



Memorandum from the Office of the Inspector General

September 29, 2014

James R. Dalrymple, LP 3K-C

**REQUEST FOR FINAL ACTION – EVALUATION 2014-15216 – FOLLOW-UP REVIEW
OF TVA'S COAL PLANT FIRE PROTECTION SYSTEMS**

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.

Information contained in this report may be subject to public disclosure. Please advise us of any sensitive information in this report that you recommend be withheld.

If you have any questions or wish to discuss our findings, please contact Janell B. Cunio, Senior Auditor, at (423) 785-4811 or Gregory R. Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the review.

Robert E. Martin

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

JC:FAJ
Attachment
cc (Attachment):

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. 2014-15216



Office of the Inspector General

Evaluation Report

To the Senior Vice President,
Power Operations

FOLLOW-UP REVIEW OF TVA'S COAL PLANT FIRE PROTECTION SYSTEMS

Audit Team
Meghan H. Petty
Janell B. Cunio

Evaluation 2014-15216
September 29, 2014

ABBREVIATIONS

ERT	Emergency Response Training
FPG	Fossil Power Group
FPSA	Fire Protection Self-Assessment
FY	Fiscal Year
NFPA	National Fire Protection Association
OIC	Operations Information Center
OIG	Office of the Inspector General
O/E	Operating Experience
PER	Problem Evaluation Report
SPP	Standard Programs and Processes
TVA	Tennessee Valley Authority

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MEMORANDUM DATED SEPTEMBER 22, 2014, FROM JAMES R.
DALRYMPLE TO ROBERT E MARTIN



Evaluation 2014-15216 – Follow-Up Review of TVA’s Coal Plant Fire Protection Systems

EXECUTIVE SUMMARY

Why the OIG Did This Evaluation

This review was initiated as a follow-up to a previous inspectionⁱ completed about 3 years ago. Although fires are not a daily occurrence at the Tennessee Valley Authority (TVA), they could cause severe property damage and business interruption. To mitigate this risk, various fire protection systems are installed at TVA fossil plants (e.g., pumps, hoses, portable fire extinguishers). Fire protection systems are a combination of mechanical and electrical components and, like power generation equipment, need regular attention. If these systems are needed, they are counted on to perform reliably and protect vital plant equipment from fire. The objective of our review was to determine if the fire protection systems are adequately maintained and mitigating actions are taken to minimize the impacts of fires at TVA fossil plants.

What the OIG Found

We found TVA’s maintenance of fire protection systems is improving; however, there is heightened risk of damaging fires at TVA sites due to (1) restoration times for certain priority systems exceeding TVA targets; (2) delays in addressing fire protection work orders; (3) instances of noncompliance with TVA’s inspection, testing, and maintenance procedure; and (4) difficulties of maintaining aging equipment. We noted improvements have also been made to minimize the impacts of fire, such as equipping fire trucks for each plant, replacing the fire brigade room at Kingston, and updating a portion of personal protective equipment for brigade members. However, many issues noted in the original inspection remain. For example, fire brigade members continue to have concerns about fire response preparedness, and lessons learned are not shared consistently across the fleet. We also found Fire Protection Self-Assessments present the condition of TVA’s fire protection systems in a more positive manner than other sources might suggest is warranted.

What the OIG Recommends

We recommend the Senior Vice President, Power Operations:

- Take steps to restore impaired fire protection systems to service as appropriate and determine if additional personnel or resources are needed to expedite repairs of fire protection systems in the future.

ⁱ Inspection 2010-13530, Review of TVA’s Fossil Fire Protection Systems, September 30, 2011.



Evaluation 2014-15216 – Follow-Up Review of TVA’s Coal Plant Fire Protection Systems

EXECUTIVE SUMMARY

- Determine the equipment needs of fire brigade members and take steps to provide that equipment.
- Identify additional training needs for fire brigade members and take steps to provide that training.
- Determine whether increased staffing is warranted for fire brigades.
- Create and implement a formal process for capturing and sharing lessons learned from fire events across the fleet.
- Amend the Fire Protection Self-Assessments to include ratings of fire protection system equipment, provide a more objective means for determining whether preventive maintenance was performed, reflect prioritization of impairments and work orders outstanding, and provide a synopsis of additional drivers of fire risk at each site. In addition, methodology for assessing a site’s compliance rate should be shared with site and corporate managers to allow accurate interpretation of reports.

TVA Management’s Comments

TVA management agreed with the findings and recommendations and provided clarifying comments, which we evaluated and incorporated into the final report as appropriate. See Appendix B for TVA’s complete response.

Auditor’s Response

The Office of the Inspector General concurs with TVA management’s response and planned actions.

BACKGROUND

Fire hazards such as large quantities of fuel, combustible/flammable liquids, electrical hazards, combustible dusts, and warehousing are common in electric generating plants. Although fires are not a daily occurrence at the Tennessee Valley Authority (TVA), they could cause severe property damage and business interruption. To mitigate this risk, various fire protection systems are installed at TVA fossil plants (e.g., pumps, hoses, portable fire extinguishers).

Fire protection systems are a combination of mechanical and electrical components and, like power generation equipment, need regular attention. If these systems are needed, they are counted on to perform reliably and protect vital plant equipment from fire. However, every year fire protection systems throughout the industry fail to operate satisfactorily in fire situations. In about one-third of these cases, the cause is inadequate inspection, testing, and maintenance.

At TVA's coal-fired plants, a number of plant personnel participate as fire brigade members. These individuals take on the responsibilities of fire brigade members in addition to their normal job duties. Each fire brigade member is required to receive specialized training. According to TVA policy, fire brigade members are part of an organized group of TVA employees who are qualified, knowledgeable, trained in industrial firefighting, and skilled in at least basic structural firefighting operations, who perform advanced exterior and interior structural firefighting response duties, and who are trained in the use of protective clothing and breathing apparatuses.

Fire prevention and fire protection codes and standards are established by the National Fire Protection Association (NFPA).¹ NFPA codes provide recommendations, not requirements, for fire prevention and fire protection for electric generating plants. TVA's policies and standards for fire protection equipment and fire brigades are based on NFPA guidelines. Other fire protection codes and standards exist, but its contents are usually based on NFPA documents.

¹ NFPA is an international nonprofit organization whose mission is to reduce the burden of fire and other hazards on the worldwide quality of life. NFPA has designed 300 codes and standards to minimize the risk and effects of fire. NFPA also provides public safety education, advocacy campaigns, professional development training, a premier source for fire data research, and multiple publications on fire and fire safety.

OBJECTIVE, SCOPE, AND METHODOLOGY

This review was initiated as a follow-up to Inspection 2010-13530 – Review of TVA’s Fossil Fire Protection Systems issued September 30, 2011. The objective of our review was to determine if the fire protection systems are adequately maintained and mitigating actions are taken to minimize the impacts of fires at TVA fossil plants.

TVA will idle or retire 2,700 megawatts of older, less-economical coal-fired capacity by the end of 2017. To limit the impact of plants due for closure on our assessment, the scope of our review included coal plants that were planned to operate beyond 2017. As of February 2014, seven coal plants met this criterion: Allen, Bull Run, Cumberland, Gallatin, Kingston, Paradise, and Shawnee.²

To achieve our objective, we:

- Reviewed policies, procedures, and fire codes to identify changes since our original inspection.
- Reviewed insurance reports, Fire Protection Self-Assessments (FPSA), and Problem Evaluation Reports (PER) to identify reported issues with fire protection systems.
- Reviewed fire incidents for trends since our original inspection.
- Reviewed fire impairment reports for trends in number of impairments and length of time to restore out-of-service critical fire equipment since our original inspection.
- Interviewed key corporate and site personnel to identify information available to management for minimizing impacts of fires.

In addition, we reviewed fire protection systems at four of TVA's coal plants in detail, focusing on documentation from calendar years 2012 and 2013. The four plants we judgmentally selected were: (1) Bull Run, (2) Cumberland, (3) Gallatin, and (4) Kingston. At these four plants, we interviewed fire protection coordinators and system engineers assigned to fire protection as well as performed walkdowns to identify outstanding issues with fire protection systems. We also interviewed fire brigade members to determine whether they felt adequately prepared to respond to fires.

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

² We excluded Widows Creek Unit 7 as it is anticipated to idle shortly after fiscal year (FY) 2017, in FY2019. We included Paradise Unit 3 as it is anticipated to continue to operate.

FINDINGS

During our review, we found TVA's maintenance of fire protection systems is improving, however, there is heightened risk of damaging fires at TVA sites due to (1) restoration times for certain priority systems exceeding TVA targets; (2) delays in addressing fire protection work orders; (3) instances of noncompliance with TVA's inspection, testing, and maintenance procedure; and (4) difficulties of maintaining aging equipment. We noted improvements have also been made to minimize the impacts of fire, such as equipping fire trucks for each plant, replacing the fire brigade room at Kingston, and updating a portion of personal protective equipment for brigade members. However, many issues noted in the original inspection remain. Fire brigade members continue to have concerns about fire response preparedness and lessons learned are not shared consistently across the fleet. We also found FPSAs present the condition of TVA's fire protection systems in a more positive manner than other sources might suggest is warranted.

TVA'S MAINTENANCE OF FIRE PROTECTION SYSTEM IS IMPROVING; CAPITAL IMPROVEMENTS AND PRIORITIZING RESTORATION OF EQUIPMENT STILL NEEDED

We found TVA's maintenance of fire protection systems is improving. System impairments are reported more frequently and are impaired for fewer days than in 2010. In addition, TVA is taking actions recommended by its insurer to reduce risk. However, there is heightened risk of damaging fires at TVA sites due to (1) restoration times exceeding TVA thresholds; (2) delays in addressing fire protection work orders; (3) instances of noncompliance with TVA's inspection, testing, and maintenance procedure; and (4) difficulties of maintaining aging equipment.

Fire Impairment Restoration Times Continue to Exceed TVA Targets for Certain Priority Systems

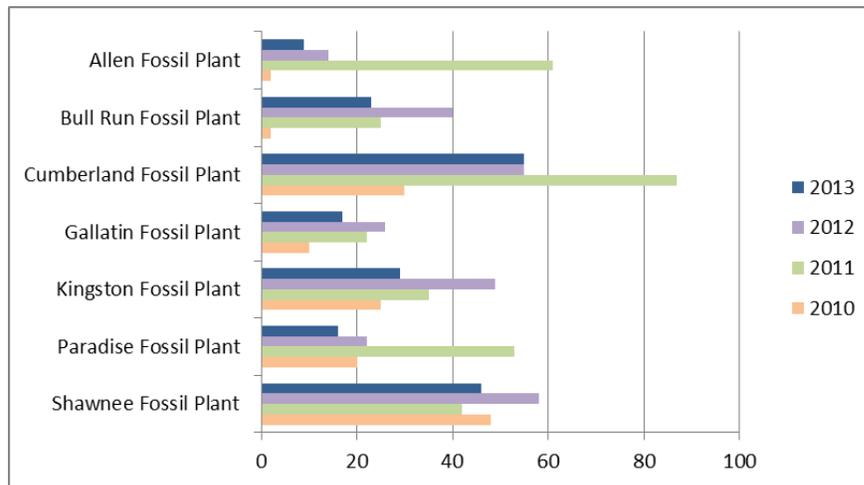
We observed while TVA is reporting fire impairments more frequently and taking actions to restore fire impairments³ more quickly, numerous impaired fire protection systems exist at coal plants and certain priority impairments were not returned to service in a timely manner. Impaired fire protection systems place plant personnel and plant assets at a greater risk from fire.

Overall, fire impairments increased 42 percent from 2010 to 2013. According to fire protection coordinators and engineers at the sites we visited, impairments are being reported more frequently. Management began emphasizing the need for better reporting during 2011, and the highest number of impairments were recorded that year (325)—representing a 137 percent increase from 2010 levels. In the years following 2011, TVA sites have decreased the total number of impairments each year—264 reported in 2012 and 195 reported in 2013.

³ A fire impairment is a term used for a fire protection system that is out of service.

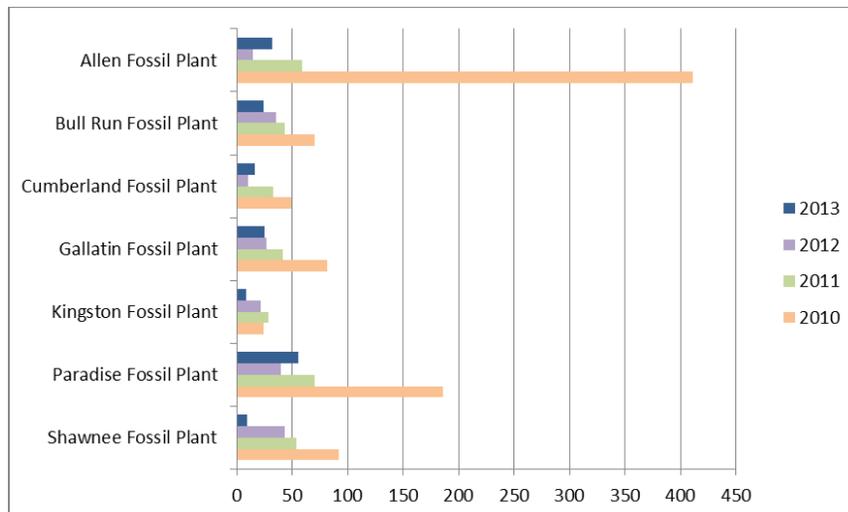
The number of fire impairments in calendar years 2010-2013 at the plants we reviewed can be seen in Figure 1 below.

Figure 1: Fire Impairments, 2010 - 2013



As shown in Figure 2, TVA coal plants have also greatly improved the timeliness of response to impairments. The average number of days fire protection systems remained impaired decreased by 78 percent since 2010, reflecting greater emphasis placed on correcting impairments in a timely manner.

Figure 2: Average Days Impaired, 2010 - 2013



In response to our initial inspection, TVA management revised Fossil Power Group (FPG), Standard Programs and Processes (SPP) 18.119, Fire Protection System Impairments, to correspond with levels of priority defined in FPG-SPP-07.020, Work Prioritization and Approval. The change resulted in removal of targets for Priority I and III and significant extension of time allowed for restoring Priority II systems. According to the Work Prioritization and Approval process:

- Priority I impairments create an immediate hazard to employees and property or affect equipment critical to continued operations. Priority I impairments will be worked 24/7 until restored or the work order is downgraded to a lower priority. Previously, Priority I impairments were required to be restored to operation within 8 hours.
- Priority II impairments seriously jeopardize employee safety, environmental safety, or plant availability. For Priority II impairments, work is started within 24 hours. Work is targeted to complete within 14 days. Previously, Priority II impairments were required to be restored to operation within 24 hours.
- Priority III impairments must be corrected to restore degraded components or programs that reduce safety or cause a risk to generation. Maintenance to restore Priority III impairments is scheduled as resources allow. Previously, Priority III impairments were required to be restored to operation within 48 hours.

While restoration times have improved across the seven sites we reviewed, timeliness of response to impairments at three sites continues to not meet targets established in FPG-SPP-18.119, Fire Protection System Impairments, for Priority II systems. As shown in the Appendix, closed impairments were impaired for an average length ranging between 9 and 56 days. Priority I impairments were generally closed within a 24-hour time frame. Priority II impairments were not on average closed within the 14-day time frame at three of the seven sites we reviewed. Priority III impairment restoration varied greatly by site, from an average of 9 to 76 days.

Unacceptable Number of Work Orders Outstanding for 30 or More Days

According to the FPSAs,⁴ TVA aims to have no work orders outstanding for more than 30 days for fire protection systems. Having greater than 10 outstanding work orders for fire protection systems would receive a rating of unacceptable⁵ in the FPSA. In our original inspection, we noted there was an unacceptable number of work orders outstanding at the sites we reviewed—citing a high of more than 125 work orders outstanding at Paradise in 2010. Based on our review of 2012 and 2013 FPSAs, fewer work orders are reported to be outstanding than in 2010. However, Allen, Bull Run, Paradise, and Shawnee were consistently rated unacceptable for the entirety of 2012 and 2013. No site was consistently rated acceptable (zero work orders outstanding for 30 or more days). It should also be noted some sites did not consistently report the total number of outstanding work orders in its comments, adding difficulty in determining the severity of the backlog.

⁴ FPSAs are monthly self-assessments designed to reflect the overall status of fire protection readiness at the facility. FPSA questions are answered by Acceptable, Watch List, Marginal, Unacceptable, or Not Applicable. Results are automatically calculated as a percentage of compliance, with Percent of Activities Evaluated in Compliance this Assessment calculated.

⁵ Unacceptable is defined in the FPSAs as an item that does not comply with the requirements for fire preparedness, fire codes, and TVA requirements.

Instances of Noncompliance With Fire Protection System Inspection, Testing and Maintenance Policy

TVA policy FPG-SPP-18.121, Fire Protection System Inspection, Test, and Maintenance, specifies the weekly, monthly, quarterly, semiannual, and annual testing and maintenance of fire suppression systems, fire detection systems, and other related equipment. Our original inspection noted the policy was not complied with in some cases. Based on our review of insurance assessments and FPSAs, there continue to be instances of noncompliance. For example, Cumberland had not completed its annual fire pump performance testing at the time of the insurance review. The insurer also noted Kingston did not fully comply with FPG-SPP-18.121, Fire Protection System Inspection, Test, and Maintenance Policy. In 2013, other areas of noncompliance noted in the FPSAs included annual functional tests for special hazard fire protection systems, triennial hydrostatic testing of fire hoses, and monthly inspections and annual tests of emergency lighting systems.

Difficulty Maintaining Aging Equipment

TVA's insurer rates the overall condition of fire protection systems at the sites we visited as "fair". As shown in Figure 3 below, component systems were rated "good" to "fair" at the sites we visited. Risk reduction suggestions to improve ratings included:

- Installing smoke detection systems for certain areas of the plants.
- Installing automatic sprinkler systems for certain areas of the plants.
- Securing backup water supply at Kingston and Gallatin.
- Installing additional fire protection for major equipment.

Figure 3: Fire Protection System Condition Ratings, 2013

Component System	Bull Run	Cumberland	Gallatin	Kingston
Water Supply & Distribution System	G	G	F	F
Fire Protection Systems & Equipment	F	F	F	F
Fire Signaling System	G	G	G	G
Fire Detection Systems	F	F	F	F

	Excellent	The facility has taken measures according to industry standards and best practices. Loss potential is considered significantly reduced.
	Good	The facility has taken measures that are consistent with industry standards and best practices. Loss potential is considered to be average.
	Fair	The facility has taken some measures that approach industry standards and best practices; however, deficiencies exist. Loss potential is considered somewhat increased.
	Poor	The facility has major deficiencies and does not approach industry standards and best practices. Loss potential is considered to be significantly increased.

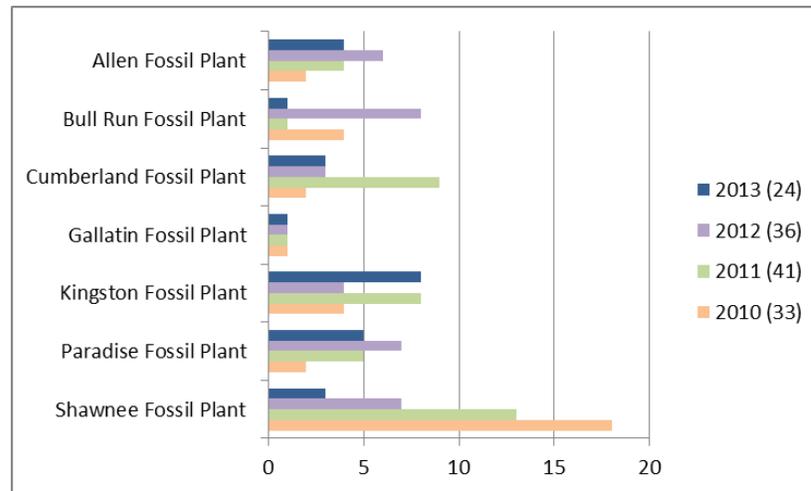
While TVA sites are taking actions to reduce risk as recommended by the insurers, the actions taken have typically involved dedicating operations and maintenance resources to address the risk. The vast majority of risk reduction strategies remaining are capital improvements to fire protection systems. During our site interviews, engineers assigned to fire protection named several components of the fire protection system that were aging or broken. In addition, one engineer indicated replacement parts were difficult to find. The Fossil Fire Protection Program Manager is currently working to obtain quotes for the recommended repairs and upgrades and to prioritize the projects based on risk.

WHILE TVA IS TAKING ACTIONS, MORE EMPHASIS ON PREVENTION AND PREPAREDNESS COULD REDUCE THE IMPACT OF FIRES

In our previous review, we identified opportunities to minimize impacts of fire, including: (1) adequately preparing the fire brigade to respond to fires, (2) reviewing the cause of past incidents at TVA for lessons learned, (3) improving fire prevention, and (4) ensuring all fire incidents are reported. While improvements have been made in these areas, many issues noted in the original inspection remain.

According to the TVA Corporate Fire Protection Policy,⁶ TVA operates under the principles that (1) all fire incidents are preventable, and (2) zero fire incidents is an achievable goal. In 2010, a common cause analysis was performed due to an adverse trend in fire incidents occurring at TVA coal plants. Since that time, fire incidents do not appear to be trending lower, despite improvements made. Figure 4 on the following page shows the fire events from the past 4 years at coal plants planned to operate past FY2017. In 2013, the fire events ranged from none at Gallatin to eight at Kingston. Given the number of fire incidents continuing at TVA coal plants, sustained effort at minimizing fire impacts is critical.

⁶ TVA-POL-18.7, TVA Corporate Fire Protection Policy was adopted April 1, 2013. According to Safety Support personnel, while the Corporate Fire Protection Program no longer exists, the policy is still being followed.

Figure 4: Fire Incidents, 2010 - 2013

Fire Brigade Members Continue to Have Concerns About Fire Response Preparedness

Since 2010, TVA has equipped fire trucks for each site, replaced the fire brigade room at Kingston, and updated a portion of personal protective equipment for brigade members. During our interviews with fire brigade members, several areas of concern in 2010 were repeated regarding the fire brigade's preparedness to respond in the event of a fire. These included personal protective equipment, equipment staging, training, and staffing. Proper training and equipment are imperative to fire brigade personnel being able to safely and effectively combat fires. As a result of the identified deficiencies, TVA's fire brigade may not be adequately prepared to fight fires and personnel safety, and plant assets may be at greater risk.

- Personal Protective Equipment* – Some fire brigade members were concerned personal protective equipment was aged and inappropriately sized for site staff. In response to our original inspection, the Emergency Response Training (ERT) staff was to inspect equipment rooms annually. While we were provided with current inspections for three of four sites,⁷ we noted ERT's inspections do not provide an inventory of aged or inappropriately sized equipment. According to the Senior Compliance Program Manager, coal plants have an average of 17 expired sets of equipment. In FY2014, \$150,000 was allotted for replacing expired equipment, of an estimated \$375,000 needed.
- Equipment Staging* – According to the Fire Brigade Organization policy, at the beginning of each shift, fire brigade members should assemble and stage their properly sized, full firefighting equipment in the fire equipment room or in a designated area. At the end of each shift, all equipment is returned to its

⁷ Kingston was not inspected due to inaccessibility of equipment during the transition to a new fire brigade room.

proper location. During our site visits, we observed this occurring at Kingston (see Figure 5 below) where a new fire brigade room was recently constructed.

Figure 5: Equipment Staging at Kingston



At the remaining three sites, it did not appear sufficient space was available for each fire brigade member to properly stage their personal protective equipment (see Figure 6 below). One fire brigade member believed it may not be a requirement to do so at his site.

Figure 6: Equipment Staging at Bull Run and Cumberland



According to Gallatin's Plant Manager, construction of a new, larger, fire brigade room is budgeted for the current FY.

- *Training* – As in our original review, brigade members we interviewed indicated training could be expanded, improved, and/or occur more frequently to better prepare them to respond in a fire event.
 - In response to our original inspection, ERT implemented an annual refresher course in 2012. In addition, fire brigade members participate in

an increased number of fire drills since our original review. While they previously participated once every 6 months, drills are currently conducted quarterly.

- Fire brigade members mentioned concern about off-site fire departments' familiarity of the site if they were called upon to assist in a fire incident. Off-site fire departments typically called in for mutual aid during fire events are offered an annual walkdown of the facility annually. Most fire brigade members felt periodic inclusion of off-site fire department personnel in drills could improve fire response for larger events. In addition, site security could also be considered for participation in drills.
- Fire brigade members at Gallatin expressed a desire to have confined space training as they are currently not trained in confined space rescue; maintenance personnel are trained instead. One fire brigade member indicated he was concerned that maintenance staff is not at the site 24/7 should the need arise for a confined space rescue.
- *Staffing* – In our original review, several fire brigade members told us they did not believe they have adequate staffing to fill fire brigade positions. TVA management indicated staffing comments were predominately related to John Sevier Fossil Plant, which was slated for retirement by the end of calendar year 2012. Since the original inspection, John Sevier Fossil Plant has closed, altering its fire brigade staffing plan.

FPG-SPP-10.013, Fire Brigade Organization, requires a minimum of one fire brigade leader and four fire brigade members working on each shift. When minimum eligible staffing is not met, a PER should be filed in the Corrective Action Program. We noted the following issues related to minimum staffing at sites we visited:

- Bull Run – In response to our original inspection, a gap analysis was conducted in 2012 for coal plant fire brigade staffing. At that time, Bull Run identified deficiencies in staffing and put an action plan in place to address the deficiency. During our review, we found staffing deficiencies persist at Bull Run. We reviewed PERs for 2013 and observed Bull Run had three PERs relating to insufficient fire brigade staffing. In two of these instances, additional fire brigade members were called in to satisfy the staffing requirement. According to the Operations Manager, overtime is typically paid for individuals who are called in to staff the brigade. We were told there were more instances where staffing levels did not meet fire brigade requirements but were not documented in PERs.
- Gallatin – While we were told minimum staffing levels were scheduled at Gallatin, fire brigade members indicated the fire brigade was not always fully staffed. However, we did not see evidence of the issue documented in PERs.
- Cumberland – A fire brigade member expressed concern while minimum staffing levels in the policy were adequate for sites with fewer units and

- were routinely met at their site, Cumberland's nine coal units should warrant a higher brigade staffing minimum.
- In addition, some fire brigade members mentioned Unit Operators are typically included in the fire brigade staffing, but due to the nature of their primary duty, they would not be available to respond to fire. Concern was raised that by including the Unit Operators in minimum staffing, fire response was reduced in some instances by half, such that sites would have two available responders for any incidents that may arise.
 - *Pre-Fire Plans* - Pre-fire plans identify the important hazards and safety equipment in each area of the plant, along with cautions and procedures for certain firefighting functions. The pre-fire plans are used as reference documents for emergency responders during a fire scenario and as training documents to familiarize all personnel with plant configuration and hazards. According to its 2013 insurance report, Gallatin pre-fire plans did not include the coal handling yard. Site personnel indicated large construction areas such as the scrubbers should also be reflected in the pre-fire plans.

Lessons Learned From Fire Events Are Not Being Consistently Communicated Across the Fleet

In our previous review, we found lessons learned from fire events were not being communicated on a consistent basis. Communicating consistently across the fleet may help to prevent the recurrence of similar events at the various sites. If information is not communicated, prevention opportunities are missed, and the risk to plant personnel and assets may be greater.

In response to our original inspection, TVA management agreed to include the Operations peer team and the Operations Experience Manager⁸ on automatic notifications when fire incidents are recorded in the Operators Information Center (OIC) database. According to the Operations Experience Manager, he is responsible for sharing Operating Experiences (O/E) across TVA organizations and sites. Once notified of an event, he decides on whether the event is worthy of sharing as an O/E and who should see the information.

However, the Operations Experience Manager is not currently receiving notifications from the OIC related to fire incidents. Individuals included on the notification list are hardcoded into the OIC program; when a new person takes on the responsibility, the program would need to be updated to include the individual. It appears this was not performed in this case. The O/E Manager was unaware of the OIC system. He recalled a single fire protection related O/E in 2013. A crusher building fire at Gallatin was shared and other coal plants initiated PERs to demonstrate how the fire would be handled at their site.

⁸ The Operations Experience Manager is one responsibility of a specialist in the Enterprise and Business Applications Management group.

During our interviews, plant personnel indicated lessons learned were shared in different ways across the plants and are not always shared with fire brigade members. While a couple of fire brigade members indicated they did not directly receive written lessons learned, many members indicated they have seen fire incident reports from other sites. Fire incident reports provide a description of the incident, but do not typically identify lessons learned. Other fire brigade members stated information on lessons learned is passed down from the Shift Operations Supervisor during pre-shift meetings. One individual who led a response to a serious fire event said he was never interviewed about the response.

Fire Incident Reporting

FPG -SPP-18.120, Fire Incident Reporting, states all fire-related incidents shall be reported using the electronic fire incident report form within 8 hours of the occurrence. Based on our review of PERs, we found fire incidents were reported in the OIC.

Fire Prevention

In response to our original inspection, TVA management reinforced the nonsmoking policy. During our walkdowns, we did not detect violations of this policy. We did not review coal dust accumulation as a part of this evaluation due to its coverage in a recently released audit.⁹

TVA'S FPSA DOES NOT ADEQUATELY REFLECT FIRE RISK

We found FPSAs to present the condition of TVA's fire protection systems in a more positive manner than other sources might suggest is warranted. While the purpose of the tool includes directing management attention to the status of the fire protection program, individuals responsible for filling out the report do not believe it to be an accurate summary of fire risk. In addition, a senior manager raised concerns about the accuracy of the report. However, plant managers we interviewed indicated they had all the information they needed to assess fire risks at their sites.

TVA's FPSAs "evaluate FPG Facility Fire Protection Program, procedures and requirements to provide employees with a safe working environment, reduce and control fires or explosions, and to reduce the possibility of a fire event and to mitigate the impact of a fire." The assessments are to be performed at all FPG plants and facilities "to direct management's attention to the status of their Fire Protection Program, focus on key program requirements, provide a comparison with other facilities, provide periodic progress tracking, and provide the ability to assign and track specific activities." The assessments are shared with

⁹ Audit 2012-14631 – Review of TVA's Management of Combustible Coal Dust, November 2013, found that despite some improvements in combustible dust management, actions have been inadequate to improve deteriorating equipment conditions, address housekeeping challenges, and provide appropriate combustible dust conditions at TVA's coal plants.

operations managers, plant managers, regional Coal and Gas vice presidents, and the Senior Vice President of Power Operations, among others.

Individuals responsible for filling out the report do not believe it to be an accurate summary of fire risk at their facilities. One individual observed that within the last 7 years, the site's assessments did not vary more than 4 percentage points, although their actual fire protection has varied wildly during that span of time. Another individual stated it is easy to overlook things to make your score go up, and the self-assessment is more a reflection of how the individual feels about the fire protection system that month. In addition, when asked how the site uses the information, one individual stated the site does not use it and it does not add value for them. However, several cited its value as an advocacy tool to garner resources for areas needing improvement.

In addition, a senior manager expressed concern the reports do not reflect fire risks or present the state of the fire protection program at sites accurately. The manager cited an example of Colbert Fossil Plant where funds were recently released to a contractor to catch up on inspections, testing, and maintenance. While the manager indicated the site was behind on testing for some time prior to December 2013, as of December 2013, the site showed 91 percent compliance on the FPSA.

However, plant managers indicated they had all the information they needed to assess fire risks at their sites. In addition to FPSAs, plant managers receive monthly combustible dust reports and daily reports showing current fire impairments. When asked what the FPSA report indicates, one plant manager explained it is a relative measure of risk with respect to being able to respond to fires that indicates how systems are performing and whether preventive maintenance is being performed.

Our review of FPSAs indicated they reflect a more positive view of fire protection systems than insurance reports appeared to warrant. Insurance reports evaluate overall conditions of fire protection systems, which is noted below as a lacking element in the FPSA reports. While insurers rated the fire protection systems at our sites as fair, self-assessments graded our sites worst at 78 percent in compliance and best at 93 percent. These reports are not directly comparable as currently designed. However, it is important to note the difference that can result when the overall condition of fire protection systems are considered in the assessment tool.

We identified the following limitations of the FPSA tool to assess fire risks as it is currently designed:

- Overall condition of fire protection systems not considered.
- Use of subjective self-reporting on testing, inspection, and maintenance activities.

- Impairments outstanding are reported in aggregate rather than by priority.
- Work orders outstanding are reported in aggregate rather than by priority.
- Tool uses an unclear methodology for weighting compliance rates.
- Tool excludes other relevant drivers of risk (e.g., housekeeping of combustible dust).

RECOMMENDATIONS

We recommend the Senior Vice President, Power Operations:

- Take steps to restore impaired fire protection systems to service as appropriate and determine if additional personnel or resources are needed to expedite repairs of fire protection systems in the future.
- Determine equipment needs of fire brigade members and take steps to provide that equipment.
- Identify additional training needs for fire brigade members and take steps to provide that training.
- Determine whether increased staffing is warranted for fire brigades.
- Create and implement a formal process for capturing and sharing lessons learned from fire events across the fleet.
- Amend the FPSAs to include ratings of fire protection system equipment, provide a more objective means for determining whether preventive maintenance was performed, reflect prioritization of impairments and work orders outstanding, and provide a synopsis of additional drivers of fire risk at each site. In addition, methodology for assessing a site's compliance rate should be shared with site and corporate managers to allow accurate interpretation of reports.

TVA Management's Comments – TVA management agreed with the findings and recommendations and provided clarifying comments, which we evaluated and incorporated into the final report as appropriate.

In response to our recommendations, management plans to complete the following actions:

- Prioritize current impairments and establish a due date for all long-term fire impairments or make a formal decision to not pursue repair.
- Train sites on the proper use of work management priorities for fire impairments.
- Track high priority fire impairments to completion using a monthly scorecard.

- Revise FPG-SPP-18.119, Fire Protection System Impairments, to allow for a formal nonconformance process.
- Inventory fire brigade equipment at all coal plants to determine baseline equipment status.
- Revise FPG-SPP-10-013, Fire Brigade Organization, to (1) include standard equipment list and develop an action plan with dates to replace or purchase needed equipment to fill those gaps and (2) require when minimum staffing is not met that a PER will be generated and reviewed by site management to identify corrective actions.
- Institute new training requirements based on participant feedback.
- Revise Attachment 1 to FPG-SPP-18.120, Fire Incident Reporting, to include requirement to write a lessons learned for all fires.
- Revise OIC for fire incidents to make lessons learned check box a mandatory field before the incident can be archived.
- Utilize the Enterprise Lessons Learned Information System to enter lessons learned and operating experiences which will allow for automatic communications to those who need it.
- Generation Engineering will revise FPG-SPP-18.123, Fire Protection Assessment, to include a new rating calculation and process for sharing assessment data.

See Appendix B for TVA's complete response.

Auditor's Response – The Office of the Inspector General concurs with TVA management's response and planned actions.

Priority Level of Impairments, 2013^{*,+}

Coal Plant	Allen	Bull Run	Cumberland	Gallatin	Kingston	Paradise	Shawnee
Number of Impairments	9	23	55	17	29	16	46
Average Number of Days Impaired	32	24	16	25	9	56	9
Priority I: Emergency Conditions							
Number of Impairments	2	0	1	0	1	0	0
Average Days Impaired	2	--	1	--	0	--	--
Range	1 - 2	--	--	--	--	--	--
Priority II: Urgent Conditions							
Number of Impairments	2	1	10	4	0	6	9
Average Days Impaired	12	0	22	35	--	82	3
Range	1 - 22	--	0 - 150	11 - 52	--	21 - 216	0 - 7
Priority III: Operational Conditions							
Number of Impairments	3	13	36	11	7	8	21
Average Days Impaired	76	9	16	24	13	47	10
Range	24 - 143	0 - 44	0 - 367	1 - 90	1 - 47	0 - 97	0 - 42
<u>Not Categorized</u>	0	0	1	0	3	0	0

* The average days and day range were calculated only for closed impairments.

+ Number of impairments in each priority level do not sum to the total number of impairments because we did not report on all priority levels. In addition, of the 195 total impairments in 2013, 4 were not given a prioritization level as required by FPG-SPP-18.119, Fire Protection System Impairments.

September 22, 2014

Robert E. Martin, ET 3C-K

REQUEST FOR COMMENTS – DRAFT EVALUATION 2014-15216 – FOLLOW-UP REVIEW
OF TVA'S COAL FIRE PROTECTION SYSTEMS

We appreciate the opportunity to provide further comments and details on the OIG's evaluation report of TVA's coal fire protection systems dated August 29, 2014.

What the OIG Recommends

We recommend the Senior Vice President, Power Operations:

- *Take immediate steps to restore all impaired fire protection systems to service and determine if additional personnel or resources are needed to expedite repairs of fire protection systems in the future.*
- *Determine the equipment needs of fire brigade members and take steps to provide that equipment.*
- *Identify additional training needs for fire brigade members and take steps to provide that training.*
- *Determine whether increased staffing is warranted for fire brigades.*
- *Create and implement a formal process for capturing and sharing lessons learned from fire events across the fleet.*
- *Amend the Fire Protection Self-Assessments to include ratings of fire protection system equipment, provide a more objective means for determining whether preventive maintenance was performed, reflect prioritization of impairments and work orders outstanding, and provide a synopsis of additional drivers of fire risk at each site. In addition, methodology for assessing a site's compliance rate should be shared with site and corporate managers to allow accurate interpretation of reports.*

Recommendation

- Take immediate steps to restore all impaired fire protection systems to service and determine if additional personnel or resources are needed to expedite repairs of fire protection systems in the future.

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Response

- Since the last OIG audit of fire protection in 2011, the average age of fire impairments has been cut in half across the coal and gas fleets. Some planned fire impairments will always be necessary (due to maintenance outages) and these can extend for months – these are not the problem. The real problem is: 1) impairments that are categorized as high priority are not resolved in a timely manner, consistent with TVA's work management procedures; 2) long-term impairments continue at several sites (such as Allen Fossil Plant, Johnsonville Combustion Turbine, and Paradise Fossil Plant) with no apparent plan to resolve.
- Site management and the corporate fire protection engineer will prioritize current impairments and Power Operations Programs and Performance will then work with each site to either establish a due date for all long-term fire impairments or make a formal decision to not pursue repair.
- Each site will be trained on the proper use of work management priorities for fire impairments.
- Power Operations will track high priority (1 and 2) fire impairments to completion using a monthly scorecard that gets reviewed by Power Operations executive management in monthly performance review meetings.
- By March 30, 2015 the Fire Protection System Impairments procedure (FPG-SPP-18.119) will be revised to allow for a formal non-conformance process. A process will be created to use when requesting a fire impairment not be restored, due to impending plant retirement for example. The site will submit and seek concurrence for a non-conformance report to the vice president responsible for that site.

Recommendation

- Determine the equipment needs of fire brigade members and take steps to provide that equipment.

Response

- By December 5, 2014 Power Operations Programs and Performance will take an inventory at all coal plants to determine baseline equipment status.
- By March 30, 2015 Power Operations Programs and Performance will revise the Fire Brigade Organization procedure (FPG-SPP-10-013) to include standard equipment list and develop an action plan with dates to replace or purchase needed equipment to fill those gaps.

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Recommendation

- Identify additional training needs for fire brigade members and take steps to provide that training.

Response

- Beginning September 29, 2014 new training requirements will be instituted based on participant feedback. The changes reflect an increase from 24 hours of refresher training to 32 hours of refresher training. Refresher training is conducted on a four-year cycle. This increase coupled with the existing quarterly fire brigade drill schedule will provide additional training to fire brigade members.

Recommendation

- Determine whether increased staffing is warranted for fire brigades.

Response

- Staffing is based on the minimum requirements in 29 CFR 1910.156, 1910.134 and NFPA 600. As a minimum we are required to have a fire brigade leader and four (4) members (this meets the requirement in 1910.134.g for "two in and two out" for structural fire fighting). Site or corporate management can add personnel due to plant conditions or hazards as needed.
- The revision to the Fire Brigade procedure (FPG-SPP-10.013) will require when minimum staffing is not met that a PER will be generated and reviewed by site management to identify corrective actions.

Recommendation

- Create and implement a formal process for capturing and sharing lessons learned from fire events across the fleet.

Response

- Revise Fire Incident FPG-SPP-18.120, Attachment 1 by December 26, 2014 to include requirement to write a lessons learned for all fires.
- Revise Operations Instructional Center for fire incidents by December 26, 2014 to make the lessons learned check box a mandatory field before the incident can be archived.
- The Enterprise Lessons Learned Information System (ELLIS) is going live for TVA Operations September 30, 2014. Until now it has been used by project management groups at TVA to capture lessons learned from projects.

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- Lessons learned (LL) and operating experience (OE) that involve fire protection systems will be flagged as such when entered into ELLIS. The alert feature in ELLIS will then allow anything flagged as fire protection to be emailed to the appropriate audience. This will allow LL and OE on fire protection systems to be automatically communicated to those who need it. Fire protection OE and LL can also be easily searched in ELLIS later by searching for everything flagged as fire protection in the database.
- The expectation that fire protection LL and OE should be flagged as fire protection in ELLIS will be added into the forthcoming OE and LL procedure for Operations, which will supersede COO-SPP-02.003.
- All draft LLs are reviewed by Power Operations and General Electric executives weekly to ensure they are in agreement with the message and any follow-up actions before they are sent to each site. Each site then reviews the LLs during weekly management review committee meetings and takes actions accordingly.

Recommendation

- Amend the Fire Protection Self-Assessments to include ratings of fire protection system equipment, provide a more objective means for determining whether preventive maintenance was performed, reflect prioritization of impairments and work orders outstanding, and provide a synopsis of additional drivers of fire risk at each site. In addition, methodology for assessing a site's compliance rate should be shared with site and corporate managers to allow accurate interpretation of reports.

Response

- By March 30, 2014 Generation Engineering will revise the Fire Protection Assessment procedure (FPG-SPP-18.123) to include a new rating calculation and process for sharing assessment data with Power Operations senior leadership.

Please let us know if you have any other questions or need additional information.



James R. Dalrymple
Senior Vice President
Power Operations
LP 3K-C

SHB:WHR:AEP
cc: See page 5

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cc: Suzanne H. Biddle, LP 2R-C
Dwain K. Lanier, MR 3K-C
Daniel C. McIntire, LP 3K-C
R. Windle Morgan, WT 4D-K
William W. Morrison, LP 3K-C
Kenneth L. Mullinax, LP 3K-C
Charles G. Pardee, WT 7B-K
Andrea L. Williams, WT 9B-K
EDMS, WT CA-K