

Closure of Unlined CCR Impoundments: Working with State and Federal Agencies to Develop a Mutually Acceptable Solution

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ABSTRACT

Operational coal combustion residue (CCR) surface impoundments in Illinois are regulated under the State's water program implementing both water and groundwater quality rules. Those rules provide for protection of groundwater quality and impacts to water bodies but do not specifically address design or closure standards for surface impoundments. Prior to the work described here, the policy of the State's environmental regulatory agency was to apply a different set of rules governing the management of solid waste landfills to the closure of ash impoundments. The landfill rules were promulgated after many of the CCR impoundments in Illinois were already constructed, and include numerous design criteria and closure requirements that are impractical when applied to surface impoundments, particularly after the impoundment structure had been in use and had accumulated significant volumes of CCRs. Therefore, Ameren and its legal team, supported by technical analyses from its environmental consulting team, worked with the State to develop a site-specific rule governing closure of a CCR impoundment along the Wabash River in Illinois. The first part of this presentation will focus on the site specific rule developed and the process for negotiating this first of its kind regulatory approach.

The second part of this presentation describes application of the essential elements or "protocol" established by the site specific rule for closure of a second unlined CCR impoundment. This second impoundment is located near the Mississippi River, and one of the impoundment berms is a flood control levee. The existence of the levee presented an additional complexity requiring the development of additional information to be submitted to the US Army Corps of Engineers demonstrating that closure would not compromise the levee. This portion of the presentation will discuss issues encountered and solutions employed to obtain approval of the overall closure plan.

PART 1: DEVELOPMENT OF REGULATIONS FOR CLOSURE OF A SURFACE IMPOUNDMENT IN ILLINOIS

Ameren and its predecessors operated a CCR impoundment (Pond D) at a power station in southeastern Illinois from 1968 until 2000. The impoundment had not reached capacity; however, it was unlined and there were groundwater quality issues caused by seepage from the impoundment.

Ameren initiated the closure process shortly after removing the impoundment from service; however, closure was not feasible because the requirements under which the impoundment operated were intended for clean closure, where all solids would be removed prior to closing the unit. In this case, the impoundment had to be closed with the solids in place. As a result, the State environmental regulatory agency called for closure of the impoundment under rules developed for municipal solid waste landfills. Among other things, these rules included requirements for a leachate collection and management system, facility maintenance, and groundwater monitoring that were not practical for a closed surface impoundment.

The impoundment was constructed in 1968 before waste disposal regulations were promulgated, and as such was built without a liner and leachate collection system. Ameren considered options for installation of a leachate collection system, but these options were either technically infeasible or cost prohibitive. Maintenance items in the regulations that do not apply to closure of an impoundment included requirements for daily cover and compaction of waste. Groundwater monitoring requirements that were not practical for a CCR impoundment included requirements for monitoring organic constituents and establishing maximum allowable predicted concentrations within the facility's zone of attenuation—the latter being impractical because it inherently assumes there is no release from the facility and a release was evident from Pond D.

Groundwater quality was also of issue because shallow groundwater had concentrations of inorganic constituents such as boron that were higher than both background and Illinois groundwater quality standards. There was also evidence of off-site migration. However, no drinking water aquifers were affected, and groundwater discharged to a large river adjacent to the impoundment. Therefore, there was no risk to human health. Furthermore, there was no evidence of measurable impacts to the river resulting from this groundwater discharge.

Ameren first attempted to close the impoundment under the existing regulatory structure (35 IAC Sections 811 and 814) by seeking adjusted standards as allowed under 35 IAC 104. The proposed adjusted standards would have:

- waived requirements for leachate collection, maintenance items not applicable to a closed impoundment, and monitoring for organic constituents;
- established an alternative method for calculating maximum allowable predicted concentrations, and
- established alternative groundwater concentration standards.

When proposing adjusted standards in Illinois, the petitioner submits the proposal to the Illinois Environmental Protection Agency (IEPA) and the Illinois Pollution Control Board (IPCB). IEPA then recommends to IPCB whether the adjusted standard should be approved, modified, or denied. Ameren elected to submit drafts to IEPA prior to submitting a final proposal to IPCB. In follow-up meetings, IEPA did not express significant concerns with adjusted standards for the leachate collection, maintenance, and organic constituent monitoring waivers. However, the IEPA expressed reservations concerning the off-site impacts and the proposed adjusted water quality standards. Previously only one similar ash management unit closed pursuant to the landfill regulations but that facility was permitted as a solid waste landfill under the applicable regulations. The difficulty of “adjusting” the rules to apply to Pond D, which had operated pursuant to a water permit, continued to trouble Ameren and the Agency.

The petition was submitted to IPCB but Ameren very clearly discussed the awkwardness of applying the landfill regulations to the impoundment closure. Specifically, Ameren highlighted that it had not been required to obtain a landfill permit to operate the impoundment and that the landfill regulations were not promulgated to address the closure of impoundments used for ash management. The IPCB accepted the adjusted standard petition for consideration but did ask whether a site specific mechanism may be more appropriate under the circumstances. Ameren and IEPA agreed that the site-specific rule would be a better and more comprehensive mechanism than petitioning for adjustment of solid waste regulations developed for landfills and the company began development of a site-specific rule that included the following key elements:

- A hydrogeologic investigation to characterize groundwater flow and quality. This investigation had already been completed for Pond D.
- Establishment of a groundwater monitoring program. Monitoring wells were present at Pond D; however, the monitoring program in the site-specific rule included a larger list of inorganic constituents than previously monitored at the facility.
 - The site-specific rule did not include monitoring of organic constituents.
 - The rule included provisions for reducing the number of monitored constituents and frequency of monitoring.
 - Boron, iron, manganese, pH, sulfate, and TDS cannot be removed from the list of monitored constituents.
- Establishment of site-specific groundwater quality standards.
 - On-site groundwater quality standards are existing concentrations if higher than IPCB established groundwater quality standards (Class I).
 - Off-site groundwater quality standards are Class I groundwater quality standards within the shallow groundwater where data suggested potential off-site impacts, or non-degradation standards (i.e., background) in deeper groundwater where impacts were not observed. However, the site-specific rule also enabled an off-site groundwater management zone

(GMZ) in which concentrations can exceed the Class I standards as long as Class I standards are achieved at the downgradient edge of the GMZ.

- Performance based evaluation of compliance, based on trend analyses.
 - On-site groundwater is in compliance as long as there is no statistically significant increasing trend.
 - Off-site groundwater within a GMZ is in compliance when statistically significant decreasing trends are demonstrated and concentrations at the edge off the GMZ are at or below Class I groundwater quality standards.
- Annual trend analysis using Sen's estimate of slope and the Mann-Kendall test for slope significance.
- A mitigation action to assure that off-site migration does not reach irrigation wells within ¼ mile of Pond D (there are no potable wells downgradient of Pond D).
- Requirements for final cover and slope stability.
 - CCR allowed as a fill material to bring the facility to final grade.
 - Final slope less than 5 percent.
 - Final slope must meet the applicable stability criteria for new solid waste facilities (35 IAC 811).
- A final cover consisting of a 40-mil geosynthetic barrier layer equivalent or superior to a 3-foot thick soil layer with hydraulic conductivity of 10^{-7} cm/s, overlain by a 3-foot thick protective layer capable of supporting vegetation.
- A schedule for implementation of closure activities, and preparation of closure documents.

Ameren filed its original proposal for a site-specific rule in May 2009. Elements of this proposal were opposed by IEPA, and Ameren worked with IEPA to resolve conflicting elements. Ameren and IEPA developed a joint proposal for the site-specific rule, which was submitted to IPCB in September 2009. IPCB received nine public comments, six of which were by Ameren or IEPA, and three from other organizations. IPCB requested additional information to address some of the public comments, and after considering the information, adopted the joint proposal in January 2011 as 35 IAC 840.

PART 2: APPLICATION OF 35 IAC 840 AND ISSUES ASSOCIATED WITH IMPOUNDMENT CLOSURE ADJACENT TO A LEVEE

Even though 35 IAC 840 is a site-specific rule, IEPA has been using the elements of the rule as a template for closure of other CCR impoundments in Illinois. The first impoundment to be closed under this template is in the western portion of the state. This facility, covering an area of 60 acres, was constructed on the landward side of a Mississippi River levee, and the levee forms the western containment dike (Figure 1). Similar to Pond D, there is evidence of off-site migration; although there is no potential for human health impacts because the use of groundwater for potable purposes is prohibited in the surrounding municipalities and there are no water supply wells in the area.

Application of 35 IAC 840 to this closure was straightforward. The only deviation from the site-specific rule was that groundwater mitigation was not necessary because there are no water supply wells in the area. The challenge in implementing this closure was that one of the impoundment berms is a major river levee. As a result, the closure was reviewed by both the US Army Corps of Engineers and IEPA. Issues related to the levee were:

- The levee has a clay veneer over a sand core, and there was concern that excavation into the levee could allow seepage that would potentially compromise the structure.
- Storm water runoff from the cover could not be directed west, over the levee and to the river, due to concerns for levee erosion and destabilization. Furthermore, runoff could not be directed south and east because:
 - These areas are not owned by the power company, so there was no real estate for construction of storm water management ponds, and
 - These areas, being behind the levee, are closed depressions, and sheet flow off the cover could cause flooding.



Figure 1. GoogleEarth Pro™ image of the site showing dikes and the levee

- Storm water management ditches and swales were not allowed adjacent to the levee due to concerns for increased potential for seepage beneath the levee during flood events.
- The stability evaluation had to consider the stability of the levee during river flood events, in addition to the stability of the dikes.

To address these issues, the closure design incorporated the following innovative elements:

- An anchor trench will not be used to secure the geomembrane along the levee. Instead, the geomembrane will extend to the levee and be covered with 3 feet of protective soil.
- Storm water will be managed on top of the cover. Rather than a crown, the cover will be configured with two large, shallow depressions (Figure 2) that will feature:
 - Shallow slope (1-2%) to minimize site grading effort. This approach made design for effective drainage of protective cover soils over the geomembrane challenging; however, it simplified compliance with stability criteria.
 - Pump stations (Figure 3) to transmit the storm water collected on the cover through pipes over the top of the levee to the river. The pump station design is unique because there is more available storage than typical (the depressions on the cover are each about 30 acres); however this storage cannot be utilized for long periods due to concerns with increased infiltration through the cover. As a result, the design needed to consider:
 - Drainage of small and large storm events rather than focusing on a single design storm event, and
 - Wide variations in flow both within a particular storm event and between storm events which made pump design challenging because pumps operate at a specific rate. One alternative was use of expensive and difficult to operate variable speed controls. This alternative was avoided because a drainage layer—which is not required by the rule—was included in the design; enabling use of storage available on cover for short periods of time (12 hours).
- The only special design considerations for levee stability were avoidance of excavation into the levee and minimization of grading on the levee side of the cover.

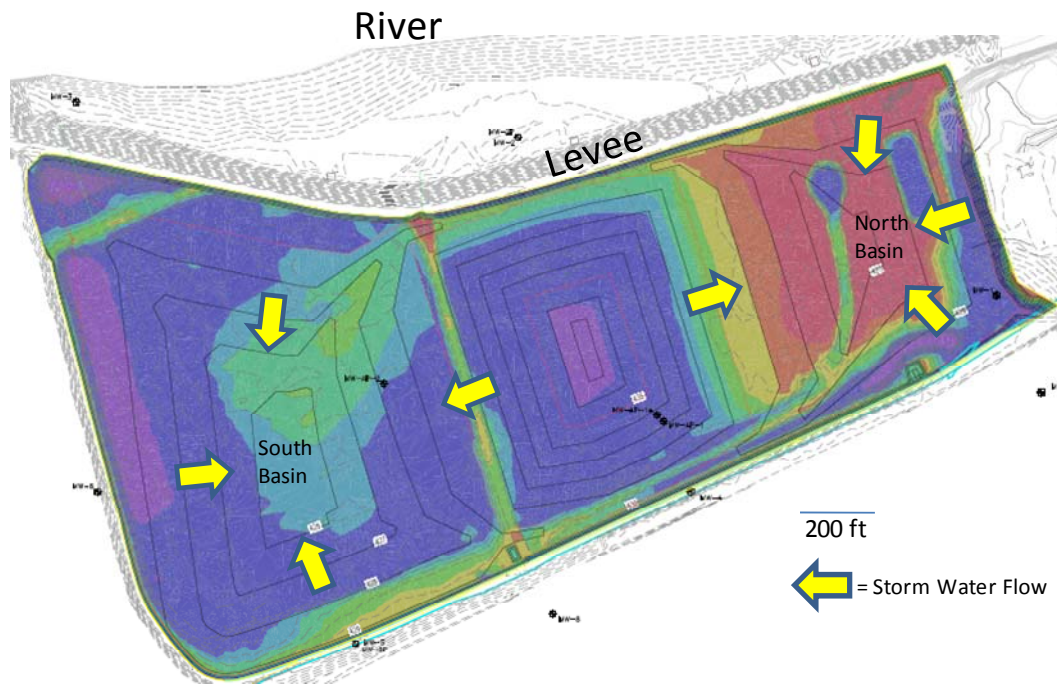


Figure 2. Grading plan showing shallow depressions where storm water will be managed. Red, yellow, green indicate cut areas, blue and purple indicate fill areas

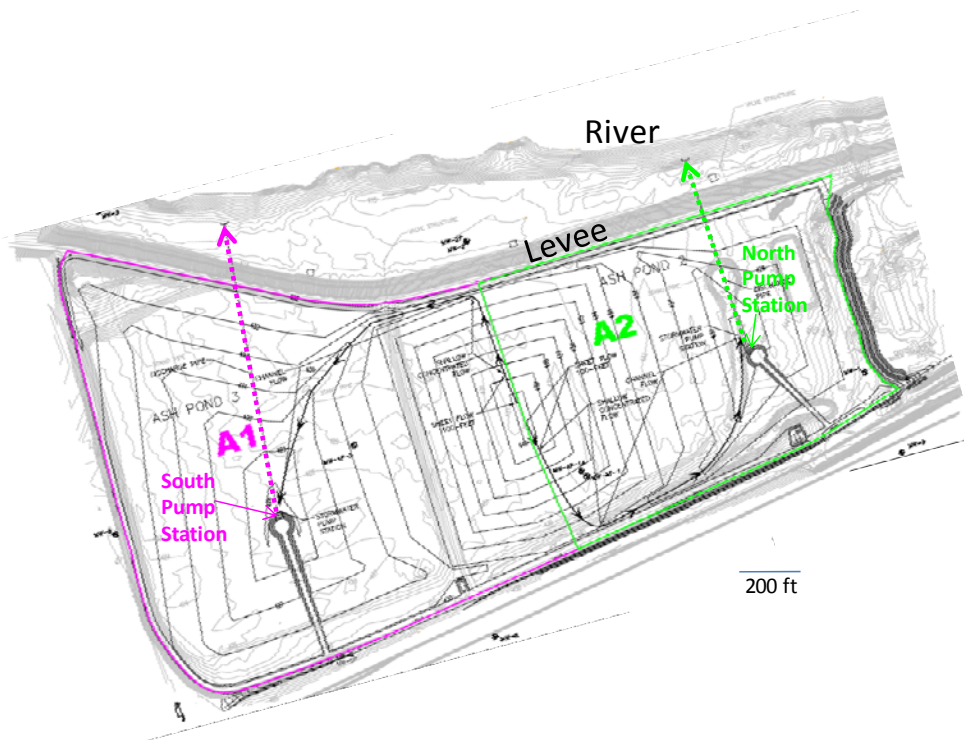


Figure 3. Storm water drainage plan showing locations of pump stations and path of discharge pipes to the river

CLOSING

The trend in the electric power industry is toward increased use of CCR landfills and decreased use of impoundments (Figure 4). The approach used in Illinois may serve as a template for power companies and regulatory agencies in other states if the rules for impoundment closure are either impractical or undefined.

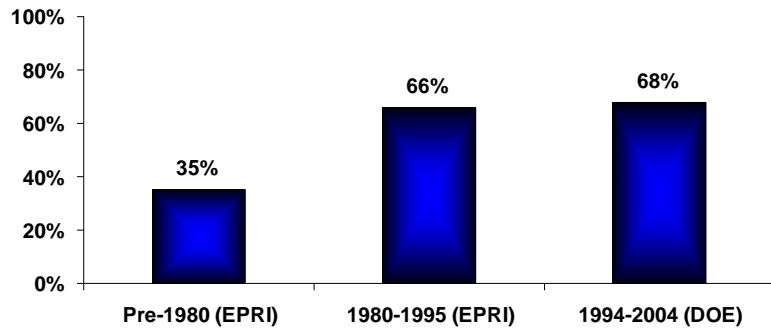


Figure 4. Percent of CCR Management facilities built or permitted as landfills during three periods (data sources in parentheses)

Key elements of the approach described here are also comparable with many aspects of the coal combustion residual rules proposed by USEPA. In particular, the cover requirements under 35 IAC 840 are more stringent than those proposed by USEPA for closure of existing impoundments, groundwater monitoring is required for a larger list of constituents than proposed by USEPA under the Subtitle D option for assessment monitoring, and closure and post-closure plans are required.

However, there are also differences between the Illinois approach and the USEPA proposal. For example, the implementation schedule proposed by USEPA under the Subtitle D option calls for completion of closure activities within 210 days of final receipt of CCR, which is a short period for completion of a closure plan, cover design, review and approval by the state, procurement of contractors, and construction activities—particularly for impoundments in regions where climate interferes with construction schedules. The closure schedule under 35 IAC 840 takes a more feasible approach, requiring completion of a closure plan within 180 days and completion of closure activities according to the site-specific schedule outlined in the closure plan.

If there is a release from the impoundment to groundwater, then groundwater will be monitored under a corrective action approach under the USEPA co-proposed rules and corrective action measures may be necessary. The USEPA and Illinois approaches are structurally different in this regard, and compatibility needs to be reviewed on a site-specific basis.