COAL COMBUSTION RESIDUAL MARKET

Introduction

Coal combustion residuals (CCR), also known collectively as coal ash, is the second largest industrial waste stream generated by volume in the United States. Coal ash is a broad term encompassing various by-products produced from the combustion process, including:

1. Fly Ash: a mostly silica based fine powder generated from burning fine ground coal in a boiler.

2. Bottom Ash: heavy angular waste product which forms at the bottom of a coal furnace.

3. Boiler Slag: molten bottom ash from slag tap and cyclone furnaces that turns into pellets with glassy appearance after it is cooled with water.

4. Flue Gas Desulfurization Material: a wet sludge-like residual consisting of calcium sulfite or calcium sulfate or a dry powdered mixture of sulfites and sulfates produced in the emission control process when flue gas is scrubbed or cleaned after coal burning.

Coal-fired power plants and independent power producers, which account for about 30% of total power generation in the U.S., currently are the predominant generators of CCR waste, which is estimated to approximate 21 million tons annually.

Antecedents

Historically, power utilities managed their generated CCRs in landfills and surface impoundments or ash ponds. Surface impoundments (or ponds) are natural topographic depressions, man-made excavations, or diked areas primarily of earthen materials that are used to manage slurry, a mixture of coal ash and water. While many of these impoundments were not lined with synthetic liners, use of compacted clay as a barrier was the standard safeguard measure employed, though each were susceptibility to seepage into surrounding waterways or soils. Landfills are "dry" excavations filled with CCR which could, or could not, have been lined with protective composite plastic geosynthetic materials atop compacted clay barriers. When both the surface impoundments and the landfills were filled to capacity, both were then sealed or capped with synthetic materials to control or limited moisture infiltration. Both surface impoundments and landfills are regulated

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by state authorities. The efficacy of these legacy management techniques came under scrutiny following several high profile environmental situations.

1. **Tennessee Valley Authority (TVA)**: In December 2008, an ash dike ruptured at the TVA's 84-acre solid waste containment area at its Kingston Fossil Plant in Roane County, TN. 1.1 billion gallons of fly ash slurry was released and traveled across the Emory River and its Swan Pond recess, onto the opposite shore, covering up to 300 acres of surrounding land. The stored waste also traveled up and down stream in nearby waterways, such as the Clinch River, damaging at least 42 residential properties along the way. As of April 2015, TVA estimated that the total cost of the cleanup amounted to $1.2 billion, though there are outstanding potential costs related to illnesses manifesting in workers involved in the actual cleanup process. In total the volume of waste released was 101 times larger than the 1989 Exxon Valdez oil spill, at the time considered the largest environmental disaster in U.S. history. The spill drew intense scrutiny into the containment methods employed by the facility. The US Environment Protection Agency (EPA) concluded that the 84-acre above ground ash fill was unlined and within proximity (74 feet) of a nearby major waterway, the Emory River. Additionally, the dredge cell containing the residual dry fly ash product was surrounded by 60-foot earthen walls which had twice developed leaks since 2002.

2. **Duke Energy**: In February 2014, over five years after the initial agency work began on CCR legislation, up to 39,000 tons of coal ash spilled into the Dan River from an Eden, North Carolina facility owned by Duke Energy when a drainage pipe burst at a coal ash containment pond. The utility subsequently pleaded guilty to nine misdemeanor violations and over $102 million in fines and restitution. While the spill was officially concluded to be a product of a single pipe failure, it again highlighted the risks posed by open ash ponds and landfills with poor structural containment procedures.

The Federal Coal Combustion Residuals Rule

Following the TVA spill, the EPA formally began a process of drafting regulations to address the treatment and disposal of CCRs and in June 2010 initially proposed a set of federal standards to establish minimum national criteria for the management and disposal of CCRs. Perhaps motivated in part by the Duke Energy pond breech in 2014, but most likely responding to a deadline suit filed by Earthjustice on behalf of a number of environmental groups, such as the Environmental Integrity Project and the Sierra Club, the Agency published the final CCR Rule in April 2015 under the authority of Subtitle D of the Resource Conservation and Recovery Act (RCRA), a non-hazardous waste program, to be effective October 2015.

It might be noted that in June 2010, the EPA had originally proposed regulations that classified coal ash as either a "hazardous waste" under Subtitle C of RCRA, or a "special waste" under Subtitle D. While CCR is mostly composed of aluminum, calcium and silica oxides, there was evidence that the TVA spill generated elevated levels of various heavy metals including arsenic, copper, barium, cadmium, chromium, lead, mercury, nickel and thallium, but the Agency concluded that the record supported a Subtitle D regulation designation. That determination was a relief to the utility industry as management under Subtitle C could have cost upwards to three times what it will cost to dispose of CCR in a Subtitle D landfill and, perhaps more importantly, severely limited or eliminated CCR as a beneficial reuse additive to construction materials. Needless to say, environmental groups have continued to voice their opposition to this EPA decision, but in actuality, there would not have been sufficient Subtitle C landfill disposal capacity to accommodate that quality of CCR.

Additionally, the CCR rule does not regulate coal ash impoundments closed before 2015 – most environmental advocacy groups maintain that virturally all coal ash sites have some level of groundwater contamination.

The enactment of the first ever federal regulations regarding the disposal of CCRs, along with the effluent limitation guideline for steam electric power plants, the ELG Rule, has significantly affected the coal-fired power generation industry. The CCR rule establishes design requirements, location restrictions and groundwater protection standards for the disposal of the aforementioned materials (on page 1) while the ELG Rule regulates individual wastewater streams from power plants, including a prohibition on the discharge of waters associated with ash transport. The combined effect of both these regulations has driven coal-fired utilities away from management and disposal of CCR in surface impoundments to more beneficial reuse applications of the ash, which the American Coal Ash Association currently estimates reached 56% last year out of the total ash generated (primarily added as an ingredient to concrete and synthetic gypsum) as well as into existing or new landfills.

In December 2016, Congress passed the Water Infrastructure Improvements for the Nation Act (WIIN). This Act gave the EPA the authority to implement a federal permit program, or to review and approve state permit programs to regulate CCRs, provided the state rules are as protective or more stringent than the federal rule. While many states have solid waste programs to address CCRs, these operate in addition to the federal CCR Rule. Once a state permit program is approved, it will operate in lieu of federal regulations. To date, only Oklahoma has a program that has been approved by the USEPA but Alabama, Georgia and Kansas have applied for approval.

In September 2017, the EPA agreed to reconsider certain aspects of the CCR Rule in two phases, earmarked to be completed by June and December of 2019.

1. Phase 1 dealt with a number of issues and was finalized in part in July 2018. Of the various issues, most of which dealt with groundwater migration from a CCR impoundment, such as allowing states to suspend monitoring when zero discharge to the groundwater is demonstrated, suffice it is to say, reflecting the current Adminstration's favorable disposition toward coal usage for power generation, more flexibility was granted for meeting performance standards such as extending closure deadlines to allow time for permanent solutions to be developed The consequence: an estimated $100 million in savings in compliance costs for the utility industry. It should be added however, that while the savings for the utility industry is not insignficant, as least from a public relations point of view, its impact will not be particularly material in the overall scheme of the CCR cleanup, if the projections to follow are anything close to correct.

2. Phase 2 determinations have yet to be published, but will likely be delayed as the EPA deals with establishing a closure deadline for unlined surface impoundments – the D.C. Circuit Court of Appeals ruled in 2018 that the EPA had to strengthen the CCR Rule as all unlined ponds must be closed irregardless of any groundwater contamination and those impoundments that are clay lined can no longer be considered lined (use of 2 feet of clay as the barrier to prevent groundwater contaminination).

Impact of the CCR Rule

In general terms, the purpose of the CCR Rule is to address risks from the structure failure at surface impoundments and the potential groundwater impact from such impoundments and landfills. This is achieved through minimum criteria including site location requirements, design and structural integrity standards, and groundwater monitoring and response to releases. The key points are as follows.

1. While the rule itself is self-implementing and enforcement is via citizen's lawsuits, therefore no federal oversight, the subsequent WIIN Act gave the USEPA the authority to enforce the CCR Rule (though currently unfunded).

2. The rule requires posting of specified compliance or publicly accessible via the internet.

3. There are several "closure for cause" scenarios, which if triggered, require surface impoundments to cease receiving CCR within 6 months and initiate closure.

4. EPA estimates that the rule will affect more than 700 surface impoundments and 310 active landfills at more than 450 coal-fired power plants.

Including a closure in place solution, entailing dewatering the CCR, stabilizing and capping the impoundment as well as a closure removal solution, also including dewatering of the CCR, excavating and transporting to a landfill, the EPA estimates the projected cost to comply with the CCR Rule could range **$7.3 billion to $23.2 billion**, to re-intern roughly ?? million tons of previously disposed of coal ash waste. The Utility Solid Waste Activities Group, an informal consortium of approximately 80 utility operating companies, the Edison Electric Institute, the National Rural Electric Cooperative Association, and the American Public Power Association estimates the cost to comply with the CCR Rule could range **$22.8 billion to $34.7 billion.** However, when reflecting last year's DC Court of Appeals ruling that all surface impoundments must close, an additional **$39 billion** could be added to the overall cost of the CCR clean up.

Although work has already been initiated at several sites by a number of utilities, it is projected that the total cleanup effort may take upwards of 20 years to be completed. It is estimated there is currently 3.4 billion tons of CCR to be addressed, or some 2.3 billion in utility landfills and 1.1 billion in surface impoundments.

Finally, notwithstanding the current Adminstration's efforts to encourage more coal usage in the U.S., it is a fact is that power plant retirements and declining utilization rates are continuing to impact coal usage by the power generating industry, who currently account for 93% of total coal consumption. Additionally, cheaper natural gas and the trend towards renewable energy sources are also contributing to coal's eroding power generation market share.

Yet, even reduced ongoing power generation with coal in the future will still be a source of new CCRs generation for sometime to come. In 2018, the U.S. Energy Information Administration estimated that 691 million tons of coal was used for power generation but with recent plant closures, the amount of coal usage for power generation will decrease to 635 million tons this year and further decline to 597 million tons in 2020. Approximately 10% of the coal tonnage burned becomes a CCR residual waste.