

Section B - Environmental Radiation Program Activities

The Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (DNR) conducts environmental radiation monitoring and emergency response activities related to nuclear facilities in and around Georgia. These activities are designed to protect the current generation and future generations of Georgia citizens from the harmful effects of chronic and acute releases of radioactive materials, including the transportation of radioactive materials. Assuring an adequate level of protection requires a robust program to monitor for radioactive materials in the environment and an equally robust radiological emergency response capability.

The primary emphasis for this program is the operation of an environmental monitoring program of sufficient depth and breadth to determine the extent to which radioactive materials are released into the air and water (both surface water and ground water) of Georgia. The program augments previous monitoring conducted by EPD, places additional emphasis on early detection and notification of releases of radioactive materials, and focuses on waterborne releases and pathways, and to a lesser extent on airborne and food-based pathways. During the past three years, EPD's ability to detect, quantify and assess the significance of both chronic and acute releases required increased sample collection and laboratory analysis efforts, including increases in the types and numbers of samples collected, more frequent sample collections, more comprehensive laboratory analyses of existing samples, and the performance of laboratory testing for additional radionuclides. A great deal of emphasis was placed on a buffer area approximately 1-5 miles wide along the Georgia side of the Savannah River from Augusta to Savannah.

The Georgia Environmental Radiation Program has benefited significantly by EPD's newly opened (2001) East Central District Office in Augusta. Two Environmental Specialists were hired and located in the Augusta office. The bulk of the environmental monitoring effort centered around the Savannah River Site and Plant Vogtle was transferred from Atlanta staff to the new Augusta staff toward the end of 2001. By mid-2002, the Augusta staff was fully operational.

With few exceptions, radiochemical analyses on samples collected were performed under contract at the Environmental Radiation Laboratory (ERL) at the Georgia Institute of Technology in Atlanta. EPD also established limited laboratory capabilities in the Augusta office with a liquid scintillation counter to perform routine tritium analyses on all water samples not requiring distillation. EPD has also continued to perform limited confirmatory and operational analyses in its Mobile Radiation Laboratory (MRL) based in Atlanta.

RADIOLOGICAL SAMPLING PROGRAM

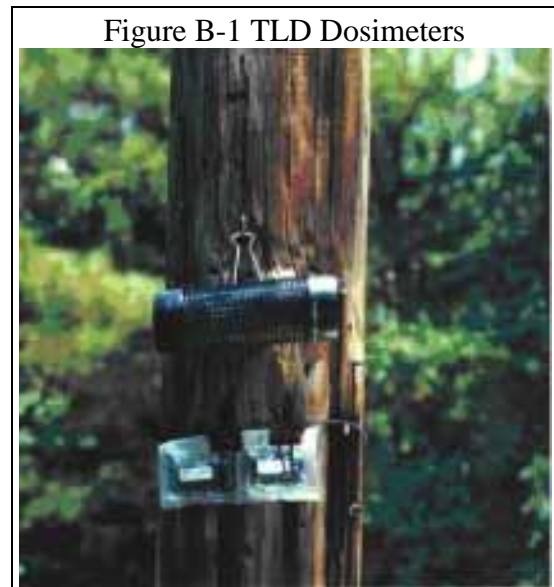
The Environmental Radiation Program conducts routine environmental sampling activities throughout the year around nuclear facilities that may impact the State's environment, including facilities in Georgia, as well as facilities that are adjacent to the borders of Georgia. These facilities are as follows:

- 1) USDOE's Savannah River Site in Aiken and Barnwell Counties, South Carolina
- 2) Georgia Power Company's Vogtle Nuclear Station in Burke County
- 3) Georgia Power Company's Edwin I. Hatch Nuclear Station in Appling County
- 4) Alabama Power Company's Farley Nuclear Station in Houston County, Alabama
- 5) Kings Bay Nuclear Submarine Base in Camden County
- 6) Georgia Institute of Technology's Neely Nuclear Research Center (Research Reactor)
- 7) Dawson Forest Wildlife Management Area in Dawson County (Decommissioned)
- 8) TVA's Sequoyah Nuclear Plant in Hamilton County, Tennessee.
- 9) Duke Power Company's Oconee Nuclear Station in Oconee County, South Carolina

A wide variety of environmental media are sampled and tested around these facilities, including thermoluminescent dosimeters (TLD) for monitoring direct radiation, air, precipitation, soil, vegetation, milk, assorted crops, surface (river) water, groundwater, fish, seafood, and river sediment. Descriptions of these environmental media and their respective collection frequencies follow.

Direct Radiation (TLDs)

Thermo-luminescent dosimeters (TLDs) are collected from 228 locations around Georgia to measure exposure from direct gamma radiation in the environment. In 2002 EPD added 6 TLD monitoring locations around the Savannah River Site. Direct radiation exposure measured by TLDs in the environment may come from several sources, including gamma radiation from naturally occurring radionuclides in soil, cosmic radiation from outer space, gamma radiation from air-borne discharges at nuclear facilities, and from gamma radiation associated with fallout deposited in soil. Georgia uses a special type of TLD, which is also capable of recording other types of radiation exposure, including beta radiation and low-energy x-rays. All environmental TLDs are exchanged on a quarterly basis at active facilities. Since Dawson Forest is a decommissioned facility, TLDs are changed less frequently (semi-annually). TLDs are typically mounted two meters above the ground to a tree or to a telephone pole, using a plastic "cricket cage" holder.



Air Samples

Continuous air samples are collected from 17 locations near several major facilities, as recommended by the US Nuclear Regulatory Commission and US Department of Energy, including Plant Hatch, Plant Vogtle, Plant Farley, and Savannah River Site. Samples collected include bi-weekly particulate filters, bi-weekly charcoal cartridges, and monthly silica gel cartridges (at selected locations near SRS for tritium H-3).

Figure B-2 Air & Precipitation Sampler



In 2002 EPD increased the sample collection frequency to bi-weekly for air and tritium testing around the Savannah River Site. Testing includes alpha, beta, H-3, gamma isotopic (Cs-137, etc.), radioiodine (I-131), strontium (Sr-89 & Sr-90, at selected locations), and plutonium (Pu-238 & Pu-239, at selected locations). Screening for trace Noble gases on the charcoal cartridges is also performed.

Precipitation Samples

Continuous precipitation samples are collected on a monthly basis from 11 locations near Plant Vogtle and the Savannah River Site. These samples are collected in a one-square-foot rain-pan collector and deposited into a 20-liter bottle. Testing includes alpha, beta, tritium (H-3), gamma isotopic (e.g., Cs-137), strontium (Sr-89 & Sr-90, at selected locations), and plutonium (Pu-238 & Pu-239, at selected locations).

Soil Samples

Soil samples are collected annually from 50 locations around all nuclear facilities, in order to test for potential build-up of man-made radionuclides deposited in soil via fallout. Over the past three years EPD has increased soil sample locations by 13 sites. Naturally occurring radionuclides, which contribute to direct radiation exposure, are also tested in soil. Representative samples of the top 2 inches of undisturbed soil are collected in a 500-milliliter container. Testing includes gamma isotopic (Cs-137, naturally occurring radionuclides: Ra-226, Ra-228, K-40; etc.), strontium (Sr-89 & Sr-90, at selected locations), and plutonium (Pu-238 & Pu-239, at selected locations).

Vegetation Samples

Vegetation samples of green, leafy grasses are collected quarterly from 47 locations (6 additional sites have been added over the past three year period) around all active nuclear facilities. EPD tests for recent deposition (fallout) or uptake of man-made radionuclides in vegetation that could enter the food chain. Sampling at Dawson Forest WMA is less frequent as it is decommissioned. Representative samples of the vegetation are collected in 500-milliliter containers. Larger size samples (up to 5 gallons) are required when more extensive testing is performed near SRS. Testing includes gamma isotopic (Cs-137, naturally occurring radionuclides: Be-7, K-40), tritium (H-3), strontium (Sr-89 & Sr-90, at selected locations), plutonium (Pu-238 & Pu-239, at selected locations), and alpha/beta screening (at selected locations).

Milk Samples

Raw, unprocessed milk samples are collected monthly from 11 dairies near three facilities: Plant Hatch, Plant Vogtle, and the Savannah River Site. Over this monitoring period, four more dairies have been added for sampling. One gallon samples are collected at these dairies, primarily by the Georgia Department of Agriculture field inspectors. Testing includes gamma isotopic (e.g., Cs-137), ultra-low-level radioiodine (I-131), tritium (H-3), strontium (Sr-89 & Sr-90), and natural potassium (for quality assurance purposes).

Crop and Game Samples

For the past three years, EPD, in conjunction with the Georgia Department of Agriculture has collecting samples from four commercially-grown crops: (1) corn, (2) peanuts, (3) pears, and (4) pecans. Samples taken from 15 locations in Georgia are analyzed to determine if radionuclides enter the food supply. These radioisotopes include Cesium-137, Hydrogen-3 (tritium), Potassium-40, Plutonium-238 & -239, and Strontium-89 & -90. Additionally, DNR (Wildlife Resources Division's Game Management) has provided deer from 5 zones in East Central Georgia, along the Savannah River. EPD analyzes these deer samples for the presence of radioactive materials.

Surface (River) Water Samples

Surface water samples are collected from 29 locations on Georgia rivers, lakes, and coastal waters. EPD tests monthly at higher priority on locations near Plant Hatch, Plant Vogtle, Savannah River Site. Quarterly samples are collected at lower-priority locations: Kings Bay Submarine Base, Plant Farley, Plant Oconee). Semi-annual samples are collected from the decommissioned facility at Dawson Forest WMA. Testing includes alpha, beta, gamma isotopic (Cs-137), radioiodine (I-131), tritium (H-3), strontium (Sr-89 & Sr-90, at selected locations), and plutonium (Pu-238 and Pu-239, at selected locations). Sample collection sizes are either four liters (for the more-extensive, monthly testing program) or one liter (for quarterly or semi-annual collections).



High-priority surface water samples are collected continuously and retrieved on a weekly or bi-weekly basis from a network of 7 water samplers on the Savannah River. This network, which uses special-purpose, sequential / composite water samplers operated by the DNR Environmental Radiation Program, stretches over a 70-mile stretch of the Savannah River, from Augusta to the US-301 bridge. The primary purpose of this network is to monitor each outfall to the Savannah River. These samplers are used to collect individual, weekly, one-gallon aliquots, which may be tested on an individual basis (weekly basis) or on a monthly basis (composite of 4 weeks), as needed. Additional, monthly, composite split-samples are collected at four other locations, on the Savannah River and on the Altamaha River, for DNR by Georgia Power Company. Both groups of samplers (DNR & GPC) samplers are strategically placed to monitor each major nuclear facility's discharge into Georgia waters. Two continuous water samplers are also strategically placed near drinking surface water supply intakes for the City of Augusta and for the City of Savannah (Port Wentworth), in order to assure that the water supplies are adequately monitored on a monthly basis for possible radionuclides.

Groundwater Samples

Groundwater samples are collected on an annual basis from available groundwater supply wells at 76 locations surrounding nuclear facilities. EPD added 42 groundwater sampling locations in 2002, most of these near SRS. The majority of wells tested draw water from relatively deep aquifers (generally 70 to 300 feet). Testing includes alpha, beta, tritium, and gamma-emitting isotopes (e.g., Cs-137). Strontium and plutonium testing is not conducted unless excess alpha/beta emitters are detected. Naturally occurring radionuclides (such as Ra-226, Ra-228, natural Uranium) are also

tested occasionally, when excess alpha/beta emitters are detected. EPD cooperatively collected 40 samples from 8 well clusters in Burke County, in conjunction with an underflow study conducted by the US Geological Survey and the Georgia Geological Survey. EPD is measuring tritium levels from groundwater migrating westerly from South Carolina. EPD jointly collects the underflow study groundwater samples with Savannah River Site personnel.

Figure B-4 Underflow Study Groundwater Sampling by EPD and SRS Personnel



Figure B-5 Sediment Collection Using a Ponar Dredge



Sediment Samples

Sediment samples, taken from rivers and coastal areas, are collected annually from 90 (up from 64) locations. The new sampling locations are along the Savannah River, in oxbows from Steel Creek to Clyo. Using a Ponar Dredging Unit, this sampling device dredges a 500 cubic centimeter sample from the top 6 inches of sediment, in areas where annual sediment build-up is most favorable. Sediment testing provides a useful and sensitive tool for determining what radionuclides were discharged by a facility over a relatively long time period. Consequently, those

radionuclides may enter the food web and end up in fish. Testing includes gamma isotopic (Cs-137; Co-60; natural radionuclides: Ra-226, Ra-228, K-40; etc.), strontium (Sr-89 & Sr-90, for selected locations), and plutonium (Pu-238 & Pu-239, for selected locations).

Sediment sampling is conducted at the following facilities:

- a) Plant Hatch: Samples for Hatch Nuclear Plant network are collected over a 100-mile-plus stretch of the Altamaha River, beginning above the US Highway 1 bridge in Appling County to the mouth of the Altamaha River in Darien, Georgia.
- b) Plant Vogtle & Savannah River Site: Samples for the Savannah River Site and Vogtle network are collected over a 190-mile stretch of the Savannah River beginning at the Augusta Lock and Dam to the mouth of the river in Savannah, Georgia.
- c) Plant Farley: Samples for the Farley Nuclear Plant network are collected over a 30-mile stretch of the Chattahoochee River from Andrews Lock and Dam to Lake Seminole.
- d) Naval Submarine Base, Kings Bay: Samples for Kings Bay are collected from Cumberland Sound, Kings Bay, and various tributaries in close proximity to the sub base.
- e) Oconee Nuclear Plant: Samples for Oconee are collected from several locations in Lake Hartwell.

Fish Samples

Fish and shellfish samples are collected from 21 locations annually. DNR staff (from the EPD Environmental Radiation Program, Coastal Resources and Wildlife Resources Divisions) catch these fish. These samples are collected from the Savannah River, the Chattahoochee River, the Altamaha River, and along the Georgia coast, including Cumberland Sound. Facilities monitored include Plant Hatch, Plant Farley, Plant Vogtle, the Savannah River Site, and US Navy Kings Bay



Figure B-6 Fish Collection by DNR

Submarine Base. Several varieties of fish are typically collected, including largemouth bass, panfish, and catfish, in freshwater areas, and sea trout, flounder, or red drum, in saltwater areas. Shellfish and marine samples, including shrimp and crab, are also collected from saltwater areas.

Coastal Samples

Various types of samples are collected along the Georgia coast, including shrimp, crabs, sediment and water. Coastal samples are collected off shore of the Savannah River (downstream of SRS and Vogtle), the Altamaha River (downstream of Plant Hatch), and Kings Bay (near the Kings Bay Submarine Base).

Figure B-7 Trawling for Shrimp Samples on the Georgia Sea Dog



Figure B-8 Direct Radiation Survey Meter



Direct-Radiation, Real-Time Monitoring (Hand-Held Instruments)

Real-time direct radiation monitoring with a Micro-R meter instrument is performed at each TLD location, during the TLD change-out cycle, in order to determine current conditions. EPD is also in the process of installing on-line, continuous, real-time radiation monitors in the environment, near several facilities. These monitors will be able to provide up-to-date, 24-hour monitoring results for direct radiation in critical areas.

Remote Real-Time Gamma Monitoring

Remote, real-time gamma-dose monitors are located near each nuclear electrical generating plant in Georgia, as well as near the Georgia Tech Research Reactor, which has decommissioned. These monitors measure the gamma radiation dose every 5 minutes. Results are transmitted to a DNR central control unit each day. Any significantly elevated readings are sent immediately and alarms are activated.



Figure B-9 RADOS Remote Gamma-Monitor System

In-situ Gamma Spectrometer and Underwater Gamma Spectrometer

Occasionally, special-purpose, direct, field testing of gamma-emitting radionuclides is performed using the Department's In-situ Gamma Spectrometer (ISGS). ISGS is utilized when it is not possible or timely to transport the sample back to a conventional lab for testing. "Samples" may include whole trucks, rail cars, underwater areas, air-borne plumes, contaminated areas, and field specimens.



Figure B-10 In-Situ Gamma Spectrometer Testing Of Game Specimens

DNR uses an underwater, in-situ, gamma spectrometer for special surveys of rivers and harbors, as needed. It is especially well suited for testing of short-lived nuclides, that otherwise may decay before testing in the lab. It also provides a more representative picture of what materials may be on the bottom, as it is able to detect radioactive materials through at least 12 inches of sediment layer. Traditional sediment sampling only reaches the top 4-6 inches.

This instrument has proven to be particularly invaluable in several situations:

- (1) Several scrap-metal and waste-related incident responses requiring immediate, on-scene identification of gamma-emitting radioactive materials, were handled more easily with ISGS, with reduced risk of injury to personnel.

- (2) Better underwater assessments of impacted areas of the Savannah River near the Savannah River Site were performed using the ISGS. This utilization also permitted testing for short-lived materials that could otherwise decay before testing could occur at a fixed laboratory.
- (3) Suspect areas have scanned to determine (and to quantify) whether any low-level, man-made contamination was present.
- (4) Dose characterization studies have been conducted at some areas using ISGS. This utilization permits dose to be traced and assigned to various natural radionuclides (and some man-made, fall-out radionuclides) in the soil and surrounding structures.
- (5) Airborne Argon-41 plumes have been traced with ISGS.



Figure B-11: Underwater Gamma Spectrometer for testing the bottom of the Savannah River

RADIOLOGICAL EMERGENCY RESPONSE

By Executive Order of the Governor, the Department of Natural Resources is the lead state agency for response to and technical assessment of peacetime radiological incidents and emergencies. This responsibility, assigned to the Environmental Protection Division, is implemented by the Environmental Radiation Program, with assistance from the Radioactive Materials Program. The Program also plays a major role in radiological emergency planning and preparedness efforts for the state, including participation in radiological emergency preparedness exercises at Plant Hatch, Plant Vogtle, Plant Farley, and the Savannah River Site. Program associates are also involved in emergency preparedness activities related to the transportation of radioactive materials.

Figure B-12 Monitoring a Truck for Radioactive Materials during an Incident Response



The capability that the Environmental Radiation Program, in conjunction with the Radioactive Materials Program, brings to bear during and after a radiological incident

includes:

- In-depth radiological expertise
- Field-based independent technical assessment of facility status, condition of nuclear fuel and potential for release of radioactive materials
- Field-based assessment of the consequences of atmospheric or waterborne dispersion of actual or potential releases of radioactive materials
- Radiological field monitoring and sample collection
- Field-based operation of a Mobile Radiation Laboratory to analyze samples collected during field monitoring activities.
- Liaison with Georgia Emergency Management Agency local emergency management agencies and federal agencies (U.S. Nuclear Regulatory Commission, U.S. Department of Energy, U.S. Environmental Protection Agency, Federal Emergency Management Agency).
- Oversight of and verification of the effectiveness of decontamination activities

Figure B-13 Emergency Response Sample Testing in the Mobile Radiation Laboratory



Performance of these duties requires specialized equipment, including vehicles, boats, portable air and water sampling equipment, fixed-location air, rain and surface water sampling equipment,

fixed-location active and passive radiation monitors, hand-held radiation monitoring equipment, portable computers with atmospheric dispersion and mapping software and secure communications equipment.

Figure B-14 Florida, North Carolina, and Georgia Mobile Labs at Joint Venture Exercise



The Federal Emergency Management Agency (FEMA) evaluates radiological emergency preparedness exercises at commercial nuclear power facilities. EPD participates in three evaluated radiological exercises every two years. FEMA consistently has reported that the EPD emergency response capability for protecting the health and safety of Georgia’s citizens in the event of a radiological incident as “adequate”, and in many instances as “superior”.

In addition to participation in radiological exercises, the Environmental Radiation Program, in conjunction with the Radioactive Materials Program, has responded to 84 incidents involving radioactive materials during this report period. These incidents have included minor incidents at radioactive materials licensees as well as transportation-related investigations. Over half of the incidents involved contaminated scrap metal detected at landfills and buildups of naturally occurring radioactive materials (NORM) in manufacturing process equipment. There are a few unusual incidents. In one incident the Federal Bureau of Investigation requested identification of a mailed package that was radioactive. The FBI, fearing a radioactivity dispersion device, wanted EPD to characterize the package, which turned out to be a strong beta-emitter, later determined to be Sr-90. EPD took possession of the package for later safe disposal. Although none of these incidents during this reporting period resulted in significant releases of radioactive materials to the environment, several incidents required decontamination of facilities and equipment. Contaminated scrap metal poses a special problem for EPD radiation specialists, in that the material involved needs to be quickly identified without undue risk to the investigator. EPD routinely uses a portable gamma spectrometer to help in the field identification of radionuclides. In most cases, the source of radiation is NORM deposited on the surface equipment. However, during one response, EPD personnel determined the source of radiation to be a radioactive gage that had been improperly disposed.

	2000	2001	2002	Totals	%
Licensee	4	8	16	28	33.3%
Transportation	2	3	1	6	7.1%
Landfill	4	3	4	11	13.1%
NORM	10	10	16	36	42.9%
Other	1	0	2	3	3.6%
Totals:	21	24	39	84	100.0%

Table B-1: Radiological Incident Responses

In April 2002, Georgia had the unprecedented opportunity to participate in an exercise alongside the bulk of the federal resources that together represent the Federal Radiological Monitoring and Assessment Center (FRMAC), the Aerial Measurement System (AMS) and the Advisory Team for Environment, Food and Health (A-Team). The Joint Venture ingestion pathway exercise (IPX) extended over 3 days, and included participation by state radiological health personnel from Alabama, Florida, Georgia, North Carolina and South Carolina, as well as federal participants. The exercise simulated a major release of radioactive materials affecting both Georgia and South Carolina. Staff of both the Environmental Radiation Program and the Radioactive Materials Program were fully involved in the exercise, as were contract laboratory personnel from Georgia Tech.

Figure B-15 Staff from Florida and Georgia Work with DOE Personnel in Federal Radiological Monitoring and Assessment Center (FRMAC) at Joint Venture Exercise (Aiken, SC - April 2002)

