PLANNING AN ENVIRONMENTAL RESTORATION: CLOSING THE MIXED WASTE SETTLING BASIN AT THE SAVANNAH RIVER PLANT

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ABSTRACT

From 1958 to 1985 wastes generated by aluminum forming/metal finishing processes at the Savannah River Plant (Aiken, SC) were discharged to a settling basin; the waste in the basin is a mixed waste (both hazardous.and radioactive). Use of the basin was discontinued in 1985, and physical closure in situ began in 1988. State and federal environmental requirements affect all aspects of closure and must be an integral part of the closure strategy to enable processing and construction activities to proceed while still protecting the environment. Significant resources were expended to meet environmental protection requirements and resolve the issues involved in implementing these requirements for closure of the M-Area Settling Basin.

INTRODUCTION

The Savannah River Plant (Aiken, SC) produces Special Nuclear Materials for U.S. Government defense activities. Wastes generated by aluminum forming/metal finishing processes used to manufacture fuel and target components were discharged to the M-Area Settling Basin from 1958 to 1985. In 1985,use of the basin was discontinued shortly before a $24 million waste water treatment facility began operation to treat the process wastes.

A plan for closure of the M-Area settling basin was submitted to the State of South Carolina Department of Health and Environmental Control (SCDHEC) in July 1987, and closure is currently in progress. Providing a stable disposal site which protects the environment is the desired end result in closing the basin.

State and federal environmental requirements affect all aspects of closure and must be an integral part of the closure strategy to enable processing and construction activities to proceed while still protecting the environment. The environmental protection requirements of major concern with the M-Area basin closure are: Executive Order 11990 Protection of Wetlands, the National Environmental Policy Act (NEPA), the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Clean Air Act (CAA), and the Endangered Species Protection Act.

Integration of state and federal environmental requirements with the physical closure strategy ranged from permitting mobile treatment processes to planning the capture of the basin's resident alligator. The integration activities began four years before physical closure began, and took about three times the amount of time needed for the physical closure. Significant resources were expended to meet environmental protection requirements and resolve the issues involved in implementing these requirements for closure of the basin.

BACKGROUND

The M-Area Settling Basin (Fig. 1) was constructed in 1958 to contain uranium and other metals in process effluents, and it performed this function well. The basin is a 2.5 acre unlined surface impoundment, with a capacity of about 30,000 cubic meters. Overflow from the basin entered a ditch which leads to a seepage area and a natural Carolina bay known as Lost Lake; Lost Lake has no outlet, so all liquids which entered this area seeped into the ground or evaporated.

Fig. 1. M Area Settling Basin Before Closure.

For closure purposes, the basin area included the inlet process sewer line, overflow ditch, seepage area, and Lost Lake as well as the basin itself. The total area to be closed is approximately 30 acres. Defining the closure area in this manner simplified permitting as discussed later in this paper.

PLANNING

As part of the planning process, several closure options were evaluated to establish the range for environmental consequences: no action (natural drying), excavation of portions of the 30-acre area with in situ closure of the basin, and complete excavation of the area (clean closure); site maintenance and monitoring were included in each option.

A multitude of studies were conducted for the three options. The potential human population and occupation worker risks due to contaminant transport (subsurface, surface, and atmospheric) were estimated using computer modeling. Further modeling studies and an endangered species survey provided ecological assessments of impacts to surface water quality and to aquatic and terrestrial communities. A wetlands assessment was conducted since Lost Lake is a Carolina bay, and the assessment's availability was

published in the Federal Register to meet requirements of Executive Order 11990. Accident analyses, archeological and historical surveys, unavoidable and irreversible impact studies, site control and security assessments, and cost analyses were conducted in addition to the studies on potential environmental consequences.

The information obtained in the studies were considered in a NEPA document, and excavation of portions of the 30-acre area with in situ closure of the basin was selected as the preferred option. The waste in the basin is mixed (hazardous and radioactive) waste since the basin received wastes from a nickel-plating operation as well as wastes from product-testing and uranium-recovery processes. Since the basin contained hazardous waste, a Basin Closure Plan was prepared to meet RCRA Interim Status Standards (part 265) requirements and was submitted to SCDHEC for approval in October 1984.

The plan specified that vegetation in the closure area would be cleared and burned. The plan proposed discharging the basin water to the seepage area since the basin was already permitted as a waste water treatment facility and most of the metals had settled to the sludge layer on the bottom of the basin; the seepage area would act as an additional filter. After removing the water above, the sludge layer would be removed, dewatered, mixed with grout for stabilization, returned to the basin, and compacted. Ash from the vegetation burning and excavated soil from the process sewer line and overflow area would be placed into the basin, and clean soil would be used to finish filling the basin.

A cap consisting of six layers would cover the basin to minimize migration through the closed basin and provide long-term protection against erosion. The layer placed on top of the backfill would be a 0.6-meter-thick layer of impervious clay to provide long-term protection against rainwater intrusion. A 36-mil-thick synthetic layer would be added to provide additional rainwater protection, and a 0.3-meter-thick fine sand layer would be installed to protect the synthetic layer from damage. Next, a 0.3-meter-thick gravel layer would be added to promote drainage away from the layers below; another synthetic drainage/filter layer would be installed to separate the final layer, consisting of 0.6 meters of soil, from underlying layers. Vegetation will be established on the soil layer to minimize maintenance and erosion.

Post-closure monitoring for 30 years after closure will be conducted under RCRA final permit standards (Part 264) and has been approved by SCDHEC in a separate document. By grouping the inlet process sewer, overflow ditch, seepage area, and Lost Lake with the settling basin as the designated closure area, material from these sections could be relocated to the basin under the closure plan. Additional permits, such as an operating permit for the basin as a RCRA waste disposal facility, would have been required for the same physical action if the closure boundary had separated the sections. Thus, judicious boundary selection reduced additional administrative requirements for the physical closure activity.

The Closure Plan was reviewed by both SCDHEC and the Environmental Protection Agency (EPA) Region IV and underwent public review and comment before approval in July 1987. The approval notice contained several conditions; the two major conditions were use of a burn box for vegetation and installation of a temporary waste water treatment system for the basin water.

VEGETATION INCINERATION

The closure plan was modified to include vegetation incineration in a burn box; however, the process for preparing the vegetation was not simple due to the variety of material requiring incineration (such as trees, vines, grasses, roots, and soil mixtures). Extensive studies of vegetation uptake were conducted which indicated that significant amounts of heavy metals, the concern in closure of this basin, were not assimilated by plants. Modeling studies were also conducted which indicated negligible environmental effects with open-air burning even using conservative plant uptake values. After reviewing the results of these studies and conducting another public review and comment period, SCDHEC allowed carefully controlled open-air burning rather than requiring use of the burn box. CAA requirements were examined, and additional restrictions were not deemed necessary. Scientists from the Savannah River Laboratory monitored the vegetation burning and took air samples around the burn site for use in future modeling; samples are now being evaluated.

TEMPORARY WASTE WATER TREATMENT SYSTEM

A waste water treatment system was developed to meet conditions imposed by SCDHEC on the RCRA closure plan, and use of this system was permitted by the SCDHEC Water Pollution Control Division under the CWA. The construction permit application for the temporary treatment system was submitted to SCDHEC in December 1987 and approved in March 1988. Since the temporary system would be treating water from the same waste streams as are now going to be permanent waste water treatment facility, SCDHEC granted approval to discharge the treated water without modifying the National Pollutant Discharge Elimination System (NPDES) permit; two stipulations accompanied this approval: 1) the effluent from the temporary system must be mixed with effluent from the permanent system and 2) the existing NPDES permit guidelines must be met. In the waste water treatment system, basin water was pumped from the basin, adjusted from pH 10 to around pH 7, and treated using conventional precipitation and clarification technology. The clean water was discharged to a permitted outfall, and any solids collected in the system were held for processing with the sludge from the basin.

The treatment system, the construction permit, and the RCRA closure plan were modified later to enhance the filtration step to continue meeting uranium discharge guidelines of 0.5 ppm daily average and 1.0 ppm daily maximum when the water at middle to lower depths

contained high uranium concentrations than anticipated (40 ppm versus 2-5 ppm).The closure plan was also modified when a two-year drought ended 12 weeks after beginning water processing and necessitated processing approximately one million additional gallons of rainwater.

ALLIGATOR REMOVAL

Almost everyone at the plant supported closure of the basin; however, one individual was not happy about the basin closure. "Wally", an American alligator, had taken up residence three years before closure and would have preferred to remain at the basin. Wally was removed from the endangered species list and placed on the protected species list while the closure plan was undergoing the review and approval process.

After evading capture for eight months, Wally was finally captured by a biologist from the Savannah River Ecology Laboratory (SREL) after water processing was well underway. Wally was relocated to an SREL study basin and is undergoing nondestructive examination. He has shown no uptake of uranium or genetic damage from the test results received to date, and the remaining test results for chemical uptake are expected soon. Current plans are to release Wally to another favorable habitat at SRP upon completion of all tests.

CONCLUSION

In conclusion, physical closure of the basin began with processing basin water in May 1988, 10 months after receiving initial approval of the closure plan and three and a half years after the first closure plan submittal. The experience gained during this closure program will help to reduce the time needed for similar operations in the future. The "learning curve" in understanding the applicable state and federal regulations is formidable! Also, the interaction with the state and federal regulators so that you can determine how they intend to interpret and apply the regulations is very time-consuming. Therefore, the lessons learned during this operation will lead to more efficient environmental activities in the future at this and other DOE sites.

REFERENCES

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