



Memorandum from the Office of the Inspector General

October 17, 2013

Charles G. Pardee, WT 7B-K

**REQUEST FOR FINAL ACTION – EVALUATION 2012-14587 – REVIEW OF TVA’S
NUCLEAR POWER GROUP AND COAL & GAS OPERATIONS CRITICAL SPARE
PARTS PROGRAMS**

The Tennessee Valley Authority (TVA) has identified asset performance and operations as a major risk for the agency. Without effective management of critical spare parts, TVA could face equipment failure which could result in safety and generating failures. This review was initiated to determine if the Nuclear Power Group (NPG) and Coal & Gas Operations (C&GO) are effectively managing critical spare parts.

Our review found that critical spare parts could be managed more effectively. We found there were inconsistencies in TVA’s management of its critical spare parts related to (1) procedures governing critical spare parts, (2) preventive maintenance (PM)¹ performed on parts in the store rooms, and (3) accuracy of information maintained on critical spare parts. We also found that the lack of critical spare parts has negatively affected system and/or component health. We noted that TVA has taken steps to improve the identification of critical spare parts but has not followed through with implementing all of the changes. Additionally, our physical inventory counts at the plants were consistent with the information contained in Maximo.²

We recommend the Executive Vice President and Chief Generation Officer, Generation, (1) develop C&GO procedures to govern the identification and procurement of critical spare parts; (2) ensure proper maintenance is performed on spare parts; (3) take steps to follow-up on actions recommended by MCR Performance Solutions;³ (4) work with Engineering Environmental & Support Services to implement controls over the information maintained in Maximo, including who can identify what are critical spare parts; and (5) work with Supply Chain to accurately update Maximo to reflect what items should be listed as critical spare parts.

TVA management agreed with our findings and recommendations. See the Appendices for TVA’s complete response.

¹ PM is predictive, repetitive, and planned maintenance actions taken to maintain a piece of equipment and extend its life.

² Maximo is the TVA system of record for asset and location information.

³ MCR is a management consulting firm focused exclusively on the utilities industry.

BACKGROUND

Asset Performance and Operations was one of the 19 risks identified on the TVA Risk Scorecard for the 2nd quarter of fiscal year 2012. Fossil Power Group–Coal, Fossil Power Group–Gas, and NPG each identified at least one risk that related to asset vulnerability or equipment reliability.⁴ Each group identified the utilization of critical spare parts as a way to mitigate the risks associated with the vulnerabilities of the assets.

A critical spare part can be defined as an item that is unique to the asset it supports, whose absence would cause a significant loss of asset service availability or a significant negative impact on safety, the environment, or meeting regulatory requirements; is rarely used; and can have a long lead time for replenishment. The lack of these parts could contribute to safety risks and inefficiencies if the piece of equipment they were needed for failed.

According to NPG-Standard Programs and Processes (SPP)-09.18.10, Critical Spares Program, the program should identify critical components requiring spares; determine the right number of spare parts to maintain in stock; and request authorization for their procurement. The process should (1) identify critical components requiring spare replacement parts to mitigate critical component failure and (2) ensure analysis is performed to evaluate alternative solutions to critical spare issues. This process also ensures rigorous analysis is performed to evaluate alternative solutions to critical spare issues. Examples of alternative solutions are whether one spare, two spares, or even no spare is needed. According to NPG-SPP-09.18.10, an evaluation process should be conducted on all critical components whose failure would result in a reduction of safety or loss of generating capacity.

OBJECTIVE, SCOPE, AND METHODOLOGY

TVA has identified asset performance and operations as a major risk area. Without effective management of critical spare parts, TVA could face equipment failure which could result in safety and generating failures. The objective of our review was to determine if NPG and C&GO are effectively managing critical spare parts. The scope of our review was limited to NPG and C&GO critical spare parts programs. We judgmentally selected seven coal, gas, and nuclear plants including Allen Fossil Plant, Gallatin Fossil Plant, Bull Run Fossil Plant, Allen Combustion Turbine (CT) Plant, Caledonia Combined Cycle Plant, Gallatin CT Plant, and Watts Bar Nuclear Plant to perform plant visits and testing.

To achieve our objective, we:

- Reviewed documentation and interviewed TVA personnel from various organizations to identify processes for managing critical spare parts.
- Interviewed plant personnel to obtain information concerning the plants' management of critical spare parts, including how each plant identifies, tracks, and maintains its parts.

⁴ Fossil Power Group was subsequently changed to C&GO.

- Selected a random sample of critical spare parts at each plant and performed a physical inventory to determine if the items listed in Maximo as critical spare parts were stored in the plants' store room.
- Obtained documentation to verify that PM was being performed on the critical spare parts. We did not ascertain the extensiveness of the PM performed.
- Reviewed random samples of both Nuclear and Coal System and Component Health Reports with poor ratings from calendar years 2011-2012 to determine if critical spare parts were a contributing factor to the poor health. Gas Operations was not included because it does not perform system health reports.

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

Our review found that critical spare parts could be managed more effectively. We found inconsistencies in TVA's management of its critical spare parts related to (1) procedures governing critical spare parts, (2) PM performed on parts in the store rooms, and (3) accuracy of information maintained on critical spare parts. We also found that the lack of critical spare parts has negatively affected system and/or component health. We noted that TVA has taken steps to improve the identification of critical spare parts but has not fully implemented all of the actions. Additionally, our physical inventory counts at the plants were consistent with the information contained in Maximo.

C&GO Does Not Have an SPP to Govern its Critical Spare Parts Program

While NPG has an SPP to govern its Critical Spares Program, C&GO does not. Each coal and gas plant uses its own approach to identify and procure its critical spare parts.

NPG-SPP-09.18.10 explains the procedure for identifying high value critical components (costs greater than or equal to \$250,000) and guides the asset owner through an evaluation process to develop an economic basis for the acquisition of critical spares. The SPP also provides details on the approach that should be used for critical spare items that are less than \$250,000. NPG-SPP-09.18.10 was developed to improve management of critical spare parts because individual plant management of critical spares had led to insufficient spare availability, deferrals of planned refurbishments and overhauls, and an increase in outage durations when spares were not available.

PM is Not Being Performed on Critical Spares at Certain Plants

C&GO and NPG have SPPs that provide guidance related to PM for parts stored in the store rooms. Since conducting PM is important for the reliable operation of assets, if critical spares are not maintained, they may not be in working condition when they are needed. In both C&GO and NPG SPPs, there is guidance related to the PM of critical spare parts. Specifically, the SPPs indicate that if PM is required for certain equipment it should be done. The SPPs also provide more specific guidance for how to handle certain equipment, such as piping and motors. However, five of the seven plants we visited could not provide documentation indicating they perform any type of maintenance on critical

spare parts stored in the store rooms. The nuclear plant and one coal plant was able to provide documentation but none of the gas plants in our sample were able to do so.

Information Maintained on Critical Spares is Unreliable

Based on our interviews and review of items identified as critical spare parts in Maximo, we determined the information maintained in Maximo regarding critical spare parts is unreliable. According to Supply Chain personnel, Maximo is used to track and procure the required inventory of consumable inventory, component inventory, and spare parts in inventory, including critical spares. Inaccurate data in Maximo could increase the risk that critical spare parts not marked as critical are not procured and available when needed.

TVA personnel stated there are parts in the store rooms that have (1) not been appropriately identified as critical and (2) been incorrectly identified as critical. For example, we identified items, such as personal overalls, office supplies, beakers, lighting fixtures, wrenches, along with miscellaneous identification tags, plates, and signs that were identified as critical spare parts in Maximo. According to plant personnel, there is inconsistency in identifying parts in Maximo, because any user can check a box and identify any item as a critical spare part. Also, when requisitioning a part, the requester can identify the part as critical. Requiring the appropriate engineer to identify the criticality of a part could increase the validity of the information maintained in Maximo.

Lack of Critical Spare Parts Has Negatively Affected System and/or Component Health

System, program, and component health monitoring provides a method to improve and maintain equipment performance by identifying (1) shortfalls in equipment or programs, (2) issues from internal or external operating experience, (3) issues which will affect future performance of equipment, and (4) opportunities offered by emerging technologies, benchmarking, or innovations that improve equipment performance. As part of separate reviews, we found that the lack of critical spare parts has negatively affected system and/or component health at nuclear and coal plants.

As part of a review of nuclear plant systems, components, and programs with poor ratings,⁵ a random sample of 50 system, component, and program health reports from nuclear plants with statuses of red or yellow (which indicates poor health) was selected for testing.⁶ Thirteen of the 50 reports sampled noted issues with critical spare parts as contributing factors to the poor health ratings. Specifically, 10 of the 34 system health reports, 3 of the 8 component health reports, and none of the 8 program health reports noted issues with critical spare parts. The 10 system health reports were rated red or yellow for the indicator titled "Major Component Critical Spares – unavailability of a major component critical spare to support plant operations." The three component health reports indicated the need for transformers and/or motors. The following detailed comments were provided in some of the reports reviewed:

- A system health report stated there was no critical component spare available for the diesel generator exhaust fan motor.

⁵ Evaluation 2012-14842 – Actions to Address Nuclear Plant Systems, Components, and Programs With Poor Ratings, which is in progress and will be issued at a later date.

⁶ NPG defines a red rating as intolerable and a yellow rating as not acceptable.

- A system health report stated the plant did not have spare parts or replacements for many obsolete components in a feedwater system.
- A system health report stated the lack of critical spares for the pump in the motor driven auxiliary feedwater trains put Sequoyah Nuclear Plant at risk. Performance history has been reliable, but one failure on the right component could put Unit 1 and/or Unit 2 at risk for shutdown.
- A component health report stated a spare cooling tower transformer is needed because if one was lost it could force a unit to derate depending upon environmental factors.
- A component health report stated “. . . six critical components do not have a spare replacement, including three safety-related motors that if a failure should occur, would enter the site into a 72 hour LCO [limited condition of operations] Action and typically have a repair and recovery time of one month.”

As part of a review of coal plant systems and programs with poor ratings,⁷ we also randomly selected a sample of 50 system and program health reports with statuses of red or yellow.⁸ Of the 50 reports in the sample, two system health reports listed critical spare parts as contributing factors to the poor health ratings. One of the reports indicated a spare breaker needed to be repaired and the other report stated there was not a spare transformer readily available onsite.

Steps to Mitigate the Critical Spare Parts Risks Have Not Been Fully Implemented

TVA has recently taken steps to mitigate its risks related to identifying and procuring critical spare parts. In 2012, Supply Chain established an Equipment Reliability (ER) group whose vision includes ensuring that the TVA inventory catalog and procedures and processes will fully support excellence in equipment reliability on a sustainable level. TVA also hired a contractor to identify critical components in its (CT) fleet in 2011; however, we were unable to determine what actions TVA has taken based on the contractor's analysis.

Initially, ER was tasked with aiding NPG in implementing its SPP governing its critical spare parts. Currently, ER, with the help of PKMJ Technical Services,⁹ is identifying (1) NPG's critical spare parts and the quantities on hand and (2) obsolete parts in inventory. ER personnel indicated they are working to expand their review of critical spare parts fleet-wide.

In 2011, TVA signed a contract with MCR for about \$200,000 to complete a Failure Modes and Effects Analysis of TVA's CT fleet. The Failure Modes and Effects Analysis identified critical components in TVA's CT fleet. The critical components identified could be used to create a critical spare parts list for the CT fleet. As a result of the analysis, MCR recommended TVA increase the number of critical spare CT components. The contractor also provided TVA with alternatives related to storing critical spare parts at a centralized

⁷ Evaluation 2013-15135 – Actions to Address Coal Plant Systems and Programs With Poor Ratings, which is in progress and will be issued at a later date.

⁸ Coal Operations defines a yellow rating as needs improvement and a red rating as unsatisfactory.

⁹ PKMJ Technical Services is a nuclear consulting organization that provides software and engineering solutions.

location. However, we were unable to determine what actions TVA has taken based on the information provided by MCR. During our interviews, plant personnel indicated they were not aware of (1) the review or (2) any actions TVA has taken since the analysis was completed.

Inventory Count of Identified Critical Spare Parts was Accurate

We conducted a physical inventory of critical spare parts identified in Maximo. We located and counted the critical spare parts and the appropriate quantities selected in our random sample. In all but two instances, our physical count matched the information contained in Maximo. The figure below shows the number of inventory items included in our sample for each plant and the number of items whose quantities did not match the information in Maximo.

Figure 1: Random Samples of Inventory Kept By Plant

<u>Plant</u>	<u>Critical Spares Sampled</u>	<u>Inaccurate Inventory Quantities</u>
Allen Fossil Plant	87	0
Gallatin Fossil Plant	95	0
Bull Run Fossil Plant	95	2
Allen CT Plant	67	0
Caledonia Combined Cycle Plant	77	0
Gallatin CT Plant	75	0
Watts Bar Nuclear Plant Unit 1	98	0

Although the inventory counts at the plants were consistent, except two instances, with the information contained in Maximo, the items sampled may or may not have been critical spares because (as discussed above) the critical spare parts information in Maximo was unreliable.

RECOMMENDATIONS

We recommend the Executive Vice President and Chief Generation Officer, Generation:

- Develop C&GO procedures to govern the identification and procurement of critical spare parts.
- Ensure proper maintenance is performed on spare parts.
- Take steps to follow-up on actions recommended by MCR.

- Work with Engineering Environmental & Support Services to implement controls over the information maintained in Maximo, including who can identify what are critical spare parts.
- Work with Supply Chain to accurately update Maximo to reflect what items should be listed as critical spare parts.

TVA Management's Comments – TVA management agreed with the findings and recommendations in the report. Management provided additional information regarding NPG's management of critical spare parts. See the Appendices for TVA's complete response.

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

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This report is for your review and final action. Your written comments, which addressed your management decision and planned actions, have been included in the report. Please notify us within one year from the date of this memorandum when final action is complete.

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 need additional information, please contact me at (865) 633-7450 or Gregory R. Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the evaluation.



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OIG File No. 2012-14587

October 9, 2013

Robert E. Martin, ET 3C-K

REQUEST FOR COMMENTS - DRAFT EVALUATION 2012-14587 - REVIEW OF TVA'S COAL
& GAS OPERATIONS CRITICAL SPARE PARTS PROGRAMS

This is in response to your memorandum dated August 27, 2013.

Power Operations agrees with the Office of the Inspector General findings and recommendations in Audit 2012-14587. We recognize there are deficiencies in our critical spare parts program that require attention to reduce TVA's risk associated with available generation. Steps are being taken to balance a robust program with inventory process efficiencies to maximize value for TVA and standardize our approach across the coal and gas fleets. These efforts align to our strategic objectives, risk tolerance, and financial goals.

Findings, Recommendations, and Comments

Finding 1: C&GO Does Not Have an SPP to Govern its Critical Spare Parts Program

Recommendation: Develop C&GO procedures to govern the identification and procurement of critical spare parts.

Comment: Power Operations understands and agrees with this finding and recommendation. We will develop the appropriate procedures to:

- Define the roles, responsibilities, and accountabilities of key persons within both Power Operations and Supply Chain organizations.
- Define the decision/approval process in regard to the eventual procurement of critical spares.
- Define the decision/approval process for the removal of the critical spare designation from spare parts in inventory.

Finding 2: PM is Not Being Performed on Critical Spares at Certain Plants

Recommendation: Ensure proper maintenance is performed on spare parts.

Comment: Power Operations understands and agrees with this finding and recommendation. Power Operations will work with Supply Chain to define maintenance program accountabilities for inventory including critical spares.

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Finding 3: Information Maintained on Critical Spares is Unreliable

Recommendation:

1. Work with Operations Support to implement controls over the information maintained in Maximo, including who can identify what are critical spare parts.
2. Work with Supply Chain to accurately update Maximo to reflect what items should be listed as critical spare parts.

Comment: Power Operations understands and agrees with this finding and recommendations. Power Operations will work with Operations Support and Supply Chain to develop the processes and procedures required to manage critical spare information.

Finding 4: Lack of Critical Spare Parts Has Negatively Affected System and/or Component Health

Comment: Power Operations understands the finding and agrees there are likely cases where the availability of critical spare parts has been a factor in determining a system's health rating. We have the following additional comments:

- Regarding the incidence where a critical spare transformer is not onsite, it is very often the case that a critical spare transformer may serve as a spare for more than one location, therefore may be stored at a location that allows effective response to all supported sites.
- Gas Operations does perform system health reports; however, they are not retained similar to coal or nuclear at this time. Power Operations, River Operations, and Operations Support are developing a common approach for system health currently.

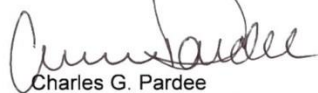
Finding 5: Steps to Mitigate the Critical Spare Parts Risks Have Not Been Fully Implemented

Recommendation: Take steps to follow up on actions recommended by MCR.

Comment: Power Operations has begun the implementation of the recommendations provided by the MCR FMEA analysis, and will move forward to complete the risk mitigation actions.

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We appreciate the insights provided by this assessment. We are developing a detailed plan and schedule for our corrective actions.



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October 9, 2013

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REQUEST FOR COMMENTS - DRAFT EVALUATION 2012-14587 - REVIEW OF TVA'S
NUCLEAR POWER GROUP CRITICAL SPARE PARTS PROGRAMS

This is in response to your memorandum dated August 27, 2013.

NPG has developed guidance to address critical spares through the fleet standard NPG-SPP-09.18.10 which was established in 2011. Additionally in 2011 a project was completed to develop a fleet listing of capital critical spares and the associated risk value associated with the absence of the critical spare. From 2009-2012 many of the critical motors were replaced or overhauled and a spare established for each group of motors throughout the fleet. A long term asset management item was entered into the LTAM process as addressed in NPG-SPP-09.18.12 for the other critical spares. A fleet project has also been initiated to establish the remaining critical spares for the fleet based on a cost benefit/risk analysis that is currently scheduled for FY 15.

In FY 13 each site developed a top ten list of capital critical spares to ensure that a priority was placed on these more urgently needed spares to ensure they were addressed in a timely fashion. A total of \$7M was allocated in FY 13 and several key motors and rotating elements were procured that are interchangeable between the Sequoyah and Watts Bar units. An additional \$7M is available for procurement of additional capital critical spares for Sequoyah and Watts Bar. At Browns Ferry the RHRSW pumps and motors will begin replacement in FY 14.

As part of our partnering with Supply Chain in 2012 to improve equipment reliability, engineering completed a reclassification of all equipment as critical, noncritical, or run to maintenance in accordance with industry guidance to align the Supply Chain priorities for addressing critical spare parts and obsolescence issues. Since that time, NPG has supported the Supply Chain ER project to focus on the more critical needs areas first of part that are both obsolete and critical. A monthly report of progress is provided and the GM of Equipment Reliability and Components helps provide management oversight of the project. Attached is a copy of the August 2013 report to show the current status of the project. This project is also addressing asset data cleanup, bill of materials and stocking levels in MAXIMO based on the criticality.

For PMs on critical spares, the control and preservation of items in storage is regulated by NPG procedures and Industry Guidance.

- NEDP-8 Technical Evaluation for Procurement of Materials and Services(for shelf life items)
 - ANSI N45.2.2, "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants"
 - EPRI NP-6408, "Guideline for Establishing, Maintaining and Extending the Shelf Life Capability of Limited Life Items" (NCIG-13)
- NPG-SPP-04.2 Material Receipt and Inspection (shelf life and In-storage maintenance)
- NPG-SPP-04.3 Material Storage and Handling (shelf life and In-storage maintenance)
 - Regulatory Guide 1.38, Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants, (endorses ANSI N45.2.2)

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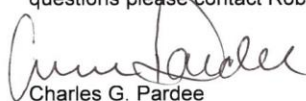
- o EPRI NP-6408, Guidelines for Establishing, Maintaining, and Extending the Shelf Life Capability of Limited Life Items (NCIG-13)

TVA Inventory Items that require in-storage maintenance have the requirements established, performed, monitored for completion using NPG-SPP-04.3. Once the Item requirements have been established along with the frequency of performance, MAXIMO is used to track and monitor the implementation and completion of the activities.

Each NPG site has dedicated personnel to implement and monitor the shelf life and in-storage maintenance programs. Technical assistance for this program is procedurally directed back to the Procurement Engineering Group.

While NPG does agree with the statement that critical spares impacts the long term health of some systems and components, we are systematically addressing this as funding permits based on our risk reviews and performance monitoring. NPG believes we are in compliance with the five recommendations represented in this report.

We appreciate the insights provided by this assessment. Should you have any additional questions please contact Rob Whalen or Sam Harvey.



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