

Chapter 4

Environmental Surveillance

Pete Fledderman, Donald Padgett, and Monte Steedley

Environmental Services Section

Timothy Jannik

Savannah River Technology Center

Robert Turner

Site Utilities Department

ENVIRONMENTAL surveillance at the Savannah River Site (SRS) is designed to survey and quantify any effects that routine and nonroutine operations could have on the site and on the surrounding area and population. Site surveillance activities are divided into radiological and nonradiological programs.

As part of the radiological surveillance program, routine surveillance of all radiation exposure pathways is performed on all environmental media that could lead to a measurable annual dose at and beyond the site boundary.

Nonradioactive environmental surveillance at SRS involves the sampling and analysis of surface water, drinking water, sediment, groundwater, and fish. Results from the analyses of surface water, drinking water, sediment, and fish are discussed in this chapter. A description of the groundwater monitoring program analysis results can be found in chapter 6, "Groundwater."

The Environmental Services Section's Environmental Monitoring and Analysis (EMA) group and the Savannah River Technology Center (SRTC) perform surveillance activities. The Savannah River also is monitored by other groups, including the South Carolina Department of Health and Environmental Control (SCDHEC), the Georgia Department of Natural Resources, and the Academy of Natural Sciences of Philadelphia (ANSP).

A complete description of the EMA surveillance program, including sample collection and analytical procedures, can be found in section 1105 of the *Savannah River Site Environmental Monitoring Section Plans and Procedures*, WSRC-3Q1-2, Volume 1 (SRS EM Program). Brief summaries of analytical results are presented in this chapter; complete data sets can be found in tables on the CD accompanying this report.

Radiological Surveillance

Air

Description of Surveillance Program

EMA maintains a network of sampling stations in and around SRS to monitor the concentration of tritium and radioactive particulate materials in the air. In October 2003, a number of changes were made to the air surveillance program, including the following:

- Sampling was discontinued at two locations (West Jackson and Windsor Road), reducing the number of air surveillance sites from 17 to 15.
- The sampling frequency for air filters and activated charcoal canisters was changed from weekly to biweekly at the remaining air surveillance sites.
- The sampling frequency for rainwater was changed from biweekly to monthly.

Surveillance Results

Except for tritium, specific radionuclides were not routinely detectable at the site perimeter. Both onsite and offsite activity concentrations were similar to levels observed in previous years.

Average gross alpha and beta results were slightly lower in 2003 than in 2002. However, they are consistent with historical results, which demonstrate long-term variability.

Cesium-137 was the only manmade gamma-emitting radionuclide observed in 2003, and was observed in only one site perimeter sample. These results are consistent with historical results, which indicate only a small number of samples with detectable activity.

Detectable alpha-emitting radionuclide activity, primarily uranium isotopes, was observed in five samples. Americium-241 was detected at one location on the site perimeter; curium-244 was detected at one

offsite location; and uranium-234 was detected in three site perimeter locations. Generally, these concentrations were consistent with historical results. All isotopes at the remaining locations were below detection levels. As observed in previous years, none of the samples showed strontium-89,90 above the minimum detectable concentration (MDC).

Tritium-in-air results for 2003 were similar to those observed in 2002. Tritium was detected at every sampling location, although not every sample from a particular location had detectable tritium. As in previous years, the Burial Ground North location showed average and maximum concentrations significantly higher than those observed at other locations. This was expected because of its proximity to SRS's tritium facilities, which are near the center of the site. Consistent with the SRS source term, tritium concentrations generally decrease with increasing distance from the tritium facilities.

Rainwater

Description of Surveillance Program

SRS maintains a network of rainwater sampling sites as part of the air surveillance program. These stations are used to measure deposition of radioactive materials.

Surveillance Results

Gamma-Emitting Radionuclides No detectable manmade gamma-emitting radionuclides were observed in rainwater samples in 2003.

Except for the Burial Ground North results that were discussed in last year's (2002) site environmental report, the gross alpha and gross beta results from 2003 were consistent with those of 2002. Although the 2003 results generally were slightly higher than those of 2002, no long-term increasing or decreasing trend was evident. This implies that the observed values are natural background and does not indicate any contribution directly attributable to SRS.

Except for plutonium-238 at one location, all actinides were below detection levels in 2003.

As in 2002, no detectable levels of strontium-89,90 were observed in rainwater samples during 2003.

As in previous years, tritium-in-rain values were highest near the center of the site. This is consistent with the H-Area effluent release points that routinely release tritium. Tritium was detected at every sampling location, although not every sample from a particular location had detectable tritium. As with tritium in air,

concentrations generally decreased as distance from the effluent release point increased.

Gamma Radiation

Description of Surveillance Program

Ambient gamma exposure rates in and around SRS are monitored by a network of thermoluminescent dosimeters (TLDs).

Surveillance Results

Exposures at all TLD monitoring locations show some variation based on normal site-to-site and year-to-year differences in the components of natural ambient gamma exposure levels. Exposure rates varied between 55 and 114 mrem per year.

In general, the 2003 ambient gamma radiation monitoring results indicated gamma exposure rates slightly lower than those observed at the same locations in 2002. However, these results generally are consistent with previously published historical results, and indicate that—except in the case of population centers—no significant difference in average exposure rates is observed between monitoring networks.

E-Area Stormwater Basins

Description of Surveillance Program

Stormwater accumulating in the E-Area stormwater basins is monitored because of potential contamination.

Surveillance Results

There are no active discharges to the E-Area stormwater basins; the primary contributor to basin water is rainwater runoff. Rain events did not supply enough water to the E-03 and E-06 basins for sampling purposes in 2003, so no samples were obtained from these locations. The highest mean tritium concentration in 2003, 1.28 E+05 pCi/L, was detected in basin E-05 and is attributed to activities at the nearby Four Mile Creek phytoremediation project. This concentration is similar to 2003's high mean tritium concentration for the same location. Mean cobalt-60, cesium-137, and gross alpha concentrations all were below the MDCs.

Gross beta concentrations for the E-Area stormwater basins declined slightly from last year's concentrations, but were typical of long-term trends. Overall, actinides were slightly lower than or consistent with last year's concentrations, and all were below their respective MDCs.

Site Streams

Description of Surveillance Program

Continuous surveillance is used on several SRS streams to monitor below process areas and to detect and quantify levels of radioactivity in liquid effluents being transported to the Savannah River. In September 2003, a number of changes were made to the radiological liquid surveillance program, including the following:

- Sampling at two sites—McQueen Branch and C Canal—was discontinued, reducing the number of stream surveillance sites from 20 to 18.
- Sampling frequency at the remaining sites was changed from biweekly to monthly.

Surveillance Results

Further investigation into the elevated 2002 gross alpha and gross beta results from the U3R-1A location proved inconclusive. No offsite activities were identified that would have affected sample results. In 2003, the gross alpha and beta concentrations at this location returned to normal levels when compared with the years before 2002. All tritium concentrations at U3R-1A were below detection in 2003.

Mean 2003 gross alpha and gross beta concentrations at the other surveillance locations generally were lower than last year's, but consistent with historical data.

Cesium-137 was detected at four locations, but the mean concentrations at two of the locations were lower than last year. The two elevated mean concentrations were at Four Mile-A7 and Four Mile-2. The Four Mile-A7 mean concentration was consistent with historical data. The Four Mile-2 mean concentration, though higher than historical data, was only $2.02\text{E}+01$ pCi/L. Cobalt-60 concentrations were below detection.

A technetium-99 measurement program begun in 2001 to establish historical technetium-99 levels continued in 2003. All the stream technetium-99 results, as well as the iodine-129 results, were below MDC.

In 2001 and 2002, technetium-99 and iodine-129 analyses were run on streamwater samples, but were not reported in the 2001 and 2002 environmental reports. Iodine-129 was not detected in 2001 or 2002. Technetium-99 was detected in Four Mile Creek. A supplemental table containing the 2001 and 2002 iodine-129 information is provided on the CD accompanying this (2003) report.

Upper Three Runs-F3 mean concentrations indicated the presence of uranium-234, uranium-235, ura-

nium-238, and plutonium-238. However, the uranium-238 and plutonium-238 values were consistent with historical data, while the uranium-234 and uranium-235 mean concentrations indicated a minor elevation, with mean concentrations of $5.81\text{E}-01$ pCi/L and $3.50\text{E}-02$ pCi/L, respectively. Americium-241 and curium-244 results were below detection. Strontium-89,90 was detected at two Four Mile Creek locations, but the results generally were consistent with historical values.

Seepage Basin and Solid Waste Disposal Facility Radionuclide Migration

To incorporate the migration of radioactivity to site streams into total radioactive release quantities, EMA monitored and quantified the migration of radioactivity from site seepage basins and the Solid Waste Disposal Facility (SWDF) in 2003 as part of its stream surveillance program. During 2003, tritium, strontium-89,90, and cesium-137 were detected in migration releases. Measured iodine-129 results, however, all were below the MDC for the laboratory's analytical procedure. Therefore, the amount last measured (in 1996) was used for dose calculations.

Figure 4-1 is a graphical representation of releases of tritium via migration to site streams for the years 1994-2003. During 2003, the total quantity of tritium migrating from the seepage basins and SWDF was 2,783 Ci, compared to 2,007 Ci in 2002. This increase is attributed primarily to the increase in rainfall during 2003, compared to the previous few years.

Radioactivity previously deposited in the F-Area and H-Area seepage basins and SWDF continues to migrate via the groundwater and to outcrop into Four Mile Creek and into Upper Three Runs.

Measured migration of tritium into Four Mile Creek in 2003 occurred as follows:

- from F-Area seepage basins, 555 Ci—a 146-percent increase from the 2002 total of 226 Ci
- from H-Area seepage basin 4 and SWDF, 390 Ci—a three-percent increase from the 2002 total of 381 Ci
- from H-Area seepage basins 1, 2, and 3, 206 Ci—a 117-percent increase from the 2002 total of 95 Ci

The measured migration from the north side of SWDF and the General Separations Area (GSA) into Upper Three Runs in 2003 was 462 Ci, a 68-percent increase from the 2002 total of 275 Ci. (The GSA is in the central part of SRS and contains all waste disposal facilities, chemical separations facilities, associated

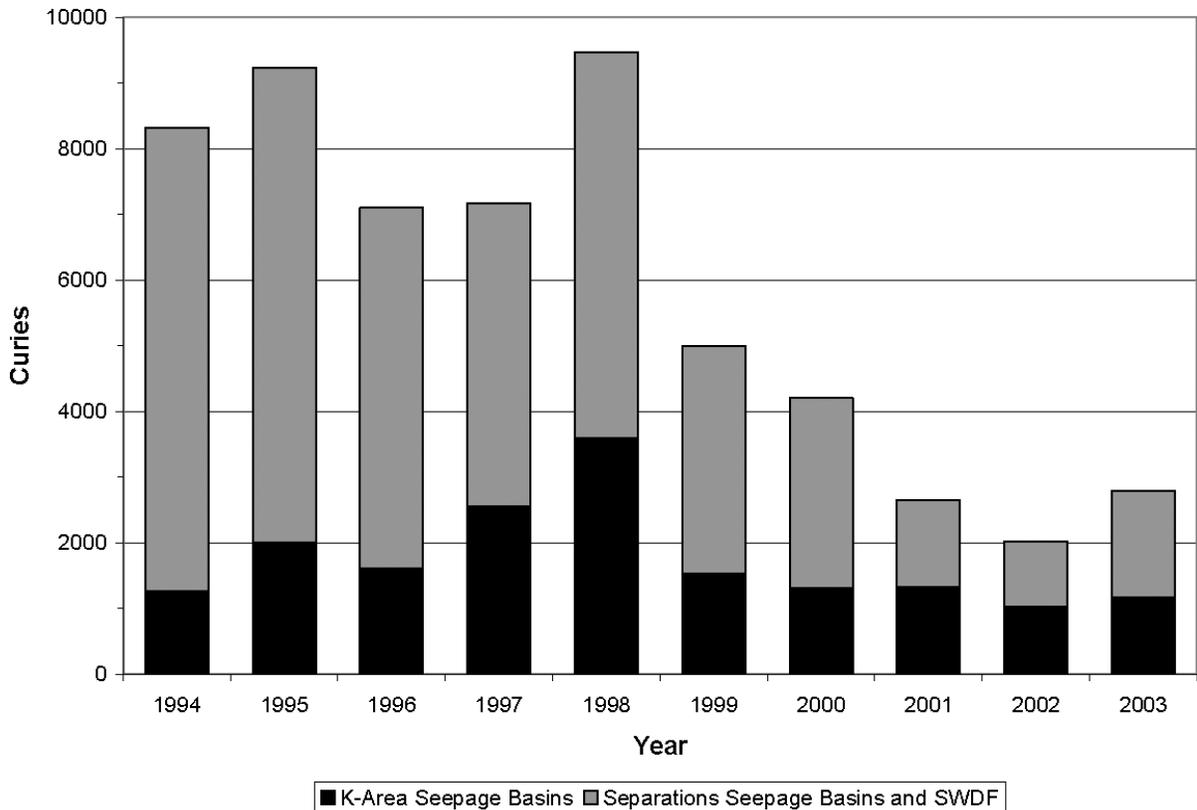


Figure 4-1 Tritium from SRS Seepage Basins and SWDF to Site Streams, 1994–2003

high-level waste storage facilities, and numerous other sources of radioactive material.)

The total amount of strontium-89,90 entering Four Mile Creek from the GSA seepage basins and SWDF during 2003 was estimated to be 94.1 mCi—a 93-percent increase from the 2002 level of 32.8 mCi. Migration releases of strontium-89,90 vary from year to year but have remained below 100 mCi the past 5 years (see data table on CD accompanying this report).

In addition, a total of 69.8 mCi of cesium-137 was estimated to have migrated from the GSA seepage basins and SWDF in 2003. This was an increase of 237 percent from the 2002 total of 20.7 mCi.

As discussed previously, iodine-129 was not measured in Four Mile Creek water samples during 2003. It was assumed that 78.2 mCi migrated from the GSA seepage basins in 2003. This was the amount last measured (during 1996).

During 2003, technetium-99 was not detected in the migration samples from the F-Area and H-Area seepage basins

K-Area Drain Field and Seepage Basin Liquid purges from the K-Area disassembly basin were released to the K-Area seepage basin in 1959 and

1960. From 1960 until 1992, purges from the K-Area disassembly basin were discharged to a percolation field below the K-Area retention basin. Tritium migration from the seepage basin and the percolation field is measured in Pen Branch. The 2003 migration total of 1,170 Ci represents a 37-percent increase from the 853 Ci recorded in 2002.

C-Area, L-Area, and P-Area Seepage Basins Liquid purges from the C-Area, L-Area, and P-Area disassembly basins were released periodically to their respective seepage basins from the 1950s until 1970.

Migration releases from these basins no longer are quantified; however, they are accounted for in the stream transport totals.

Transport of Actinides in Streams

Uranium, plutonium, americium, and curium are analyzed annually from each stream location. Values for 2003 were consistent with historical data.

Savannah River

Description of Surveillance Program

Continuous surveillance is performed along the Savannah River at points above and below SRS and

includes the point at which liquid discharges from Georgia Power Company's Vogtle Electric Generating Plant enter the river.

Surveillance Results

Tritium is the predominant radionuclide detected above background levels in the Savannah River. The annual mean tritium concentration at RM-118.8 in 2003 was about 4 percent of the drinking water standard.

The average gross alpha concentration at each river location was below the MDC in 2003.

Gross beta activities at all locations were slightly above the MDC for the analysis in 2003. Mean and maximum concentrations were similar at all locations, indicating that there was no significant release of beta-emitting nuclides attributable to SRS discharges.

The mean concentrations for cesium-137 and cobalt-60 were below their MDCs for analysis in 2003 at all Savannah River locations.

Activity levels for strontium-89,90 and for all actinides fluctuated around their respective MDCs and generally were at or below last year's concentrations.

Tritium Transport in Streams

Tritium is introduced into SRS streams and the Savannah River from production areas on site. Because of the mobility of tritium in water and the quantity of the radionuclide released during the years of SRS operations, a tritium balance has been performed annually since 1960. The balance is evaluated among the following alternative methods of calculation:

- tritium releases from effluent release points and calculated seepage basin and SWDF migration (direct releases)
- tritium transport in SRS streams and the last sampling point before entry into the Savannah River (stream transport)
- tritium transport in the Savannah River downriver of SRS after subtraction of any measured contribution above the site (river transport)

The total combined tritium releases in 2003 (direct discharges and migration from seepage basins and SWDF) were 4,319 Ci, compared to 3,096 Ci in 2002.

During 2003, the total tritium transport in SRS streams increased by approximately 45 percent (from 2,857 Ci in 2002 to 4,139 Ci in 2003).

The 2003 measured tritium transport in the Savannah River (5,910 Ci) was more than the stream transport

total. Most of this difference is attributed to Plant Vogtle's 2003 tritium releases, which totaled approximately 1,900 Ci.

SRS tritium transport data for 1960–2003 are depicted in figure 4–2, which shows summaries of the past 44 years of direct releases, stream transport, and river transport determined by EMA.

General agreement between the three calculational methods of annual tritium transport—measurements at the source, stream transport, and river transport—serves to validate SRS sampling schemes and counting results. Differences between the various methods can be attributed to uncertainties arising in the collection and analytical processes, including the determination of water flow rates and of varying transport times.

Drinking Water

Description of Surveillance Program

EMA collected drinking water samples in 2003 from locations at SRS and at water treatment facilities that use Savannah River water. Potable water was analyzed at offsite treatment facilities to ensure that SRS operations did not adversely affect the water supply and to provide voluntary assurance that drinking water did not exceed EPA drinking water standards for radionuclides.

Onsite drinking water sampling consisted of quarterly grab samples at large treatment plants in A-Area, D-Area, and K-Area and annual grab samples at wells and small systems. Collected monthly off site were composite samples from

- two water treatment plants downriver of SRS that supply treated Savannah River water to Beaufort and Jasper counties in South Carolina and to Port Wentworth, Georgia
- the North Augusta (South Carolina) Water Treatment Plant

Surveillance Results

All drinking water samples collected by EMA were screened for gross alpha and gross beta concentrations to determine if activity levels warrant further analysis. No samples collected in 2003 exceeded EPA's 1.50E+01-pCi/L alpha activity limit or 5.00E+01-pCi/L beta activity limit. Also, no onsite or offsite drinking water samples collected and analyzed by EMA in 2003 exceeded the 2.00E+04-pCi/L EPA tritium limit, and no drinking water samples collected and analyzed by EMA for strontium 89,90 in 2003 exceeded the MDC.

No cobalt-60, cesium-137, or plutonium-239 was detected in any drinking water samples collected

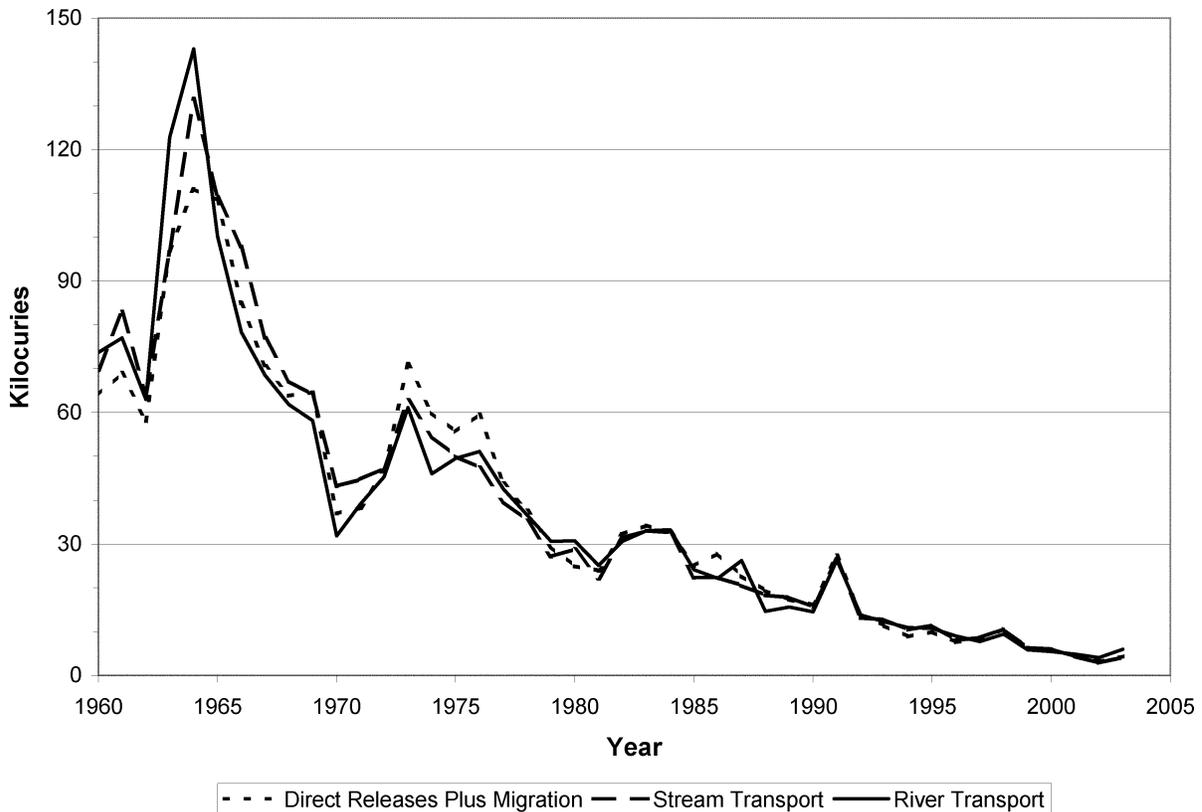


Figure 4-2 SRS Tritium Transport Summary, 1960–2003

SRS has maintained a tritium balance of direct releases plus migration, stream transport, and river transport since 1960 in an effort to account for and trend tritium releases in liquid effluents from the site. The general trend over time is attributable to (1) variations in tritium production at the site (production stopped in the late 1980s); (2) the implementation of effluent controls, such as seepage basins, beginning in the early 1960s; and (3) the continuing depletion and decay of the site's tritium inventory.

during 2003. In general, uranium isotopes, plutonium-238, and americium-241 were not detected, although samples from a few locations showed detectable levels of these nuclides.

Terrestrial Food Products

Description of Surveillance Program

The terrestrial food products surveillance program consists of radiological analyses of food product samples typically found in the Central Savannah River Area (CSRA). These food products include meat (beef), fruit, and green vegetables (collards). Data from the food product surveillance program are not used to show direct compliance with any dose standard; however, the data can be used as required to verify dose models and determine environmental trends.

Samples of food—including meat (beef), fruit (melons or peaches), and a green vegetable (collards)—are collected from one location within each of four

quadrants and from a control location within an extended (to 25 miles beyond the perimeter) southeast quadrant. All food samples are collected annually except milk.

Food samples are analyzed for the presence of gamma-emitting radionuclides, tritium, strontium-89,90, plutonium-238, and plutonium-239.

Surveillance Results

The only manmade gamma-emitting radionuclide detected in food products in 2003 was cesium-137, which was found in collards from two sampling locations. Strontium-89,90 was detected in collards at four locations, while tritium was detected in collards and milk at 21 locations. No other manmade radionuclides were detected in food products.

Tritium in milk and other samples is attributed primarily to releases from SRS. Tritium concentrations in collards and milk were similar to those of previous years. No tritium was detected in any other food sample.

These results are similar to those of previous years.

Aquatic Food Products

Description of Surveillance Program

The aquatic food product surveillance program includes fish (freshwater and saltwater) and shellfish. To determine the potential dose and risk to the public from consumption, both types are sampled.

Nine surveillance points for the collection of freshwater fish are located on the Savannah River. Effective beginning in 2003, fish no longer are collected at onsite locations for this program.

Surveillance Results

Cesium-137 was the only manmade gamma-emitting radionuclide found in Savannah River edible composites. Strontium-89,90 and tritium were detected at most of the river locations. No manmade radionuclides were found above their MDCs in saltwater fish or shellfish. These results were similar to those of previous years.

Deer and Hogs

Description of Surveillance Program

Annual hunts, open to members of the general public, are conducted at SRS to control the site's deer and feral hog populations and to reduce animal-vehicle accidents. Before any animal is released to a hunter, EMA uses portable sodium iodide detectors to perform field analysis for cesium-137. Media samples (muscle and/or bone) are collected periodically for laboratory analysis based on a set frequency, on cesium-137 levels, and/or on exposure limit considerations.

Surveillance Results

A total of 1,128 deer and 106 feral hogs were taken during the 2003 site hunts. As observed during previous hunts, cesium-137 was the only manmade gamma-emitting radionuclide detected during laboratory analysis. Generally, the cesium-137 concentrations measured by the field and lab methods were comparable. Field measurements from all animals ranged from 1 pCi/g to 17.1 pCi/g, while lab measurements ranged from 1 pCi/g to 18.2 pCi/g. The average field cesium-137 concentration was 1.29 pCi/g in deer (with a maximum of 17.1 pCi/g) and 1.18 pCi/g in hogs (with a maximum of 3.1 pCi/g).

Strontium levels are determined in some of the animals analyzed for cesium-137. Typically, muscle and bone samples are collected for analysis from the

same animals checked for cesium-137, and the samples are analyzed for strontium-89,90. As in previous years, strontium-89,90 was not quantified in muscle samples. Lab measurements of strontium-89,90 in bone ranged from a high of 11.6 pCi/g to a low of 2.56 pCi/g.

Turkeys/Beavers

Description of Surveillance Programs

Wild turkeys have been trapped on site by the South Carolina Wildlife and Marine Resources Department and used to repopulate game areas in South Carolina and other states. The U.S. Department of Agriculture Forest Service–Savannah River harvests beavers in selected areas within the SRS perimeter to reduce the beaver population and thereby minimize dam-building activities that can result in flood damage to timber stands, to primary and secondary roads, and to railroad beds. However, both programs remained inactive in 2003 because of reduced needs.

Soil

Description of Surveillance Program

The SRS soil monitoring program provides

- data for long-term trending of radioactivity deposited from the atmosphere (both wet and dry deposition)
- information on the concentrations of radioactive materials in the environment

The concentrations of radionuclides in soil vary greatly among locations because of differences in rainfall patterns and in the mechanics of retention and transport in different types of soils. Because of this program's design, a direct comparison of data from year to year is not appropriate.

Soil samples are collected from four onsite locations, four site perimeter locations and two offsite locations.

Surveillance Results

Radionuclides in soil samples from 2003 were detected as follows:

- Cesium-137 at eight locations (on site/perimeter/off site)
- Uranium-234, 235, and 238 at all locations
- Plutonium-238 at four onsite locations
- Plutonium-239 at eight locations (on site/perimeter/off site)

These results are similar to those of previous years.

Settleable Solids

Description of Surveillance Program

Settleable-solids monitoring in effluent water is required to ensure—in conjunction with routine sediment monitoring—that a long-term buildup of radioactive materials does not occur in stream systems.

DOE limits on radioactivity levels in settleable solids are 5 pCi/g above background for alpha-emitting radionuclides and 50 pCi/g above background for beta/gamma-emitting radionuclides.

Low total suspended solids (TSS) levels result in a small amount of settleable solids, so an accurate measurement of radioactivity levels in settleable solids is impossible. Based on this, an interpretation of the radioactivity-levels-in-settleable-solids requirement was provided to Westinghouse Savannah River Company (WSRC) by DOE in 1995. The interpretation indicated that TSS levels below 40 parts per million (ppm) were considered to be in *de-facto* compliance with the DOE limits.

To determine compliance with these limits, EMA uses TSS results—gathered as part of the routine National Pollutant Discharge Elimination System monitoring program—from outfalls co-located at or near radiological effluent points. If an outfall shows that TSS levels regularly are greater than 40 ppm, a radioactivity-levels-in-settleable-solids program and an increase in sediment monitoring will be implemented.

Surveillance Results

TSS sample results did not exceed 40 ppm in 2003. The results indicate that SRS is in compliance with the DOE radioactivity-levels-in-settleable-solids requirement.

Sediment

Description of Surveillance Program

Sediment sample analysis measures the movement, deposition, and accumulation of long-lived radionuclides in stream beds and in the Savannah River bed. Significant year-to-year differences may be evident because of the continuous deposition and remobilization occurring in the stream and river beds—or because of slight variation in sampling locations—but the data obtained can be used to observe long-term environmental trends.

Sediment samples were collected at eight Savannah River locations and 13 site stream locations in 2003.

Surveillance Results

Cesium-137 and cobalt-60 were the only manmade gamma-emitting radionuclides observed in river and stream sediments. The highest cesium-137 concentration in streams, $1.14\text{E}+02$ pCi/g, was detected in sediment from R-Canal. The highest level found on the river, $3.51\text{E}-01$ pCi/g, was at River Mile 134; the lowest levels were below detection at several locations. Generally, cesium-137 concentrations were higher in stream sediments than in river sediments. This is to be expected because the streams receive radionuclide-containing liquid effluents from the site. Most radionuclides settle out and deposit on the stream beds or at the streams' entrances to the swamp areas along the river.

Cobalt-60 was detected above the MDC in sediment from the following locations:

- Four Mile Creek Swamp Discharge
- Four Mile A-7A
- R-Canal

The highest cobalt-60 concentration in streams, $2.45\text{E}-01$ pCi/g, was measured at Four Mile A-7A; concentrations at the most other sediment sampling locations were below detection.

Concentrations of strontium-89,90 in stream sediment ranged from a high of $3.96\text{E}+00$ pCi/g at the FM-A7 location to lows below the MDC at most of the other locations.

Concentrations of plutonium-238 in stream sediment during 2003 ranged from a high of $1.33\text{E}+00$ pCi/g at the Four Mile A-7A location to below detection at several locations. Concentrations of plutonium-239 ranged from a high of $7.05\text{E}-01$ pCi/g at the Four Mile A-7A location to below detection at several locations. Uranium-234, 235, and 238 was detected at all locations.

Concentrations of radionuclides in river sediment during 2003 were similar to those of previous years.

Concentrations of all isotopes generally were higher in streams than in the river. As indicated in the earlier discussion of cesium-137, this is to be expected. Differences observed when these data are compared to those of previous years probably are attributable to the effects of resuspension and deposition, which occur constantly in sediment media.

Grassy Vegetation

Description of Surveillance Program

The radiological program for grassy vegetation is designed to collect and analyze samples from onsite and offsite locations to determine radionuclide concentrations. Vegetation samples are obtained to complement the soil and sediment samples in order to determine the environmental accumulation of radionuclides and help confirm the dose models used by SRS. Bermuda grass is preferred because of its importance as a pasture grass for dairy herds.

Vegetation samples are obtained from

- locations containing soil radionuclide concentrations that are expected to be higher than normal background levels
- locations receiving water that may have been contaminated

Surveillance Results

Radionuclides in the grassy vegetation samples collected in 2003 were detected as follows:

- Tritium at one perimeter location and offsite at Savannah
- Cesium-137 (the only manmade gamma-emitting radionuclide detected) at one perimeter location
- Strontium-89/90 at two perimeter locations
- Uranium-234 at all locations except D-Area perimeter
- Uranium-235 at the onsite location (Burial Ground)
- Uranium-238 at all locations

These results are similar to those of previous years.

Savannah River Swamp Surveys

The Creek Plantation, a privately owned land area located along the Savannah River, borders part of the southern boundary of SRS. In the 1960s, an area of the Savannah River Swamp on Creek Plantation—specifically, the area between Steel Creek Landing and Little Hell Landing—was contaminated by SRS operations. During high river levels, water from Steel Creek flowed along the lowlands comprising the swamp, resulting in the deposition of radioactive material. SRS studies estimated that a total of approximately 25 Ci of cesium-137 and 1 Ci of cobalt-60 were deposited in the swamp.

Comprehensive and cursory surveys of the swamp have been conducted periodically since 1974. These

surveys measure radioactivity levels to determine changes in the amount and/or distribution of radioactivity in the swamp.

Because of high water in the swamp, no survey was conducted in 2003.

Nonradiological Surveillance

Air

SRS currently does not conduct onsite surveillance for nonradiological ambient air quality. However, to ensure compliance with SCDHEC air quality regulations and standards, SRTC conducted air dispersion modeling for all site sources of criteria pollutants and toxic air pollutants in 1993. This modeling indicated that all SRS sources were in compliance with air quality regulations and standards. Since that time, additional modeling conducted for new sources of criteria pollutants and toxic air pollutants has demonstrated continued compliance by the site with current applicable regulations and standards. The states of South Carolina and Georgia continue to monitor ambient air quality near the site as part of a network associated with the federal Clean Air Act.

Surface Water

SRS streams and the Savannah River are classified by SCDHEC as “Freshwaters,” which are defined as surface water suitable for

- primary and secondary contact recreation and as a drinking water source after conventional treatment in accordance with SCDHEC requirements
- fishing and survival and propagation of a balanced indigenous aquatic community of fauna and flora
- industrial and agricultural uses

Appendix A, “Applicable Guidelines, Standards, and Regulations,” provides some of the specific guidelines used in water quality surveillance, but because some of these guidelines are not quantifiable, they are not tracked.

Surveillance Results

Analyses of the surface water data continue to indicate that SRS discharges are not significantly affecting the water quality of the onsite streams or the river.

Drinking Water

Most of the drinking water at SRS is supplied by three systems that have treatment plants in A-Area, D-Area, and K-Area. The site also has 15 small drinking water

facilities that serve populations of fewer than 25 persons.

Surveillance Results

All samples collected from SRS drinking water systems during 2003 were in compliance with SCDHEC and EPA water quality limits (maximum contaminant levels).

Sediment

The nonradiological sediment surveillance program provides a method to determine the deposition, movement, and accumulation of nonradiological contaminants in stream systems.

Surveillance Results

In 2003, as in the previous 6 years, no pesticides or herbicides were found to be above the quantitation limits in sediment samples. Metals analyses for the 2003 are comparable to those of the previous 6 years.

Fish

EMA personnel analyze the flesh of fish caught from onsite streams and ponds and from the Savannah River to determine concentrations of mercury in the fish. The fish analyzed represent the most common edible species of fish in the Central Savannah River Area (freshwater) and at the mouth of the Savannah River (saltwater).

Surveillance Results

In 2003, 149 fish were caught from the Savannah River and analyzed for mercury. Concentrations of mercury contained in fish samples from 2003 were slightly higher—from bass at Stokes Bluff, Beaver Dam Creek Mouth, and Four Mile Creek Mouth and

catfish at Augusta Lock and Dam—than in 2002, but remained similar to those of previous years.

Academy of Natural Sciences of Philadelphia River Quality Surveys

Description of Surveys

ANSP has conducted biological and water quality surveys of the Savannah River since 1951. The surveys are designed to assess potential effects of SRS contaminants and warm-water discharges on the general health of the river and its tributaries. This is accomplished by looking for

- patterns of biological disturbance that are geographically associated with the site
- patterns of change over seasons or years that indicate improving or deteriorating conditions

Samples collected for the 2001 survey were analyzed by ANSP during 2003. No adverse conditions were identified in the 2001 samples. No surveys were conducted by ANSP in 2002 because no contract was in place; SRS personnel, however, collected and archived diatoms (monthly) and macroinvertebrates (twice during the year), as had been customary.

Aquatic macroinvertebrate and fish surveys were conducted by ANSP in 2003, but the results were not available in time for publication in this report. SRS personnel collected and archived aquatic macroinvertebrates during the 2003 spring sampling period. Diatoms were collected monthly and archived by WSRC, while the August collection (per contractual agreement) was sent to the Stroud Water Research Center near Philadelphia for identification.