



Memorandum from the Office of the Inspector General

November 16, 2020

Robert M. Deacy, Sr.

**REQUEST FOR FINAL ACTION – EVALUATION 2019-15661 – MAINTENANCE OF
COAL COMBUSTION RESIDUAL STORAGE FACILITIES**

Attached is the subject final report for your review and final action. Your written comments, which addressed your management decision and actions planned or taken, have been included in the report. Please notify us when final action is complete. In accordance with the Inspector General Act of 1978, as amended, the Office of the Inspector General is required to report to Congress semiannually regarding evaluations that remain unresolved after 6 months from the date of report issuance.

If you have any questions or wish to discuss our findings, please contact Deana D. Scoggins, Senior Auditor, Evaluations, at 423-785-4822 or E. David Willis, Director, Evaluations, at (865) 633-7376. We appreciate the courtesy and cooperation received from your staff during the evaluation.

David P. Wheeler
Assistant Inspector General
(Audits and Evaluations)

DDS:FAJ
Attachment

cc (Attachment):

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OIG File No. 2019-15661



Office of the Inspector General

Evaluation Report

To the Senior Vice President,
Generation Projects and Fleet
Services

MAINTENANCE OF COAL COMBUSTION RESIDUAL STORAGE FACILITIES

Evaluation Auditor
Deanna D. Scoggins

Evaluation 2019-15661
November 16, 2020

ABBREVIATIONS

CCR	Coal Combustion Residual
CCR Rule	Disposal of Coal Combustion Residuals from Electric Utilities
CCRSSP	CCR Structural Stability Program
FY	Fiscal Year
GCP&S	Generation Construction, Projects and Services
GP&FS	Generation Projects and Fleet Services
OIG	Office of the Inspector General
SPP	Standard Programs and Processes
TVA	Tennessee Valley Authority

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
BACKGROUND.....	1
OBJECTIVE, SCOPE, AND METHODOLOGY	2
FINDINGS	3
REQUIRED MAINTENANCE WAS GENERALLY PERFORMED	3
SOME REPORTS HAD INCORRECT OR MISSING INFORMATION	4
OPPORTUNITIES FOR IMPROVEMENT	5
RECOMMENDATIONS	6

APPENDIX

MEMORANDUM DATED NOVEMBER 6, 2020, FROM SCOTT TURNBOW TO
DAVID P. WHEELER



Evaluation 2019-15661 – Maintenance of Coal Combustion Residual Storage Facilities

EXECUTIVE SUMMARY

Why the OIG Did This Evaluation

In 2008, a dike failure occurred on the north slope of the ash pond at the Tennessee Valley Authority's (TVA) Kingston Fossil Plant in Roane County, Tennessee. The failure resulted in the release of approximately 5.4 million cubic yards of coal ash spilling onto adjacent land and into the Emory River. TVA's Office of Inspector General, in conjunction with Marshall Miller & Associates,ⁱ performed an inspection that determined there was poor maintenance of coal combustion residual (CCR) storage facilities, such as not addressing erosion, standing water, and piping issues.ⁱⁱ Additionally, the inspection found there was no formalized training for personnel who inspected the dikes.

Due to past issues identified related to maintenance of CCR storage facilities, we performed an evaluation of required maintenance at TVA's CCR storage facilities. The objective of the evaluation was to determine if TVA performed required maintenance of CCR storage facilities. The scope of the evaluation was maintenance needs identified during required inspections in fiscal years 2018 and 2019 at Bull Run, John Sevier, and Paradise Fossil Plants.

What the OIG Found

We determined, in general, TVA performed required inspections and completed maintenance to address issues identified during the inspections. Specifically, TVA completed (1) stability and factor of safetyⁱⁱⁱ assessments, (2) special inspections, (3) annual inspections, (4) weekly inspections, (5) monthly instrumentation inspections, and (6) 55 of 56 quarterly inspections within the scope of this evaluation. TVA took actions to address issues identified during the inspections including repairing damaged spillways and extending toe drains to collect moisture. Although most inspections were completed, we determined some inspection reports had incorrect or missing information. We also identified opportunities for improvement related to policies for maintenance and inspection of CCR storage facilities, inspection plan requirements, and training requirements.

ⁱ Marshall Miller & Associates was the engineering consultant hired to perform a peer review of the root cause analysis of the Kingston ash spill.

ⁱⁱ Inspection 2008-12283-02, *Review of Kingston Fossil Plant Ash Spill Root Cause Study and Observations About Ash Management*, July 23, 2009

ⁱⁱⁱ Factor of safety is used to determine whether a CCR surface impoundment's dikes are engineered to withstand the specific loading conditions that can be reasonably anticipated to occur during the lifetime of the unit without failure of the dike if accepted good engineering practices are employed.



Evaluation 2019-15661 – Maintenance of Coal Combustion Residual Storage Facilities

EXECUTIVE SUMMARY

What the OIG Recommends

We recommend the Senior Vice President, Generation Projects and Fleet Services develop a process to ensure accuracy and completeness of inspection reports and update policies, inspection plans, and training requirements. Our detailed recommendations are listed in the body of this report.

TVA Management's Comments

In response to our draft report, TVA management stated that actions have been, or will be, taken to address the recommendations. See the Appendix for TVA's complete response.

Auditor's Response

We concur with TVA management's planned and completed actions for the recommendations.

BACKGROUND

In 2008, a dike failure occurred on the north slope of the ash pond at the Tennessee Valley Authority's (TVA) Kingston Fossil Plant in Roane County, Tennessee. The failure resulted in the release of approximately 5.4 million cubic yards of coal ash spilling onto adjacent land and into the Emory River. TVA's Office of the Inspector General (OIG), in conjunction with Marshall Miller & Associates,¹ performed an inspection that determined there was significant weaknesses in ash management practices including poor maintenance.² The inspection identified recurring issues at TVA plants including erosion, seepage, overgrown vegetation, sparse vegetation, tree growth, standing water, and piping issues that were not being addressed. Additionally, the inspection found there was no formalized training for personnel who inspected the dikes.

In response to the Kingston ash spill, TVA placed its coal combustion residual (CCR) impoundments under the governance and oversight of the TVA Dam Safety Program to ensure safety guidelines were in place for such structures. In 2015, the Environmental Protection Agency issued the Disposal of Coal Combustion Residuals from Electric Utilities (commonly referred to as the CCR Rule) that included inspection requirements for both CCR landfills and surface impoundments.³ The CCR Rule established a comprehensive set of requirements for safe disposal of CCRs from coal-fired plants. The CCR Rule requires weekly and annual inspections, as well as monthly instrumentation inspections, for surface impoundments and weekly and annual inspections for landfills. Additionally, the CCR Rule requires periodic stability and factor of safety assessments⁴ for some surface impoundments.

In August 2017, TVA removed impoundments regulated under the CCR Rule from the governance and oversight of TVA's Dam Safety Program. TVA later transferred the governance and oversight for all CCR structures to Generation Projects and Fleet Services (GP&FS) in September 2019. Generation Construction, Projects and Services (GCP&S)⁵ Standard Programs and Processes (SPP) 27.4.1.1, *Coal Combustion Products Inspection of CCP Storage Facilities*, requires (1) informal, typically quarterly, inspections as needed considering the hazard classification and (2) intermediate inspections, which can be annual or at a minimum once every 2.5 years based on the hazard

¹ Marshall Miller & Associates was the engineering consultant hired to perform a peer review of the root cause analysis of the Kingston ash spill.

² Inspection 2008-12283-02, *Review of Kingston Fossil Plant Ash Spill Root Cause Study and Observations About Ash Management*, July 23, 2009

³ A landfill, as defined in the CCR Rule, is an area of land or excavation that receives CCR and which is not a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, or a cave. A surface impoundment is a natural topographic depression, man-made excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR.

⁴ Factor of safety is used to determine whether a CCR surface impoundment's dikes are engineered to withstand the specific loading conditions that can be reasonably anticipated to occur during the lifetime of the unit without failure of the dike if accepted good engineering practices are employed.

⁵ GCP&S was a prior name for GP&FS.

classification. The SPP also requires special inspections to be performed after excessive rainfall or earthquakes. State permits typically required quarterly inspections once the storage facility was closed; however, in some instances the permits did not specify a frequency or allowed TVA to set the inspection frequency.

Due to past issues identified related to maintenance of CCR storage facilities, we performed an evaluation of required maintenance at TVA's CCR storage facilities.

OBJECTIVE, SCOPE, AND METHODOLOGY

The objective of the evaluation was to determine if TVA performed required maintenance of CCR storage facilities. The scope of the evaluation was maintenance needs identified during required inspections in fiscal years (FY) 2018 and 2019 at Bull Run, John Sevier, and Paradise Fossil Plants. We selected these three plants for our detailed review because their planned life cycles and number of storage facilities provided a representative sample of TVA's CCR storage facilities. To achieve our objective, we:

- Reviewed the CCR Rule, state permits, and pertinent TVA processes to determine inspection and assessment requirements.
- Performed a completeness assessment to determine if TVA had inspection and assessment reports for each applicable period and special condition.
- Reviewed documentation for 164 of 438 inspections performed during FYs 2018 and 2019 to determine if (1) the inspections were completed as required and (2) the issues identified in the inspections were addressed. Each of the CCR storage facilities in the scope of this evaluation had different inspection requirements based on whether or not they fell under the CCR Rule, GCP&S-SPP-27.4.1.1, or if there was a state permit associated with the facility.
 - Randomly selected 88 of 344 (25 percent) weekly instrumentation inspections.
 - Randomly selected 6 of 24 (25 percent) monthly instrumentation inspections.
 - Selected all 55 quarterly inspection reports.
 - Selected all 8 annual inspection reports.
 - Selected all 7 special inspection reports.
- Reviewed documentation for 3 stability assessments and 2 factor of safety assessments performed during FYs 2018 and 2019 to determine if (1) the assessments were completed as required by the CCR Rule and (2) the issues identified in the assessments were addressed.

- Reviewed training for TVA personnel who performed weekly and quarterly inspections⁶ to determine if they were sufficiently trained.
- Interviewed GP&FS employees to determine if maintenance concerns were being addressed.

This evaluation was performed in accordance with the Council of the Inspectors General on Integrity and Efficiency's *Quality Standards for Inspection and Evaluation*.

FINDINGS

We determined, in general, TVA performed required inspections and completed maintenance to address issues identified during the inspections. However, we determined some inspection reports had incorrect or missing information. We also identified opportunities for improvement related to policies for maintenance and inspection of CCR storage facilities, inspection plan requirements, and training requirements.

REQUIRED MAINTENANCE WAS GENERALLY PERFORMED

We determined, in general, TVA performed required inspections and completed maintenance to address issues identified during the inspections. Specifically, TVA completed (1) the required stability and factor of safety assessments (3 and 2, respectively);⁷ (2) all sampled weekly and monthly instrumentation inspections (88 and 6, respectively); (3) all 8 annual inspections; (4) 7 special inspections (even some not required); and (5) 55 of 56 quarterly inspections, within the scope of this evaluation. According to a GP&FS employee, the 1 quarterly inspection⁸ was missed because an engineer thought the hazard level for that facility was lower than it actually was; however, the most at-risk portion of the storage facility would have been monitored during the inspection of a different facility.⁹ Additionally, when issues were identified during inspections, TVA addressed the issues.¹⁰ This included repairing damaged spillways and extending toe drains to collect moisture.

Interviews conducted as part of OIG Inspection 2008-12283-02, following the Kingston ash spill, indicated CCRs were not important to management which created a culture that contributed to poor maintenance. However, interviews performed during this evaluation indicated GP&FS employees felt their concerns were addressed when identified.

⁶ We did not identify training requirements for quarterly inspections required by state permits, monthly instrumentation, annual, or special inspections.

⁷ One factor of safety assessment was not completed because the storage facility was closed.

⁸ The inspection was not required by CCR Rule or a state permit.

⁹ The two storage facilities share a dike wall.

¹⁰ In some instances, recommendations were made to reconnect, abandon, or replace instrumentation; however, TVA had not made a decision on those items and planned to address them in the future.

SOME REPORTS HAD INCORRECT OR MISSING INFORMATION

Instrumentation and inspection reports provide documentation that a storage disposal facility has been inspected. During our evaluation, we identified issues with some instrumentation and inspection reports. Specifically, we determined some of the monthly instrumentation reports and annual inspection reports had incorrect or missing information.

Incorrect or Missing Information in Monthly Instrumentation Reports

During our review of the 6 sampled monthly instrumentation reports, we identified the following issues:

- Paradise's July and August 2018 reports stated there were no manual piezometer¹¹ readings for multiple CCR storage facilities. According to a GP&FS employee, the data was collected, but not included in the database the engineering firm reviewed to create the reports. GP&FS personnel indicated it has since been added to the database and the site was performing within expected ranges.
- Each of the Paradise monthly reports noted instrumentation had been out of service since 2017 and would be placed back in service once slope work had been completed. However, the slope work was completed in 2017, but the instrumentation had not been placed back in service as of May 2020. According to GP&FS, the engineering firm who created the report was not aware the slope work had been completed. Additionally, GP&FS indicated the instrumentation had not been reautomated because data provided by other automated instruments was sufficient to monitor the stability of the structure.

Incorrect or Missing Information in Annual Inspection Reports

During our review of the 8 annual inspection reports, we identified the following issues:

- The FY 2019 Bull Run annual inspection report required by the CCR Rule failed to include the maximum reading for 10 of 12 instruments. The CCR Rule requires annual inspection reports to include the maximum recorded reading for any instrumentation since the previous inspection.
- The FY 2018 Bull Run annual inspection report required by the CCR Rule noted one instrument could not be read. The FY 2019 annual inspection report also indicated no reading for the same instrument. When asked about the instrument, TVA subsequently determined the cord to the instrument had been cut.
- The FY 2018 Paradise annual inspection report required by the CCR Rule contained wording regarding instrumentation that appeared to be incorrect. Specifically, it noted 1 instrument had no manual reading and then later stated the instrument had manual readings. When asked about the wording, a

¹¹ A piezometer is an instrument for measuring pressure or compressibility.

GP&FS employee stated some of the wording may have been carried over from the FY 2017 report.

- The FY 2019 Paradise annual inspection required by GCP&S-SPP-27.4.1.1 did not include a written report showing it was performed by a qualified professional engineer as required. According to a GP&FS employee, this was caused by the confusion around the hazard level of the storage facility as noted above for the missing quarterly inspection.

Based on discussions with GP&FS personnel, it does not appear any of the above missing or incorrect information, individually, had a major impact. However, missing or incorrect information in reports increases the risk that information may be misinterpreted or reported inaccurately.

OPPORTUNITIES FOR IMPROVEMENT

While we found TVA generally completed required maintenance, there were some opportunities for improvement. Specifically, (1) pertinent SPPs did not apply to most storage facilities; (2) inspections plans were not required for most storage facilities and, where required, were missing requirements outlined in GCP&S-SPP-27.4.1.1, *Coal Combustion Products Inspection of CCP Storage Facilities*; and (3) training requirements were unclear.

SPPs Did Not Apply to Most Storage Facilities

GCP&S-SPP-27.4.1.1 and GCP&S-SPP-27.3.1, *Coal Combustion Products Operations, Maintenance, and Repair of Impoundments* covered only 1¹² of 15 storage facilities identified as having inspection requirements in the scope of the evaluation. TVA removed CCR storage facilities from the governance of Dam Safety in 2017, starting with storage facilities that fell under the CCR Rule, and removed the remaining ones in 2019. Both SPPs limit the scope to structures within Dam Safety. As indicated in OIG Inspection report 2008-12283-02, a lack of policies and procedures can contribute to weaknesses in CCR management. According to a GP&FS employee, they are in the process of updating the procedures to apply to all of the CCR storage facilities.

Inspection Plans Were Not Required For Most Storage Facilities

GCP&S-SPP-27.4.1.1 required inspection plans that include requirements for inspection frequency, inspector qualifications and training, and report format. The inspection plan for the Paradise storage facility that fell under the SPP did not include a defined inspection frequency, training requirements, or report format. The facility missed a quarterly inspection and the annual inspection report format did not indicate it was completed by a certified professional engineer. A detailed inspection plan potentially could have prevented those issues from occurring.

¹² The one storage facility was at Paradise.

Training Requirements Were Unclear

GCP&S-SPP-27.4.1.1 does not specify training requirements for inspectors, but indicates the requirements will be included in inspection plans. With only one storage facility required by the SPP to have a plan, which did not include training requirements, it is unclear what training individuals performing CCR storage facility inspections should have. When asked about training requirements, GP&FS provided two courses they stated met the requirements: Dam Safety Embankment Inspections and Dam Safety Awareness. We reviewed the training records for the eight inspectors who signed the weekly and quarterly inspections and determined none of the inspectors had completed the Dam Safety Embankment Inspections course, and six of the eight inspectors had completed the Dam Safety Awareness course. For the remaining two inspectors, GP&FS provided documentation of them attending a TVA Impoundment Safety Training for By-Products Disposal. According to a GP&FS employee, this training would be sufficient to meet the training requirements.

As noted in OIG Inspection 2008-12283-02, standardized training could equip inspectors to recognize maintenance issues early, properly assess the significance of issues, and properly communicate issue.

RECOMMENDATIONS

We recommend the Senior Vice President, GP&FS:

- Develop a process to ensure accuracy and completeness of inspection reports.

TVA Management's Comments – TVA has finalized the CCR Structural Stability Program (CCRSSP) Guidelines for Performance Monitoring which includes quality management requirements and responsibilities for quality control and quality assurance actions to ensure completeness and accuracy of inspection and instrumentation reporting. See the Appendix for TVA's complete response.

Auditor Response – We concur with actions taken.

- Continue plans to update SPPs and ensure all storage disposal facilities are covered.

TVA Management's Comments – TVA updated the CCRSSP inventory to ensure all storage assets are covered. Additionally, TVA is developing guidance documents addressing the breadth and depth of the program. See the Appendix for TVA's complete response.

Auditor Response – We concur with management's planned actions.

- Develop a process to ensure inspection frequencies, report formats, and training requirements are specified for each storage disposal facility.

TVA Management's Comments – TVA reviewed and updated the existing inspection plans to provide clarity on the (1) scope and frequency of inspections and (2) requirements for qualifications and training of the inspection personnel. Additionally, the CCRSSP Guidelines for Performance Monitoring include clear standards for recurring training and requirements for the development and implementation of inspection plans that outline the scope, extent, frequency, and reporting format for inspection of each facility within the inventory. See the Appendix for TVA's complete response.

Auditor Response – We concur with actions taken.



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

November 6, 2020

David P. Wheeler,

RESPONSE TO DRAFT EVALUATION 2019-15661 - MAINTENANCE OF COAL COMBUSTION
RESIDUAL STORAGE FACILITIES

Reference: Draft OIG Evaluation Dated October 7, 2020

Generation Projects & Fleet Services (GP&FS) appreciates the opportunity to review the above-referenced draft evaluation report. Our responses are provided in the following paragraphs.

After the December 2008 Kingston ash spill, TVA incorporated Coal Combustion Residual (CCR) impoundments into the TVA Dam Safety Program to provide governance and oversight and to place responsibility for the operation of these facilities in one organization, Generation Construction Projects and Services, now GP&FS. These initial actions helped establish clear accountability and safety standards in the absence of governing state or federal regulations and promoted accountability for maintenance, inspection, and stability of TVA's CCR units.

Since that time, TVA has emerged as an industry leader in the safe management of coal ash, establishing comprehensive standards for design, construction, operation, maintenance, inspections, and instrumentation monitoring; completing rigorous engineering evaluations of each facility; and taking action where necessary to modify spillways, build buttresses, and perform various other projects to improve the stability of CCR units. Although not required by any regulatory program then or to date, GP&FS also installed more than 16,000 automated sensors that provide real-time monitoring of stability conditions, an industry first. In parallel with these actions, TVA has nearly completed the transition from wet to dry methods for handling and storing CCR materials, resulting in the construction of new landfills for dry storage, closure of several impoundments, and the pending closure of the remaining wet storage facilities.

Beginning in 2015, the U.S. Environmental Protection Agency and the states began putting in place CCR-specific regulatory programs that include standards for constructing, maintaining, monitoring, inspecting, and closing CCR units. In September 2019, TVA established a CCR-specific governance program to clarify processes and apply the appropriate standards comprehensively across the fleet of CCR facilities. In developing this program, we have maintained best practices established since the Kingston spill and have remained in compliance with the various regulatory requirements.

In addition, we have been in the process of consolidating and aligning requirements in parallel with optimizing and simplifying processes to create one overarching set of guidelines. This effort is underway because we recognized that opportunities existed to improve our internal processes in this space. For that reason, many of the improvements identified in your evaluation are items we have actively addressed through revisions to our processes and guidelines.

Our more specific responses to your comments are set forth below.

Page 2
November 6, 2020

OIG Recommendation: TVA Generation Projects & Fleet Services should develop a process to ensure accuracy and completeness of inspection reports.

TVA Response: In developing the new CCR-specific governance structure, TVA established quality management as a foundational element of the program. We self-identified a need for an improved process to help ensure accuracy and completeness in CCR reporting as reflected in our new guidelines. The CCR Structural Stability Program (CCRSSP) Guidelines for Performance Monitoring have been finalized and include quality management requirements and responsibilities for quality control and quality assurance actions to ensure completeness and accuracy of inspection and instrumentation reporting. Additionally, CCRSSP Governance personnel are accountable to perform independent, random assessments and evaluations of processes and documentation to promote compliance with program requirements and completeness and accuracy of the applicable reporting.

OIG Recommendation: TVA Generation Projects & Fleet Services should continue plans to update SPPs and ensure all storage facilities are covered.

TVA Response: TVA recognized the opportunity for a lack of clarity and coverage created by overlapping and competing regulatory requirements and took action to establish a CCR-specific governance program in September 2019. Upon assuming responsibility for governance and oversight for CCR storage assets, we updated the CCRSSP Inventory to ensure all storage assets are covered, including active, inactive, and closed CCR impoundments and landfills as well as supporting operational facilities. Additionally, we are developing guidance documents addressing the breadth and depth of the CCR Structural Stability Program.

OIG Recommendation: TVA Generation Projects & Fleet Services should develop a process to ensure inspection frequencies, report formats, and training requirements are specified for each disposal facility.

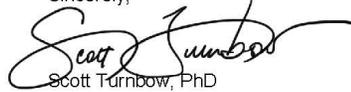
TVA Response: TVA recently completed this effort as a self-identified improvement under its new CCR governance program. Specifically, we reviewed and updated the existing inspection plans to provide clarity on the scope and frequency of inspections and requirements for qualifications and training of the inspection personnel. All inspectors have completed the required training. Additionally, the CCRSSP Guidelines for Performance Monitoring include clear standards for recurring training and requirements for the development and implementation of inspection plans that outline the scope, extent, frequency, and reporting format for inspection of each facility within the inventory.

We would like to thank the OIG evaluation team for their report and dedication to assist GP&FS with continuous improvements regarding maintenance and inspections of CCR storage facilities. Continuous improvement is a cornerstone of our culture and the way we do business. Although the OIG evaluation identified areas for improvement related to clarity in standards and rigor to ensure completeness and accuracy in reporting, we are encouraged that the thoroughness of your review yielded relatively few and minor inconsistencies, none of which is related to a lack of performing maintenance or correcting identified deficiencies. Your findings also reinforce the decisions TVA has made to develop a CCR-specific program, efforts we have expended towards actively assessing the health of the structures and actions we have taken to develop and execute an effective and industry-leading program. Again, thank you for your thorough review and engagement with our team throughout the process.

Page 3
November 6, 2020

If you have further questions, please feel free to contact me.

Sincerely,

A handwritten signature in black ink that reads "Scott Turnbow". The signature is fluid and cursive, with the first name "Scott" and last name "Turnbow" clearly legible.

Scott Turnbow, PhD
Vice President
Civil Projects, Equipment Support Services & CCP Management

MST:PVK

Enclosure

cc (Enclosure):

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David B. Fountain
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OIG File No. 2019-15661