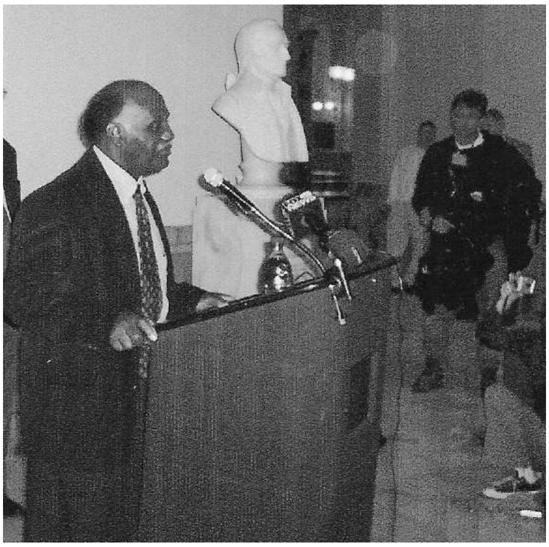
SOW THE WIND

Toxic Air Pollution from the Savannah River Site

March 2007

An Investigative Report
by the
Blue Ridge Environmental Defense League

For they have sown the wind, and they shall reap the whirlwind [Hosea 8:7]



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Citizen's Monitoring and Technical Assessment Fund

History of MTA Fund

As part of a 1998 court settlement between U.S. Department of Energy (DOE) and 39 plaintiffs (nonprofit peace and environmental groups around the country), DOE established a $6.25 million Citizens' Monitoring and Technical Assessment Fund (MTA Fund) to provide money to non-profit, non-governmental organizations and Federally recognized tribal governments working on issues related to the nuclear weapons complex. The Fund was established to help those groups procure technical and scientific assistance to perform technical and scientific reviews and analyses of environmental management activities at DOE sites. These grants may also support dissemination of the technical and scientific reviews and analyses undertaken with monies from the MTA Fund, but cannot be used for litigation, lobbying, general administrative support, or fundraising. The Fund represents an opportunity for citizens groups, tribes, and others to conduct their own research and monitoring of DOE environmental management activities at sites throughout the country. The Fund also represents an opportunity to develop new approaches for community-based research that may be applicable to other environmental issues and problems.

The cover shows the Defense Waste Processing Facility at the Savannah River Site. DWPF treats high-level radioactive waste by mixing it with borosilicate glass and heating it to 2,100 degrees-F to form a ceramic which is stored in stainless steel canisters. Photo courtesy of Department of Energy Savannah River Office.

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SOW THE WIND

Toxic Air Pollution from the Savannah River Site

Executive Summary

In the early 1950's, the United States constructed a vast new atomic weapons center in the rolling countryside between Aiken, South Carolina and Augusta, Georgia. Factories replaced farmland and whole towns were relocated to make way for a huge federal facility.

Today, nuclear weapons production has taken a back seat to environmental clean up at the Savannah River Site, SRS. The 310 square mile SRS encompasses scores of underground tanks with millions of gallons of radioactive sludge, waste dumps with thousands of tons of contaminated soil and huge amounts of polluted groundwater. Radioactive gas is being dispersed into the air. Facilities for high-level and low-level waste continue to process and store radioactive substances.

In 2001 the Blue Ridge Environmental Defense League launched an extensive investigation into the operations at the Savannah River Site. We gathered reports prepared by government contractors. We studied the surrounding communities. Using computer modeling, we calculated the impact of air pollution from SRS in nearby towns. In addition to air modeling, we collected air samples at various points around the perimeter of the site. We detected a variety of toxic air pollutants outside the boundaries. The atmospheric emissions from SRS include tritium, nitric acid, volatile organic compounds, mercury, hydrogen fluoride, styrene and many other pollutants.

Our principal conclusion based on the findings of this report is that recent and ongoing operations at SRS are having and may continue to have negative impacts on the health of residents in the central Savannah River area unless sweeping changes are made. Our investigation centered on the atmospheric emissions from smokestacks at SRS and how they affect nearby towns and rural communities. We know that the consequences of contamination have had an impact on people in all directions for hundreds of square miles around SRS. Additional exposure must be reduced and eliminated. Finally, we hold that the additional burdens which would be created by new military production facilities at SRS would be an injustice to the people in this area. Based upon the findings in this report, we make the following recommendations.

We must:

Alert people to the ongoing hazards and half-hearted cleanup under way at SRS. The 50-year remediation program envisioned by the Department of Energy in the 1990's was a more accurate assessment of the task at hand than the current plans of half that duration.

Take whatever steps are necessary to halt the spread of toxic and radioactive pollution of the soil, water and air. The clean up project must be comprehensive and should not trade one type of pollution for another.

Prevent the development and manufacture of new atomic weapons. We must talk about the environmental damages and negative health impacts that would result from a renewed reliance on SRS as a weapons plant. We must question the conventional wisdom that says nuclear deterrence must be maintained, that national security is based on weapons of mass destruction, and that weapons plants are essential to our economy.

Transform SRS into a regional center for clean, renewable energy development. There is excellent potential for wind-powered electric generation off the coast of South Carolina and Georgia that is not visible from scenic beaches. The South Carolina Energy Office says the state spent more than $10 billion for energy last year - 98 percent was imported. Much could be accomplished if just one-tenth of that sum were diverted to in-state energy resources. Let us complete the environmental cleanup of bomb factories and convert SRS to the development and implementation of clean, alternative energy technologies.

Early History

In 1950 the Atomic Energy Commission designated the location for the atomic weapons complex which was then called the Savannah River Plant. Within five years, the basic facilities were in operation and plutonium metal and tritium gas were being produced and delivered for atomic weapons. The principal construction and operations contractor was E. I. du Pont de Nemours and Company which continued as such until Westinghouse took the reins in 1989. Until the end of the Cold War in 1991, nuclear materials for tens of thousands of atomic weapons were manufactured at the Savannah River Plant. The United States produced half the plutonium and most of the tritium in the U.S. nuclear arsenal here.

The purpose of the Savannah River Plant was nuclear materials production and chemical separation of radionuclides. The facilities at SRS included five heavy water nuclear reactors, a nuclear fuel and target fabrication plant, and two chemical plants which separated plutonium-239 and tritium from the irradiated nuclear fuel. Nuclear fuel and targets were irradiated in the reactors, then removed and dissolved in acid. The useful radionuclides, isotopes of uranium and plutonium, were extracted, leaving large amounts of radioactive and hazardous wastes. Between 1953 and 1988 SRS produced approximately 39 tons of plutonium-239 and large volumes of tritium. The principal industrial operations at the Savannah River Plant were:

- fabricating atomic fuel
- extracting and purifying heavy water
- creating plutonium and tritium in atomic reactors
- purifying plutonium and tritium for weapons

The Savannah River Plant had six major operational areas: 1) nuclear production reactors (five designated 100-R, -P, -L, -K and -C), 2) two chemical separations plants located in F-Area and H-Area, called "canyons" because of their shape, 3) tritium production facilities, 4) nuclear fuel and target fabrication plants (M-Area), 5) heavy water production (D-Area), and 6) multiple waste areas including seepage basins for liquids, waste pits and piles for solids, tanks for high-level radioactive wastes (F and H Areas), and landfills for low-level radioactive wastes. Figure A illustrates the production process.

The key processes leading to tritium releases at the SRS included: nuclear reactor operations, recovery of fission products in the separations facilities, recovery of tritium in the tritium facilities, laboratory research processes and the heavy water rework facility. [a]

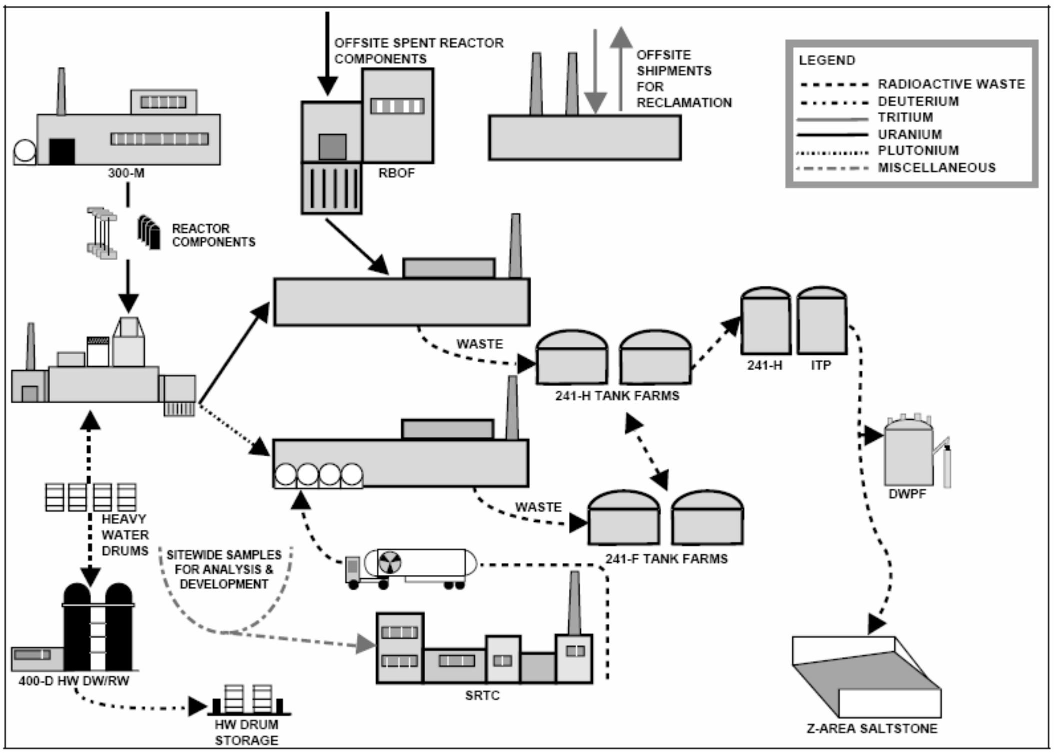

Figure A. Production Process at SRS [b]

How the Major Bomb Plant Units Worked

Nuclear Reactors

Five nuclear reactors operated at the SRS in K-Area, L-Area, P-Area, C-Area, and R-Area. Plutonium and tritium were created in these reactors using uranium and lithium absorption of neutrons. The nuclear fission reactions were moderated with heavy-water which was circulated through heat exchangers to cool the reactors. Heavy water moderates by slowing neutrons thereby increasing amount of fission. Although large amounts of energy were produced, it was an unwanted by-product which was discarded as heat to the Savannah River and two onsite lakes. [a]

Today the five reactors are shut down but some are used for storage: plutonium and highly enriched uranium (HEU) in K-Area, heavy water in C-Area, spent nuclear fuel (SNF) in L-Area and depleted uranium (DU) in R-Area. [c]

Reactor Materials: 300-M Area

M Area was the site for manufacturing nuclear fuel, control rods and nuclear target elements for use in SRS production reactors. Additional products were manufactured for military and research use and space satellites.

> Since 1952, it is estimated that M-Area has used about 13 million pounds of chlorinated solvents to degrease the reactor components produced in the facility (Christensen and Brendell 1981). Much of this solvent material was disposed onsite, and it remains as underground contaminants. Chapter 15 discusses these materials in detail. [a]

The groundwater and soil in M-Area remains heavily contaminated by solvents.

F and H Chemical Separations Areas

Nuclear materials produced in the reactors were transferred to F and H Areas for processing. These areas housed the sole nuclear chemical processing units for US military production. Today, F-Area is closed; H-Area remains operable. [d] The two chemical factories were similar. Each had two process lines which extracted uranium, plutonium, and other fission products. Other facilities in F-Area and H-Area processed the plutonium and uranium into solid form. Liquid fission products were stored in high level radioactive waste (HLW) tank farms in F and H areas. [a] Today, the tank farms hold about 36 million gallons of highly radioactive waste: a mixture of liquified salts and sludges. Also, the Receiving Basin for Offsite Fuel (RBOF) still stores nuclear fuel brought in from other locations. In addition top storage tanks F-Tank Farm and H-Tank Farm contained two evaporator systems. [d]

D Area

From 1953 to 1998 SRS operated a series of heavy water facilities which were located in D-Area —the Rework Unit, the DuPont Water Plant, the Moderator Processing Facility and the Technical Purification Facility. Their principal function was to extract deuterium from river water for use in SRS atomic reactors and to distill tritium from the irradiated water. D-Area also stored water and waste materials. Some tritium was lost to the air and to liquid effluents by evaporation of moderator leaks and carry over of tritium oxide on fuel and target elements during reactor discharge. [a] In 1998 the amount of Tritium waste was estimated to be as high as 16,000 Curies. Plutonium-239 in heavy water at D-Area was estimated by WSRC to be 15.9 grams. Excess levels of potassium permanganate ($KMnO_4$) were also present. [e]

Today groundwater in D-Area is contaminated 30 to 50 feet deep with solvents trichloroethylene, perchloroethylene and cis-dichloroethylene. A large plume with more than 100 parts per billion of TCE is moving towards the Savannah River. [f] Current operations include a coal-fired power plant operated by South Carolina Electric & Gas Company. [g]

Waste Management Areas

SRS operations generated hazardous, radioactive, and mixed radioactive and hazardous wastes. Disposal methods included seepage basins for liquids and burial pits for solid radioactive wastes.

Records indicate that there are over 150 waste sites of which 20 were used for radioactive materials. Fifteen sites were used for mixed hazardous and radioactive wastes (Christensen and Gordon 1983; Looney et al. 1986). [a]

Accidental Releases

Between 1951 and 1989, many accidents occurred at the Savannah River Plant; some involved the melting of reactor fuel while others took place at the chemical separations plants. Many incidents resulted in widespread radiation releases to the atmosphere. [h] The Risk Assessment Corporation's report to the Centers for Disease Control gives us an idea of the magnitude of the contamination:

> The search profile for the TAFFDSRS (TAFFTDSRS 1994) [Tritium Area Facilities Fault Tree Data Storage and Retrieval System] produced a printout listing 2994 incidents for just the five different curie levels (1 to 100 Ci; 100 to 1000 Ci; 1000 to 10,000 Ci; 10,000 to 100,000 Ci; and greater than 100,000 Ci). … Another list of approximately 3000 incidents was printed out under the remainder of the tritium search. … Incidents of tritium releases over 700 Ci were used as the basis for documenting inadvertent releases for this report. [i]

Large amounts of tritium was released in its elemental gaseous form (HT) and in the form of water vapor (HTO):

> A list of "Inadvertent Tritium Releases to the Environment from SRS Operations," found among C. Zeigler's personal files, notes three specific cases of atmospheric releases from reactors: (1) November to December 1961 (20,000 Ci HTO) from P-reactor stack, (2) March to June 1977 (83,000 Ci HTO) from C-reactor, and (3) early in 1978 (62,810 Ci HTO) from C-Reactor stack (Zeigler 1994). [i]

With the end of the Cold War in 1991, nuclear weapons materials production at SRS ended and, except for a brief re-start of the K-Reactor in 1992, the atomic reactors were mothballed.

The Legacy of Radioactive Waste

In the 1980's SRS began environmental restoration activities and the Savannah River Site was placed on the National Priority List, the Superfund. The Department of Energy created the division of Environmental Management in 1989 to handle the environmental damages of weapons production. A separate DOE Office of Future Liabilities was established to manage sites where ongoing projects are located.

Contamination at SRS includes the radionuclides strontium-90, cesium-137, cobalt-60, and tritium; toxic solvents trichloroethylene and tetrachloroethylene; and heavy metals arsenic, cadmium, chromium, mercury, and lead. In addition, 262 radioactive and hazardous waste dumps used for liquids, solids, and ash have these poisons plus thorium, uranium, plutonium-238, and plutonium-239. Trenches in the sand hold 16 million cubic feet of solid low-level radioactive waste, and hundreds of thousands of cubic feet of transuranic waste are stored in temporary facilities.

Much of the radioactive waste at SRS was evaporated, but large amounts remain in the tank farms, seepage basins, and waste pits at SRS. Originally, SRS had 2,800 buildings clustered on 10% of the site. Many of these have been dismantled. The principal facilities remaining include five closed nuclear reactors, two chemical plants, a heavy water plant, a nuclear target plant, a tritium extraction plant, and numerous waste facilities.

Since being put on the Superfund list, the principal activity at SRS has been cleaning up or slowing the spread of soil and water contamination left by decades of industrial weapons manufacturing. Table 1 shows groundwater pollution published in a study done by the US Geological Survey in 1995:

Table 1. Ground-water contamination at the Savannah River Site [j]

Area	**Pollutants**
A and M	Chlorinated volatile organics, radionuclides, metals, nitrate
C, K, L, and P	tritium, other radionuclides, metals, chlorinated volatile organics
D	metals, radionuclides, sulfate, chlorinated volatile organics
R	radionuclides, cadmium
Sanitary landfill	Chlorinated volatile organics, radionuclides, metals
Separations and waste-management areas	tritium, other radionuclides, metals, nitrate, chlorinated volatile organics, sulfate
TNX	Chlorinated volatile organics, radionuclides, pesticides, nitrate

By far the largest amount of radioactivity is stored in rusting underground tanks in the F-Area and H-Area tank farms. For decades waste from the F-Area and H-Area canyons was flushed into 51 steel tanks ranging in size from 0.75 million to 1.3 million gallons capacity each. The Department of Energy reports that:

> Since it became operational in 1951, SRS has produced nuclear material for national defense, research, medical, and space programs resulting in the generation of large quantities of radioactive waste which are currently stored onsite in 49 underground carbon steel waste storage tanks (SRS has a total of 51 underground waste storage tanks). [k]

Since 1951 SRS has generated over 140 million gallons of highly radioactive liquid waste laced with a mixture of salts, acids, metals and solvents. [l] Total potential volume of all the tanks combined was about 58 million gallons, but through the use of evaporators, 104 million gallons of this liquid waste was emitted into the air. Today 36.4 million gallons of liquid and solid wastes are stored in the SRS tank farm. DOE states:

> During the evaporation process, the salt waste is concentrated and forms two distinct phases – concentrated supernate solution and solid saltcake (collectively called salt waste). The solid saltcake is composed predominantly of nitrate, carbonate, aluminate, and sulfate salts and contains relatively small quantities of radioactive material. Because of the relative high solubility of cesium (Cs), the predominant radionuclide present in salt waste, 95% [Ledbetter, L. S., CBU-PIT-2004-00024, *"12/01/04 – December Monthly WCS Curie and Volume Inventory Report,"* Revision 0, December 9, 2004] of the Cs-137 in the salt waste is found in the concentrated supernate solution. As the result of the evaporation process, over 140 Mgal of liquid waste originally received have been reduced to the present volume of 36 Mgal [Ledbetter, L. S., CBU-PIT-2004-00024, *"12/01/04 – December Monthly WCS Curie and Volume Inventory Report,"* Revision 0, December 9, 2004.]. Evaporator operations have been extremely effective in minimizing waste volume stored in SRS waste tanks, but because the majority of the waste has been fully concentrated using the available SRS equipment, significant further reductions via evaporation of the total waste volume stored are not possible. [k]

Four of the 51 original high-level radioactive waste tanks have been emptied and two of those have been closed. Of the remaining 47 tanks, thirteen have leaked. The 27 newer Type III style tanks are in use; the remaining 20 old-style tanks lack secondary containment and await disposition. DOE states:

> In 1997, following approval of closure modules by the State of South Carolina, DOE operationally closed Tanks 17 and 20. On June 30, 2000, the NRC issued to DOE its final Technical Evaluation Report concerning those tanks. [k]

Today, these tanks hold over half the nation's weapons-related high-level radioactive waste: 430 million Curies. This waste is a mixture of liquid and sludge containing long-lived radioactive isotopes, hazardous chemicals, and toxic heavy metals. Of this total, 45% of the radioactivity, 223 million curies, and 93% of the volume, 33.8 million gallons, is in the form of salt waste containing a mixture of Cesium-137 and Strontium-90 and other dangerous radionuclides. DOE states:

> Prior to transfer of the waste material from the F- and H-Canyons, chemicals (sodium hydroxide) are added to adjust the waste to an alkaline state to prevent corrosion of the carbon steel waste tanks. This chemical adjustment results in the precipitation of metals including strontium (Sr) and actinides (e.g., plutonium (Pu)). These solids settle to the bottom of the waste tanks forming a layer that is commonly referred to as sludge. After settling of the solids has occurred, the salt solution (supernate) above this sludge layer is decanted off. In order to maximize the space available in the tanks for storing additional waste, DOE's practice at SRS has been to use the Tank Farm evaporator systems to reduce the volume of the decanted supernate and concentrate the waste. [k]

In 1996 DOE issued a Baseline Environmental Management Report which catalogued the massive cleanup necessary for the nation's defense sites. The Savannah River Operations Office Environmental Restoration Program published baseline information on polluted areas which estimated that SRS had over 1,000 facilities which were potentially contaminated with hazardous and radioactive materials. These areas posed major risks to public health because of continued migration of pollutants which had already contaminated groundwater at SRS. The hazardous pollutants identified included trichloroethylene, tetrachloroethylene, arsenic, cadmium, chromium, lithium, mercury, and lead. Radioactive pollutants included strontium-90, cesium-137, cobalt-60, enriched uranium, plutonium-238, plutonium-239 and tritium. The BEMR projected a massive cleanup operation lasting through mid-century. [m] Table 2 provides a summary of the BEMR cost projections through 2065.

Table 2. 1996 DOE Baseline Environmental Management Report [m]

(Thousands of Current Year Dollars)								
	FY 1996	**1997**	**1998**	**1999**	**2000**			
Savannah River Site	1,389,419	1,231,205	1,413,940	1,471,840	1,564,508	*Grey shaded area reflects annual cost estimates for the first five years of the site BEMR Base Case (as of October 1995) and includes 3% annual inflation, see Readers' Guide.*		
State-wide 1996 Appropriation	1,259,161			*These levels reflect the current estimates for compliance with applicable statutes and agreements (as of March 1996), see Readers' Guide.*				
State-wide 1997 Congressional Request		1,152,346						
(Five-Year Averages, Thousands of Constant 1996 Dollars)								
	FY 1996-2000	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	
Savannah River Site	1,330,905	1,305,762	1,208,301	1,317,708	1,376,731	1,218,920	1,011,915	
	FY 2035	**2040**	**2045**	**2050**	**2055**	**2060**	**2065**	**Life Cycle***
Savannah River Site	621,022	322,875	39,623	62				48,769,120
* Total Life Cycle is the sum of the annual costs in constant FY 1996 dollars.								

The methods employed by DOE in the remediation of surface soils and groundwater at SRS include soil cover, in situ bioremediation, grout, thermal desorbtion, excavation, vacuum extraction and air strippers. The total cost of Savannah River Site characterization, remediation, maintenance, deactivation and disposition from 1996 through 2050 was estimated to exceed $48 billion. [m] The estimated remediation of the nine principal waste areas alone was projected to last through 2045 at a cost of $12.6 billion. [n]

The Federal Facility Agreement of August 16, 1993 listed the affected facilities, detailed the required actions and set deadlines. Applicable federal laws include the National Environmental Policy Act, the Clean Water Act, the Clean Air Act, the Toxic Substances Control Act and the Comprehensive Environmental Response, Compensation, and Liability Act. Also, certain state laws apply including the South Carolina Pollution Control Act, South Carolina Storm-Water Management and Erosion Control Regulations, and South Carolina Solid Waste Regulations. However, the federal clean up effort was short-circuited when tax cuts and budget cutbacks prompted DOE to create the Accelerated Cleanup program. The new plan was supposed to save time and money by removing some of the high-level radioactive waste stored in the F-Area and H-Area Tank Farms, pour a concrete "grout" over the remainder, and abandon them. The DOE's "accelerated" plan defied expert opinion and was contrary to the law. So, DOE convinced Congress to approve Section 3116 of the 2005 National Defense Authorization Act which declared that high-level radioactive waste resulting from re-processing would now be designated "incidental" waste and that above ground storage or burial in a deep repository is no longer required. This provision applies only to waste in South Carolina and Idaho. The very same waste in any other state will still be designated high-level radioactive waste and will have to be sent to a deep geologic repository.

SRS Pollution Continues After Bomb Plants Close

The Savannah River Site is one of the most contaminated radioactive sites on earth. In 1991, weapons manufacturing ended for the most part, but other activities at SRS continue to pollute the air and water. State surveillance of radiation levels anticipate continued emissions of radioactive pollutants from the Savannah River Site:

> Although the reactors at SRS are no longer operating, millions of gallons of highly radioactive liquid waste and thousands of spent fuel elements still pose a significant, long-term environmental risk, which require continued monitoring. Future missions at SRS, including the disassembly and re-processing of plutonium pits and the recovery and recycling of excess plutonium and uranium for mixed-oxide reactor fuel, will also require continued vigilance for many years, due to the long-lived nature of the processed material and possible releases from accidents or reprocessing operations. Another significant mission, which is currently underway, is the production of replacement tritium (H-3), which will be processed and extracted at SRS in the near future. This will likely result in increased airborne H-3 releases to the off-site environment starting around the end of 2004. [o]

SOW THE WIND explores the ongoing pollution of the soil, groundwater, surface water and air at the Savannah River Site.

The land use map in Figure B indicates the principal nuclear and non-nuclear industrial areas and their location in SRS watersheds.

Figure B: SRS Land Use Map [p]

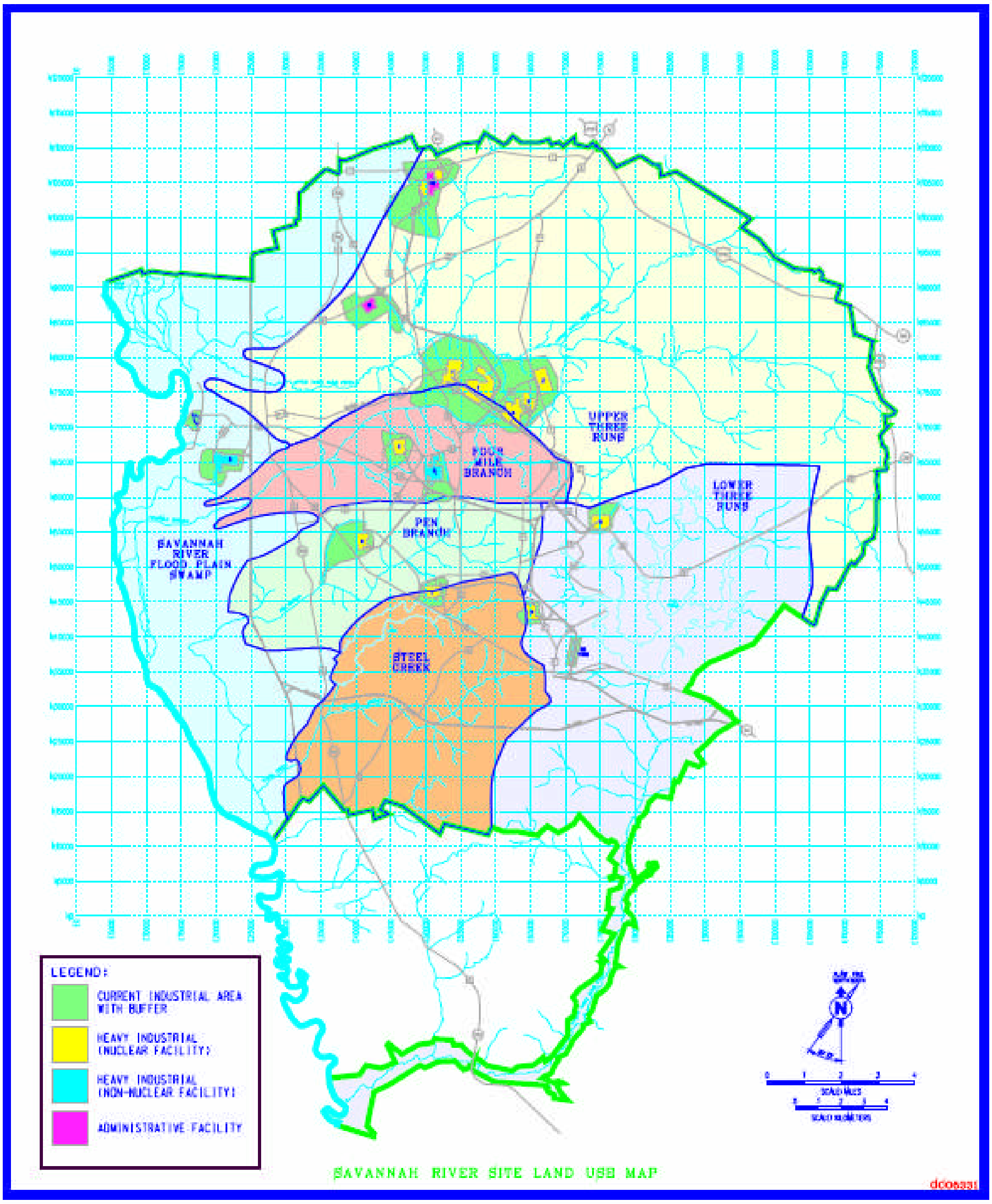

Figure 1 - SRS Land Use Map
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Water Pollution

Contamination of the tributaries and aquifers near the Savannah River Site is fairly well documented. There are upwards of one thousand locations at the Savannah River Site contaminated with radioactive and hazardous substances. Total radioactive releases from SRS to surface and ground water during the last three years are shown in Table 3.

Table 3. Radioactive Liquid Releases

Calendar Year	Curies
2003	4320
2004	2680
2005	2510

By far the greatest amount of radioactive liquid released was Tritium. Other water-borne radionuclides which together contributed less than 1% of the activity included Cesium-137, Iodine-129, Strontium-90, Technetium-99, Uranium-234/235/238, Plutonium-238/239, Americium-241 and Curium-244. [q]

SRS occupies 17 miles of riverbank on the Savannah River and is drained by five streams: Pen Branch, Steel Creek, Four Mile Branch, Upper Three Runs and Lower Three Runs. According to the DOE, SRS has 600 billion gallons of contaminated groundwater underlying about 8,300 acres (4% of the total 198,366 acres). [r] The threat to underground aquifers is great. According to an independent report, "The Savannah River Site is located within the greatest water recharge area on the southeastern seaboard." [s] Moreover, the contamination may not be limited to the South Carolina side of the river. The US geological Survey made extensive studies of the Central Savannah River Area and found that underground water flows into Georgia:

> "Flow lines on potentiometric-surface maps of the confined Dublin and Midville aquifer systems suggest possible occurance [sic] of lateral trans-river flow for a short distance into Georgia prior to discharge into the Savannah River alluvial valley." [t]

The Savannah River Site has a solid waste system plan which allows the continued dumping of low-level radioactive waste. SRS E-Area, a 200-acre facility, permits Engineered Trenches and Slit Trenches for the disposal of so-called low-level radioactive waste. Table 4 lists the DOE's Waste Acceptance Criteria for allowable levels of four radionuclides.

Table 4. DOE Waste Acceptance Criteria

Radionuclide	Slit (Ci/ft^3)	Engineered (Ci/ft^3)
H-3	1.90E-05	1.20E-05
C-14	4.50E-05	2.90E-05
Tc-99	3.20E-06	1.00E-06
I-129	5.30E-09	1.70E-09

Westinghouse Savannah River Company reports that radionuclide content of "non-routine waste" must meet the following to be dumped in these trenches:

> In addition to being non-hazardous and non-TRU, meeting the WAC package guidelines, sum of fractions criteria, and the fissile content criteria (see Sections 4.2.2 – 4.2.5), to avoid special handling, low-level waste must be in a package that has a dose rate less than 200 mrem/hr at contact (Reference 11). Although unlikely to be exceeded, this criterion is probably the one that will be limiting for the disposal of high-curie waste in a LAW container. If there is a possibility that this will be a problem, the high-activity waste should be placed in the center with lower-activity waste on the sides. [u]

A few years ago, the DOE decided that money could be saved by not burying all low-level radioactive waste in vaults. The waste disposal volume of low-level radioactive waste from decommissioning and demolition activities at SRS which has been buried on-site is 2,026,500 cubic feet. [v] Therefore, according to the WAC, 38.5 curies of Tritium, 91 curies of carbon-14, 6.5 curies of technetium-99 may have been added to the underground environment in SRS E-Area in an attempt to clean it up. The practice is ongoing.

Air Pollution

The amount of airborne radioactive pollution from SRS is massive. It is greater than the liquid releases to streams and groundwater by at least an order of magnitude. The relative impact to surrounding communities is less well understood because actual studies of air contaminants are relatively few in number. Also, there is no equivalent of the many municipal water agencies to catalog the quality of the air supply to local residents. Nevertheless, there are some emissions data for radioactive and toxic air pollutants. We have made use of the available information to provide a framework for our investigations.

Industrial facilities which emit air pollutants are regulated by the federal Clean Air Act and must conform to National Ambient Air Quality Standards (NAAQS). In South Carolina, additional regulations are enforced by the SC Department of Health and Environmental Control under Regulation 61-62, Air Pollution Control Regulations and Standards (Sections 48-1-10 *et seq.* of the 1976 South Carolina Code of Laws).

SRS has over 5,000 air emission sources but conducts no surveillance of on-site non-radiological air quality. Instead, SRS utilizes air dispersion modeling to determine compliance with state and federal air pollution regulations [w].

The WSRC Environmental Report issued annually details the radionuclide emissions from SRS, including atmospheric releases. The two basic categories of radionuclide air pollution are gases/vapors—Hydrogen-3, Carbon-14 Krypton-85 and Iodine-129/131—and particulates—Cesium-137, Technetium-99, Uranium-238, etc. Table 5 lists the gaseous and vaporous emissions since the closure of major weapons manufacturing activities.

Table 5. Annual Airborne Radionuclide Emissions (Gases and vapors)

YEAR	Total Curies	H3 (Ci)
1992 [a]		156,000
1993 [a]		191,000
1994 [a]		160,000
1995 [a]		97,000
1996 [a]		55,300
1997 [a]		58,000
1998 [a]	99,700	82,700
1999 [a]		51,600
2000 [a]		44,800
2001 [b]	112,100	47,400
2002 [b]	78,800	47,300
2003 [b]	113,800	50,800
2004 [b]	61,300	61,300
2005 [b]	40,800	40,800
Total		1,144,000

a. Environmental Report for 2001, WSRC-TR-2001-00474
b. Environmental Report for 2005, WSRC-TR-2006-00007

Emissions of radionuclides include primarily H-3, C-14, K-85, and I-129/131/133. Additional radionuclide particulate emissions include Cs-137, Sr-89/90, Pu-241, and Tc-99. Hydrogen-3 (tritium) is typically the major radionuclide quantity emitted and is also considered to have the principal impact on human health.

According to the Centers for Disease Control SRS Health Effect Subcommittee, the radionuclides of concern during air releases are Iodine-131, Hydrogen-3 (tritium) and Argon-141; the most important pathways of ingestion for airborne contamination are through the eating of beef and milk. [x]

Changes in plant operations cause occasional fluctuations in emissions; for example, from 2001 to 2003 krypton-85 emissions were greatly increased: Westinghouse Savannah River Company's 2003 report states:

> Because of increased operations in H-Canyon, the amount of krypton-85 estimated to have been released by the site increased from 31,500 Ci in 2002 to 63,000 in 2003. Krypton-85 accounted for about 56 percent of the total radioactivity released to the atmosphere from SRS operations.
>
> Tritium in elemental and oxide forms accounted for 44 percent of the total radioactivity released to the atmosphere from SRS operations. During 2003, about 50,000 Ci of tritium were released from SRS, compared to about 47,300 Ci in 2002. Because of improvements in facilities, processes, and operations, and because of changes in the site's missions, the amount of tritium (and other atmospheric radionuclides) released generally has declined during the past 15 years at SRS. In recent years, because of changes in the site's missions and the existence of the Replacement Tritium Facility, the total amount of tritium

released has fluctuated but has remained less than 100,000 Ci per year. [y]

According to the Department of Energy's proposed salt waste processing plan, at least 3 million curies of waste is to be stored indefinitely at the Saltstone Disposal Facility at SRS. [z] The plan encompasses the processing of the current waste volume via both the Interim Salt Process, to take place within this decade, and the higher-capacity Salt Waste Process, to commence in 2009. An additional 41.3 million gallons of salt waste would be generated at the SRS Defense Waste Processing Facility by 2020. This waste is to be stored in the F-Area and H-Area Tank Farms and sent to the Salt Waste Processing Facility. The processing of salt wastes involves the evaporation of water and volatile liquids from the high-level nuclear waste tanks. The DOE's salt waste plan includes the emission of 32.2 million gallons of radioactive liquid waste to the air over the next 15 years. [z]

Toxic air pollutants are non-radioactive compounds which are noxious, poisonous or carcinogenic. They include a variety of chlorinated compounds, heavy metals and reduced sulfur gases. Table 6 lists the toxic emissions reported by Westinghouse Savannah River Company in 2002, 2003 and 2004.

Table 6. Annual Emissions of Toxic Air Pollutants (Pounds) (n/d = no data)

Pollutant	**2002 [aa]**	**2003 [bb]**	**2004 [w]**
Acetaldehyde	538	268	10,580
Benzene	9,720	1,798	5,980
1,3 Butadiene	149	74	3,000
Carbon disulfide	3	9	328
Carbon tetrachloride	14	144	12,320
Chloroform	5,040	23,000	3,080
Chromium	<1	<1	3,700
Formaldehyde	1,336	742	24,400
Hexane	1,494	1,502	4,840
Hydrochloric acid	568	442	3,340
Hydrogen sulfide	12,100	12,420	n/d
Methanol	1,766	2,120	1,974
Methylene chloride	1,800	1,790	109,600
Nickel	132	137	2,560
Nitric acid	14,100	12,100	39,400
Ozone	n/d	n/d	10,160
Phosphoric acid	199	7,420	61
Sodium hydroxide	2,540	2,540	2,860
Styrene	5	4	4
Tetrachloroethylene	31,400	21,200	1,110,000
Toluene	8,420	8,260	15,780
1,1,1 Trichloroethane	22,000	19,300	9,880
Trichloroethylene (TCE)	11,840	9,300	312,000
Xylene	6,220	5,860	5,480

Emission monitors on smoke stacks are widely used to determine whether a source of pollution is operating in compliance with the law. However, SRS lacks comprehensive pollution monitoring. Westinghouse states:

> SRS has several sources of toxic air pollutants; however, there are no specific monitoring requirements in their respective permits. Because some toxic air pollutants also are regulated as VOCs [volatile organic compounds], some SRS sources (soil vapor extraction units and air strippers) are required to be monitored by calculating and reporting VOC emissions on a quarterly basis.
>
> Compliance by all SRS permitted sources is determined during annual compliance inspections by the local SCDHEC district air manager. The inspections consist of a review of each permit condition, i.e., daily monitoring readings, equipment calibrations, control device inspections, etc.
>
> Compliance by all toxic air pollutant and criteria pollutant sources also is determined by using U.S. Environmental Protection Agency (EPA)-approved air dispersion models. The Industrial Source Complex Version No. 3 model was used to predict maximum ground-level concentrations occurring at or beyond the site boundary for new sources permitted in 2003. [cc]

A category of large volume air pollutants listed in the federal Clean Air Act as "criteria pollutants" are typically emitted by the burning of fossil fuels: coal, oil and gas. Table 7 lists these pollutants emitted annually from SRS as reported by WSRC:

Table 7. Criteria Air Pollutant Annual Emissions (pounds)

Air Pollutant	**2002** [aa]	**2003** [bb]	**2004** [w]
Sulfur dioxide	1,116,000	1,072,000	4,300,000
Total suspended particulates	430,000	604,000	964,000
PM10	197,200	236,000	378,000
Carbon monoxide	2,440,000	4,580,000	1,964,000
Volatile organic compounds	159,800	186,600	1,088,000
Nitrogen dioxide	612,000	532,000	8,480,000
Lead	694	1,116	316
Hydrogen fluoride	252	228	278

This is a large amount of air pollution which has negative effects on air quality in the region. Table 8 (page 22) lists criteria air pollutants totals as they were reported by WSRC in their Title V air permit application to the South Carolina Department of Health and Environmental Control.

Criteria pollutant data are lower than the annual report totals, indicating that the emission totals compiled for the DHEC permit application underestimated the actual emission levels.

The hazardous air pollutants totals listed in Table 9 (page 22-23) were reported by WSRC in their Title V permit application to the South Carolina Department of Health and Environmental Control.

Table 8. Criteria Pollutants in Permit Application

CRITERIA POLLUTANTS	Pounds/year
Carbon monoxide	97,740
nitrogen oxides	528,590
sulfur oxides	621,778
volatile organic compounds (VOC)	145,146
particulates, total	35,013
PM-10	29,123
FACILITY-WIDE CRITERIA POLLUTANTS	1,428,267

Table 9. Hazardous Air Pollutants in Permit Application

HAZARDOUS AIR POLLUTANT	Pounds/year
Acetaldehyde	212.8
Acetonitrile	2.54
Acrolein	9.2
1,4 aioaxane	2.54
Aniline	2.54
Antimony	0.07
Arsenic	6.59
Benzene	107470.8005
Beryllium	3.58
1,3 butadiene	59.2
Cadmium	13.43
Carbon tetrachloride	2.54
Chlorobenzene	2.6
chromium 6	79.44
Cresols	2.55
Chloroform	22.54
Cobalt	0.73
Cumene	1.4
2,4, dinitrotoluene	2.54
Diphenyl	0.001
ethyl benzene	12.4
Formaldehyde	1088.34
formic acid	2.54
Hexane	417.2
Hydrazine	2.54
hydrochloric acid	62912.94
hydrogen fluoride HF	128.16
Isopropanol	87
Lead	109.152
lead oxide	0.3
Manganese	22.48
manganese oxide	0.005
Mercury	602.33
Methanol	2.54
Methyl methacrylate	2.54
Methyl ethyl ketone	2.54
Methyl isobutyl ketone	2.54

Table 9 continued ***Hazardous Air Pollutants***	Pounds/year
Naphthalene	8.12
Nickel	23.84
nitric acid	50818.5676
oxalic acid	2.54
n-paraffin	2316
Phenol	0.03
polycyclic organic matter	16.28
selenium dioxide	2.54
Selenium	0.74
sodium hydroxide	2.5404889
sulfuric acid	2.54
Styrene	0.32
Tetrachloroethane	2.54
1,1,2,2, tetrachloroethane	2.54
tetrachloroethylene (PCE)	3408
tri-butyl phosphate	53.61
1,1,1 trichloroethane	17.5
Trichloroethylene	2462.54
1,1,2 trichloro-1,2,2 trifluoroethane	1310
2,2,4 trimethylpentane	2.9
Toluene	172.76
vinyl chloride	2.54
Xylene	87.85
FACILITY-WIDE HAP	234010

The above hazardous air pollutant data are historical emissions and permitted pollution limits. But what are the impacts of these pollutants on the environment and public health? In order to determine this, one must rely on testing of the air, soil, water and living things.

Our Findings

Ambient Air Modeling

We calculated the impact on ambient air concentrations of air pollutants emitted from SRS in the nearby towns of Jackson, New Ellenton, Williston, Aiken and at the SRS property line. We based our computer modeling on Westinghouse Savannah River Company air permit application stack data, South Carolina DHEC emissions data, and SCREEN3 gaussian dispersion formulas. Appendix A details our methodology and formulas. Appendix B contains our modeling calculations.

The emissions of toxic air pollution from the exhaust stacks at SRS include nitrogen oxides (NOx), nitric acid (HNO3), volatile organic compounds (VOC), total suspended particulates (TSP), Sulfur oxides (SOx), fine particulates (PM-10), mercury (Hg), hydrogen fluoride (HF) and many other pollutants.

The results of individual and combined pollutant levels indicate harmful levels of pollution outside the boundary of the SRS. The SCREEN3 results are compiled in Appendix B and are condensed in Tables 10 through 14.

Table 10 SRS Property Line

Cm	Facility	Distance (m)	Pollutants
458.6372226	F-SP0023	9388	NOx, HNO3, VOC, TSP, SOx, PM-10
0.0001357	F-SP0256	9242	HNO3
20.9824962	H-SP0002	11523	NOx, HNO3, VOC, TSP, PM-10, Hg, Ni
0.4229316	H-TP0001	11393	TSP, PM-10, VOC, Ni
315.951165	K-PF0002	9036	TSP, SOx, NOx, CO, PM-10,VOC, Pb
85.0646	K-PF0003	9038	SOx, NOx, CO, PM-10, VOC
8.57049937	S-DP0007	10929	NOx, CH2O2, HNO3, SOX, Hg, HF
889.6290505	Total		

Table 11: Jackson

Cm	Facility	Distance (m)	Pollutants
0.00000865	F-SP0256	11120	HNO3
2.46652209	K-PF0002	17680	TSP, SOx, NOx, CO, PM-10,VOC, Pb
0.65988696	K-PF0003	17680	SOx, NOx, CO, PM-10, VOC
1.69749	M-MP0411	4550	HCN
4.8239077	Total		

Table 12: Williston

Cm	Facility	Distance (m)	Pollutants
138.9198188	F-SP0023	27110	NOx, HNO3, VOC, TSP, SOx, PM-10
0.00003706	F-SP0256	27250	HNO3
7.33038344	H-SP0002	24030	NOx, HNO3, VOC, TSP, PM-10, Hg, Ni
0.2359812	H-TP0001	24450	TSP, PM-10, VOC, Ni
146.4862204	Total	24360	

Table 13: New Ellenton

Cm	Facility	Distance (m)	Pollutants
0.00003567	F-SP0256	15550	HNO3
0.5107284	H-TP0001	15880	TSP, PM-10, VOC, Ni
16.42072304	H-SP0002	16090	NOx, HNO3, VOC, TSP, PM-10, Hg, Ni
0.67797	M-MP0411	10720	HCN
4.89201691	S-DP0007	12940	NOx, CH2O2, HNO3, SOX, Hg, HF
22.50147402	Total		

Table 14: Aiken

Cm	Facility	Distance (m)	Pollutants
0.000001192	F-SP0256	30660	HNO3
4.17989588	H-SP0002	31090	NOx, HNO3, VOC, TSP, PM-10, Hg, Ni
0.1205568	H-TP0001	31000	TSP, PM-10, VOC, Ni
4.300453872	Total		

C_m = modeled pollutant concentration in micrograms per cubic meter ($\mu g/m^3$)
Pollutants are listed in descending order of ambient concentration

Radionuclides Detected Outside SRS

Pollution's impact on human health and the environment depends first and foremost on the actual levels of contamination found in the surrounding soil, water and air. These are known as ambient levels. Also, the measurement of pollution in fish, dairy products and wild game provides an assessment of the pollutant's impact caused by ingestion.

Between 2000 and 2002, the Georgia Environmental Protection Department found radioactive tritium, hydrogen-3, many times above background levels within a 400 square mile area around the SRS reservation. The agency concluded that most of this pollution was the result of airborne radionuclides. For example, milk had up to 3 times the tritium expected; air, soil and water pollution was detected up to 5 times above background level; and vegetation was found to contain as much as 13 times the background level.[dd]

In 2003 The Radioactivist Campaign found evidence of radioactive releases into the environment which may have contaminated nearby residential areas. TRAC found Cs-137 in soil samples downwind from SRS as high as 174 picocuries/kg and downstream from SRS in vegetation as high as 1254 pCi/kg. The latter contamination was six times the EPA drinking water maximum of 200 pCi/kg. [ee]

Pollutants Detected By Sampling of Air Outside SRS

In addition to air dispersion modeling, the Blue Ridge Environmental Defense League collected air samples at various points around the perimeter of SRS. We utilized the grab-sample technique and equipment developed by Communities for a Better Environment and Contra Costa (CA) Health Services and certified by the US EPA. Appendix C contains a 2001 US EPA Region 9 quality assurance memo on the program.

We detected a variety of toxic air pollutants outside the boundaries of SRS. League staff and volunteers gathered a series of samples at various locations around SRS in 2004 and 2005. We had the samples analyzed for volatile organic compounds and sulfur compounds at a certified air quality laboratory. [ff].

We had five grab-samples analyzed for twenty sulfur compounds per modified methods SCAQMD Method 307-91 and ATSM D 5504-01 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide were quantitated against the initial calibration curve for methyl mercaptan. Also, samples were analyzed for 45 Volatile Organic Compounds by combined gas chromatograph/mass spectrometry (GCMS) and for tentatively identified compounds utilizing a direct cryogenic trapping technique. The analyses were performed according to the methodology outlined in EPA Method TO-15 modified by the use of Tedlar sample bags.

Our sample collection dates and times are listed in Table 15. The sample numbers in Table 15 correspond to the map locations in Figure C (page 26).

Figure C. Map of SRS With Air Sample Test Sites

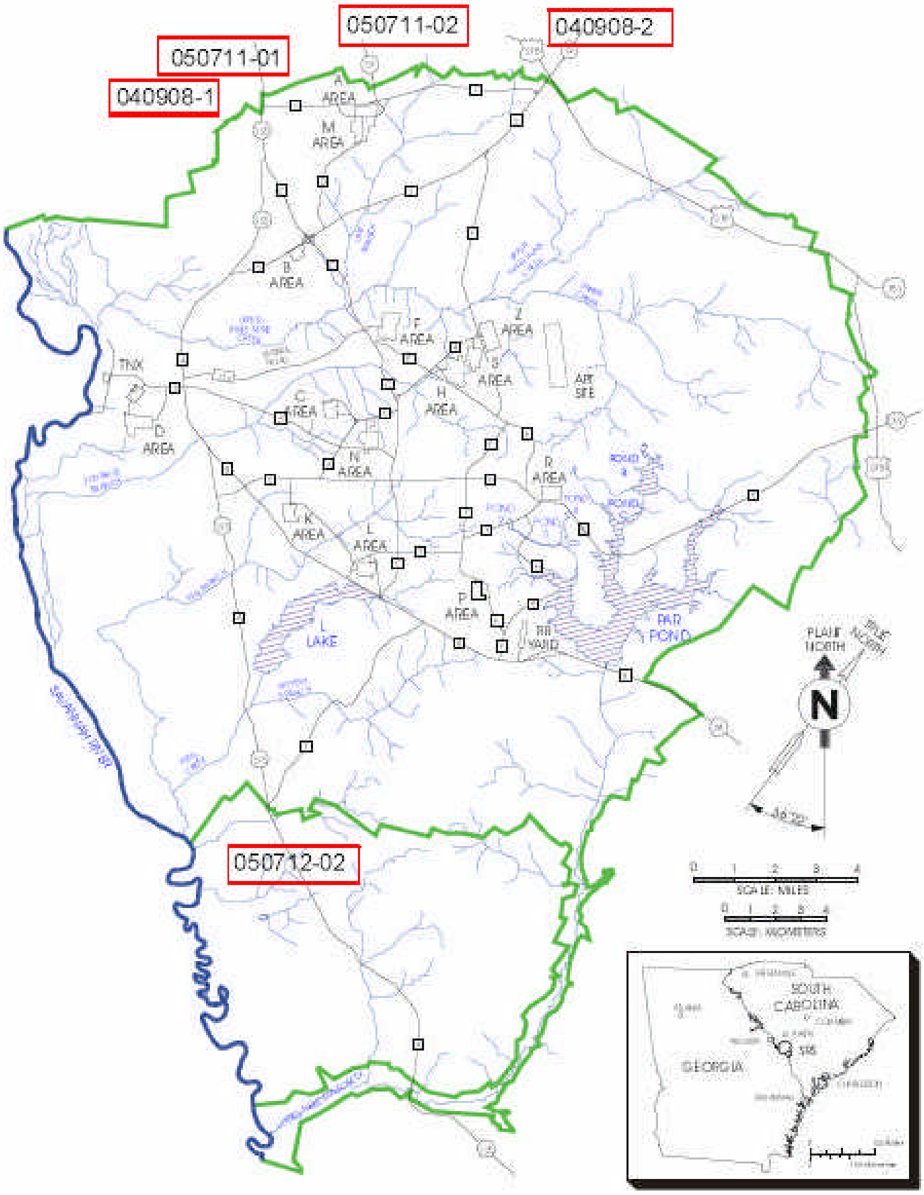


Table 15, Grab Sample Dates, Times, Vicinity

Sample # 040908-1	September 8, 2004 11:42 AM	Jackson
Sample # 040908-2	September 8, 2004 1:49 PM	New Ellenton
Sample # 050711-01	July 11, 2005 5:43 PM	Jackson
Sample # 050711-02	July 11, 2005 6:23 PM	SSR 57
Sample # 050712-02	July 12, 2005 9:42 AM	Hattieville

These tests detected actual ambient levels of a variety if volatile organic and reduced sulfur compounds in the air near SRS. Our results are listed in Tables 16 and 17. All concentrations are in micrograms per cubic meter (μ/m^3).

Table 16. Actual Ambient Concentrations

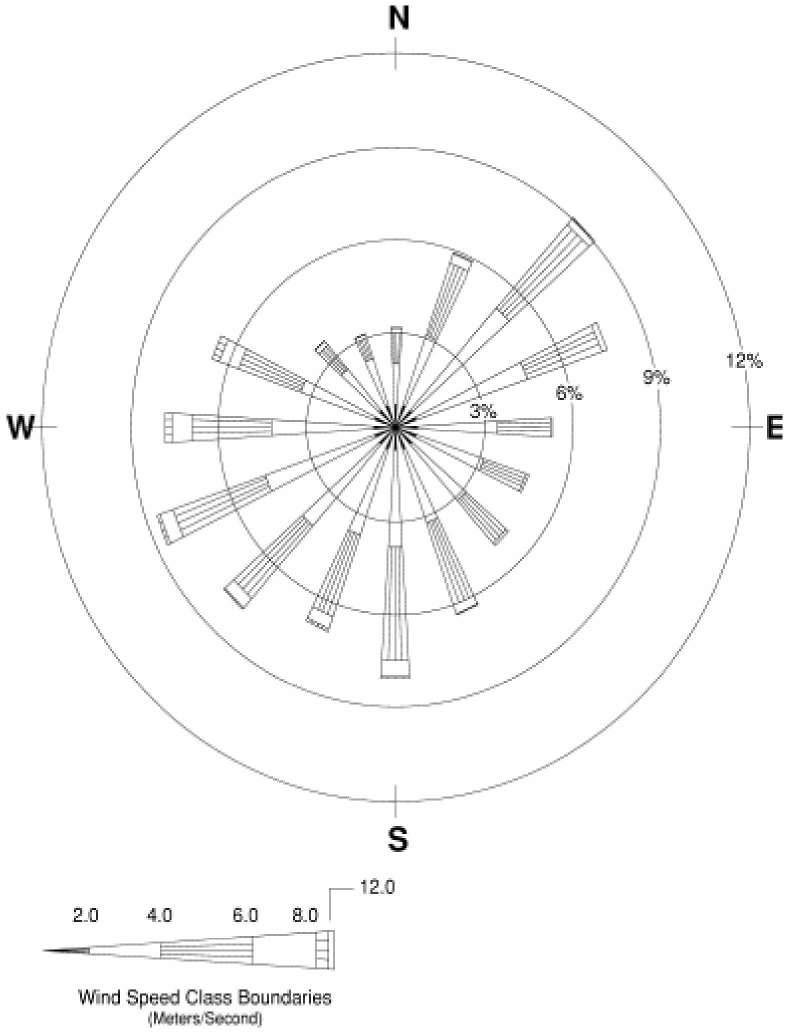
Toxic air pollutant	μ /m^3
Sample # 040908-1	
Hydrogen sulfide	5.13
dimethyl disulfide	10.6
Toluene	8.8
Styrene	7
Sample # 040908-2	
Acetone	36
Sample # 050711-01	
Toluene	19
Styrene	5.5
Sample # 050711-02	
Carbon disulfide	8
Toluene	21
Sample # 050712-02	
carbon disulfide	6.1
Toluene	25

Table 17. Tentatively Identified Compounds (Estimated results)

Toxic air pollutant	μ /m^3
Sample # 040908-1	
2-Methylpentane	10
Isooctane	20
2,4-Dimethylheptane	20
Branched alkanes	10-20
n-Dodecane	30
Isothiocyanatocyclohexane	10
Sample # 050711-01	
Isoprene	50
2-methylpentane	10
$C_{14}H_{30}$ alkane	20
Sample # 050711-02	
Isoprene	20
3-Methylpentane	20

Our grab-sample tests were typically carried out during light, steady wind conditions at points close to but outside of the perimeter of the Savannah River Site. Wind direction at time of each test was downwind from SRS. Reproduced below is a recent annual wind rose plot which records wind speed and direction in the SRS region.

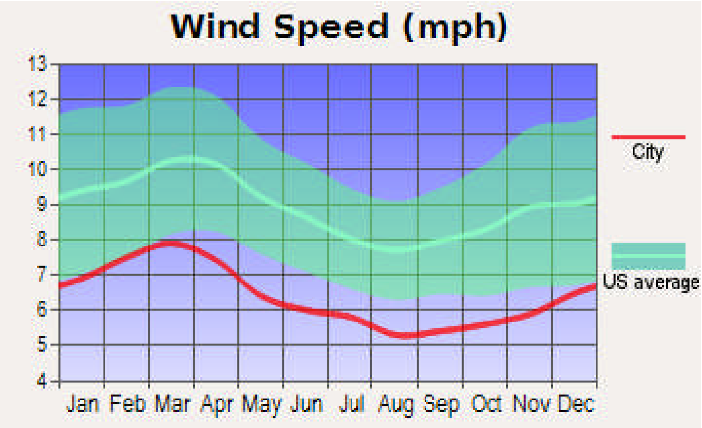
Figure D. Annual Wind Rose Diagram for SRS [ii]



Source: SRS GSAR (WSRC 1999a)

Wind speed in the Aiken-Augusta area averages from 5 to 8 miles per hour, with the high occurring in early Spring and the low in late Summer. An annual wind-speed graph is shown in Figure E (page 29).

Figure E. Annual Wind Speeds [gg]



The evidence of actual ambient levels of volatile organic compounds and reduced sulfur compounds detected in our tests and the computer modeling of stack emissions indicate that adverse levels of pollution are occurring in the communities surrounding the Savannah River Site. This suggests potentially negative public health impacts may be caused by ongoing operations at SRS.

Ambient Levels Traced to SRS Processes

Our air testing program detected styrene in the atmosphere near Jackson, SC (air test results listed in Table 16 above). Our technical experts indicated that styrene would likely have come from polymerization operations. We identified a possible source: the analysis of radioactive sludge which involves the use of polystyrene.

Tests for metals and radionuclides in waste tank sludge utilize X-ray absorption fine-structure (XAFS) techniques. To meet requirements set by the Brookhaven National Laboratory, sludge from SRS is embedded in polystyrene resin for transport. In this process polystyrene resin is heated and poured over the sludge samples. Then tests for mercury, uranium, strontium, cesium, plutonium and other metals are performed. WSRC described the process:

> Testing required the preparation of 20-mg quantities of HLW sludge from Tanks 8F and 11H. … Sludge 8F was dried in an oven at 100 degrees-C prior to use because it was in slurry form. … Once dried, the sludge samples were embedded in a polystyrene resin…. The sample was placed on top of the dried resin and then the remainder of the resin was poured. [hh]

Although no breach of containment was noted in their 2001 study, WSRC did report that gas generation continued for 60 days after embedding of the sludge in plastic. For this reason, technicians elected to use only fresh samples to “reduce risks of sample breaching.” Evidently, the emission of styrene into the air can occur during sample preparation and for many months following preparation. [hh] We believe the most likely source of the styrene detected by our program was this process at SRS.

A Turning Point?

The end of military nuclear materials production at SRS might have led to the end of operations and the beginning of a comprehensive clean up. Other Defense Department nuclear sites have been shut down and turned to non-defense use. But for a variety of reasons, the old bomb plant on the Savannah River is slated for a host of new projects.

In 1993 production began at the new Replacement Tritium Facility and three years later activity at the F-Canyon was re-started. Also, the Consolidated Incineration Facility and the Defense Waste Processing Facility came on-line during this time. In 2000 SRS was selected by DOE for a plutonium fuel factory, a plutonium pit disassembly and conversion plant, and a plutonium immobilization facility. In 2005 the new Tritium Extraction Facility was completed and now receives materials irradiated in civilian power plants. And SRS is a prime candidate for the new bomb factory, the so-called Complex 2030, which would manufacture pits of plutonium, the triggers for nuclear weapons.

Although some of the new operations at SRS are directed at waste processing—DWPF, Salt Waste Processing facility, etc—many of them signify a return to business-as-usual: the manufacture of nuclear weapons components and weapons-related nuclear fuel. These operations include:

Mixed Oxide Fuel Fabrication Facility: The proposed 41-acre plutonium fuel factory located in the F-Area of SRS would convert 37.5 tons of weapons-grade plutonium into a mixed oxide fuel of uranium and plutonium, increasing radioactive emissions from SRS and increasing the health risk to site personnel and the public. The higher neutron flux of plutonium fuel would cause increased embrittlement of reactor parts, making an accident at electric generating power plants using the fuel more likely. Plutonium fuel has greater quantities of plutonium and other hazardous radioactive isotopes such as Americium 241 and Curium 242, actinide elements which would cause additional harmful radiation exposure to the public during an accident.

Tritium Extraction Facility: Tritium producing rods are being irradiated in Tennessee Valley Authority's nuclear reactors and transported to SRS for purification and shipment to the Defense Department for refurbishing thermonuclear weapons. For the first time, an American civilian nuclear power station is producing essential materials for the nation's nuclear weapons stockpile.

Complex 2030: Plutonium pits were formerly manufactured at Rocky Flats, Colorado, infamous for thirty-five years of unsafe operations and costly accidents resulting in massive radiological contamination. Today, the United States is nowhere near a shortage in plutonium warheads. We have a stockpile of approximately 10,700 warheads plus a huge surplus of 13,000-15,000 plutonium pits. The purpose of the Complex 2030 would be to produce new nuclear weapons, prohibited under the Nuclear Non-proliferation Treaty.

All three projects are ill-conceived. Plutonium fuel would make commercial nuclear power plants more dangerous and would exacerbate the problem they are intended to solve. The door between military and civilian nuclear programs opened by the plutonium fuel program has been taken off its hinges by the new Tritium Extraction Facility. The proposed Complex 2030 would be as illegal as it is unnecessary.

Conclusion

SOW THE WIND demonstrates that recent and ongoing operations at SRS are having and will continue to have a negative impact on the health of residents in the region. Our investigation centered on the air toxics which are emitted from large and small exhaust stacks at SRS and how they interact to cause excessive downwind pollution levels in the towns of Jackson, New Ellenton, Williston and rural communities. We conclude that the additional burdens which would be created by new facilities at SRS would be an injustice to the people in this area.

The airborne emission of dangerous radionuclides has had and will continue to have a negative impact on the health of people living in the Central Savannah River Area, especially children and the unborn who are particularly vulnerable to radiation. Additional exposure to the region must be reduced and eliminated.

DOE's Accelerated Cleanup and so-called Cleanup Reform Vision at SRS are shortsighted; they are not reform and will not result in a cleanup. The National Academies of Science rightly said:

> No plan developed today is likely to remain protective for the duration of the hazards. Instead long-term institutional management requires periodic, comprehensive evaluation of those legacy waste sites still presenting risk to the public and the environment to ensure they do not fall into neglect and that advantage is taken of new opportunities for further remediation. [jj]

Decontamination work was originally predicted to take 40 years, a time equal to the period of weapons production. This estimate was more conservative and may yet prove to be more accurate than the Pollyanna predictions of the DOE's "risk-based end states."

A Vision for the Future

For over half a century, the manufacture of nuclear weapons has sown the wind. The whirlwind of the atomic age has left behind it landscapes scarred with zones of radioactive pollution which will remain dangerous for centuries. Something must now be done to avert the terrible consequences of ignorance, negligence and incompetence.

We must take every opportunity to clean up atomic weapons pollution at the Savannah River Site. Our best minds should be directed in the service of reducing the existing hazards without creating new sacrifice zones in other communities.

Finally, we must halt the construction and operation of new and dangerous weapons plants. An outcry from the people in this region can stem the tide of irresponsible proposals coming from the nuclear industry and its supporters. Resolute, persistent and principled opposition to the merchants of death must guide our campaign.

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