SAVANNAH RIVER SITE GROUNDWATER PROTECTION PROGRAM, REV. 1 (U)

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INTRODUCTION

The Groundwater Protection Program (GPP) document is much briefer than the ones that were once required by cancelled DOE Order 5400.1. It contains a concise and systematic description of how the major components of a groundwater protection program are implemented at SRS. The major components are:

-source control
-monitoring
-corrective action
-well abandonment

This document briefly describes the drivers, the actions they are driving and what organizations are responsible for those actions. The list of contacts in Appendix I is provided to aid those seeking more detailed information. The document also describes the mechanisms that integrate these independently driven components into a site-wide program.

The GPP no longer contains a detailed description of the geology of the Savannah River Site (SRS). The most comprehensive source for that information is *Hydrogeologic Framework of West-Central South Carolina* by Aadland, Gellici and Thayer, 1995. This 200 page document, Water Resource Division Report 5 of the South Carolina Department of Natural Resources, contains over 60 figures and about 50 large plates.

The GPP no longer contains a section on groundwater usage. Unlike some DOE sites in the western U.S., SRS has abundant surface water and groundwater resources upon which to draw. And as the site's mission is shifting toward closure, water usage is dropping. The threat to groundwater at SRS is not from over-usage but from contamination, and that is the focus of this GPP.

I. COMPONENTS OF GROUNDWATER PROTECTION PROGRAM

A. SOURCE CONTROL

The major potential sources of groundwater contamination at SRS are:

- high level waste tanks found in the F and H Tank Farms
- unlined pits, landfills and basins found throughout the Site

The tank farms are actively managed with a highly developed system of administrative and engineering controls including sophisticated leak detection systems. The tank farms are managed by the **Westinghouse Savannah River Company (WSRC).**

There are four active solid waste landfills at SRS and one active low level radioactive waste landfill. These facilities are operated under regulations intended to prevent or at least greatly limit groundwater contamination through strict waste acceptance

criteria and groundwater monitoring. One of the solid waste landfills, the Z Area Saltstone Disposal Facility, is operated by **WSRC.** The other landfills are operated by **Savannah River Nuclear Solutions (SRNS).**

Virtually all groundwater contamination at SRS has come from inactive pits, landfills and basins that were constructed and operated in the years before modern environmental regulations were in place. These out of service units are called out in the Federal Facilities Agreement (FFA) in either Appendix C (CERCLA regulated) or Appendix H (RCRA regulated). They are the responsibility of the **Area Completion Projects Department (ACP) of SRNS.**

The units responsible for major contaminant plumes have been closed and covered with various types of impermeable caps. The largest of these units are regulated as RCRA hazardous waste management facilities and have typical RCRA covers of thick kaolin clay or more compact geosynthetic material. Many other units have been stabilized and covered in accordance with RCRA/CERCLA records of decision (RODs). Remaining units (all on Appendix C of the FFA) are being subjected to remedial investigations and baseline risk assessments. The types of covers or other source control strategies to be used will be dictated by the risk assessment results and will be described in RODs.

In some areas, the source term has been reduced by physical removal or soil remediation strategies such as electrical resistance heating and vadose zone extraction wells.

B. MONITORING

Groundwater monitoring activities at SRS can be divided into to two major components:

-Monitoring driven by an entity external to DOE (South Carolina Department of Environmental Control (SCDHEC), U.S. Environmental Protection Agency, etc.)
-Monitoring internally driven by DOE Order or as best management practice.

1. Externally Driven Monitoring

RCRA (FFA APPENDIX H)

Monitoring at six (6) sites is driven by RCRA and South Carolina Hazardous Waste Management Regulations (R61-79). Groundwater monitoring and corrective action at these sites is the responsibility of **ACP**.

Monitoring at the sites below is prescribed by conditions in permits:

-F Area Seepage Basin Hazardous Waste Management Facility (approximately 100 wells)

-H Area Seepage Basin Hazardous Waste Management Facility (approximately 110 wells)
-M Area Settling Basin Hazardous Waste Management Facility (approximately 300 wells)
-Metallurgical Laboratory Hazardous Waste Management Facility (approximately 25 wells)
-Mixed Waste Management Facility (approximately 200 wells)
-Sanitary Landfill Hazardous Waste Management Facility (approximately 50 wells)

All of these units are undergoing corrective action and are conducting corrective action monitoring as required by RCRA. At all units except the Sanitary Landfill, the corrective action systems are still undergoing significant changes. As they do, the monitoring requirements change. Permits modifications aimed at optimizing monitoring are submitted and approved on a regular basis.

Compliance monitoring must be conducted for a period equal to the active life of the facility (including the closure period) *or* until corrective action is complete and three years of monitoring results are below the groundwater protection standards. Only the Sanitary Landfill is likely to be cleaned up within a period of time equal to its active life. Monitoring at that facility could be terminated as early as 2015. Unless there are changes in the regulation, monitoring at the other RCRA facilities will likely continue for several decades or, in the case of M Area, for more than a century.

Although final remediation will not be achieved for many years, it is anticipated that within the next 5 to 10 years, the corrective action plans at all of these sites will be finalized, and final corrective action systems will be in place and operating. After that point there should be very little change in the monitoring requirements. As the monitoring programs for individual sites reach this state of relative stability, monitoring responsibilities may be shifted to the **Environmental Protection Section (EPS) of SRNS.**

CERCLA (FFA APPENDIX C)

Sites listed on Appendix C of the FFA undergo variable amounts of groundwater monitoring. Groundwater monitoring and at these sites is the responsibility of the **ACP**. At all of these sites, several quarters of groundwater data are collected as part of the RFI/RI process. Based on the results of the RFI/RI and the Baseline Risk Assessment, a ROD is issued that may or may not require continued groundwater monitoring.

Monitoring requirements in the ROD's fall into three main types:

-At several sites, monitoring is required for a short period of time (usually 5 years) in order to assure that no further action is required. At the end of the 5 years, the need for continued monitoring is reassessed. This type monitoring has been required at the

D-Area Burning/Rubble Pit, the P-Area Burning/Rubble Pit (3 wells) and the Silverton Road Waste Site. Monitoring at the Silverton Road and D-Area sites has since been discontinued..

-At some sites, Mixing Zone Demonstrations have been made that indicate that groundwater corrective action is not necessary to avoid significant impact to receptors. At these sites, monitoring is conducted to confirm the effectiveness of the mixing zone. Mixing Zone Demonstrations have been approved for the D Area Oil Seepage Basin (22 wells), K-Area Burning/Rubble Pit (15 wells), R-Reactor Seepage Basins and the L-Area Burning/Rubble Pit (5 wells). The responsibility for long term confirmatory monitoring of mixing zones may be transferred to the **EPS** or retained by **ACP.**
-At a few sites, the ROD has required groundwater corrective action (Electrical Resistance Heating, Soil Vapor Extraction, Monitored Natural Attenuation, etc.). At those sites monitoring will be conducted to assess the effectiveness of the corrective action. Currently, corrective action is ongoing at:

-Chemical Metals and Pesticides Pits (approximately 55 wells)
-C Area Burning/Rubble Pit (approximately 25 wells)
-TNX (approximately 30 wells)

-In an area where multiple waste units are present, the groundwater underlying the larger area can be managed as a combined groundwater operable unit. This may be more efficient than dealing with each groundwater plume separately, especially if the plumes are intermingled. The combined groundwater operable units are the:

-C Reactor Groundwater Operable Unit (approximately 10 wells)
-D Area Groundwater Operable Unit (approximately 47 wells)
-L Area Southern Groundwater Operable Unit (approximately 25 wells)
-P Area Groundwater Operable Unit (approximately 55 wells)
-R Area Groundwater Operable Unit (approximately 20 wells)
-General Separations Area Eastern Groundwater Operable Unit (H Area; approximately 30 wells)
-General Separations Area Western Groundwater Operable Unit (F Area; approximately 30 wells)

Industrial Solid Waste (8 wells)

Four facilities are monitored under South Carolina solid waste landfill regulations (R61-107.19). The 288-F Ash Basin (8 wells) and the 488-4F Ash Basin (3 wells) are Class 2 Solid Waste Landfills. The Z Area Saltstone Disposal Facility (8 wells) and the Interim Sanitary Landfill (16 wells) are Class 3 Solid Waste Landfills. These landfills are subject to groundwater monitoring as described their permits and groundwater monitoring plans. Monitoring at Z Area is also required by DOE M 435.1-1 *Radioactive Waste Management Manual*.

Monitoring at these site is the responsibility of the **EPS.**

2. Internally Driven Monitoring

E-Area Vaults (19 wells)

Monitoring at the E-Area vaults is required by DOE M 435.1-1 *Radioactive Waste Management Manual*. Monitoring at this site is the responsibility of **ACP.**

Operating Facilities

Some operating facilities at SRS require groundwater monitoring as a best management practice. These facilities include:

-K Reactor (4 wells)
-L Reactor (4 wells)
-F Tank Farm (10 wells)
-H Tank Farm (35 wells)

Monitoring at these sites is the responsibility of **EPS.**

Site Perimeter

To assure that contaminated groundwater does not move offsite, monitoring wells have been installed near the site boundary. Fortunately, groundwater flow directions are oriented such that this is only necessary along the northwest perimeter of the site and very few wells are needed. This monitoring is the responsibility of **EPS.**

Production Wells

Production wells include drinking water wells and process water wells. Monitoring of the drinking water wells is conducted SCDHEC. The constituents monitored and the frequency of monitoring is prescribed by regulation.

Process water wells are periodically sampled as a best management practice. This sampling is the responsibility of **EPS.**

3. Efforts to Reduce Monitoring

A great deal of effort has been devoted to the elimination of unnecessary monitoring. But the portion of the monitoring program over which SRS can exercise full

discretion is very small (<$100K/year). Most of the monitoring is driven by the requirements of four different regulations as set down in numerous permits and RODs, and because of that, efforts at reducing monitoring usually have to be tailored to specific sites. A formal site-wide process for eliminating wells or analytes is not workable.

However, for monitoring of permitted units an informal pattern has emerged over the years. The first step has been to make sure that monitoring programs are set up to do exactly what the permit requires and no more. It is generally assumed that the requirements are very conservative and protective.

The next step is to negotiate with the appropriate regulatory agency to revise the permit such that it contains only the minimum requirements of the regulation. Again, it is assumed that the minimum requirements of the regulation are protective since it is actually the site's size and remoteness that ultimately protect the public from unacceptable exposure.

The permit negotiation process is continuing at most permitted units, but most of the possible cutbacks have been proposed at least once. The proposals that have been rejected by the regulators are periodically revisited if new data provides a more convincing argument.

Once permits are modified such that they contain only the minimum requirements of the regulation, very little further reduction in monitoring can occur. Regulators can sometimes be persuaded to interpret the regulation is favorable way, but their authority to do this is limited. At this point, efforts are best exerted in finding ways to do the required monitoring more efficiently.

For Appendix C units, there should be fewer limitations on the possible reductions that can be proposed since there is no rigid set of monitoring requirements outside of the ROD itself. Complete elimination of monitoring has already been proposed for some sites. However, changes to ROD-required monitoring can only be made every five years as part of a scheduled review cycle.

C. CORRECTIVE ACTION

Virtually all groundwater corrective action at SRS is driven by either RCRA or CERCLA (Appendix H and Appendix C of the FFA). The RCRA corrective action sites include:

-F Area Seepage Basin Hazardous Waste Management Facility
(in situ pH adjustment to immobilize contaminants)
-H Area Seepage Basin Hazardous Waste Management Facility
(in situ pH adjustment to immobilize contaminants)
-M Area Settling Basin Hazardous Waste Management Facility
(pump and treat, steam injection, recirculation wells, vadose zone extraction)

-Metallurgical Laboratory Hazardous Waste Management Facility
(pump and treat)

-Mixed Waste Management Facility
(phytoremediation)
-Sanitary Landfill Hazardous Waste Management Facility
(enhanced bioremediation through methane injection)

The current CERCLA corrective action sites include:

-Chemical Metals and Pesticides Pits (electrical resistance heating)
-C Area Burning/Rubble Pit (natural attenuation, vadose zone extraction)
-TNX (enhanced bioremediation through injection of edible oil, vadose zone extraction)

Groundwater corrective action is the responsibility of the **ACP.**

D. WELL ABANDONMENT

For most of the last decade, well abandonments have been a low priority at SRS. Virtually all of the site's well drilling resources were needed to conduct investigations at Appendix C (CERCLA) units and continued characterization at Appendix H (RCRA) units. However, well installation work has finally begun to slow down which means resources can be shifted to well abandonment.

There are two groups, **ACP** and the **EPS,** actively involved in well abandonments. The **ACP** will be responsible for abandonment of the out-of service wells formerly used to support their monitoring and characterization efforts. The **EPS** will support other site organizations in abandoning all other unused wells. This will take years to accomplish.

In general, wells will be prioritized for abandonment based on the threat they pose to groundwater resources. The factors examined in characterizing the threat include proximity to contamination, depth, construction method, casing material, and age. Practical and logistical considerations will also be taken into account. For instance, some wells may represent a low threat because they are in very remote locations. However, if such wells go unused for too long, roads disappear and access becomes an expensive problem.

Another factor in prioritizing abandonments is a desire to integrate the abandonments as much as practical into the site's overall facilities disposition plan. For instance, the demolition of unneeded buildings in F Area is one of the first items in the facilities disposition plan. For that reason, abandonment of all out of service wells in F Area is a high priority. This will means there will be fewer "loose ends" to tie up after area demolition bringing the area that much closer to true closure.

II. SITEWIDE INTEGRATION OF GROUNDWATER PROTECTION PROGRAM

A. Geographical Integration

Groundwater protection activities related to waste sites are integrated geographically by the organizational structure of teams assigned to deal with them. The **ACP** organization is made up of teams assigned to cover entire watersheds. Groups within those teams deal with the individual units within the watershed. Because the fate and transport of groundwater plumes commonly overlap within a given watershed (and seldom do between watersheds), this organizational structure is judged to maximize cooperation between individual waste site teams. This philosophy is also embraced by the regulatory community and is reflected in the designation of "Intergrator Operable Units" within the FFA. These units roughly correspond to watersheds.

B. Process Integration

1. Source Control

ACP is responsible for the management and closure of RCRA/CERCLA waste sites while WSRC is responsible for management and closure of the high level waste tanks. The **Regulatory Integration and Environmental Services Department** of SRNS coordinates the efforts of the two organizations.

2. Monitoring

Groundwater monitoring are integrated from "cradle to grave".
Steps in the monitoring process that are subject to sitewide integration mechanisms are:

-well drilling
-well sampling
-sample data management
-data screening
-well abandonment

-Well Drilling

All monitoring wells installed at SRS must be cleared by the Site Groundwater Permitting Coordinator (SGPC) as a necessary step toward obtaining a Well Approval from SCDHEC. Well Approvals issued by SCDHEC are mailed to the SGPC and then forwarded to the field. Hence, there is at least one person at SRS who is aware of all drilling activities planned or ongoing at any time. The SGCP function resides within **EPS**.

Location and construction information on all existing wells can be obtained by a simple query of the Environmental Restoration Data Management System (ERDMS). This database can be accessed by any user of SRS's primary information network, SHRINE.

When groundwater data is needed at a particular location, a call to the SGCP and a query of ERDMS can be used to determine whether already planned or existing wells can be used. In this way, duplication of effort can be avoided.

-Well Sampling

Currently, all but a very small number of groundwater sampling events are mobilized by the Geochemical Monitoring group within **ACP**. Sample request forms or Sampling and Analysis Plans are submitted to that group which then issues chains of custody to the samplers and delivery orders to the laboratories.

-Sample Data Management

Laboratories send analytical results directly to the Geochemical Monitoring Group. After being subjected to any necessary verification and validation, the results are loaded into ERDMS. Anyone on site can access the results for any well.

Most of the data collected is destined to be reported in some form of regulation-required report. The report preparers can extract their data directly from ERDMS. Some data, such as that from operating facilities and perimeter wells, are not reported to any regulatory agency. It is the responsibility of **EPS** to evaluate data for which **ACP** is not directly responsible. The data and any necessary interpretation and trending will be reported to the appropriate facility representative. Some of the data such as that from the perimeter wells will be reported in the annual *Savannah River Site Environmental Report.*

-Well Abandonment

Before any well is abandoned at SRS, a Well Abandonment Plan must be approved by the Site Groundwater Permitting Coordinator. The approval process assures that useful wells are not abandoned. It also assures that abandonments are conducted in accordance with appropriate regulations.

APPENDIX I - CONTACTS

MONITORING		
Environmental Protection Section	Janelle Janssen	(803) 952-7648
	Dan Wells	(803) 725-4332
Area Completion Projects Department	Winston Moore	(803) 952-6806
WELL INSTALLATIONS/ABANDONMENTS		
Environmental Protection Section	Janelle Janssen	(803) 952-7648
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Area Completion Projects Department	Don Frazier	(803) 952-6661
CORRECTIVE ACTION		
Area Completion Projects Department	Michael Hartz	(803) 952-9343