

U.S. EPA's Final CCR Rule Impact on Past, Current, and Future Disposal What Actions Are Required?

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Introduction

Coal Combustion Residuals (CCR) handling and disposal activities are rapidly changing in the electric power generating industry. Although recycling, reusing, and repurposing all coal combustion by products is preferred, if some portion requires dewatering, treatment, and disposal, EPA's Final CCR Rule (Rule), published on April 17, 2015, may financially impact your past, present, and future operations. That is the date the compliance clock started ticking. If the State in which your generating stations are located do not already have CCR regulations that meet EPA's final rule and your disposal areas are currently in compliance, you'll need to make decisions and prepare documentation for your former, existing, and ongoing ash impoundments and landfills.

Some states have begun to integrate the Rule with their exist regulations. Other state regulators have indicated that because the Rule is a federal guideline, they are not responsible for enforcement, which is effectively true. State adoption of the Rule and enforcement by the individual States' is voluntary, although legislation has been

introduced at the federal level to make the Rule mandatory for all states. The conservative approach to compliance is to understand both your State's regulations and the Rule, and comply with the most restrictive requirements.

Currently across the U. S., States' CCR regulations range from no rules in place in some states to disposal sites requiring double liner and double leachate collections systems in others, with multiple variations between those extremes including differing closure standards. According to U. S. EPA, approximately 17 states have regulations similar to the Final Rule leaving 33 states to come up to regulatory speed.

An additional factor that will affect your compliance decisions is U. S EPA's Effluent Limitation Guidelines (ELG), published on September 30, 2015 (pre-publication version). The new treatment standards in the Guideline for discharging all wastewater from your generating station and the expense to provide upgraded treatment facilities may cause you to consider converting wet CCR handling and disposal to dry operations. Associated potential additional wastewater treatment costs will affect your final decision. The most challenging requirement of the ELG is the prohibition of discharging all water used to convey (sluice) ash. The CCR Rule and the ELG need to be evaluated together to identify the best options for your plant.

To comply with these rules, managers at coal fired power plants need to know:

1. Where to find answers;
2. Time remaining to comply with each Rule requirement;
3. Existing Impoundment Disposal Site Alternatives – close in place or excavate and dispose; and,
4. Additional factors that affect decisions.

This paper covers key components to assist you through a decision making framework for your past, current, and anticipated CCR disposal and processing facilities, offers

locations where you can find answers for your facilities, explains factors to be evaluated, and itemizes compliance dates and requirements.

Whether your CCR operation is wet or dry bottom/fly ash/FGD byproducts, above or below grade, permanent disposal or treatment and transfer, your basic options for your existing sites during the transition period include closing and capping CCR in place with the prescribed cover system or complete removal of CCR and disposal at a compliant site. The specific situations that trigger required closure for existing impoundments such as known groundwater impacts or less than 5 feet of separation from groundwater to the bottom of your CCR disposal materials, are spelled out in the Rule. Once the closure requirement is triggered, you have 6 months to begin closure activities and up to 5 years to complete construction. To be exempt from specific rule requirements such as groundwater monitoring, you must have filed a notice of intent to close by December 17, 2015 and must complete closure construction activities by April 17, 2018.

1. Where to Find Answers

With the individual states' being designated as the voluntary enforcement body, the first place to seek answers is at the governing agency for your state to determine if and how they plan to integrate the Rule with their existing requirements. Comparing the specific state and federal requirements and using the most restrictive regulations will confirm you are in compliance with both standards.

The Final rule can be accessed at the following web site:

<http://www2.epa.gov/coalash/coal-ash-rule>

As is typical with publication of government rules and guidelines, every varied condition at the regulated generating stations can't be anticipated. As plant owners review the

regulations, questions develop about very specific conditions that require clarifications from EPA. EPA has been consolidating these questions as they are submitted and developing responses describing their interpretation and intent of the Rule. These clarifications can be accessed at the following web site:

<http://www2.epa.gov/coalash/frequent-questions-about-implementing-final-rule-regulating-disposal-coal-combustion>

Keeping track of EPA's responses to the submitted questions as they develop may provide answers for operations at your generating station. The two most important initial actions you should take are to consult your legal staff for interpretation of the Rule and request clarifications from EPA for your specific site conditions.

2. Time Remaining to Comply with Each Requirement

The Final Rule contains a complex web of requirements that may or may not apply to your site(s), along with approximately 47 time critical dates. Such compliance dates cover reporting, documentation, analysis, operation changes, and decision points. As an owner/operator, you need to know required components for each of these steps and determine if they apply to your facility. Every existing CCR disposal or processing/treatment site in the U. S., estimated by EPA at approximately 1,000 individual impoundments/landfills, has a unique set of requirements based on the Rule. The compliance starting whistle sounded as of the date of Rule publication in the Code of Federal Regulations.

Ultimately, the Rule is intended to reduce the potential for a release of CCR to the environment through groundwater impacts or a surface discharge. To achieve this goal, EPA included in the Rule, specific tasks and timeframes to critical deadlines for completion of

specific documents, and actions including posting these documents on a publically accessible website.

Imbedded within the Rule are the specific required compliance actions and associated time frames. Implementation of these compliance actions will be impacted based on your State's current regulations and how close they match the Final Rule, what requirements have you already satisfied, timing that your State adopts these requirements, and variations on how your State interprets each compliance issue. A general list of the compliance actions and the deadlines follows, based December 2015:

ACTION	REMAINING TIME
1. Stop placing CCR in an impoundment to be classified as "INACTIVE"	-2 Months
2. Prepare and implement a fugitive dust control/mitigation plan	-2 Months
3. Initiate weekly inspections and documentation	-2 Months
4. Establish publically accessible website with required information	-2 Months
5. Notification of intent to close "INACTIVE" disposal operations	0 Months
6. Initiate annual inspections	1 Month
7. Develop written closure and post closure plan "ACTIVE" AND "INACTIVE"	10 Months
8. Perform hazard ranking, if applicable	10 Months
9. Construction documentation of disposal/handling operations	10 Months
10. Slope stability analysis	10 Months
11. Storm water run-on/run-off analysis	10 Months
12. Prepare emergency action plan (for accidental release)	16 Months
13. Prepare groundwater monitoring, analysis, assessment, and corrective action plan	22 Months
14. Evaluate seismic zone and fault locations	34 Months
15. Evaluate unstable areas that could affect the site	34 Months
16. Demonstrate of separation to groundwater (5')	34 Months

17. Document environmental condition impacts (wetlands etc.)

34 Months

Not all of these actions may be required for your site(s), so complete understanding of the rule is essential. As of October 17, 2015, if you have not established the publically accessible website and posted the required information, begun weekly inspections and recording reports and remedies, developed and implemented a fugitive dust plan, and stopped receiving ash in a disposal site you wish to classify as "inactive", it could be interpreted that you are not in compliance with the Rule and could be subject to litigation by the public, an agency, or an environmental group.

The following graphic summarizes the general time frames contained in the rule based on the publication date of April 17, 2015 and presents for each of these tasks the:

1. Completion date and time remaining;
2. Recommended activity start date;
3. Which documents required professional engineer certification;
4. Applicability to specific operational conditions; and,
5. Specific Rule Reference.

As an owner/operator, this table can be used to help guide you through the compliance process. The Rule contains some of the information to be included in the required documents however several states have very detailed guidelines for what exactly needs to be provided.

FINAL CCR RULE COMPLIANCE DEADLINES - GENERATING STATION

(For active CCR landfills and all impoundments)

Note: Steps are not required to be performed sequentially.

Enforcement and interpretation of the Final EPA Rule is governed by the (State Agency) Department of Environmental Quality (DEQ). The state agency will need to adapt the intent of the Rule to the existing regulations. Requesting the DEQ's interpretation of the Rule is critical to maintain compliance.

<p>1. Completion Date October 19, 2015 (2 months overdue)</p> <p>Recommended Start Work Date July 2015</p> <p>A. Initiate "Weekly" Inspections and "Monthly" monitoring of instruments for landfills and surface impoundments per § 257.83 and § 257.84. <i>Required for Surface Impoundments.</i></p> <p>Continue inspections at intervals not greater than 7 days and monitoring of instruments at 30 days interval.</p> <p>B. Prepare and Implement Fugitive Dust Plan per § 257.80. <i>Required for _____</i></p> <p>Continue fugitive dust control work in perpetuity. Prepare and submit annual fugitive dust control report (less than 14 mo. After initial Dust Control Plan put in facilities operative record).</p> <p>c. Record Keeping, Notifications and Internet Posting § 257.105 through § 257.107</p> <p>It is anticipated that Station will self perform this work. However, S&L could assist in developing a strategy of compliance. Initiation of effort will depend on Station's compliance and information technology group schedule. Continue Record Keeping, Notifications and Internet Posting in perpetuity. <i>Required for _____</i></p>	<p>2. Completion Date December 17, 2015 (0 months remaining)</p> <p>Recommended Start Work Date July, 2015</p> <p>A. Procure and install the required Identification Marker Signs at each impoundment per § 257.73 (a) (i) (does not apply to incised impoundments). Signs must be permanent and at least 6" high and contain: 1. ID # of the CCR Unit (if assigned by the state) 2. Name associated with the CCR unit. 3. Name of Owner or Operator <i>Required for Surface Impoundments.</i></p> <p>B. Prepare and place in facility's operating record a Notification of Intent to Initiate Closure of an inactive CCR surface impoundment per § 257.100 (c)(1). <i>Required for Surface Impoundments.</i></p>	<p>3. Completion Date January 17, 2016 (1 month remaining)</p> <p>Recommended Start Work Date August, 2015</p> <p>A. Start planning and collecting data to perform and report first Annual Inspection of the landfills and large impoundments (either heights more than 20' or heights more than 5' with more than 20 acre-ft storage) per § 257.83 and § 257.84. <i>Required for Surface Impoundments.</i></p> <p>Per the Rule, at least one of the engineers performing the inspection must be licensed in (STATE). Continue Annual Inspections at intervals not greater than 12 months. Future Deadline for completing an Annual Inspection report is the same date the prior Annual Inspection report was completed.</p>	<p>4. Completion Date October 17, 2016 (10 months remaining)</p> <p>Recommended Start Work Date July, 2015</p> <p>A. Complete and Document History of Construction for CCR impoundment (if required - note 1) per § 257.390 <i>Required for Surface Impoundments.</i></p> <p>B. Complete and document initial Design Flood Control system plan for each CCR impoundment per § 257.82(c). <i>Required for Surface Impoundments.</i></p> <p>D. Complete and document initial Hazard Potential Ranking for each CCR impoundment per § 257.73(a). <i>Required for Surface Impoundments.</i></p> <p>E. Complete Run-On-off Evaluation and plan for each CCR landfill per § 257.81(c). <i>Required for Surface Impoundments.</i></p>	<p>5. Completion Date April 17, 2017 (16 months remaining)</p> <p>Recommended Start Work Date December, 2016</p> <p>A. Prepare Emergency Action Plan for each CCR impoundment per § 257.73 (e) (3). Update Plan every 5 years. (Note: Excludes incised impoundments). <i>Required if impoundment is determined to be either a high hazard potential or a significant hazard potential. Not required if impoundment is determined to be low hazard potential. Required for Surface Impoundments.</i></p>	<p>6. Completion Date October 17, 2017 (22 months remaining)</p> <p>Recommended Start Work Date July, 2015</p> <p>A. Deviate, Implement, and document a Groundwater Monitoring Program for each CCR impoundment and landfill per § 257.90 through § 257.98. <i>Required for Surface Impoundments.</i></p> <p>B. Prepare Annual groundwater monitoring and corrective action report per 257.90 (e). Initial report must be issued no later than January 31, 2018 and annually thereafter. <i>Required for Surface Impoundments.</i></p>	<p>7. Completion Date October 17, 2018 (32 months remaining)</p> <p>Recommended Start Work Date July, 2015</p> <p>A. Evaluate and document compliance with the Location Restrictions for impoundments and landfills per § 257.60 through § 257.64. Unstable areas for impoundments and landfills. <i>Required for Surface Impoundments.</i></p> <p>Aquifer separation (impoundments) Wellhead impacts (impoundments) Fault areas (impoundments) Seismic Impact Zones (impoundments) <i>Required for Surface Impoundments.</i></p> <p>A. Complete Closure or Retrofit for Required impoundments and landfills. Separation to groundwater Known groundwater impacts Unlined impoundments</p>
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Note 1. Where noted, Rule applies to an existing CCR surface impoundment that either has a height of five feet or more and a storage volume of 20 acre-feet or more, or has a height of 20 feet or more.

Note 2. Indicates certification from a qualified professional engineer is required for this activity.

Note 3. In addition to the requirements of Final Rule the station is expected to maintain documents for food plain, endangered species and surface water impacts per § 257.3-1, § 257.3-2 and § 257.3-3.



3. Existing Impoundment Disposal Site Alternatives – Close In Place or Excavate and Dispose

Each of the EPA estimated 700 active wet impoundment disposal sites in the U. S. will have to be addressed under the Rule if not in compliance, by either capping the unit with the prescribed closure cover system or have all the CCR removed and disposed of in a compliant site. Conditions that trigger closure action include: less than 5 foot vertical separation between the CCR and the highest seasonal groundwater elevation, evidence of ground water impacts, location within 200 feet of a Holocene fault line, location within the defined seismic impact zone, situated in unstable location (subsurface Karst area or naturally occurring landslide zone), or impact on environmental resources such as wetlands.

There may be other facility specific factors that cause you to consider closure such as conversion to dry CCR handling and disposal, corporate policy, general environmental risk concerns, proximity to flood plain, etc. The fundamental question is “how do I decide what action is right for my impoundments?” On the surface, the decision may seem to have a simple solution. If you have a relatively small and shallow CCR dewatering impoundment where the ash is periodically removed, it makes perfect sense to remove the material, install a compliant liner, and continue operations if needed. If you have a very large and deep impoundment, the cost of removal is prohibitive and closure in place by installing the required cover system is the likely solution.

Is your decision, based on this ‘first-pass’ analysis, final? Perhaps not. Where do you draw the line between ‘close in place’ VS ‘remove and dispose’ based on size and depth of your’ impoundment? Many other factors need to be considered. For a ‘first pass’ analysis, you can compare the cost of removal and disposal to installation of a compliant closure cover.

Under the Rule, the cost to construct a cover system will range from \$150,000 to \$250,000 per acre, depending on how complex the cover requirements are in your existing state's regulations, liquids removal from the ash, the quantity of regrading required to provide positive drainage off the cover, and the proximity of capping materials including clay, protective cover soil, and topsoil. Although the Rule requires a (2-foot) clay layer at a maximum permeability of 1×10^{-5} cm/s, 18 inches of protective soil cover, and 6 inches of topsoil, existing state landfill regulations vary from no closure requirements to more than 6 feet of cover materials incorporating clay, membranes, geosynthetics, and drainage layers.

Once you've estimated the cost for closure in place on a per-acre basis using the more restrictive of your state regulations or EPA Rule, you can compare this value to the cost of removal to a compliant disposal site.

The relative importance of this cost comparison is a function of the depth of your CCR disposal site(s). A thin layer of CCRs such as 10 feet will cost substantially more to close in place on a CCR per-ton or yard basis compared to one that is 40 feet thick. Similarly, the cost of removal from a shallow CCR disposal or treatment impoundment is relatively low on a per acre basis compared to a substantially deeper site.

If clay liner or cover materials, protective soil cover, or topsoil are in short supply in your region requiring substantial import costs, equivalent liner and cover systems can be considered as long as the state approves. Options include secondary High Density Polyethylene (HDPE) or other membranes, geosynthetic clay liners, evapotranspiration covers, and artificial turf for final site stabilization. Due to the wide range of soil and climate conditions around the U. S., many states have already allowed alternative liner and cover designs.

CCR excavation combined with liquids removal, transport, and disposal to a compliant site are equally complex tasks. Potential costs such as required dewatering/stabilizing and drying the CCRs in preparation for loading and hauling, transportation distance, disposal

fees, feasibility of removing the material that may have been placed below the water table, and most importantly, the total volume to remove, are all factors that impact the unit costs.

As a simplified example comparison, if a CCR fill is 10' thick, the cost per yard of in place CCR, to install a compliant cover system is estimated in the range of \$ 15 to \$20. If that same 10' high CCR site has a compliant disposal land fill on site, estimated cost of dewatering, removal, and disposal could be in the range of \$25 to \$27 per yard. If the existing fill depth is greater than 7' to 10', the in-place closure cost per yard becomes even more favorable when compared with the removal option. This breakeven point assumes you have a compliant disposal facility at your site so the haul and disposal costs are relatively small.

To make the right decision for your existing non-compliant CCR disposal/handling operations you must weigh the costs of closure in place VS CCR removal.

In addition to comparing the various costs of alternatives, several other environmental criteria will influence your ultimate decision. Regardless of whether your existing disposal site is lined, monitored, or impacts groundwater, the best alternative may be to combine these options by continuing to use your existing disposal site, close in place and continue to operate in compliance with the new Rule, above and adjacent to the former disposal area.

4. Additional Factors That Affect Decisions.

If you examine Records of Decision of both State and Federally-led Superfund and RCRA landfill site corrective actions over the past 30 years, a clear precedent has been set. For large disposal sites, when a feasibility study is completed to compare costs and effectiveness of excavating and disposal versus closing in place, the removal option typically becomes cost prohibitive. The exception to this precedent is removal of isolated hot spots containing buried drums of hazardous waste. Disposal site closure in place and

controlling affected groundwater, if any, is by far the typical documented Record of Decision for sites with municipal and similar solid waste. However, if groundwater is impacted, additional remedial actions will likely be required.

The following table represents a basic comparison of general example factors and conditions and the likely preferred decision:

TABLE 1
GENERAL CLOSURE DECISIONS AND SITE FACTORS

<u>Factor/Condition</u>	<u>Close in Place</u>	<u>Remove and Dispose</u>
Site Size	Large	Small
Compliant Site Distance	Far	Close Proximity
Subsurface Geology	Low Permeability Soil	Sands and Gravels
Groundwater Depth	Deep, Slow Migration	Shallow, Fast Migration
Buffer to Property Line	Large	Small
Original Construction	Liner	No Liner
Seismic Setting	Low Risk	High Risk

Comparison and balancing of costs against all of the factors that can affect your decision is challenging unless there is an overwhelming condition that controls or outweighs the others. The most important issue is that no two sites are alike because of all the variables that must be considered.

The factors presented in Table 1 are ultimately affected by many other potential conditions at your generating station. Features in and around the impoundments and how those features might affect the closure or removal actions include:

- Groundwater elevations and the ability to control intrusion during dewatering

- Storm water run-on/off controls and potential discharge points
- Distance to potential borrow sources for clay and topsoil
- Proximity of groundwater impact receptors

Features of the impoundment and CCR materials that affect your decision include:

- In-situ liner whether constructed or naturally occurring clay layers
- Original construction methods – whether dikes were built of engineered fill or ash
- Dewatering potential and material stabilization and handling challenges
- Regrading quantities
- Containment dike stability

Ancillary conditions that affect the decision may include:

- Cost of conversion from wet to dry fly, FGD and bottom ash systems
- Your corporate company's position on short and long term environmental risk
- Cost to comply with the ELG Rule
- Potential market value of the CCR and reclaim costs
- Future potential use value of the impoundment area
- Potential sale and reuse of the property
- Cost of groundwater monitoring system and 30 years of data collection and analysis
- Cost to complete other required documentation:
 - Weekly and Annual Inspections
 - Documenting History of Construction
 - Flood Control Analysis, Design, and Implementation
 - Storm Water Run-On/Off Controls Analysis and Implementation
 - Slope Stability Analysis and Potential Remediation
 - Emergency Action Plan Preparation

Ultimately you must consider each of these factors and conditions and apply costs to evaluate the total system impacts to your options.

One of the most frequently used closure scenarios is on-site consolidation of CCR from multiple handling and disposal areas at a generating station and in-place closure. Removing CCR from smaller, shallow fill areas to larger on-site disposal landfills and then closing the consolidated CCR in place provides the best economic alternative combination.

The decision of removal versus close in place can be much more complex than the above example and there may be many other site-specific conditions to evaluate that could outweigh any of the example factors.

If you have a current groundwater monitoring program required by your state's regulations, you may have several of these factors already evaluated: impacted groundwater, geologic conditions, and migration potential. Evaluating such factors will help you decide what quality level the final closure system should be if closure in place appears applicable for your site.

For comparison purposes, placing an impermeable cover on a disposal site can cut off additional rain water from percolating through the CCRs and transporting chemicals of concern toward the groundwater. Excavation and disposal removes the source. However with both of these options, if the ground water is already impacted, you will likely have to address contamination migration. The potential of contaminated groundwater controls must also be added to the overall costs with either decision.

To further reduce the ongoing risk of groundwater impacts, removal of water/leachate within the fill using extraction wells is required to close and impoundment, regardless whether or not there is any current evidence of leachate migration from the fill area. If new monitoring wells required under the Rule identify groundwater impacts, other actions may

be required such as groundwater containment or capture using cut off walls or extraction and treatment. The need for these potential remediation techniques is dependent on how far and how concentrated the groundwater impact extends, if the chemicals of concern are leaving your property, and if there are receptors down gradient – meaning private or public water supplies and surface water lakes or streams. Implementation of these remediation requirements is based on RCRA rules and actions that have been occurring since the late 1970s and early 1980s.

The estimated costs to prepare and compile the required documentation and install and sample monitoring wells, is highly variable depending on specific subsurface geologic conditions at your generating station. The cost of compliance is also affected by what similar activities you've already completed, at least in part, as required by your existing State's regulations.

The overall requirements are spelled out in the Final Rule but each State must define specific detailed documents that need to be prepared. As these documents are developed, they are required to be posted on a publically accessible web site and submitted to the State agencies as requested. Actions you take now will affect what documents you have to complete during this transition period.

It's critical to understand that the overview of these documentation requirements defined in the Rule are very general and nonspecific. Many states have similar regulations with intricate details of submittal requirements. Integrating the Rule with your State's regulations will be needed to meet the intent of both agencies.

Summary

The decision making process to answer the question of "how should I close my existing CCR disposal site?" is complex and unique for each facility.

The goal of this technical paper is to provide a basic understanding of how the new Rule will affect your site and the potential associated costs, depending on decisions you make and actions you take. This is accomplished, in part, by defining a framework of factors to consider:

1. Where to find answers;
2. Time Remaining to Comply with Each Requirement;
3. Existing Impoundment Disposal Site Alternatives – close in place or excavate and dispose; and,
4. Additional factors that affect decisions.

Perhaps most importantly, it's essential to understand that the solution(s) for your situation is unique and what's right for one site may not be the best solution for others, even between two CCR disposal locations at a generating station. There is no single optimum answer. If appropriate for your site and there are no overruling factors, your best solution may be to consolidate your CCR and close the site in place.

Arriving at the best answers for your site(s) is a complex process and unique for every setting. In addition to cost, your ultimate decision may be based on the level of short and long term environmental risk your company is willing to accept.

As a generating station owner/operator, your first actions need to be evaluation of current CCR disposal sites and development of estimate costs for alternatives and compliance requirements, including consideration of potential environmental risk and wet to dry ash handling and disposal conversion. Second, review Rule compliance dates and requirements to determine what sections apply to your facility. Third, you need to integrate this evaluation with the other pending rules especially the Effluent Limitation Guidelines (ELG) wastewater treatment requirements. These two rules are interrelated and your response to the CCR Rule may affect what needs to be done for compliance with the ELGs. Taking action to address one rule may require backtracking to comply with the other.

Once overall potential plant modifications including potential operation changes such as conversion from wet to dry CCR handling are decided for compliance with both rules, you'll be ready to develop an integrated schedule and action plan to meet all your required objectives.

References:

[1] Title 40, Chapter I, of the Code of Federal Regulations, Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundment. April 17, 2015.

[2] Title 40, Code of Federal Regulations, Part 423 – Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, September 30, 2015.