480.82	2.021	2/ 121	2.531	1/ 41		
0-361	0.210	1.51	18M 480.82	1.51-	2.53	2.53-	2.53		
0-371	0.220	1.41	18M 472.80	1.411	1/ 121	1.411	1/ 41		
0-381	0.230	1.41	18M 472.80	1.41-	1.41	1.41-	1.41		

a. Non-Inch Lower Limit of Detection (LLD) as described in Table 2.

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

TABLE 24
 ENVIRONMENTAL MONITORING SUMMARY
 RADIOACTIVITY IN CLAM FLESH

NAME OF FACILITY: SECOYAE		DOCKET NO.: RB-28-4-501						
LOCATION OF FACILITY: HAMLET, TENNESSEE		REPORTING PERIOD: 27						
MEDIUM OR PATHWAY SAMPLED	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION ^a	ALL INDICATOR LOCATIONS MEAN (F) ^b RANGE ^b	LOCATION WITH HIGHEST NAME DISTANCE AND DIRECTION	ANNUAL MEAN MEAN (F) ^b RANGE ^b	CONTROL LOCATIONS MEAN (F) ^b RANGE ^b	NUMBER OF NONROUTINE REPORTED MEASUREMENTS	
CLAM FLESH AVE PC/1GM (DRY WEIGHT) (3.7×10^{-2} Bq/gm)	GRUSS (ETA) 1.	0.100	1.031 77 81 0.37- 4.53	TRM 490.82	1.391 47 41 0.37- 4.33	0.381 47 41 0.10- 0.59		
	GRUSS (ETA) 1.	0.100	7.664 87 81 3.00- 29.44	TRM 490.82	10.501 47 41 3.02- 29.44	4.491 47 41 2.14- 7.03		
	GAMMA (GELL) 1.							
	CS-137 1.	0.080	1.281 17 61 1.28- 1.28	TRM 490.82	1.281 17 31 1.28- 1.28	<LLD		
	SI-214 1.	NOT ESTAB		0.941 67 61 0.32- 1.87	TRM 490.82	1.081 37 31 0.32- 1.87	2.071 17 41 2.07- 2.07	
	TI-208 1.	NOT ESTAB		0.381 17 61 0.38- 0.38	TRM 490.82	0.381 17 31 0.38- 0.38	<LLD	
	AC-228 1.	NOT ESTAB		0.931 27 61 0.68- 1.17	TRM 490.82	1.171 17 31 1.17- 1.17	<LLD	

a. Nominal Lower Limit of Detection (LLD) as described in Table 2.

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

TABLE 25
ENVIRONMENTAL MONITORING SUMMARY
RADIOACTIVITY IN CLAM SHELL

LOCATION OF FACILITY	NAME OF FACILITY	TYPE AND TOTAL WEIGHT OF SAMPLES RETURNED	UPPER LIMIT OF DETECTION ^a	INDICATOR LOCATIONS		DISTANCE AND DIRECTION	HIGHEST AND LOWEST MEAN (FP) ^b		CONTROL LOCATIONS	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
				MEAN (FP)	RANGE ^b		MEAN (FP)	RANGE ^b		
CLAM SHELL AVE				ALL						
FCI/UM	1000		0.700	5/ 81	TRM 480.82	2.44	4/ 41	<11.0		
		1c		0.71	7.44	0.71	7.44			
		1c	0.700	1.32	8/ 81	TRM 480.82	4/ 41	8.88	4/ 41	
		1c		6.25	11.12		11.32	7.65	9.92	
		1c	0.210	0.03	5/ 81	TRM 480.82	4/ 41	0.02	1/ 41	
		1c		0.01	0.03		0.03	0.02	0.02	
		1c	0.020	0.11	4/ 81	TRM 480.82	1/ 41	0.03	1/ 41	
		1c		0.04	0.14		0.13	0.03	0.03	
		1c	0.020	0.20	8/ 81	TRM 480.82	4/ 41	0.18	4/ 41	
		1c		0.09	0.35		0.23	0.10	0.26	
		1c	0.100	0.36	1/ 81	TRM 480.82	1/ 41	<11.0		
		1c		0.07	0.34		0.34	0.34		
		1c	0.020	0.04	5/ 81	TRM 480.82	4/ 41	0.05	4/ 41	
		1c		0.06	0.30		0.10	0.02	0.06	
		1c	0.060	0.35	6/ 81	TRM 480.82	4/ 41	0.31	4/ 41	
		1c		0.15	0.49		0.49	0.29	0.35	
		1c	5.000	<11.0				5.23	2/ 41	
		1c	1.000	1.90	8/ 81	TRM 480.82	4/ 41	1.90	3/ 41	
		1c		1.05	2.70		2.70	1.32	2.49	

a. Minimal Lower Limit of Detection (LLD) as described in Table 2.

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

Quality Control

A quality control program has been established with the 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 Sequoyah Nuclear Plant has not achieved criticality, there has been no contribution of radioactivity from the plant to the environment. The levels of radioactivity being reported in this document are due to natural background radiation, nuclear weapons testing, or other nuclear operations in the area.

Increased levels of radioactivity were observed in milk, rainwater, air particulates, heavy particle fallout, vegetation, and in atmospheric radioiodine in September and October following the atmospheric nuclear weapons testing conducted by the Peoples' Republic of China. This increase was widely reported in the eastern portion of the United States. Levels of ^{131}I in milk as high as 8.1 pCi/l were observed. The primary radioisotopes identified in the atmospheric media were ^{95}Zr , ^{95}Nb , ^{131}I , ^{132}I , ^{140}Ba , ^{140}La , and ^{239}Np .