Memorandum from the Office of the Inspector General

September 20, 2012

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REQUEST FOR FINAL ACTION – INSPECTION 2009-12883 – SURVEY OF TVA'S PROCESS FOR DETERMINING CONDITION OF ASSETS

With the age of Tennessee Valley Authority (TVA) generating assets, the need to understand the condition of those assets and use that information to effectively plan is crucial to TVA. As a result, we initiated a review to determine how TVA (1) assesses the condition of electric assets and (2) uses that information in planning. However, the scope of this review did not include assessing the condition of TVA assets. The organizations we reviewed included Nuclear Power Group (NPG), Fossil Power Group (FPG), Energy Delivery, and River Operations (RO).

We found the condition of assets is identified through system, program, and component[1] health assessments. While all the organizations we reviewed use health assessments, the process varies among the organizations. We also found the condition of assets information is used by TVA for planning purposes. According to processes and interviews, all of the organizations we reviewed use asset condition information to identify corrective actions when necessary. RO personnel stated that they take actions to address any system with poor ratings even though the RO process, RO-SPP-09.21, System and Component Health Program, does not specifically include the requirement, as the other organizations do. The condition of assets information is also used by (1) the organizations to develop and prioritize projects for business planning purposes and (2) System Planning for future costs. In addition, TVA has instituted a Capital Productivity Initiative[2] to improve management of capital and operations and maintenance (O&M) projects to capture savings. As part of the new initiative, projects will be reviewed by a Project Review Board, and the condition of assets information could be a factor for consideration in its project reviews.

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1 An example of a system health assessment would be a feedwater system that would include evaluating the pumps, piping, valves, controls, and some electrical items that take the water from the condenser to the boiler. A program health assessment evaluates a specific area, such as fire protection. A component health assessment evaluates similar items (e.g., pumps) across multiple systems.

2 The Capital Productivity Initiative has only recently been implemented. We did not assess the effectiveness of the initiative.

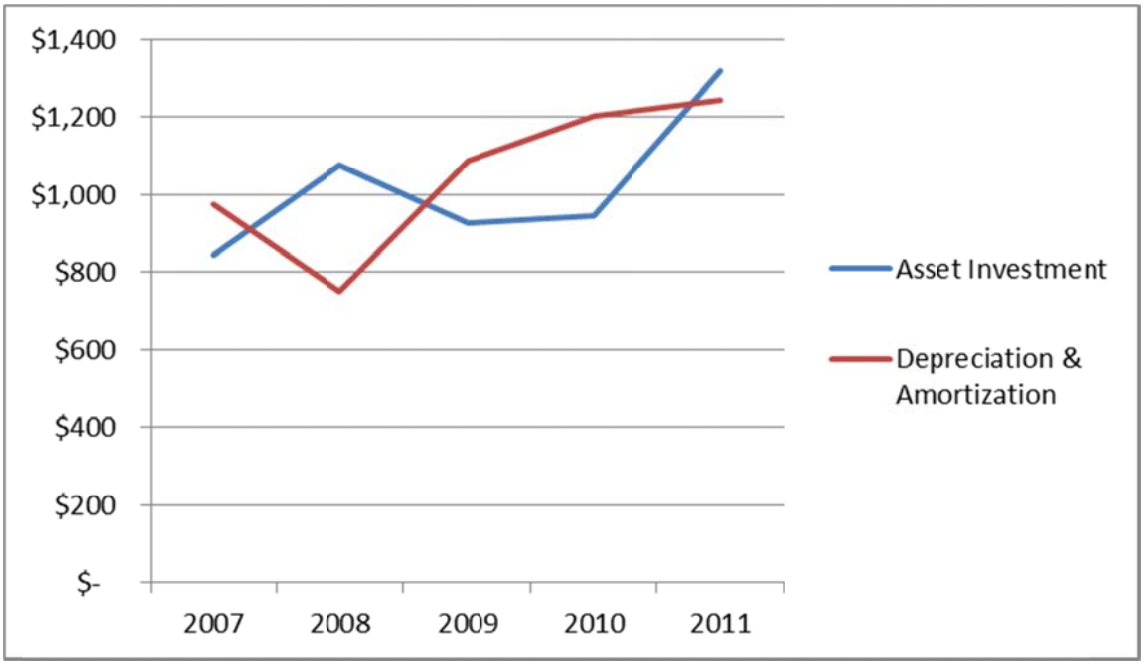
We make two recommendations in this report that pertain to requiring (1) defined actions where assessments have resulted in poor ratings in the RO organization and (2) the condition of assets information be included as an evaluation factor for proposed capital or O&M projects where the condition is relevant.

TVA management generally agreed with our recommendations and plans to take actions. Based on the information we obtained during this review, we plan to do additional work related to O&M spending and systems with poor ratings.

BACKGROUND

In 2010, TVA conducted a benchmark study that found as of 2008, TVA had an aging generating fleet that was on average 36 years old. This includes fossil units with an average age of 47 years. Of the ten utilities that participated in the benchmark, TVA fell into the bottom quartile with respect to the age of its assets. As of September 30, 2011, TVA's completed plant assets for NPG, FPG, Energy Delivery, and RO totaled more than $21 billion. Figure 1 shows total asset investment, which is O&M expense as well as capital spending and the operations portion of depreciation and amortization for 2007 through 2011.[3]

Figure 1: Asset Investment and Depreciation and Amortization (Dollars in Millions)



[3] The information regarding plant assets, asset investment, and depreciation and amortization was provided by TVA and was not reviewed as part of this project.

While TVA does not have any Winning Performance (WP)[4] goals directly related to its asset condition, there are goals related to Equivalent Forced Outage Rate and Equivalent Availability Factor, both of which can be impacted by asset condition. Equivalent Forced Outage Rate is the percentage of generation loss due to forced outages with respect to total generation capability. Forced outages are unplanned outages caused by equipment failures or other problems. Equivalent Availability Factor is a ratio of actual available generation in a given period to maximum availability. Additionally, in 2011, Power System Operations[5] had a WP goal for Load Not Served, which is a measure expressed in system minutes of the magnitude and duration of transmission system outages that affect TVA customers. Poor asset condition could cause performance to drop in one or all of these goals.

Asset condition poses a risk for the electric generation and distribution organizations we evaluated within TVA. Each of the organizations identified at least one risk that related to the condition of its assets in risk maps[6] for the second quarter of fiscal year 2012. As shown in Figure 2 below, three of the four organizations had determined the probability of an asset condition issue was "very likely."

Figure 2: Organizational Risks Related to the Condition of Assets

Organization	Risk	Probability	Consequences
NPG	Long Term Equipment Reliability	Very Likely	Major
FPG[7]	Asset Performance Vulnerability – Coal	Very Likely	Moderate
FPG	Asset Performance Vulnerability – Gas	Even Odds	Moderate
Energy Delivery	Significant Equipment Failure	Very Likely	Moderate
RO	Material Condition of Select Hydro Plants	Even Odds	Moderate

OBJECTIVE, SCOPE, AND METHODOLOGY

With the age of TVA generating assets, it is important that TVA understands the condition of those assets and use that information to plan effectively. As a result, we initiated a review to determine how TVA (1) assesses the condition of electric assets and (2) uses that information in planning.

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4 WP is the program in which TVA ties incentive compensation to achievement of goals.

5 Power System Operations was incorporated into a new group, Energy Delivery, in early 2012.

6 The risk maps visually represent the probability and consequences associated with the risks identified by the organization. In addition, the organizations identify possible mitigations that may reduce the probability and consequences associated with the risk.

7 During our review, FPG and RO were integrated into a new organization, Generation. However, for the purposes of this review, FPG and RO were treated as separate organizations.

This review focused on TVA's electric generation and distribution assets. Therefore, the organizations we reviewed were NPG, FPG, Energy Delivery, and RO. To achieve our objectives, we:

- Interviewed key TVA personnel and reviewed the organizations' processes to determine how the organizations assess the condition of their assets.
- Reviewed examples of assessments from each organization.
- Interviewed TVA management and reviewed business planning processes and business plans to determine how the condition of assets is used in planning.

This review was conducted in accordance with the *Quality Standards for Inspections*.

FINDINGS AND RECOMMENDATIONS

Our review found the condition of assets is identified through system, program, and component health assessments. While all the organizations we reviewed use health assessments, the process varies among the organizations. According to processes and interviews, all of the organizations we reviewed use asset condition information to identify corrective actions when necessary. RO personnel stated that they take actions to address any system with poor ratings even though the RO process, RO-SPP-09.21, System and Component Health Program, does not specifically include the requirement, as the other organizations do. The condition of assets information is also used by (1) the organizations to develop and prioritize projects for business planning purposes and (2) System Planning[8] for future costs. In addition, TVA has instituted a Capital Productivity Initiative to improve management of capital and O&M projects to capture savings. As part of the initiative, a new Project Review Board will be reviewing projects, and the condition of assets information could be a factor for consideration in its project reviews.

Health Assessments Are a Method Used to Determine the Condition of Assets
System, program, and component health assessments provide a method to improve and maintain equipment performance. All of the organizations we reviewed use system and/or component health assessment as a method to evaluate the condition of their assets. NPG and FPG also use program health to assess their assets. While health assessments are used by all the organizations we reviewed, the process for the assessments varies among the organizations.

NPG and FPG management stated health assessments have been in place in these organizations for a number of years. However, FPG has just started working toward implementing health assessments at gas plants in the last year.[9] According to management, Energy Delivery initiated its current system health reporting two years ago. According to RO management, in the past, RO assessed 12 systems annually; however,

[8] System Planning develops plans for the optimized operation of generating assets including long-term asset expansions and retirements, current and future capacity and resource requirements, and strategic alignment of transmission infrastructure to support resource and load requirements.

[9] For the purposes of this report, information discussing FPG applies only to coal plants and not to gas plants because FPG has not fully implemented the health assessments at gas plants.

they are working toward developing standards[10] and completing assessments of all their systems and components by the end of fiscal year 2012. RO expects to have approximately 30 systems and components to assess.

Each of the four organizations uses a different software package to maintain its health assessments. In 2008, NPG adopted Web-based software that was described as easy to use and accessible through NPG's Web site. FPG has a proposed plan to enhance the efficiency of its health assessments by utilizing the tools available in its current software and integrating it with other programs it uses. Energy Delivery stores its system health information on a Web page. RO uses an in-house developed equipment condition assessment program to maintain its health assessments that can be accessed through a Web site.

According to processes, the time frames for completing the health assessments are also different for NPG, FPG, and Energy Delivery. NPG assesses each system's health three times a year and each component's and program's health are assessed semiannually. FPG performs system health assessments annually or biannually depending on the system. Program health assessments are completed semiannually for each component, and component health assessments are done on an as-needed basis. Energy Delivery's system health reviews are performed on a monthly basis for each transmission service center. Energy Delivery management also stated additional reviews are performed for transformers due to the high cost of those assets. While RO's process does not address the time frame, RO management has stated they plan to assess their systems and components on an annual basis but do not yet have all of their standards in place. The assessment types and annual frequency are shown in Figure 3 below.

Figure 3: Annual Assessment Frequency by Organization

Organization	Program Health	System Health	Component Health
Energy Delivery	Not performed	12[11]	Not performed
FPG	2	1[12]	As needed
NPG	2	3	2
RO[13]	Not performed	1	1

[10] Standards are engineering guidelines developed to provide all necessary inspection guidelines to perform a system and component assessment.

[11] Additional assessments are performed for transformers on a periodic basis.

[12] The majority of FPG systems are assessed on an annual basis; however, some are assessed on a biannual basis.

[13] The assessment frequency is planned according to RO management.

The documented processes related to conducting the health assessments varied in detail among the organizations. NPG and FPG have detailed processes for their system health reviews. However, NPG's system health process also covers component and program health, while FPG has separate processes for each of those areas. The RO process covers both system and components; however, it is less descriptive than NPG and FPG processes. While Energy Delivery does not have a specific system health process, a brief description is included in an asset management process, which is still in draft. Prior to the development of the asset management process, system health details were described in a document that explained System Engineer responsibilities in relation to system health. According to Energy Delivery management, while there is not yet a documented process, the process is being performed.

The assessment types and governing processes are shown in Figure 4 below.

Figure 4: Process Information by Organization

Organization	Program Health	System Health	Component Health
Energy Delivery	Not performed	Included in a draft asset management process	Not performed
FPG	Has its own process	Has its own process	Has its own process
NPG	One process for program, system, and component	One process for program, system, and component	One process for program, system, and component
RO	Not performed	One process for system and component	One process for system and component

NPG has also incorporated System Vulnerability Reviews in addition to the component, system, and program health assessments. A System Vulnerability Review is an in-depth, detailed review of a system that begins with the original design of the system. The System Vulnerability Review is designed to identify conditions that have the potential to cause plant issues.

The Condition of Assets Is Used for Business and System Planning

According to processes and interviews, the organizations we evaluated use asset condition information to identify corrective actions when necessary. The information is also used for business planning for each of the organizations and system planning for TVA as a whole. In addition, TVA has instituted a Capital Productivity Initiative to improve management of capital and O&M projects to capture savings. As part of the initiative, a new Project Review Board will be reviewing projects, and the condition of assets information could be a factor for consideration in its project reviews.

According to processes and interviews, all of the organizations we reviewed are using asset condition information to identify corrective actions when necessary. As part of the health assessments, systems and components in NPG, FPG, and RO are assigned a rating. Additionally, programs in NPG and FPG are assigned a rating. NPG's process

requires the initiation of an action plan for any system, component, or program that has been assigned a yellow or red rating.[14] While FPG's processes for systems and programs require corrective actions for ratings that are yellow or red, they do not require ratings for component health assessments. While Energy Delivery does not use a rating as part of system health, its draft process requires that issues having the potential to impact the customer or transmission system operation or pose a safety or environmental risk be added to the TOM (Transmission Operations and Maintenance) Watch List.[15] While the RO process, RO-SPP-09.21, System and Component Health Program, does not define any requirements for assessments with poor ratings, the process does state Plant Management can decide ownership and resolution of issues. However, according to RO management, when there are issues with a system or component, a maintenance order is entered or a project to address the issue is initiated.

The condition of assets is also included in each of the organizations' business planning process. Through discussions with each of the organizations' management, we found the condition of assets information is used to develop and prioritize projects for business planning purposes. Additionally, both FPG and RO specifically state in their business planning processes that the condition of assets should be reviewed to assist with identifying gaps in performance. The condition of assets is also considered in TVA's system planning. According to the Vice President, System Planning, the condition of assets information is considered for cost purposes when making decisions about future generation, including plant retirement.

TVA has implemented a Capital Productivity Initiative to improve management of capital and O&M projects to capture savings. One focus area of this initiative is selecting and doing the right projects. According to the Director, Capital Productivity and Economic Analysis, the economic analysis performed by a new Project Review Board could consider the condition of assets information depending on the proposed project.

Recommendations

We recommend the:

- Vice President, Generation Engineering, consider revising RO-SPP-09.21, System and Component Health Program, to require an action when a health assessment has resulted in a poor rating. This would be in line with processes in the other organizations we reviewed.

  TVA Management's Comments – In response to our recommendation, the Vice President, Generation Engineering, provided informal comments stating they agreed with the recommendation for RO-SPP-09.21 procedure to be updated to clarify the expectation that an action item be put in place to track correction of systems with

[14] A yellow rating is defined by FPG as "needs improvement" and NPG as "not acceptable." FPG defines a red rating as "unsatisfactory," and NPG defines it as "intolerable."

[15] The TOM Watch List is a listing of issues identified by each Transmission Service Center that (1) has the potential to impact the ability to serve the customer or operate the transmission system; (2) requires a long-term solution, such as a capital project; or (3) is considered a safety or environmental risk.

improvement needs. They are currently in the process of revising the procedure and the action is being tracked in the corrective action process.

Auditor's Response – The OIG concurs with planned actions.

- Director, Capital Productivity and Economic Analysis, consider requiring the condition of assets information be included as an evaluation factor for projects where the condition is relevant.

  TVA Management's Comments – In response to our recommendation, TVA stated that as part of the economic reviews on capital projects greater than $8 million and O&M projects greater than $3 million, they include any improvements to material condition made by the project in the benefit analysis. They will work toward making sure that information is included in the packages brought forward to the Project Review Board.

  Auditor's Response – The OIG concurs with planned actions.

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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 wish to discuss our observations, please contact Deana D. Scoggins, Senior Auditor, at (423) 785-4822 or Greg R. Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the inspection.

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OIG File No. 2009-12883

September 10, 2012

Robert E. Martin, ET 3C-K

RESPONSE TO DRAFT INSPECTION 2009-12883 - SURVEY OF TVA'S PROCESS FOR DETERMINING CONDITION OF ASSETS

This is in response to your memorandum dated August 9, 2012. Thank you for the opportunity to respond to your report.

RECOMMENDATIONS

1. Director, Capital Productivity and Economic Analysis, consider requiring the condition of assets information be included as an evaluation factor for projects where the condition is relevant.

- I agree with the recommendation that we consider requiring the condition of assets information be included as an evaluation factor for projects where the condition is relevant. As part of our economic reviews on capital projects greater than $8 million and O&M projects greater than $3 million, we already include any improvements to material condition made by a project in the benefit analysis. We will work toward making sure that information is included in the packages brought forward to the Project Review Board.

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