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BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Honorable
Ernest F. Hollings,
United States Senate

Department Of Energy Acting To Control Hazardous Wastes At Its Savannah River Nuclear Facilities

Since the Department of Energy's (DOE's) discovery in 1981 that the groundwater beneath the fuel fabrication facility at its Savannah River Plant was contaminated with nonradioactive hazardous wastes, DOE has taken several steps to clean up the problem and to prevent future environmental damage. There is no evidence that contaminants from small amounts of wastes reaching the deep Tuscaloosa Aquifer--a source of drinking water for much of the Southeast--have migrated offsite. DOE has implemented a 20-year plan to remove the wastes from the upper level groundwater. It has also begun to identify and monitor other waste disposal sites within the plant's boundaries and has developed an environmental action plan that prioritizes work necessary to prevent future problems. In addition, DOE has entered into formal agreements with the Environmental Protection Agency and the state of South Carolina to increase coordination on nonradioactive waste disposal matters at the Savannah River Plant.



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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-216332

The Honorable Ernest F. Hollings
United States Senate

Dear Senator Hollings:

In response to your request, this report provides our evaluation of the Department of Energy's efforts to control and cleanup groundwater contamination from hazardous wastes at the Department of Energy's Savannah River Plant.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this report. At that time, we will send copies to the Chairmen of the House Committee on Government Operations, Senate Committee on Governmental Affairs, and Senate Committee on Energy and Natural Resources; the Administrator of the Environmental Protection Agency; and other interested parties.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "J. Dexter Peach".

J. Dexter Peach
Director

10

D I G E S T

The Department of Energy's (DOE's) Savannah River Plant produces nuclear materials for the nation's defense program. The plant's five nuclear reactors and several large processing facilities are located on a 300-square-mile tract in South Carolina bordering the Savannah River near Augusta, Georgia.

Since the plant opened in 1952, E.I. du Pont de Nemours and Company (Du Pont), the on-site DOE contractor, has disposed of large amounts of radioactive and nonradioactive wastes within the plant's boundaries. For many years nonradioactive wastes, including hazardous chemicals, were often deposited in seepage basins¹ or buried in sealed containers. DOE, Du Pont, and environmentalists for many years considered these methods to be efficient and acceptable means of disposal. In some instances, however, they proved inadequate to protect the underlying groundwater and the surrounding environment. In June 1981 Du Pont discovered that the groundwater underlying the seepage basin that receives liquid chemical wastes from the fuel fabrication facilities was contaminated with suspected carcinogens. (See p. 1.)

GAO performed this review in response to Senator Ernest F. Hollings' July 21, 1983, request, which asked GAO to determine (1) what steps DOE has taken or plans to take to clean up existing groundwater contamination at the Savannah River Plant, (2) what information is available on the past disposal of hazardous wastes at the Savannah River Plant, (3) what actions DOE has taken or plans for monitoring and preventing future problems, and (4) how well DOE is coordinating with the Environmental Protection Agency (EPA) and other federal and state agencies on Savannah River Plant hazardous waste matters. (See p. 5.)

GAO found that while wastes discarded in that part of the plant known as the M-Area (the fuel

¹Ponds or impoundments, either natural or manmade, intended for disposing waste liquids into the ground by percolation through the basins' bottoms and sides.

fabrication plant) have contaminated groundwater in the immediate vicinity, to date they have had no impact outside of the Savannah River Plant boundaries. DOE and Du Pont have taken actions to clean up the M-Area. In addition, since 1981 DOE and Du Pont have acted to identify and monitor other sites at the Savannah River Plant where wastes were disposed of, and have prepared an environmental action plan that prioritizes work needed to prevent further environmental damage. DOE has also established formal agreements to improve coordination with EPA and South Carolina officials in dealing with hazardous waste disposal.

IDENTIFYING AND CLEANING UP
GROUNDWATER CONTAMINATION
IN THE M-AREA

DOE and Du Pont officials stated that the contamination of the M-Area groundwater is the most serious environmental threat caused by nonradioactive hazardous wastes at the Savannah River Plant. Wastes from the fuel fabrication facilities, including 3.5 million pounds of organic solvents used to strip grease from metal fuel assemblies, have been discharged into the M-Area seepage basin since 1958. EPA has since determined that these solvents are hazardous and suspected carcinogens. DOE officials said that while most of these substances probably evaporated upon disposal, unknown quantities did seep into the ground from the M-Area seepage basin. Once underground, solvents readily permeate groundwater systems. (See p. 8.)

After the initial discovery of solvents in the M-Area groundwater, Du Pont, the South Carolina Department of Health and Environmental Control, and a groundwater consultant conducted a series of tests throughout 1982 and 1983 to determine the extent of the contamination. Tests showed that concentrations exceeding existing drinking water (but not groundwater quality) standards adopted by DOE have contaminated groundwater beneath the M-Area in the geological strata above the large, deep Tuscaloosa Aquifer. This aquifer provides drinking water to a large part of the Southeast. (See p. 3.) EPA is preparing federal standards for many hazardous wastes, including the solvents, but could not state when they will be finalized. South Carolina is also working on hazardous waste standards. (See p. 11.)

Subsequent investigations by Du Pont and the consultant also revealed that much smaller amounts of solvents have seeped down into the Tuscaloosa Aquifer through the defective linings of two of the four wells providing drinking and process water to the M-Area. According to the groundwater consultant, very small amounts of the solvents entered the Tuscaloosa and the contamination has been limited to the water in and immediately around the two water wells. (See p. 12.)

Since discovery of the contamination, DOE and Du Pont have undertaken several initiatives to clean up and prevent future contamination of the M-Area. Steps have been taken to reduce the discharge of pollutants to the seepage basin, and DOE and Du Pont have initiated a 20-year plan to remove the solvents already in the underlying groundwater by pumping the contaminated water to the surface and exposing it to the air so that the volatile solvents will evaporate. Total cost of the M-Area cleanup is estimated to be \$49 million to \$54 million, plus annual operating costs. (See pp. 14 and 15.)

DOE ACTING TO IDENTIFY, MONITOR,
AND PREVENT OTHER HAZARDOUS WASTE
PROBLEMS AT THE SAVANNAH RIVER PLANT

Spurred by the discovery of contaminants in M-Area groundwater and the increased attention of South Carolina environmental officials, Du Pont initiated efforts in 1982 to identify all waste disposal sites at the Savannah River Plant. These efforts identified 153 sites, including 68 seepage basins, where radioactive and nonradioactive wastes have been disposed of or stored since the plant began operating in 1952. Of this total, 118 sites contain nonradioactive wastes, 15 contain both radioactive and nonradioactive, and 20 just radioactive. Although some information on the kinds of wastes disposed of at each site is available, accurate records on the specific types and quantities of nonradioactive chemicals and other hazardous wastes disposed at most sites were not maintained or required. At the time of disposal, little was known about the potential future impact of these wastes. (See p. 18.)

Existing studies made by South Carolina and a private institution have concluded that, to date,

hazardous waste disposal at the Savannah River Plant has had little impact outside its boundaries. The M-Area problem has demonstrated, however, the impact of hazardous waste disposal on-site and the potential for widespread problems. It has also led to the realization that very little information is available on the extent to which contamination exists near many of the disposal sites, or on the potential of the pollutants to migrate off-site where they could affect drinking water. (See p. 22.)

Du Pont is collecting additional information through an expanded monitoring program and has identified projects designed to protect the Savannah River Plant environment in a comprehensive draft environmental action plan issued in October 1983. The plan identifies each emission or discharge to the environment at the Savannah River Plant along with a priority for proposed action based on existing information. DOE states that the plan will be continually revised as new data indicate the need for different priorities. (See p. 23.)

Although work on identifying the priority project list for all environmental concerns is not complete, an implementation plan has been developed for groundwater-related projects. This plan, issued on April 4, 1984, contains a priority listing of groundwater concerns, proposed remedial action projects, and an expanded groundwater monitoring program that requires installing monitoring wells at disposal sites where none currently exist or where the existing ones are insufficient. (See pps. 23, 24).

DOE and Du Pont are also planning, over the next several years, to: (1) decommission 36 of the 68 seepage basins located on-site, (2) build at least four process wastewater treatment facilities, (3) excavate buried hazardous materials for incineration or redrumming, and (4) construct hazardous waste storage and incinerating facilities. Capital and operating funds needed for these projects are estimated at over \$117 million. (See p. 25.)

In fiscal year 1984 DOE expects to obligate about \$97 million for Savannah River Plant environmental projects and has requested \$73.6 million for the Savannah River Plant environmental program in

fiscal year 1985. These amounts are over 10 times greater than the budget for fiscal year 1983, which totaled \$7.1 million. (See p. 18.)

COORDINATION BETWEEN DOE, EPA,
AND SOUTH CAROLINA IMPROVING

Until hazardous waste regulations were developed and authority for their enforcement passed from EPA to the state, little coordination on hazardous waste matters between the Savannah River Plant, South Carolina, and EPA regional officials was required. Following that delegation, which began in 1980, DOE's concerns about security, and its view that DOE was exempt from regulation by EPA under the Resource Conservation and Recovery Act of 1976--the nation's most important hazardous waste act--hindered coordination. DOE stated that EPA regulation under the act would be duplicative and inconsistent with DOE's authority and activities under the Atomic Energy Act of 1954. (See p. 28.)

DOE's desire to restart one of the Savannah River Plant's production reactors--shut down since 1968 because of reduced production demands--led to a formal agreement between the Secretary of Energy and South Carolina in April 1983 calling for an increased DOE commitment to hazardous waste management at the Savannah River Plant. Following that agreement, coordination improved. For example, during a December 1983 workshop on the M-Area groundwater contamination problem, Du Pont and DOE officials agreed that the state has the regulatory lead for this program. In addition, state officials are now provided timely access for on-site monitoring and inspection. (See pp. 31 and 32.)

At the national level, EPA and DOE signed a memorandum of understanding in February 1984 that addressed the longstanding question of the degree of oversight EPA has over DOE's program for the management of hazardous and mixed wastes. Under the terms of the memorandum, DOE agreed to comply with the technical provisions of the Resource Conservation and Recovery Act. Following that agreement a federal district court ruled in April 1984 that the act applies to DOE's nonradioactive hazardous wastes at atomic energy facilities at Oak Ridge, Tennessee. DOE officials have now concluded that this is a precedent-setting case for all atomic energy facilities and as of July 1984 were

meeting with EPA officials to formalize EPA and DOE responsibilities under the act. (See pps. 29, 30.)

AGENCY COMMENTS

DOE and EPA stated that GAO's report was an accurate summary of the progress being made in managing hazardous wastes at the Savannah River Plant. DOE noted however, that its Savannah River Operations Office took strong initiative in interacting with the South Carolina Department of Health and Environmental Control while formulating its hazardous waste management program. DOE stated that this aggressive program of cooperation was not evident in the report. (See pp. 34 and 36.) The South Carolina Department of Health and Environmental Control stated that GAO's report did not adequately describe the leadership its office provided in initiating much-needed changes within the Savannah River Plant's hazardous waste program. (See p. 37.)

It is very difficult to attribute the source of the impetus behind many of the steps taken to control hazardous wastes at the plant. In many cases, it was not possible to clearly identify which institution took the lead at any one point in time. GAO's report recognizes the contributions of DOE, Du Pont, and South Carolina to the extent they are identifiable and measurable.

The South Carolina Department of Health and Environmental Control comments also emphasized the scope of the hazardous waste problem at the Savannah River Plant from its perspective. In particular, it highlighted the amount of resources needed to carry out the state's delegated environmental responsibilities at the Savannah River Plant. (See p. 37).

DOE, EPA, and the state also had several technical comments that have been incorporated into the report. Appendixes I, II, and III contain the complete text of the DOE, EPA, and South Carolina comments.

C o n t e n t s

	<u>Page</u>
DIGEST	i
CHAPTER	
1 INTRODUCTION	1
Nonradioactive waste disposal at SRP	1
Environmental legislation directed toward regulating hazardous wastes	3
Objectives, scope, and methodology	5
2 DOE WORKING TO CLEAN UP M-AREA GROUNDWATER CONTAMINATION	8
Groundwater contamination confined to the M-Area	8
Cleanup efforts in the M-Area	14
3 DOE ACTIONS TO IDENTIFY, MONITOR, AND CLEAN UP OTHER HAZARDOUS WASTE PROBLEMS	18
Limited data available on disposed SRP hazardous wastes	19
Environmental impact from hazardous wastes limited to SRP, but largely unknown	22
SRP's environmental action plan	23
Other ongoing and planned environmental projects	25
Conclusion	26
4 COORDINATION BETWEEN DOE, EPA, AND SOUTH CAROLINA IMPROVING	27
Resolution of RCRA application to DOE facilities	28
Coordination between DOE, regional EPA, and state officials	30
Conclusion	33
Agency comments	33
APPENDIX	
I Letter dated July 17, 1984, from DOE's Assistant Secretary, Management and Administration	34
II Letter dated July 24, 1984, from EPA's Assistant Administrator for Policy, Planning, and Evaluation	35
III Letter dated July 13, 1984, from the South Carolina Deputy Commissioner for Environmental Quality Control	37

ILLUSTRATIONS

The Savannah River Plant	2
Tuscaloosa Group Formation	4
M-Area Seepage Basin	9
SRP Fuel Fabrications Facility (M-Area)	10
M-Area Contaminated Water Well	13
50-Gallon-per-Minute Demonstration Air Stripper	16
Major Waste Disposal Areas at the Savannah River Plant	20

ABBREVIATIONS

DOE	Department of Energy
EPA	Environmental Protection Agency
GAO	General Accounting Office
RCRA	Resource Conservation and Recovery Act of 1976, as amended
SRP	Savannah River Plant
PCE	tetrachlorethylene
TCE	trichlorethylene
TCI	1,1,1-trichloroethane

CHAPTER 1

INTRODUCTION

The Department of Energy's (DOE's) Savannah River Plant (SRP) produces plutonium, tritium, and other special materials for use in the nation's defense program. Major facilities at SRP include five nuclear production reactors, two large plutonium/uranium separations plants, a fuel fabrication plant, a heavy water production plant, and the Savannah River Laboratory. These, along with several support facilities, are located on 300 square miles on the Savannah River in South Carolina, near Augusta, Georgia. (See map, p. 2.) Construction of the initial plant began in 1951, with operations beginning in August 1952. SRP's fiscal year 1984 budget totals almost \$1.1 billion.

E.I. du Pont de Nemours and Company (Du Pont) has operated SRP under a nonprofit contract since the plant was built. Du Pont, which employed almost 10,000 people at SRP as of December 1983, handles on-site research and development, engineering, and construction, and operates the production and processing facilities. All production costs and program activities, including environmental cleanup measures, although sometimes initiated by Du Pont, are overseen and paid for by DOE. DOE's Savannah River Operations Office, with a staff of 254 as of December 1983, administers and monitors Du Pont's operations.

NONRADIOACTIVE WASTE DISPOSAL AT SRP

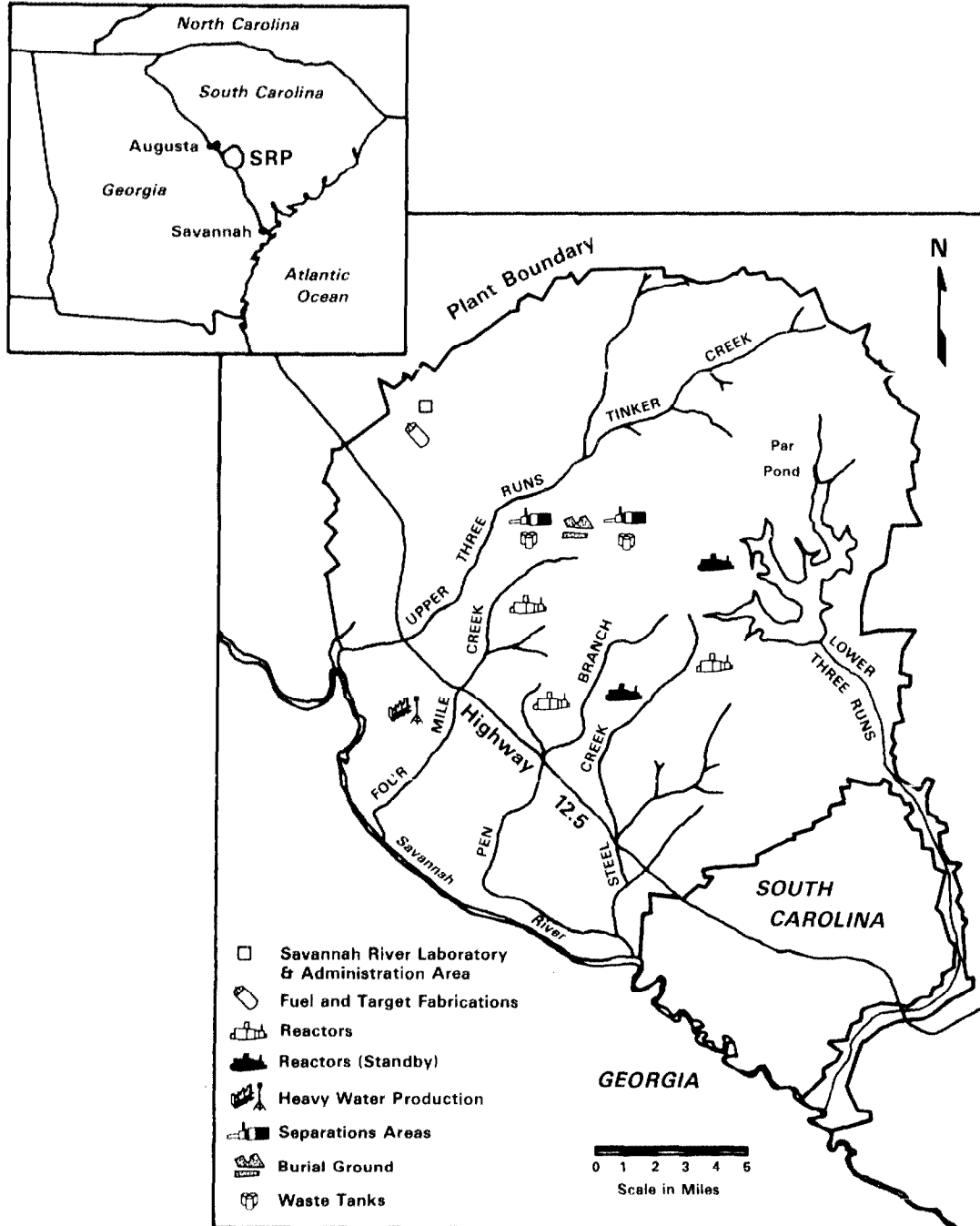
From the beginning of SRP operations, the plant has used a variety of materials and chemicals in its production processes that have resulted in large quantities of radioactive wastes and nonradioactive waste chemicals, metals, and other materials. Some wastes contain both radioactive and nonradioactive components. Programs to control, monitor, and store radioactive wastes at SRP have been in effect since the plant's inception. For example, high-level radioactive liquid wastes are stored, separated, and monitored in large, underground carbon-steel tanks at SRP.

The disposal of nonradioactive wastes at SRP has not been as extensively monitored as has that of radioactive wastes, mainly because for many years the dangers of groundwater¹ contamination and other potential environmental damage from chemicals and other nonradioactive wastes were not well recognized. Initially some nonradioactive wastes were even dumped into local streams. Since

¹Groundwater is water that flows through porous rock and other sedimentary material in the ground. Aquifers are rock materials that store, transmit, and yield water in usable quantities. Aquifers can be separated from each other at various depths by consolidated (less porous) rock or clay.

Figure 1

Savannah River Plant



The Savannah River Plant in South Carolina is about 150 miles northwest of Savannah, Georgia, and about 25 miles southeast of Augusta, Georgia. It was designed and built and is operated by E. I. du Pont de Nemours and Company for the federal government.

Source: DOE.

the late 1950's, however, nonradioactive wastes have mostly been disposed of on-site in seepage basins and wastes pits, or buried in drums. Seepage basins are waste ponds or impoundments, either natural or manmade, intended for disposing liquids into the ground by percolation through the basins' bottoms and sides. It was thought that the sand and gravel under the basins would filter out harmful chemicals and other materials as the liquids seeped into the ground.

During the 1950's and 1960's, these disposal methods, including the use of seepage basins, were considered acceptable and efficient means of chemical and other nonradioactive waste disposal. Over time, and throughout the country, however, these methods have often proved to be inadequate to protect underlying groundwater and the surrounding environment. Such was the case at SRP.

In 1981 Du Pont discovered during routine monitoring that the groundwater under the seepage basin serving the SRP fuel fabrication plant, known as the M-Area, was contaminated with suspected carcinogens. Subsequent testing led to suspicions that the large Tuscaloosa Aquifer that underlies SRP had also been contaminated. As shown on the map on page 4, what is generally known as the Tuscaloosa Aquifer is actually a group of interconnected aquifers known as the Tuscaloosa Group Formation. East of central Georgia it is called the Middendorf Formation. Outcrops, such as surface streams that originate in the underground aquifer, extend into a large portion of the Southeast. The Tuscaloosa Aquifer also provides drinking water to a large portion of the Southeast. Water from the Tuscaloosa formation under the SRP site generally outcrops into the Savannah River and is hydrologically separate from other geographic areas.

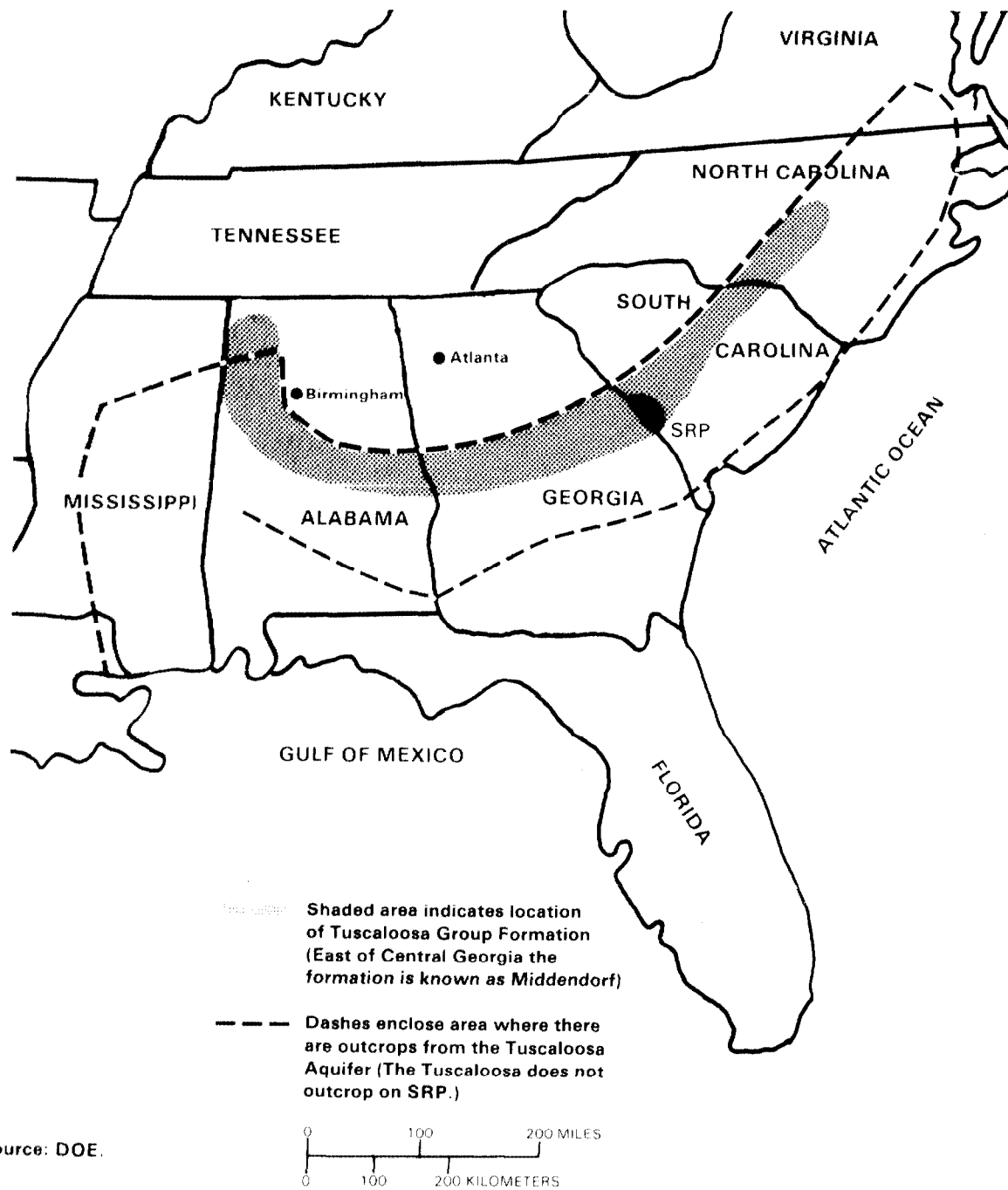
ENVIRONMENTAL LEGISLATION DIRECTED TOWARD REGULATING HAZARDOUS WASTES

Since the dangers associated with nonradioactive wastes and their potentially harmful effect on groundwater were not generally recognized until the early 1970's, specific legislation to control the dumping of wastes on land to protect groundwater and wildlife was not enacted until the Resource Conservation and Recovery Act of 1976 (RCRA) was passed. Although previous solid waste laws were in effect, existing environmental legislation largely addressed the discharge of pollutants to the air or in water only.

Even now, a comprehensive national groundwater protection policy does not exist, although six federal laws, including RCRA, address specific contamination problems. The Environmental Protection Agency (EPA) has issued a draft groundwater protection strategy placing primary responsibility on the states, and the Congress is currently considering establishing a commission to

Figure 2

Tuscaloosa Group Formation



Source: DOE.

assess the roles of federal, state, and local governments in protecting groundwater.²

Under RCRA, EPA has authority to regulate the management, transportation, and disposal of hazardous wastes. RCRA defines hazardous wastes as nonradioactive substances that may be harmful to man or may degrade the quality of groundwater. Natural radioactive materials and some specially produced radioactive materials are also subject to RCRA authority. EPA also states that RCRA applies to radioactive wastes that are mixed with hazardous materials. (See p. 30.)

Following the passage of RCRA, EPA deliberated the definition of hazardous wastes and the regulatory program it would establish. For example, EPA officials said that they did not publish their initial list of hazardous wastes until December 18, 1978. In May 1980 that list was expanded; EPA further defined a list of over 300 hazardous substances under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, known as "Superfund."

OBJECTIVES, SCOPE, AND METHODOLOGY

In a letter dated July 21, 1983, Senator Ernest F. Hollings requested that we determine (1) what steps DOE has taken or plans to take to clean up existing SRP groundwater contamination, (2) what information is available on past dumping of chemical and heavy metal³ wastes at SRP, (3) what DOE plans to do to monitor and prevent future problems, and (4) how well DOE has coordinated with EPA and other federal and state agencies, especially the South Carolina Department of Health and Environmental Control, on hazardous waste matters. Senator Hollings also asked us to address several SRP nuclear health and safety questions. These questions were examined in a separate review.

Our review focused on SRP's hazardous waste management controls. Although large amounts of radioactive wastes are also generated during SRP operations, separate programs, and in many cases, separate locations have been established for the disposal of these wastes. We did not examine radioactive waste management at SRP in this review.

To address Senator Hollings' concerns, we performed work at SRP in South Carolina; at DOE and EPA headquarters in

²For more information on U.S. groundwater clean-up programs, see our Feb. 21, 1984, report, Federal and State Efforts to Protect Ground Water (GAO/RCED-84-80).

³Chemical elements such as mercury, lead, and cadmium that are generally metallic and can cause substantial harm to human health or to the environment.

Washington, D.C.; at EPA's Region IV office in Atlanta, Georgia; and at South Carolina's Department of Health and Environmental Control and the U.S. Geological Survey's field office, both in Columbia, South Carolina.

To determine what is being done to clean up hazardous wastes at SRP, we discussed the M-Area cleanup operation and other environmental action projects with DOE headquarters and SRP officials and with Du Pont representatives. We also discussed with state and EPA regional officials the appropriateness of DOE plans to clean up groundwater at SRP. In addition, we discussed the SRP situation with officials of Geraghty and Miller, Inc., groundwater consultants who have performed groundwater contamination studies for DOE at SRP.

To determine what information is available on chemicals and other hazardous wastes disposed of at SRP, and to assess their impact on groundwater contamination, we held discussions with responsible DOE and Du Pont officials at SRP. We also reviewed relevant studies, including the Savannah River Laboratory's Technical Summary of Groundwater Quality Protection Program at Savannah River Plant.

To ascertain what is being done to monitor and prevent future SRP hazardous waste environmental problems, we discussed environmental action planning and monitoring procedures with SRP, Du Pont, and state officials. We obtained and reviewed copies of SRP environmental action plans. We also reviewed DOE procedures for monitoring and analyzing groundwater samples and discussed with DOE environmental officials their overview of Du Pont's activities in the environmental protection area.

To address the extent of coordination between DOE, EPA, and other federal and state agencies, we met with EPA Region IV officials to determine their role in monitoring environmental control programs at SRP. Because EPA has delegated to South Carolina's Department of Health and Environmental Control all but final authorization to administer the state hazardous waste program, we limited our work at EPA to determining whether and how EPA assured itself that South Carolina was fulfilling its responsibilities under RCRA.

We discussed with South Carolina environmental officials (1) the extent to which hazardous waste activities at SRP are being monitored, (2) the documentation generated on SRP's hazardous wastes program, and (3) the coordination of its activities with EPA. We reviewed reports generated by the state in the process of carrying out its oversight role. We also obtained copies of pertinent South Carolina legislation pertaining to hazardous wastes and groundwater protection.

To understand the issues involved in the application of EPA's RCRA regulations to DOE facilities, we interviewed DOE

headquarters officials in the offices of Operational Safety and the General Counsel and EPA officials in EPA's Office of Federal Activities and Office of General Counsel. We also reviewed related court documents, correspondence, and reports explaining each agency's stand on this issue.

We conducted our review between October 1983 and January 1984 in accordance with generally accepted government auditing standards.

CHAPTER 2

DOE WORKING TO CLEAN UP

M-AREA GROUNDWATER CONTAMINATION

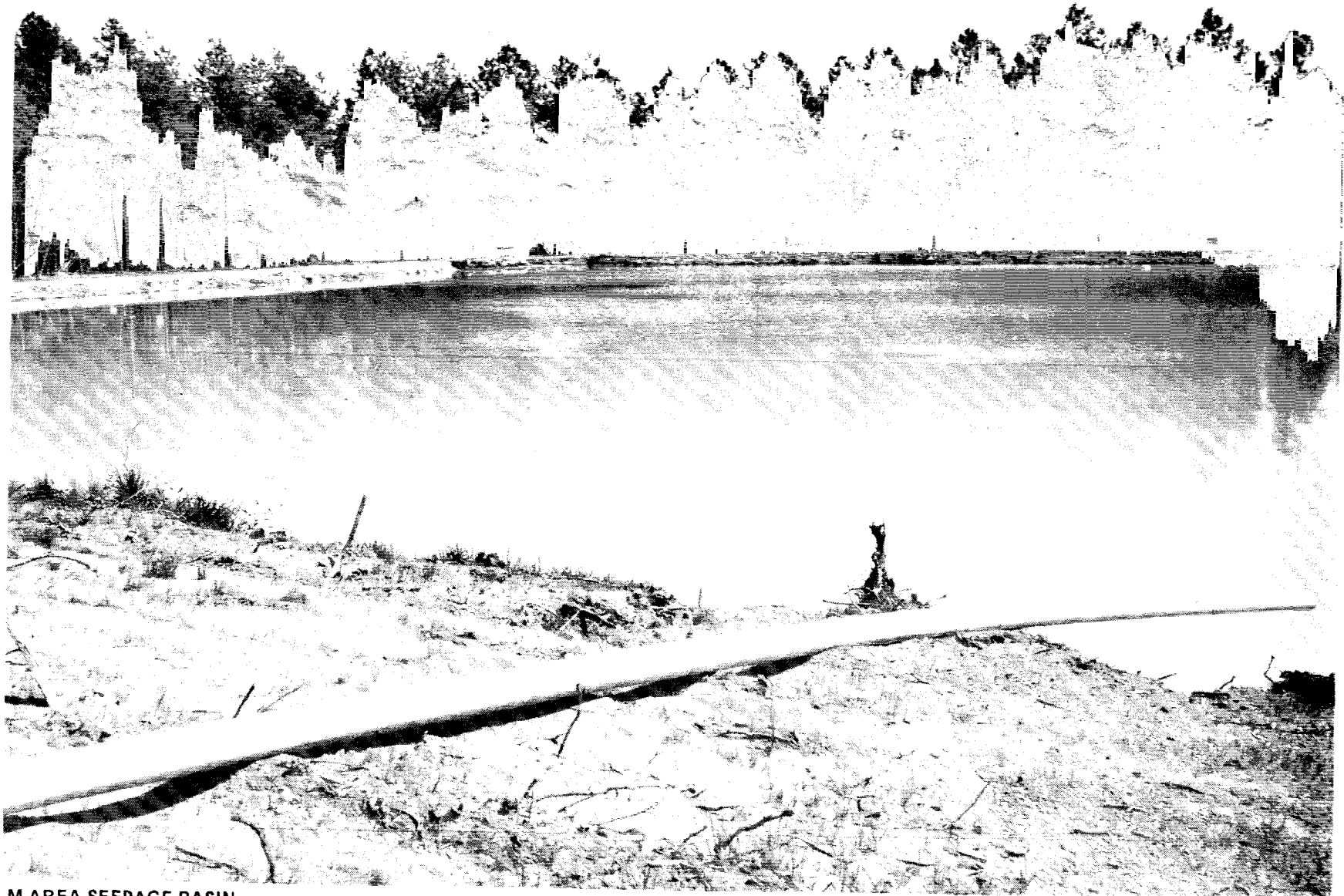
The contamination of M-Area groundwater is by far the most serious environmental threat caused to date by the disposal of hazardous wastes at SRP. Since June 1981, when Du Pont discovered chemical solvents in the groundwater near the M-Area seepage basin, Du Pont and the DOE Savannah River Operations Office have given the M-Area problem substantial attention and have taken steps to identify and reduce the extent of the contamination. Du Pont's investigation, conducted by a groundwater consultant, has shown that the solvents have spread extensively throughout the groundwater above the deep Tuscaloosa Aquifer. The consultant also determined that a small amount of the solvents also seeped down to the Tuscaloosa Aquifer through two defective SRP water wells. The contamination in the aquifer has been limited, however, to the two wells and the area immediately surrounding them.

To combat the problem, Du Pont has reduced the discharge of solvents to the seepage basin and is taking steps to remove the solvents from the surrounding groundwater. The cost to clean up and prevent future problems in the M-Area is estimated to be at \$49 million to \$54 million, with operating costs of the equipment needed to separate contaminants from the groundwater estimated at \$500,000 annually for at least 20 years.

GROUNDWATER CONTAMINATION CONFINED TO THE M-AREA

Waste effluents from the fuel fabrication production operations in the M-Area have been transported by pipe into a seepage basin since 1958. (The M-Area seepage basin is shown on p. 9; the map on p. 10 depicts the location of M-Area facilities in relation to the rest of SRP.) Included in these wastes was about 3.5 million pounds of organic chemical solvents used for dissolving grease and oil and other substances on metal parts. These solvents--trichlorethylene (TCE), tetrachlorethylene (PCE), and 1,1,1-trichloroethane (TCI)--pose an immediate threat of groundwater contamination because they move readily with groundwater flow and can quickly permeate groundwater systems. TCE and PCE are classified as hazardous wastes by EPA and are also suspected carcinogens. In 1979, after EPA had classified TCE and PCE as hazardous materials, Du Pont began using TCI. TCI is presently considered a hazardous waste but is not a suspected carcinogen.

DOE stated that while most of the volatile solvents disposed of in the M-Area evaporated immediately, substantial but unknown quantities did seep into the underlying soil and groundwater

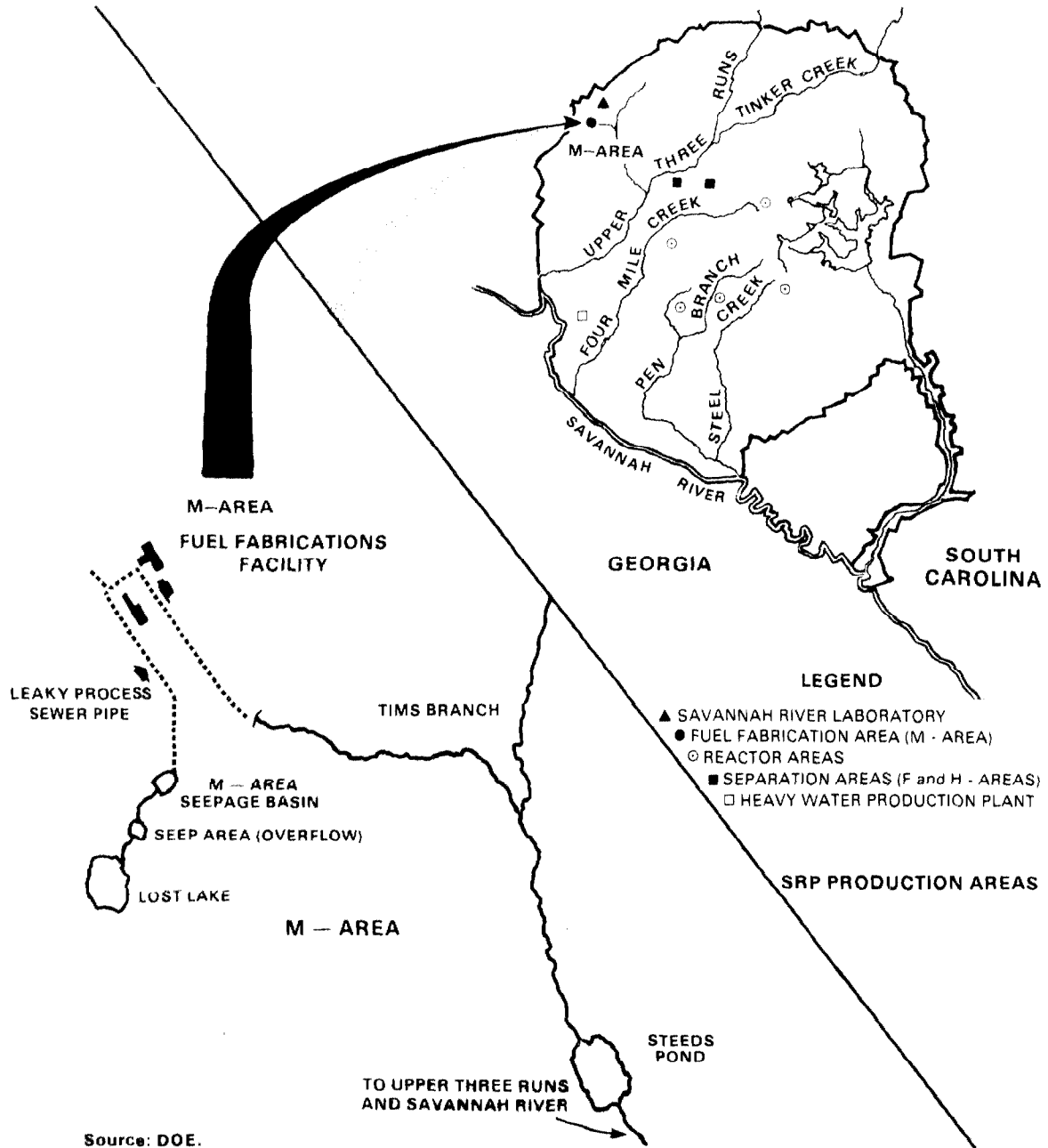


M-AREA SEEPAGE BASIN

Source: DOE

Figure 3

SRP Fuel Fabrications Facility (M - Area)



through the seepage basin and from a leaky process sewer pipe leading to the basin. (See map on p. 10.) As a routine part of the permit application procedure required under the Clean Water Act, Du Pont analyzed samples from the overflow of the M-Area seepage basin. Because several solvents were found in these samples, Du Pont drew groundwater samples on June 9, 1981, from four monitoring wells installed around the basin. (These monitoring wells do not extend into the deep Tuscaloosa Aquifer.) The samples, analyzed by an independent laboratory, showed significant levels of TCE and PCE in each monitoring well.

Because these initial samples were taken from water standing in the well piping and therefore might not have been representative of the groundwater, Du Pont resampled the wells on July 22, 1981. Analysis reports of these samples received on July 29, 1981, confirmed that organic solvents had contaminated the groundwater. By letter dated July 31, 1981, Du Pont informed the Acting Manager of the SRP Operations Office of the problem.

The Operations Office staff met and discussed the problem with South Carolina officials on August 5, 1981, and provided confirmation and additional information to the state by letter on September 4, 1981. This letter also informed the state that Du Pont was starting an investigation to determine the extent of groundwater contamination in the vicinity of the M-Area seepage basin.

SRP's Savannah River Laboratory conducted the initial investigation and issued a report¹ of its preliminary findings in October 1982. During the investigation several exploratory wells were installed; analysis of the samples showed solvent concentrations as high as 50,000 parts per billion in the groundwater below the M-Area basin. These levels greatly exceeded the drinking water standards (4.5 parts per billion TCE, 3.5 parts per billion PCE) but not groundwater quality standards adopted by DOE, imposed on Du Pont, and concurred with by EPA's regional office in Atlanta and the South Carolina Department of Health and Environmental Control. EPA is currently working on establishing federal standards for many hazardous wastes, including these solvents, but could not tell us when they will be finalized. South Carolina is also working on hazardous waste standards.

In November 1982 SRP contacted a specialist in groundwater management, Geraghty and Miller, Inc., to obtain an independent estimate of the M-Area contamination and to obtain the specialized expertise necessary to determine the extent of the migration of the solvents. Geraghty and Miller was also asked to review and comment on the laboratory's work and the proposed cleanup methodology.

¹M-Area Groundwater Cleanup Facility, Preliminary Technical Data Summary, Savannah River Laboratory (DPSTD-82-69, Oct. 1982).

The consultant issued a preliminary report² suggesting changes in the scope and extent of the investigation. These changes were presented to Du Pont in the form of a proposal for additional work by Geraghty and Miller. Du Pont accepted the proposal and hired Geraghty and Miller under a \$500,000 contract that ran through March 1984 to provide technical guidance for the investigation and a remedial action program.

Because Geraghty and Miller was concerned with the possible downward migration of solvents in the groundwater above the clay layer covering the upper Tuscaloosa Aquifer, it suggested that Du Pont resample groundwater drawn from water wells in the M-Area that extend into the deep Tuscaloosa Aquifer. (See illustration on p. 13 showing location of contaminated groundwater.) These wells had been sampled earlier, but the procedures used had allowed the samples to become diluted to the point where contamination was undetectable. The four wells supplying water to the M-Area were retested in March and April 1983; very small amounts of solvents were found in two wells, although some of these samples also exceeded the adopted standards. Du Pont shut the wells down and began an investigation with Geraghty and Miller to determine the source and extent of the problem in the Tuscaloosa Aquifer.

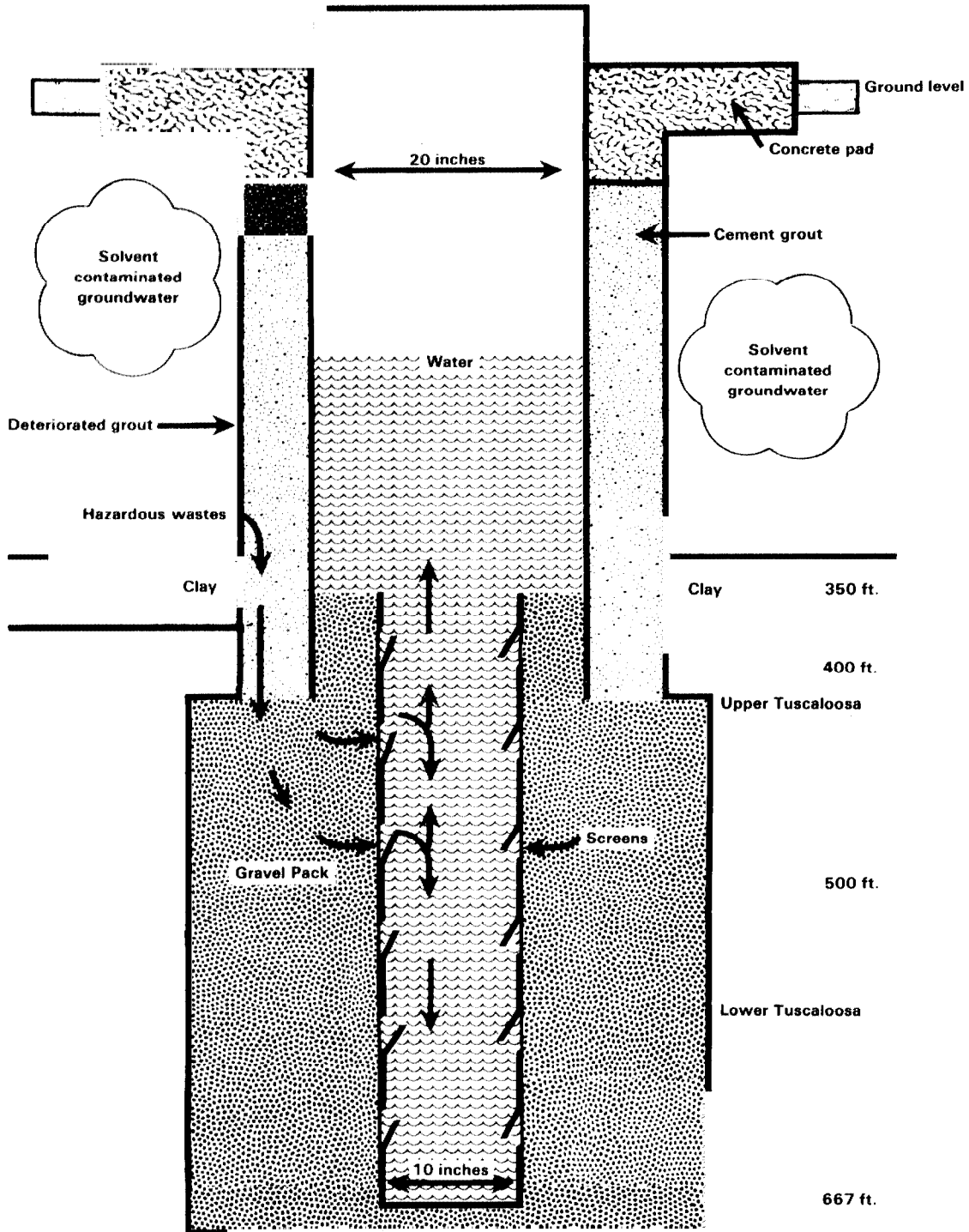
Seven new monitoring wells, strategically placed in the zones of predicted contamination, were drilled into the Tuscaloosa Aquifer. Samples from these wells showed no traces of solvent in the aquifer. Additional tests, including the lowering of a television camera into one of the contaminated wells, have shown that the solvents entered the Tuscaloosa Aquifer through the two contaminated water wells and have not seeped down through the clay covering the top of the aquifer. As illustrated on page 13, contaminated water from the water-bearing layers over the clay is flowing downward through deteriorated cement grouting in the two water wells, through screens in the well casing, and into the aquifer.

As an interim measure Du Pont proposes to pump the two contaminated water wells to remove the contaminated water and to prevent the solvents from settling at the bottom of the well and spreading in the aquifer. Plans will then be developed to repair the defective grout and seal the wells. The proposal to pump the wells was under review by South Carolina in July 1984 and must be approved by the state before pumping operations begin. Solvent levels in one of the wells are much lower than in the other, and the state has approved the use of that well for M-Area process water in an emergency.

²Evaluation of the On-Going Groundwater Quality Investigation, M-Area, Savannah River Plant, South Carolina, Geraghty and Miller, Inc., Dec. 22, 1982.

Figure 4

M-AREA Contaminated Water Well



Source: DOE.

While small amounts of solvents have seeped down the two water wells to the Tuscaloosa Aquifer, all samples indicate that the contamination is confined to the wells and their immediate area. A Geraghty and Miller official told us, however, that the solvents could eventually seep from the contaminated upper water-bearing layers in the M-Area through the clay barrier to the Tuscaloosa Aquifer or migrate laterally off the plant site. As described in the next section, Du Pont is taking actions to reduce the wastes entering the ground, and to remove the existing solvents already in the groundwater so that further contamination does not occur.

CLEANUP EFFORTS IN THE M-AREA

The M-Area groundwater contamination has received high priority since its discovery by Du Pont in 1981. To combat the problem, Du Pont has undertaken a program to (1) reduce the contaminants discharged into the M-Area seepage basin, (2) separate drinking and process water supply lines, and (3) remove the contamination from the surrounding groundwater. In addition, Du Pont plans to build a wastewater treatment facility in 1985 and to decommission³ the seepage basin.

The use of TCE as a metal degreaser in M-Area operations was discontinued in 1971. PCE was then used until it was replaced with TCI in 1979. Currently, TCI is used, but discharges to the seepage basin have decreased from about 33 pounds per day to about one-quarter pound per day as a result of changes in processing techniques and administrative controls.

In 1983 noncontaminated cooling water that previously had been discharged into the basin was routed to an area stream to minimize dispersion of contaminants already in the groundwater. The water had placed additional downward pressure on solvents already in the basin or surrounding groundwater. Also, in 1983, the contractor began relining a leaky process sewer pipeline that had allowed contaminants to leak to the ground between the manufacturing facilities and the seepage basin. According to a DOE Operations Office official, this project was completed in February 1984 at an estimated cost of \$210,000.

Du Pont recently completed the first part of a two-phase project to separate the drinking and process water supply lines for the M-Area and nearby administration area. The project was initiated after solvents were discovered in two of the four water wells that provided both process and drinking water for the two areas. Separation will allow more stringent standards to be

³Closing the basin and clearing and monitoring the site in accordance with RCRA or state hazardous waste management regulations. (See p. 26.)

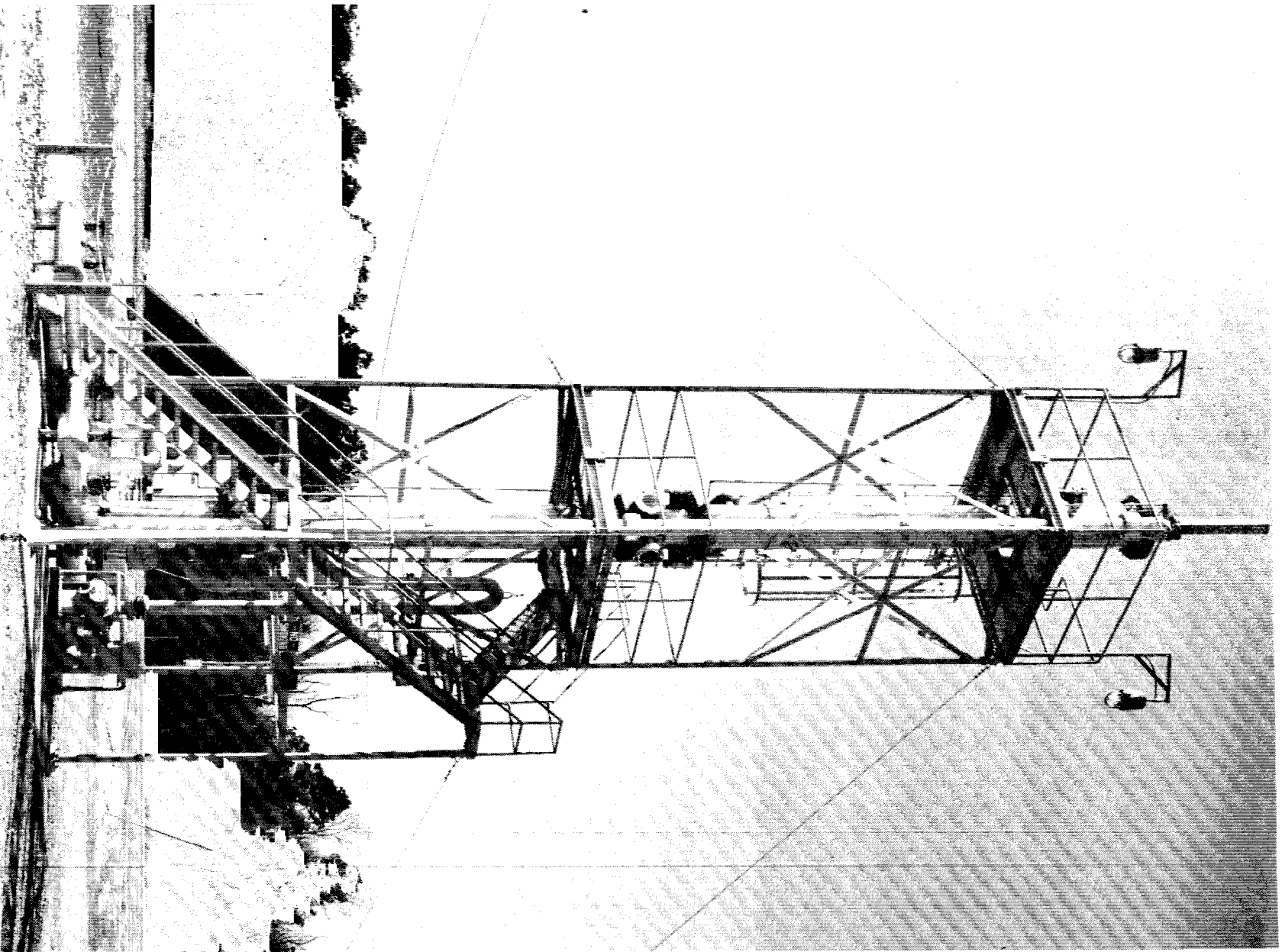
applied to drinking water and will enable the wells where contamination has been detected to be used exclusively for process water. The first phase involves segregation of the water lines and was completed in February 1984 at an estimated cost of \$150,000. The second phase includes installation of a separate drinking water supply tank. Phase two has been approved by South Carolina, and the tank has been ordered. DOE estimates that the project will be completed early in 1985 at an estimated cost of \$300,000.

DOE and Du Pont have also started an extensive project to remove solvent contamination from the shallow groundwater under the M-Area by a process called air stripping--a technique recommended by EPA to treat contaminated groundwater. In this process, contaminated groundwater is pumped from recovery wells to the top of a column and then trickles down the interior of the column while air is blowing in through the bottom. The solvents are transferred from the water to the air at the top of the column. The cleansed water is discharged from the base of the column, and in the SRP operation, routed to the M-Area seepage basin. In the future, Du Pont plans to discharge the treated water to a surface stream rather than to the seepage basin once it is assured that residual solvent levels in the water do not exceed regulatory discharge limits.

A small (20-gallon-per-minute) pilot air stripper was started in January 1983 for the purpose of obtaining data for design of a full-scale system to remove solvents from M-Area groundwater. A second air stripping unit was placed in operation January 2, 1984. (See photo. p. 16.) This larger (50-gallon-per-minute) demonstration unit will be used to slow or stop migration of the solvents in the shallow water-bearing formations. Du Pont estimates the cost of the larger unit to be \$235,000.

DOE and Du Pont also plan to install a 330-gallon-per-minute air stripping column with related recovery wells and storage tank for startup in March 1985. Total estimated capital cost of this project is between \$5 million and \$10 million. SRP Operations Office officials estimate that the facility may have to be operated 20 years or more at an annual cost of \$500,000, depending on the allowable levels of residual contaminants set by regulatory authorities.

Planning has also started for construction of an M-Area liquid effluent treatment facility to be completed in 1985 at a projected cost of \$38 million. This facility will be used to treat process groundwater from the fuel fabrication facility that is currently discharged into the M-Area seepage basin. Completion of the treatment facility will enable DOE to comply with the 1984 Supplemental Appropriations Act (Public Law No. 98-181), which requires DOE to discontinue using the M-Area seepage basin after November 1985. When this new facility is complete, the M-Area seepage basin will be decommissioned at an estimated cost of \$5



FIFTY-GALLON-PER-MINUTE DEMONSTRATION AIR STRIPPER AT SRP M-AREA

Source: DOE

million or more, depending on the methods needed to completely close the basin.

CHAPTER 3

DOE ACTIONS TO IDENTIFY, MONITOR, AND

CLEAN UP OTHER HAZARDOUS WASTE PROBLEMS

Because of increasing concerns about the impact of hazardous wastes, and motivated by the discovery of contaminants in the M-Area groundwater, DOE and Du Pont initiated efforts in 1982 to identify all locations where wastes had been disposed of at SRP. These efforts identified a total of 153 sites where discarded wastes are located. The sites include seepage basins, burial grounds, rubble pits, and buildings designed to store specific wastes. They do not include the large tanks used to store high-level (very radioactive) wastes at SRP.

Although some information is available on the kinds of wastes disposed of at each site, accurate records on the specific types and quantities of nonradioactive hazardous wastes disposed of were not required or maintained, since at the time of disposal, little was known about the potential future impact of these wastes. With information so limited for many sites, the potential environmental impact of these wastes is unknown. Existing studies indicate, however, that hazardous wastes have not had an impact off-site.

To avoid future problems, DOE is collecting additional information through monitoring wells and is initiating cleanup steps on-site according to an environmental action plan that prioritizes individual sites for action based on existing information. While top priority has been given to investigating and cleaning up the M-Area, other environmental projects underway include an expanded groundwater protection and monitoring program and a pollution discharge elimination program. The environmental action plan calls for building at least four waste treatment facilities and the decommissioning of several SRP seepage basins and burial sites over the next several years. The total estimated cost of these new projects is about \$117 million.

DOE expects to obligate about \$72 million on environmental efforts at SRP in fiscal year 1984, not including a \$25-million project associated with mitigating the effects of restarting the SRP L-Reactor in 1985.¹ DOE has also requested \$73.6 million for fiscal year 1985. In contrast, about \$7.1 million went to SRP environmental projects in fiscal year 1983.

¹In 1982 DOE decided to restart the SRP L-Reactor, one of the plant's production reactors which had been in standby status since 1968, to meet increased production demands. Restarting has been delayed until 1985. In fiscal year 1984 DOE initiated several studies to examine ways to mitigate the impact of the hot water to be discharged by the reactor. Total cost of the studies is estimated to be \$25 million.

LIMITED DATA AVAILABLE ON
DISPOSED SRP HAZARDOUS WASTES

Since operations began at SRP in 1952, a variety of hazardous materials has been used in manufacturing processes and support activities, resulting in large quantities of residual chemical and metallic wastes. Currently, for example, over 33 different types of hazardous chemical wastes are generated and disposed of at SRP. These wastes, including organic solvents and toxic metals such as chromium and mercury, have been discharged into seepage basins or containerized and buried on-site. Some containerized wastes are now being stored in buildings, awaiting final disposal. In many cases these disposal actions were not well documented for many years, and until recently a centralized listing of SRP disposal sites did not exist. Following the initial discovery of contaminants in the M-Area groundwater, DOE and Du Pont initiated efforts to identify for further environmental planning all disposal sites at SRP.

Efforts to identify and
characterize waste sites

In 1982, spurred by the discovery of the M-Area contamination problem and the increased attention of South Carolina officials, Du Pont pursued the identification of all areas where wastes had been disposed of since the plant began operations. In January 1983 Du Pont released a report² prepared by its Health Protection Department that identified the location and general content of 131 waste disposal sites. To develop the information, the department searched plant records and interviewed current and retired employees who have or did have waste disposal responsibilities. According to Du Pont officials, the report served as a basis for later research and planning.

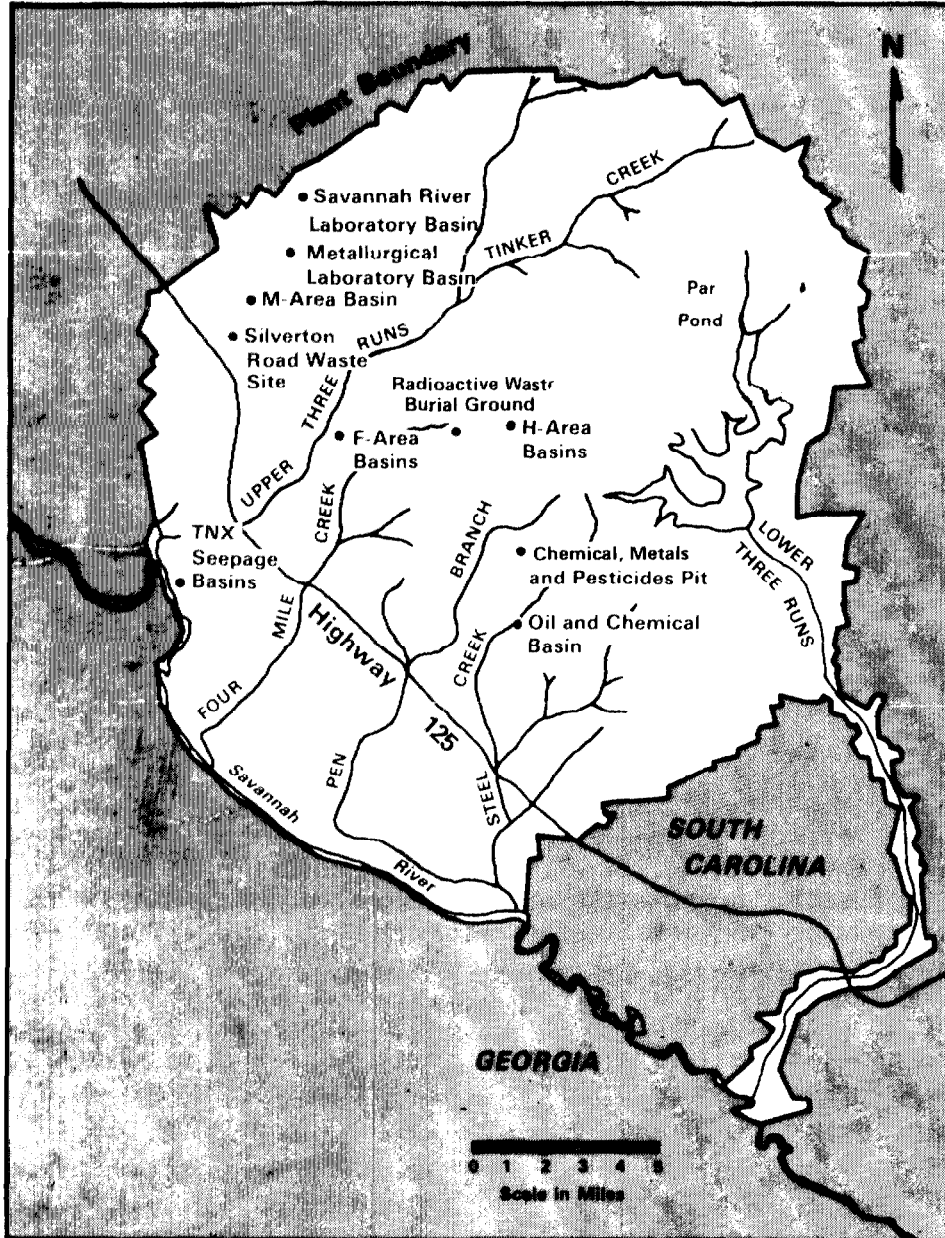
In May 1984 the Savannah River Laboratory published a report³ that included the known details of both active and inactive SRP sites used for disposal of solid and hazardous wastes. In preparing the report, laboratory staff identified and collected data on 153 waste disposal sites, including the 131 identified in the earlier Du Pont study. These sites are located in about 100 different areas at SRP. (See map, p. 20 for location of some of the larger disposal sites.) Most of the identified sites, except seepage basins, are not now being used. Forty-seven of the 68 seepage basins built at SRP, however, are still in use.

²Waste Sites on the Savannah River Plant (DPSP-83-1008, Jan. 5, 1983).

³Technical Summary of Groundwater Quality Protection Program at Savannah River Plant (DPSP-83-829, May 1984).

Figure 5

Major Waste Disposal Areas at the Savannah River Plant



This map only indicates major disposal areas. Some areas contain more than one actual disposal site. For example, the H-Area contains four seepage basins and other waste sites.

Source: DOE.

Of the 153 identified sites, 118 contain nonradioactive wastes, 20 contain low-level radioactive wastes, and 15 contain both low-level radioactive and nonradioactive materials, or mixed wastes. The 153 sites do not include the large underground tanks used to store high-level radioactive wastes at SRP.

The Savannah River Laboratory report also characterized, based on available information, the wastes found at each major disposal site. Nonradioactive wastes found at these sites include

- nonhazardous solids such as wood, lumber, and concrete blocks and slabs;
- nonvolatile organic substances such as fuel and motor oil;
- hazardous solids such as asbestos;
- anions⁴ and acidic wastes, such as coal pile runoff acids and hydrofluoric acid;
- hazardous pesticides;
- toxic heavy metals such as mercury; and
- hazardous volatile organics such as chlorinated hydrocarbons and solvents.

Much more is known about some sites than others. For example, as discussed on pages 8 to 11, considerable information has been gathered on M-Area solvent contamination. In another example, the report notes that the four seepage basins receiving the waste effluents from the two large chemical separations plants at SRP received a total of about 560 tons of nitrates per year between 1961 and 1970. The report also estimates that about 4,000 pounds of mercury has been deposited in these basins since they were placed in service. (The mercury discharges were greatly reduced by process changes in 1972.)

On the basis of available information, the report also prioritized the identified disposal sites for additional investigation or cleanup action using a numerical system. Factors considered in rating the sites included distance to the plant boundary, distance to surface streams, size and type of facility, and present status of the facility (closed or active). If groundwater-monitoring wells were already installed, factors indicating the levels of pollutants in samples were included. For sites with no monitoring wells, consideration was given to the types of materials that had been deposited at the site. Sites ranking high in priority

⁴Negatively charged ions that affect the soil's ability to slow the flow of certain contaminants.

include the M-Area seepage basin; seepage basins in the separations areas known as the F- and H-Areas; the chemicals, metals, and pesticides pits; the low-level radioactive waste burial grounds; the Silverton Road waste site; and the chemical experimental area seepage basin also known as the TNX area. (See map, p. 20 for locations of these sites.)

ENVIRONMENTAL IMPACT FROM
HAZARDOUS WASTES LIMITED TO
SRP, BUT LARGELY UNKNOWN

Since information on disposed hazardous wastes is limited for many sites, the present and potential environmental impacts of these wastes are largely unknown. Although existing studies by the state and the Philadelphia Academy of Sciences indicate that hazardous wastes have not had an impact off-site, DOE and Du Pont officials told us that the extent of the migration of these wastes from seepage basins or from leaking drums in burial sites is uncertain. In some areas the locations, quantities, and movements of specific chemicals have been studied and documented. In addition to identifying the effects of the organic solvent problem in the M-Area, DOE and Du Pont officials stated that they know the general effect of heavy metals and other wastes disposed of in the separations areas. In other areas, however, adequate monitoring wells have not yet been installed; the impact of unknown quantities of chemicals in the ground is unknown.

The contamination of groundwater by M-Area solvents has created the most serious SRP hazardous waste environmental problem to date, and as described on page 12, the impact has been confined to SRP. Du Pont officials told us that concerns generated by the M-Area problem led them to examine the separations areas basins, where there are concentrations of heavy metals and nitrates. Recent Du Pont studies indicate, however, that the groundwater affected by these basins surfaces within SRP boundaries. Therefore, they told us that they believe that any contaminant migration is controlled since the site is restricted and that there should be no adverse impact on public water supplies. Du Pont studies also show that the heavy metals disposed of in the separations areas generally adhere to and are retained by the clay soil under the seepage basins, limiting their migration potential in groundwater. Du Pont officials expect nitrate concentrations in the ground to dissipate in the future.

Groundwater underlying SRP surfaces in many area creeks and streams; water from the Tuscaloosa Aquifer generally outcrops into the Savannah River. The impact of SRP operations on various aspects of the environment has been studied by different groups since operations began in 1952. Those studies we reviewed did not show any negative off-site effects from the hazardous chemicals generated by SRP operations. For example, the Philadelphia Academy of Natural Sciences has studied the effects of SRP

operations on the Savannah River continually since 1951. This effort has not shown any impact from chemical disposals at SRP. In addition, South Carolina monitors drinking water in surrounding communities. State sampling reports off-site do not indicate any contaminant levels above regulatory limits.

SRP'S ENVIRONMENTAL ACTION PLAN

In May 1983 Du Pont established a Site Environmental Action Plan Task Force to identify each discharge or potential discharge to the environment at SRP and to plan to control conditions affecting the environment in a manner to meet all applicable government regulations. In October 1983 the task force issued a draft Site Environmental Action Plan. The plan consists of a data sheet for each source of plant discharge to the environment, including emissions to the air and discharges to water or land. The sheet identifies the location of the discharges, cause for concern, proposed action, and priority of action.

This plan is considered a draft, pending the completion of internal reviews. Du Pont operating departments are responsible for developing and implementing the plan and issuing revised data sheets to report any major changes or developments. Du Pont's Environment and Energy Department is to coordinate and audit the actions taken to ensure that the plan is implemented and that the document is kept current.

The action plan serves as the master planning document for SRP environmental projects. A priority system is being developed to aid in selecting projects from the plant to be included in the SRP budget. At present, each department has ranked its proposed projects, and department representatives have met and are working toward an overall site priority list covering all environmental projects.

Although work is not yet complete on the priority project list for all environmental concerns, because of the immediate concerns generated by the M-Area contamination problem, an implementation plan,⁵ subordinate to the overall action plan, has already been developed for monitoring groundwater and related projects. Closely associated to the groundwater protection plan is an upgraded groundwater-monitoring program.

SRP groundwater protection plan

Based on the Technical Summary of Groundwater Quality Protection Program at SRP and its rating of disposal sites for additional actions (see p. 19), the April 1984 SRP groundwater protection plan contains a list of groundwater concerns and

⁵SRP Groundwater Protection Implementation Plan at Savannah River Plant, Apr. 15, 1984).

proposed action projects. It describes the nature of known contamination present at each site and planned action and contains proposed schedules for implementation.

Certain elements of Du Pont's groundwater action plan have already been approved and initiated. For example, in September 1983 DOE authorized Du Pont to begin a \$22.6-million plantwide project designed to control and contain nonradioactive hazardous waste. The project, expected to be completed in fiscal year 1987, includes the construction of

- chemical spill containment facilities around 43 tanks and 17 unloading stations,
- effluent neutralization and treatment facilities for the SRP experimental chemical processing test site, and
- a solid hazardous waste incinerator that will be used to detoxify and reduce the volume of hazardous wastes.

SRP groundwater-monitoring program

Integral to the groundwater protection plan is an expanded groundwater-monitoring program. Under the groundwater protection plan, disposal sites where there is a potential for contamination because of the types of waste disposed will be systematically monitored. If elevated levels of specific contaminants are found during routine monitoring, additional wells will be drilled. Samples from the additional wells will be analyzed and models developed to determine the extent of the problem.

Groundwater-monitoring programs were initiated at SRP to establish baseline conditions before facility operations began in 1952. According to DOE officials, initial emphasis was on monitoring for the presence and effects of radioactive materials, although some monitoring for hazardous materials such as mercury was done in the mid-1970's in response to growing industry concern and pending environmental legislation. In 1981, in response to RCRA and the increasing emphasis placed on groundwater protection, Du Pont expanded the groundwater-monitoring program for hazardous nonradioactive chemical contaminants.

Du Pont's expanded monitoring program includes installation of monitoring wells at sites where none are present and where current wells do not provide sufficient coverage. Generally, four wells are installed around a suspected contamination site; three wells are in the direction of groundwater flow. More wells may be added if the site is large or other conditions warrant. As of December 1, 1983, 152 wells had been drilled for routine hazardous waste monitoring, including 70 installed during 1983 at a cost of about \$210,000. Du Pont plans to add new wells until all areas identified in the groundwater action plan are monitored.

OTHER ONGOING AND PLANNED
ENVIRONMENTAL PROJECTS

Other projects for protection and cleanup of the SRP environment have been initiated or proposed in the SRP environmental action plan for the next several years. Included are plans for completing a pollution discharge elimination program and decommissioning seepage basins and hazardous waste burial sites. The total estimated cost of these newly identified environmental initiatives at SRP is about \$117 million.

Pollution discharge
elimination project

In 1984 DOE authorized Du Pont to start the second phase of an SRP-wide project for pollution discharge elimination. The first phase, completed in May 1982 at a total cost of \$9 million, provided wastewater treatment facilities, new water wells, and other construction to control pollution. The second phase, estimated to cost about \$10 million, is to be completed in fiscal year 1986 or 1987, depending on available funding. Phase two work includes

- diverting power station effluents containing ash, coal dust, and chemicals from state waters to ash basins and constructing additional basins;
- constructing dikes around oil-filled transformers to prevent oil from reaching state waters in the event of a major transformer failure;
- constructing covered, diked pads to prevent release of oil and chemicals from plant stores and drum salvage yards;
- redirecting M-Area cooling water discharges to a surface stream instead of into the M-Area seepage basin; and
- building facilities to neutralize the acid runoff from power station coal piles.

Seepage basin and burial
site decommissioning and
related construction

Following its review of existing waste sites for the Technical Summary of Groundwater Quality Protection Program at SRP, Du Pont determined that approximately 18 nonradioactive hazardous waste seepage basins and 18 basins containing mixed wastes at SRP will require decommissioning. This means that the basins will be closed and that the sites will be cleaned up or monitored in accordance with RCRA and South Carolina hazardous waste management regulations or Superfund legislation requirements, depending on

when discharges to the basins were stopped. Detailed decommissioning plans are subject to review and approval by South Carolina environmental officials. Du Pont hopes to start decommissioning actions on all of these sites by 1988.

Prior to final closure, at least four effluent treatment facilities will be built to treat the wastes currently discharged to active basins, and detailed studies will be made of the basin areas to determine the type and quantities of specific contaminants present. DOE officials told us that on the basis of these investigations, they will decide what will be done during decommissioning and will prepare detailed plans to be reviewed by the state.

Solid and/or hazardous chemical wastes including chemicals, metals, and pesticides have also been buried in drums at various sites at SRP. Du Pont also plans to decommission several of these sites in accordance with state and federal hazardous waste regulations and to excavate, redrum, and store some of the buried wastes beginning in fiscal year 1984. Final decommissioning will depend on the construction of the new redrumming facility, on-site storage facility, and an on-site, state-approved landfill for the disposal of hazardous wastes.

CONCLUSION

We agree with the direction of DOE and Du Pont efforts to identify and monitor waste sites at SRP to prevent future problems. We believe that the comprehensive environmental action plan that identifies and prioritizes environmental action projects is a useful tool to direct SRP's complex environmental program. The environmental action projects already initiated--the M-Area groundwater cleanup efforts, plantwide hazardous waste projects, the construction of groundwater-monitoring wells, and the pollution discharge elimination project--are significant steps. However, much remains to be done to effectively monitor and to prevent hazardous waste problems at SRP. The SRP environmental action plan recognizes this and calls for the construction of at least four effluent waste treatment facilities and the decommissioning of several seepage basins and waste disposal sites over the next several years.

CHAPTER 4

COORDINATION BETWEEN DOE, EPA, AND SOUTH CAROLINA IMPROVING

Coordination and cooperation between DOE, EPA, and the South Carolina Department of Environment Control is vital to ensure the cleanup of the M-Area and the completion of plans and projects to prevent or correct similar problems in other parts of SRP. According to state officials, limited coordination was all that was required before the development of hazardous waste regulations under RCRA. After RCRA was passed, however, with the increased environmental responsibilities assigned to the state, coordination was initially hindered by DOE's reluctance to concede to EPA's or the state's oversight of DOE's activities because of security concerns, and because, according to DOE officials, they did not believe RCRA applied directly to atomic energy facilities.

Recently, however, cooperation has improved. South Carolina and DOE entered a formal agreement, and in December 1983, held a workshop involving the state, Du Pont, and the Savannah River Operations Office. At that workshop, a regulatory program to be applied to the M-Area groundwater problem was defined. DOE and EPA signed a memorandum of understanding in February 1984 concerning the oversight EPA is to have over DOE's hazardous waste activities. The new agreement allows EPA to conduct on-site inspections and calls for EPA-approved hazardous waste compliance programs to be developed for each DOE atomic energy facility.

Furthermore, RCRA was recently held applicable to nonradioactive hazardous waste at DOE's Oak Ridge facility. In a suit brought in Tennessee by the Legal Environmental Assistance Foundation, Inc., and others against DOE, plaintiffs claimed, in part, that RCRA applies to DOE's activities at Oak Ridge and that DOE violated RCRA at that facility. In April 1984 the United States District Court for the Eastern District of Tennessee issued an opinion holding that RCRA applies to the Oak Ridge facility and directing DOE to seek a RCRA permit for the treatment, storage, and disposal of hazardous waste. DOE officials told us that DOE is not appealing the ruling and is presently working with EPA to coordinate initial permitting procedures under RCRA for all DOE atomic energy facilities, including SRP.

This chapter discusses the approach DOE and EPA have taken on the issue of RCRA's application to DOE's atomic energy facilities, and discusses the nature of coordination between SRP officials, the EPA regional office, and South Carolina.

RESOLUTION OF RCRA APPLICATION
TO DOE FACILITIES

RCRA and its accompanying regulations establish a comprehensive program ". . . to promote the protection of health and the environment . . . by . . . regulating the treatment, storage, transportation, and disposal of hazardous wastes which have adverse effects on health and the environment." Under RCRA, EPA has principal authority to regulate hazardous waste practices or may delegate this authority to a state through an authorization program. Until recently, DOE has claimed that its facilities regulated under the Atomic Energy Act are exempt from RCRA. EPA and others disagreed with DOE's interpretation.

Until recently, DOE has maintained that section 1006 of RCRA exempts all of its waste disposal activities at facilities performing work under the Atomic Energy Act from RCRA coverage. Section 1006 of RCRA provides:

"Nothing in this Act shall be construed to apply to (or authorize any State, interstate, or local authority to regulate) any activity or substance which is subject to . . . the Atomic Energy Act of 1954 (42 U.S.C. 2011...) except to the extent that such application (or regulation) is not inconsistent with the requirements of [the Atomic Energy Act]."

In a memorandum dated November 14, 1980, to the EPA Associate General Counsel, DOE's Assistant General Counsel for the Environment stated that the application of EPA's hazardous waste management regulations to DOE's atomic energy activities would be duplicative and inconsistent with the requirements of the Atomic Energy Act and with DOE's responsibilities under the statute. DOE's General Counsel again analyzed the RCRA question and reported to the Secretary of Energy in December 1983 that responsibility for waste-handling regulation of atomic energy facilities is vested exclusively in DOE.

In supporting this position, DOE defense production officials expressed concerns about access to waste stream data that EPA reporting and permitting procedures under RCRA normally require that could reveal top secret production information. Also, these officials told us that they were uncomfortable with the idea that EPA, or a state--which under RCRA can establish even more stringent requirements than EPA--could halt operations at an atomic energy facility for lack of compliance. They also expressed concern over the potential costs of RCRA requirements.

In lieu of direct compliance with EPA regulations, DOE's Office of Environmental Health and Safety established in 1983 a hazardous waste management program for facilities operated under the Atomic Energy Act. According to DOE, this program, to the extent practicable, was designed to follow EPA regulations, and to provide technical comparability with EPA requirements.

EPA internal memoranda show that EPA initially wavered in its efforts to seek direct DOE compliance with RCRA regulations. However, in an internal June 22, 1983, memorandum, EPA's Acting General Counsel (1) affirmed the applicability of RCRA to nonradioactive Atomic Energy Act-related wastes, (2) rejected the notion that DOE could exercise blanket exemption from EPA regulation under RCRA merely by establishing its own program, and (3) concluded that the question of whether certain atomic energy activities are exempt from RCRA must be addressed on a case-by-case basis. Furthermore, an EPA official told us that DOE's internal hazardous waste program was less than adequate because it did not allow independent oversight or public participation, and could allow for exemptions that were inconsistent with RCRA.

EPA/DOE memorandum of understanding

In November 1983 EPA and DOE officials formed a task force with the objective of reaching an agreement on a working arrangement that would satisfy DOE's security and access concerns and also meet EPA's desire to ensure the proper handling and disposal of hazardous wastes. As a result of the task force's efforts, the Administrator of EPA and the Secretary of DOE signed a memorandum of understanding on February 22, 1984, for the management of hazardous and radioactive mixed wastes at DOE facilities operated under the Atomic Energy Act. The agreement contains the following provisions:

- (1) DOE will comply with RCRA technical standards. However, EPA and DOE can modify the standards by agreement when necessary to ensure worker health and safety.
- (2) EPA inspectors will be allowed to perform site inspections and will be granted access to pertinent hazardous waste management information at DOE facilities.
- (3) A Hazardous Waste Compliance Plan will be developed by DOE and approved by EPA for each DOE atomic energy facility. The state and the general public will be afforded the opportunity to review and comment on each plan.
- (4) DOE agreed to implement a negotiated compliance schedule once any facility is found deficient through the inspection program. EPA is not afforded the opportunity to "close down" DOE operations under the agreement.

Court affirms RCRA applicability to Oak Ridge atomic energy plant

On September 20, 1983, the Legal Environmental Assistance Foundation, Inc., and the Natural Resources Defense Council, Inc.,

filed a citizens' suit against the Secretary of Energy and DOE seeking a court order and civil penalties under RCRA and the Clean Water Act to redress claimed past and continuing violations of hazardous waste generation, treatment, storage, and disposal methods at DOE's Y-12 plant in Oak Ridge, Tennessee. The state of Tennessee later intervened as plaintiff to protect its interests in the case. In the case, the plaintiffs claimed, in part, that RCRA did in fact apply to DOE activities at its Oak Ridge atomic energy facilities and that DOE had violated RCRA hazardous waste disposal procedures at Oak Ridge.

On April 13, 1984, the U.S. District Court for the Eastern District of Tennessee issued an opinion holding that RCRA applies to the Oak Ridge facility and ordered DOE to file for a RCRA permit for the facility with all deliberate speed.

DOE has decided not to appeal the opinion and is also assuming that the reasoning in the opinion applies to all DOE atomic energy facilities regarding hazardous wastes but excludes radioactive wastes. DOE is proceeding with EPA to determine permitting procedures. In addition, both DOE and EPA consider the February 1984 memorandum operative, especially as it pertains to security access. EPA and DOE have agreed that the hazardous waste plans called for in that agreement will be accomplished under the RCRA permitting process.

At the conclusion of our review, EPA and DOE were meeting to formalize their responsibilities under RCRA. The two agencies were also meeting to define RCRA jurisdiction over mixed wastes. EPA states that hazardous materials that are comingled with radioactive materials that would normally be exempt from EPA regulations are also subject to RCRA oversight.

COORDINATION BETWEEN DOE, REGIONAL EPA, AND STATE OFFICIALS

Until the 1976 passage of RCRA and the establishment of federal regulations under that act beginning in 1980, existing coordination among EPA, state, and SRP officials on hazardous waste concerns was primarily done at the technical level. DOE and EPA officials told us that following the passage of these regulations, state agencies delegated the responsibility for their enforcement, and DOE officials were uncertain about the degree of oversight EPA could exercise over DOE facilities. Thus, individual states dealt in an ad hoc manner with DOE atomic energy facilities.

Because EPA and DOE did not agree on how they would interact on RCRA until February 1984, SRP Operations Office personnel initially coordinated with EPA regional and state officials in an informal manner. After some initial concerns about the amount of communication and coordination taking place, regional EPA, state, and SRP officials agreed in December 1983 on a regulatory program

for SRP hazardous wastes and the cleanup of the M-Area groundwater problem, with the state playing the principal regulatory role.

EPA, through its Region IV office in Atlanta, has delegated most of its enforcement and inspection authority under RCRA within South Carolina to the state. EPA still, however, retains overview responsibility. Consequently, the state and EPA coordinate on SPR environmental problems. The SRP Operations Office has also offered EPA officials the opportunity to review and comment on its plans and programs. For example, in January 1983 EPA Region IV officials reviewed the draft SRP Groundwater Quality Protection Program and associated implementation plan and commented that it was not extensive or detailed enough. DOE responded by issuing an expanded report in September 1983. EPA officials plan to use the final plan as a guide for monitoring future actions affecting groundwater quality at SRP.

The DOE Savannah River Operations Office and the South Carolina Department of Health and Environmental Control are coordinating effectively on hazardous waste matters. Part of DOE's current incentive for effective coordination can be traced to its efforts in 1983 to restart the L-reactor, an SRP production reactor that has been inactive since 1968 because of decreased production demands. To restart the L-reactor, SRP needed the state to waive certain permitting requirements. State officials initially threatened to sue to prevent the startup, but in April 1983, the state announced an agreement with DOE to withdraw from such a suit in exchange for a federal commitment for major environmental improvements at SRP.

An April 1983 memorandum of understanding between the Secretary of Energy and South Carolina formalized that agreement and clarified DOE's responsibility for managing solid and hazardous waste at SRP. Among other things, the memorandum provided that:

- (1) DOE will continue an expanded program of monitoring and study of groundwater impacts of all operations at SRP;
- (2) appropriate state agencies, in accordance with their statutory responsibilities, will be involved in on-site and off-site monitoring of groundwater impacts;
- (3) DOE will take appropriate mitigative actions regarding groundwater impacts both on-site and off-site; and
- (4) a mutually agreed-upon compliance schedule will be established.

Notwithstanding any other provisions of the agreement, DOE agreed to comply with all applicable state and federal environmental statutes and regulations relating to toxic and hazardous wastes at SRP. Later, in July 1983, the Energy and

Water Development Appropriation Act of 1984 (Public Law No. 98-50) formally required DOE to adhere to the memorandum of understanding.

During our initial contacts in October 1983 at South Carolina's Department of Health and Environmental Control, officials expressed concern over the availability of data from SRP and site access. While South Carolina officials conceded that the Savannah River Operations Office provided them with requested data, they expressed doubt that they knew all of the documents that they should request. The officials were also worried that SRP did not coordinate projects with the state during the planning stage but rather waited until after project implementation to provide notification.

South Carolina officials also stated that there were some restrictions on their access to SRP to conduct inspections and obtain well samples. We were told that while the Operations Office was willing to accommodate short notice visits when the situation warranted, it preferred a 2-week notice in order to arrange appropriate security measures. According to state officials, the advance notification compromised their independence.

Recent indications are that coordination between the state and Savannah River Operations Office has improved. Several meetings between state, DOE, Du Pont, and other officials appear to have generated confidence in each party's capabilities. For example, frequent meetings were held to discuss the groundwater contamination problems in the M-Area.

In a December 1983 workshop involving state, DOE, EPA, and Du Pont officials, it was agreed that South Carolina has the regulatory lead for the M-Area groundwater contamination cleanup program. As such, the state will assess the regulatory approach and work with DOE in defining specific requirements. It was also made clear that major projects will be submitted to the state for comment before implementation. Other coordination problems also seemed to have been resolved. DOE now requires only reasonable notification for on-site sampling and inspections, and high-level security clearances are being granted to some state inspectors to allow them easier access to SRP.

With the signing of the EPA/DOE memorandum of understanding and the federal district court's decision, existing roles may have to be adjusted. The EPA official on the interagency task force stated that there probably will not be any major changes in existing relationships between the state and SRP management because it is generally understood that the enforcement of RCRA hazardous waste regulations is a state responsibility.

CONCLUSION

Coordination between SRP and South Carolina officials has improved following (1) an April 1983 formal agreement between the Governor of South Carolina and the Secretary of DOE and (2) the February 1984 memorandum of understanding between EPA and DOE. In addition, the reasoning of the April 1984 district court decision may also provide guidance for other DOE atomic energy facilities. As of July 1984, EPA and DOE were meeting to formalize their areas of responsibility under RCRA and to define RCRA jurisdiction over mixed wastes.

AGENCY COMMENTS

DOE and EPA formally commented that the report was an accurate summary of the progress being made in managing hazardous wastes at SRP. The South Carolina Department of Health and Environmental Control also commented that improvements were rapidly being made, but that the report should more clearly reflect the scope of the hazardous waste problem at SRP from the state's perspective. See appendixes I, II, and III for the complete text of DOE's, EPA's and South Carolina's comments.

DOE commented that the draft report did not adequately credit its Savannah River Operations Office for the strong initiative it took in coordinating with South Carolina and toward instigating changes in the SRP hazardous waste program. The South Carolina Department of Health and Environmental Control also stated that the draft report did not adequately describe the leadership of its office in initiating changes at SRP. We believe that our report recognizes the contributions of the state, DOE, and Du Pont to the extent they are identifiable and measurable. In many cases, it was not possible to clearly attribute which institution took the lead and provided the impetus behind the steps taken to control hazardous wastes at the plant.

South Carolina officials also emphasized their concerns over the immensity of the SRP situation from their perspective, and the drain on state resources that RCRA monitoring and enforcement activities at SRP will require. The state also commented that our report did not discuss whether there were other unreported, unregulated hazardous waste problems at SRP, nor did it discuss the states' role in regulating mixed wastes--wastes that contain both radioactive and hazardous materials. Our review did not reveal hazardous waste problems that were not already known by the state. Furthermore, at the conclusion of our review, DOE and EPA were conducting a series of meetings in the wake of the recent federal district court decision to determine how DOE was going to comply with the RCRA permitting process and other reporting procedures. The two agencies were also discussing how to apply RCRA to mixed wastes.

DOE, EPA, and the state also made several technical comments that have been incorporated into the report.



Department of Energy
Washington, D.C. 20585

JUL 17 1984

Mr. Dexter Peach
Director, Resources, Community and
Economic Development Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Peach:

The Department of Energy (DOE) appreciates the opportunity to review and comment on the General Accounting Office (GAO) draft report entitled "DOE Taking Steps to Control Hazardous Wastes at Its Savannah River Plant."

In August 1977, the Savannah River Operations Office (SR) began cooperating with the South Carolina Department of Health and Environmental Control (SCDHEC) on solid and hazardous waste management at the Savannah River Plant. SR took strong initiative in interacting with SCDHEC while formulating its solid and hazardous waste management program. After formalizing the DOE position on the applicability of the Resource Conservation and Recovery Act to its Atomic Energy Act facilities, SR continued to provide information to and cooperate with SCDHEC on solid and hazardous waste management matters. This aggressive program of cooperation is not evident in the draft report.

With the above exception, the report is an accurate summary of the significant progress being made at the Savannah River Plant in managing hazardous substances and wastes.

The Department has been developing an aggressive waste management program. Implementation of this program within the full scope and schedule requires supplemental funding in FY 1984. This supplemental funding has not yet been received.

DOE hopes that these comments will be helpful to GAO in their preparation of the final report.

Sincerely,

A handwritten signature in cursive script, appearing to read "Martha Hesse Dolan".

Martha Hesse Dolan
Assistant Secretary
Management and Administration



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 24 1984

OFFICE OF
POLICY, PLANNING AND EVALUATION

Mr. J. Dexter Peach
Director
Resources, Community and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

On June 15, 1984, the General Accounting Office (GAO) sent the Environmental Protection Agency (EPA) a draft report for our review and comment. The report is entitled "DOE Taking Steps To Control Hazardous Wastes At Its Savannah River Plant." As required by Public Law 96-226, EPA has prepared this response on the draft report for GAO's use when preparing the final report.

The report is informative and accurate with three exceptions we would like to note for the record.

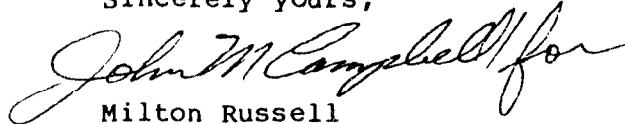
- ° on page i, second paragraph; the seepage basins used at the Savannah River Plant (SRP) were not state-of-the-art, but were the least costly means of disposal and were considered acceptable practice at the time.
- ° on page 5, second paragraph, where the report states that "hazardous wastes are defined by the Resource Conservation and Recovery Act (RCRA) to be nonradioactive substances that may be harmful to man or may degrade the quality of the groundwater." While this statement is correct with respect to one class of radioactive materials, it is not correct to assert that all radioactive materials are exempted. The report is correct when it states on page 33, fourth paragraph, that section 1004 of RCRA expressly exempts from the definition of hazardous wastes, radioactive or source material as defined in the Atomic Energy Act of 1954. However, the report should also state that other radioactive materials, such as natural radionuclides and those produced in an accelerator (NARM materials) and material which would be exempt, but for mixing with other wastes subject to RCRA, are subject to RCRA authority.

-2-

° on page 8, third paragraph, the last sentence should be corrected to read that on May 19, 1980, 40 CFR 261 Subpart D, Lists of Hazardous Wastes, identified 1, 1, 1, TCE as a hazardous waste (U226).

We appreciate the opportunity to comment on the draft report, and hope that GAO will find these comments useful.

Sincerely yours,



Milton Russell
Assistant Administrator
for Policy, Planning and Evaluation

Note: Page numbers changed to accurately reflect the final report.

South Carolina Department of Health and Environmental Control

2600 Bull Street
Columbia, S. C. 29201

Commissioner
Robert S. Jackson, M.D.



July 13, 1984

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Mr. J. Dexter Peach, Director
Resources, Community, and
Economic Development Division
United States General Accounting Office
Washington, D. C. 20548

Re: DOE Taking Steps to Control
Hazardous Wastes at its
Savannah River Plant Draft

Dear Mr. Peach:

We have reviewed the referenced draft and appreciate the opportunity for input.

We disagree somewhat with the tone of the draft in that it does not reflect the comments we provided in interviews regarding the State role. We feel that we have provided substantial impetus (e.g., March 1982 letter) to initiate the much-needed changes and improvements being made; yet, the draft gives the impression that DOE and DuPont have independently undertaken these tasks voluntarily. In addition, the draft does not place into State perspective the scope of the hazardous-wastes problem at SRP and the drain that has been placed on the State as a result of our recently being delegated authority to regulate hazardous wastes at SRP.

We agree that improvements are rapidly being made; however, the draft should clearly explain the immensity of the situation from the State's perspective. Also, there is no discussion as to whether there are other unregulated hazardous waste activities at SRP which have not been reported to EPA or to the State; and there is no mention of the State role in regulating mixed wastes, as the State was not party to the February 1984 EPA/DOE Memorandum of Understanding.

We have the following technical comments and suggested changes.

1. First Page. We disagree with the definition of seepage basins. Seepage basins are impoundments, either natural or manmade, intended for disposing liquids into the subsurface by percolation through its bottom and sides. They are not necessarily large.

2. Page ii We consider the term "Tuscaloosa" to be inappropriate. It should be placed in quotation marks to indicate that it is a colloquial expression.

Mr. Peach.

Re: DOE Taking Steps to Control Hazardous Wastes
at its Savannah River Plant Draft

Page 2.

3. Page ii. South Carolina is also "working on establishing.....standards for many hazardous wastes including the solvents." Draft ground water standards are out for public comment and should go to the General Assembly in January 1985. The proposed standards would not allow synthetic organic compounds in ground water in concentrations which would interfere with use, actual or intended, as determined by the Department.

4. Pageii. As previously stated, we disagree that "DuPont initiated efforts in 1982."

5. Page ii. Recommend the term "public drinking water" be changed to "drinking water" to avoid the confusion regarding the regulatory difference between "public" (i.e., community) and "private or domestic" (i.e., single-family).

6. Page 3. The poor definition of seepage basin is repeated and it is stated that "They can be lined or unlined--meaning the bottoms may be sealed to prevent liquids from seeping into the soil." This is contradictory in concept and the necessary changes are evident.

7. Page 1. The definition of ground water (note 1) is antiquated. As a minimum, the term "underground rivers" should be deleted to help avoid perpetuating this common misconception.

8. Page 3. The discussion of the "Tuscaloosa Group Formation" is but one opinion. Because there are other more recent stratigraphic nomenclature schemes, this sentence is not necessary. (See Comment 2, above.)

9. Page 4. This figure is terribly inaccurate and should be deleted.

10. Page 11. See Comment 3, above.

11. Page 13. We recommend deleting reference to the "Ellenton Clay" for the reasons stated in Comment 8, above.

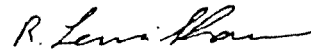
12. Page 15. The air stripper is now planned to handle 330 gallons-per-minute, rather than 400 gallons-per-minute.

13. Page 19. Same as Comment 4, above.

14. Page 29. We have received a copy of an EPA letter, dated June 27, 1984, from Charles R. Jeter to M. J. Sires, III, which indicates that the statement, "...both DOE and EPA consider the February 1984 memorandum operative", is not necessarily the case.

If there are questions regarding these comments, we can provide further explanations. We will hold the two copies of the draft on file and request a copy of the final report.

Sincerely,



R. Lewis Shaw, P.E.
Deputy Commissioner
Environmental Quality Control

RLS/JMF/JAJ
cc: Grover Smithwick, DOE
Charles R. Jeter, EPA

Note: Page numbers were changed to accurately reflect the final report.

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