



A Brief Look at Radiation Levels in Georgia

by: Jim Hardeman, Environmental Radiation Program Manager

GEORGIA DEPARTMENT OF NATURAL RESOURCES · ENVIRONMENTAL PROTECTION DIVISION

Radiation Monitoring in Georgia

The Environmental Radiation program, which monitors radiation throughout Georgia, is nearing publication of our biennial monitoring report. This report looks at radionuclide and direct radiation levels in Georgia's environment from 2000 through 2002.

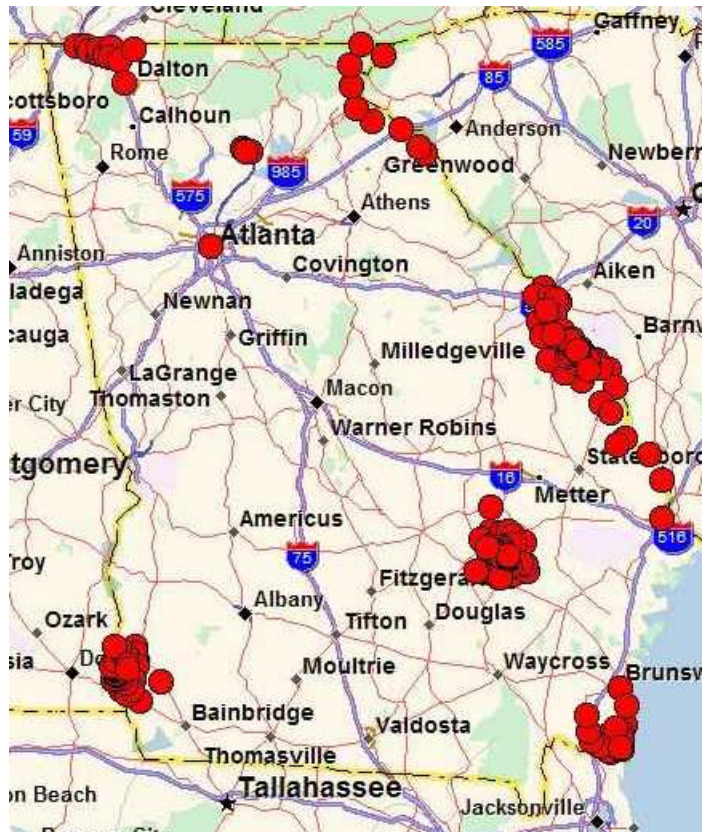
Our staff monitor some 3,000 square miles of land and over 300 miles of waterways. We focus on areas around the two commercial nuclear power generating facilities and the nuclear submarine base in Georgia. We also monitor nuclear sites the border Georgia, including nuclear

power plants and the Savannah River Site. The accompanying map show the locations where Georgia EPD monitors.

The vast majority of the results from EPD's radiological monitoring indicate radiation levels and man-made radionuclide concentrations remained consistent with background radiation levels. However, several areas had elevated concentrations of man-made radionuclides or radiation that are attributable to operations at a nuclear facility. None of these locations regularly exceed the US Nuclear Regulatory Commission

reporting levels, though there were some exceptions:

- Panfish and Catfish from Beaver Dam Creek and Catfish from Four Mile Creek (Savannah River area) exceeded 10 millirem per year.
- Leafy vegetation in 2 locations in southern Richmond County exceeded 15 millirem per year.
- Direct radiation along two fence lines at the Georgia Tech Research Reactor exceeded NRC's reporting level, but not the annual dose limit of 100 millirem.



Georgia EPD monitors many sites throughout the state for man-made radionuclides and direct radiation. The red circles indicate monitoring sites within Georgia.

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Behind the Lines: An in-depth look at...

Q&A on Radiological Monitoring Along the Savannah River Site

By: Jim Hardeman, Environmental Radiation Program Manager

EPD has conducted radiological monitoring around the Savannah River Site since 1977

In 1993 and again in 2001, EPD significantly expanded the monitoring to look at more locations, more often

EPD regularly participates in emergency preparedness activities related to the Savannah River Site

Why does EPD monitor for radioactive materials near SRS?

The Savannah River Site, a nuclear weapons production facility, releases a variety of radioactive materials to the environment. These releases originate not only from current and past site operations, but also from large quantities of radioactive materials buried and stored at the site.

A series of SRS reports produced in the early 1990's looked at radioactive tritium, cesium, carbon, strontium, iodine, technetium and uranium in the Savannah River environment. In many cases, the findings in these reports indicated the need for further monitoring to determine the fate of materials released from SRS.

In 1989, Admiral James Watkins, then Secretary of Energy, announced a 10-point initiative "to improve the accountability of the DOE in the areas of environmental protection, public health and safety". DOE invited states hosting DOE facilities to negotiate formal agreements to "improve their environmental monitoring capabilities." Shortly thereafter, DOE staff at SRS advised Georgia that SRS had requested of DOE headquarters "approval to develop a single overall program on environmental monitoring / emergency response at SRS with South Carolina and Georgia". DOE and the State of Georgia ultimately entered into an Agreement in Principle (AIP) for environmental monitoring and emergency preparedness related to SRS in 1993.

What does EPD monitor?

EPD collects samples of air (11 locations), rain (11 locations), surface water (11 locations), groundwater (46 locations), crops (5 locations each of 4 crops), milk (8 locations), game (5 locations), fish (8 locations) and seafood (1 location), soil (15 locations), vegetation (15 locations) and river sediment (55 locations). EPD also measures direct gamma radiation in the environment with thermoluminescent dosimeters (TLDs) at 54 locations. EPD and SRS also cooperatively collect groundwater from 44 U.S. Geologic Survey (USGS) and Georgia Geologic Survey (GGS) test wells.

Where does EPD monitor near the Savannah River site?

All of EPD's samples are collected in Georgia. The majority are collected in Richmond, Burke, Screven, Effingham and Chatham counties. EPD also collects a few samples in Columbia, McDuffie and Jefferson counties (see map on next page).

How frequently does EPD monitor?

Until the recent elimination of DOE grant funding, EPD collected surface water samples weekly; air samples every two weeks, tritium-in-air every two weeks; milk monthly; rain monthly; direct radiation measurements quarterly; vegetation quarterly; fish twice per year; river sediment twice per year; seafood (Savannah area) twice per year; groundwater annually; soil annually, crops annually and game (deer) annually. In 2003, EPD collected 2,815 environmental samples near SRS and performed 5,074 separate analyses on those samples.

What do EPD's monitoring results show?

Recent EPD monitoring shows elevated tritium (H-3) in virtually all media – air, surface water, groundwater, rain, milk, vegetation, fish and game; cobalt 60 (Co-60) in river sediment; strontium 90 (Sr-90) in leafy vegetation and fish; iodine-129 (I-129, an extremely long-lived fission product) in surface water; cesium 137 (Cs-137) in deer, fish, soil and river sediment; plutonium 238 (Pu-238) in river sediment; and plutonium 239 (Pu-239) in soil and river sediment.

How significant are EPD's findings?

Tritium (H-3) in water ranges from ~5% of EPA's Drinking Water Maximum Contaminant Level (MCL) in Savannah, to well over 100% of the MCL at the mouths of SRS site streams. I-129 in surface water at the mouth of Four Mile Creek typically runs 25% - 50% of the MCL for I-129. Cs-137 in fish, while not sufficiently elevated to cause any short term health concern, is sufficiently elevated to cause concern for persons who eat significant quantities of fish over several years, particularly fish caught in or near the mouths of SRS site streams. Sr-90 in vegetation, again while not sufficiently elevated to cause short-term health concerns, may be of concern for those whose diet contains significant quantities of leafy vegetables.

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Behind the Lines: An in-depth look at...

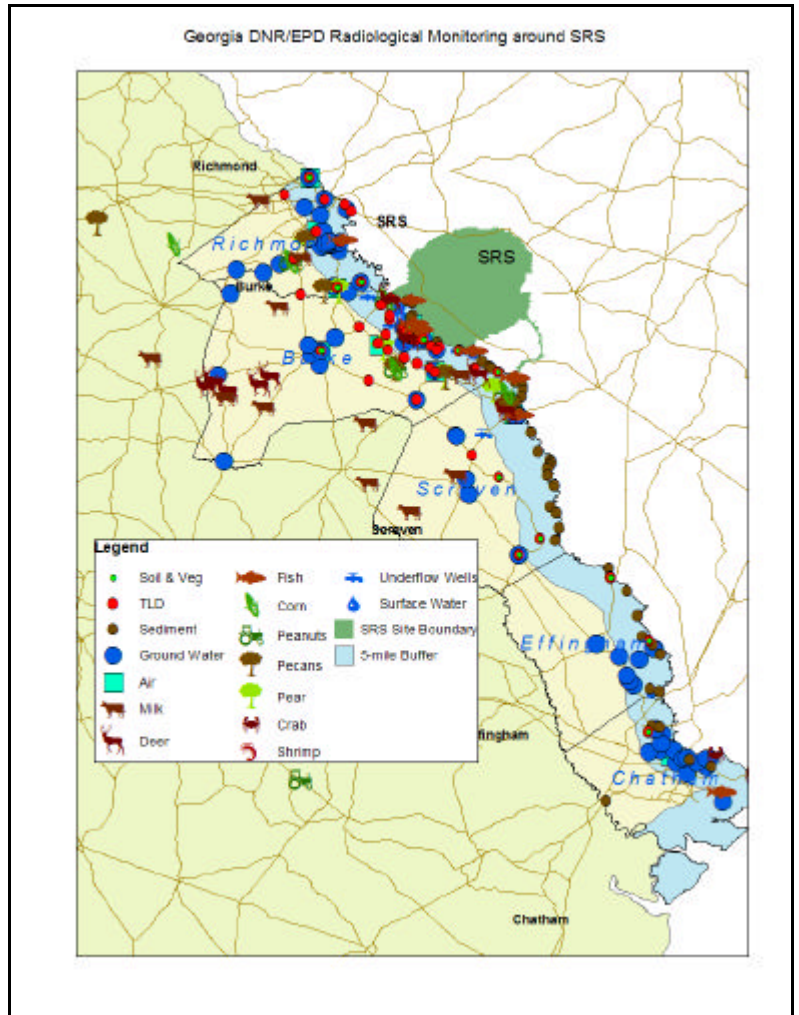


Q&A on Radiological Monitoring Along the Savannah River Site (continued)

Are these radioactive materials in the environment due to SRS operations?

Sr-90, Cs-137, and Pu-239 are all found in global nuclear weapons fallout, so it is difficult to state conclusively how much of what EPD finds in the environment is due to SRS. Based on comparison with EPD results from monitoring around other nuclear facilities, however, it appears that many of the findings of elevated levels of these nuclides are related to current or past releases from SRS. More than 90% of the tritium (H-3) EPD detects in all media is due to SRS operations, as are Sr-90 and Cs-137 in fish (again, based on comparisons with other nuclear facilities). EPD estimates that more than 80% of the Cs-137 and more than 90% of the Pu-238 and Pu-239 in river sediments are due to SRS operations. All of the I-129 observed in surface water is due to groundwater migration from buried waste and closed seepage basins at SRS. Co-60 in river sediment is due both to SRS operations and operations of the Georgia Power Company Plant Vogtle. EPD does not have sufficient information to determine the source of Cs-137 found in deer.

“For many years Georgia officials have wrestled with citizen concern over radioactive contamination from the Department of Energy’s Savannah River Site. I note that four previous Georgia Governors have strongly communicated their concerns and requested action of DOE Secretaries on a number of occasions.”
 —Former Governor Roy E. Barnes, in a September 30 1999 letter to former Secretary of Energy Bill Richardson



Above: Monitoring around the Central Savannah River Area.
 Below: Fish, Sediment, Groundwater, Air, River sampling by Georgia EPD.

In summary

Georgia EPD environmental radiation monitoring is an integral part of the vigorous and comprehensive environmental monitoring program at SRS. It is largely due to oversight, both by Georgia and South Carolina, that we can assure Georgians that we work together to protect our communities.



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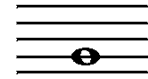
Clean Air,
Clean Water,
Productive Land,
Healthy Communities



Liquid Scintillation testing for tritium in Savannah River water conducted in our Augusta District Office.

A Whole Note about ... Central Savannah River Area Sampling Results

By: Jim Hardeman, Environmental Radiation Program Manager



Below is a summary of sampling results from 2000-2002 in the Central Savannah River Area, grouped by radionuclide.

Tritium (H-3)

Air: Elevated levels of tritium (\geq **5X** Background) were periodically detected at 8 out of 10 locations within 30 miles of SRS, with highest concentrations detected within SRS' predominant down-wind footprint. H-3 concentrations ranged from 2,000 - 24,000 fCi/m³. All results were equivalent to less than 0.01 mRem per year or 0.1 % of the air-pathway reporting level (15 mRem/yr).

Rain: Elevated levels of tritium (up to **5X** Bkg) were observed in precipitation at several locations within 30 miles of SRS, with highest concentrations within SRS's predominant down-wind footprint. Detectable deposition (fallout) values for H-3 ranged from 4,000 to 92,000 pCi/m² per year. Even though a significant amount of H-3 was deposited in the rain, H-3 concentrations in the rainwater did not exceed the Safe Drinking Water Standard: 400 pCi/L average (2% MCL) and 1,000 pCi/L maximum (5% MCL).

Groundwater: Elevated concentrations of tritium (up to **5X** Bkg) were detected in relatively shallow (< 100 ft.) groundwater within 15 miles of the center of SRS. Concentrations were the equivalent to 5% of the Drinking Water MCL.

River Water: Elevated concentrations of tritium (up to **300X** Bkg) were detected in river water adjacent to SRS effluent creeks (outfalls), with concentrations ranging up to 60,000 pCi/L (equivalent to 300% of the MCL for a one-week period at Four-Mile Creek). Annual average concentrations were less than the Safe Drinking Water MCL, however, at all locations monitored: Upper Three Runs Creek—13,000 pCi/L (66% MCL), Beaver Dam Creek—2,500 pCi/L (13% MCL), Four Mile Creek—13,000 pCi/L (66% MCL), Steel Creek—1,200 pCi/L (6% MCL), Lower Three Runs Creek—1,000 pCi/L (5% MCL). Elevated tritium (up to **50X** Bkg) in river water was detected below the Vogtle outfall. H-3 concentrations averaged 2,200 pCi/L (11% of MCL), with the highest concentration (11,000 pCi/L) associated with a chemistry problem in one of the reactors. Elevated tritium (up to **16X** Bkg) was detected in river water downstream of SRS and VEGP at the US-301 Bridge. H-3 concentrations averaged 1,000 pCi/L (5% MCL), with a maximum of 3,300 pCi/L (16% MCL).

Drinking Water: Elevated concentrations of tritium (up to **11X** Bkg) were detected in downstream drinking water from the Savannah I&D Water Plant. Concentrations averaged 800 pCi/L (4% MCL), with a maximum of 2,300 pCi/L (11% MCL).

Fish: Elevated concentrations of H-3 in fish filets (up to **290X** Bkg) were detected adjacent to SRS, with the highest concentration detected in largemouth bass from Upper Three Runs Creek. Average concentrations by location ranged from 100 to 9,700 pCi/kg fresh-weight (filet portion), for all species tested.

Milk: Slightly elevated levels of tritium (up to **3X** Bkg) were detected in milk from 2 locations within 50 miles of SRS. Detectable H-3 values ranged from 200 to 700 pCi/L, with average results less than 0.05 % of the air-pathway reporting level (15 mRem/yr).

Crops: Slightly elevated levels of H-3 (**2X** Bkg) were detected in pears from the Waynesboro area, about 25 miles from the center of SRS. H-3 concentrations had a projected dose less than 0.002 mRem per year (<0.02% of the reporting level).

Leafy Vegetation: Elevated levels of tritium (up to **13X** Bkg) were detected in leafy vegetation or forage from several locations within 50 miles of SRS. Detectable H-3 concentrations averaged approximately 500 pCi/kg of fresh weight, with a maximum of 2,600 pCi/kg.

Deer: Slightly elevated levels of H-3 (**3X** Bkg) were detected in deer samples collected near the Savannah River (within 5 miles of SRS). H-3 concentrations had a projected dose less than 0.002 mRem per year (~0.01% or the air-pathway reporting level).

Cesium 137 (Cs-137)

Sediment: Elevated concentrations of Cs-137 in sediment (up to **540X** Bkg) were detected adjacent to and up to 100 miles downstream of SRS. Elevated Cs-137 in sediment (from SRS creeks) is responsible for most of the Cs-137-problem found in fish from this area.

Fish: Elevated concentrations of Cs-137 (up to **220X** Bkg) were detected in fish filets from the Savannah River adjacent to SRS, with the highest concentration detected in largemouth bass from Steel Creek. Average concentrations by location ranged from less-than 10 to 1,100 pCi/kg fresh-weight (filet portion), for all species tested.

Deer: Elevated concentrations of Cs-137 (up to **4X** Bkg) were detected in deer samples collected

within 2-5 miles of SRS. The projected 2002 deer-consumption dose (near SRS) to an average offsite-hunter in Georgia, averaged 3.5 mRem (or 22% of the reporting level), due primarily to Cs-137.

Strontium 90 (Sr-90)

Leafy Vegetation: Elevated Sr-90 (up to **4X** Bkg) concentrations were detected in leafy-vegetation (forage) samples southeast of Augusta near Bush Field and McBean (~20 miles from the center of SRS). Leafy vegetation from both locations in southeastern Richmond County **exceeded** the air-pathway reporting level of 15 mRem/yr (**370%** near Bush Field and **170%** near McBean).

Fish: Elevated concentrations of Sr-90 in fish (up to **10X** Bkg)

were detected adjacent to SRS, with the highest concentrations detected in catfish from Beaver Dam Creek. Most of the Sr-90 is located in the bones of the fish. Average concentrations by location ranged from less-than 10 to 190 pCi/kg fresh-weight (whole fish), for all species tested.

Plutonium (Pu-238/239)

Sediment: Elevated Pu-238 (up to **3X** Bkg) and Pu-239 (up to **6X** Bkg) were detected in sediment samples adjacent to and up-to 100 miles downstream of SRS, which probably entered the Savannah River from Four-Mile Creek. Global fallout-related Pu-239 was also detected at a saltwater control location in the Richmond Hill area on the Ogeechee River. Neither Pu-238 nor Pu-239 were detected in drinking water or fish samples.

Cobalt 60 (Co-60)

Sediment: Elevated concentrations of Co-60 (approximately **22X** Bkg) in sediment were measured below Steel Creek and Lower Three Runs Creek as well as below Plant Vogtle, suggesting that Co-60 originated from both SRS and Vogtle. Co-60 was also detected up to 100 miles downstream. Co-60 was not detected in drinking water or fish samples.

Iodine 129 (I-129)

River Water: Elevated I-129 (up to **6X** Bkg) levels in river water was detected at Four-Mile Creek. Concentrations ranged from 0.2 pCi/L to 0.7 pCi/L, averaging 0.4 pCi/L, which is equivalent to 40% of the Drinking Water MCL.