Memorandum from the Office of the Inspector General

May 29, 2025

Kris G. Edmondson

REQUEST FOR FINAL ACTION – EVALUATION 2024-17503 – CONDITION OF FIRE PROTECTION AND AMMONIA SAFETY SYSTEMS AT COAL PLANTS

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 Samuel L. Ruble, Senior Auditor, at (865) 633 7384 or Lindsay J. Denny, Director, Evaluations Operations, at (865) 633-7349. We appreciate the courtesy and cooperation received from your staff during the evaluation.

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

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OIG File No. 2024-17503

Office of the Inspector General

Evaluation Report

To the Vice President,
Power Operations

CONDITION OF FIRE PROTECTION AND AMMONIA SAFETY SYSTEMS AT COAL PLANTS

Auditor
Samuel L. Ruble

Evaluation 2024-17503
May 29, 2025

ABBREVIATIONS

CUF	Cumberland Fossil Plant
KIF	Kingston Fossil Plant
GAF	Gallatin Fossil Plant
SHF	Shawnee Fossil Plant
FFPD	Fixed-Fire Protection and Detection
NOx	Nitrogen Oxide
PO	Power Operations
SPP	Standard Programs and Processes
TVA	Tennessee Valley Authority
WO	Work Order

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APPENDIX

Evaluation 2024-17503 – Condition of Fire Protection and Ammonia Safety Systems at Coal Plants

EXECUTIVE SUMMARY

Why the OIG Did This Evaluation

The Tennessee Valley Authority (TVA) has four active coal plants that produce nearly 7,000 megawatts–enough to power more than 4 million homes. These plants contain hazards such as ammonia, large quantities of fuel, combustible/flammable liquids, electrical hazards, and combustible dust, all of which have the potential to cause a catastrophic event. TVA uses ammonia in selective catalytic reduction systems to aid in the removal of nitrogen oxide (NOx), a by-product of burning coal. Ammonia is hazardous when inhaled, ingested, or when it comes in contact with the eyes, skin, or mucous membranes. Power Operations (PO) Standard Programs and Processes (SPP) 09.060, *Highly Hazardous Chemical – Ammonia Compliance Program*, provides standards and expectations for assuring PO compliance with the Occupational Safety and Health Administration ammonia-related requirements.

In addition, fire has the potential to injure employees, cause severe property damage, and result in business interruption at coal plants. PO-SPP-18.121, *Fixed Fire Protection and Detection Subsystems - Inspection, Testing, Maintenance*, establishes the minimum requirements for inspection, testing, and maintenance of fixed-fire protection and detection subsystems to ensure the preservation of assets, generation, and personnel safety at PO facilities. TVA's SPPs for fire-protection equipment and fire brigades are based on industry codes and standards.

Due to the potential risks to personnel and equipment, we performed an evaluation of fire-protection and ammonia safety systems at TVA coal plants. The objective of our evaluation was to determine if safety systems were being properly maintained[i] and identified issues were being addressed.

What the OIG Found

We determined ammonia systems were being properly maintained and identified issues were being addressed. However, we determined fire-protection systems were not always properly maintained and issues were not always being addressed timely. Specifically, (1) some inspections and testing of fire-protection systems were not performed as

[i] We evaluated if fire-protection and ammonia safety systems were properly maintained based on compliance with inspection, testing and maintenance requirements.

required, (2) some fire-protection system issues were not resolved timely, and (3) one fire-protection subsystem was missing safety locks at one plant, which was subsequently addressed. In addition, we identified concerns with documentation, including incomplete fire-protection impairment documentation and discrepancies in the required frequency of inspections between the fire-protection SPP and site-specific job plans, which provides details of each plant's fire-protection subsystems.

What the OIG Recommends

We made recommendations to the Vice President, PO, to address (1) inspections and testing not performed as required, (2) timeliness of issue resolution, (3) incomplete documentation, and (4) alignment of the fire-protection SPP with site-specific job plans.

TVA Management Comments

In response to our report, TVA management agreed with our recommendations and provided planned actions to address the recommendations. See the Appendix for TVA management's complete response.

Auditor's Response

We concur with TVA management's planned actions to address the recommendations.

BACKGROUND

The Tennessee Valley Authority (TVA) has four active coal plants that produce nearly 7,000 megawatts–enough to power more than 4 million homes. These plants contain hazards such as ammonia, large quantities of fuel, combustible/flammable liquids, electrical hazards, and combustible dust, all of which have the potential to cause a catastrophic event. TVA uses ammonia in selective catalytic-reduction systems to aid in the removal of nitrogen oxide (NOx), a by-product of burning coal. Ammonia is hazardous when inhaled, ingested, or when it comes in contact with the eyes, skin, or mucous membranes.

Occupational Safety and Health Standards 1910.119, *Process Safety Management of Highly Hazardous Chemicals*, (29 CFR § 1910.119) contains requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals, including ammonia. Power Operations (PO) Standard Programs and Processes (SPP) 09.060, *Highly Hazardous Chemical – Ammonia Compliance Program*, provides standards and expectations for assuring PO compliance with the Occupational Safety and Health Administration ammonia-related requirements. According to PO-SPP-09.060, ammonia program health is measured by self-assessments conducted by plant or corporate personnel responsible for the program and daily rounds that are executed by the ammonia system operator. Additionally, the senior program manager maintains an ammonia program health scorecard that measures program elements.

Fire hazards such as large quantities of fuel, combustible/flammable liquids, electrical hazards, combustible dust, and warehousing are common in coal plants. At TVA generating plants, fires have the potential to injure employees, cause severe property damage and result in business interruption.

PO-SPP-18.121, *Fixed Fire Protection and Detection Subsystems – Inspection, Testing, Maintenance*, establishes the minimum requirements for Inspection Testing and Maintenance of fixed-fire protection and detection (FFPD) subsystems to ensure the preservation of assets, generation, and personnel safety at PO facilities. Some examples of subsystems are the (1) Deluge Subsystem, which has open nozzles so water flows when the deluge valve is actuated, (2) Sprinkler Subsystem, which has closed nozzles and water flows only when activated by heat, and (3) Standpipe Subsystem, which has manual outlet valves to connect fire hoses for manual firefighting. TVA's SPPs for fire-protection equipment and fire brigades are based on fire-protection industry codes and standards.

The number of FFPD subsystems installed at each coal plant is listed in Table 1.

Site	Number of Subsystems
Cumberland Fossil Plant (CUF)	11
Gallatin Fossil Plant (GAF)	12
Kingston Fossil Plant (KIF)	13
Shawnee Fossil Plant (SHF)	14

Table 1

Additionally, TVA has created job plans[1] to enhance the FFPD inspection schedules where industry standards allow approved alternatives (or deviations) to the requirements in the codes.

According to TVA PO-SPP-18.119, *Fire Protection Impairments*, an impairment is defined as a condition where a fire-protection subsystem or portion thereof is out of service, and the condition can result in the fire-protection subsystem not functioning during a fire event. PO-SPP-18.119, *Fire Protection Impairments*, standardizes the requirements for managing impairments to fire-protection systems and provides guidance to restore those elements of the fire-protection systems to service on an assigned priority level[2] consistent with the level of risk to personnel and equipment. Due to potential risks to personnel and equipment, we performed an evaluation of fire-protection and ammonia safety systems at TVA coal plants.

OBJECTIVE, SCOPE, AND METHODOLOGY

The objective of our evaluation was to determine if safety systems were being properly maintained[3] and identified issues were being addressed. Our scope included fire-protection and ammonia safety data from June 2023 through May 2024 at TVA's four active coal plants. To achieve our objective, we:

- Reviewed the following to gain an understanding of the requirements for fire-protection and ammonia systems:
  - Occupational Safety and Health Administration Standards 1910.119, *Process Safety Management of Highly Hazardous Chemicals*
  - PO-SPP-09.060, *Highly Hazardous Chemical – Ammonia Compliance Program*
  - PO-SPP-18.119, *Fire Protection Impairments*
  - PO-SPP-18.121, *Fixed Fire Protection and Detection Subsystems – Inspection, Testing, and Maintenance*

[1] According to TVA, site-specific job plans document the details of each plant's fire-protection subsystems, including the required frequency for inspections.

[2] There are six priority levels but only Priority Levels 1 and 2 establish specific time frames for completing repairs.

[3] We evaluated if fire-protection and ammonia systems were properly maintained based on compliance with inspection, testing and maintenance requirements.

- Reviewed all 94 fire-protection impairments during our scope to determine if they had been resolved timely.
- Reviewed maintenance schedules and work orders (WO) for applicable fire-protection subsystems to determine if required inspections were completed.
- Reviewed the Ammonia Compliance Monthly Program Health Scorecards to identify any issues.
- Reviewed the most recent Ammonia Compliance Program Annual Self-Assessment Checklist and Process Safety Management/Risk Management Plan Assessment to determine if identified issues were being resolved.[4]
- Reviewed ammonia daily rounds monitoring to ensure they were completed and identified concerns were resolved.
- Conducted walkdowns at all four TVA coal plants to observe fire-protection and ammonia safety systems.

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

FINDINGS

We determined ammonia systems were being properly maintained and identified issues were being addressed.[5] However, we determined fire-protection systems were not always being properly maintained and issues were not always being addressed timely. Specifically, (1) some inspections and testing of fire-protection systems were not completed as required, (2) some fire-protection system issues were not resolved timely, and (3) one fire-protection subsystem was missing safety locks at one plant, which was subsequently addressed. In addition, we identified concerns with documentation, including incomplete fire-protection impairment documentation and discrepancies in the required frequency of inspections between the fire-protection SPP and site-specific job plans, which provides details of each plant's fire-protection subsystems.

The following provides a detailed discussion of each of our findings regarding the fire-protection systems.

[4] Ammonia Compliance Program Annual Self-Assessment Checklists and Process Safety Management/Risk Management Plan Assessments are performed on a 5-year frequency. Three sites had assessments completed during our scope.

[5] Our site walkdowns and review of records identified some items that needed correction; however, in each instance the issue had previously been identified and corrected or plans were in place to do so.

SOME FIRE PROTECTION, INSPECTIONS, AND TESTING WERE NOT COMPLETED AS REQUIRED

According to PO-SPP-18.121, fire-protection and detection subsystems shall be inspected, tested, and maintained[6] in accordance with industry standards, which include inspections on varying frequencies (monthly, quarterly, etc.). Our testing of the subsystems at TVA's four coal plants determined (1) some inspections were not performed, and (2) some inspections were not performed timely.

Our review of inspections performed from June 2023 through May 2024 found that GAF and KIF had completed all required inspections. However, CUF and SHF did not complete all required inspections, as noted in Table 2.

Fire-Protection Subsystems Inspections, Testing and Maintenance Completed[7]				
	Monthly	**Quarterly**	**Semiannual**	**Annual**
CUF	93 of 108	20 of 24	7 of 8	11 of 11
SHF	142 of 144	24 of 24	10 of 10	12 of 13

Table 2

We also found some inspections were not conducted timely. According to PO-SPP-18.121 and TVA, grace periods allow for inspections to be performed up to 25 percent before and after the time frame when an inspection is due. However, we found 11 subsystems had inspections outside the grace periods of more than 25 percent before or after their required frequency. For example, at one site, monthly inspections required for June, July, August, September, October, and November 2023 were all signed off as completed on December 18, 2023. All six would be considered late because they were beyond the grace period.

Inspections, testing, and maintenance are how most problems are identified. If they are not performed, or not performed timely, there are increased risks that problems could go unidentified.

SOME FIRE-PROTECTION SYSTEM ISSUES WERE NOT RESOLVED TIMELY

According to TVA PO-SPP-18.119, *Fire Protection Impairments*, an impairment is defined as a condition where a fire-protection subsystem or portion thereof is out of service, and the condition can result in the fire-protection subsystem not functioning during a fire event. Each impairment shall be prioritized based on the

[6] Maintenance occurs on an as-needed basis resulting from inspections and testing.

[7] To determine the number of inspections required, we multiplied the number of subsystems with inspection requirements at each site (see Table 1).

level of risk to personnel and equipment. PO-SPP-18.119 also states, for equipment failures that result in a fire impairment, a repair WO should be initiated to restore the affected fire-protection subsystem or component and establishes specific time frames for repairs to be completed for impairments with Priority Levels 1 and 2. Priority Level 1 repairs are to be worked 24/7 until finished or downgraded to a lower priority, and Priority Level 2 repairs are to be started within 24 hours and targeted for completion within 14 days.

TVA documented 94 impairments active between June 2023 and May 2024. Of the 94 total impairments, 1 was a Priority Level 1 and 19[8] were Priority Level 2. We reviewed the impairments and found:

- The Priority Level 1 impairment did not have an assigned WO, so there was no documentation the impairment had been addressed, or if it was addressed timely.
- One Priority Level 2 impairment was 26 days late.
- Five impairments did not have a priority level so we could not determine if they were addressed timely.

In addition, we identified findings from an inspection that were not addressed at the time of our evaluation. The annual CUF Emergency Communication Subsystem inspection performed in May 2024 identified issues with emergency notification devices and some batteries. TVA informed us actions had not been taken to correct these findings and subsequently initiated a WO to resolve the issues.

ONE FIRE-PROTECTION SUBSYSTEM WAS MISSING SAFETY LOCKS

During our walkdown at KIF, we observed locks were missing on the transformer deluge valves. The deluge subsystem is to have open valves so water will flow when the system is actuated. Locking the valves open prevents inadvertent valve closure and ensures proper system operation. A closed valve at the time of a fire increases the risk to employees and the facility. The site was made aware of the missing locks and has corrected the deficiency.

[8] If a priority level was missing in the Fire Impairment Database, or conflicted with the WO priority level, we relied on the priority level assigned to the WO.

DOCUMENTATION FOR THE FIRE-PROTECTION IMPAIRMENT DATABASE WAS INCOMPLETE

The Fire Impairment Database is a tool used to monitor fire impairments in the fleet and identify trends or common issues. According to PO-SPP-18.119: "For equipment failures that result in a FP [fire-protection] impairment, ensure that a repair WO is initiated to restore the affected FP [fire-protection] subsystem or component." In addition, PO-SPP-18.119 states all Fire Protection Impairment Reports in the Fire Impairment Database are to be reviewed for accuracy and completeness. TVA provided data from the Fire Impairment Database documenting 94 identified impairments active between June 2023 and May 2024. However, the data provided by TVA contained WO information for only 29 of 94 impairments. Site personnel were able to find WOs for an additional 57 impairments that were not included in the Fire Impairment Database.

In addition, TVA informed us all 94 impairments during our scope were closed. However, we identified eight of the associated WOs were still open. Subsequently TVA closed six of the eight WOs. The remaining WOs are classified as Priority Level 3, which do not have a required time frame for completion.

Without accurate documentation to track and verify actions were taken to remedy impairments, there is a risk that impairments remain unresolved, increasing the risk of fire systems not being functional when needed.

THERE IS A DISCREPANCY BETWEEN THE FIRE-PROTECTION SPP AND SITE-SPECIFIC JOB PLANS

As mentioned previously, fire-protection and detection subsystems shall be inspected, tested, and maintained on varying frequencies (such as monthly, quarterly, etc.). PO-SPP-18.121 includes a table indicating the specific frequency for inspections for each fire-protection subsystem. TVA informed us their site-specific job plans also include frequencies for required inspections for each fire-protection subsystem. We compared the PO-SPP-18.121 table to the job plans and identified significant discrepancies in the frequency of required inspections. According to TVA, the job plans include allowable variances to the inspection schedules based on the design of each subsystem, which the SPP does not. Differences between the site-specific plans and the SPP increase the risk inspections could be missed.

RECOMMENDATIONS

We recommend the Vice President, PO, take steps to:

- Conduct all inspections and testing of fire-protection subsystems as required.

  TVA Management's Comments –TVA management stated the missing preventative maintenance at CUF was mostly tied to the loss of a team member who was devoted to fire protection during a portion of the time frame assessed. The site worked to replace this resource gap as quickly as possible but did miss preventative maintenance during the time of transition. TVA Management also stated they agree that when a critical fire protection resource is lost, a more proactive plan to replace the team member is implemented by the site. See the Appendix for TVA management's complete response.

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

- Resolve fire-protection system issues in a timely manner.

  TVA Management's Comments – TVA management agreed with this recommendation and stated use of the site fire impairment logs will be reinforced with each site fire protection coordinator and associated site management, including additional enhancements (to address priority levels and impairment information). See the Appendix for TVA management's complete response.

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

- Assign a priority level to each impairment as required by PO-SPP-18.119.

  TVA Management's Comments – TVA management agreed with this recommendation and stated the site impairment logs and PO-SPP-18.121 will be updated to require a preliminary priority level. The actual priority will be determined by the coal plant's Work Management process and recorded in Maximo[9] on the repair work order if and when a repair is required. See the Appendix for TVA management's complete response.

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

- Emphasize the importance of including all impairment information in the Fire Impairment Database.

  TVA Management's Comments – TVA management agreed with this recommendation and stated the work order section of the impairment logs will

[9] Maximo is TVA's asset management system.

be updated to read condition report or work order if repair is required and will become a required field, PO-SPP-18.119 will be revised accordingly. See the Appendix for TVA management's complete response.

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

- Review the differences between PO-SPP-18.121 and the site-specific job plans and make changes as necessary to clarify the requirements.

  TVA Management's Comments – TVA management agreed with this recommendation and stated PO-SPP-18.121 will be updated to clarify allowable variances to the inspection schedule based on the design of each subsystem. See the Appendix for TVA management's complete response.

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

May 22, 2025

David P. Wheeler

COAL OPERATIONS' RESPONSE TO 30-DAY REQUEST FOR COMMENTS – DRAFT EVALUATION 2024-17503 – CONDITION OF FIRE PROTECTION AND AMMONIA SAFETY SYSTEMS AT COAL PLANTS

Tennessee Valley Authority (TVA) Coal Operations would like to thank Sam Ruble, Senior Auditor, for evaluating the fire-protection and ammonia safety systems at TVA Coal plants. Maintaining reliable safety systems is a top priority to ensure compliance with applicable OSHA requirements and industry codes. We appreciate the TVA Office of the Inspector General (OIG) team's insights in their report as it provides us with an opportunity to further strengthen our safety processes and procedures.

As there were no findings from the ammonia system assessment, the follow up responses below are in response to the findings from the fire protection system assessment.

As requested in the OIG memorandum dated April 24, 2025, Coal Operations has reviewed your draft evaluation and provides the following response:

Recommendations

You recommended the Vice President, Power Operations (PO), Coal Operations, take steps to:

- Conduct all inspections and testing of fire protection subsystems as required.

Response
In 2021 Coal Operations implemented an improvement plan focused on improving the fire protection preventative maintenance - inspection program. To support all the work associated with the maintenance - inspection program, each site dedicated a resource(s) to ensure compliance. Performance of the new program requirements has been very strong. As noted, this OIG assessment did identify some missed PM's (preventative maintenance), most of which occurred at Cumberland Fossil Plant (CUF). Shawnee, Gallatin, and Kingston had strong results for completion at 98%, 100%, and 100%, respectively. The missing PM's at CUF were most all tied to the unfortunate loss of one of our team members devoted to fire protection during a portion of the time frame assessed. The site worked to replace this resource gap as quickly as possible but did miss PM's during that time of transition. Coal Operations agrees that when a critical fire protection resource is lost that a more proactive plan to replace the team member is implemented by the site.

- Resolve fire protection system issues in a timely manner.

Response
Coal Operations agrees with this recommendation. To address this recommendation, use of the site fire impairment logs will be reinforced with each site Fire Protection Coordinator and associated site management, including additional enhancements outlined in the next two responses. (Due date: 4/30/2026)

- Assign a priority level to each impairment as required by PO-SPP-18.119.

Response
Coal Operations agrees with this recommendation. To address this recommendation, the site impairment logs and PO-SPP-18.121 will be updated to require a preliminary priority level. The actual priority will be determined by the Coal plant's Work Management process and recorded in Maximo on the repair work order if and when a repair is required. (Due date: 4/30/2026)

- Emphasize the importance of including all impairment information in the Fire Impairment Database.

Response
Coal Operations agrees with this recommendation. To address this recommendation, the work order section of the impairment logs will be updated to read condition report (CR) or work order (WO) if repair is required and will become a required field, and PO-SPP-18.119 will be revised accordingly. (Due date: 4/30/2026)

- Review the differences between PO-SPP-18.121 and the site-specific job plans and make changes as necessary to clarify the requirements.

Response
Coal Operations agrees with this recommendation. To address this recommendation, PO-SPP-18.121 will be updated to clarify allowable variances to the inspection schedule based on the design of each subsystem. (Due date: 12/31/2025)

Thank you for allowing me the opportunity to provide this response. Please contact me with any questions.

Kris G. Edmondson
Vice President
Generation, Coal Operations

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