AEP's CCR Impoundment Closure Projects - Lessons Learned, Insights & Exemplary Practices

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1. ABSTRACT

American Electric Power (AEP) is actively engaged in multiple coal combustion residual (CCR) impoundment closure projects in various stages of engineering, permitting, construction, and post closure care & monitoring. AEP's Generation groups routinely utilize lessons learned processes in execution of its projects.

The closure of wet fly ash impoundments can be extremely challenging endeavors that require the integration of engineering & design, permitting and very specialized construction knowledge and skills. AEP has revised its heavy civil, contractor selection and procurement processes to integrate its lessons learned, exemplary practices and other insights into its institutional knowledge for managing risks in closure of its coal combustion residual impoundments. A select number of lessons learned, insights and exemplary practices are shared with conference participants.

2. ACKNOWLEDGEMENTS

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3. INTRODUCTION

AEP's CCR impoundment closure program includes a variety of fly ash, bottom ash or flue gas desulphurization (FGD) by-product impoundments located at power plants, in states spanning an area from Ohio in the northeast to Texas in the southwest. The impoundment structures range from large reservoirs in valleys held by dams, to other earthen dam or dike impoundments and incised impoundment facilities. The use of the

term CCR within the remainder of this document pertains to coal fly ash and/or bottom ash materials, unless otherwise noted.

4. ABOUT LESSONS LEARNED

Lessons learned may consist of activities that were known to have negatively impacted the execution of a project or the performance of an organization or may be activities or events that worked well and had a positive effect. The projects and engineering groups, within AEP's Generation business unit, routinely utilize lessons learned processes in execution of their projects. Through documentation and dissemination of lessons learned, project teams and organizations learn from and avoid the reoccurrence of miss-steps. Additionally, and equally as important, lessons learned processes may extend to the identification of exemplary practices and recommended process improvements that help mature performing teams and organizations, increasing their value to and contributing to the bottom lines of their companies.

5. LESSONS LEARNED PROCESS

Documentation of lessons learned is required in execution of projects within AEP Generation. Project teams may be asked to document lessons learned following a specific incident, action or activity. Alternatively, lessons learned are compiled following completion of a short term project of a year or less; or, in the case of a long term project performed over multiple years, they may be compiled following the completion of a project phase (e.g. initial front-end engineering and design, detailed engineering, construction, and start-up and commissioning). Over the course of a multi-year site construction effort, project lessons learned may be documented semi-annually or on an annual frequency.

6. LESSONS LEARNED, INSIGHTS AND EXEMPLARY PRACTICES

6.1. Scope and Organization of Discussion

The discussions contained herein primarily pertain to lessons learned, insights and exemplary practices associated with in-place closures of CCR impoundments. The discussions and advice shared within this section are also organized along category headings of: lessons learned, insights, and exemplary practices. The format employed for presenting the subject matter is as follows:

> 6.1.1. *Lesson Learned, Insight or Exemplary Practice*:
> A recommendation statement is listed, followed by a discussion, as appropriate for understanding and context.

The lessons learned, insights and exemplary practices listed and discussed in the sections to follow are judged to be some of the more significant issues worthy of listing and discussion; they are not, however, listed in any prioritized ranking.

6.2. Lessons Learned

6.2.1. Water Management

Develop detailed expectations of bidders for water management in your request for proposals (RFPs); be sure to cover all aspects of water management. The closure of a CCR impoundment is as much about water management, if not more, than the actual excavation and placement of materials in closure construction. Expectations for water management should cover all water associated with the execution of the work and within the limits of disturbance as defined on the drawings; including but not limited to surface water run-on, temporary surface water storage, ground water, monitoring of the phreatic surface, rate of surface water pool drawdown and discharges of non-contact storm water and process water in accordance with the Owner's relevant permits.

6.2.2. Asbestos

Look for the presence of asbestos coatings on structures within an impoundment. Old wooden discharge structures may have been treated with coatings that contain asbestos. Late discovery and special handling of asbestos materials will add unexpected cost to the project.

6.2.3. Abandoned Gas Pipeline Rights-of-Way

Don't assume that gas pipelines (e.g. oil, natural gas, etc.) have been removed from abandoned rights-of-way. Abandoned large diameter (i.e. 18 to 30 inch diameter) transport pipelines and smaller gathering lines from wells may be present in planned borrow areas and within your projects' limits of disturbance.

6.2.4. Vegetation and Hidden Voids

Don't assume that cattails and other vegetation growing over a CCR impoundment are at the surface of the CCR. Vegetation can hide the true CCR surface and localized water pools. Planned excavation and placement quantity estimates could be off, impacting a contractor's material movement plan and schedule of work.

6.2.5. Quantity of Borrow Material

Borrow material needs may be greater than planned. Allocate contingency use of additional borrow material, including classification and quantification of additional materials for the following considerations, as applicable:

- excavated CCR may compact at up to a 1:0.8 ratio, requiring additional borrow material to fill an area to design grade;
- more borrow material than anticipated may be needed to help stabilize a soft subgrade in areas of fill;
- CCR cut to subgrade may have soft areas that require further excavation and fill to bridge these areas;
- plan for settlement in areas of fill and use of borrow material to bring the area up to design grade; and
- the use of borrow to fill eroded areas of CCR exposed at subgrade.

6.2.6. Exposed Ash at Subgrade

Try to limit the amount of CCR intentionally exposed at subgrade. This lesson learned helps reduce the risks for additional quantities of borrow material as noted above and any rework due to erosion. Dust control of exposed CCR and the freeze drying of the material in the winter are additional considerations.

6.2.7. Stream and Wetland Impacts

Optimization and mitigation of stream and wetland impacts require considerable more time and effort than may be envisioned. Plan your stream and wetland delineation efforts well ahead of project design to provide:

- optimization of borrow areas and project limits of disturbance to avoid ephemeral, intermittent and perennial streams;
- a clearer understanding of mitigation costs; and
- early determination of self-mitigation costs relative to: payment of an in-lieu fee, purchase of available stream or wetland credits or even transfer of permittee responsible stream and wetland mitigation to third party.

6.3. Insights

6.3.1. Construction Means & Methods

Recognize that there are a number of construction means and methods for closing a wet CCR impoundment. As an Owner, you need to factor in a number of parameters and varying risk exposures associated with the range of means and methods offered by bidders. Risk exposures may include:

- quantities of borrow material needed to help stabilize a soft subgrade or to seal the subgrade to help prevent erosion prior to deployment of the cap cover system,
- adequacy of water management plan, and
- potential need for water treatment.

6.3.2. Use of shallow and/or deep dewatering points

Carefully consider how deployment of shallow or deeper dewatering points will impact your water management plan. Consider installation of a multiport well or other temporary well(s) to characterize CCR pore water; the contractor's selection of shallow or deeper dewatering points may impact other aspects of the overall water management plan.

6.3.3. Cenospheres

Plan to collect and dispose of cenospheres. As ponded CCR is excavated or otherwise disturbed, cenospheres will be liberated and they will float on the surface of the main pool and move around the water pool depending on the direction of the wind.

6.3.4. Cattails and Other Vegetation

Take advantage of cattails and other vegetation. Don't feel that the five to six foot or more of vegetation growth needs to be burned or otherwise removed before starting closure construction. The vegetation will provide some stability during deployment of geo-grid materials or floating roads; deep root structures may have been growing for years as ash accumulated in the impoundment.

6.3.5. Construction Season

The construction season for cost effective CCR excavation and placement is more limited than normal heavy civil work. Cool, wet and overcast days prolong drying of CCR during handling (i.e. excavation, stockpiling and placement). In the Ohio Valley area, count on five to six months of warm weather, for cost effective CCR handling; site recovery time after summer rain storms may only be one-half to one day verses multiple days in late Fall, Winter and early Spring.

6.3.6. Old Aerial Photos

Consider how a wet CCR impoundment may have evolved over time and factor that evolution into your construction execution plan. Dredging, excavation and dewatering operations can be adversely impacted or positively exploited through understanding of past site activity (i.e. floating roads, geotextiles, intermixing of fly ash and bottom ash, discharge points, etc.). Examples include, among others, dredge cutter heads and discharge lines could be impaired by previously placed geo-grid and use of dewatering points could be enhanced in locations of old floating roads and CCR discharge locations to the impoundment.

6.3.7. Trace Constituent Analyses

Consider performing trace constituent analyses of the CCR materials within an impoundment. Should a potential reportable situation arise, any calculations of constituent releases would be based on the actual CCR material.

6.3.8. Monitoring of Settlement

Allow adequate time for settlement of fill over CCR in an impoundment. A contractor's construction execution plan and schedule for deployment of the cap cover system over the CCR subgrade, in areas of fill, may not sync with the Owner Engineer's requirements. Be sure to communicate settlement monitoring requirements as a part of a request for proposals; bidder exceptions need to be evaluated from a risk cost standpoint and factored into the overall bidder evaluation.

6.3.9. Intermediate Phase Best Management Practices (BMPS) for Storm Water Pollution Prevention Plans (SWPPP)

Consider the adequacy of BMPs at various phases of construction phases. Projects can be exposed to low probability/high impact risk situations during certain phases of construction. Build time into the review of a design to ask constructability questions around the need for any particular BMPs to help mitigate low probability/high impact risk events; at a minimum, contingency plans should be thought out and communicated to site personnel.

6.3.10. *Specific Water Withdrawal & Discharge Permits*

Determine the need for any special water withdrawal permits ahead of the bid/award process, if possible. Depending on a contractor's construction execution plan (e.g. installation of dewatering points), a specific water withdrawal permit may be required ahead of the installation of dewatering points and/or a specific water discharge permit may be needed prior to operation of the system.

6.4. Exemplary Practices

6.4.1. *Carefully select and prescreen the contractors that you allow to bid on your CCR closure projects.*

AEP places a high priority on finding contractors that have cultural performance and behaviors consistent with our Beliefs, Behaviors and Outcomes. Key beliefs are:

- all injuries are preventable,
- do the right thing every time,
- our best solutions are a result of teamwork, and
- pursue greatness.

The closure of large CCR impoundments requires a laser focus on safety and a belief that all injuries are preventable. Furthermore, the price of transferring all closure construction risks to a contractor may be too high to an owner; therefore you need to develop a positive job site culture of teamwork and trust to navigate changing or unexpected jobsite conditions.

6.4.2. Look for multi-project synergies

Time other plant site work to generate material for closure of the CCR impoundment. Significant cost savings can be exploited by incorporating clean fill as a contouring material into the subgrade of the impoundment.

6.4.3. Carefully review bidder proposals

Take the time to carefully review and score the various components of a bidder's proposal. The low bid may not be the best bid once you take the time to carefully examine a bidder's execution plan and exceptions. Understand your major risks and secure management buy-in for a process that allows you to apply risk dollars to a bid submittal to help determine the best bid from a total evaluated cost standpoint.

6.4.4. Geo-Grid Material

Geo-Grid provides a margin of safety and is a relatively inexpensive. Geo-grid works well over CCR in the construction of floating roads when a granular material is placed on the geo-grid to make the floating road. The geo-grid and granular material allow increases of CCR pore water to come to the surface and dissipate within the granular material while maintaining the integrity of the floating road.

6.4.5. Site Post Project Use

Consider post project uses for the site (e.g. environmental stewardship options, stream mitigation, installation of renewable resources, etc.) in addition to site access for post closure care and monitoring. Certain necessary temporary or permanent construction features can be located and left in-place to facilitate post closure care and monitoring and any access related to an environmental stewardship activity or other projected use.

6.4.6. Standby Emergency Equipment

Consider use of standby equipment for low probability/high impact risk events. Types of equipment may include but not be limited to:

- stop logs for decant towers,
- inflatable plugs for water discharge outlets,
- extraction vehicles for equipment stuck in soft subgrades, and
- water craft.

6.4.7. Detailed Construction Site Mapping

Consider development and use of a site map showing: phases and sub-phase areas, borrow sites, named floating roads, perimeter roads, etc. The map will help facilitate communication among construction and other on-site vehicle traffic.

SUMMARY

Closures of wet CCR impoundments are challenging endeavors for both an Owner and the successful bidder (i.e. site contractor). Carefully prescreen and choose prospective bidders to insure that they align with your desired culture. An Owner/contractor collaborative approach will be a win-win proposition for both parties.

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