

COMPREHENSIVE STRATEGY FOR CORRECTIVE ACTIONS AT THE SAVANNAH RIVER SITE GENERAL SEPARATIONS AREA*

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ABSTRACT

The Savannah River Site (SRS), operated by the Westinghouse Savannah River Company for the United States Department of Energy, contains a number of waste disposal units that are currently in various stages of corrective action investigations, closures, and post closure corrective actions. Many of these sites are located within a 40-square-kilometer area called the General Separations Area (GSA). The SRS has proposed to the regulatory agencies, the United States Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC), that groundwater investigations and corrective actions in this area be conducted under a comprehensive plan. The proposed plan would address the continuous nature of the hydrogeologic regime below the GSA and the potential for multiple sources of contamination. This paper describes the proposed approach.

INTRODUCTION

The Savannah River Site, SRS, is operated by the Westinghouse Savannah River Company for the Department of Energy of the United States. At the geographic center of the 800-square-kilometre site, a number of waste disposal units are currently in various stages of corrective action investigations, closures, and post-closure corrective actions. Many of these sites are located within a 40-square-kilometre area called the General Separations Area, GSA, shown in Fig. 1. The SRS has proposed to the regulatory agencies, the Environmental Protection Agency of the United States, EPA, and the South Carolina Department of Health and Environmental Control, SC DHEC, that groundwater investigations and corrective actions in the GSA be conducted under a comprehensive plan, (1). The proposed plan would address the continuous nature of the hydrogeologic regime below the GSA and the potential for multiple sources of contamination. This paper describes the proposed approach.

BACKGROUND

The GSA contains two fuel reprocessing chemical plants, a tritium processing facility, and their associated high level and low level radioactive waste handling facilities. Many of the facilities have been operated for three decades while others are of recent construction. The older waste

handling facilities constitute the primary source groundwater contamination. Figure 2 identifies the major facilities of interest in considering groundwater corrective actions. The extensive network of monitoring well clusters that exists in the area is also shown in Fig. 2

Chemical and radiochemical contamination exists in the uppermost aquifer in the GSA. This aquifer contains three principal water-bearing units. The flow of water in these units is controlled by three streams bounding the GSA: Upper Three Runs to the north and northwest, McQueen Branch to the east, and Fourmile Branch to the south. The hydrogeologic regime of the GSA is such that contaminated groundwater plumes from adjacent facilities intermingle. This complicates both characterization of the individual sites and corrective actions if these are undertaken singly for each disposal unit.

The uppermost aquifer is separated from an underlying regional aquifer by a competent aquitard, known as the Ellenton clay formation. Current evidence indicates that the underlying regional aquifer is protected by the integrity of the Ellenton formation and by the existence of an upward gradient across the formation.

Six units in the GSA are being evaluated and closed under SCDHEC Hazardous Waste Management Regulations as authorized by the Resource Conservation and Recovery Act, (RCRA). These are listed in Table I. Fourteen units are being investigated under both Section 3004 (U) of

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Fig. 1. Relative location of the GSA in the Savannah River Site

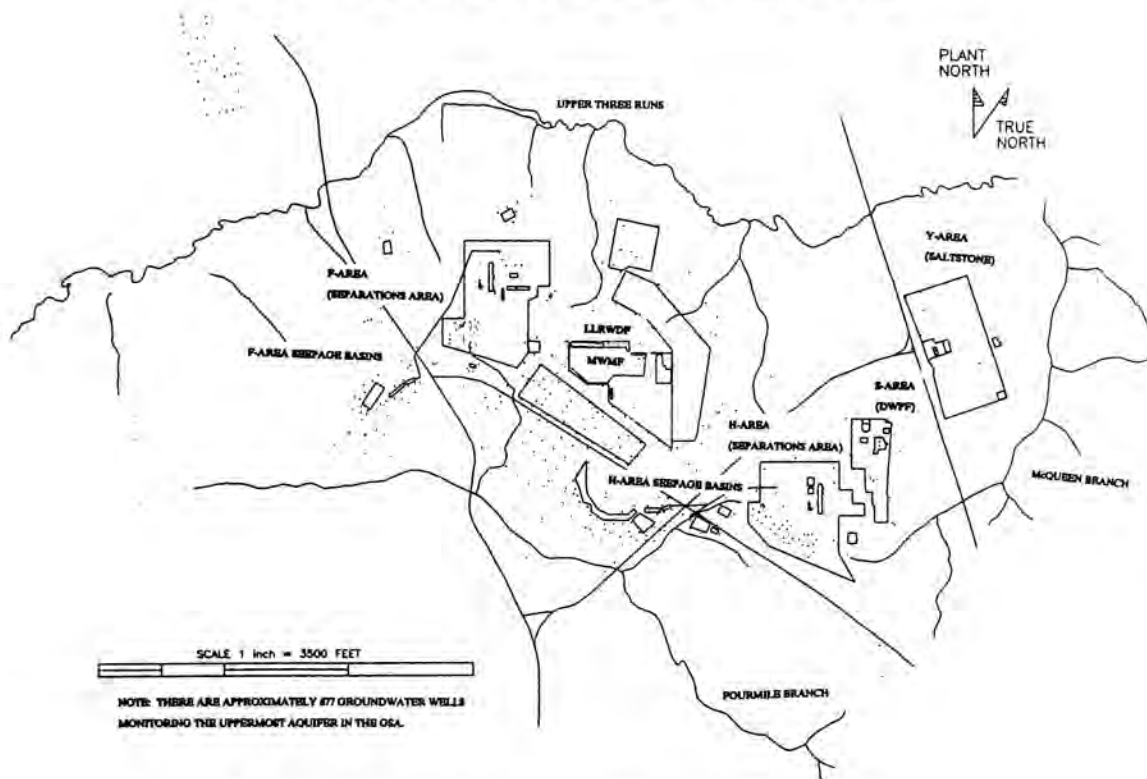


Fig. 2. General separations area well locations and facilities.

RCRA and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) regulations. These units are currently in the RCRA Facility Investigation/Remedial Investigation, (RFI/RI) stage. They are listed in Table II.

TABLE I

RCRA Closures in the GSA

Facility	Waste Type
Mixed Waste Management Facility:	solid, radioactive, hazardous
F-Area Seepage Basin:	aqueous, radioactive, hazardous
H-Area Seepage Basins:	aqueous, radioactive, hazardous
F-Area Vitrified Clay Pipes, fence out:	aqueous, radioactive, hazardous
H-Area Vitrified Clay Pipes, fence out:	aqueous, radioactive, hazardous
LLRWDF*	solid, radioactive, hazardous

* Low Level Radioactive Waste Disposal Facility

Closure actions are at or near completion at the three F-Area Seepage Basins, the four H-Area Seepage Basins, and the Mixed Waste Management Facility, MWMF. The seepage basins received low radioactivity, dilute sodium nitrate aqueous wastes from 1955 to 1988. They were designed for slow seepage to allow time for radioactive decay before discharge to surface streams. The basins were operated at a pH of 2. The MWMF is part of the Low Level Radioactive Waste Disposal (LLRWD) complex at SRS. It received wastes from 1969 to 1986. The closure of the MWMF is described in another paper being presented at this conference (2).

The basins and the MWMF received regulated materials including heavy metals - Cd, Pb, Hg - and incidental amounts of organic solvents. Groundwater monitoring data of these facilities and wetlands characterization of associated groundwater discharge areas provide evidence both of the extent of contamination and the absence of near-term risks to human health. A Corrective Action Plan has already been submitted for the basins (3,4) and one is under

preparation for the MWMF, as required by settlement agreements.

TABLE II

RFI/RI Sites in the GSA

Site	Waste type
Tank 16:	high level radioactive, aqueous
F-Burning/Rubble Pits:	construction rubble
Burma Road Rubble Pit:	construction rubble
Old H-Seepage Basin:	aqueous, radioactive, hazardous
Old F-Seepage Basin:	aqueous, radioactive, hazardous
F & H Acid Caustic Basins:	aqueous, hazardous
F & H Coal Pile Runoff Basins:	stormwater runoff
F Vitrified Clay Pipes, fence in:	aqueous, radioactive, hazardous
H-Vitrified Clay Pipes, fence in:	aqueous, radioactive, hazardous
Inactive LLRWDF:	solid, radioactive, hazardous
LLRWDF:	solid, radioactive, hazardous
Tank 37 CTS* Line Leak:	high level radioactive, aqueous

* Condensate Transfer System

DISCUSSION

The proposed plan includes provisions for characterization of the total extent of contamination in the GSA; evaluation, testing, and selection of appropriate groundwater corrective actions; and implementation of corrective actions on a regional basis. If approved the proposed plan will consolidate characterization under five major units and address post-closure corrective actions on a regional basis. Closures will continue to be handled as required by regulations or agreements.

Figure 3 shows the potentiometric surfaces of the Water Table Unit, Aquifer Zone IIB₂ in the GSA. The lithological characteristics and hydrographic nomenclature of the Tertiary hydrostratigraphic systems of the GSA have been described (5). It is the hydrogeologic characteristics that led SRS to propose an integrated approach to groundwater corrective actions in place of a unit by unit approach driven by regulations.

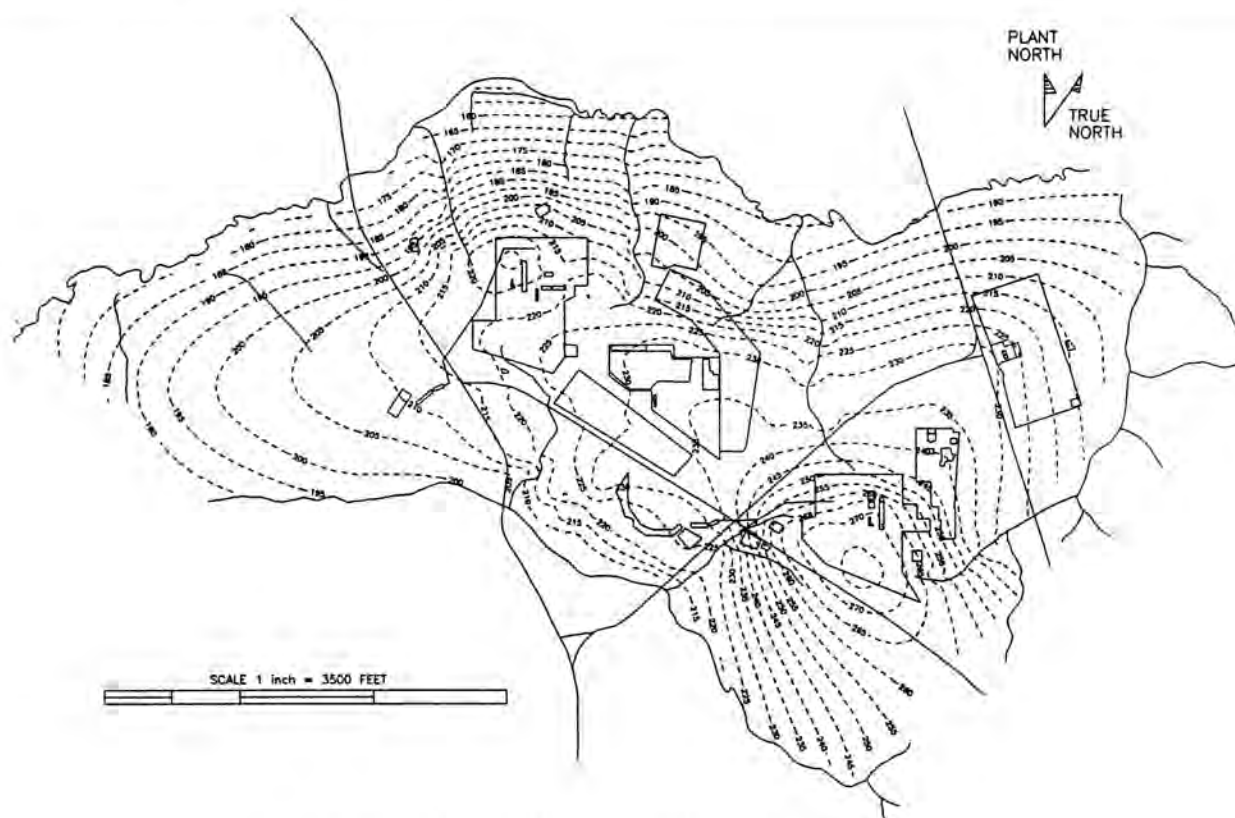


Fig. 3. General separations area 1Q90 zone IIB2 surface.

The assessment strategy would focus on the five major units in the area and their impact on groundwater: the F-Area Seepage Basins, the H-Area Seepage Basins, the LLRWD, complex, the 200-F operating area, and the 200-H operation areas, vehicles and personnel. The initial monitoring phase in each of these areas would consist of perimeter wells monitoring the three water-bearing units. In places where contamination is detected additional plume assessment wells would be installed to delineate the contamination

A complete ecological characterization of the wetlands and the creeks will be included in the comprehensive assessment. The wetlands along Fourmile Branch were impacted by the operation of the F- and H-Areas Seepage Basins (3,4). However, since the basins stopped receiving waste water and began to undergo closure, there has already been evidence of recovery by natural flushing. Upper Three Runs and McQueen Branch wetlands are not as well characterized as those of Fourmile Branch.

Professionals in environmental restoration community are increasingly questioning the effectiveness of the pump-and-treat approach to groundwater corrective actions (6). One aspect of the comprehensive assessment would focus on laboratory and field studies of alternative technologies for in-situ corrective actions. Some of the technologies under consideration are: immobilization by deep soil mix-

ing, immobilization by in-situ vitrification, extraction of contaminants by electrolytic migration, bioremediation, in-situ precipitation; and containment technologies.

It will be crucial to the comprehensive approach to conduct risk assessments as data become available. The selection of corrective actions should be determined by actual human health and ecological needs rather than being compliance driven. Significant expenditures have already taken place to effect closure actions and these expenditures will continue in future closures. The additional expense of groundwater corrective actions must be commensurate with the additional benefits to be gained. Current data available in GSA do not indicate a risk to operating personnel or to the offsite population. However, as additional data become available they will need to be closely evaluated. Long term impacts must also be carefully assessed through a formal risk assessment process. SRS proposes continuing statistical evaluation of the monitoring data to identify changes that would cause corrective actions to be initiated earlier than currently deemed necessary.

Fourteen deliverables have been identified for submission to the EPA and SCDHEC over a period of approximately six years if the plan is approved. These are: Comprehensive Assessment Strategy Document, Criteria for Initiation of Corrective Actions, GSA Hydrogeologic Assessment Report - Phase 1, Monitoring and Data Collec-

tion Plan - Phase 1, Unsaturated Zone Characterization, Stream and Wetlands Characterization, GSA Hydrogeologic Assessment Report - Phase 2, Monitoring and Data Collection Plan -Phase 2, GSA Hydrogeologic Assessment Report - Phase 3, Groundwater Flow and Transport Modeling, Risk Assessment Summary, Feasibility Studies and Assessment of Innovative Technologies, Recommendations for Corrective Action, Executive Summary.

SUMMARY

The comprehensive assessment of the GSA will be the basis for a conceptual plan for groundwater corrective remediation of the GSA as a whole. The comprehensive assessment will include an interpretation of existing data, a plan for acquisition of additional data, a proposal for a monitoring program, and conceptual design and testing of appropriate corrective actions. Groundwater modeling will be used to simulate the hydrogeologic system and gauge the effectiveness of proposed corrective action scenarios. Risk assessment will be use to justify a decision not to remediate contamination or to quantify the benefits of proposed corrective actions.

The initial response from the regulatory agencies has been to request that a preliminary risk assessment be conducted immediately on units where corrective action is currently driven by regulations. If such an assessment confirms the initial evaluation that none of these units present a near-term risk, the regulatory agencies would then consider allowing a deferral to individual action to allow time for the comprehensive strategy to be implemented.

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