Chapter 5

Environmental Surveillance

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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 7, "Groundwater."

The Environmental Services Section's Environmental Permitting and Monitoring (EPM) group and the Savannah River National Laboratory (SRNL) perform surveillance activities for SRS. 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 (ANS).

A complete description of the EPM 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

EPM maintains a network of 15 sampling stations in and around SRS to monitor the concentration of tritium and radioactive particulate materials in the air.

Surveillance Results Summary

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 results were slightly higher in 2005 than in 2004, while average gross beta results were slightly lower. However, they are consistent with historical results, which demonstrate long-term variability.

No detectable manmade gamma-emitting radionuclides were observed in 2005. These results are consistent with historical results, which indicate only a small number of air samples with detectable activity.

During 2005, detectable levels of uranium-234 were observed in all air samples, while uranium-238 was observed in most of these samples. These results are similar to those observed in 2004. Concentrations of the uranium isotopes were slightly higher than, but similar to, those observed in 2004. Aside from uranium, alpha-emitting radionuclide activity was observed in 11 samples from eight locations. Americium-241 was detected at five locations on the site perimeter and two 25-mile locations, while plutonium-238 was detected at one site perimeter location. 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 their mimimum detectable concentration (MDC).

Tritium-in-air results for 2005 were similar to those observed in 2004. 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 15 rainwater sampling sites as part of the air surveillance program. These stations are used to measure deposition of radioactive materials.

Surveillance Results Summary

Gamma-Emitting Radionuclides No detectable manmade gamma-emitting radionuclides were observed in rainwater samples in 2005.

Gross alpha and gross beta results from 2005 were consistent with those of 2004. In 2005, both the gross alpha and gross beta results generally were slightly higher than those of 2004. However, no long-term increasing or decreasing trend was evident, which implies that the observed values are natural background and does not indicate any contribution directly attributable to SRS.

Detectable levels of uranium-234 and uranium-238 were present in most samples. Significantly elevated results were observed at the D-Area location. D&D activities in the immediate vicinity of the D-Area sampling site resulted in the movement of a large amount of soil and the subsequent formation of a large soil pile. It is believed that this exposed soil is responsible for the observed increase. Americium-241 was observed at five locations (one onsite, three site perimeter, and Savannah) and plutonium-238 was observed at one location. All other actinides were below detection levels in 2005.

As in 2004, no detectable levels of strontium-89,90 were observed in rainwater samples during 2005.

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 system of thermoluminescent dosimeters (TLDs).

Surveillance Results Summary

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 62 and 116 mrem per year.

In general, the 2005 ambient gamma radiation monitoring results indicated gamma exposure rates slightly higher than those observed at the same locations in 2004. However, these results generally are consistent with previously published historical results, and indicate that no significant difference in average exposure rates is observed between monitoring networks—except in the case of population centers. Exposure rates in population centers are slightly elevated compared to the other monitoring networks—as expected—because of factors such as buildings and roadways.

E-Area Stormwater Basins

Description of Surveillance Program

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

Surveillance Results Summary

There are no active discharges to the E-Area stormwater basins. The primary contributor to the E-Area basins in 2005 was rainwater runoff from the low-level waste burial ground. Rain events did not supply enough water to the E–06 basin for sampling purposes in 2005. The highest E-Area basin mean tritium concentration was observed at E–05, and was slightly higher than in 2004. No detectable cobalt-60, cesium-137, strontium-89,90, uranium-235, curium-244, or plutonium-239 were observed at any of the basins. However, uranium-234, uranium-238, plutonium-238, and americium-241 were detected at basin E–03, but at none of the other basins. Samples were obtained from basin E–03 for only the third time since 1999, and the actinide detection likely was due to long-term sediment accumulation in the

discharge path. Gross alpha and gross beta were detected at all basins in amounts generally consistent with those of previous years.

Site Streams

Description of Surveillance Program

Continuous surveillance monitoring occurs downstream of several process areas to detect and quantify levels of radioactivity in effluents transported to the Savannah River.

Surveillance Results Summary

Demolition and construction activities are impacting some of the site stream surveillance locations. Due to construction activities at the MOX Fuel Fabrication Facility (MFFF), U3R–F3 was removed from service in 2005. Efforts are under way to relocate the sampling site.

Tritium, the predominant radionuclide detected above background levels in SRS streams, was observed at all stream locations in 2005.

No detectable concentrations of cobalt-60 and cesium-137 were observed at the farthest downstream locations on any of the five major SRS streams. As expected, gross alpha and gross beta were observed in all streams, and were elevated at the FMC–2B, U3R–1A, and Central Sanitary Wastewater Treatment Facility (G–10) locations. Iodine-129 and technetium-99 were detected only at the Four Mile Creek locations. Uraniam-234, 235, and 238 and plutonium-238 were detected only at U3R–1A, U3R–F3, G–10, and TNX–008. Plutonium-239 was observed at the U3R–F3 location. Americium-241 was observed at U3R–1A, U3R–F3, and G–10. Curium-244 was observed only at the U3R–F3 location. Demolition activities near U3R–F3 and TNX–008 are suspected as the reason for the actinide concentrations observed in 2005.

At U3R–1A, the SRS control point location, elevated gross alpha and gross beta levels were observed. It was determined in late 2005 that this situation was caused by placement of the sampler strainer in a shallow location near the edge of the stream, resulting in the collection of sediment and suspended solids. Moving the strainer provided a more representative sample, with an observed decrease in alpha activity. In addition, a laboratory error occurred, and nine unplanned, biweekly composite samples from U3R–1A were analyzed for actinides. Annual stream characterization samples are collected by the grab method. Because these samples were collected before the strainer was repositioned, they contained sediment and solids (as discussed above), and the results showed concentrations not typically seen. However, the data from these has been preserved for informational purposes only.

Seepage Basin and Solid Waste Disposal Facility Radionuclide Migration

To incorporate the migration of radioactivity to site streams into total radioactive release quantities, EPM continued to monitor and quantify the migration of radioactivity from site seepage basins and the Solid Waste Disposal Facility (SWDF) in 2005 as part of its stream surveillance program. Tritium, strontium-89,90, technetium-99, iodine-129, and cesium-137 were detected in migration releases.

Figure 5–1 is a graphical representation of releases of tritium via migration to site streams for the years 1996–2005. During 2005, the total quantity of tritium migrating from site seepage basins and SWDF was 2,180 Ci, compared to 1,927 Ci in 2004. This 13-percent increase is attributed mainly to increased rainfall in 2005, compared with 2004, and to the planned repair work on the Mixed Waste Management Facility Groundwater Retention Dam, which allowed a greater amount of contaminated water to reach Four Mile Creek. This repair work began in September 2005 and is scheduled for completion by April 2006.

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 Upper Three Runs.

Measured migration of tritium into Four Mile Creek in 2005 occurred as follows:

- from F-Area seepage basins, 630 Ci—a 20-percent increase from the 2004 total of 526 Ci
- from H-Area seepage basin 4 and SWDF, 592 Ci—a 134-percent increase from the 2004 total of 253 Ci
- from H-Area seepage basins 1, 2, and 3, 242 Ci—a 15-percent increase from the 2004 total of 211 Ci

The measured migration from the north side of SWDF and the General Separations Area (GSA) into Upper Three Runs in 2005 was 75 Ci, a 65-percent decrease from the 2004 total of 215 Ci. (The GSA is in the central part of SRS and contains all waste disposal facilities, chemical separations facilities, and associated high-level waste storage facilities, and numerous other sources of radioactive material.)

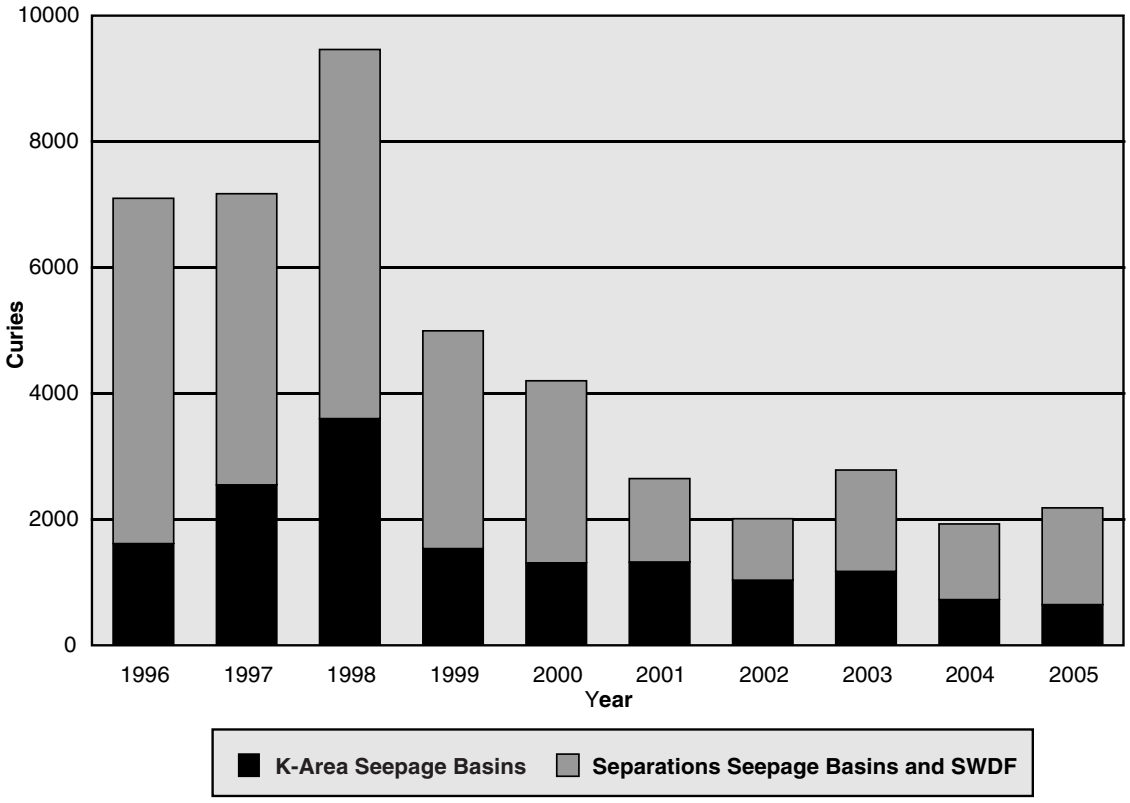

Figure 5–1 Tritium from SRS Seepage Basins and SWDF to Site Streams, 1996–2005

The total amount of strontium-89,90 entering Four Mile Creek from the GSA seepage basins and SWDF during 2005 was estimated to be 36.1 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 96.4 mCi of cesium-137 was estimated to have migrated from the GSA seepage basins and SWDF in 2005. This 230-percent increase from the 2004 total of 29.2 mCi is attributed primarily to the planned repair work on the Mixed Waste Management Facility Groundwater Retention Dam, previously discussed.

In 2005, 4.43 mCi of technetium-99 and 8.0 mCi of iodine-129 were estimated to have migrated into Four Mile Creek.

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 2005 migration total of 641 Ci represents an 11-percent decrease from the 722 Ci recorded in 2004.

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

Because of their historically low levels, the actinides uranium, plutonium, americium, and curium no longer are quantified in SRS streams. However, the streams are sampled and analyzed annually for the presence of these actinides. The resulting concentrations are compared to those of previous years to identify any trends. Values for 2005 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 Summary

Tritium is the predominant radionuclide detected above background levels in the Savannah River. The annual mean tritium concentration at RM–118.8 in 2005 was about 3 percent of the drinking water standard.

The mean gross alpha concentrations at all river locations were below the representative MDC in 2005. Detectable gross beta activity was observed at all river sampling locations, and was consistent with long-term gross beta levels in the river.

Except for tritium, as indicated above, no manmade radionuclides were detected in Savannah River water.

Tritium Transport in Streams

Tritium is introduced into SRS streams and the Savannah River from former 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 combined tritium releases in 2005 (direct discharges and migration from seepage basins and SWDF) totaled 2,494 Ci, compared to 2,683 Ci in 2004.

The total tritium transport in SRS streams decreased slightly, from 2,785 Ci in 2004 to 2,364 Ci in 2005.

The total tritium transport in the Savannah River for 2005 was 4,480 Ci, compared with the previous year's 3,630 Ci. Both Plant Vogtle and SRS contributed to these release values. Accounting for Plant Vogtle's contribution, SRS's calculated releases of tritium to the river in 2005 totaled approximately 2,620 Ci.

SRS tritium transport data for 1960–2005 are depicted in figure 5–2, which shows summaries of the past 46 years of direct releases, stream transport, and river transport, as determined by EPM.

Domestic and Drinking Water

Description of Surveillance Program

EPM collected domestic and drinking water samples in 2005 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 domestic 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

- three 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 Summary

All domestic and drinking water samples collected by EPM were screened for gross alpha and gross beta concentrations to determine if activity levels warrant further analysis. No domestic water used for drinking purposes 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 domestic or drinking water samples exceeded the 2.00E+04-pCi/L EPA tritium limit, and no domestic or drinking water samples exceeded the strontium 89,90 MDC.

No cobalt-60, cesium-137, or plutonium-239 was detected in any domestic or drinking water samples. At most locations, no uranium isotopes or plutonium-238 were detected.

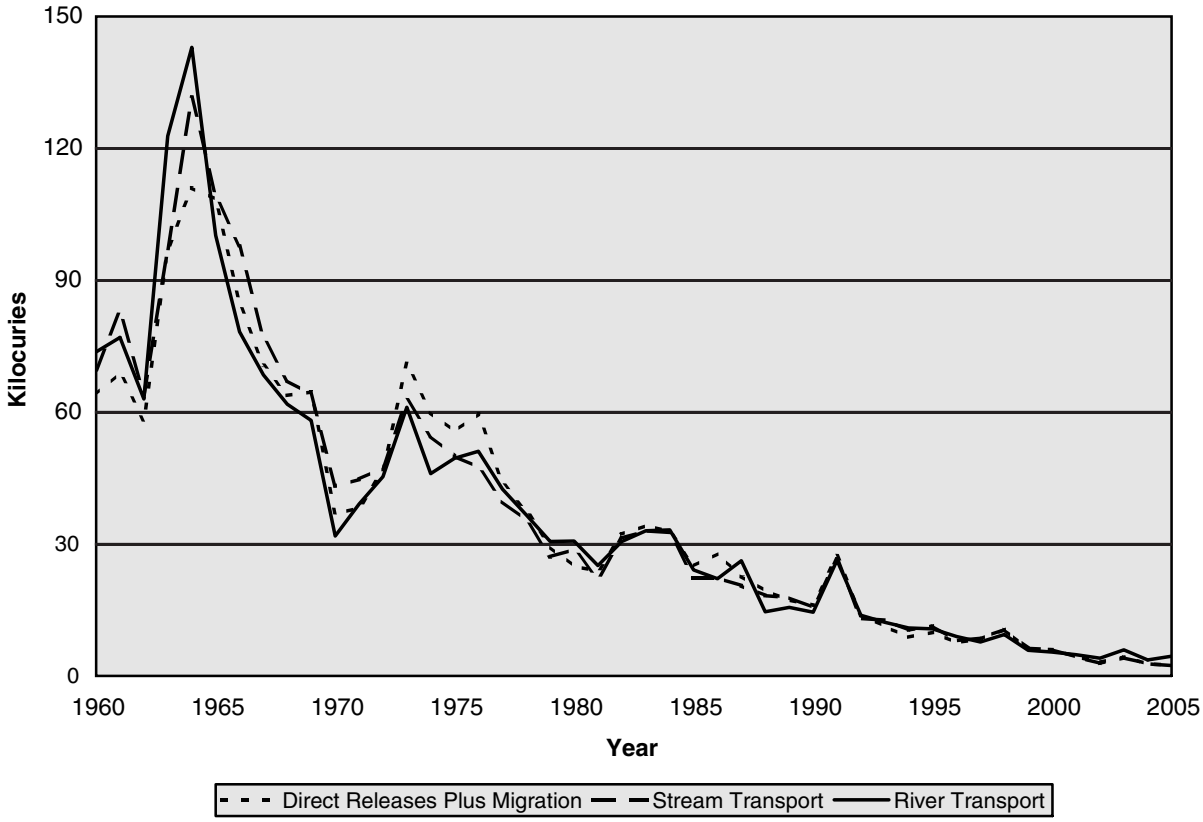

Figure 5–2 SRS Tritium Transport Summary, 1960–2005

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.

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. The food product surveillance program was expanded in 2005 to include secondary crops on a rotating schedule. Peanuts and pecans were sampled in 2005 as part of this program.

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

Surveillance Results Summary

Gamma-emitting radionuclides detected in food products in 2005 were cesium-137, which was found in collards

at four sampling locations and in milk at one location. Cobalt-60 was detected in peanuts at one location. Strontium-89,90 was detected in collards and milk at two locations each. Tritium was detected in collards at two locations, beef at one location, and pecans at three locations. Pecans from the 25-mile location were not available for analysis. No other manmade radionuclides were detected in food products in 2005. These results appeared to be randomly distributed among the monitoring locations, and no underlying spatial distribution was observed.

Tritium in food products is attributed primarily to releases from SRS. Tritium was detected in collards, beef, and pecans. No tritium was detected in any other food samples. This is similar to results 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—from above SRS at Augusta, Georgia, to the coast at Savannah, Georgia.

Surveillance Results Summary

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. Plutonium-238 was found slightly above the MDC in composites from five locations. No manmade radionuclides were detected in shellfish. Except for the detection of plutonium-238, 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, EPM personnel use portable sodium iodide detectors to perform field analyses 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 Summary

A total of 215 deer and 33 feral hogs were taken during the 2005 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 8.1 pCi/g, while lab measurements ranged from 1 pCi/g to 5.3 pCi/g. The average field cesium-137 concentration was 2.32 pCi/g in deer (with a maximum of 8.1 pCi/g) and 1.68 pCi/g in hogs (with a maximum of 5.2 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 1.9 pCi/g to a low of 1.0 pCi/g.

Turkeys/Beavers

Description of Surveillance Programs

Prior to 2003, wild turkeys were trapped on site by the South Carolina Department of Natural Resources 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.

Both programs continued to remain inactive in 2005 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. However, these results may be evaluated over a period of years to determine long-term trends.

During 2005, the soil monitoring program was expanded to include sampling at all the air surveillance locations. However, analyses of all radionuclides from these additional samples were not completed by the laboratory in time for inclusion in this report.

Surveillance Results Summary

Radionuclides in soil samples from 2005 were detected as follows:

- cesium-137 at 15 locations (three onsite, nine perimeter, and three offsite)
- strontium-89,90 at one offsite location
- uranium-234, 235, and 238 at 18 locations (each at five onsite, nine perimeter, and four offsite)
- plutonium-238 at 13 locations (three onsite, seven perimeter, and three offsite); as previously stated, analyses have not been completed on samples from several locations
- plutonium-239 at 19 locations (five onsite, 10 perimeter, and four offsite); analyses not completed on samples from several locations
- americium-241 at 16 locations (three onsite, 10 perimeter, and three offsite); analyses not completed on samples from several locations
- curium-244 at four locations (three onsite and one offsite); analyses not completed on samples from several locations

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, EPM uses TSS results—gathered as part of the routine National Pollutant Discharge Elimination System (NPDES) monitoring program—from outfalls co-located at or near radiological effluent points. If an outfall shows that TSS levels regularly are greater than 30 ppm, a radioactivity-levels-in-settleable-solids program and an increase in sediment monitoring will be implemented.

Surveillance Results Summary

In 2005, one TSS sample exceeded 30 ppm. This result (43 ppm) occurred at Outfall A–11 and is the result of an upstream bank collapse caused by a rain event during the monitoring period. Overall, the 2005 NPDES TSS results indicate that SRS remains 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 and 13 site stream locations in 2005.

Surveillance Results Summary

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, 6.86E+02 pCi/g, was detected in sediment from R-Canal. The highest level found on the river, 5.33E-01pCi/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 in sediment from the Four Mile Creek Swamp Discharge and R-Canal locations. The highest cobalt-60 concentration in streams, 1.01E+00 pCi/g, was measured at Four Mile Creek Swamp Discharge.

Strontium-89,90 was detected in sediment at one river and six stream locations. The maximum value was 1.75E+00 pCi/g, at the Four Mile Creek Swamp Discharge.

Plutonium-238 was detected in sediment during 2005 at all stream locations except Tinker Creek, and at one river location. The results ranged from a maximum of 6.11E+01 pCi/g at FM–A7 to below detection at several locations. Plutonium-239 was detected in sediment at most stream and two river locations. The maximum value was 2.73E-01 pCi/g—also at FM–A7. Uranium-234, 235, and 238 were detected at most locations.

The distribution and concentration of radionuclides in river sediment during 2005 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 to 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
- all air sampling locations

Surveillance Results Summary

Radionuclides in the grassy vegetation samples collected in 2005 were detected as follows:

- tritium at one perimeter and one onsite location
- cesium-137 at seven perimeter and one offsite location
- strontium-89/90 at 13 locations (all the vegetation sampling sites except one perimeter location and the Savannah location)
- uranium-234 at 12 locations (all the vegetation sampling sites except two perimeter locations and one 25-mile location)
- uranium-235 at one perimeter location
- uranium-238 at 11 locations (all the vegetation sampling sites except four perimeter locations)
- plutonium-238 at one perimeter location
- amercium-241 at seven locations (the onsite location, five of the 10 perimeter locations, and the Savannah location)

These results are similar to those of previous years.

Savannah River Swamp Surveys

Introduction

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.

A series of 10 sampling trails—ranging from 240 to 3,200 feet in length—was established through the swamp. Fifty-two monitoring locations were designated on the trails to allow for continued monitoring at a consistent set of locations.

The 2005 survey was identified as a comprehensive survey, requiring extensive media sampling and analysis—as well as exposure rate measurement.

Analytical Results Summary

The sampling portion of the 2005 survey was conducted in November. Because of high water levels and a lack of vegetation, approximately 30 soil samples and 30 vegetation samples could not be obtained. Similarly, exposure rate determination via TLDs could not be completed due to high water levels during the measurement period. Because of these conditions, a comprehensive survey is scheduled to be conducted again in 2006.

As anticipated, based on source term information and historical survey results, cesium-137 was the primary manmade gamma-emitting radionuclide detected in 2005. Cesium-137 was detected in all soil samples and 11 of the 20 vegetation samples. Cesium-137 concentrations in soil varied from below detection limits to approximately 65 pCi/g, while cesium-137 concentrations in vegetation varied from nondetectable to approximately 1.25 pCi/g. The observed concentration range is consistent with historical results. In general, higher levels of cesium-137 in soil were observed in the samples at shallower depths. As observed in previous surveys, this vertical distribution profile in soil is not as pronounced as it is in undisturbed areas. This indicates some movement (mobilization, movement, and/or redeposition) of contamination in the swamp.

Cesium-137 was observed in samples as far as approximately five miles from the site boundary (on trail 10). Cobalt-60 was detected in one soil sample. This is consistent with historical survey results, in which cobalt-60 is detected in low concentrations at a relatively small number of sample sites.

Strontium-90 was detected in two of the soil samples and all 20 vegetation samples. The maximum observed concentration in soil was approximately 1.25 pCi/g, while the maximum concentration in vegetation was approximately 0.31 pCi/g. No correlation was observed between soil and vegetation strontium-90 concentrations, or between cesium-137 and strontium-90.

Nonradiological Surveillance

Air

SRS does not conduct onsite surveillance for nonradiological ambient air quality. However, to ensure compliance with SCDHEC air quality regulations and standards, SRNL 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 Summary

At every site, most water quality parameters and metals were detected in at least one sample. No sample had detectable pesticides/herbicides. These results 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 14 small drinking water facilities, each of which serves populations of fewer than 25 persons.

Surveillance Results Summary

All samples collected from SRS drinking water systems during 2005 were in compliance with SCDHEC and EPA water quality standards. Additional information is provided in the Safe Drinking Water Act section of chapter 3, "Environmental Compliance."

Sediment

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

Surveillance Results Summary

In 2005, as in the previous 5 years, no pesticides or herbicides were found to be above the quantitation limits in sediment samples. Metals analyses results for 2005 also were comparable to those of the previous 5 years.

Fish

EPM personnel analyze the flesh of fish caught 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 CSRA (freshwater) and at the mouth of the Savannah River (saltwater).

Surveillance Results Summary

In 2005, 151 fish were caught from the Savannah River and analyzed for mercury. Concentrations of mercury generally were slightly higher than those observed in 2004, but were similar to those of previous years. The highest concentrations were found in bass at the mouth of Steel Creek (4.08 µg/g), bream at Augusta Lock and Dam (1.25µg/g), and catfish at the mouth of Steel Creek (2.11µg/g).

River Water Quality Surveys

Description of Surveys

ANS personnel conducted biological and water quality surveys of the Savannah River from 1951 through 2003, when EPM assumed this responsibility. The surveys were 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

EPM conducted macroinvertebrate and diatom sampling during the spring and fall of 2005. The diatom slides were sent to ANS for archiving and processing of the 2005 spring collection. No adverse biological impacts were identified in the Savannah River diatom communities.

The number of macroinvertebrates collected from river traps during 2004 was similar to that of past surveys. No adverse biological impacts were observed in the macroinvertebrate communities. Collections from 2005 will be sorted and archived during 2006.