The CCR Rule 's Impact on Electric Utilities

by Matthew McDermott

Abstract: America's electricity generation industry has historically been almost entirely dependent on the burning of coal. This necessity to burn coal so as to provide vital energy for our nation will likely continue for several decades into the future. Due to the large volumes of ash generated by the burning of coal and the toxins associated with coal ash, the Environmental Protection Agency (EPA) has identified coal combustion residuals, or CCR, as a potential threat to the environment. To help protect both society and the environment, the EPA instituted a new regulation in the Federal Register in the Fall of 2015, stipulating both design and operation measures for all electric utility facilities across the nation. With such drastic regulation comes much controversy and concern over the necessity of governing coal ash disposal. This paper provides an overall summary of the history, make up, controversy, and implementation of the new CCR Rule so that members of the engineering community can gain a better understanding of the new regulation.

Just before sunrise on December 22, 2008 in rural Tennessee, a catastrophe was minutes from occurring that would ultimately change the operation of hundreds of power plants across the nation. That morning, a surface impoundment at the Tennessee Valley Authority power plant failed, releasing 1.7 million cubic yards of coal ash into the surrounding environment. As one of the largest releases of coal combustion residuals (CCR) in American history, the spill flooded 300 acres and contaminated both the Emory and Clinch Rivers [1]. Meanwhile, in the United States Environmental Protection Agency (EPA), much discussion was already happening concerning the handling of CCR waste across the nation. To environmental activist groups that were pushing for such legislation, the recent spill in Tennessee was the perfect catalyst for their arguments of tightening restrictions on the handling of CCR waste. Despite much opposition by the electric utility industry, a final regulation further governing the disposal of CCR was published in the Federal Register less than seven years after the spill. For Americans, the production of CCR will certainly continue for several decades into the future as coal forms the basis of electricity production. Therefore the new CCR Rule (or simply the Rule) will need to be fully embraced. As a result, an understanding of the Rule's history, its structure, and resulting implications to both the electric utility community and American economy is valuable for civil engineers serving the industry.

I. Background

As stated on the EPA's central website, the purpose of the Rule is to provide a comprehensive set of requirements for the safe disposal of coal combustion residuals from coal-fired power plants. The rule was shaped by the inputs of various entities from the electric utility industry along with numerous environmental activist organizations that, together with the public, generated some 450,000 comments during the review of the proposed Rule [1]. These comments served as the voice of the public, representing the views of both sides of the argument, and were used by the EPA to revise the draft of the Rule and make decisions about controversial requirements as published in the final version of the Rule. The resulting legislation was placed under subpart D of the Resource Conservation and Recovery Act, the nation's primary regulation of solid waste. During the proposal process of the rule, there was much controversy over whether the final Rule would

be under subpart C or subpart D, as the specific subpart had implications towards its regulatory structure and effectiveness. Under subpart D, the enforcement organization is unlike almost any other similar solid waste regulation because a permitting program is not employed. Instead the Rule is only enforceable by civil lawsuit. The Rule is one of the first regulations structured this way, so there is both skepticism and concern on the degree of its effectiveness and its consequent effect on the industry [2].

Though CCR has been a waste of society for centuries, this new regulation intends to mitigate its future detrimental effects to the environment and protect the health of society by improving the waste management criteria for nearly all CCR units across the nation. The first and most likely avenue for CCR waste to impact the health of society in the future is through the contamination of groundwater. Though CCR is known to cause little bodily harm while interacted with in small doses, it contains small amounts of heavy metals that have the potential to cause significant bodily harm over an extended exposure period. During the burning of coal, slight amounts of these heavy metals such as arsenic, lead, selenium, and mercury are released that can become trapped in the ash. Over time these toxins can seep out of the ash at the disposal site and infiltrate into the ground. Eventually there is a possibility that the underlying groundwater could be affected by the toxins and reach unsafe concentrations, thus compromising the local source of drinking water [3]. Because this process takes time, the effects of poor waste management could be realized decades after placement of the waste. This means that improving the waste management practices today will help to improve the quality of life for future generations.

The second concern addressed by the Rule is the potential for catastrophic failure of coal ash surface impoundments. The Rule sets detailed structural integrity criteria for both design and maintenance in attempt to prevent events such as the spill at the Tennessee Valley Authority's Kingston, TN power plant in 2008. Though these events are rare, they have the potential to cause the most harm to the public and local property. The Rule intends to protect both society and the environment through these criteria by ensuring that good engineering practices are employed and maintained throughout the life of a surface impoundment.

Finally, the Rule addresses the potential of CCR to become an air born contaminant. Once CCR becomes dry enough to be blown away, the heavy metals generated during the burning of coal have the potential to also be carried by the wind to almost any part of the earth. There is already a global issue with airborne mercury that has caused harm to the environment; so as a national administration, the EPA supports responsible management of the nation's global input of mercury [4]. On a local scale, fugitive CCR dust can also raise issue for the health and aesthetic desires of the surrounding community. Though daily inhalation of CCR by local residents would likely not be fatal, it could generate potential health hazards over a lifetime of exposure. Further, the amount of dust produced by a CCR waste facility through several decades could be substantial and thus accumulate in the surrounding areas. As a result, the Rule requires CCR facilities to nearly eliminate fugitive dust and take note of all local complaints [4].

II. The CCR Rule

The CCR Rule is structured into six main divisions that establish design, operation, closure, and notification characteristics of the regulation. As found in the preamble to the regulation, almost every part of the Rule received comment from both environmental groups and electric utility representatives that commonly influenced the decision by the EPA as reflected in the final Rule [4]. Though there are particular aspects of some parts with which each side of the discussion still likely has issue, the Rule is published in the Federal Register so electric utility companies must embrace the Rule. Ultimately, the goal of the Rule is to mitigate the potential for groundwater contamination, catastrophic failure, and fugitive dust associated with CCR units. Consequently, each part of the Rule serves an integral purpose in protecting the environment and society against these three major issues, among others.

The initial criterion the Rule addresses is a location restriction on new and existing CCR landfills and CCR surface impoundments. Location limits are intended to ensure the waste is located a suitable distance from water sources as well as out of

seismically active areas. Some of the specific locations that are considered in the Rule are placements by the uppermost aquifer, wetlands, fault areas, seismic impact zones, and unstable areas. By simply not placing a CCR unit in these locations, the risk for water contamination as well as structural damage is greatly reduced.

The second major division of the Rule focuses on design and is arguably the most important aspect concerning the effectiveness of a CCR unit. The liner design and surface impoundment embankments are critical in regards to protecting against seepage of toxins into the groundwater and mitigating the risk of a surface impoundment failure. Consequently, the Rule contains much stipulation on the minimum design requirements as well as regular inspection standards that must be met. For the liner construction, an extremely impermeable liner is required to be used in new CCR units that will prevent nearly any seepage into the underlying earth. In regards to surface impoundment design, the Rule establishes detailed embankment criteria ensuring a considerable factor of safety is employed, thus reducing the risk of future failure. To ensure a CCR unit continues to be a safe and suitable containment unit long into the future, the third section of the Rule contains several requirements so as to ensure proper operation and maintenance of the facility. Among several operating criteria discussed in the Rule is the requirement of a CCR facility to manage erosion within and around CCR units. The Rule requires that *a run-on run-off* plan be in place for CCR landfills and hydrologic and hydraulic capacity requirements be evaluated for surface impoundments to address issues with erosion.

To ensure all these criteria are being met on a periodic basis, weekly and annual inspections are required to be performed and recorded. In addition to hydrologic concerns, the Rule also requires facilities managing CCR to adopt measures towards diminishing fugitive dust from their facility. Even further, a *fugitive dust control plan* needs to be developed, practiced, and placed in a facility's operating record according to the Rule. These operation and maintenance criteria are all intended to improve the management of CCR so as to protect the nation's natural resources along with the health of society.

The next major part of the Rule is centered on implementing a groundwater monitoring program for both existing and new CCR units. The Rule requires the implementation of a groundwater monitoring program at all CCR units within 2 years after the effective date of the Rule. Many electric utility companies have raised concern with this ambitious implementation time. The implied costs associated with implementing a monitoring program are substantial, and if they were not anticipated correctly in the facility's budget, the facility could face significant financial burdens. The monitoring program includes the installation of anywhere from a few to dozens of monitoring wells depending on the size of the facility. These monitoring wells are to be used for determining if the underlying aquifer is being affected by the CCR unit through any seepage of toxins. Based on periodic assessments of the data collected by the wells, potential issues can be identified and the required corrective actions performed.

Closure procedures are addressed next in the Rule as it is inevitable for almost all CCR units to reach design capacity or be closed. While closing a CCR unit, it is essential that the cell be closed in a way that will minimize maintenance and ensure its effectiveness for encapsulating the CCR waste long into the future. As a result, the Rule includes several requirements concerning the preservation and maintenance of the unit even after a CCR facility is long out of commission. Since the heavy metals common within CCR waste generally do not disintegrate very quickly, they can still pose a threat to the environment and society long into the future [3]. The closure section of the Rule is intended to prevent future harmful effects of escaping CCR due to the deterioration of a CCR unit.

Finally, the Rule ends by stipulating how the previous parts of the Rule are to be reported so as to demonstrate that the required actions have, in fact, been completed. The Rule requires three types of reporting including placing items in the facility's operating record, notifying the state director, and placing items on the facility's publically accessible website. Unlike most regulations of this kind, the enforcement of the Rule is dependent upon civil lawsuit rather than federal permitting. This final section of the Rule regarding public reporting is a direct result of the the civil regulatory approach as it allows the general public to be the regulating party though scrutiny of each facilities' public records.

III. Controversy

With nearly half a million comments received during the revision of the proposed regulation, almost anyone would agree this Rule was surrounded by much controversy during, and even after, its development. The majority of unrest occurred early in the lawmaking process while the EPA was deciding whether to create the Rule under Subpart C or Subpart D of the Resource Conservation and Recovery Act. Because this difference would change the entire nature of the Rule, the initial decision between the two subparts was critical. The two approaches vary significantly on their regulatory approach and also on the financial burden the federal government would adopt after the Rule came into effect. Under Subpart C, CCR would be treated as a hazardous waste requiring a permitting process to be constructed and continually regulated. As a hazardous waste, CCR would have to be disposed in hazardous waste management facilities. This structure under Subpart C was largely supported by environmental groups as they felt CCR needed to be handled very seriously. Unfortunately, this strict regulatory structure would have cost the federal government large amounts of tax dollars to oversee and manage the permitting program. Further, many existing hazardous waste facilities across the nation are not prepared to handle the large volumes of CCR waste that are generated by electric utilities. The power industry favored the structure of the proposed rule under Subpart D as it was less strict compared to Subpart C. Under Subpart D, CCR would not be treated as a hazardous waste, and no permitting program would be necessary, thus making the waste management more flexible for CCR management facilities [5].

Without a federal permitting program, the EPA needed to maintain some kind of regulatory approach, so the EPA implemented a civil lawsuit method to ensure the Rule would be upheld. This uncommon regulatory approach has also raised much concern as there is little evidence of its effectiveness. Environmental activist groups are concerned that, without direct governmental oversight, electric utility companies will take advantage of their flexibility and ultimately not obey the Rule. On the other hand, the electric industry is tentative at this point about the regulatory structure as only one mistake could be grounds for a lawsuit. Because concerned environmental activist groups will be very keen to jump on any compliance failure, the public posting website will be watched closely, and action will likely be taken on any instance of noncompliance [2,6]. Both sides of the controversy are uneasy by the civil lawsuit approach, but only time will tell how successfully it functions.

The ground water monitoring program was perhaps the most controversial part of the Rule itself as the cost implications for electric utilities are quite high. The electric utility industry has argued that proper design of a CCR cell should be enough to ensure waste is properly contained. This has lead the majority of the industry to believe that excessive monitoring wells are not necessary for the management of CCR and would only serve to increase the required operating budget of a facility. Environmental activist groups claim that monitoring wells are essential to ensure the CCR unit's design is, in fact, protecting the groundwater from contamination. Since one of the main reasons for implementing the Rule is to protect groundwater, environmental groups felt it was reasonable to require the implementation of an extensive monitoring program. In the final rule, the EPA decided to require a relatively extensive monitoring program be developed and practiced [2,6].

Clearly neither side of the argument felt completely satisfied after the final publishing of the Rule. Environmental groups generally felt as though regulation under Subpart D was too weak and that the EPA was giving into industry desires instead of upholding their role to fairly protect the nation's environment. The electric utility industry, on the other hand, never wanted the Rule to go into effect in the first place as it would inevitably cost them millions of dollars over the coming years, thus decreasing profits and raising production costs. In the end, the EPA did result in taking action by instating the Rule, so each side of the argument must embrace the rule as it is for the time being [7].

IV. Impact

The general concern shared by both the electric utility industry and members of the public is the likelihood of an increase in cost to produce electricity

as a result of added operating costs pursuant to the Rule. The actions required by the Rule to ensure environmental protection generally require some type of action to be performed by the CCR unit facility that otherwise would not be necessary. These added practices equate to increased operating costs which in turn raise the cost to the consumer. As a result, critics have noted that the Rule is just one of many relatively recent legislations aimed at phasing out the burning of fossil fuels that have paid little regard to the consequent and potentially detrimental effects to the nation's economy.

The preamble of the Rule delves deeply into the potential implied costs associated with implementation of the Rule due to the large number of CCR facilities affected. Currently across the nation there are 1,045 CCR management units that are run by 166 companies, all of which have to follow the regulations that went into effect in October 2015. The EPA estimates the total cost resulting from the implementation of the Rule over the lifespan of all applicable CCR units could be as much as $23.2 billion. Further, the EPA estimates there will be $8.71 billion in benefits to society, resulting in a 0.38 cost to benefit ratio [4]. This means more funds will go into obeying the Rule than will be saved by society, which is questionable when considering the overall benefit to society.

The largest impact is due to the aggressive time frame of the Rule. Various sections of the regulation have their own time frames, but in general, the actions that are required to be carried out by the CCR facilities are required to be completed very soon after the publication date of the Rule. For example, the fugitive dust control plan was required to be created and placed in the facility's operating record by the effective date of the Rule, which was in October 2015. For some facilities, their budgets may not have been planned appropriately to support the development of such a plan as engineering costs can be quite steep. This likely left many electric utility companies in a pinch by the end of 2015 as they would have been forced to choose between cutting other operation costs to make budget for actions required by the Rule or risk breaking the law, which will likely lead to the closure and potential bankruptcy of the owner [7]. If the time frame of the Rule were extended on some of the requirements, it is likely that electric utility companies could plan better financially. Nevertheless, there will almost surely be an increase in demand for engineering guidance due to the rapid integration of the Rule into the electric industry.

V. Conclusion

The CCR Rule will likely be a hot topic in engineering circles over the coming months while the integration of the Rule continues and electric utility companies embrace the realities of this new legislation. Despite much controversy during the development of the Rule, it is here to stay, so the engineering community must continue to recognize the breadth of the Rule and prepare to assist clients with the various activities required of them. The key to succeeding in properly serving clients on legislative related projects is becoming an expert on the requirements and then applying good engineering practices to the problem.

References:

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