Background

The Savannah River Site (DOE-SR) is a U.S. Department of Energy (DOE) facility, adjacent to the Savannah River, encompassing approximately 310 square miles in South Carolina. The U.S. Atomic Energy Commission established the site in 1950 to produce plutonium, tritium, and other materials for national defense and civilian purposes.

Tritium, radioactive iodine, other beta-gamma-emitters, and alpha emitters are among the many materials released to the environment during production activities. Tritium, one of the principle nuclear materials produced at SRS, continues to be one of the primary radionuclides released to the environment. Historically, the majority of tritium releases came from the reactors and tritium facilities through routine operations. There were approximately 3000 release incidents that occurred involving tritium. The primary source of the current tritium releases is from the Effluent Treatment Facility (ETF) and outcropping to the site streams from groundwater contamination. Radioactive iodine and other beta-gamma-emitting materials were produced during the fission of uranium and plutonium in reactor fuels. Alpha emitters, primarily uranium and plutonium, were released from the fuel fabrication and reprocessing facilities. To cool reactors, incoming Savannah River water was stored in holding basins at each reactor, passed through heat exchangers and discharged back to the site streams. The five production reactors were the source of the majority of radionuclide releases to surface water from the SRS. Most surface water releases came from the disassembly basins in the reactor areas. These legacy releases were primarily to the air and surface water, and potentially impact groundwater, food products (fish, wildlife, milk), vegetation, soils, and drinking water. The Savannah River is used as a drinking water supply source for approximately 56,000 residents downriver of SRS in Beaufort and Jasper Counties.

In 1991, when the Cold War ended, DOE responded to the changing world conditions and national policies by refocusing its missions. The site's priorities shifted toward waste management, environmental restoration, technology transfer, and economic development. Although the site's mission continues to evolve, it is understood that DOE activities at SRS will continue far into the future making it necessary for the state to maintain an ongoing independent monitoring program to assess the effectiveness of DOE's monitoring programs.

Charged with the mission of verifying that the SRS programs are adequate to detect impacts on the environment and public health, the South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) independently evaluates the Savannah River Site (SRS) non-regulatory environmental monitoring programs through an established multi-media network on and around the site. Environmental monitoring data are valuable because they provide direct information about the concentrations of radionuclides in the air, water, vegetation, and foods at particular times and places.

Introduction

As reported in the Westinghouse Savannah River Company's Environmental Reports, the SRS has conducted surveillance and monitoring activities to determine the concentration and migration of radionuclides in the environment; detect and/or verify accidental releases; characterize concentration trends; and determine associated impacts on the environment and human health.

The ESOP group examines all aspects of non-regulatory environmental monitoring programs conducted at the SRS. Through an independent environmental monitoring network around SRS, ESOP provides data quantifying levels of contaminants possibly released to the environment from SRS activities. Information gathered from these efforts aids in determining if the DOE-SR activities are protective of the public health and the environment. Using this information, the ESOP helps support emergency response activities in the event of an unplanned release of radioactive materials; educates the public on monitoring activities around the SRS; and provides recommendations to the DOE for improving their environmental monitoring programs.

There are 11 media specific ESOP projects for monitoring the impacts on the environment and human health as related to releases by the SRS. These include Radiological Atmospheric Quality Adjacent to SRS; Ambient Groundwater Quality Adjacent to the SRS; Drinking Water Quality Monitoring; Radiological Surface Water and Sediment Surveillance; Non-Radiological Ambient Sediment and Surface Water Quality Monitoring; Radiological Surveillance of Surface Soils On and Adjacent to the SRS; Radiological Monitoring of Terrestrial Vegetation On and Adjacent to SRS; Radiological Monitoring of Dairy Milk; Radiological Monitoring of Fish in the Savannah River; Game Animal Monitoring Adjacent to SRS; Oversight Monitoring and Support Activities.

The implementation of radiological and nonradiological surveillance monitoring by ESOP represents a significant increase in the SCDHEC monitoring efforts at the SRS. ESOP has identified additional field oversight projects to verify the validity and effectiveness of monitoring activities at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites. Additional projects are being considered to fill data gaps and evaluate other SRS non-regulatory monitoring programs. This improvement in monitoring indicates a commitment by the SCDHEC to fulfill its mission to protect public health and the environment, and reinforces the DOE's commitment to improving open communication and cooperation with host states.

This 1999 ESOP Data Report provides a summary of the ESOP environmental monitoring results generated during the 1999 calendar year. The data and information presented are in accordance with the ESOP's Standard Operating Procedures and project monitoring plans. Complete data tables are located in the appendices. Copies of environmental reports may be obtained by contacting:

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Acronyms

AEC	Atomic Energy Commission
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DOE	US Department of Energy
DOE-SR	US Department of Energy at Savannah River Site
EMS	Environmental Monitoring Section of the Environmental Protection Department (of Westinghouse Savannah River Company)
EPA	US Environmental Protection Agency
ESOP	Environmental Surveillance and Oversight Program (of the South Carolina Department of Health and Environmental Control)
ETF	Effluent Treatment Facility
GIS	Geographic Information System
LLD	Lower Limit of Detection
MCL	Maximum Contamination Level
MDA	Minimum Detectable Activity
NBN	No Building Number
PH	Measure of the hydrogen ion concentration in an aqueous solution (acidic solutions, pH from 0-6; basic solutions, pH>7; and neutral solutions, pH=7)
RBC	Risk Based Concentrations
REML	Radiological Environmental Monitoring Laboratory (of SC Department of Health and Environmental Control)
SCDHEC	South Carolina Department of Health and Environmental Control
SRS	Savannah River Site
TLD	Thermoluminescent Dosimeter
VEGP	Vogtle Electric Generating Plant
WSRC	Westinghouse Savannah River Company

Units of Measurement

Celsius	C	milliroentgen	mR
cubic centimeters	cc	nephelometric turbidity	NTO
cubic meter	m^3	ohm	mho
Curie	Ci	Orthophosphate	Ortho
Liter	L	oxidation reduction potential	ORP
microcurie	μCi	phenolphthalein	Pth
microgram	μg	picocurie	pCi

Radiological Atmospheric Quality Adjacent to the Savannah River Site

Airborne releases at SRS can be from point (stacks), and diffuse and fugitive sources (basins, structures without ventilation, contaminated land). Radiological airborne contaminants can impact the public through chronic low dose exposures, or acute short-term high dose exposures from accidental releases. ESOP provides monitoring of atmospheric media on a routine basis to measure radionuclide concentrations in the environment, to verify that levels of radionuclides are within reported levels and are protective of the public health and the environment, and to identify trends, which would require further investigation. Radiological atmospheric monitoring sites are located to provide spatial coverage of the project area where public exposure could occur (**Map 1**).

SCDHEC air monitoring capabilities in 1999 included air monitoring six stations with capacity for sample collection of glass fiber filters, precipitation, and silica gel columns. Thermoluminescent dosimeters (TLDs) were collected from 18 locations. The glass fiber filters were used to collect total airborne particulates. Particulates were screened weekly for gross alpha, gross beta, and gamma-emitting radionuclides. Glass fiber filters were composited annually and analyzed for selected isotopic analyses. Precipitation, when present, was sampled and analyzed weekly for tritium, from January through March. Starting in April, precipitation was collected weekly and composited for monthly tritium analysis. Silica gel distillates of atmospheric moisture were analyzed every other week for tritium. All tritium analyses were performed at the SCDHEC Lower Savannah District Laboratory. TLDs were collected and analyzed every three months for ambient beta/gamma levels; data is reported for third and fourth quarters of 1999.

All SCDHEC data (**Appendix A**) collected confirmed historically reported DOE-SR values for radionuclides in the ambient environment at the SRS boundary. SCDHEC reported gross alpha activities were nominally higher than those reported by DOE-SR at colocated sampling locations, but were still within the same order-of-magnitude. The increased gross alpha values noted during the first half of the year, when the increase was most pronounced, coincided with sample hold times longer than six months.

SCDHEC air and precipitation tritium data were consistently lower than the DOE-SR reported values, although also within an order-of-magnitude. The influence of a new method of calculating air tritium activity performed by DOE-SR this year resulted in an increase for all atmospheric tritium analyses.

In summary, no standards were exceeded and there were no significant elevations of radiological pollutant concentrations associated with SRS operations at monitored locations. Sampling results by SCDHEC indicate that SRS activities did have a measurable but insignificant impact on local air quality.

Ambient Groundwater Quality Adjacent to SRS

The ESOP Ambient Groundwater Monitoring Network (**Map 2**) is comprised of 72 existing groundwater wells owned by various government agencies and members of the public. ESOP evaluates ambient groundwater quality adjacent to SRS in an effort to develop background water quality information and determine if contaminants have migrated off SRS. This information complements DOE-SR and other SCDHEC groundwater monitoring programs. The objectives of the project were to evaluate groundwater quality adjacent to SRS, compare results with historical data, determine any off-site contaminant migration, expand current ambient water quality databases, and provide the public with independently generated groundwater quality information. ESOP established a study area to include SRS and a 10-mile perimeter from the site boundary in South Carolina. ESOP evaluated five aquifer zones within the study area from the shallow water table to confined aquifers more than 1200 feet deep. ESOP analyzed filtered and nonfiltered groundwater for basic water quality parameters, metals, tritium, and gamma-emitting radioisotopes. ESOP is also developing a Geographic Information Systems (GIS) database of water quality data and well information.

Based on a review of the analytical data (**Appendix B**), contaminants that do not appear to be associated with SRS activities were present in several wells. Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCL) for six constituents was exceeded in 29 wells. These exceedances included eight wells with detectable concentrations of lead, six of which had concentrations over the 15μg/L action level. These levels are similar to the levels detected in previous years. The persistence of lead in these wells is most likely due to well construction material or formation chemistry interacting with the low pH waters in the northern half of the study area. SCDHEC samples for the drinking water systems associated with these wells did not indicate lead contamination. Nitrate and nitrite contamination over MCL was noted in one well. Beryllium was also detected at the MCL of 4 μg/L in one monitoring well.

Secondary MCLs for aluminum, iron, or manganese were exceeded in 23 wells. Most of the impacted wells were monitoring wells and not used for potable water. ESOP will reevaluate all impacted drinking water wells during further sampling events and SCDHEC Bureau of Water staff will investigate them.

Drinking Water Quality Monitoring

The ESOP Drinking Water Monitoring Project (**Map 3**) evaluates drinking water quality to provide assurance to the public that radiological constituents have not impacted the municipal drinking water systems adjacent to DOE-SR and Vogtle Electric Generating Plant (VEGP). Monthly composite raw drinking water samples were collected from water treatment plants using the lower portion of the Savannah River. Quarterly grab samples were collected from selected municipal and large community drinking water systems within 30 miles of SRS. ESOP analyzed samples for gross alpha, nonvolatile beta, gamma-emitting radionuclides, and tritium.

The DOE-SR historically sampled 19 water systems semi-annually for radiological constituents. Routine sampling ended on the 16 groundwater fed systems in mid-1996 when this sampling element was discontinued from the DOE-SR monitoring program. The remaining three, which use surface water sources, are currently being sampled by DOE-SR.

SCDHEC currently monitors all community/municipal water systems for various contaminants, including radionuclides. SCDHEC requires monitoring for man-made and naturally occurring radionuclides for a minimum of four consecutive quarters during system start-up. Monitoring continues quarterly if the running average exceeds the EPA MCL. Monitoring is reduced to once every four years if activities are below the MCL. ESOP has expanded this monitoring by sampling selected systems quarterly and collecting monthly composites of raw surface water from water treatment plants that use the lower portion of the Savannah River.

The study area was established as a 30-mile radius circle centered in SRS. All public water systems in the study area were identified using the SCDHEC GIS. All of the municipal and large community systems within the study area were selected for sampling. Of the systems selected, 25 were groundwater fed and three were surface water fed systems. These systems serve approximately 236,000 customers with nearly 102,000 receiving their water from groundwater sources. Monthly and quarterly samples were labeled, preserved, and transferred to a laboratory with a chain-of-custody. Samples were submitted to the Lower Savannah District Laboratory for tritium analysis. SCDHEC Radiological Environmental Monitoring Laboratory (REML) conducted gamma spectroscopy, gross alpha, and gross non-volatile beta analyses. All data collected was verified, validated, and stored in project files and spreadsheets.

Tritium continues to be the most abundant radionuclide detected in public drinking water supplies potentially impacted by SRS and VEGP. It was detected in both groundwater and surface water-fed systems. However, these tritium activities were relatively small when compared to the 20,000 pCi/L MCL. Gross alpha, gross beta, and gamma-emitting radionuclides were not detected at activities above their respective MCLs. ESOP tritium data (**Appendix C**) is consistent with DOE-SR data generated from the three colocated systems.

Radiological Surface Water and Sediment Surveillance

ESOP Surface Water and Sediment Surveillance focused on detecting and/or verifying the concentration of radionuclides in surface water and sediments associated with SRS; detecting and/or verifying any routine or accidental radionuclide releases; validating the results of the DOE-SR radiological environmental surveillance program; and characterizing the trends of radionuclides in streams and sediments associated with SRS.

A monitoring strategy was developed and implemented based upon historical monitoring data for radionuclides in surface water and sediments on and adjacent to the SRS. When possible, existing DOE-SR locations were used to provide a means of data comparison. Surface water samples were collected at 13 predetermined locations (**Map 4**) using the grab method and using automatic samplers. Seventeen sediment samples were collected in May 1999.

Analytical results (**Appendix D**) indicated that tritium could be detected in all streams on SRS. The results also indicated that the SRS is a contributor of tritium concentrations to the Savannah River. Fourmile Branch (SV-2039) and Pen Branch (SV-2048) have consistent tritium concentrations above the EPA MCL for drinking water of 20,000 pCi/L. This is most likely due to base flow contribution of contaminated groundwater into these two water basins from various waste sites. All public access locations sampled downstream from the SRS were below the EPA MCL of 20,000 pCi/L. However, data reported from samples collected from the Fourmile Branch Mouth (SV-2015) location, adjacent to SRS, in the Savannah River indicate that the public could be exposed to tritium concentrations greater than 20,000 pCi/L.

Monthly composites were analyzed for gross alpha, gross beta, and gamma-emitting radionuclides. Quarterly composites from Fourmile Branch (SV-2039) were analyzed for strontium-90. Upper Three Runs samples indicated higher concentrations of gross alpha than any other stream that was sampled. This is most likely the result of discharges from the Effluent Treatment Facility (ETF) located in H-Area. The ETF treats low-level radioactive contaminated wastewater. Elevated levels of gross beta, strontium-90 and gamma-emitting radionuclides were detected in Fourmile Branch. These elevated levels are the result of groundwater contamination coming from the Old Rad Waste Burial Grounds, C-Area basins and the former Seepage Basins located in F- and H-Areas.

Gross alpha, gross beta, strontium-90 and cesium-137 data were also compared between ESOP and DOE-SR. Overall, the data was very similar and within the same order-of-magnitude at each colocated sampling point. Sediment data was also similar from colocated stations.

Non-Radiological Surface Water and Sediment Monitoring

The streams located on the SRS receive treated wastewater and nonpoint source runoff from on-site facilities. Recent and historical data from SRS Environmental Reports indicate that the SRS waters are in accordance with Freshwaters Standard guidelines stated in the SCDHEC Water Classifications and Standards (Regulation 61-68), 1998.

ESOP assessed the nonradiological surface water and sediment quality on SRS by sampling the on-site streams for inorganic and organic contaminants. Specific parameters were analyzed monthly, quarterly, and annually. Eight surface water and seven sediment sites were strategically chosen (**Map 5**) to monitor ambient conditions to detect any nonradiological impact from DOE-SR operations.

The overall non-radiological water quality on the SRS meets the Freshwaters Standard for South Carolina streams. All but two of the surface water parameters, nitrate and pH, were within expected ranges for South Carolina streams (**Appendix E**). Nitrate concentrations from the Four Mile Creek (SV-326) sample location were higher than comparable South Carolina streams. These higher nitrate concentrations are most likely the result of discharges into Four Mile Creek from the upstream waste treatment facility. Also, surface water pH from Upper Three Runs (SV-2027) sample location was lower than comparable South Carolina streams. Data from ESOP nonradiological surface water locations were compared to DOE-SR data where sample points were colocated. The data from the colocated stations were similar for the parameters that were analyzed by both ESOP and DOE-SR. Sediment data from this study, as well as 1999 DOE-SR sediment data, indicated no measurable impacts from DOE-SR operations.

Radiological Surveillance of Surface Soils On and Adjacent to SRS

In 1999, the SCDHEC evaluated surface soil gamma radionuclide concentrations on and around the SRS. This project provides independent data for gamma-emitting radionuclide levels in soil,

as well as to verify historic and current DOE-SR monitoring. DOE-SR soil monitoring was reduced from 24 sample locations in 1995 to six sample locations currently. ESOP surface soil monitoring has been configured to provide thorough perimeter coverage of SRS at potential public exposure locations (**Map 6**). The SCDHEC REML conducted gamma spectroscopy on all samples. The primary radionuclide of concern for this study was cesium-137. Historic cesium-137 data from DOE-SR environmental reports was used as a reference for trending data. Direct data comparison was not performed due to the inherent variability usually found in soils.

ESOP conducted soil monitoring in 1999 at 16 locations around the perimeter of SRS; three locations 25 miles from the center of SRS (former DOE-SR environmental monitoring locations); two locations chosen at random from within a 50-mile radius of SRS; and a background location approximately 100 miles from SRS. Samples were collected from the surface to a depth of 6 inches during September 1999.

Laboratory results (**Appendix F**) indicate the presence of low levels of cesium-137 in all samples, except for sample location LEX-050. This is a randomly selected location within a 50-mile radius of SRS. The laboratory result for LEX-050 was below the Minimum Detectable Activity (MDA). Levels of cesium-137 along the perimeter were consistent with background locations. Reported levels were minimally higher than the MDA. Nominally elevated cesium-137 levels (1.272E+00 pCi/g) were detected north of A- and M-Areas along the site perimeter. Lead-212, a naturally occurring radionuclide indicative of the thorium decay series, was reported at consistent levels throughout the study area. Although actinium-228 should not have been observed due to its short half-life, it was reported as an indicator of the thorium decay series. This indicated the presence of thorium-232 and radium-228, at one order-of-magnitude above the MDA. Lead-214, a naturally occurring radionuclide and an indicator of the uranium decay series, was also reported at consistent levels throughout the study area. 1999 results are consistent with background levels and are within one order-of-magnitude of 1998 ESOP and DOE data.

Cesium-137 data from the 1990-1999 SRS Environmental Reports was evaluated along with ESOP 1999 data. Corresponding quadrants of SRS soil data were paralleled with ESOP data. Radionuclide levels were very similar; results were within one order-of-magnitude of historic data. ESOP 1999 data corresponds with historic SRS data and ESOP 1998 data.

Radiological Monitoring of Terrestrial Vegetation On and Adjacent to SRS

The DOE-SR has historically collected and analyzed terrestrial vegetation, primarily Bermuda grass, on and around the SRS to determine concentrations of radionuclides. Sampling was

discontinued at four 25-mile and three of four 100-mile stations in mid-1995. In 1996, the sampling frequency at locations outside the burial ground and the 14 SRS perimeter stations was reduced from quarterly to annually. In 1998, the number of on-site and perimeter stations was reduced from 100 to five. This sampling program remained constant for 1999.

This project addresses public concerns regarding SRS operations and the presence of radionuclides in vegetation around the SRS. ESOP conducted independent vegetation monitoring in 1999 at 16 locations around the perimeter of the SRS; three former SRS monitoring locations 25 miles from the center of SRS; eight locations selected at random from within a 50-mile radius of SRS; and a background station approximately 110 miles from SRS (**Map 7**). Sampling was performed in March, June, September, and December 1999.

Samples were analyzed for tritium activity and gamma-emitting radionuclides (**Appendix G**). Tritium was detected in vegetation at 21 of the 28 sites sampled in 1999, including all perimeter stations and two 25-mile stations. Five of the perimeter stations produced tritium levels greater than the Lower Limit of Detection (LLD) in all four sampling months. The stations with the highest detectable activity were generally located on the western and northern sides of the SRS, including vegetation collected near D-Area. This is possibly due to heavy water reprocessing and historical operations at that facility. Tritium was detected at three of the random 50-mile radius stations, but not the 100-mile background station.

Vegetation was collected for gamma analysis every quarter at the three 25-mile stations and once at the randomly selected stations in 1999. The perimeter stations were sampled on an alternating basis during alternating quarters so that each station was sampled twice in 1999. Gamma-emitting radionuclides were detected in all samples. Cesium-137 was detected at generally lower levels than in 1998, especially at stations on the northern and southeastern sides of the SRS.

ESOP data confirms the DOE-SR conclusion that elevated tritium levels at the site perimeter are due to atmospheric releases from SRS. Despite monitoring and analysis differences, tritium results from both programs at similar locations were all relatively low. The one colocation produced no detectable tritium from either program. Results for the colocation were similar for cesium-137. To facilitate comparisons, ESOP recommends that DOE-SR modify its reporting format for tritium, either to picocuries/milliliter, or as picocuries/gram of fresh vegetation (i.e. wet weight). ESOP also recommends that a full list of radionuclides detected in SRS analyses should be reported in the annual SRS Environmental Data report.

Radiological Monitoring of Dairy Milk

Consumption of milk and other food products containing radioactive materials can be a significant source of human exposure to radioactivity. Dairy milk can become contaminated through atmospheric deposition of radioactive particles on grass and plants that are ingested by

cows, and transferred to milk. The pathway via milk is of particular importance in the case of infants and children. Not only are they more likely to drink large quantities of milk, they are actively developing bones and teeth. Strontium, a calcium analogue, can bioconcentrate in bones and teeth displacing the calcium. Since dairy milk is an important pathway for human exposure to radioactivity, milk samples from dairies around SRS are routinely analyzed for levels of radioactivity that could be detrimental to human health.

DOE-SR personnel have historically conducted monitoring around SRS to determine concentrations of certain radionuclides in dairy milk. Due to a change in the scope of environmental monitoring at SRS, only five of the 17 initial sampling locations remain active. SCDHEC ESOP personnel performed dairy milk sampling to provide an independent source of data on concentrations of radionuclides in milk within a 50-mile radius of SRS (**Map 8**).

ESOP personnel collected five milk samples with one duplicate on a monthly basis in 1999. The samples were analyzed for tritium with a maximum of 240±102 pCi/L. Selected beta-gamma emitters reported a maximum for strontium-90 as 1.16 ±0.49 pCi/L and cesium-137 as 6.819± 2.271 pCi/L (**Appendix H**). An evaluation of the analytical results between SCDHEC and DOE-SR indicates they are consistent for 1999. Quality Assurance and Quality Control measures were performed in accordance with established standard operating procedures concerning the collection and evaluation of milk.

Radiological Fish Monitoring Associated with the Savannah River Site

Due to current public concerns of increased risk to human health associated with the consumption of Savannah River fish, SCDHEC monitoring of radionuclide concentrations in fish continues in an effort to determine the magnitude, extent, and trends of radionuclide concentrations. The DOE-SR also conducts fish monitoring to assess the effects of routine and

accidental releases of radionuclides and other contaminants. Published documents and data concerning radionuclide concentrations in fish were used to evaluate the DOE-SR Radiological Fish Monitoring Program. In 1996, ESOP implemented an independent program to monitor fish. Largemouth bass and channel catfish were used as the target species. Because of the availability encountered at many sample areas, white catfish were added to the bottom-feeder target species. White catfish were collected where channel catfish were not available. These species are consumed in the study area and among the catch of local anglers. Studies have shown that these species bioaccumulate measurable amounts of radionuclides.

Five fish for each species (i.e. bass and catfish) were collected from 11 sample locations (**Map 9**) using boat mounted electrofishing equipment. Samples were collected at five stations where creeks from DOE-SR meet the Savannah River. In addition, samples were collected at one station above DOE-SR, two stations below the DOE-SR, and three background locations. All fish were composited, by species and sample location, and separated into edible and non-edible homogeneous portions. Composites were analyzed for gamma-emitting isotopes, tritium, and strontium-90 (**Appendix I**).

Gamma results indicated the highest levels of cesium-137 were from the Steel Creek location. The highest levels of tritium and strontium-90 were reported from the Four Mile Creek location. Data summaries, for this project, were compared with DOE-SR reported values. Cesium-137 and strontium-90 compared values for several locations were more than one order-of-magnitude different. This discrepancy in results could be attributed to the natural variation of radionuclide concentrations in a population.

Project information will be available for the SCDHEC Bureau of Water, and the Health Hazard Evaluation Division to further evaluate potential human health risk associated with the consumption of Savannah River fish. The information provided will also help in advising, informing, and protecting the people at risk, and in comparing current and historical data.

Game Animal Monitoring Adjacent to SRS

Legacy releases to the environment by DOE-SR may directly affect game animal populations and their food sources. DOE-SR has monitored deer and hogs harvested as part of population control hunts since 1965. In 1998, the DOE-SR reported cesium-137 values ranging from 1 pCi/g to 77 pCi/g in harvested whitetail deer. In 1999, ESOP analyzed muscle tissue from samples harvested by local hunters for gamma emitting radioisotopes within the study area (**Map**

10). Three samples were collected. Gamma spectroscopy data for these samples is provided (**Appendix J**). Cesium-137 was detectable in two of the deer samples collected with wet weight concentrations of 2.3 and 7.3 pCi/g. A single duck sample was below the MDL for cesium-137. All ESOP samples were collected from one discrete area approximately 2 miles from the SRS boundary along a tributary of Upper Three Runs Creek known as Boggy Gut Creek.

Results from the 1999 Game Animal Project indicate that the level of sampling should be increased in the 2000 sampling year in order to draw meaningful conclusions from analyses. Although local hunters were very supportive of the project concept, the level of effort requested of them by the project resulted in an insufficient number of samples. The 2000 plan allows project staff more time to contact hunters directly, after hours and on weekends, which should result in a sufficient number of samples for analysis from within the study area, as well as a background location. Additionally, the project scope will focus on deer (and hogs where available) as these are the predominant game animals consumed by the local population.

Oversight Monitoring and Support Activities

As part of the Site Evaluation process, agreed upon in the Federal Facility Agreement between the EPA, the DOE, and the SCDHEC, the site evaluation program evaluates areas with potential or known releases of hazardous substances unidentified before the effective date of the Federal Facility Agreement, August 16, 1993. The primary objective of these support projects was to evaluate the potential impact of facility operations on the soil. Other objectives were to conduct document review; establish contacts concerning each activity; acquire, validate, and report discrepancies in raw data; provide oversight of sampling activities; conduct split sampling; and

implement independent sampling programs.

A total of six sites (**Map 11**) were evaluated and data for the GIS database collected at all six sites (**Appendix K**). At one (KAC-001) site, the evaluation consisted of only oversight of sampling activities for adherence to established sampling protocol. The remaining five sites included oversight of field activities and the acquisition of split samples from selected locations. ESOP obtained soil samples from the C-Area Sandblast, CMC-001; K-Area sandblast, CMK-002; K-Areas Sandblast CMK-02, K-Area Sandblast, CMK-003; Road 9 Rubble Pit pile; S-Area Sandblast CMS-001. These split samples were shipped to SCDHEC Analytical Services Laboratory for analysis of metals, volatiles, pesticides, herbicides and other constituents.

The ESOP provided oversight and participated in the pre-characterization soil sampling activities at all of these sites. Oversight activities included the observation of sampling; splitting of soil samples; acquisition of GIS data points; contractor adherence to the SRS's sampling protocol; and the acquisition of photographs for documentation and visual representation. Samples were acquired through the use of hand augering. A DOE-SR contractor performed the sampling in accordance with established protocols and procedures. Samples were collected as composites from depths 0-1 foot and 1-4 feet within the unit confines. ESOP personnel did not perform any independent sampling.

C-Area Sandblast: CMC-001

DOE-SR collected soil samples by from the C-Area Sandblast, CMC-001 (NBN) on February 11, 1999. The primary objective of sampling at C-Area Sandblast was to evaluate the potential impact to soil due to DOE-SR operations. The oversight included observation of sampling activities for contractor adherence to DOE-SR sampling protocol and the splitting of soil samples, limited to three locations. These were designated as CMC1-1A-01, CMC1-2A-01 and CMC1-3A-01. The majority of the analytical results for SCDHEC and DOE-SR were below detection limits. The only inorganic detected above its Risk Based Concentration (RBC) was arsenic. Arsenic was detected above both its residential and industrial RBC in the three split soil samples from DOE-SR and in one sample by the SCDHEC laboratory. The SCDHEC laboratory could not achieve the detection limits necessary to evaluate arsenic at or near its residential RBC.

K-Area Sandblast: CMK-002

DOE-SR collected soil samples from the K-Area Sandblast, CMK-002, on April 13, 1999. The primary objective of sampling at K-Area Sandblast, CMK-002, was to evaluate the potential impact to soil by sandblasting activities around K -Area. The Sandblast area was used to remove paint and corrosion from metal items. The oversight included observation of sampling activities, contractor adherence to the DOE-SR sampling protocol, and the acquisition of split soil samples for comparative purposes, limited to three locations. These were designated as CMK2-02-01, CMK2-05-01, and CMK2-08-01. The only inorganic detected above its RBC was arsenic. Analytical results indicated arsenic above its residential RBC in the two split soil samples from DOE-SR. The SCDHEC laboratory could not achieve the detection limits necessary to evaluate

arsenic at or near its residential RBC. Arsenic continues to be pervasive at SRS. An independent study evaluating arsenic at SRS might provide a clear understanding of this continual point of contention.

K-Area Sandblast: CMK-003

DOE-SR collected soil samples from the K-Area Sandblast, CMK-003, on March 10, 1999. The primary objective of sampling at K-Area Sandblast, CMK-003, was to evaluate the potential impact to soil by sandblasting activities. The sandblast area was used for sandblasting the two existing 3000-gallon fuel oil tanks and associated equipment. The oversight included observation of sampling activities, contractor adherence to the DOE-SR sampling protocol, and the acquisition of split soil samples for comparative purposes, limited to three locations. These were designated as CMK3-3B-02, CMK3-4B-02, and CMK3-5B-02. The only inorganic detected above its RBC was arsenic. Analytical results indicated arsenic above its residential RBC in the three-split soil samples from DOE-SR. The SCDHEC laboratory could not achieve the detection limits necessary to evaluate arsenic at or near its residential RBC. Arsenic continues to be pervasive at SRS. An independent Study evaluating arsenic at SRS might provide a clear understanding of this continual point of contention.

K-Area Sandblast: KAC-001

DOE-SR collected soil samples from the K-Area Sandblast, KAC-001on September 10, 1999. The primary objective of sampling at K-Area of Concern, KAC-001 was to evaluate the potential impact to soil caused by sandblasting activities around. The K-area was used to remove paint and corrosion from metal items. The oversight included observation of sampling activities, contractor adherence to DOE-SR sampling protocol, and the acquisition of split soil samples for comparative purposes, limited to three locations. These were designated as KAC1-011-04, KAC1-013-03, and KAC1-028-02.

Road 9 Rubble Pile

DOE-SR collected soil samples from the Road 9 Rubble Pile Site on January 7, 1999.
The primary objective of sampling at Road 9 Rubble Pile Site was to evaluate the potential impact to soil due to the disposal of concrete rubble. The oversight included splitting soil samples, observation of sampling activities, and contractor adherence to DOE-SR sampling protocol limited to three locations, designated as R9-1B-02, R9-3A-01, and R9-6A-01. The majority of the analytical results were below detection limits. The few results that exceeded their detection limits are slightly above the residential Risk Based Concentration (RBC). Only one arsenic result exceeded twice the residential RBC. The SCDHEC laboratory could not verify this result because its detection limit was above the RBC.

S-Area Sandblast: CMS-001

Soil samples were collected from the S-Area Sandblast, CMS-001, July 27, 1999. The primary objective of sampling at S-Area Sandblast, CMS-001, was to evaluate the potential impact to soil caused by sandblasting activities around S-Area. The Sandblast area was used to remove paint and corrosion from metal items. The oversight included observation of sampling activities, contractor adherence to DOE-SR sampling protocol, and the acquisition of split soil samples for comparative purposes limited to four locations designated as CMS1-18-01, CMS1-20-01, CMS1-21-01, and CMS1-28-02.The majority of analytical results were below regulatory concern. The four arsenic results that exceeded their RBC are slightly elevated over their respective residential RBC, but do not exceed the industrial RBC. The SCDHEC laboratory could not verify the arsenic results because its detection limit was above the RBC.