WM2013 Conference, February 24 - 28, 2013, Phoenix, Arizona, USA

Lower Three Runs Remediation Safety Preparation Strategy - 13318

Alexander Mackay, Scotty Fryar and Alan Doane
United States Department of Energy
Building 730-B, Aiken, SC 29808

ABSTRACT

The Savannah River Site (SRS) is a 310-square-mile United States Department of Energy (USDOE) nuclear facility located along the Savannah River near Aiken, South Carolina that contains six primary stream/river systems.

The Lower Three Runs Stream (LTR) is one of the primary streams within the site that is located in the southeast portion of the Savannah River Site. It is a large blackwater stream system that originates in the northeast portion of SRS and follows a southerly direction before it enters the Savannah River. During reactor operations, secondary reactor cooling water, storm sewer discharges, and miscellaneous wastewater was discharged and contaminated a 20 mile stretch of Lower Three Runs Stream that narrows and provides a limited buffer of USDOE property along the stream and floodplain. Based on data collected during the years 2009 and 2010 under American Recovery and Re-investment Act funding, the stream was determined to be contaminated with cesium-137 at levels that exceeded acceptable risk based limits. In agreement with the Environmental Protection Agency and the South Carolina Department of Health and Environmental Control, three areas were identified for remediation [1] (SRNS April 2012).

A comprehensive safety preparation strategy was developed for safe execution of the LTR remediation project. Contract incentives for safety encouraged the contractor to perform a complete evaluation of the work and develop an implementation plan to perform the work. The safety coverage was controlled to ensure all work was observed and assessed by one person per work area within the project. This was necessary due to the distances between the fence work and three transects being worked, approximately 20 miles. Contractor Management field observations were performed along with DOE assessments to ensure contractor focus on safe performance of the work. Dedicated ambulance coverage for remote worker work activities was provided. This effort was augmented with access to medical evacuation services. The areas where the work was performed were remote and difficult to get emergency vehicles to in a timely manner in case of an accident. Satellite phones were utilized due to intermittent phone coverage. High visibility vests were utilized to enable any hunters in the area to see the workers; due to the limited buffer areas along the stream route. An innovative approach to providing the necessary protection for workers during periods of extreme heat and humidity was also employed, which included the use of “heat islands” with fans and crew trailers and ice vests for workers.

INTRODUCTION

The Savannah River Site (SRS) is a 310-square-mile United States Department of Energy (USDOE) nuclear facility located along the Savannah River near Aiken, South Carolina that contains six primary watersheds.

Due to the complexity and size of multiple waste units located in different areas of the Savannah River Site (SRS), the site is divided into six watersheds for the purpose of managing a comprehensive cleanup strategy. In addition, the SRS identifies six Integrator Operable Unit (IOUs) which are defined as surface water bodies (e.g., streams, floodplains, lakes) and associated wetlands, including the sediment, floodplain soil, and related biota (animal and plant life) that correspond to the six watersheds. The Lower Three Runs (LTR) IOU (see figure 1) is one of six SRS IOUs and is located in the southeast portion of SRS. LTR is a large blackwater stream that originates in the northeast portion of SRS and follows a southerly direction for approximately 40 km (24.5 mi) before it enters the Savannah River. The watershed includes two SRS facility areas: P Area Operable unit (PAOU) including P-Reactor (105-P) and R Area Operable Unit (RAOU) including R-Reactor (105-R). In addition, the upper portion of the watershed contains a 2,500-acre man-made impoundment (PAR Pond), several smaller pre-cooler ponds and canal systems. From the PAR Pond Dam, LTR flows approximately 30 km (19 mi) before it enters the Savannah River. During reactor operations, secondary reactor cooling water, storm sewer discharges, sheet flow from the facility areas, disassembly basin water purges and miscellaneous wastewater was discharged into LTR IOU. Today, both P and R Reactors have ceased operations and have been in situ decommissioned, removing the potential additional contamination [1] (SRNS April 2012).

Approximately five miles downstream from the PAR Pond Dam, the SRS boundary narrows providing a limited buffer of USDOE property along the LTR stream and flood plain. This area is referred to as the “LTR Tail” section. Based on data collected during the years 2009 and 2010, three sampling transects (see figure 2) within the middle and lower section were found to have soils contaminated with cesium Cs-137 exhibiting risk greater than 1x 10-4 (23.7 pCi/g) for the adolescent trespasser receptor. The contamination at these locations is contained entirely within USDOE property. The Cs-137 contaminated sediment/soil could, have posed an unacceptable future risk to adolescent trespassers if action was not taken to remove the contamination. Previous actions had been initiated to post warning and no trespassing signs and the construction of fencing to prevent public access, fishing, and hunting on USDOE-owned property. USDOE, as lead agency, is mandated to take action to reduce the adverse effects of contamination per the National Contingency Plan (NCP). The USDOE, US Environmental Protection Agency (USEPA) and South Carolina Department of Health and Environmental Control (SCDHEC) agreed that Cs-137 contaminated sediment/soil present at three transect locations along the middle and tail portions of the LTR IOU was a candidate for action to reduce risk to human health and the environment consistent with Section 300.415(b)(2)(i) of the NCP: *"Actual or potential exposure to nearby human populations, animals, or food chain from hazardous substances or pollutants or contaminants."* [1] (SRNS April 2012).

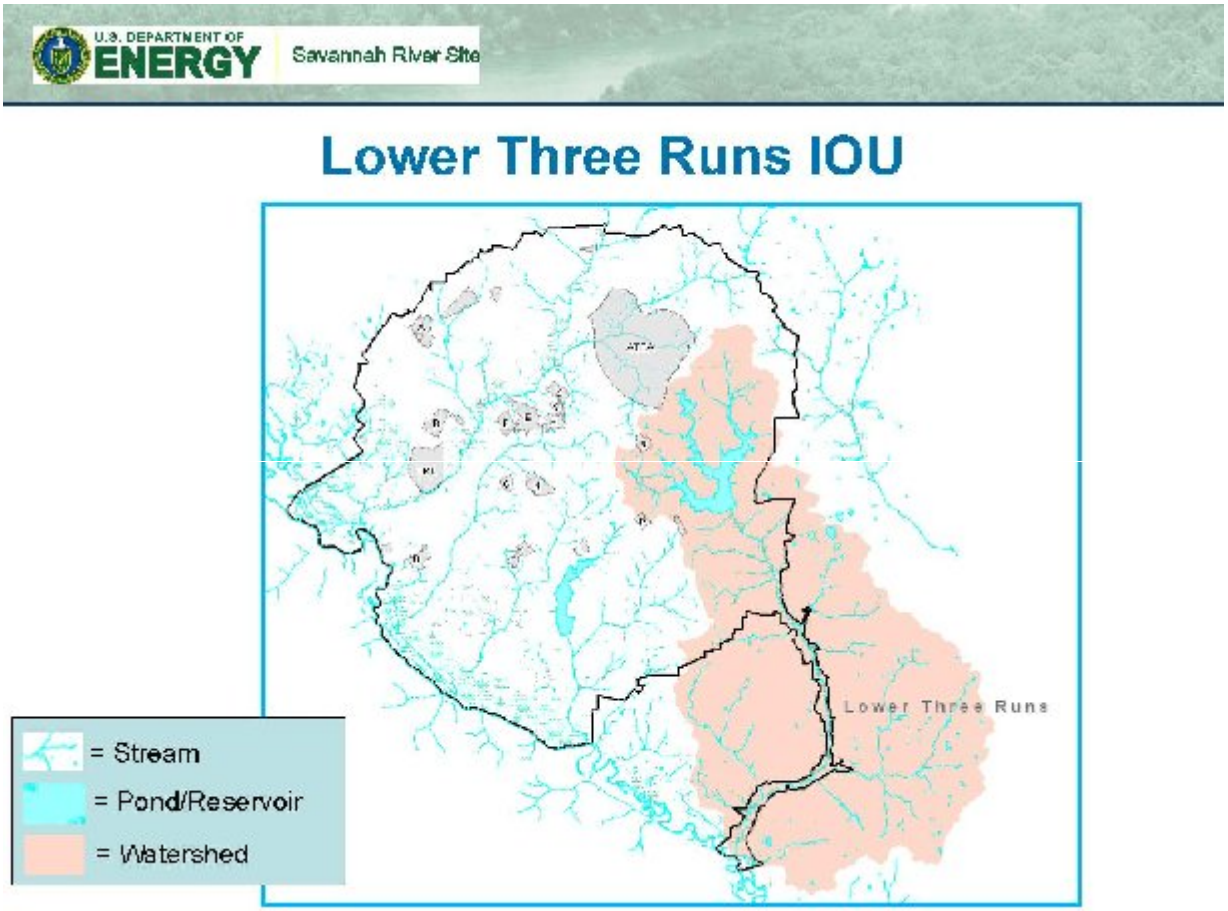

Figure 1
[3] (DOE October 2012)

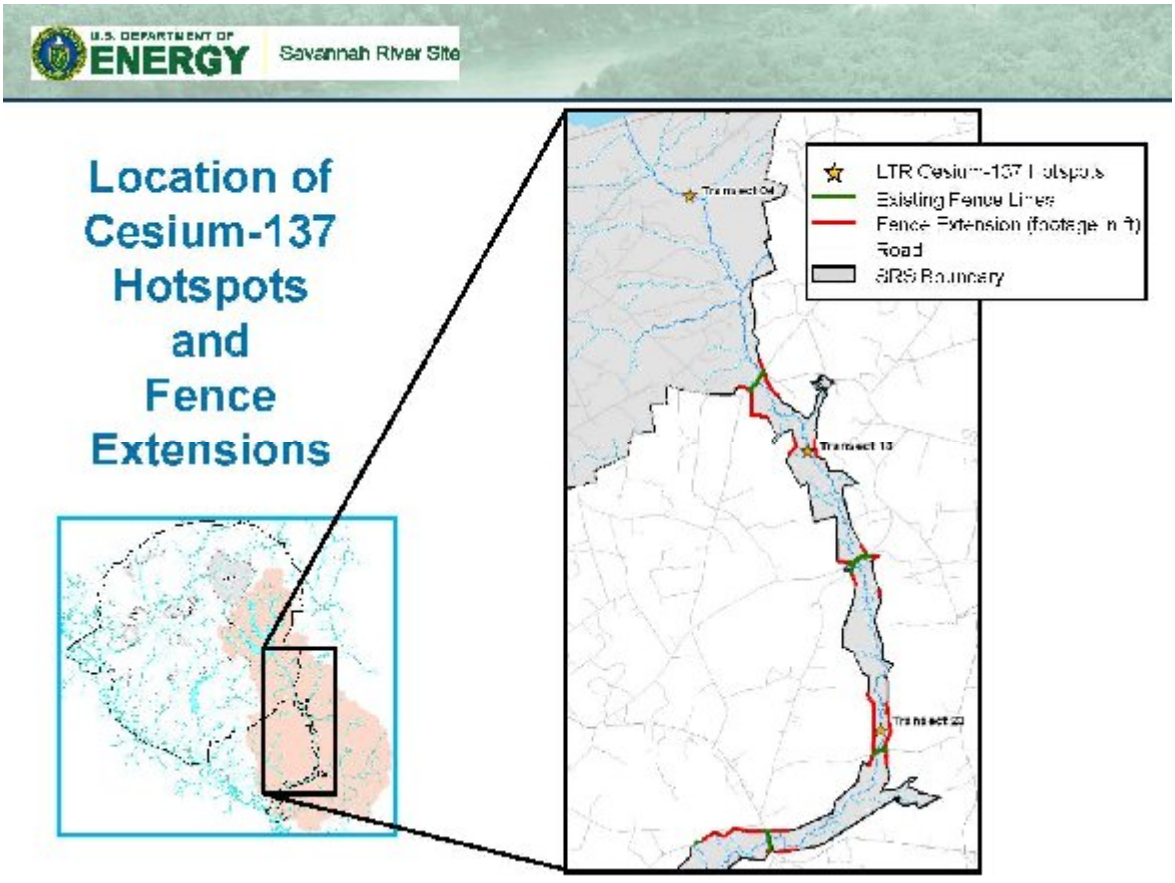

Figure 2
[3] (DOE October 2012)

The remediation effort included additional fencing in discrete areas of the LTR. The removal action selected to manage the potential risk to adolescent trespassers was Removal and Off-unit Disposal with Land Use Controls. The objectives of the removal action were to:

- Perform confirmatory soil sampling analysis and radiological survey within the excavated areas to demonstrate that residual Cs-137 concentration in sediment/soils was equal to or less than the established cleanup goal of 12 pCi/g (5 X 10-5 risk level for the adolescent trespasser).
- Excavate Sediment/Soil in three transect locations where the Cs-137 concentrations exceed 23.7 pCi/g (1X10-4 risk level for the adolescent trespasser) to a depth necessary to achieve the cleanup goal of 12 pCi/g (5 X 10-5 risk level for the adolescent trespasser).
- Install fencing and signs as necessary to control access at selected locations along USDOE's LTR IOU property boundary. Remove trees and shrubs up to 6 in (15.2 cm) in diameter to allow access to the contaminated soils, leaving in place vegetation larger than 6 in (15.2 cm) to maintain stability of the floodplain. Vegetation was deemed not to be a radioactive concern and was left to decompose naturally, enriching the soil. The waste streams generated as part of this removal action will be transported to the appropriate Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Off-Site Rule disposal facility.

DISCUSSION

During development of the LTR remediation process, safety was a major consideration. A number of hazards were identified. However, the location of this work site presented challenges and hazards that routine remediation work does not present. Identifying hazards and mitigating those hazards were discussed by a project team of subject matter experts. Hazards identified to be mitigated include:

Hazard: Work will take place in a remote area on SRS

Mitigation: Subcontractor was required to comply with the SRS remote worker procedure and based on past experiences secure satellite phones as necessary. Workers were not to be allowed to work alone on the job, so the buddy system was implemented.

Hazard: Inability of medical personnel to respond in reasonable time due to the remoteness of the work.

Mitigation:

1) The subcontractor provided for an ambulance service with two trained Emergency Medical Technician (EMTs) present for activities at transects 13 and 23(see figure 2). The ambulance was centrally located based on work activities at these two transect(s). In the event of an emergency, site emergency response personnel were able to provide emergency assistance to the subcontractor at transect 4 because of its location on site. Medical Evacuation services were on standby as needed in case of workers incurring serious and life threatening injuries.

2) The subcontractor required a Safety Professional available throughout the project on the job and was dedicated to the entire project. A Safety Professional was required for each work areas, that is, each transect and the signs/fences.
3) The SRS Safety Engineer alerted proper SRS response personnel of the work scope and work and access locations [2] (SRNS May 2012).

Hazard: The possibility of hunters in the area hunting especially at the tail which has very little DOE property buffer.
Mitigation:

1) The subcontractors Task Specific Plan (TSPs) required high visibility vest as part of their Personal Protective Equipment (PPE). This would allow all personnel to be seen by hunters who may be in the area.
2) SRS personnel were instructed to have high visibility vests on when in the field. This applied to all visitors to the site.
3) Completion dates coincide with hunting season. Special permission by SRS to continue work past these dates was required so a thorough review as to how the subcontractor will mitigate these hazards can be performed.
4) SRS hunts in the area were managed according to site procedures [2] (SRNS May 2012).

Hazard: The need to perform radiological work in wet locations.
Mitigation:

1) SRS radiological management approved a deviation for wearing radiological protective equipment that allowed workers to wear water resistant snake boots as credited radiological protective clothing.
2) Due to the damp work area, radiological surveys were conducted of each person that entered the work area to ensure contamination was not spread to "clean" areas.

Hazard: The possibility of snakes being present at work locations.
Mitigation:

1) All personnel, to include SRS personnel and subcontractors, were required to wear snake boots or chaps with steel toed boots that covered the ankle.

Hazard: The possibility of worker exposure to dust/airborne radionuclides.
Mitigation:

1) The area of work was wet or under water. The levels of cesium in the soils did not warrant air monitoring. Extensive monitoring was performed prior to start of work.

Other hazards were identified and reviewed however no special requirements to mitigate these hazards were needed beyond standard safety, project, construction or SRS practices and procedures. Some of the hazards reviewed included: heat stress, slips, trips, falls and hazardous environment, LTR stream or water environment, hazardous plants and animals, radiological environment, and night work. These hazards were mitigated utilizing standard industrial procedures and practices.

CONCLUSION

The Department of Energy and Savannah River Nuclear Solutions LLC successfully completed the cleanup of a 20 mile Savannah River Site Lower Three Runs stream. Over five million pounds of contaminated soil, erection of miles of fence and placement of over 2,000 signs have made Lower Three Runs safer and significantly reduced the Site's footprint.
Project planning, with an extensive safety preparation strategy, enabled the contractor to perform the remediation work safely and efficiently. The significant safety oversight provided by project and DOE personnel, along with regulatory involvement, all contributed to successful project completion.

REFERENCES

1 SRNS, 2012. *Removal Site Evaluation Report (RSER) for the Lower Three Runs (LTR) Integrator Operable Unit (IOU) Tail Portion (Middle and Lower Subunits)(U) SRNS-RP-2012-00118 Rev 1* , Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC, April.

2 SRNS, 2012. *Lower Three Runs Stream Safety Mitigation Strategy*. Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC, May.

3 DOE, 2012. *Annual Integrator Operable Unit (IOU) Program Update*, Department of Energy Savannah River Site, October.