



Memorandum from the Office of the Inspector General

September 30, 2014

Robert M. Deacy, Sr., LP 5D-C

FINAL REPORT – EVALUATION 2014-15217 – TVA’S COAL COMBUSTION PRODUCT MANAGEMENT

This review was initiated as part of the Tennessee Valley Authority’s (TVA’s) Office of the Inspector General’s (OIG) commitment to provide oversight of Coal Combustion Product (CCP) management. The objective of our review was to determine if TVA is meeting its commitments for CCP management.

We found TVA is meeting its commitments for CCP management. In order to address these commitments, TVA has taken a number of steps. Specifically, we found TVA has implemented programmatic improvements, stabilized its coal ash storage facilities, and improved oversight of CCP management. Additionally, we found TVA is taking steps to become an industry leader in CCP management.

BACKGROUND

On Monday, December 22, 2008, between 12 midnight and 1 a.m., a portion of the dike for an ash containment area at Kingston Fossil Plant failed. Approximately 5.4 million cubic yards of fly ash and bottom ash were released onto land and into adjacent waterways, including the Emory River that flows into the Clinch River near the plant. The approximate 1 billion gallons of coal combustion waste slurry covered about 300 acres of which 8 acres were privately owned lands, not owned or managed by TVA. The impacts of the coal ash spill destroyed and/or damaged (1) the railroad adjacent to the plant; (2) real and personal property; and (3) community infrastructure, including roads and utilities. TVA took immediate and ongoing actions to address the needs of those affected, clean up the spill, and protect human health and the environment. TVA also took action and made commitments to restore the area and regain public confidence.

TVA’s OIG committed to providing ongoing oversight where warranted and completed several reviews pertaining to the initial emergency response, root cause analysis, environmental monitoring, and impoundment stability.¹

¹ Inspection 2008-12283-01 – Kingston Fossil Plant Ash Slide Interim Report; Inspection 2008-12283-02 – Review of the Kingston Fossil Plant Ash Spill Root Cause Study and Observations About Ash Management; Inspection 2008-12283-07 – Review of the Environmental Sampling and Monitoring Plans for the Kingston Ash Spill; Inspection 2009-12910-01 – Peer Review of Stability Analysis of Dike C at Kingston Fossil Plant; Inspection 2010-13034 – Review of TVA’s Kingston Ash Spill Clean-Up and Recovery Efforts; and Inspection 2011-14109 – Review of Non-Time-Critical Kingston Ash Recovery Project Activities.

CCP is residue that remains after pulverized coal is burned. CCP consists of three main by-products: fly ash, bottom ash, and gypsum. Fly ash is composed mainly of non-combustible inorganic material contained in coal and typically consists of fine particles entrained in the combustion exhaust gas. Bottom ash is comprised of the incombustible coarse particles that settle to the bottom of the combustion chamber of a boiler. Gypsum is hydrated calcium sulfate, a by-product of clean air controls.

Following the Kingston ash spill on July 21, 2009, TVA's Board of Directors adopted resolutions, one of which was to provide a formal Fossil Remediation Plan covering not only Kingston, but also all other fossil ponds including all mitigation plans or remediation actions in process, prior to August 20, 2009.

OBJECTIVE, SCOPE, AND METHODOLOGY

This review was initiated as part of the OIG's commitment to provide oversight of CCP management. The objective of our review was to determine if TVA is meeting its commitments for CCP management. The scope of this review includes TVA commitments made regarding CCP management following the Kingston Ash Spill.

In order to achieve our objective, we (1) reviewed documentation to identify TVA's CCP commitments and (2) interviewed key Civil Projects and CCP management personnel and reviewed documentation to determine if TVA is meeting its CCP management commitments.

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

FINDINGS

We found TVA is meeting its commitments for CCP management. We identified four areas of CCP management that TVA committed to improve. The areas include (1) programmatic improvements, (2) storage stability, (3) oversight, and (4) industry leadership. Specifically, we identified the following commitments made by TVA related to Civil Projects and CCP Management:

- On July 21, 2009, TVA's Board of Directors adopted resolutions that authorized and directed TVA Senior Management to provide a Formal Fossil Remediation Plan covering not only Kingston, but all other fossil ponds to eliminate identified deficiencies in systems, standards, and controls.
- On July 28, 2009, Tom Kilgore, former President and Chief Executive Officer of TVA, testified before the U.S. Congress and outlined TVA commitments to ensure stability of storage facilities, aggressive and rigorous inspections processes, standardization in engineering, design, construction of facilities, and standardization in handling, storage, and disposal of coal combustion by-products.
- On August 20, 2009, TVA presented its remediation plan to the board that aimed to position TVA as an industry leader for coal combustion product operations. The remediation plan outlined a plan to eliminate existing wet ash and gypsum storage at

all fossil plants and high-hazard classifications for TVA ash and gypsum impoundments, and convert all wet fly ash, bottom ash, and gypsum operations to dry ash handling.

In order to address these commitments, TVA has taken a number of steps. Specifically, we found TVA has implemented programmatic improvements, stabilized its coal ash storage facilities, and improved oversight of CCP management. Additionally, we found TVA is taking steps to become an industry leader in CCP management.

Programmatic Improvements

TVA has made programmatic improvements by implementing standard policies and procedures addressing CCP management. Prior to the Kingston ash spill, TVA had no policies or procedures regarding the handling and storage of coal combustion by-products, resulting in management at each fossil plant implementing their own strategies for handling and storing coal combustion by-products.

In the aftermath of the Kingston ash spill, TVA hired URS Corporation² to develop extensive coal combustion by-product policies and procedures for TVA. URS developed a Master Programmatic Document that consisted of three volumes designed as a management tool to address key areas such as:

- Engineering design.
- Environmental compliance.
- Safety.
- Training.
- Data management.
- Procedural requirements for construction, inspection, monitoring, and operation of the selected coal combustion by-product streams and provide guidance for effective management and planning.

According to TVA, the Master Programmatic Document is no longer in use and has since been superseded by Strategic Business Unit, Standard Programs and Processes (SPP) that include:

- GC-SPP-27.1.1, Coal Combustion Products Design and Evaluation of CCP Storage Facilities.
- GC-SPP-27.4.1, Coal Combustion Products Inspection of CCP Storage Facilities.
- GC-SPP-27.2.1, Coal Combustion Products Construction of CCP Storage Facilities.
- GC-SPP-27.5.1, Coal Combustion Products Instrumentation and Monitoring of CCP Storage Facilities.
- GC-SPP-27.3.1, Coal Combustion Products Operations, Maintenance, and Repair of Impoundments.

² According to its website, URS Corporation is a leading provider of engineering, construction, and technical services for public agencies and private sectors companies around the world.

- GC-SPP-27.6.1, Coal Combustion Products Emergency Preparedness for CCP Storage Facilities.

These SPPs are used to govern TVA CCP storage facility:

- Design and evaluation.
- Safety inspections.
- Instrumentation and monitoring related to seepage and stability.
- Construction.
- Operations & Maintenance requirements.
- Emergency preparedness.

The facilities covered in these SPPs include wet ash and gypsum ponds, dry ash, and gypsum stacks constructed over abandoned ash ponds, stilling ponds, miscellaneous ponds, drainage basins, ditches, and dredge cells.

Coal Ash Storage Facility Stability

TVA has stabilized its coal combustion by-product storage facilities. TVA commissioned the engineering firm Stantec, Inc.,³ to inspect, evaluate, and make recommendations to improve the stability of all coal combustion by-product storage facilities at all of TVA's fossil plants. Stantec began its work in January 2009 in a four-phase approach:

- Phase 1 consisted of geotechnical engineering work that was broken down into two parts. Phase 1a consisted of onsite interviews and site walkovers. Phase 1b consisted of interviews with plant personnel and completion of field activities as well as the notation of the extent of seepage, slope instability, erosion, sparse vegetation, trees, animal burrows, poor surface drainage and other relevant features. Phase 1 was completed on June 24, 2009.
- Phase 2 consisted of detailed engineering studies and analysis at each facility including (1) geotechnical explorations; (2) stability, hydrologic, hydraulic analysis; (3) remediation engineering and workplan development; and (4) conceptual designs. Stantec submitted 16 final reports resulting from Phase 2 work in 2010.
- Phase 3 included remediation design and construction. TVA assessed its ash storage facilities against dam safety guidelines with a goal of complying with dam safety guidelines where possible. The "as found" factors of safety for the various disposal facilities included ten impoundments with factors of safety at less than 1.3. The global engineering safety factor (1.3) means the forces keeping the impoundment in place are 1.3 greater than those that would move it. TVA adopted the US Army Corps of Engineers long-term, minimum target factor of safety criteria of 1.5 and achieved global stability of 1.5 on all initial CCP program facilities by August 2011.

³ Stantec provides professional consulting services in planning, engineering, architecture, landscape architecture, surveying, environmental sciences, project management, and project economics for infrastructure and facilities projects.

Shortly after the Kingston ash spill, the Environmental Protection Agency (EPA) initiated a nationwide assessment of CCP management facilities. TVA Dam Safety and CCP engineers performed a preliminary hazards potential assessment for CCP facilities and submitted this information to the EPA. Four fossil sites had impoundments classified as high hazards. These sites were Bull Run, Colbert, Cumberland and Widows Creek. The hazard ratings were based on an evaluation of what the damage would be if the dam failed as opposed to the likelihood of failure. According to TVA, changes were completed in 2011 that resulted in eliminating these high-hazard classifications.

- Phase 4 included programmatic improvements, specifically Dam Safety Inspection Training and the development of programmatic documents. More information regarding development of programmatic documents can be found above. Initially, Stantec provided Dam Safety Training to all CCP individuals that included elements such as (1) roles and responsibilities, (2) failure modes, (3) case histories, (4) specific plant CCP features, (5) design philosophy, and (6) an inspection program. Training was provided at each fossil plant. As of 2010, more than 300 individuals had received training. However, TVA identified this training was delivered inconsistently. As a replacement, TVA initiated refresher training in 2012 to all CCP personnel. Additionally, as a practical replacement for the Stantec training, TVA began administering a site training called Ash 101 to contract personnel handling ash. According to TVA, CCP policies and procedures are currently being revised. Upon completion, TVA will initiate a refresher course for personnel working on CCP activities, including engineering, routine operations, construction, and project management.

Improved Oversight of Coal Ash Management

TVA has improved oversight of CCP management. TVA has made organization changes, completed inspections, and developed 20 CCP initiatives.

In fiscal year (FY) 2009, the Clean Strategies and Project Development organization was established with a stand-alone budget to help position TVA to meet the many challenges following the environmental event at Kingston. To strengthen the focus on TVA's coal combustion by-products and clearly establish accountability, the Coal Combustion Products Projects and Engineering Group, and the Coal Combustion Management Group were created within Clean Strategies and Project Development. More recently, TVA has established roles and responsibility by having all CCP activities under the direction of one organization—Civil Projects and CCP Management. CCP management is separate from fossil plant management and the Senior Vice President, Projects (formerly Vice President, Clean Strategies and Project Development) continues to manage all the funding.

Within the Civil Projects and CCP organization is a Dam Safety Construction group that implements the upgrades on TVA's dams. TVA decided to include coal ash impoundments under the Dam Safety Program to increase governance and utilize expertise of TVA's Hydro Review Board in assessing the safety and stability of coal ash impoundments. The Hydro Review Board is now called the Independent Review Board and is part of TVA's Dam Safety Program.

TVA Generation Construction GC-SPP-27.4.1, Coal Combustion Product Inspection of CCP Storage Facilities, governs the performance of safety inspections of active and inactive impoundments and disposal facilities included on the National Inventory of Dams as maintained by TVA's Dam Safety Officer, owned and operated by TVA. The inspection program consists of Informal, Intermediate (Annual) Inspections, Formal Inspections, and Special Inspections. Intermediate inspections are conducted approximately annually and at least every 15 months. Formal Inspections are conducted at intervals not exceeding 5 years. Special inspections are conducted at active ash ponds following impoundment instability incidents, significant earthquakes, unusually large floods, sabotage, other potentially damaging events, or if unusual conditions are observed during routine inspections. We reviewed TVA's annual inspections for all 11 plants for each of the last four years or formal inspections when they were completed. In addition, TVA has a schedule to complete formal inspections at the remaining plants.

As part of its remediation plan, TVA also developed an improvement plan to address gaps in training, communications, quality assurance/quality control program, and other management tools. TVA developed 20 CCP Initiatives in response to findings from the 2008-2009 AECOM, McKenna Long & Aldridge LLP, and OIG audits.⁴ The 20 CCP Initiatives addresses areas of (1) standard policies, procedures, and processes; (2) organization, roles, and responsibilities; (3) budgeting and planning; (4) training; (5) management reporting and communications; (6) measures and metrics; and (7) best practices and industry leadership. Each initiative has an objective, expected benefit, owner(s), and related audit finding(s). Additionally TVA tracks progress made/milestones achieved and recommended ongoing improvement efforts on each initiative.

TVA is Taking Steps to Become an Industry Leader in CCP Management

We found TVA is taking steps to become an industry leader in CCP management. In a congressional testimony on December 9, 2009, Tom Kilgore, former TVA CEO, made a commitment that TVA would become an industry leader in CCP management. To address this commitment, TVA is in the process of completing a \$1.5 billion to \$2 billion capital program to improve ash handling. Additionally, TVA is taking steps through its 20 CCP Initiatives to engage in industry benchmarking and further industry involvement.

We found TVA is in process of completing a \$1.5 billion to \$2 billion capital program to improve ash handling. The capital program will fund, among other things, the conversion of several wet fly ash and gypsum facilities to dry storage collection facilities. We found TVA developed master strategies that outlined planned dates of conversion and closure for each facility.

Originally, TVA planned to convert 6 coal-burning plants using wet ash systems to dry fly ash systems and to convert all 11 fossil plants to dry bottom ash systems. However, this plan was impacted by Board decisions to shut down some plants. According to TVA, conversion will continue as planned at Kingston, Bull Run, Gallatin, Cumberland and Paradise Unit 3. However, Colbert, Widows Creek, John Sevier, Johnsonville, Allen, and Paradise Units 1 and 2 will shut down and the impoundments closed by 2022, and they will not be converted. According to TVA, Shawnee is still being studied, and decisions

⁴ Prior to, and as a result of, the Kingston ash spill, independent assessments of TVA CCP facilities were conducted by the TVA OIG, McKenna Long & Aldridge LLP, and AECOM.

must still be made, which is a risk for the planned completion date of 2022. According to TVA, approximately \$600 million has been spent as of August 2014 on the capital program.

The capital program includes closing 18 existing ash and gypsum ponds and stabilization of CCP facilities. Work covered in the program includes (1) dry storage landfill construction and dry ash stack expansion; (2) closure of CCP facilities including ash ponds, chemical ponds, and dredge cell closures; (3) wet-to-dry CCP process conversion including dewatering facilities and dry fly ash conversion; and (4) CCP facility stabilization/remediation including buttressing, slope modifications, and seepage, spillway, and drainage repairs. As mentioned above, TVA completed work to improve stability of all CCP facilities to a minimum factor of safety rating of 1.5 and eliminated high-hazard impoundments in 2011.

The table below is a breakdown of the status of planned and completed CCP actions at each of TVA's fossil plant.

Table 1: Status of Planned and Completed CCP Actions at Each Fossil Plant

Plant	Action
Allen Fossil Plant	Closure of the active ash pond during FY2020. Board decision currently has the retirement of the Fossil Plant set for December 2018.
Bull Run Fossil Plant	Fly ash currently managed in a dry fly ash stack. Conversion of the remaining CCPs to dry management during FY2015.
Colbert Fossil Plant	Will be dry stacking until planned date of idling in FY2016. A study is planned in FY2015 to determine future plant state and transitional projects required to prepare the plant for retirement/deconstruction.
Cumberland Fossil Plant	Fly ash currently managed in a dry fly ash stack. Conversion of the remaining CCPs to dry management during FY2020.
Gallatin Fossil Plant	Conversion to dry fly ash & gypsum management during FY2015-2017. Conversion to dry bottom ash management during FY2018-2019.
Johnsonville Fossil Plant	The plant is forecasted to be idled by December 31, 2016, and then retired. Wet CCP management is forecasted through December 31, 2016.
John Sevier Fossil Plant	According to TVA, all four units have been formally retired. All power generation from coal fired boilers and CCP production at the plant have ceased. Demolition is scheduled in FY2016-2017. The Dry Fly Ash stack closure is underway, with completion in FY2015/2016. The Bottom Ash Pond will close in FY2017.

Plant	Action
Kingston Fossil	Dry fly ash conversion completed FY2011. Conversion to dry gypsum management complete. Conversion to dry bottom ash management during FY2016.
Paradise Fossil Plant (PAF)	First cell of new landfill will be available in FY2019. A study is planned in FY2015 to determine future plant state and transitional projects required to prepare Units 1 and 2 for retirement/deconstruction, which is scheduled for FY2017-2019. According to TVA, fly ash conversion, bottom ash dewatering, and gypsum dewatering is planned for completion for Unit 3 in FY2020.
Shawnee Fossil Plant	Planned for complete plant closure in FY2025 upon retirement of remaining active units. Shawnee's ash pond/dry stack complex will also be completed at this time. According to TVA, Shawnee is a risk to completing the \$1.5 to \$2 billion capital program in 2022.
Widows Creek Fossil Plant	Units 1-6 are idled and are scheduled to be retired by 2015. Unit 8 is scheduled for idling in September 2014 and Unit 7 in 2019. Plant demolition studies have commenced. Dredge cell closure is scheduled for 2017, ash pond dewatering in 2020, and ash pond closure in 2021.

TVA has engaged in benchmarking and tracking metrics. TVA engaged several third parties to compare data points with TVA's estimates and actual costs for landfill construction/expansion that (1) provided landfill design and cost information that will assist TVA in the conversion from wet CCP operations to dry operations and to address proposed regulations by the EPA governing the landfilling of CCP and (2) developed a report to serve as the basis for disposal site cost estimates for coal combustion residuals to be used by utilities as a guideline for preparing high-level evaluations of disposal costs, based on Subtitle D (nonhazardous waste) regulations as specified in the proposed U.S. EPA Disposal of Coal Combustion Residuals from electric utilities.

TVA has also benchmarked CCP marketing with other utilities that compares the amount of CCPs sold in tons versus the percentage sold of what was produced. TVA markets CCP by-products from 4 of its 11 coal-fired facilities that helps extend the life of existing landfills. Examples of the way these by-products are used include making abrasives, roofing products, wallboard, and cement. According to these benchmarks, TVA was a top ten utility for CCPs sold between 2008 and 2011. Additionally, TVA has begun tracking metrics on a CCP scorecard that include indicators in (1) General Management, (2) Facility Health, (3) Operations, and (4) Marketing/Utilization. According to TVA Management, the metrics have been in place 3 to 4 years. As of July of FY2014, CCP management (1) was approximately 9 percent (\$31.7 million) under its year-to-date budget of \$34.9 million; (2) had no Reportable Environmental Events, Environmental Notice of Violation, or Environmental Near Misses; and (3) produced a total of approximately 3.7 million tons of boiler slag, bottom ash, fly ash, and gypsum. TVA marketed approximately 1 million tons (27 percent) of these by-products for approximately \$3.3 million in revenue.

Robert M. Deacy, Sr.
Page 9
September 30, 2014

We also found TVA has presented at several CCP conferences, including the American Coal Ash Association (2014), the World Coal Ash Conference (2013), American Society of Civil Engineers (2013), Coal-Gen Conference (2014), and Tennessee Society of Professional Engineers (2013). Additionally, other utilities have reached out to TVA to discuss its CCP program and tour the Kingston plant.

This memorandum does not include any recommendations and is to be used for informational purposes only. Accordingly, no response is necessary.

- - - - -

Information in this memorandum may be subject to public disclosure. Please advise us of any sensitive information that you recommend be withheld. If you have any questions or wish to discuss our observations, please contact Kristin S. Leach, Senior Auditor, at (423) 785-4818 or Gregory R. Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the evaluation.



Robert E. Martin
Assistant Inspector General
(Audits and Evaluations)
ET 3C-K

KSL:FAJ

cc: William D. Johnson, WT 7B-K
Dwain K. Lanier, MR 3K-C
Justin C. Maierhofer, WT 7B-K
Richard W. Moore, ET 4C-K
R. Windle Morgan, WT 4D-K
Charles G. Pardee, WT 7B-K
TVA Board of Directors
OIG File No. 2014-15217