Finding Balance: How Future Use Guides Ash Pond Closure Strategies

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CONFERENCE: 2019 World of Coal Ash – (www.worldofcoalash.org)

KEYWORDS: coal combustion residual (CCR), ash pond closure, impoundment closure, landfill closure, decommissioning, coal yard, brownfield, redevelopment

ABSTRACT

Even the simplest impoundment closures come with design challenges. It is a challenge to navigate project constraints; whether technical, regulatory, or financial; to design and implement an effective closure strategy. Cost often helps to determine the “balance” between project constraints when the future end use of a closed coal combustion residual (CCR) surface impoundment or the property it occupies is undefined. When a post-closure end use is defined, finding balance among project constraints to best serve that future use provides rewarding challenges.

SCS Engineers (SCS) has navigated this balancing act on impoundment closure projects during generating facility decommissioning. Through a presentation of case studies, you will learn how this team has approached ash pond closure planning and execution where the future use of the impoundment site ranged from undefined to the home of a new solar photovoltaic (PV) installation. Examples also include potential future industrial use or property sale.

Case studies will highlight how geotechnical, hydrological, regulatory, or simple physical constraints have influenced the design and implementation of CCR surface impoundment closures.

INTRODUCTION

In the context of CCR surface impoundment closures, it is challenging for project owners and their teams, including consultants and contractors, to navigate project constraints. Whether the constraints are technical, regulatory, risk-based, or financial, the team must manage them all during the closure process. In our experience, defining the post-closure end use for a site helps the team find balance among project constraints. When the project owner knows the desired end use, we can develop a creative closure strategy that best serves the future site use and the owner’s project goals.
PURPOSE

CCR surface impoundments are closing now and in the near future. While assisting utility clients, SCS has navigated the process of balancing constraints on CCR surface impoundment closure projects during generating facility decommissioning. If we are successful in understanding the owner’s goals for the site’s future use, balancing the end use with site constraints allows us to:

- Make efficient project decisions during design and construction
- Design for flexibility to reduce construction costs and delays
- Reduce future or long-term costs
- Improve the overall value of the project and the property

We want project owners to have the opportunity to maximize the value of their sites after closure. We want owners to meet their project goals, and hope that by sharing our experiences it will help owners find creative solutions.

Through a presentation of case studies, you will learn how our team has approached ash pond closure planning and execution. Future use of these impoundment sites range from undefined to the home of a new solar PV installation. The case studies highlight and focus on how technical constraints influenced the design of CCR surface impoundment closures.

CASE STUDIES

Each of the following case studies represents a CCR surface impoundment closure project completed in the context of generating facility decommissioning. The impoundments closed while the power plant facilities they supported were undergoing demolition. The owners were also closing coal yards and on-site landfills at the facilities. Each of the generating facilities involved was of similar size and function. Each of the facilities handled fly ash dry; therefore, the CCR impoundments were small to moderately sized for handling bottom ash or slag. The facilities also had low-volume wastewaters from plant operations. The case studies examined include legacy surface impoundments that were not subject to the Federal CCR rule (40 CFR 257 Subpart D). Each of these sites were being converted and positioned for future use or long-term risk management.

CASE STUDY #1

Background
Our first case study site involves a 1950’s era coal-fired generating facility that the owner refueled to burn natural gas in 2000 and then idled in approximately 2010. Decommissioning of the plant and supporting infrastructure began in 2012. SCS supported the owner’s decommissioning team with planning, design, permitting, and construction oversight for the closure of the following plant infrastructure:
• Coal yard
• Coal yard runoff pond
• CCR beneficial reuse storage area
• On-site landfill
• Ash ponds
• Low-volume wastewater ponds

Other project team members were responsible for the removal of the generating station and support buildings.

Project Goals
The site owner proposed to redevelop portions of the generating facility property. The team considered two potential redevelopment opportunities while preparing the site for closure. First, the team evaluated the property as a candidate site for the expansion of a neighboring natural gas-fired combined cycle generating facility. Next, having long-term liability for maintenance and monitoring of the on-site landfill, the owner proposed to develop a solar PV system on the landfill following final closure.

Constraints
Project constraints had the potential to impact the proposed post-closure redevelopment opportunities and included both technical and regulatory items. Regulatory constraints included local zoning requirements, Federal Aviation Administrative (FAA) safety requirements for the construction of potential wildlife attractants (new storm water pond) and solar PV panel reflectivity, and the state department of natural resources process for development on a fill site (i.e., landfill). Technical constraints included the volume of decommissioning waste material generated during closure of the coal yard, ponds, and beneficial reuse storage area; geotechnical site conditions; storm water management; and development of the PV system on the landfill cover.

The most significant of these constraints was ensuring the closure design included enough capacity to dispose of decommissioning wastes on site. Disposing of these wastes on site avoided the high cost of off-site disposal. Providing the required on-site landfill capacity while balancing the facilitation of the potential redevelopment of the landfill became the focus through the closure design process.

Closure Approach
Because the on-site landfill license was still active, the closure approach was to consolidate decommissioning wastes into a final closure plan for the landfill. The coal yard, coal yard runoff pond, and portions of the beneficial reuse storage area and low-volume wastewater ponds were closed by removing residual coal, coal-impacted soil, sediment, and CCR. We consolidated the waste materials from these areas into the landfill and capped it with a composite final cover system. The closure plan included final landfill grades that were flexible enough to accommodate variations in decommissioning waste volumes during construction. The flexibility also facilitated the potential solar PV development on the cover.
A geotechnical investigation of the property provided preliminary geotechnical data and recommendations to evaluate the siting of the new natural gas-fired power plant.

A solar feasibility assessment of the landfill site helped the team ensure the closed landfill could provide enough space to develop the solar PV generating capacity desired by the owner.

Results

Working with the owner’s decommissioning team, SCS developed a closure plan that balanced the technical and regulatory constraints identified above with the site redevelopment goals. The team incorporated regulatory requirements for zoning, FAA safety, and landfill redevelopment into a county zoning permit and a closure plan for the facility. The state department of natural resources approved the closure plan. The county zoning permit and state closure plan considered and incorporated the future solar PV development in the permit documents. Including the solar development in the permitting upfront will streamline future permit approvals or eliminate the need for them.

During closure construction, the flexibility built into the closure plan and permits allowed the team to modify the grades in the final landfill and impoundment closure areas to accommodate the actual volume of waste material the project generated. The team developed the final landfill grades to accommodate all of the waste material generated from the coal yard, coal yard runoff pond, beneficial use storage area, and low-volume wastewater pond closure. With the design flexibility already in place, the team incurred no additional costs or delays while making the necessary changes. No additional regulatory agency interaction was required to implement the changes beyond the documentation report submitted after completion.

Approximately 15 acres of the landfill was available for the development of a solar PV system after closure. The landfill final grades developed during closure also maximized the potential for solar PV production by providing relatively low (e.g., 2 percent) south-facing slopes using the flexible design criteria established in the closure plan. Shortly after the landfill closure was completed, the owner worked with a developer to install a solar PV facility capable of generating approximately 2.3 megawatts (MW) of solar power. The team had already addressed the technical considerations of the solar PV development that impacted the closure design and discussed these aspects of the project with local and state regulators. These technical considerations included items such as:

- Slopes and slope stability
- Settlement
- Final cover system
- Foundation design/impact on the final cover
- Vehicle loading
- Storm water
- Erosion control
These technical efforts streamlined the regulatory process for the solar PV facility development and allowed the team to focus on the technical design details of the system.

The completed site included storm water management features capable of accommodating runoff from the remediated/restored coal yard and the closed landfill, meeting all state and local storm water management requirements.

The natural-gas fired combined cycle plant was eventually sited on a neighboring greenfield site, and not the former power plant site.

CASE STUDY #2

Background
The second case study site involves the closure of CCR surface impoundments that supported the operation of a coal-fired power plant. Since that time, the owner demolished the plant with the support of other decommissioning team members. SCS assisted the site owner with the planning, design, permitting, and construction oversight for closing four discrete pond areas comprising approximately 10 acres of CCR impoundment area.

The CCR impoundments are located under an interstate bridge constructed in and over the impoundments in the 1960s. The current four-pond configuration was developed around the bridge’s support structure on top of the existing ash ponds in the 1980s. The impoundments are surrounded by wetlands to the southwest and southeast, by a railroad right-of-way to the northwest, and a surface parking facility and road right-of-way to the northeast.

Project Goals
The future use of the surface impoundment property was limited by its location under the interstate bridge; therefore, the site owner proposed to close the impoundment site as green space and leave CCR in place under a final cover. The goal was to accomplish closure, which required the input of numerous project stakeholders outside their organization, as cost effectively as possible.

Constraints
Project constraints limiting post-closure redevelopment opportunities were mainly technical, and more specifically physical and geotechnical. The location of the bridge and an existing agreement between the utility and the state department of transportation (DOT) eliminated the possibility of closure by removing existing CCR. Bridge piles and pier structures were located in and on CCR, and the owner’s agreement with the state DOT dictated the limits of excavation and CCR removal. A technical review of the potential closure by the state DOT also identified further restrictions on the placement of fill materials above existing grades in an area surrounding three sets of bridge piers located near the center of the impoundment closure area. The restricted area is referred herein as the “no fill” area.
In addition to capping soft sediments and CCR in place, the west berm of the current ponds was constructed on deep organic soils. An evaluation of the stability of the west berm dictated careful monitoring of soil pore pressures during closure construction.

Besides the physical and geotechnical constraints, water from the surface impoundment closure area and storm water moving through the surrounding wetlands all needed to discharge to an adjacent lake. Water was conveyed to the lake through a single culvert running under a rail storage yard and right-of-way that could not be interrupted by the impoundment closure activities.

These technical constraints also resulted in project constraints dictated by regulatory and other project stakeholders including state department of natural resources solid waste management staff, state DOT staff, and the railroad owner. These project constraints were manifested as permit or agreement conditions that dictated construction activities or related communications. Generally, the permit or agreement conditions did not require design solutions beyond those needed to address technical constraints discussed above.

Closure Approach
The surface impoundments were closed with CCR left in place under a final cover. In this case, the material required to develop the final cover grades was minimized due to very little on-site material available for use as fill. Fill material required to establish final cover slopes and provide positive drainage was imported at a cost to the site owner, and consisted of clean off-site soil.

Results
SCS worked with the project owner to develop a closure plan for the surface impoundments that satisfied regulatory and stakeholder requirements while balancing technical solutions. The goal of the closure plan was to minimize closure construction and long-term maintenance costs. This case study was balanced by identifying smart and simple solutions to site constraints that did not require significant capital resources.

Unlike our previous case study where landfill cover grades were established as a gently sloping mound to promote the solar PV system development, the “no fill” area under the bridge required a different approach. In this case study, the “no fill” area became a pond, and the final cover grades were inverted. As a result, storm water drained internally instead of to the perimeter of the site. The pond was lined to serve as the cap for the sediments left in place. A laminated GCL was used to allow for a simple method of sealing the pond liner to the bridge structure.

Outside the pond, the site was capped with clay and topsoil. Aggregate was used in place of topsoil where the bridge shades the cover. The aggregate was used in lieu of topsoil in order to minimize maintenance associated with establishing and maintaining vegetation.
A swale was designed to discharge water from the “no fill” area pond and runoff from the final cover. A discharge structure was designed to maintain peak storm water flows below pre-construction levels to minimize impacts to the downstream railroad. After available on-site fill was utilized, clean fill was imported to establish the minimum required drainage to the no fill area pond and swale. Imported fill specifications allowed the use of a wide range of suitable soil material to minimize the cost of imported fill.

No work stoppages were required due to the pore pressure monitoring conducted in the west berm. A geotechnical monitoring system was installed that used vibrating wire piezometers to monitor the soft organic soils during closure construction. Geotechnical monitoring data was obtained remotely and in real time to guide the placement of fill materials during closure construction. The geotechnical monitoring system also included bench marks installed along the west berm and the bridge piers that were fitted with survey prisms. The bench marks and bridge pier prisms could be surveyed efficiently to monitor for movement during the closure activities.

Dewatering and stabilization of the existing impoundments was simplified by discharging water to the sanitary sewer with limited treatment for suspended solids. This option was possible due to upfront stakeholder discussions that presented opportunities to collaborate and address technical issues as a team. The project team worked with the closure contractor to develop a cost-effective system to stabilize the impoundment subgrade using a geogrid and non-woven geotextile before fill material was placed. The stabilization technique allowed the owner to maximize the funds budgeted for subgrade stabilization and apply the method as needed without significant budget impacts. Subgrade conditions were relatively unknown before the start of construction; therefore, forethought was key.

Other creative solutions were incorporated into the closure plan design and permits that allowed the contractor to install temporary drainage structures to divert storm water away from their work. The site was internally drained and the overlying bridge deck drained to the existing CCR impoundments. Diverting storm water flows away from active closure construction offered opportunities to save time and cost to rework in areas that might otherwise be impacted by bridge deck drainage. Incorporating these elements into the design saved the team time and prevented delays. Delays would have been likely if state DOT approval of the diversion structures was required during construction.

SUMMARY

Defining a post-closure end use for your CCR surface impoundment or landfill before the planning, design, and permitting of a closure project will help project teams find balance between project constraints and project goals more efficiently. Two case studies are offered to provide examples of how developing this understanding early in the development of a project can lead to effective project solutions and positive outcomes for project stakeholders.