Tennessee Valley Authority, Post Office Box 2000, Soddy Daisy, Tennessee 37384-2000

April 27, 2015

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Washington, D. C. 20555-0001

Sequoyah Nuclear Plant, Units 1 and 2
Facility Operating License Nos. DPR-77 and DPR-79
NRC Docket Nos. 50-327, 50-328 and 72-034

Subject: **Annual Radiological Environmental Operating Report**

Enclosed is the Annual Radiological Environmental Operating Report for the period of January 1 to December 31, 2014. This report is being submitted as required by the respective Sequoyah Nuclear Plant (SQN), Units 1 and 2, Technical Specification 6.9.1.6 and SQN's Offsite Dose Calculation Manual Administrative Control Section 5.1, each of which specifies that the report be submitted prior to May 1st of each year.

There are no new regulatory commitments contained in this letter. If you have any questions concerning this matter, please contact Erin Henderson at (423) 843-7170.

Respectfully,

J. T. Carlin
Site Vice President
Sequoyah Nuclear Plant

Enclosure:
Annual Radiological Environmental Operating Report, Sequoyah Nuclear Plant, January - December 2014

cc (Enclosure):

NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Sequoyah Nuclear Plant

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LIMS526

ENCLOSURE

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
SEQUOYAH NUCLEAR PLANT
January - December 2014

Annual Radiological Environmental Operating Report

Sequoyah Nuclear Plant 2014

TVA

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
SEQUOYAH NUCLEAR PLANT
2014

TENNESSEE VALLEY AUTHORITY

April 2015

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EXECUTIVE SUMMARY

This report describes the radiological environmental monitoring program (REMP) conducted by TVA in the vicinity of the Sequoyah Nuclear Plant (SQN) in 2014. The program includes the collection of samples from the environment and the determination of the concentrations of radioactive materials in the samples. Samples were collected from locations in the general area of the plant and from areas that would not be influenced by plant operations. Monitoring includes the sampling of air, water, milk, foods, soil, fish, shoreline sediment and the measurement of direct radiation levels. Results from stations near the plant are compared with data from control stations and with preoperational measurements to determine potential impacts of site operations.

The vast majority of radioactivity measured in environmental samples from the SQN program resulted from naturally occurring radioactive materials. Trace quantities of cesium-137 (Cs-137) were measured in soil and fish. Very low levels of strontium-90 (Sr-90) were detected in milk. The concentrations were typical of the levels expected to be present in the environment from past nuclear weapons testing or operation of other nuclear facilities in the region. The fallout from accidents at the Chernobyl plant in the Ukraine in 1986 and Fukushima plant in Japan in 2011 may have also contributed to the low levels of Cs-137 measured in environmental samples. Tritium at concentrations slightly above the analytical detection limit was detected in a limited number of water samples collected from Chickamauga Reservoir and in seven samples of groundwater collected from the onsite REMP well. These levels do not represent a significant contribution to the radiation exposure to members of the public.

INTRODUCTION

This report describes and summarizes the results of radioactivity measurements taken in the vicinity of SQN and laboratory analyses of samples collected in the area. The measurements are taken to comply with the requirements of the Code of Federal Regulations (CFR), 10 CFR 50, Appendix A, Criterion 64 and 10 CFR 50, Appendix I, Sections IV.B.2, IV.B.3 and IV.C, and to determine potential effects on public health and safety. This report satisfies the annual reporting requirements of SQN Plant Technical Specification (TS) 6.9.1.6 and Offsite Dose Calculation Manual (ODCM) Administrative Control 5.1. The data presented in this report include results from the prescribed program and other information to help correlate the significance of results measured by this monitoring program to the levels of environmental radiation resulting from naturally occurring radioactive materials.

Naturally Occurring and Background Radioactivity

Many materials in our world contain trace amounts of naturally occurring radioactivity. For example, approximately 0.01 percent of all potassium is radioactive potassium-40 (K-40) which has a half-life of 1.3 billion years. An individual weighing 150 pounds contains about 140 grams of potassium (Reference 1). Other examples of naturally occurring radioactive materials are beryllium (Be)-7, bismuth (Bi)-212 and 214, lead (Pb)-212 and 214, thallium (Tl)-208, actinium (Ac)-228, uranium (U)-238 and 235, thorium (Th)-234, radium (Ra)-226, radon (Rn)-222 and 220, carbon (C)-14, and hydrogen (H)-3 (generally called tritium). These naturally occurring radioactive materials are in the soil, our food, our drinking water, and our bodies. The remainder of the natural background radiation is produced by cosmic rays. The relative hazard of different types of radiation sources can be compared by evaluating the amount of radiation the U.S. population receives from each type of radiation source as displayed in the following table. This table was adapted from References 2 and 3.

U.S. GENERAL POPULATION AVERAGE DOSE EQUIVALENT ESTIMATES

Source	Millirem/Year Per Person
Natural background dose equivalent	
Cosmic	33
Terrestrial	21
In the body	29
Radon	228
Total	311
Medical (exposure)	300
Nuclear energy	0.28
Consumer products	13
Total	624 (approximately)

As can be seen from the table, natural background radiation dose equivalent to the U.S. population normally exceeds that from nuclear plants by several hundred times. The 0.28 mrem attributable to nuclear plant operations results in a population radiation dose equivalent that is insignificant compared to that which results from natural background radiation.

Electric Power Production

Nuclear power plants are similar in many respects to conventional coal burning (or other fossil fuel) electric generating plants. The basic process behind electrical power production in both types of plants is that fuel is used to heat water to produce steam which provides the force to turn turbines and generators. In a nuclear power plant, the fuel is uranium and the heat is produced in the reactor through the fission of the uranium. Nuclear plants include many complex systems to control the nuclear fission process and to safeguard against the possibility of reactor malfunction. The nuclear reactions produce radionuclides commonly referred to as fission and activation products. Very small amounts of these fission and activation products are released into the plant systems. This radioactive material can be transported throughout plant systems and some of it released to the environment.

The pathways through which radioactivity is released are monitored. Liquid and gaseous effluent monitors record the radiation levels for each release. These monitors provide alarm mechanisms to prompt termination of release above limits.

Releases are monitored at the onsite points of release and through the environmental monitoring program which measures the environmental radiation in areas around the plant. In this way, not only is the release of radioactive materials from the plant tightly controlled, but measurements are made in surrounding areas to verify that the population is not being exposed to significant levels of radiation or radioactive materials.

The SQN ODCM, which is required by the plant technical specifications, prescribes limits for the release of radioactive effluents, as well as limits for doses to the general public from the release of these effluents.

The dose to a member of the general public from radioactive materials released to unrestricted areas, as given in Nuclear Regulatory Commission (NRC) guidelines and the ODCM, is limited as follows:

Liquid Effluents

Total body	≤3 mrem/year
Any organ	≤10 mrem/year

Gaseous Effluents

Noble gases:

Gamma radiation	≤10 mrad/year
Beta radiation	≤20 mrad/year

Particulates:

Any organ	≤15 mrem/year

The Environmental Protection Agency (EPA) limits for the total dose to the public in the vicinity of a nuclear power plant, established in the Environmental Dose Standard of 40 CFR 190, are as follows:

Total body	≤25 mrem/year
Thyroid	≤75 mrem/year
Any other organ	≤25 mrem/year

Appendix B to 10 CFR 20 presents annual average limits for the concentrations of radioactive materials released in gaseous and liquid effluents at the boundary of the unrestricted areas. Table 1 of this report compares the nominal lower limits of detection (LLD) for the SQN monitoring program with the regulatory limits for maximum annual average effluent concentrations released to unrestricted areas and levels requiring special reports to the NRC. It should be noted that the levels of radioactive materials measured in the environment are typically only slightly above the lower limit of detection. The data presented in this report indicate compliance with the regulations.

SITE/PLANT DESCRIPTION

Sequoyah is located on a site near the geographical center of Hamilton County, Tennessee, on a peninsula on the western shore of Chickamauga Lake at Tennessee River Mile (TRM) 484.5. Figure 1 shows the site in relation to other TVA projects. The SQN site, containing approximately 525 acres, is approximately 7.5 miles northeast of the nearest city limit of Chattanooga, Tennessee, 14 miles west-northwest of Cleveland, Tennessee, and approximately 31 miles south-southwest of TVA's Watts Bar Nuclear Plant (WBN) site.

Population is distributed unevenly within 10 miles of the SQN site. Approximately 60 percent of the population is in the general area between 5 and 10 miles from the plant in the sectors ranging from the south, clockwise, to the northwest sector. This concentration is a reflection of suburban Chattanooga and the town of Soddy-Daisy. This area is characterized by considerable vacant land with scattered residential subdivisions. Residential subdivision growth has continued within the 10-mile radius of the plant. There is also some small-scale farming located within 5 miles of the plant.

Chickamauga Reservoir is one of a series of highly controlled multiple-use reservoirs located on the Tennessee River whose primary uses are flood control, navigation, and the generation of electric power. Secondary uses include industrial and public water supply and waste disposal, commercial fishing, and recreation. Public access areas, boat docks, and residential subdivisions have been developed along the reservoir shoreline.

SQN consists of two pressurized water reactors. Fuel was loaded in Unit 1 on March 1, 1980, and the unit achieved criticality on July 5, 1980. Fuel was loaded in Unit 2 in July 1981, and the unit achieved initial criticality on November 5, 1981.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Most of the radiation and radioactivity generated in a nuclear power reactor is contained within the reactor itself or one of the other plant systems. Plant effluent monitors are designed to detect the small amounts of radioactive material released to the environment. Environmental monitoring provides a final verification that the systems are performing as planned. The monitoring program is designed to monitor the pathways between the plant and the general public in the immediate vicinity. Sample types are chosen so that the potential for detection of radioactivity in the environment will be maximized. The radiological environmental monitoring program is outlined in Appendix A.

There are two primary pathways by which radioactivity can move through the environment to humans: air and water (see Figure 2). The air pathway can be separated into two components: the direct (airborne) pathway and the indirect (ground or terrestrial) pathway. The direct airborne pathway consists of direct radiation and inhalation by humans. In the terrestrial pathway, radioactive materials may be deposited on the ground or on plants and subsequently be ingested by animals and/or humans. Human exposure through the liquid pathway may result from drinking water, eating fish, or by direct exposure at the shoreline. The types of samples collected in this program are designed to monitor these pathways.

A number of factors were considered in determining the locations for collecting environmental samples. The locations for the atmospheric monitoring stations were determined from a critical pathway analysis based on weather patterns, dose projections, population distribution, and land use. Terrestrial sampling stations were selected after reviewing such factors as the locations of dairy animals and gardens in conjunction with the air pathway analysis. Liquid pathway stations were selected based on dose projections, water use information, and availability of media such as fish and sediment. Table A-2 (Appendix A, Table 2: This identification system is used for the tables and figures in the appendices.) lists the sampling stations and the types of samples collected. Modifications made to the SQN monitoring program in 2014 are described in Appendix B. Deviations from the sampling and analysis schedule are presented in Appendix C.

To determine the amount of radioactivity in the environment prior to the operation of SQN, a preoperational radiological environmental monitoring program was initiated in 1971 and operated until the plant began operation in 1980. Measurements of the same types of radioactive materials that are measured currently were assessed during the preoperational phase to establish normal background levels for various radionuclides in the environment. The knowledge of pre-existing radionuclide patterns in the environment permits a determination, through comparison and trending analyses, of any impact on the environment due to the operation of SQN.

The determination of impact from the plant during the operating phase also utilizes the data from control stations that have been established in the monitoring program. Results of environmental samples taken at control stations (far from the plant) are compared with those from indicator stations (near the plant) to establish the extent of SQN influence.

Samples are analyzed by TVA's Environmental Radiological Monitoring and Instrumentation (ERM&I) group located at the Western Area Radiological Laboratory (WARL) in Muscle Shoals, Alabama, with the exception of the Sr-89, 90 analysis of soil samples which is performed by a contract laboratory. Analyses are conducted in accordance with written and approved procedures and are based on accepted methods. A summary of the analysis techniques and methodology is presented in Appendix D. Data tables summarizing the sample analysis results are presented in Appendix H.

The radiation detection devices and analysis methods used to determine the radionuclide content of samples collected in the environment are very sensitive to small amounts of radioactivity. The sensitivity of the measurements process is defined in terms of the lower limit of detection. A description of the nominal LLDs for the radioanalytical laboratory is presented in Appendix E.

The ERM&I laboratory employs a comprehensive quality assurance/quality control program to monitor laboratory performance throughout the year. The program is intended to detect any problems in the measurement process as soon as possible so they can be corrected. This program includes equipment checks, to ensure that the radiation detection instruments are working

properly, and the analysis of quality control samples. The laboratory participated in a blind cross check program administrated by a vendor. This program provided an independent interlaboratory comparison program. A complete description of the laboratory's quality assurance/quality control program is presented in Appendix F.

DIRECT RADIATION MONITORING

Direct radiation levels are measured at various monitoring points around the plant site. These measurements include contributions from cosmic radiation, radioactivity in the ground, fallout from atmospheric nuclear weapons tests conducted in the past, and any radioactivity that may be present as a result of plant operations. Because of the relatively large variations in background radiation as compared to the small levels from the plant, contributions from the plant may be difficult to distinguish.

Measurement Techniques

The Landauer InLight environmental dosimeter is used in the radiological environmental monitoring program for the measurement of direct radiation. This dosimeter contains four elements consisting of aluminum oxide detectors with open windows as well as plastic and copper filters. The dosimeter is processed using optically stimulated luminescence (OSL) technology to determine the amount of radiation exposure.

The dosimeters are placed approximately 1 meter above the ground, with two at each monitoring location. Sixteen monitoring points are located around the plant near the site boundary, one location in each of the 16 compass sectors. One monitoring point is also located in each of the 16 compass sectors at a distance of approximately four to five miles from the plant.

Dosimeters are also placed at additional monitoring locations out to approximately 32 miles from the site. The dosimeters are exchanged every 3 months. The dosimeters are sent to Landauer for processing and results reporting. The values are corrected for transit and shielded background exposure. An average of the two dosimeter results is calculated for each monitoring point. The system meets or exceeds the performance specifications outlined in American National Standards Institute (ANSI) N545-1975 and Health Physics Society (HPS) Draft Standard N13.29 for environmental applications of dosimeters.

Results

The results for environmental dosimeter measurements are normalized to a standard quarter (91.25 days or 2190 hours). The monitoring locations are grouped according to the distance from the plant. The first group consists of the monitoring points within 2 miles of the plant. The second group is made up of the locations greater than 2 miles from the plant. Past data have shown that the average results from the locations more than 2 miles from the plant are essentially the same. Therefore, for purposes of this report, monitoring points 2 miles or less from the plant are identified as "onsite" stations and locations greater than 2 miles are considered "offsite."

The quarterly gamma radiation levels determined from the dosimeters deployed around SQN in 2014 are summarized in Table H-1. The exposures are measured in milliroentgens (mR). For purposes of this report, one milliroentgen, one millirem (mrem) and one millirad (mrad) are assumed to be numerically equivalent.

The rounded average annual exposures, as measured in 2014, are shown below. For comparison purposes, the average direct radiation measurements made in the preoperational phase of the monitoring program are also shown.

	Annual SQN Average Direct Radiation Levels mR/Year	
	2014	(Pre-operational) 1976-79
Onsite Stations	63	79
Offsite Stations	58	63

The data in Table H-1 indicate that the average quarterly direct radiation levels at the SQN onsite stations are approximately 1.3 mR/quarter higher than levels at the offsite stations. This difference is consistent with levels measured for the preoperation and construction phases of TVA nuclear power plant sites where the average levels onsite were slightly higher than levels offsite. Figure H-1 compares plots of the data from the

onsite stations with those from the offsite stations over the period from 1976 through 2014. The Landauer InLight Optically Stimulated Luminescence (OSL) dosimeters were deployed since 2007 replacing the Panasonic UD-814 used during the previous years.

The data in Table H-2 contains the results of the individual monitoring stations. The results reported in 2014 are consistent with direct radiation levels identified at locations which are not influenced by the operation of SQN. There is no indication that SQN activities increased the background radiation levels normally observed in the areas surrounding the plant.

ATMOSPHERIC MONITORING

The atmospheric monitoring network is divided into three groups identified as local, perimeter, and remote. Four local air monitoring stations are located on or adjacent to the plant site in the general directions of greatest wind frequency. Four perimeter air monitoring stations are located in communities out to about 10 miles from the plant, and four air monitors are located between 10-20 miles. These four stations are used as control or baseline stations. The monitoring program and the locations of monitoring stations are identified in the tables and figures of Appendix A.

Sample Collection and Analysis

Air particulates are collected by continuous sampling of air at a flow rate of approximately 2 cubic feet per minute (cfm) through a 2-inch glass fiber filter. The sampling system consists of a pump, magnehelic gauge for measuring the drop in pressure across the system, and a dry gas meter to measure the volume of air sampled. This sampling system is housed in a metal building. The filter is contained in a sampling head mounted on the outside of the monitor building. The filter is replaced weekly. Each filter is analyzed for gross beta activity about 3 days after collection to allow time for the radon daughters to decay. Every 4 weeks composites of the filters from each location are analyzed by gamma spectroscopy.

The presence of gaseous radioiodine is monitored using a commercially available cartridge containing TEDA impregnated charcoal. This system is designed to collect iodine (I) in both the elemental form and as organic compounds. The cartridge is located in the same sampling head as the air particulate filter and is downstream of the particulate filter. The cartridge is changed at the same time as the particulate filter and samples the same volume of air. Each cartridge is analyzed for I-131 by gamma spectroscopy analysis.

Results

The results from the analysis of air particulate samples are summarized in Table H-3. Gross beta activity in 2014 was consistent with levels reported in previous years. The annual average gross beta activity for air filter samples was 0.020 pCi/m^3. The annual average of the gross beta activity in air particulate filters at these stations for the years 1971-2014 are presented in Figure H-2. Increased levels due to fallout from atmospheric nuclear weapons testing are evident, especially in 1971, 1977, 1978, and 1981. Evidence of a small increase resulting from the Chernobyl accident can also be seen in 1986. These patterns are consistent with data from monitoring programs conducted during the preoperation and construction phases at other TVA nuclear plant sites.

Only naturally occurring radionuclides were identified by the monthly gamma spectral analysis of the air particulate samples. As shown in Table H-4, no I-131 was detected in any of the charcoal cartridge samples collected in 2014.

TERRESTRIAL MONITORING

Terrestrial monitoring is accomplished by collecting samples of environmental media that may transport radioactive material from the atmosphere to humans. For example, radioactive material may be deposited on a vegetable garden and be ingested along with the vegetables or it may be deposited on pasture grass where dairy cattle are grazing. When the cow ingests the radioactive material, some of it may be transferred to the milk and consumed by humans who drink the milk. Therefore, samples of milk, soil, and food crops are collected and analyzed to determine potential impacts from exposure through this pathway. The results from the analysis of these samples are shown in Tables H-5 through H-12.

A land use survey is conducted annually to locate milk producing animals and gardens within a 5-mile radius of the plant. The only location identified where milk was being produced for human consumption was a small farm located approximately 1.2 miles northwest of the plant. The location was sampled in accordance with the SQN sampling program. The results of the 2014 land use survey are presented in Appendix G.

Sample Collection and Analysis

Milk samples are collected every 2 weeks from the indicator location and from at least one control dairy. A radiochemical separation analysis for I-131 and a gamma spectroscopy analysis are performed on each sample and Sr-89, 90 analysis is performed quarterly.

The monitoring program includes provision for sampling of vegetation from locations where milk is being produced when milk sampling cannot be conducted. There were no periods during this year when vegetation sampling was necessary.

Soil samples are collected annually from the air monitoring locations. The samples are collected with either a "cookie cutter" or an auger type sampler. After drying and grinding, the sample is analyzed by gamma spectroscopy and for Sr-89, 90.

Samples representative of food crops raised in the area near the plant are obtained from individual gardens. Types of foods may vary from year to year as a result of changes in the local vegetable gardens. Samples of apples, cabbage, corn, green beans, potatoes, and tomatoes were collected in 2014 from local gardens. Samples of these same food crops were purchased from area produce markets to serve as control samples. The edible portion of each sample is analyzed by gamma spectroscopy.

Results

The results from the analysis of milk samples are presented in Table H-5. The I-131 results were less than the established nominal LLD of 0.4 pCi/liter. The results for the quarterly Sr-89 analysis were less than the normal LLD value of 3.5 pCi/liter. Very low levels of Sr-90 slightly above the nominal LLD value of 2.0 pCi/liter were detected in the quarterly analysis of samples from the indicator location. The levels were consistent with Sr-90 concentrations that are present in the environment as a result of past nuclear weapons testing. The Sr-90 results for samples from the control locations were less than the nominal LLD value.

The gamma analysis of soil samples detected trace levels of Cs-137. The concentrations of Cs-137 are consistent with levels previously reported from fallout. All other radionuclides reported were naturally occurring isotopes. The soil analysis data are provided in Table H-6.

A plot of the annual average Cs-137 concentrations in soil is presented in Figure H-3. The concentrations of Cs-137 in soil are steadily decreasing as a result of the cessation of weapons testing in the atmosphere, the 30-year half-life of Cs-137 and transport through the environment.

Radionuclides reported in food samples were all naturally occurring. Analysis of these samples indicated no contribution from plant activities. The results are reported in Tables H-7 through H-12.

LIQUID PATHWAY MONITORING

Potential exposures from the liquid pathway can occur from drinking water, ingestion of edible fish, or from direct radiation exposure from radioactive materials deposited in the river sediment. The monitoring program includes the collection of samples of surface water, groundwater, drinking water supplies, fish, and shoreline sediment. Samples from the reservoir are collected both upstream and downstream from the plant.

Sample Collection and Analysis

Samples of surface water are collected from the Tennessee River downstream and upstream of the plant using automatic sampling systems. A timer turns on the system at least once every 2 hours and the sample is collected into a composite jug. A 1-gallon sample is removed from the composite jug at 4-week intervals and the remaining water in the jug is discarded. The composite sample is analyzed for gamma emitting radionuclides and gross beta activity. A quarterly composite sample is analyzed for tritium.

Samples are collected by an automatic sampling system at the first downstream drinking water intake and at the water intake for the city of Dayton located approximately 20 miles upstream. At other selected locations, grab samples are collected from drinking water systems which use the Tennessee River as their source. The drinking water samples are analyzed every 4 weeks by gamma spectroscopy and for gross beta activity. A quarterly composite sample from each station is analyzed for tritium. Additional tritium analyses are performed on samples from two of the locations that are shared with the Watts Bar monitoring program. The sample collected at the water intake for the city of Dayton also serves as control sample for surface water.

Groundwater is sampled from an onsite well using an automatic composite sampler and a grab sample is collected quarterly from a private well in an area unaffected by SQN. Gamma spectroscopy and tritium analyses are performed monthly on samples from the onsite well and gross beta analysis is performed on a quarterly composite sample. The samples from the offsite well are analyzed by gamma spectroscopy and for tritium and gross beta activity.

Samples of commercial and game fish species are collected semiannually from each of two reservoirs: the reservoir on which the plant is located (Chickamauga Reservoir) and the upstream reservoir (Watts Bar Reservoir). The samples are collected using a combination of netting techniques and electrofishing. Samples are prepared from filleted fish. After drying and grinding, the samples are analyzed by gamma spectroscopy.

Samples of shoreline sediment are collected from two downstream recreational use areas and one upstream location. The samples are dried and ground and analyzed by gamma spectroscopy.

Results

There were no fission or activation product radionuclides identified from the gamma spectroscopy analyses performed on surface water samples. Tritium was detected in one sample collected from the downstream (indicator) monitoring location at a concentration of 832 pCi/liter. Tritium was measured in a limited number of samples from the upstream (control) monitoring location at an average concentration of 352 pCi/liter. This tritium concentration represented only a small fraction of the EPA drinking water limit of 20,000 pCi/liter. The values were consistent with previously reported values. Gross beta activity above the nominal LLD value was measured in most surface water samples. The gross beta concentrations in samples from the indicator location averaged 2.7 pCi/liter and control location samples averaged 3.0 pCi/liter. The values were consistent with previously reported levels. A trend plot of the annual average gross beta activity in surface water samples from 1971 through 2014 is presented in Figure H-4. A summary table of the results is shown in Table H-13.

There were no fission or activation product radionuclides identified by the gamma analysis of drinking water samples. Tritium activity above the nominal LLD value was measured in a limited number of drinking water samples. The tritium concentrations in samples from the indicator location averaged 589 pCi/liter and samples from the control location averaged 352 pCi/liter. These tritium levels represented only a small fraction of the EPA drinking water limit of 20,000 pCi/liter. The values were consistent with previously reported values. Average gross beta activity was 2.8 pCi/liter for the downstream stations and 3.0 pCi/liter for the upstream station. The values were consistent with previously reported values. The results are shown in

Table H-14 and a trend plot of the annual average gross beta activity in drinking water from 1971 through 2014 is presented in Figure H-5.

No fission or activation products were detected by the gamma analyses performed on ground-water samples from the REMP monitoring locations. Tritium above the nominal LLD value of 270 pCi/liter was detected in seven samples collected from the onsite monitoring well, Well 6. The average tritium concentration was 364 pCi/liter. The average gross beta concentration in samples from the onsite well was 2.3 pCi/liter, and the average from the offsite well was 4.0 pCi/liter. These gross beta levels are representative of the levels typically found in groundwater. The results from the analysis of groundwater samples are presented in Table H-15.

Cesium-137 was identified in one fish samples collected from the control location. The maximum Cs-137 concentration in these samples was 0.05 pCi/g. No Cs-137 was detected for indicator location samples. The results are summarized in Tables H-16 and H-17.
A plot of the annual average Cs-137 concentration in samples of game fish is presented in Figure H-6.

No fission or activation products were detected by the gamma analyses performed on shoreline sediment samples. Results from the analysis of shoreline sediment samples are shown in Table H-18. Figure H-7 presents a plot of the annual average Cs-137 concentrations measured in shoreline sediment since 1980.

ASSESSMENT AND EVALUATION

Potential doses to the public are estimated from measured effluents using computer models. These models were developed by TVA and are based on methodology provided by the NRC in Regulatory Guide 1.109 for determining the potential dose to individuals and populations living in the vicinity of a nuclear power plant. The results of the effluent dose calculations are reported in the Annual Radioactive Effluent Release Report. The doses calculated are a representation of the dose to a "maximum exposed individual." Some of the factors used in these calculations (such as ingestion rates) are maximum expected values which will tend to overestimate the dose to this "hypothetical" person. The calculated maximum doses due to plant effluents are small fractions of the applicable regulatory limits. In reality, the expected dose to actual individuals is significantly lower.

Based on the very low concentrations of radionuclides actually present in the plant effluents, radioactivity levels measured in the environment as a result of plant operations are expected to be negligible. The results for the radiological environmental monitoring conducted for the SQN 2014 operations confirm this expectation.

Results

As stated earlier in this report, the estimated increase in radiation dose equivalent to the general public resulting from the operation of SQN is negligible when compared to the dose from natural background radiation. The results from environmental samples are compared with the concentrations from the corresponding control stations as well as appropriate preoperational and background data to determine influences from the plant. Measurable levels of Cs-137 were detected in fish and soil and Sr-90 was detected in milk. The Cs-137 and Sr-90 concentrations are consistent with levels identified previously that are the result of fallout from past atmospheric nuclear weapons testing. The low levels of tritium measured in water samples from Chickamauga Reservoir and from the onsite well represented concentrations that were significantly lower than the EPA drinking water limit.

Conclusions

It is concluded from the above analysis of the environmental sampling results and from the trend plots presented in Appendix H that the exposure to members of the general public which may have been attributable to SQN plant operations is negligible. The radioactivity reported herein is primarily the result of fallout or natural background radiation. Any activity which may be present as a result of plant operations does not represent a significant contribution to the radiation exposure to members of the public.

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1. Merril Eisenbud, Environmental Radioactivity, Academic Press, Inc., New York, NY, 1987.

2. National Council on Radiation Protection and Measurements, Report No. 160, "Ionizing Radiation Exposure of the Population of the United States," March 2009.

3. United States Nuclear Regulatory Commission, Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure," February 1996.

Table 1

COMPARISON OF
PROGRAM LOWER LIMITS OF DETECTION WITH THE REGULATORY LIMITS FOR
MAXIMUM ANNUAL AVERAGE EFFLUENT CONCENTRATIONS
RELEASED TO UNRESTRICTED AREAS
AND REPORTING LEVELS

	Concentrations in Water, pCi/Liter			Concentrations in Air, pCi/Cubic Meter		
Analysis	Effluent Concentration[1]	Reporting Level[2]	Lower limit of Detection[3]	Effluent Concentration[1]	Reporting Level[2]	Lower limit of Detection[3]
H-3	1,000,000	20,000	270	100,000	--	--
Cr-51	500,000	--	45	30,000	--	0.02
Mn-54	30,000	1,000	5	1,000	--	0.005
Co-58	20,000	1,000	5	1,000	--	0.005
Co-60	3,000	300	5	50	--	0.005
Zn-65	5,000	300	10	400	--	0.005
Sr-89	8,000	--	5	1,000	--	0.0011
Sr-90	500	--	2	6	--	0.0004
Nb-95	30,000	400	5	2,000	--	0.005
Zr-95	20,000	400	10	400	--	0.005
Ru-103	30,000	--	5	900	--	0.005
Ru-106	3,000	--	40	20	--	0.02
I-131	1,000	2	0.4	200	0.9	0.03
Cs-134	900	30	5	200	10	0.005
Cs-137	1,000	50	5	200	20	0.005
Ce-144	3,000	--	30	40	--	0.01
Ba-140	8,000	200	25	2,000	--	0.015
La-140	9,000	200	10	2,000	--	0.01

Note: 1 pCi = 3.7×10^{-2} Bq.

Note: For those reporting levels that are blank, no value is given in the reference.

1 Source: Table 2 of Appendix B to 10 CFR 20

2 Source: SQN Offsite Dose Calculation Manual, Table 2.3-2

3 Source: Table E-1 of this report

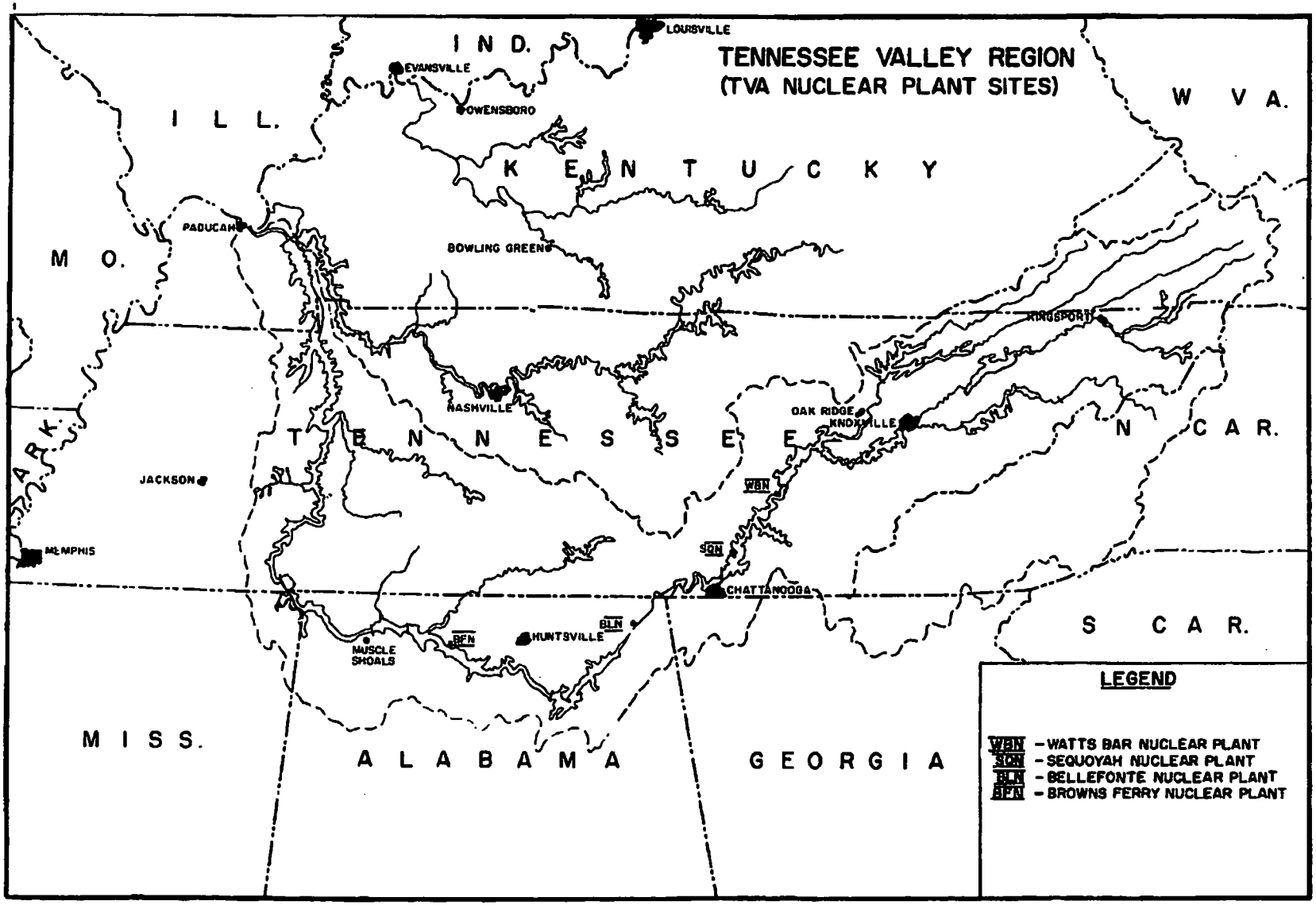
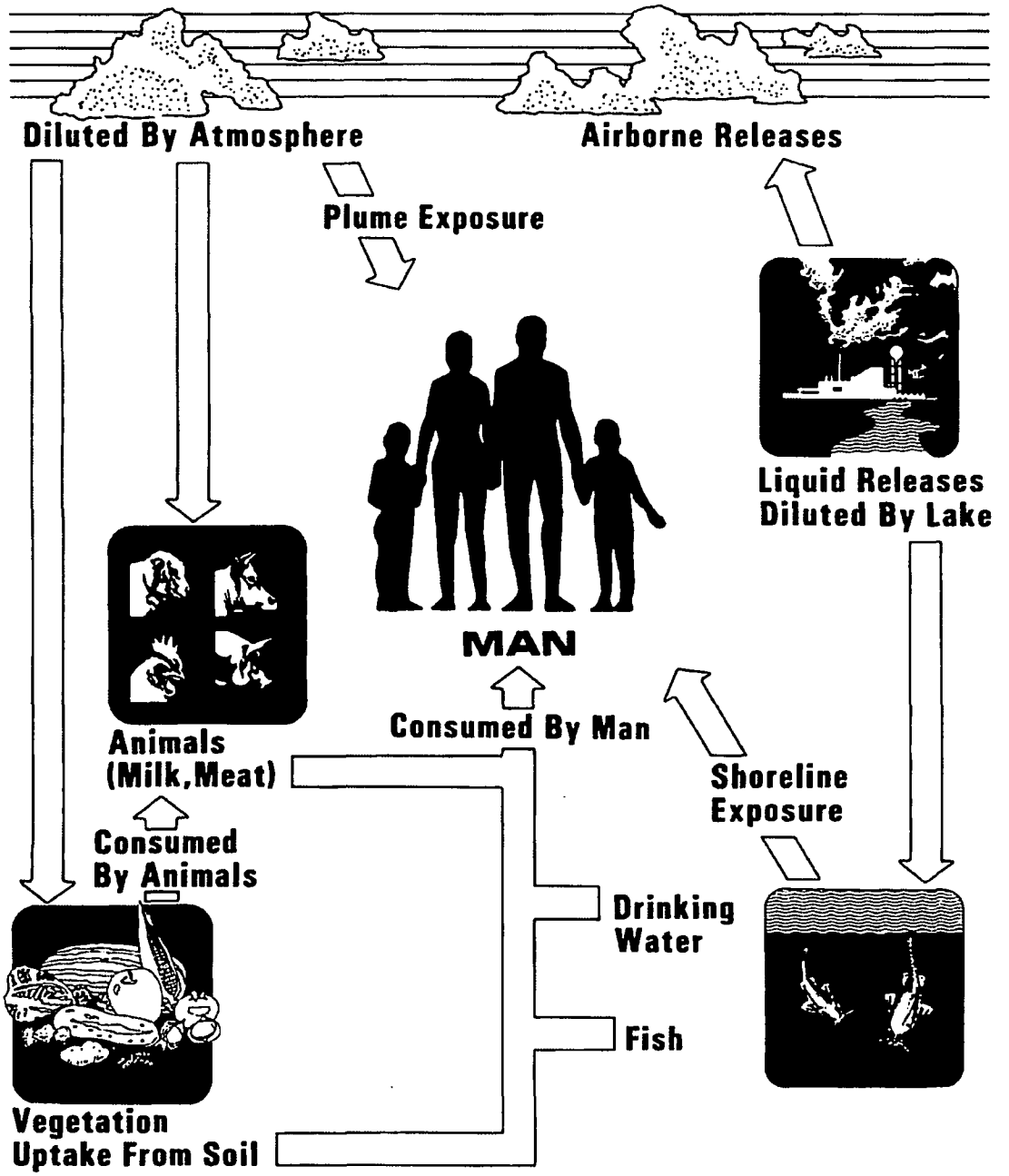

TENNESSEE VALLEY REGION
(TVA NUCLEAR PLANT SITES)
I N D.
I L L.
W V A.
K E N T U C K Y
M O.
ARK.
T E N N E S S E E
N C A R.
S C A R.
M I S S.
A L A B A M A
G E O R G I A
LOUISVILLE
EVANSVILLE
OWENSBORO
PADUCAH
BOWLING GREEN
KINGSPORT
NASHVILLE
OAK RIDGE
KNOXVILLE
JACKSON
MEMPHIS
WBN
SQN
CHATTANOOGA
BLN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

Figure 1

Figure 2

ENVIRONMENTAL EXPOSURE PATHWAYS OF MAN DUE TO RELEASES OF RADIOACTIVE MATERIAL TO THE ATMOSPHERE AND LAKE.



APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM AND SAMPLING LOCATIONS

Table A-1
SEQUOYAH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM[a]

Exposure Pathway and/or Sample	Number of Samples and Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
a. Particulates	4 samples from locations (in different sectors) at or near the site boundary (LM-2, LM-3, LM-4, and LM-5).	Continuous sampler operation with sample collection once per 7 days (more frequently if required by dust loading).	Analyze for gross beta radioactivity greater than or equal to 24 hours following filter change. Perform gamma isotopic analysis on each sample when gross beta is greater than 10 times yearly mean of control samples. Composite at least once per 31 days (by location) for gamma scan.
	4 samples from communities approximately 6-10 miles from the Plant (PM-2, 3, 8, and 9).		
	4 samples from control locations greater than 10 miles from the plant (RM-1 RM-2, RM-3and RM-4).		
b. Radioiodine	Same locations as air particulates.	Continuous sampler operation with charcoal canister collected at same time as particulate filters at least once per 7 days.	I-131 by gamma scan on each sample.
c. Soil	Samples from same locations as air particulates	Once per year.	Each sample is analyzed by gamma isotopic and for Sr-89 and Sr-90.

Table A-1 (continued)
SEQUOYAH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM[a]

Exposure Pathway and/or Sample	Number of Samples and Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
2. DIRECT RADIATION	2 or more dosimeters placed at locations at or near the site boundary in each of the 16 sectors.	At least once per 92 days.	Gamma dose at least once per 92 days.
	2 or more dosimeters placed at stations located approximately 4 to 5 Miles from the plant in each of the 16 sectors.		
	2 or more dosimeters in other locations of special interest.		
3. WATERBORNE			
a. Surface water	TRM 503.8[d] TRM 483.4	Collected by automatic sequential-type sampler[c] with composite samples collected over a period of less than or equal to 31 days.	Gross beta and gamma scan on each composite sample. Composite for tritium analysis at least once per 92 days.
b. Groundwater	1 sample adjacent to the plant (Well No. 6).	At least once per 31 days.	Composited for gross beta, gamma scan, and tritium at least once per 92 days.
	1 sample from groundwater source upgradient (Farm HW).	At least once per 92 days.	Gross beta, gamma scan, and tritium at least once per 92 days.

Table A-1 (continued)
SEQUOYAH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM[a]

Exposure Pathway and/or Sample	Number of Samples and Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
c. Drinking Water	1 sample at the first potable water supply downstream from the plant (TRM 473.0).	Collected by automatic sequential-type sampler[c] with composite sample collected over a period of less than or equal to 31 days.	Gross beta and gamma scan on each composite sample. Composite for tritium at least once per 92 days.
	1 sample at the next 2 downstream potable water systems (greater than 10 miles downstream) (TRM 469.9 and TRM 465.3).	Grab sample once per 31 days.	
	1 sample at the upstream control location (TRM 503.8[d]).	Samples collected by sequential-type sampler[c] with composite sample collected over a period of less than or equal to 31 days.	
d. Shoreline sediment	TRM 485 TRM 480 TRM 479	At least once per 184 days.	Gamma scan of each sample.

Table A-1 (continued)
SEQUOYAH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM[a]

Exposure Pathway and/or Sample	Number of Samples and Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION			
a. Milk	1 sample from milk producing animals in each of 1-3 areas indicated by the cow census where doses are calculated to be highest. If samples are not available from a milk animal location, doses to that area will be estimated by projecting the doses from concentrations detected in milk from other sectors or by sampling vegetation where milk is not available. At least 1 sample from a control location	At least once per 15 days.	Gamma isotopic and I-131 analysis of each sample. Sr-89 and Sr-90 once per quarter.
b. Fish	1 sample each from Chickamauga and Watts Bar Reservoirs.	At least once per 184 days. 1 sample representing a commercially important species and 1 sample representing a recreationally important species.	Gamma scan on edible portion.

Table A-1 (continued)
SEQUOYAH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
c. Food Products	1 sample each of principal food products grown at private gardens and/or farms in the immediate vicinity of the plant.	At least once per 365 days at time of harvest. The types of foods available for sampling will vary. Following is a list of typical foods which may be available: Cabbage, lettuce, or greens Corn Green Beans Potatoes Tomatoes	Gamma scan on edible portion.
	1 sample of each of the same foods grown at greater than 10 miles distance from the plant.		
d. Vegetation[e]	Samples from farms producing milk but not providing a milk sample.	At least once per 31 days.	I-131 and gamma scan at least once per 31 days.
	Control sample from 1 control dairy farm when sampling is performed at an indicator location.		

a. The sampling program outlined in this table is that which was in effect at the end of 2014.
b. Sample locations, sector and distance from plant, are described in Table A-2 and A-3 and shown in Figures A-1, A-2, and A-3.
c. Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.
d. The sample collected at this location shall be considered a control for the drinking water and surface water.
e. Vegetation sampling is applicable only for farms that meet the criteria for milk sampling and when implementation of milk sampling is not possible.

Table A-2
SEQUOYAH NUCLEAR PLANT
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS

Map Location Number[a]	Station	Sector	Approximate Distance (Miles)	Indicator (I) or Control (C)	Samples Collected[b]
2	LM-2	N	0.7	I	AP,CF,S
3	LM-3	SSW	2.0	I	AP,CF,S
4	LM-4	NE	1.5	I	AP,CF,S
5	LM-5	NNE	1.8	I	AP,CF,S
7	PM-2	SW	3.8	I	AP,CF,S
8	PM-3	W	5.6	I	AP,CF,S
9	PM-8	SSW	8.7	I	AP,CF,S
10	PM-9	WSW	2.6	I	AP,CF,S
11	RM-1	SW	16.7	C	AP,CF,S
12	RM-2	NNE	17.8	C	AP,CF,S
13	RM-3	ESE	11.3	C	AP,CF,S
14	RM-4	NW	20.0	C	AP,CF,S
19	Farm HW	NW	1.2	I	M,W[c]
24	Well No. 6	NNE	0.15	I	W
25	Farm K	NE	40.0	C	M
31	TRM[e] 473.0 (East Side Utilities)	--	10.7[d]	I	PW
32	TRM 469.9 (E. I. DuPont)	--	13.8[d]	I	PW
33	TRM 465.3 (Chattanooga)	--	18.4[d]	I	PW
35	TRM 503.8 (Dayton)	--	20.1[d]	C	PW,SW
37	TRM 485.0	--	1.3[d]	C	SS
38	TRM 483.4	--	0.3[d]	I	SW
40	TRM 479.0	--	4.7[d]	I	SS
44	TRM 480.0	--	3.7[d]	I	SS
46	Chickamauga Reservoir (TRM 471-530)		--	I	F
47	Watts Bar Reservoir (TRM 530-602)		--	C	F

a. See Figures A-1, A-2, and A-3
b. Sample codes:
AP = Air particulate filter
CF = Charcoal filter
F = Fish
M = Milk
PW = Public Water
S = Soil
SS = Shoreline Sediment
SW = Surface water
W = Well water

c. A control for well water.
d. Distance from plant discharge (TRM 483.7).
e. TRM = Tennessee River Mile

Table A-3
SEQUOYAH NUCLEAR PLANT
ENVIRONMENTAL DOSIMETER LOCATIONS

Map Location Number[a]	Station	Sector	Approximate Distance (miles)	Onsite (On)[b] or Offsite (Off)
3	SSW-1C	SSW	2.0	On
4	NE-1A	NE	1.5	On
5	NNE-1	NNE	1.8	On
7	SW-2	SW	3.8	Off
8	W-3	W	5.6	Off
9	SSW-3	SSW	8.7	Off
10	WSW-2A	WSW	2.6	Off
11	SW-3	SW	16.7	Off
12	NNE-4	NNE	17.8	Off
13	ESE-3	ESE	11.3	Off
14	NW-3	NW	20.0	Off
49	N-1	N	0.6	On
50	N-2	N	2.1	Off
51	N-3	N	5.2	Off
52	N-4	N	10.0	Off
53	NNE-2	NNE	5.3	Off
55	NE-1	NE	2.4	Off
56	NE-2	NE	4.1	Off
57	ENE-1	ENE	0.2	On
58	ENE-2	ENE	5.1	Off
59	E-1	E	1.2	On
60	E-2	E	5.2	Off
62	ESE-1	ESE	1.2	On
63	ESE-2	ESE	4.9	Off
66	SE-1	SE	1.4	On
67	SE-2	SE	1.9	On
68	SE-4	SE	5.2	Off
69	SSE-1	SSE	1.6	On
70	SSE-2	SSE	4.6	Off
71	S-1	S	1.5	On
72	S-2	S	4.7	Off
73	SSW-1	SSW	0.6	On
74	SSW-2	SSW	4.0	Off
75	SW-1	SW	0.7	On
76	WSW-1	WSW	0.9	On
77	WSW-2	WSW	2.5	Off
78	WSW-3	WSW	5.7	Off
79	WSW-4	WSW	7.8	Off
81	W-1	W	0.6	On
82	W-2	W	4.3	Off
83	WNW-1	WNW	0.4	On
84	WNW-2	WNW	5.3	Off
85	NW-1	NW	0.4	On
86	NW-2	NW	5.2	Off
87	NNW-1	NNW	0.6	On
88	NNW-2	NNW	1.7	On
89	NNW-3	NNW	5.3	Off
90	SSW-1B	SSW	1.5	On

a. See Figures A-1, A-2, and A-3.
b. Dosimeters designated "onsite" are located 2 miles or less from the plant; "offsite" are located more than 2 miles from the plant.

Figure A-1

Radiological Environmental Monitoring Locations

Within 1 mile of the Plant

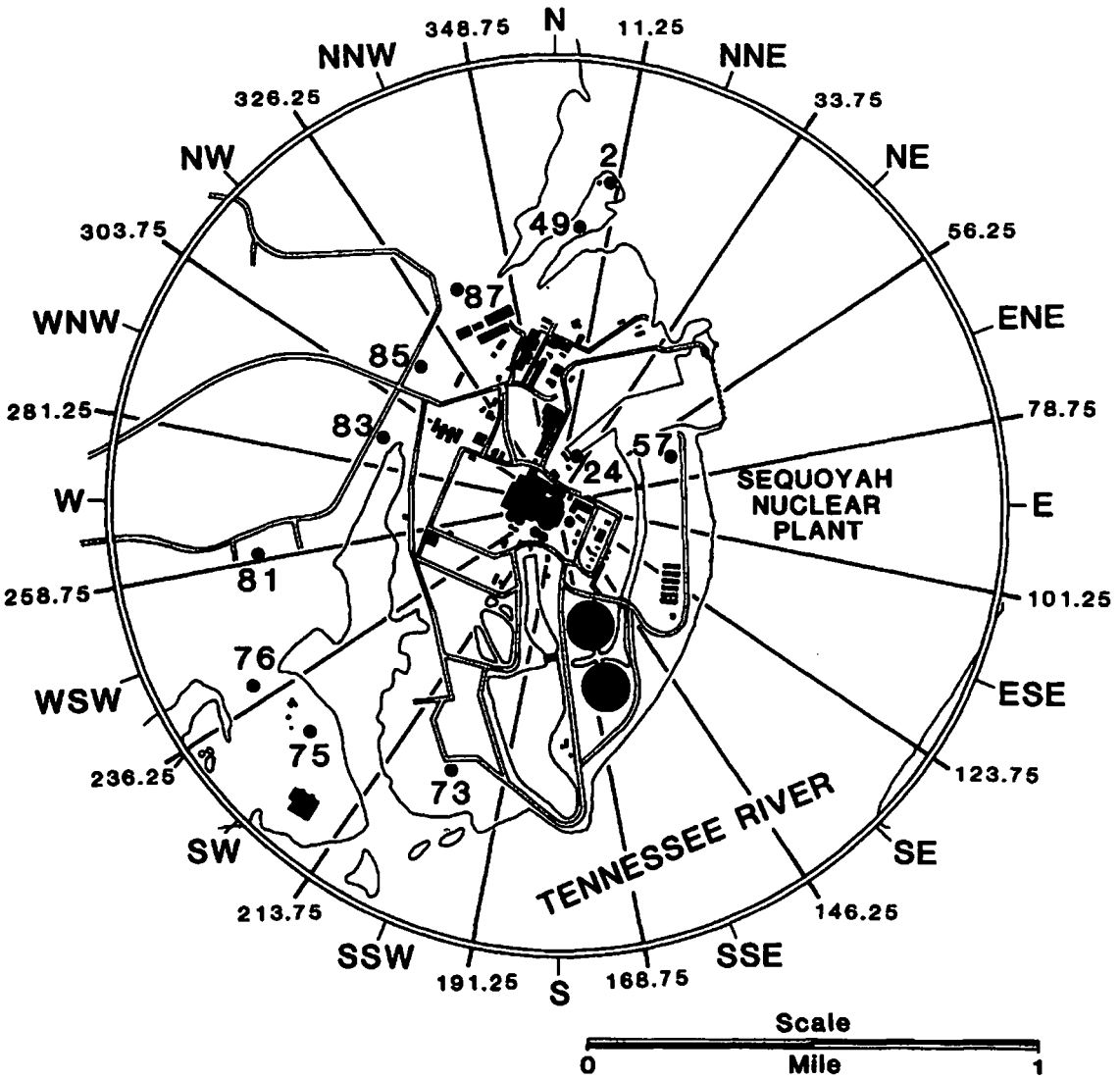


Figure A-2

Radiological Environmental Monitoring Locations

Between 1 and 5 miles from the Plant

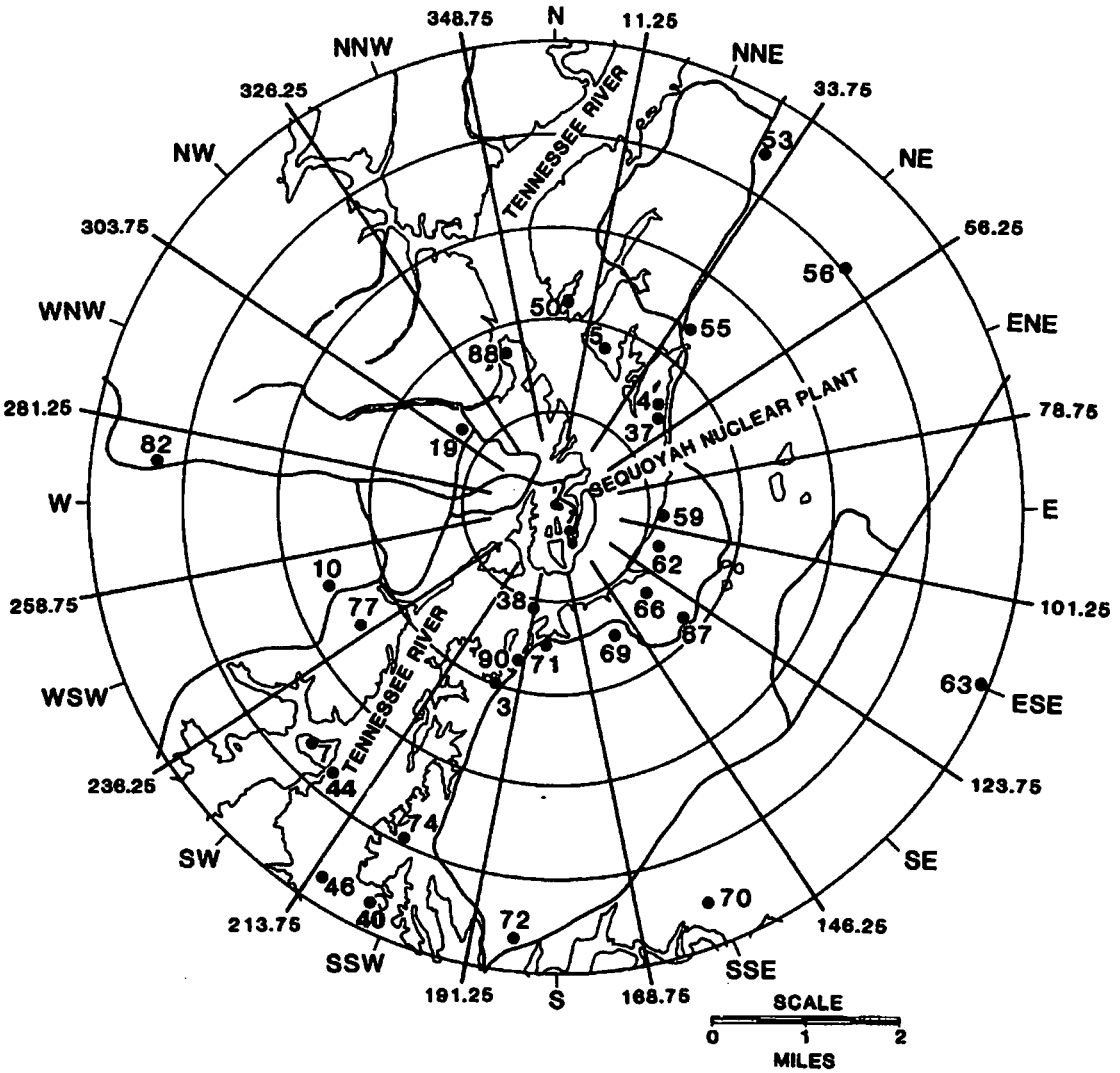
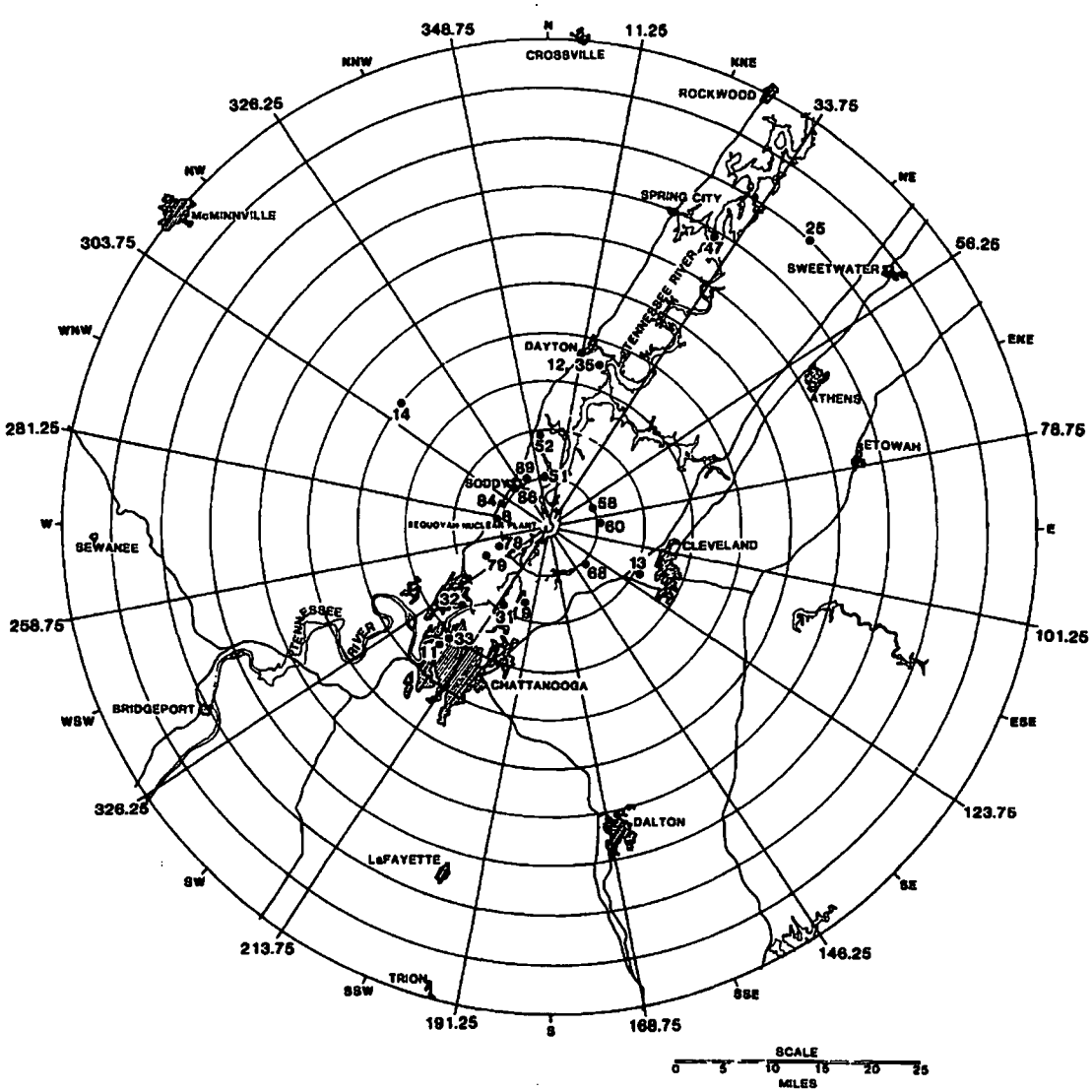


Figure A-3

Radiological Environmental Monitoring Locations

More than 5 miles from the Plant



APPENDIX B

PROGRAM MODIFICATIONS

Appendix B

Radiological Environmental Monitoring Program Modification

During 2014, the milk sampling location identified as Farm EH closed its operation. The last milk sale occurred on 2/17/2014 and the cows were then sold. This location was one of two control locations for milk sampling. The location was removed from the REMP program. The change is reflected in the Tables and Figures of Appendix A of this report.

APPENDIX C

PROGRAM DEVIATIONS

Appendix C

Program Deviations

During 2014, issues with sampling equipment at five sampling stations resulted in one water, four air filter, and four charcoal cartridge samples not being collected. The one missed water sample serves as the control for both the public and surface water samples. Milk was not being produced for 4 out of 26 sampling periods at the small farm milk sampling location identified as Farm HW.

Table C-1 provides additional details on the missed samples.

Table C-1
Radiological Environmental Monitoring Program Deviations

Date	Station	Location	Sample Type	Description
01/20/2014	PM-8	8.7 Miles SSW	Air Monitor	The sample volume was not adequate for air filter and charcoal cartridge samples. The sampling pump was not running at the time of sample collection. The motor base was loose and the breaker had tripped. Emergency preparedness replaced the pump and returned the station to service. This problem was documented with PER 835572
02/17/2014	LM-2	0.7 miles N	Air Monitor	The sample volume was not adequate for air filter and charcoal cartridge samples. The sampling pump was not running at the time of sample collection. The motor/pump was seized and the breaker had tripped. Emergency preparedness replaced the motor, lubricated the pump and returned the station to service. This problem was documented with PER 847499
02/17/2014	LM-4	1.5 miles NE	Air Monitor	The sample volume was not adequate for air filter and charcoal cartridge samples. The sampling pump was not running at the time of sample collection. The motor/pump was seized and the breaker had tripped. Emergency preparedness de-greased and lubricated the pump and returned the station to service. This problem was documented with PER 847500
03/10/2014	RM-2	17.8 miles NNE	Surface and Public Water	The continuous water sampler at Dayton water plant intake did not collect water for the previous sample period for REMP. Emergency Preparedness replaced the tubing to the sampler and returned it to service. This problem was documented with PER 858118

Table C-1 continued
Radiological Environmental Monitoring Program Deviations

2nd Qtr 2014	14 SQNW-1	4.8 miles	Dosimeter	Both dosimeters were missing at station 14 during the regular change out. The stake was found lying nearby in the field. The stake was reset for the next collection period. The problem was documented in PER 921249
04/07/2014	Farm HW	1.2 miles NW	Milk	The owner was sick and no milk was being produced during this collection week.
4/22/2014	Farm HW	1.2 miles NW	Milk	This sample location is a small farm with only one milk cow. The cow was dry at this time and no milk was being produced.
12/02/2014 12/22/2014	Farm HW	1.2 miles NW	Milk	This sample location is a small farm with only one milk cow. The cow had a calf and the owner was not milking the cow at this time and until further notice after the calf is weaned.
05/12/2014	LM-2	0.7 miles N	Air Monitor	The sample volume was not adequate for air filter and charcoal cartridge samples. The sampling pump was not running at the time of sample collection. The belt was broken and the breaker had tripped. Emergency preparedness replaced the belt, verified operation and returned the station to service. This problem was documented with PER 884061

APPENDIX D

ANALYTICAL PROCEDURES

Appendix D

Analytical Procedures

Analyses of environmental samples, except for the Sr-89, 90 analysis of soil samples, are performed by the radioanalytical laboratory located at the Western Area Radiological Laboratory facility in Muscle Shoals, Alabama. The analysis procedures are based on accepted methods. A summary of the analysis techniques and methodology follows. The Sr-89, 90 analyses for soil samples are performed by a commercial laboratory.

The gross beta measurements are made with an automatic low background counting system. Normal counting times are 50 minutes. Water samples are prepared by evaporating 500 ml of sample to near dryness, transferring to a stainless steel planchet and completing the evaporation process. Air particulate filters are counted directly in a shallow planchet.

The specific analysis of I-131 in milk is performed by first isolating and purifying the iodine by radiochemical separation and then counting the final precipitate on a beta-gamma coincidence counting system. The normal count time is 50 minutes. With the beta-gamma coincidence counting system, background counts are virtually eliminated and extremely low levels of activity can be detected.

After a radiochemical separation, milk samples analyzed for Sr-89, 90 are counted on a low background beta counting system. The sample is counted a second time after minimum ingrowth period of six days. From the two counts, the Sr-89 and Sr-90 concentrations can be determined.

Water samples are analyzed for tritium content by first distilling a portion of the sample and then counting by liquid scintillation. A commercially available scintillation cocktail is used.

Gamma analyses are performed in various counting geometries depending on the sample type and volume. All gamma counts are obtained with germanium type detectors interfaced with a computer based multichannel analyzer system.

The charcoal cartridges used to sample gaseous radioiodine are analyzed by gamma spectroscopy using a high resolution gamma spectroscopy system with germanium detectors.

The necessary efficiency values, weight-efficiency curves, and geometry tables are established and maintained on each detector and counting system. A series of daily and periodic quality control checks are performed to monitor counting instrumentation. System logbooks and control charts are used to document the results of the quality control checks.

APPENDIX E

NOMINAL LOWER LIMITS OF DETECTION (LLD)

Appendix E

Nominal Lower Limits of Detection

A number of factors influence the Lower Limit of Detection (LLD) for a specific analysis method, including sample size, count time, counting efficiency, chemical processes, radioactive decay factors, and interfering isotopes encountered in the sample. The most probable values for these factors have been evaluated for the various analyses performed in the environmental monitoring program. The nominal LLDs are calculated from these values, in accordance with the methodology prescribed in the ODCM. The current nominal LLD values achieved by the ERM&I radioanalytical lab are listed in Table E-1. For comparison, the maximum values for the lower limits of detection specified in the ODCM are given in Table E-2.

The nominal LLDs are also presented in the data tables in Appendix H. For analyses for which LLDs have not been established, an LLD of zero is assumed in determining if a measured activity is greater than the nominal LLD. In these cases, the LLD value will appear as -1.00E+00 in the data tables in Appendix H.

Table E-1
Nominal LLD Values
A. Radiochemical Procedures

Analysis	Air Filters (pCi/m^3)	Water (pCi/L)	Milk (pCi/L)	Wet Vegetation (pCi/kg wet)	Sediment and Soil (pCi/g dry)
Gross Beta	0.002	1.9	--	--	--
Tritium	--	270	--	--	--
Iodine-131	--	0.4	0.4	6.0	--
Strontium-89	--	5.0	3.5	31.0	1.6
Strontium-90	--	2.0	2.0	12.0	0.4

Table E-1 (continued)
Nominal LLD Values
B. Gamma Analyses

Analysis	Air Particulates pCi/m^3	Charcoal Filter pCi/m^3	Water and Milk pCi/L	Vegetation and Grain pCi/g, dry	Wet Vegetation pCi/kg, wet	Soil and Sediment pCi/g, dry	Fish pCi/g, dry	Clam Flesh pCi/g, dry	Foods Tomatoes Potatoes, etc. pCi/kg, wet
Ce-141	.005	0.02	10	0.07	35	.10	.07	.35	20
Ce-144	.01	0.07	30	0.15	115	.20	.15	.85	60
Cr-51	.02	0.15	45	0.30	200	.35	.30	2.4	95
I-131	.005	0.03	10	0.20	60	.25	.20	1.7	20
Ru-103	.005	0.02	5	0.03	25	.03	.03	.25	25
Ru-106	.02	0.12	40	0.15	190	.20	.15	1.25	90
Cs-134	.005	0.02	5	0.03	30	.03	.03	.14	10
Cs-137	.005	0.02	5	0.03	25	.03	.03	.15	10
Zr-95	.005	0.03	10	0.05	45	.05	.05	.45	45
Nb-95	.005	0.02	5	0.25	30	.04	.25	.25	10
Co-58	.005	0.02	5	0.03	20	.03	.03	.25	10
Mn-54	.005	0.02	5	0.03	20	.03	.03	.20	10
Zn-65	.005	0.03	10	0.05	45	.05	.05	.40	45
Co-60	.005	0.02	5	0.03	20	.03	.03	.20	10
K-40	.04	0.30	100	0.40	400	.75	.40	3.50	250
Ba-140	.015	0.07	25	0.30	130	.30	.30	2.4	50
La-140	.01	0.04	10	0.20	50	.20	.20	1.4	25
Fe-59	.005	0.04	10	0.08	40	.05	.08	.45	25
Be-7	.02	0.15	45	0.25	200	.25	.25	1.9	90
Pb-212	.005	0.03	15	0.04	40	.10	.04	.30	40
Pb-214	.005	0.07	20	0.50	80	.15	.50	.10	80
Bi-214	.005	0.05	20	0.10	55	.15	.10	.50	40
Bi-212	.02	0.20	50	0.25	250	.45	.25	2.0	130
Tl-208	.002	0.02	10	0.03	30	.06	.03	.25	30
Ra-224	--	--	--	--	--	.75	--	--	--
Ra-226	--	--	--	--	--	.15	--	--	--
Ac-228	.01	0.07	20	0.10	70	.25	.10	.75	50
Pa-234m	--	--	800	--	--	4.0	--	--	--

Table E-2
Maximum Values for the Lower Limits of Detection (LLD)
Specified by the SQN Offsite Dose Calculation Manual

Analysis	Water pCi/L	Airborne Particulate or Gases pCi/m^3	Fish pCi/kg, wet	Milk pCi/L	Food Products pCi/kg, wet	Sediment pCi/kg, dry
Gross Beta	4	1×10^{-2}	N.A.	N.A.	N.A.	N.A.
H-3	2000[a]	N.A.	N.A.	N.A.	N.A.	N.A.
Mn-54	15	N.A.	130	N.A.	N.A.	N.A.
Fe-59	30	N.A.	260	N.A.	N.A.	N.A.
Co-58,60	15	N.A.	130	N.A.	N.A.	N.A.
Zn-65	30	N.A.	260	N.A.	N.A.	N.A.
Zr-95	30	N.A.	N.A.	N.A.	N.A.	N.A.
Nb-95	15	N.A.	N.A.	N.A.	N.A.	N.A.
I-131	1[b]	7×10^{-2}	N.A.	1	60	N.A.
Cs-134	15	5×10^{-2}	130	15	60	150
Cs-137	18	6×10^{-2}	150	18	80	180
Ba-140	60	N.A.	N.A.	60	N.A.	N.A.
La-140	15	N.A.	N.A.	15	N.A.	N.A.

a. If no drinking water pathway exists, a value of 3000 pCi/liter may be used.

b. If no drinking water pathway exists, a value of 15 pCi/liter may be used.

APPENDIX F

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Appendix F

Quality Assurance/Quality Control Program

A quality assurance program is employed by the laboratory to ensure that the environmental monitoring data are reliable. This program includes the use of written, approved procedures in performing the work, provisions for staff training and certification, internal self assessments of program performance, audits by various external organizations, and a laboratory quality control program.

The quality control program employed by the radioanalytical laboratory is designed to ensure that the sampling and analysis process is working as intended. The program includes equipment checks and the analysis of quality control samples along with routine samples. Instrument quality control checks include background count rate and counts reproducibility. In addition to these two general checks, other quality control checks are performed on the variety of detectors used in the laboratory. The exact nature of these checks depends on the type of device and the method it uses to detect radiation or store the information obtained.

Quality control samples of a variety of types are used by the laboratory to verify the performance of different portions of the analytical process. These quality control samples include blanks, replicate samples, blind samples, and cross-checks.

Blanks are samples which contain no measurable radioactivity or no activity of the type being measured. Such samples are analyzed to determine whether there is any contamination of equipment or commercial laboratory chemicals, cross-contamination in the chemical process, or interference from isotopes other than the one being measured.

Duplicate samples are generated at random by the sample computer program which schedules the collection of the routine samples. For example, if the routine program calls for four milk samples every week, on a random basis each farm might provide an additional sample several

times a year. These duplicate samples are analyzed along with other routine samples. They provide information about the variability of radioactive content in the various sample media.

If enough sample is available for a particular analysis, the laboratory staff can split it into two portions. Such a sample provides information about the variability of the analytical process since two identical portions of material are analyzed side by side.

Analytical knowns are another category of quality control sample. A known amount of radioactivity is added to a sample medium. The lab staff knows the radioactive content of the sample. Whenever possible, the analytical knowns contain the same amount of radioactivity each time they are run. In this way, analytical knowns provide immediate data on the quality of the measurement process.

Blind spikes are samples containing radioactivity which are introduced into the analysis process disguised as ordinary environmental samples. The lab staff does not know the sample contains radioactivity. Since the bulk of the ordinary workload of the environmental laboratory contains no measurable activity or only naturally occurring radioisotopes, blind spikes can be used to test the detection capability of the laboratory or can be used to test the data review process. If an analysis routinely generates numerous zeroes for a particular isotope, the presence of the isotope is brought to the attention of the lead chemist in the daily review process. Blind spikes test this process since the blind spikes contain radioactivity at levels high enough to be detected. Furthermore, the activity can be put into such samples at the extreme limit of detection (near the LLD) to verify that the laboratory can detect very low levels of activity.

Another category of quality control samples is the internal cross-checks. These samples have a known amount of radioactivity added and are presented to the lab staff labeled as cross-check samples. This means that the quality control staff knows the radioactive content or "right answer" but the lab personnel performing the analysis do not. Such samples test the best performance of the laboratory by determining if the lab can find the "right answer." These samples provide information about the accuracy of the measurement process. Further information is available about the variability of the process if multiple analyses are requested on the same sample. Like blind spikes or analytical knowns, these samples can also be spiked with

low levels of activity to test detection limits. The lab results for the internal quality control program samples met the program performance goals.

To provide for an independent verification of the laboratory's ability to make accurate measurements, the laboratory participated in an environmental level cross-check program available through Eckert and Ziegler Analytics during 2014. The results of TVA's participation in this cross-check program are presented in Table F-1. All results were within the program agreement limits.

The quality control data are routinely collected, examined and reported to laboratory supervisory personnel. They are checked for trends, problem areas, or other indications that a portion of the analytical process needs correction or improvement. The end result is a measurement process that provides reliable and verifiable data and is sensitive enough to measure the presence of radioactivity far below the levels which could be harmful to humans.

Table F-1

Results For 2014 External Cross Checks

Test Period	Sample Type / Analysis	Results Known	Results TVA	Agreement
First Quarter	Water (pCi/L)			
	Gross Beta	2.49E+02	2.05E+02	Yes
First Quarter	Water (pCi/L)			
	^{3}H	1.00E+04	1.09E+04	Yes
First Quarter	Water (pCi/L)			
	^{131}I	8.99E+01	9.75E+01	Yes
	^{51}Cr	3.19E+02	3.23E+02	Yes
	^{134}Cs	1.36E+02	1.27E+02	Yes
	^{137}Cs	1.64E+02	1.67E+02	Yes
	^{58}Co	1.74E+02	1.77E+02	Yes
	^{54}Mn	1.93E+02	2.07E+02	Yes
	^{59}Fe	1.42E+02	1.47E+02	Yes
	^{65}Zn	2.10E+02	2.16E+02	Yes
	^{60}Co	2.19E+02	2.21E+02	Yes
	^{141}Ce	7.71E+01	7.68E+01	Yes
First Quarter	Synthetic Urine (pCi/L)			
	^{3}H	1.20E+04	1.18E+04	Yes
First Quarter	Milk (pCi/L)			
	^{131}I	9.98E+01	1.06E+02	Yes
	^{89}Sr	8.46E+01	9.27E+01	Yes
	^{90}Sr	1.39E+01	1.99E+01	Yes
First Quarter	Air Filter (pCi/Filter)			
	Gross Beta	8.90E+01	8.66E+01	Yes
Third Quarter	Water (pCi/L)			
	^{3}H	9.85E+03	1.06E+04	Yes
Third Quarter	Sand (pCi/gram)			
	^{141}Ce	1.90E-01	1.73E-01	Yes
	^{51}Cr	4.34E-01	4.12E-01	Yes
	^{134}Cs	2.37E-01	2.45E-01	Yes
	^{137}Cs	2.90E-01	2.79E-01	Yes
	^{58}Co	2.15E-01	2.13E-01	Yes
	^{54}Mn	2.13E-01	2.33E-01	Yes
	^{59}Fe	2.37E-01	2.28E-01	Yes
	^{65}Zn	1.10E-01	1.22E-01	Yes
	^{60}Co	4.47E-01	4.48E-01	Yes
Third Quarter	Air Filter (pCi/Filter)			
	Gross Beta	9.06E+01	8.10E+01	Yes
Third Quarter	Air Filter (pCi/Filter)			
	^{141}Ce	7.88E+01	7.94E+01	Yes
	^{51}Cr	1.80E+02	1.82E+02	Yes
	^{134}Cs	9.85E+01	8.53E+01	Yes
	^{137}Cs	1.21E+02	1.20E+02	Yes
	^{58}Co	8.93E+01	8.96E+01	Yes
	^{54}Mn	8.86E+01	9.49E+01	Yes
	^{59}Fe	9.86E+01	1.05E+02	Yes
	^{65}Zn	4.56E+01	4.84E+01	Yes
	^{60}Co	1.86E+02	1.92E+02	Yes
Third Quarter	Synthetic Urine (pCi/L)			
	^{3}H	8.99E+03	9.42E+03	Yes
Third Quarter	Milk (pCi/L)			
	^{131}I	9.90E+01	9.72E+01	Yes
	^{89}Sr	9.89E+01	1.04E+02	Yes
	^{90}Sr	1.67E+01	1.37E+01	Yes

APPENDIX G

LAND USE SURVEY

Appendix G

Land Use Survey

A land use survey is conducted annually to identify the location of the nearest milk producing animal, the nearest residence, and the nearest garden of greater than 500 square feet producing fresh leafy vegetables in each of 16 meteorological sectors within a distance of 5 miles (8,047 meters) from the plant.

The land use survey is conducted between April 1 and October 1 using appropriate techniques such as door-to-door survey, mail survey, telephone survey, aerial survey, or information from local agricultural authorities or other reliable sources.

Using survey data, relative radiation doses are projected for individuals living near the plant. These projections use the data obtained in the survey and historical meteorological data. They also assume that releases are equivalent to the design basis source terms. The calculated doses are relative in nature and do not reflect actual exposures received by individuals living near SQN. Calculated doses to individuals based on measured effluents from the plant are well below applicable dose limits.

Using the locations identified in the 2014 SQN land use survey, annual dose projections were calculated for air submersion, vegetable ingestion, and milk ingestion. External doses due to radioactivity in air (air submersion) are calculated for the nearest resident in each sector, while doses from drinking milk or eating foods produced near the plant are calculated for the areas with milk producing animals and gardens, respectively.

There were no changes in the location of the nearest resident or the nearest garden as identified in 2014 compared to 2013. For milk ingestion, there was no change as compared to 2013. The one milk location was the small farm in the NW sector. There was a small decrease in the calculated dose projection for this location due to a small change in the feeding factor information reported by the farmer.

Tables G-1, G-2, and G-3 show the comparative relative calculated doses for 2014 and 2013.

Table G-1

SEQUOYAH NUCLEAR PLANT

Relative Projected Annual Air Submersion Dose to the Nearest Resident
Within Five Miles (8,047 meters) of Plant
mrem/year

	2013 Survey		2014 Survey	
Sector	Approximate Distance Meters	Annual Dose	Approximate Distance Meters	Annual Dose
N	1,389	0.13	1,389	0.13
NNE	2,456	0.07	2,456	0.07
NE	2,361	0.06	2,361	0.06
ENE	2,127	0.02	2,127	0.02
E	1,685	0.02	1,685	0.02
ESE	1,693	0.02	1,693	0.02
SE	1,721	0.03	1,721	0.03
SSE	2,073	0.04	2,073	0.04
S	1,764	0.13	1,764	0.13
SSW	2,129	0.14	2,129	0.14
SW	2,502	0.04	2,502	0.04
WSW	1,036	0.06	1,036	0.06
W	982	0.05	982	0.05
WNW	1,331	0.03	1,331	0.03
NW	1,316	0.05	1,316	0.05
NNW	864	0.13	864	0.13

Table G-2

SEQUOYAH NUCLEAR PLANT

Relative Projected Annual Dose to Child's Bone from
Ingestion of Home-Grown Foods
mrem/year

	2013 Survey		2014 Survey	
Sector	Approximate Distance Meters	Annual Dose	Approximate Distance Meters	Annual Dose
N	4,329	0.74	4,329	0.74
NNE	3,271	1.53	3,271	1.53
NE	4,551	0.68	4,551	0.68
ENE	7,487	0.12	7,487	0.12
E	2,638	0.33	2,638	0.33
ESE	1,861	0.51	1,861	0.51
SE	3,406	0.30	3,406	0.30
SSE	4,476	0.38	4,476	0.38
S	4,137	1.14	4,137	1.14
SSW	4,532	1.55	4,532	1.55
SW	4,440	0.64	4,440	0.64
WSW	1,152	1.69	1,152	1.69
W	1,419	0.89	1,419	0.89
WNW	5,363	0.14	5,363	0.14
NW	1,316	1.48	1,316	1.48
NNW	1,586	1.64	1,586	1.64

Table G-3

SEQUOYAH NUCLEAR PLANT

Relative Projected Annual Dose to Receptor Thyroid
from Ingestion of Milk
mrem/year

Location	Sector	Approximate Distance (Meters)[a]	Annual Dose 2013	Annual Dose 2014	X/Q (units-s/m^3)
Farm HW	NW	2,074	0.067	0.064	6.18 E-07

a. Distances measured to nearest property line.

APPENDIX H

DATA TABLES AND FIGURES

Table H - 1

DIRECT RADIATION LEVELS

Average External Gamma Radiation Levels Onsite and Offsite
Sequoyah Nuclear Plant for Each Quarter - 2014
mR / Quarter (a)

Average External Gamma Radiation Levels (b)

	1st qtr	2nd qtr	3rd qtr	4th qtr	mR/yr
Average, 0 - 2 miles (onsite)	14.3	17.3	17.0	14.3	63
Average, > 2 miles (offsite)	13.3	16.3	15.3	13.0	58

(a) Field periods normalized to one standard quarter (2190 hours)
(b) Average of the individual measurements in the set

TABLE H - 2

DIRECT RADIATION LEVELS

Individual Stations at Sequoyah Nuclear Plant

Map Location Number	Dosimeter Station Number	Direction, degrees	Approx Distance, miles	Environmental Radiation Levels mR / quarter 1st Qtr Jan-Mar 2014	2nd Qtr Apr-Jun 2014	3rd Qtr Jul-Sep 2014	4th Qtr Oct-Dec 2014	Annual Exposure mR/year
49	N-1	3	.6	17.4	19.1	16.4	16.5	69.4
50	N-2	4	2.1	15.1	18.2	19.2	14.0	66.5
51	N-3	358	5.2	12.3	16.7	16.4	13.6	59.0
52	N-4	355	10.0	12.3	19.2	17.5	14.0	63.0
5	NNE-1	13	1.8	15.6	19.2	19.7	15.4	69.9
53	NNE-2	31	5.3	12.3	15.2	13.7	10.3	51.5
12	NNE-4	32	17.8	11.0	14.0	13.9	13.7	52.6
55	NE-1	38	2.4	15.1	18.2	16.4	15.9	65.6
4	NE-1A	50	1.5	14.5	18.7	20.2	14.5	67.9
56	NE-2	51	4.1	9.0	11.7	12.1	8.0	40.8
57	ENE-1	73	.2	12.3	11.2	14.8	13.6	51.9
58	ENE-2	66	5.1	13.4	13.7	15.9	14.5	57.5
59	E-1	96	1.2	13.4	13.7	13.7	13.6	54.4
60	E-2	87	5.2	14.5	16.2	16.4	11.2	58.3
62	ESE-1	110	1.2	10.7	16.2	16.4	11.2	54.5
63	ESE-2	112	4.9	14.0	17.7	17.5	14.0	63.2
13	ESE-3	117	11.3	10.7	13.7	13.7	15.4	53.5
66	SE-1	131	1.4	10.1	12.7	12.6	10.8	46.2
67	SE-2	129	1.9	12.9	16.2	17.0	11.7	57.8
68	SE-4	136	5.2	15.6	17.7	19.7	16.4	69.4
69	SSE-1	154	1.6	11.2	14.7	15.9	12.6	54.4
70	SSE-2	158	4.6	14.5	21.7[a]	17.5	17.8	66.4

(1) Sum of available quarterly data normalized to 1 year for the annual exposure value.
(a) Dosimeter 25B received damage. Reported dose best evaluation possible

TABLE H - 2 continued

DIRECT RADIATION LEVELS

Individual Stations at Sequoyah Nuclear Plant

Map Location Number	Dosimeter Station Number	Direction, degrees	Approx Distance, miles	Environmental Radiation Levels mR / quarter 1st Qtr Jan-Mar 2014	2nd Qtr Apr-Jun 2014	3rd Qtr Jul-Sep 2014	4th Qtr Oct-Dec 2014	Annual Exposure mR/year
71	S-1	183	1.5	18.9	20.2	18.6	15.4	73.1
72	S-2	185	4.7	14.5	14.2	12.1	11.7	52.5
73	SSW-1	203	.6	15.1	18.2	19.7	16.5	69.5
90	SSW-1B	192	1.5	10.7	15.7	13.2	10.3	49.9
3	SSW-1C	198	2.0	12.3	18.7	17.0	13.1	61.1
74	SSW-2	204	4.0	16.2	23.2	20.2	16.8	76.4
9	SSW-3	203	8.7	15.1	21.7	16.4	15.4	68.6
75	SW-1	228	.7	16.2	19.7	18.5	12.6	67.0
7	SW-2	227	3.8	11.8	14.7	14.8	13.2	54.5
11	SW-3	228	16.7	18.9	21.2	21.0	17.3	78.4
76	WSW-1	241	.9	14.5	18.7	17.9	18.2	69.3
77	WSW-2	238	2.5	10.1	14.2	9.4	8.9	42.6
10	WSW-2A	250	2.6	13.4	13.6	10.5	10.8	48.3
78	WSW-3	248	5.7	16.3	17.6	17.0	14.6	65.5
79	WSW-4	244	7.8	17.4	14.6	12.1	9.9	54.0
81	W-1	260	.6	17.8	21.2	21.7	18.7	79.4
82	W-2	275	4.3	10.7	13.3	13.1	9.4	46.5
8	W-3	280	5.6	13.4	14.3	14.3	12.2	54.2
83	WNW-1	292	.4	17.3	19.4	18.5	12.6	67.8
84	WNW-2	295	5.3	14.5	16.7	14.3	9.4	54.9
85	NW-1	315	.4	19.5	(1)	15.3	20.1	73.2
86	NW-2	318	5.2	10.7	13.2	18.6	12.2	54.7
14	NW-3	320	20.0	9.6	15.3	12.1	12.1	49.1
87	NNW-1	344	.6	16.7	19.4	17.9	15.9	69.9
88	NNW-2	342	1.7	9.6	15.7	15.3	13.6	54.2
89	NNW-3	334	5.3	9.6	14.2	11.5	12.6	47.9

(1) Sum of available quarterly data normalized to 1 year for the annual exposure value.

Tennessee Valley Authority

RADIOACTIVITY IN AIR FILTER
pCi/m^3 = 0.037 Bq/m^3

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GROSS BETA - 620						
	2.00E-03	2.05E-02 (412 / 412) 8.68E-03 - 3.82E-02	PM-2 COUNTY PARK TN 3.8 MILES SW	2.08E-02 (52 / 52) 1.14E-02 - 3.45E-02	2.00E-02 (208 / 208) 1.10E-02 - 3.23E-02	
GAMMA SCAN (GELI) - 156						
AC-228	1.00E-02	104 VALUES < LLD	LM-2 NORTH 0.8 MILES NORTH	13 VALUES < LLD	1.01E-02 (1 / 52) 1.01E-02 - 1.01E-02	
BE-7	2.00E-02	9.93E-02 (104 / 104) 6.16E-02 - 1.45E-01	LM-5 WARE POINT 1.8 MILES NNE	1.01E-01 (13 / 13) 7.03E-02 - 1.34E-01	9.84E-02 (51 / 52) 6.71E-02 - 1.47E-01	
BI-214	5.00E-03	2.66E-02 (104 / 104) 8.30E-03 - 9.69E-02	PM-8 HARRISON TN 8.7 MILES SSW	3.28E-02 (13 / 13) 1.16E-02 - 9.69E-02	2.50E-02 (52 / 52) 6.40E-03 - 6.32E-02	
K-40	4.00E-02	104 VALUES < LLD	LM-3 HARRISON BAY RD 2.0 MILES SSW	13 VALUES < LLD	52 VALUES < LLD	
PB-212	5.00E-03	104 VALUES < LLD	PM-9 LAKESIDE 2.6 MILES WSW	13 VALUES < LLD	52 VALUES < LLD	
PB-214	5.00E-03	2.64E-02 (104 / 104) 7.60E-03 - 9.24E-02	PM-8 HARRISON TN 8.7 MILES SSW	3.34E-02 (13 / 13) 1.17E-02 - 9.24E-02	2.46E-02 (52 / 52) 5.50E-03 - 6.90E-02	
TL-208	2.00E-03	2.00E-03 (1 / 104) 2.00E-03 - 2.00E-03	PM-2 COUNTY PARK TN 3.8 MILES SW	2.00E-03 (1 / 13) 2.00E-03 - 2.00E-03	2.60E-03 (1 / 52) 2.60E-03 - 2.60E-03	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonroutine measurements

Table H-3

Tennessee Valley Authority

RADIOACTIVITY IN CHARCOAL FILTER
pCi/m^3 = 0.037 Bq/m^3

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 620						
BI-214	5.00E-02	8.53E-02 (264 / 412) 5.01E-02 - 2.65E-01	PM-8 HARRISON TN 8.7 MILES SSW	9.93E-02 (41 / 51) 5.39E-02 - 2.65E-01	8.31E-02 (136 / 208) 5.04E-02 - 2.97E-01	
I-131	3.00E-02	SEE NOTE 4				
K-40	3.00E-01	3.51E-01 (72 / 412) 3.00E-01 - 4.91E-01	LM-2 NORTH 0.8 MILES NORTH	3.71E-01 (9 / 50) 3.07E-01 - 4.91E-01	3.48E-01 (43 / 208) 3.00E-01 - 4.68E-01	
PB-212	3.00E-02	3.18E-02 (1 / 412) 3.18E-02 - 3.18E-02	LM-4 SKULL ISLAND 1.5 MILES NE	3.18E-02 (1 / 51) 3.18E-02 - 3.18E-02	208 VALUES < LLD	
PB-214	7.00E-02	1.04E-01 (133 / 412) 7.00E-02 - 2.71E-01	LM-3 HARRISON BAY RD 2.0 MILES SSW	1.13E-01 (21 / 52) 7.02E-02 - 2.71E-01	1.03E-01 (71 / 208) 7.05E-02 - 3.28E-01	
TL-208	2.00E-02	412 VALUES < LLD	LM-5 WARE POINT 1.8 MILES NNE	52 VALUES < LLD	208 VALUES < LLD	

Notes:
1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements
4. The analysis of Charcoal Filters was performed by Gamma Spectroscopy. No I-131 was detected. The LLD for I-131 by Gamma Spectroscopy was 0.03 pCi/cubic meter.

Table H-4

Tennessee Valley Authority

RADIOACTIVITY IN MILK
pCi/L = 0.037 Bq/L

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
IODINE-131 - 52						
	4.00E-01	22 VALUES < LLD			30 VALUES < LLD	
GAMMA SCAN (GELI) - 52						
AC-228	2.00E+01	2.10E+01 (1 / 22) 2.10E+01 - 2.10E+01	H WALKER FARM 1.2 MILES NW	2.10E+01 (1 / 22) 2.10E+01 - 2.10E+01	30 VALUES < LLD	
BI-214	2.00E+01	3.52E+01 (15 / 22) 2.07E+01 - 8.38E+01	H WALKER FARM 1.2 MILES NW	3.52E+01 (15 / 22) 2.07E+01 - 8.38E+01	3.15E+01 (28 / 30) 2.19E+01 - 4.67E+01	
CS-137	5.00E+00	22 VALUES < LLD	H WALKER FARM 1.2 MILES NW	22 VALUES < LLD	30 VALUES < LLD	
K-40	1.00E+02	9.57E+02 (22 / 22) 4.05E+02 - 1.30E+03	H WALKER FARM 1.2 MILES NW	9.57E+02 (22 / 22) 4.05E+02 - 1.30E+03	1.25E+03 (30 / 30) 9.41E+02 - 1.39E+03	
PB-212	1.50E+01	1.53E+01 (1 / 22) 1.53E+01 - 1.53E+01	H WALKER FARM 1.2 MILES NW	1.53E+01 (1 / 22) 1.53E+01 - 1.53E+01	30 VALUES < LLD	
PB-214	2.00E+01	3.00E+01 (13 / 22) 2.05E+01 - 8.03E+01	H WALKER FARM 1.2 MILES NW	3.00E+01 (13 / 22) 2.05E+01 - 8.03E+01	2.82E+01 (25 / 30) 2.06E+01 - 4.05E+01	
TL-208	1.00E+01	22 VALUES < LLD	H WALKER FARM 1.2 MILES NW	22 VALUES < LLD	30 VALUES < LLD	
SR 89 - 8						
	3.50E+00	4 VALUES < LLD			4 VALUES < LLD	
SR 90 - 8						
	2.00E+00	2.59E+00 (2 / 4) 2.47E+00 - 2.72E+00	H WALKER FARM 1.2 MILES NW	2.59E+00 (2 / 4) 2.47E+00 - 2.72E+00	4 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-5

Tennessee Valley Authority

RADIOACTIVITY IN SOIL
pCi/g = 0.037 Bq/g (DRY WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 12						
AC-228	2.50E-01	9.42E-01 (8 / 8) 4.05E-01 - 1.61E+00	LM-5 WARE POINT 1.8 MILES NNE	1.61E+00 (1 / 1) 1.61E+00 - 1.61E+00	8.58E-01 (4 / 4) 6.54E-01 - 1.15E+00	
BE-7	2.50E-01	2.61E-01 (2 / 8) 2.52E-01 - 2.69E-01	PM-3 DAISY TN 5.6 MILES W	2.69E-01 (1 / 1) 2.69E-01 - 2.69E-01	6.66E-01 (1 / 4) 6.66E-01 - 6.66E-01	
BI-212	4.50E-01	1.10E+00 (7 / 8) 6.91E-01 - 1.75E+00	LM-5 WARE POINT 1.8 MILES NNE	1.75E+00 (1 / 1) 1.75E+00 - 1.75E+00	9.25E-01 (4 / 4) 6.39E-01 - 1.27E+00	
BI-214	1.50E-01	8.44E-01 (8 / 8) 3.88E-01 - 1.09E+00	LM-4 SKULL ISLAND 1.5 MILES NE	1.09E+00 (1 / 1) 1.09E+00 - 1.09E+00	8.00E-01 (4 / 4) 6.90E-01 - 9.86E-01	
CS-137	3.00E-02	2.20E-01 (6 / 8) 3.71E-02 - 6.48E-01	LM-4 SKULL ISLAND 1.5 MILES NE	6.48E-01 (1 / 1) 6.48E-01 - 6.48E-01	1.91E-01 (4 / 4) 3.66E-02 - 4.89E-01	
K-40	7.50E-01	6.19E+00 (8 / 8) 1.61E+00 - 1.20E+01	LM-5 WARE POINT 1.8 MILES NNE	1.20E+01 (1 / 1) 1.20E+01 - 1.20E+01	7.38E+00 (4 / 4) 2.65E+00 - 1.64E+01	
PA-234M	4.00E+00	8 VALUES < LLD	PM-8 HARRISON TN 8.7 MILES SSW	1 VALUES < LLD	4 VALUES < LLD	
PB-212	1.00E-01	8.62E-01 (8 / 8) 3.49E-01 - 1.49E+00	LM-5 WARE POINT 1.8 MILES NNE	1.49E+00 (1 / 1) 1.49E+00 - 1.49E+00	8.31E-01 (4 / 4) 6.11E-01 - 1.09E+00	
PB-214	1.50E-01	9.07E-01 (8 / 8) 4.32E-01 - 1.23E+00	LM-4 SKULL ISLAND 1.5 MILES NE	1.23E+00 (1 / 1) 1.23E+00 - 1.23E+00	8.71E-01 (4 / 4) 7.21E-01 - 1.09E+00	
RA-226	1.50E-01	8.44E-01 (8 / 8) 3.88E-01 - 1.09E+00	LM-4 SKULL ISLAND 1.5 MILES NE	1.09E+00 (1 / 1) 1.09E+00 - 1.09E+00	8.00E-01 (4 / 4) 6.90E-01 - 9.86E-01	
TL-208	6.00E-02	2.96E-01 (8 / 8) 1.24E-01 - 5.19E-01	LM-5 WARE POINT 1.8 MILES NNE	5.19E-01 (1 / 1) 5.19E-01 - 5.19E-01	2.71E-01 (4 / 4) 1.97E-01 - 3.70E-01	
SR 89 - 12						
	1.60E+00	8 VALUES < LLD			4 VALUES < LLD	
SR 90 - 12						
	4.00E-01	8 VALUES < LLD			4 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-6

Tennessee Valley Authority

RADIOACTIVITY IN APPLES
pCi/Kg = 0.037 Bq/Kg (WET WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 2						
BI-214	4.00E+01	8.74E+01 (1 / 1) 8.74E+01 - 8.74E+01	H WALKER FARM 1.2 MILES NW	8.74E+01 (1 / 1) 8.74E+01 - 8.74E+01	1.21E+02 (1 / 1) 1.21E+02 - 1.21E+02	
K-40	2.50E+02	1.04E+03 (1 / 1) 1.04E+03 - 1.04E+03	H WALKER FARM 1.2 MILES NW	1.04E+03 (1 / 1) 1.04E+03 - 1.04E+03	8.33E+02 (1 / 1) 8.33E+02 - 8.33E+02	
PB-212	4.00E+01	1 VALUES < LLD	H WALKER FARM 1.2 MILES NW	1 VALUES < LLD	1 VALUES < LLD	
PB-214	8.00E+01	9.32E+01 (1 / 1) 9.32E+01 - 9.32E+01	H WALKER FARM 1.2 MILES NW	9.32E+01 (1 / 1) 9.32E+01 - 9.32E+01	1.13E+02 (1 / 1) 1.13E+02 - 1.13E+02	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-7

Tennessee Valley Authority

RADIOACTIVITY IN CABBAGE
pCi/Kg = 0.037 Bq/Kg (WET WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 2						
BI-214	4.00E+01	1.31E+02 (1 / 1) 1.31E+02 - 1.31E+02	1 MILES NW	1.31E+02 (1 / 1) 1.31E+02 - 1.31E+02	1.24E+02 (1 / 1) 1.24E+02 - 1.24E+02	
K-40	2.50E+02	1.09E+03 (1 / 1) 1.09E+03 - 1.09E+03	1 MILES NW	1.09E+03 (1 / 1) 1.09E+03 - 1.09E+03	1.20E+03 (1 / 1) 1.20E+03 - 1.20E+03	
PB-214	8.00E+01	1.51E+02 (1 / 1) 1.51E+02 - 1.51E+02	1 MILES NW	1.51E+02 (1 / 1) 1.51E+02 - 1.51E+02	1.22E+02 (1 / 1) 1.22E+02 - 1.22E+02	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-8

Tennessee Valley Authority

RADIOACTIVITY IN CORN
pCi/Kg = 0.037 Bq/Kg (WET WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 2						
BI-214	4.00E+01	7.22E+01 (1 / 1) 7.22E+01 - 7.22E+01	1 MILES NW	7.22E+01 (1 / 1) 7.22E+01 - 7.22E+01	8.31E+01 (1 / 1) 8.31E+01 - 8.31E+01	
K-40	2.50E+02	1.99E+03 (1 / 1) 1.99E+03 - 1.99E+03	1 MILES NW	1.99E+03 (1 / 1) 1.99E+03 - 1.99E+03	2.14E+03 (1 / 1) 2.14E+03 - 2.14E+03	
PB-214	8.00E+01	1 VALUES < LLD	1 MILES NW	1 VALUES < LLD	8.24E+01 (1 / 1) 8.24E+01 - 8.24E+01	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-9

Tennessee Valley Authority

RADIOACTIVITY IN GREEN BEANS
pCi/Kg = 0.037 Bq/Kg (WET WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 2						
AC-228	5.00E+01	1 VALUES < LLD	1 MILES NW	1 VALUES < LLD	1 VALUES < LLD	
BI-214	4.00E+01	1.11E+02 (1 / 1) 1.11E+02 - 1.11E+02	1 MILES NW	1.11E+02 (1 / 1) 1.11E+02 - 1.11E+02	9.62E+01 (1 / 1) 9.62E+01 - 9.62E+01	
K-40	2.50E+02	2.33E+03 (1 / 1) 2.33E+03 - 2.33E+03	1 MILES NW	2.33E+03 (1 / 1) 2.33E+03 - 2.33E+03	1.92E+03 (1 / 1) 1.92E+03 - 1.92E+03	
PB-214	8.00E+01	1 VALUES < LLD	1 MILES NW	1 VALUES < LLD	1 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-10

Tennessee Valley Authority

RADIOACTIVITY IN POTATOES
pCi/Kg = 0.037 Bq/Kg (WET WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 2						
BI-214	4.00E+01	1.36E+02 (1 / 1) 1.36E+02 - 1.36E+02	1 MILES NW	1.36E+02 (1 / 1) 1.36E+02 - 1.36E+02	7.78E+01 (1 / 1) 7.78E+01 - 7.78E+01	
K-40	2.50E+02	3.43E+03 (1 / 1) 3.43E+03 - 3.43E+03	1 MILES NW	3.43E+03 (1 / 1) 3.43E+03 - 3.43E+03	2.96E+03 (1 / 1) 2.96E+03 - 2.96E+03	
PB-212	4.00E+01	1 VALUES < LLD	1 MILES NW	1 VALUES < LLD	1 VALUES < LLD	
PB-214	8.00E+01	1.37E+02 (1 / 1) 1.37E+02 - 1.37E+02	1 MILES NW	1.37E+02 (1 / 1) 1.37E+02 - 1.37E+02	1 VALUES < LLD	

Notes:
1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-11

Tennessee Valley Authority

RADIOACTIVITY IN TOMATOES
pCi/Kg = 0.037 Bq/Kg (WET WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 2						
BI-214	4.00E+01	9.68E+01 (1 / 1) 9.68E+01 - 9.68E+01	1 MILES NW	9.68E+01 (1 / 1) 9.68E+01 - 9.68E+01	9.33E+01 (1 / 1) 9.33E+01 - 9.33E+01	
K-40	2.50E+02	2.22E+03 (1 / 1) 2.22E+03 - 2.22E+03	1 MILES NW	2.22E+03 (1 / 1) 2.22E+03 - 2.22E+03	1.93E+03 (1 / 1) 1.93E+03 - 1.93E+03	
PB-212	4.00E+01	1 VALUES < LLD	1 MILES NW	1 VALUES < LLD	1 VALUES < LLD	
PB-214	8.00E+01	9.59E+01 (1 / 1) 9.59E+01 - 9.59E+01	1 MILES NW	9.59E+01 (1 / 1) 9.59E+01 - 9.59E+01	1 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-12

Tennessee Valley Authority

RADIOACTIVITY IN SURFACE WATER (Total)
pCi/L = 0.037 Bq/L

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GROSS BETA - 25						
	1.90E+00	2.73E+00 (9 / 13) 1.92E+00 - 3.82E+00	TRM 483.4	2.73E+00 (9 / 13) 1.92E+00 - 3.82E+00	3.01E+00 (8 / 12) 1.93E+00 - 5.46E+00	
GAMMA SCAN (GELI) - 25						
BI-214	2.00E+01	3.98E+01 (11 / 13) 2.07E+01 - 1.39E+02	TRM 483.4	3.98E+01 (11 / 13) 2.07E+01 - 1.39E+02	3.74E+01 (9 / 12) 2.45E+01 - 6.29E+01	
K-40	1.00E+02	13 VALUES < LLD	TRM 483.4	13 VALUES < LLD	12 VALUES < LLD	
PB-212	1.50E+01	13 VALUES < LLD	TRM 483.4	13 VALUES < LLD	12 VALUES < LLD	
PB-214	2.00E+01	4.00E+01 (6 / 13) 2.23E+01 - 1.02E+02	TRM 483.4	4.00E+01 (6 / 13) 2.23E+01 - 1.02E+02	3.16E+01 (8 / 12) 2.06E+01 - 4.91E+01	
TL-208	1.00E+01	13 VALUES < LLD	TRM 483.4	13 VALUES < LLD	12 VALUES < LLD	
TRITIUM - 20						
	2.70E+02	8.32E+02 (1 / 4) 8.32E+02 - 8.32E+02	TRM 483.4	8.32E+02 (1 / 4) 8.32E+02 - 8.32E+02	3.52E+02 (4 / 16) 2.73E+02 - 4.82E+02	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-13

Tennessee Valley Authority

RADIOACTIVITY IN PUBLIC (DRINKING) WATER (Total)
pCi/L = 0.037 Bq/L

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GROSS BETA - 51						
	1.90E+00	2.75E+00 (23 / 39) 1.92E+00 - 4.53E+00	CHATTANOOGA TRM 465.3	2.93E+00 (9 / 13) 1.96E+00 - 4.53E+00	3.01E+00 (8 / 12) 1.93E+00 - 5.46E+00	
GAMMA SCAN (GELI) - 51						
AC-228	2.00E+01	2.16E+01 (2 / 39) 2.15E+01 - 2.17E+01	E.I. DUPONT TRM 470.5	2.17E+01 (1 / 13) 2.17E+01 - 2.17E+01	12 VALUES < LLD	
BI-214	2.00E+01	3.88E+01 (36 / 39) 2.04E+01 - 1.16E+02	E.I. DUPONT TRM 470.5	4.57E+01 (13 / 13) 2.63E+01 - 1.16E+02	3.74E+01 (9 / 12) 2.45E+01 - 6.29E+01	
K-40	1.00E+02	39 VALUES < LLD	CF INDUSTRIES TRM 473.0	13 VALUES < LLD	12 VALUES < LLD	
PB-212	1.50E+01	39 VALUES < LLD	CHATTANOOGA TRM 465.3	13 VALUES < LLD	12 VALUES < LLD	
PB-214	2.00E+01	3.63E+01 (31 / 39) 2.00E+01 - 8.91E+01	E.I. DUPONT TRM 470.5	4.06E+01 (13 / 13) 2.29E+01 - 8.79E+01	3.16E+01 (8 / 12) 2.06E+01 - 4.91E+01	
TL-208	1.00E+01	39 VALUES < LLD	E.I. DUPONT TRM 470.5	13 VALUES < LLD	12 VALUES < LLD	
TRITIUM - 41						
	2.70E+02	5.89E+02 (8 / 25) 3.34E+02 - 9.88E+02	CF INDUSTRIES TRM 473.0	6.15E+02 (6 / 17) 4.05E+02 - 9.88E+02	3.52E+02 (4 / 16) 2.73E+02 - 4.82E+02	

Notes:
1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-14

Tennessee Valley Authority

RADIOACTIVITY IN WELL (GROUND) WATER (Total)
pCi/L = 0.037 Bq/L

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GROSS BETA - 8						
	1.90E+00	2.32E+00 (1 / 4) 2.32E+00 - 2.32E+00	SQN WELL #6 ONSITE NNE	2.32E+00 (1 / 4) 2.32E+00 - 2.32E+00	4.02E+00 (4 / 4) 2.25E+00 - 7.25E+00	
GAMMA SCAN (GELI) - 17						
AC-228	2.00E+01	13 VALUES < LLD	SQN WELL #6 ONSITE NNE	13 VALUES < LLD	4 VALUES < LLD	
BI-212	5.00E+01	13 VALUES < LLD	SQN WELL #6 ONSITE NNE	13 VALUES < LLD	4 VALUES < LLD	
BI-214	2.00E+01	3.26E+01 (11 / 13) 2.06E+01 - 5.08E+01	SQN WELL #6 ONSITE NNE	3.26E+01 (11 / 13) 2.06E+01 - 5.08E+01	3.52E+02 (4 / 4) 2.77E+02 - 5.27E+02	
K-40	1.00E+02	13 VALUES < LLD	SQN WELL #6 ONSITE NNE	13 VALUES < LLD	4 VALUES < LLD	
PB-212	1.50E+01	13 VALUES < LLD	SQN WELL #6 ONSITE NNE	13 VALUES < LLD	4 VALUES < LLD	
PB-214	2.00E+01	3.00E+01 (9 / 13) 2.06E+01 - 4.30E+01	SQN WELL #6 ONSITE NNE	3.00E+01 (9 / 13) 2.06E+01 - 4.30E+01	3.52E+02 (4 / 4) 2.78E+02 - 5.30E+02	
TL-208	1.00E+01	13 VALUES < LLD	SQN WELL #6 ONSITE NNE	13 VALUES < LLD	4 VALUES < LLD	
TRITIUM - 17						
	2.70E+02	3.64E+02 (7 / 13) 2.86E+02 - 5.43E+02	SQN WELL #6 ONSITE NNE	3.64E+02 (7 / 13) 2.86E+02 - 5.43E+02	4 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Tennessee Valley Authority

RADIOACTIVITY IN COMMERCIAL FISH
pCi/g = 0.037 Bq/g (DRY WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 4						
BI-214	1.00E-01	2.66E-01 (2 / 2) 2.18E-01 - 3.14E-01	CHICKAMAUGA RES TRM 471-530	2.66E-01 (2 / 2) 2.18E-01 - 3.14E-01	2.35E-01 (2 / 2) 1.50E-01 - 3.20E-01	
CS-137	3.00E-02	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	4.75E-02 (1 / 2) 4.75E-02 - 4.75E-02	
K-40	4.00E-01	1.09E+01 (2 / 2) 1.02E+01 - 1.17E+01	CHICKAMAUGA RES TRM 471-530	1.09E+01 (2 / 2) 1.02E+01 - 1.17E+01	1.31E+01 (2 / 2) 1.16E+01 - 1.46E+01	
PB-212	4.00E-02	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	2 VALUES < LLD	
PB-214	5.00E-01	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	2 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. *Blanks in this column indicate no nonrountine measurements*

Table H-16

Tennessee Valley Authority

RADIOACTIVITY IN GAME FISH
pCi/g = 0.037 Bq/g (DRY WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 4						
BI-214	1.00E-01	3.25E-01 (2 / 2) 2.65E-01 - 3.84E-01	CHICKAMAUGA RES TRM 471-530	3.25E-01 (2 / 2) 2.65E-01 - 3.84E-01	2.22E-01 (2 / 2) 1.51E-01 - 2.93E-01	
CS-137	3.00E-02	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	2 VALUES < LLD	
K-40	4.00E-01	1.25E+01 (2 / 2) 1.23E+01 - 1.27E+01	CHICKAMAUGA RES TRM 471-530	1.25E+01 (2 / 2) 1.23E+01 - 1.27E+01	1.23E+01 (2 / 2) 1.23E+01 - 1.24E+01	
PB-212	4.00E-02	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	2 VALUES < LLD	
PB-214	5.00E-01	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	2 VALUES < LLD	
TL-208	3.00E-02	2 VALUES < LLD	CHICKAMAUGA RES TRM 471-530	2 VALUES < LLD	2 VALUES < LLD	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-17

Tennessee Valley Authority

RADIOACTIVITY IN SHORELINE SEDIMENT
pCi/g = 0.037 Bq/g (DRY WEIGHT)

Name of Facility: SEQUOYAH NUCLEAR PLANT
Location of Facility: HAMILTON, TENNESSEE

Docket Number: 50-327,328
Reporting Period: 2014

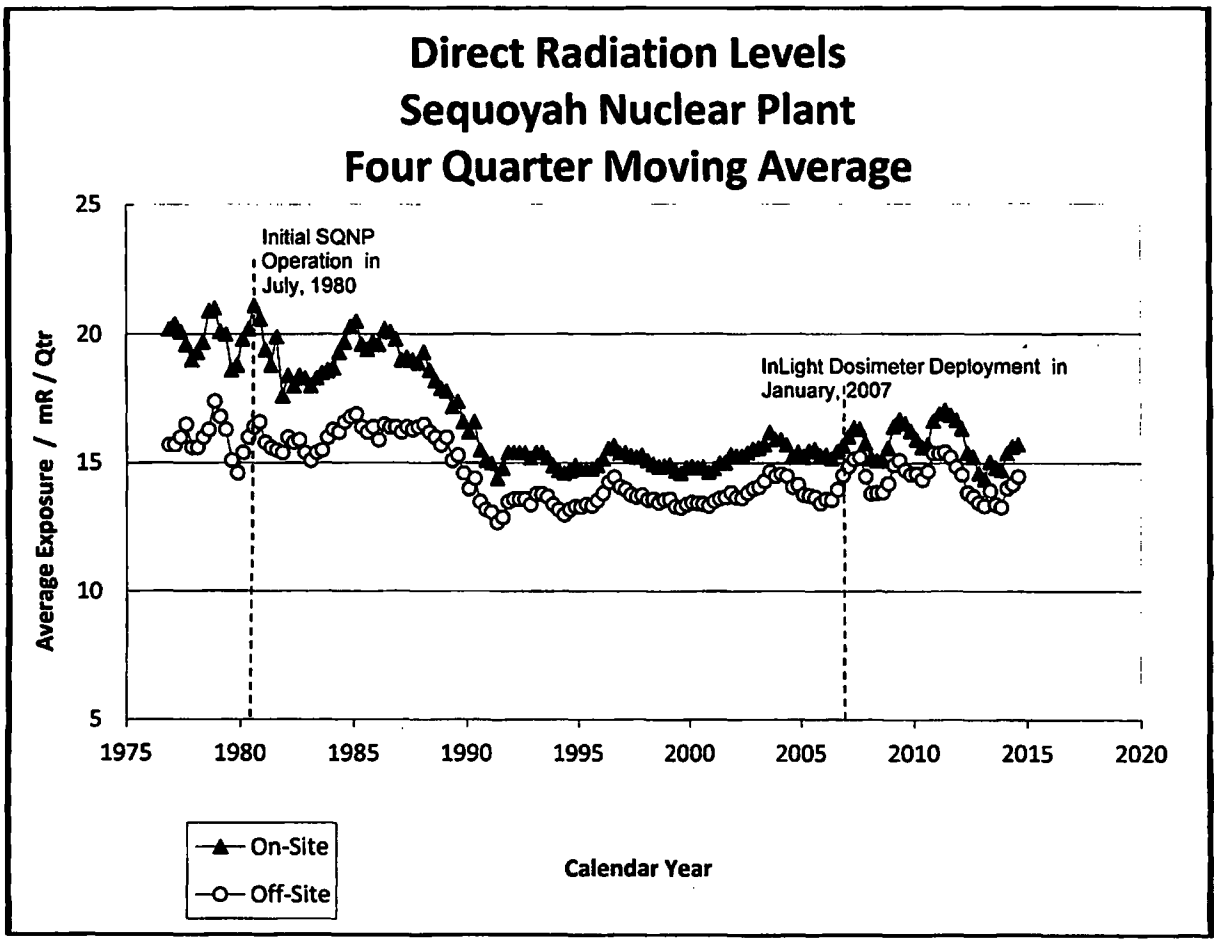
Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) See Note 1	Indicator Locations Mean (F) Range See Note 2	Location with Highest Annual Mean: Location Description with Distance and Direction	Location with Highest Annual Mean: Mean (F) Range See Note 2	Control Locations Mean (F) Range See Note 2	Number of Nonroutine Reported Measurements See Note 3
GAMMA SCAN (GELI) - 6						
AC-228	2.50E-01	8.32E-01 (4 / 4) 4.93E-01 - 1.24E+00	TRM 479.0 TRM 479.0	8.67E-01 (2 / 2) 4.93E-01 - 1.24E+00	2.52E-01 (1 / 2) 2.52E-01 - 2.52E-01	
BE-7	2.50E-01	6.33E-01 (1 / 4) 6.33E-01 - 6.33E-01	TRM 480.0 TRM 480.0	6.33E-01 (1 / 2) 6.33E-01 - 6.33E-01	2 VALUES < LLD	
BI-212	4.50E-01	9.39E-01 (4 / 4) 4.77E-01 - 1.45E+00	TRM 480.0 TRM 480.0	9.63E-01 (2 / 2) 4.77E-01 - 1.45E+00	2 VALUES < LLD	
BI-214	1.50E-01	8.55E-01 (4 / 4) 4.99E-01 - 1.34E+00	TRM 479.0 TRM 479.0	9.55E-01 (2 / 2) 5.68E-01 - 1.34E+00	3.22E-01 (2 / 2) 3.17E-01 - 3.26E-01	
CS-137	3.00E-02	4 VALUES < LLD	TRM 479.0 TRM 479.0	2 VALUES < LLD	2 VALUES < LLD	
K-40	7.50E-01	2.34E+00 (3 / 4) 7.54E-01 - 3.23E+00	TRM 480.0 TRM 480.0	3.04E+00 (1 / 2) 3.04E+00 - 3.04E+00	1.51E+00 (2 / 2) 1.26E+00 - 1.76E+00	
PA-234M	4.00E+00	4 VALUES < LLD	TRM 479.0 TRM 479.0	2 VALUES < LLD	2 VALUES < LLD	
PB-212	1.00E-01	8.19E-01 (4 / 4) 4.58E-01 - 1.20E+00	TRM 479.0 TRM 479.0	8.41E-01 (2 / 2) 4.79E-01 - 1.20E+00	2.48E-01 (2 / 2) 2.44E-01 - 2.52E-01	
PB-214	1.50E-01	9.02E-01 (4 / 4) 5.05E-01 - 1.43E+00	TRM 479.0 TRM 479.0	1.01E+00 (2 / 2) 5.97E-01 - 1.43E+00	3.31E-01 (2 / 2) 3.26E-01 - 3.36E-01	
RA-226	1.50E-01	8.55E-01 (4 / 4) 4.99E-01 - 1.34E+00	TRM 479.0 TRM 479.0	9.55E-01 (2 / 2) 5.68E-01 - 1.34E+00	3.22E-01 (2 / 2) 3.17E-01 - 3.26E-01	
TL-208	6.00E-02	2.75E-01 (4 / 4) 1.51E-01 - 4.02E-01	TRM 479.0 TRM 479.0	2.85E-01 (2 / 2) 1.67E-01 - 4.02E-01	8.06E-02 (2 / 2) 7.32E-02 - 8.80E-02	

Notes: 1. Nominal Lower Level of Detection (LLD) as described in Table E - 1
2. Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location is indicated in parentheses (F).
3. Blanks in this column indicate no nonrountine measurements

Table H-18

Figure H-1

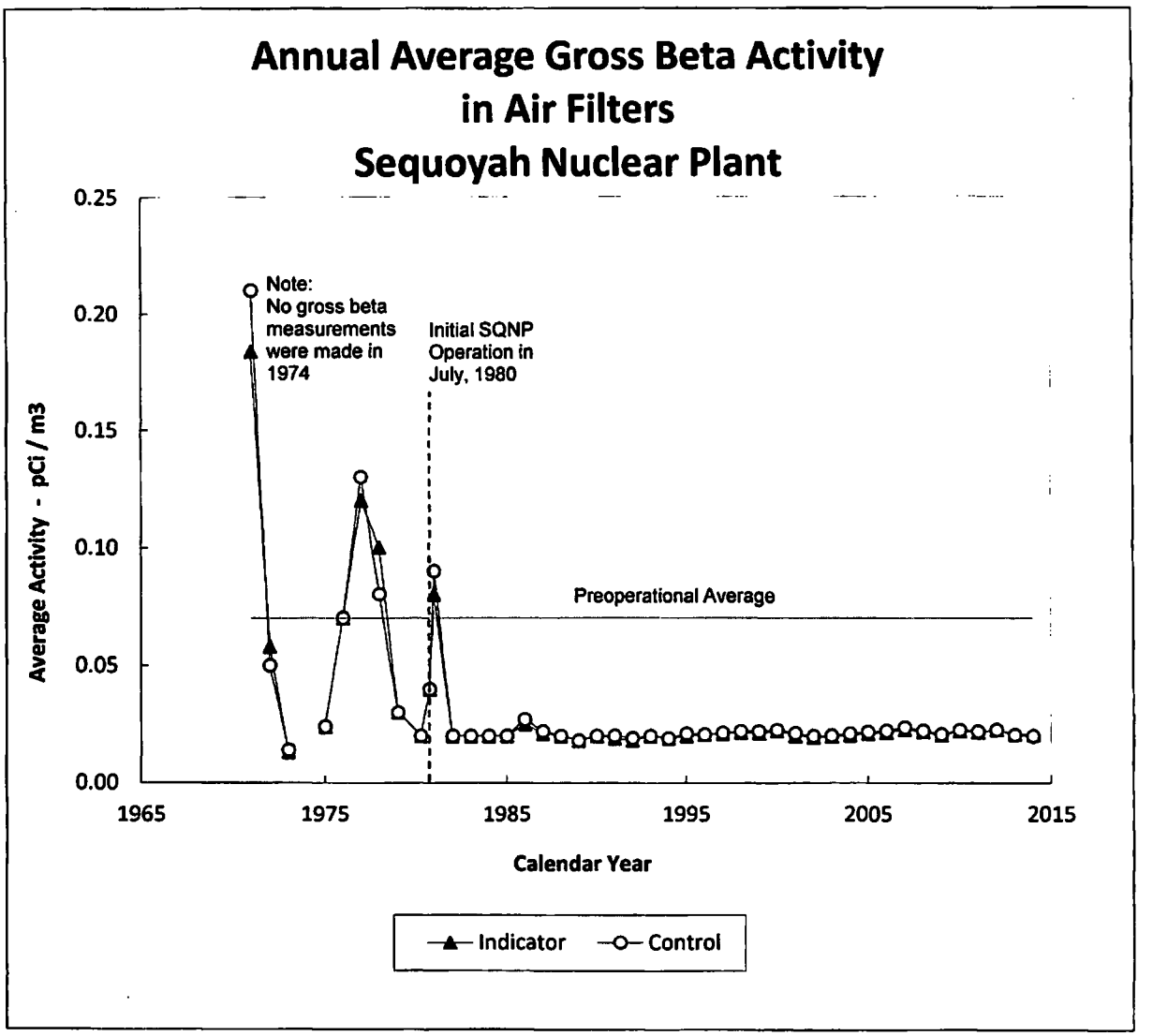
Direct Radiation



Dosimeters are processed quarterly. This chart shows trends in the average measurement for all dosimeters grouped as "on-site" or "off-site". The data from preoperational phase, prior to 1980, show the same trend of "on-site" measurements higher than "off-site" measurements that is observed in current data indicating that the slightly higher "on-site" direct radiation levels are not related to plant operations.

Figure H-2

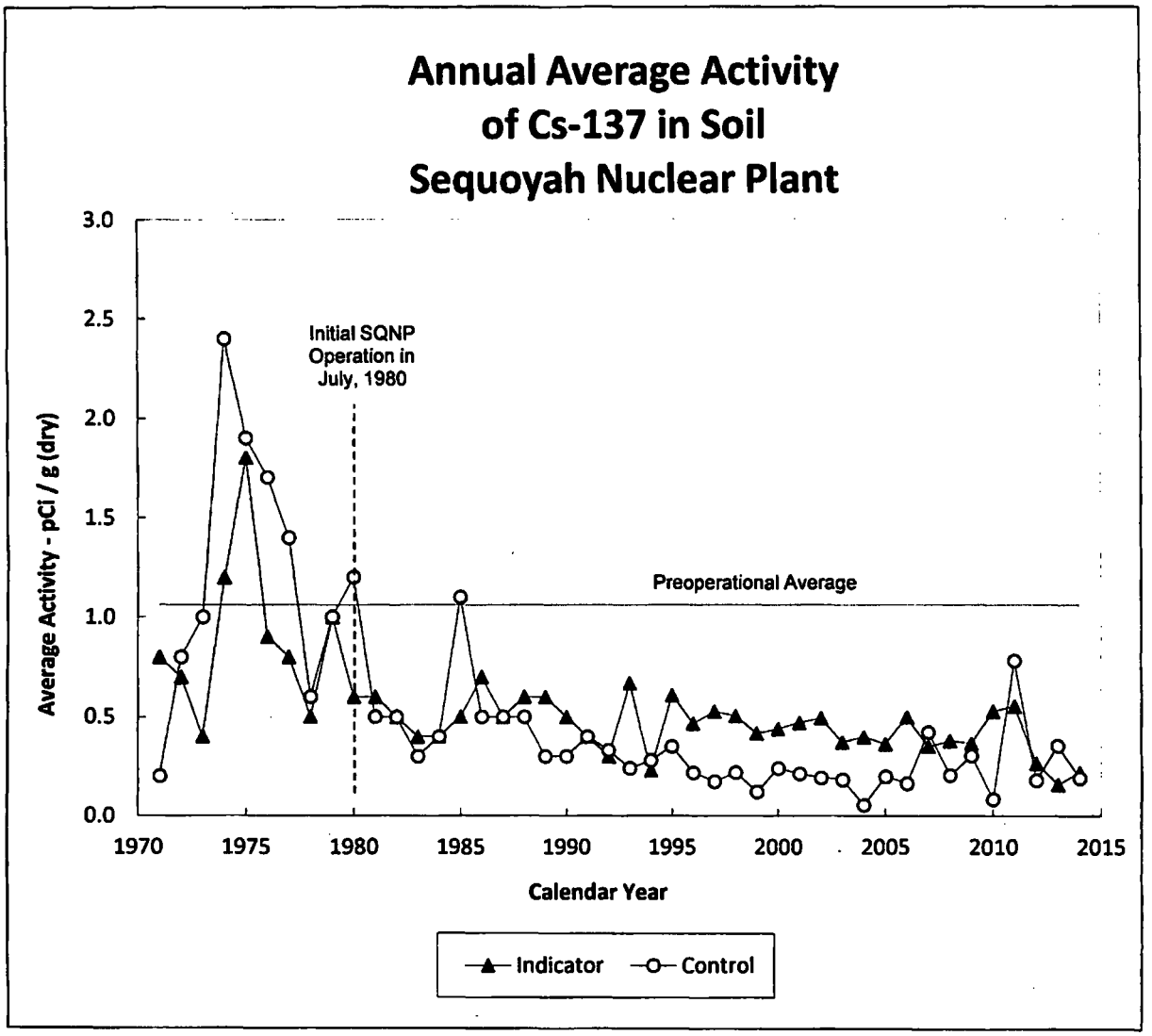
Radioactivity in Air Filters



As can be seen in the trend plot of gross beta activity, the gross beta levels in air particulates have remained relatively constant with the exception of years when the beta activity was elevated due to fallout from nuclear weapons testing. The data also shows that there is no difference in the gross beta activity levels for sampling conducted at the indicator stations as compared to the control stations.

Figure H-3

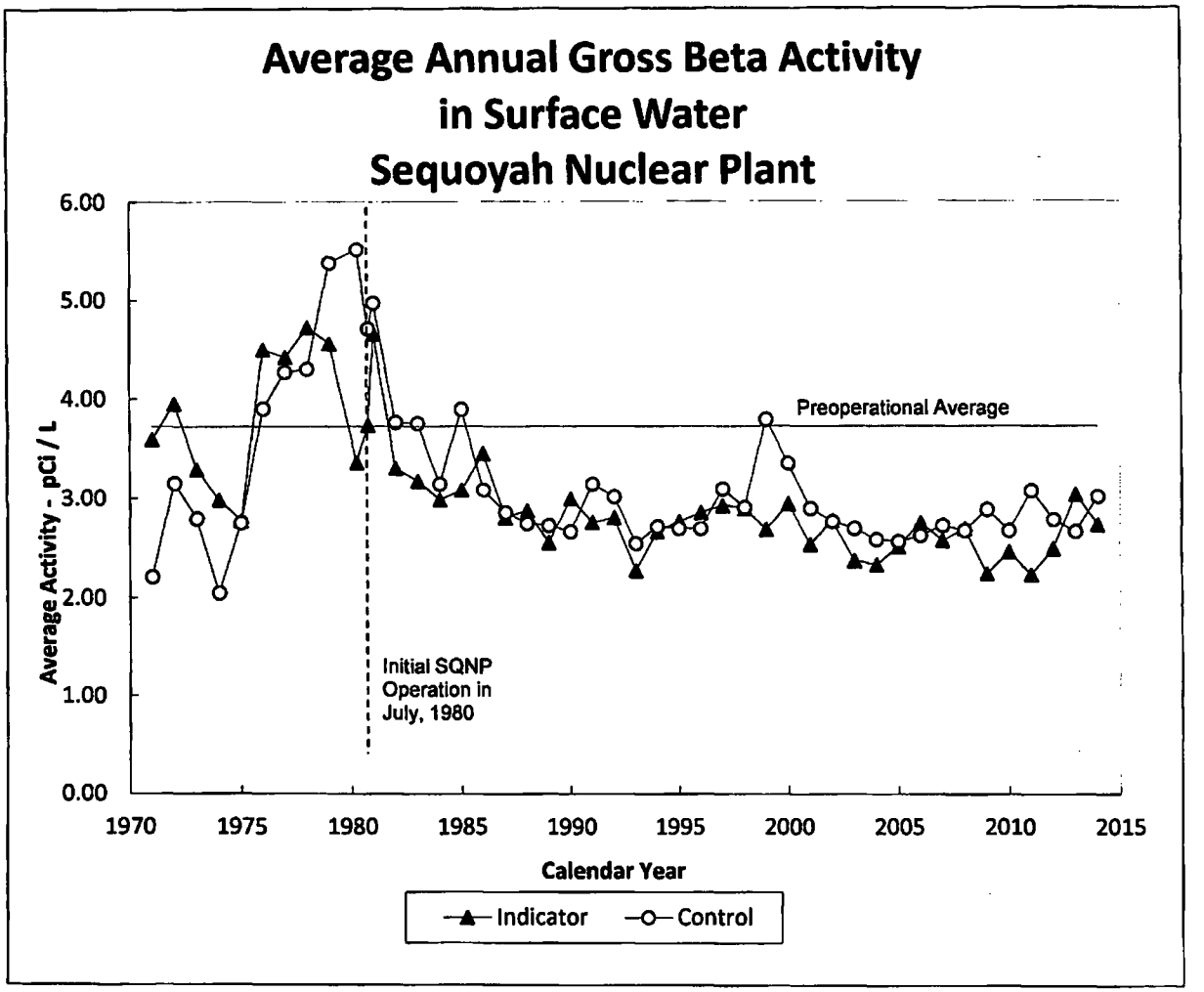
Cs-137 in Soil



Cesium-137 was produced by past nuclear weapons testing and is present in almost every environmental soil sample exposed to the atmosphere. The fallout from accidents at the Chernobyl plant in the Ukraine in 1986 and Fukushima plant in Japan in 2011 may have also contributed to the low levels of Cs-137 measured in environmental samples.

Figure H-4

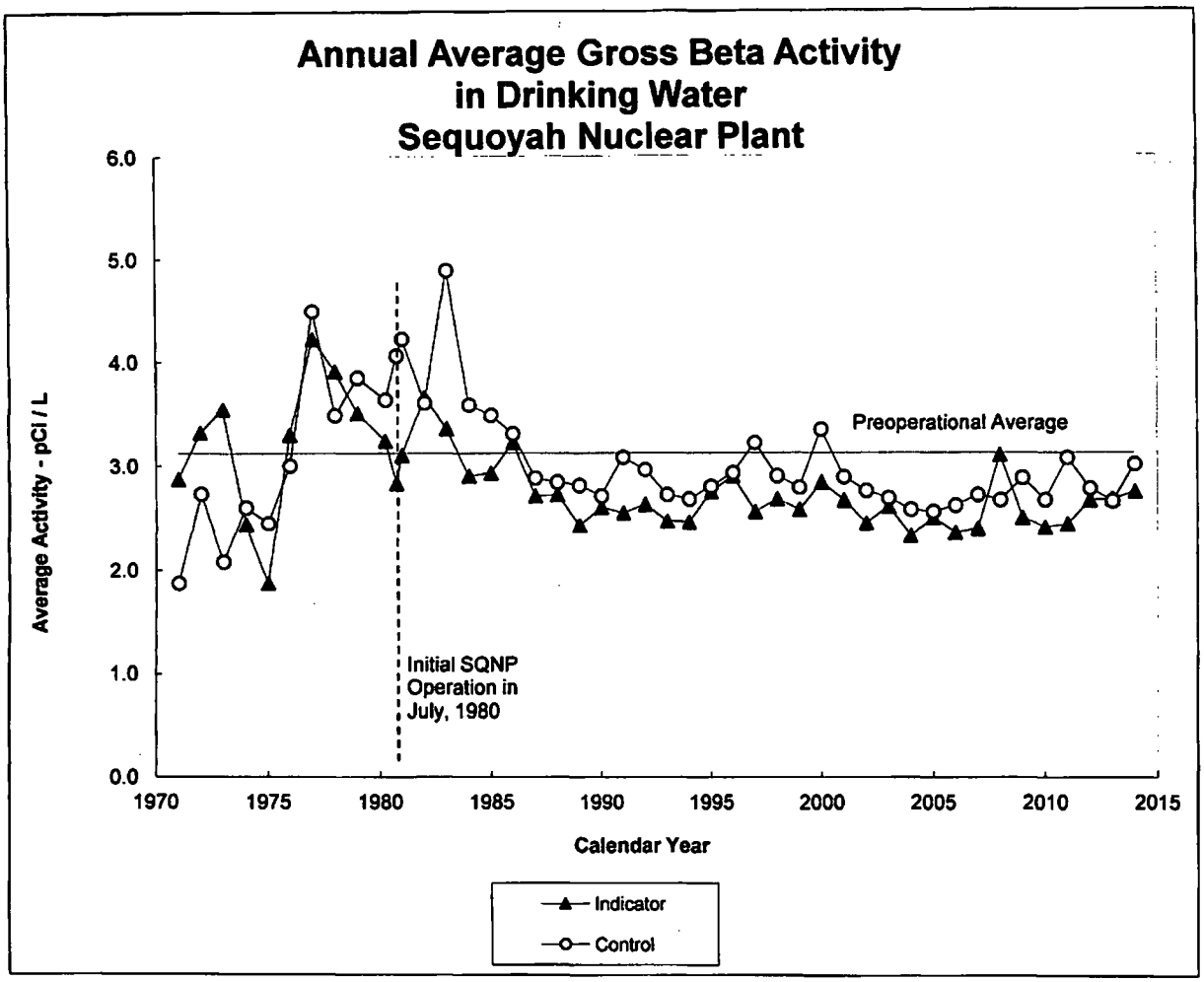
Gross Beta Activity in Surface Water



As shown in the graph, the gross beta activity in samples from the downstream indicator locations has been essentially the same as the activity in samples from the upstream control locations. The average gross beta activity in these samples has been trending down since the early 1980's.

Figure H-5

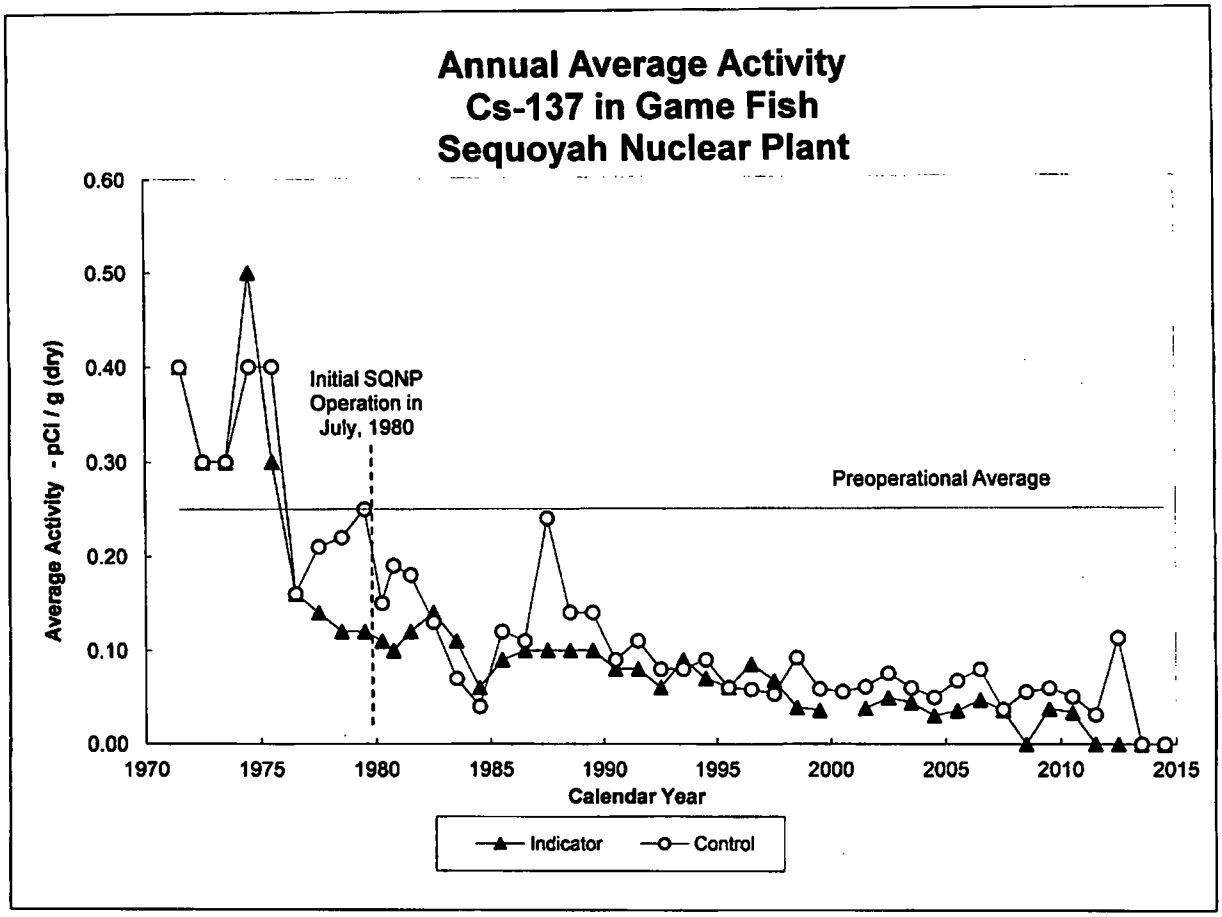
Gross Beta Activity in Drinking Water



The average gross beta activity in drinking water samples from the upstream control locations has typically been slightly higher than activity level measured in samples from the downstream indicator locations. The annual average gross beta activity has been relatively constant since the start of plant operations in 1980 and is slightly lower than preoperational levels.

Figure H-6

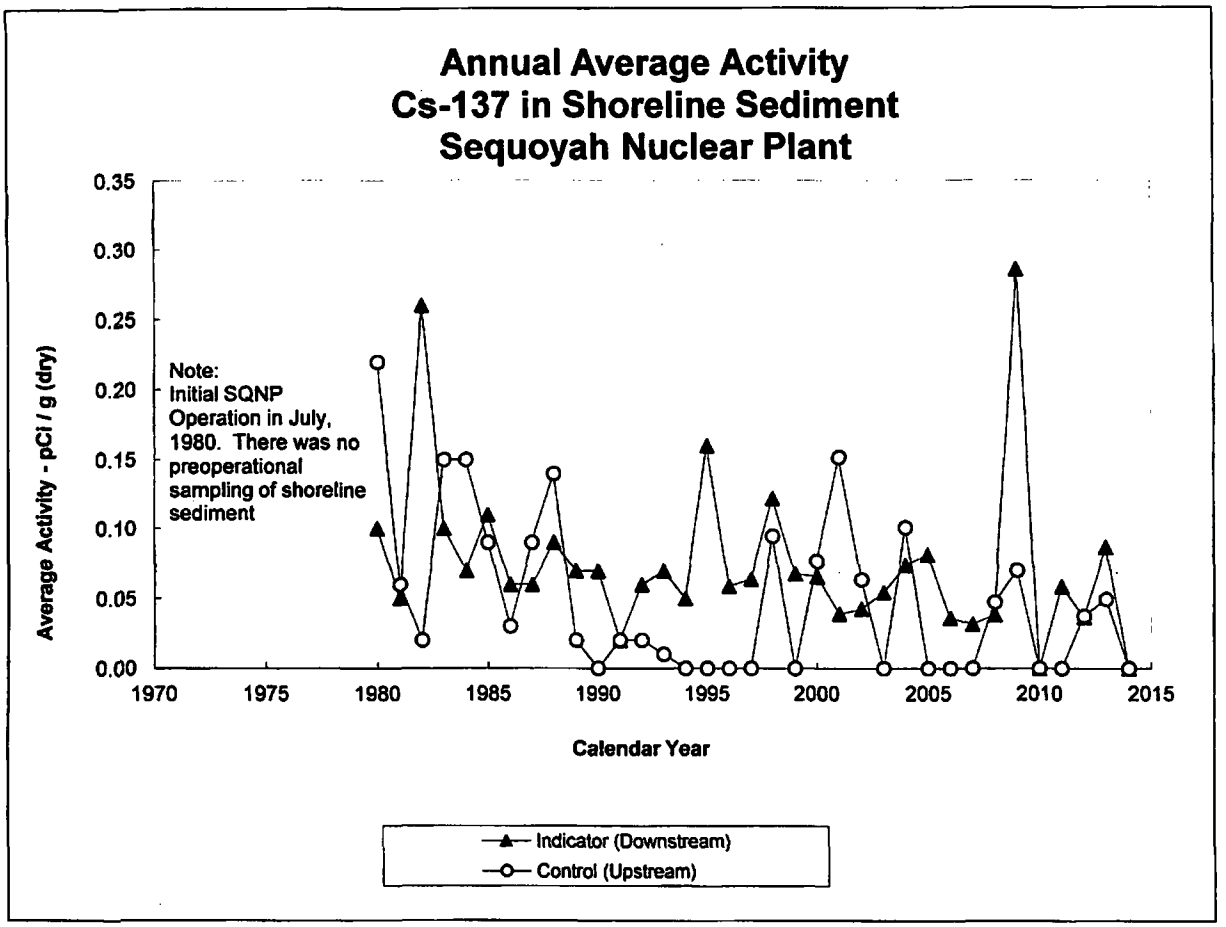
Radioactivity in Fish



The concentrations of Cs-137 found in fish are consistent with levels present in the Tennessee River due to past atmospheric nuclear weapons testing and operation of other nuclear facilities in the upper reaches of the Tennessee River Watershed. As shown in the graph, the levels of Cs-137 have been decreasing consistent with the overall levels of Cs-137 in the environment.

Figure H-7

Radioactivity in Shoreline Sediment



The Cs-137 present in the shoreline sediments of the Tennessee River system was produced both by past atmospheric testing of nuclear weapons and the operation of other nuclear facilities in the upper reaches of the Tennessee River Watershed. The abnormally high value for the 2009 data from the downstream locations resulted from a problem with one sample collected in April, 2009. The sample was collected during a period of high water levels and was actually surface soil and not the normal shoreline sediment material. This sample contained Cs-137 at a level typical for environmental soil but was much higher than levels normally found in shoreline sediment. This issue was discussed in the 2009 SQN report.