

Accelerated Remediation and Nuclear Facility Demolition at the Separations Process Research Unit

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ABSTRACT

The Separations Process Research Unit (SPRU) is located at the Knolls Atomic Power Laboratory (KAPL), a Department of Energy Naval Reactors (NR) site near Schenectady, New York. The SPRU facilities include two 1950-era buildings (G2 and H2) that were used to research the separation of plutonium and uranium from irradiated materials. The SPRU project will decontaminate the buildings, remove waste from underground tanks, demolish the buildings, remove contaminated soil, and ship all wastes off site (including the underground tanks). The SPRU project also includes two 15-acre land areas (Lower Level and North Field) that have been contaminated from historical waste handling operations; these will be remediated to agreed-upon cleanup levels and waste will be shipped off site. The primary contaminant in the land areas is cesium-137, although minor amounts of chemical contaminants are present. Work on the SPRU land areas began in August 2008 and will extend into mid-2010. The U.S. Department of Energy (DOE) is proceeding with the SPRU project using its non-time critical removal authority under CERCLA. The chemical contamination is being removed under the auspices of a RCRA corrective action only permit issued by New York State. The SPRU project has received American Recovery and Reinvestment Act funding to accelerate its overall completion date to September 2011, at which point the land will be returned to NR. The object of the project is to remove radioactive and non-radioactive contamination to such an extent that no further monitoring and maintenance will be required.

INTRODUCTION

SPRU occupies approximately 30 acres of the 170-acre KAPL site in eastern New York State. The Atomic Energy Commission (AEC) established KAPL in the mid-1940s to research the process to separate uranium and plutonium from irradiated materials. These materials were brought to SPRU from Hanford Operations. The REDOX and PUREX processes for chemical separation were developed at SPRU, and later exported to other parts of the DOE complex. Figure 1 provides the layout of the KAPL site with the locations of the SPRU nuclear facilities and associated land areas.

The DOE Office of Environmental Management (EM) oversees the SPRU Disposition Project. The SPRU Disposition Project includes:

- Building G2 (the building in which the chemical processes were researched);
- Building H2, including the H2 Tank Farm (the SPRU waste treatment facility);
- Contaminated soil adjacent to or originating from Buildings G2 and H2;

- Contaminated soil in the vicinity of the former K5 retention basin, former K6 and K7 storage pads, and the railroad staging area (Lower Level land area);
- Contaminated soil associated with SPRU waste storage in the North Field area; and,
- Contaminated soil associated with SPRU used in the Lower Level Parking Lot as fill (Lower Level land area).

SPRU operated between February 1950 and October 1953. Partial decommissioning and decontamination of the SPRU facilities began in October 1953 and continued through the 1990s, although the SPRU nuclear facilities and associated land areas still contained residual radioactive and chemical contaminants. Some removals of radioactive contamination from the land areas took place as well. In 1988, the Environmental Protection Agency (EPA) conducted a preliminary assessment at KAPL, including the SPRU facilities, and concluded that the site did not pose an imminent danger to human health or the environment. Therefore, SPRU was not included on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL).

Prior to transfer to EM (completed in April 2009) KAPL safely managed the SPRU facilities; however, they were largely unused by DOE or NR. The existence of residual contamination and the specialized purpose for which AEC designed these facilities make them largely unusable. EM will transfer the areas occupied by the SPRU facilities to NR upon completion of decontamination and decommissioning for its future mission use. No further stewardship activities are expected after project completion.

EM work at SPRU began in February 2000. Early work included radiological and chemical characterization of the SPRU land areas. In the 2005-2006 time frame, small waste storage structures in the Lower Level and a cooling tower near Building H2 were demolished and removed. The SPRU project also gathered extensive historical information that would be needed to plan the major portion of the work, now underway. The *Nuclear Facility Historical Site Assessment for the Separations Process Research Unit (SPRU) Disposition Project (1)* and the *Land Areas Historical Site Assessment for the Separations Process Research Unit (SPRU) Disposition Project (2)* present the history and current conditions of the SPRU nuclear facilities and land areas, including the nature and extent of contamination and detailed property identification and descriptions. Both documents are available at the SPRU project web site, www.spru.doe.gov.

The remedial objectives for the selected actions at SPRU are:

- Ensure that site workers will not be exposed to more than an additional 25 milliRem per year from residual radioactive contamination left in the soil;
- Meet New York State Department of Environmental Conservation (NYSDEC) “No Further Action” requirements for residual chemical contamination in soil and groundwater; and,
- Remove sources of local groundwater contamination.

In their current state, the SPRU nuclear facilities and land areas do not pose a threat to public health or welfare or the offsite environment. However, action is needed to prevent risk to future site workers, and to eliminate the need for ongoing surveillance and maintenance.

REGULATORY FRAMEWORK

The SPRU Field Office is following DOE policy and is using the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) non-time critical removal action process, which offers a streamlined process to guide evaluation efforts and document decisions for DOE remediation projects. The preferred alternative (removal of buildings and contaminated soil) was selected in the September, 2007, *Action Memorandum for the Separations Process Research Unit (SPRU) Disposition Project (3)*. No significant changes to the preferred alternative occurred as a result of regulator or public comment.

DOE-SPRU was informed that it would receive funding pursuant to the American Recovery and Reinvestment Act of 2009 to accelerate the completion of remediation work in the North Field to the 2010-2011 time frame, ahead of the planned completion date of 2013. This required an update to the original *Action Memorandum*, which deferred a decision on the action to be taken in the north field until additional characterization could be performed in adjacent areas (that characterization took place in the fall of 2009). Soil removal was proposed as the preferred alternative for the North Field, and DOE-SPRU held a formal public comment period to solicit public input on this alternative. Limited public input was received; the single commenter suggested that the ‘no action’ alternative be selected. DOE-SPRU revised the *Action Memorandum* in August 2009 to reflect the selection of soil removal as the remedial alternative for the North Field. The revised *Action Memorandum* is also available on the SPRU web site.

On September 29, 2008, the New York State Department of Environmental Conservation (NYSDEC) issued a RCRA “corrective-action-only” permit for SPRU. The permit required DOE-SPRU to submit a schedule for implementation of the interim corrective measures in the upper and lower levels in the SPRU areas within 30 calendar days of issuance of the permit. DOE-SPRU met this requirement on October 28, 2008. The schedule submitted to NYSDEC is consistent with the project schedule contained in the SPRU project documentation approved by DOE. The SPRU permit is believed to be one of the few corrective-action-only permits in New York State.

A Federal Facility Agreement does not exist at KAPL or for the SPRU project, and none is contemplated. The SPRU project incorporates National Environmental Policy Act values into the CERCLA documents as required by DOE policy.

Cleanup levels for radiological constituents in the SPRU areas generally are based upon levels that provide a worker no more than 25 millirem per year of additional exposure. The cleanup level for cesium-137, which is the predominant contaminant, was set at 30

picoCuries per gram. This level is more conservative than the 25 millirem per year remedial objective, and corresponds to an on-site KAPL administrative limit. DOE-SPRU performed an As Low As Reasonably Achievable (ALARA) analysis of the 30 pCi/g cleanup level. The ALARA analysis showed that reaching this level was both practical and cost-effective.

Cleanup levels for RCRA-regulated chemical constituents are based upon table values found in New York State's Restricted Use Soil Cleanup Objectives. Chemical contaminants of concern at SPRU include metals such as mercury, arsenic and silver, although the extent of these contaminants is much less than that for the SPRU radionuclides (all areas in which elevated RCRA constituents are found also have radioactive contamination). New York State's cleanup levels are based upon future use scenarios. The scenarios selected for SPRU were the more conservative of groundwater protection and residential use, although release of this property from Naval Reactors is not likely to occur for the foreseeable future.

PROJECT STATUS

The DOE issued its Critical Decision 1, which authorizes contractors to be selected, in August 2007. DOE selected Accelerated Remediation Company (aRc; a Portage-Shaw joint venture) to conduct the soil remediation work in the SPRU Lower Level in September 2007. DOE selected Washington Group International (WGI) in December 2007 to demolish the SPRU buildings. Both of the SPRU contractors are working under task orders issued pursuant to DOE's Indefinite Delivery/Indefinite Quantity contract. DOE issued its Critical Decision 2/3 in August 2008, which authorized field work to begin for both SPRU efforts.

aRc began its work at SPRU by writing its work planning documents, including numerous documents requiring DOE approval, such as the Radiological Protection Program, the Worker Safety and Health Program, and the Quality Assurance Program. aRc also prepared RCRA corrective action plans for NYSDEC review and approval for the RCRA-regulated portion of the cleanup. Document preparation and approval took longer than anticipated, in part because the contractor's initial approach was to modify program documents from other projects, and these documents did not fully address site-specific conditions encountered at SPRU.

aRc received a Notice to Proceed from DOE-SPRU to begin removal of contaminated soil in the Lower Level Rail Bed Area in August 2008. Removal was done using standard excavation equipment. aRc worked until December, at which point it paused its operations for the winter. Work in the Lower Level Rail Bed resumed in April 2009, and excavation in the Lower Level Parking Lot began in September. aRc completed excavation of contaminated soil in the Lower Level in December 2009, and all site work there, including backfilling and re-grading is expected to be complete in Spring 2010. aRc removed about 12,000 cubic yards of soil in its remediation of the SPRU Lower Level.

aRc's operations became highly systematized, leading to steady production, characterization and shipping of excavated soil. aRc used a progression of three soil staging areas, with one being filled, one being analyzed, and one being loaded for shipment at any given time. aRc loaded soil into lift bags for transport to the eventual disposal site in Clive, Utah. Lift bags, which weighed 16-18,000 pounds when filled, were loaded three at a time onto flat bed trailers. These were taken about 15 miles to a rail spur in Guilderland, New York, where they were loaded onto gondolas for the trip to Utah. aRc shipped twelve lift bags a day at normal production rates, and the time to load a flat bed trailer was ultimately reduced to 15-20 minutes. Once underway, aRc encountered few significant technical or safety issues. Perhaps the most significant issue encountered was infiltration of groundwater into some of the deeper excavations. This water needed to be removed and managed. The issue was resolved collaboratively among DOE-SPRU, Naval Reactors, aRc and NYSDEC. To resolve the issue aRc collected the water, filtered it, tested it, and released the water to an area that was previously excavated, where the water was allowed to percolate into the ground.

aRc's work at the Lower Level is expected to cost about \$19 million. The Lower Level, like all SPRU lands, will be returned to Naval Reactors for future mission use following project completion, after agreement is reached that cleanup goals have been met.

DOE-SPRU is using the Oak Ridge Institute for Science and Engineering (ORISE) to perform independent verification of aRc's confirmation sampling for radionuclides and RCRA-regulated constituents. ORISE's results have consistently validated aRc's results.

WGI, like aRc, began its work with the production of program documents. As with aRc, document production and approval took longer than originally anticipated, for much the same reason. WGI first occupied portions of Building G2, those portions that did not have significant levels of radioactive contamination, in December 2008. Initial work included routine surveillance and maintenance and characterization of non-radiologically contaminated areas. WGI's facility hazard categorization, which found that the SPRU facilities (Buildings G2 and H2, the H2 tank vaults and interconnecting tunnels) were less than hazard category 3 facilities, was approved by DOE in April 2009. At that time, DOE-SPRU gave its approval for WGI to assume responsibility for all the SPRU nuclear facilities.

Following acquisition of accredited dosimetry in June 2009, WGI's initial activities focused on characterization of previously inaccessible areas of the SPRU buildings, some of which had not been entered since the 1960's. Removal of asbestos also began in June. Both G2 and H2, given their age, contain large amounts of asbestos in insulation, floor tiles, and wall board. Much of the outer skin of the buildings is made of transite panels.

During the spring of 2009, DOE-SPRU and WGI received information that low levels of beryllium contamination may be present in the SPRU buildings. WGI undertook an extensive characterization of the buildings, and found beryllium contamination. The contamination in Building G2 was centered on an historical laundry area where beryllium-contaminated protective clothing had been washed. Beryllium contamination

was found in other areas as well, where it has not been linked to historical activities. Although more widespread than originally expected, beryllium contamination levels have been low, and have not exceeded 'housekeeping' levels; no airborne beryllium contamination has been found. DOE approved the WGI Chronic Beryllium Disease Prevention Program in April 2009.

A major portion of the WGI work at SPRU involves the excavation and removal of underground waste storage tanks located in vaults attached to Building H2. The vaults contain six 10,000-gallon tanks and one 5,000-gallon tank. The tanks and other portions of Building H2 were used for radioactive waste treatment by Naval Reactors' contractors for some time after the SPRU activities ceased. The SPRU tanks were cleaned out twice after SPRU ceased operations. In 1964-1965, SPRU and KAPL wastes in the tanks were removed and treated for offsite disposal. The wastes were removed using the standard KAPL waste disposal practices in place in 1965; a copy of these procedures does not exist, but standard practices at that time would have been to agitate the liquid, and to remove it by pumping. Estimates are that 2,377 Curies of activity were removed in the 1964-1965 cleanout. In 1978, KAPL ceased using the tanks and cleaned them out using steam education. KAPL documents characterize the efforts to flush out the residue as "significant" and that further residue could not be removed without "heroic effort." The remaining waste in the tanks was very difficult to remove, and therefore the 1978 effort on KAPL's part met with limited success. The cleanout operations in 1965 and 1978 removed an estimated 2,379 Curies of activity. Currently, these tanks contain approximately 252 cubic feet of residual waste (tank heels) with an estimated 146 Curies of activity.

WGI excavated the nine feet of soil covering the tanks in the fall of 2009, and constructed a temporary structure to house the sludge removal and treatment system. The sludge removal system will use a very high pressure (20,000 pounds per square inch) self-propelled nozzle to remove and slurry the tank sludge, which will be pumped to two shielded mixer/liners that will serve as holding tanks. Characterization will then determine whether the resulting waste is transuranic or low-level (historical characterization was not adequate to conclusively determine this). Transuranic waste may be subjected to additional treatment to remove cesium-137, to allow the waste to be dealt with as contact-handled transuranic waste at the Waste Isolation Pilot Plant. Low-level waste will be sent to the Nevada Test Site for disposal.

Following removal of the tank waste, asbestos removal and decontamination, both buildings will be demolished and their foundations (which extend up to 30 feet below grade) will be removed. Building H2 has limited amounts of contamination from cesium-137 and strontium-90 around its foundation; WGI will remove this contamination as well, to meet the limits that have been agreed to with NR. The area will be back-filled and re-graded. Following agreement that cleanup goals have been met, the SPRU building area will be returned to NR for future mission-related use. WGI's work is expected to cost \$75 million, and will be completed in September 2011.

THE AMERICAN RECOVERY AND REINVESTMENT ACT AT SPRU

The SPRU project has received approximately \$51.8 million in funding from the American Recovery and Reinvestment Act of 2009 (ARRA). This funding has two purposes. The first is to accelerate soil remediation in the 15-acre SPRU North Field area. The second is to augment base program funding and accelerate the demolition of the SPRU buildings.

The North Field project involves removal of about 6,000 cubic yards of soil in the SPRU North Field area, using \$14.8 million of ARRA funding. Like the SPRU Lower Level, contamination in the North Field resulted from historical storage and subsequent leakage of SPRU waste drums there. The contamination is primarily from cesium-137, but there are no RCRA-regulated contaminants associated with the cleanup. The same soil cleanup levels will apply to the North Field as are used in other portions of the SPRU project.

DOE awarded the North Field remediation to aRc through a task order modification in May 2009. The North Field project took advantage of the existing aRc program documents, which required little in the way of revision to begin the North Field work. DOE-SPRU issued a Notice to Proceed to aRc to begin contaminated soil removal in October 2009, and removal began in November. No major technical or safety issues have been encountered in the execution of the North Field work, which employs the same methodologies as were used in the SPRU Lower Level. Field work is expected to be complete by July 2010, with the contract end date being November 2010. North Field work had originally been scheduled to be completed in 2013. aRc hired 21 persons using ARRA funds to execute the North Field work.

DOE used \$37 million of ARRA funding to supplement base program funds to demolish Buildings G2 and H2. DOE issued a task order modification to WGI in July 2009 to incorporate the requirements of ARRA, to separate ARRA from base program work, and to accelerate the overall end date of the SPRU building demolition from December 2011 to September 30, 2011. WGI is using ARRA funding to accomplish the portion of the project that are considered to be relatively low risk from a cost and schedule standpoint. Work performed under ARRA is therefore concentrating on decontamination and demolition of the building shells of G2 and H2, including asbestos removal. Higher-risk work, such as removal, treatment and disposal of tank sludge, is funded by the base program. WGI prepared a separate work breakdown structure for its ARRA and base program work, and tracks the performance for the two separately. WGI hired twenty workers, primarily asbestos abatement personnel, using ARRA funds provide to the SPRU project.

SUMMARY AND CONCLUSIONS

The SPRU project is expected to be completed by September of 2011, at a total cost of about \$124 million. ARRA funding will contribute approximately \$52 million of that cost, and will have the effect of accelerating the overall project by almost three years. DOE-SPRU expects that the project will return over 30 acres of contaminated property

back to NR for its long-term mission use, without the need for long-term monitoring or maintenance. Completion will result in another site closure for the DOE-EM program.

REFERENCES

- 1) Environmental Resource Group, LLC. *Land Areas Historical Site Assessment for the Separations Process Research Unit (SPRU) Disposition Project*. December 2006.
- 2) Environmental Resource Group, LLC. *Nuclear Facility Historical Site Assessment for the Separations Process Research Unit (SPRU) Disposition Project*. April 2006.
- 3) U.S. Department of Energy, Separations Process Research Unit Field Office. *Action Memorandum for the Separations Process Research Unit (SPRU) Disposition Project*. September 2007



Figure 1. SPRU Nuclear Facilities and Land Areas