Memorandum from the Office of the Inspector General

December 8, 2011

Preston D. Swafford, LP 3R-C

FINAL REPORT – INSPECTION 2010-13233 – REVIEW OF NUCLEAR POWER GROUP'S PERFORMANCE TRENDS

Attached is the subject final report for your review and action. Please advise us of your planned actions in response to our findings within 60 days of the date of this report.

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

If you have any questions, please contact Heather R. Kulisek, Auditor, at (423) 785-4815 or Greg R. Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during this review.

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OIG File No. 2010-13233

Tennessee Valley Authority
Office of the Inspector General

Inspection Report

REVIEW OF NUCLEAR POWER GROUP'S PERFORMANCE TRENDS

Inspection 2010-13233
December 8, 2011

ACRONYMS AND ABBREVIATIONS

CAP	Corrective Action Program
FY	Fiscal Year
INPO	Institute of Nuclear Power Operations
NPG	Nuclear Power Group
NRC	Nuclear Regulatory Commission
NSRB	Nuclear Safety Review Board
OHI	Organizational Health Index
OIG	Office of the Inspector General
PER	Problem Evaluation Report
QA	Quality Assurance
SCRAM	Safety Control Rod Axe Man
TVA	Tennessee Valley Authority
WANO	World Association of Nuclear Operators

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APPENDIX

Inspection 2010-13233 – Review of Nuclear Power Group's Performance Trends

EXECUTIVE SUMMARY

Why the OIG Did This Review

This review was included in our 2010 Inspection Plan and was initiated to assess the performance of the Tennessee Valley Authority's (TVA) Nuclear Power Group (NPG). This review included identifying (1) performance trends based on the Institute of Nuclear Power Operations (INPO) reports, (2) major contributing factors affecting the performance trends, and (3) patterns of behavior that have an impact on culture.

What the OIG Found

We assessed the performance of TVA's three nuclear generating plants individually and collectively over the 6-year period beginning 2005 through 2010. Overall, NPG's performance with respect to the INPO index declined through 2007 and has shown improvement through 2010. As discussed in more detail later, the INPO Index is the industry standard in trending nuclear performance safety and reliability. Through interviews and our review of documentation, we found that outages, both planned and forced, were a major contributing factor to the changes in INPO performance. The majority of the unplanned outages appear to be a result of equipment reliability issues. Factors contributing to performance improvement include a gap-based business plan and other new initiatives, including a focus on equipment reliability, within the organization.

As part of our review, we identified a number of steps management has taken to improve NPG performance as well as address areas for improvement in culture. As noted later, TVA is in the midst of a substantial cultural change effort. This review by the OIG (Office of the Inspector General) was meant to supplement TVA's broader effort, not supplant it. The elements of culture that we reviewed included: (1) Alignment, (2) Progress, (3) Standards, (4) Accountability, and (5) Attitude. In the areas of (1) Alignment and (2) Progress, management has taken actions that enhanced culture, as follows:

- Alignment – NPG has adopted a fleet mentality, which focuses on operating plants as one team and one fleet to accomplish common goals. NPG also continues to work toward educating the workforce on their role and responsibilities in the organization.
- Progress – NPG is taking strides to enhance the organization by considering recommendations made by both internal and external assessments to improve performance and integrating site business plans, projects, and other performance initiatives into NPG budgets and enterprise risk assessments to improve performance fleet-wide.

In the areas of (1) Standards, (2) Accountability, and (3) Attitude, we noted that while management has taken some corrective actions, the culture could be further enhanced by addressing certain issues:

- Standards – Some standards and expectations are not clear or have not been clearly communicated or reinforced. However, this deficiency has been identified, and NPG is working to improve in this area.
- Accountability – A lack of accountability has been to blame for issues that have arisen at the plants. There is an increased focus being placed on accountability to drive it down and throughout the organization. Specific examples of this behavior include revisions made to the Corrective Action Program (CAP) and regular accountability meetings held at each of the sites. However, the CAP and NPG's accountability efforts have not been fully effective.
- Attitude – There have been efforts to improve the attitude of NPG's workforce, such as the management at Browns Ferry working to regain the trust of its employees. However, the lack of embracing initiatives and complacency of the workforce could hinder the organization's effectiveness.

What the OIG Recommends

We recommend the Chief Nuclear Officer:

- Increase the focus on standards within the organization by (1) evaluating adequacy of standards as compared to industry, (2) clarifying the expectations and standards that everyone should follow, and (3) reinforcing those standards throughout the organization.
- Continue to promote the fleet mentality throughout the organization and consider input from the workforce when making decisions that would directly affect their work.
- Continue efforts to be proactive in identifying opportunities that would enhance the organization.
- Work to build relationships and trust throughout NPG, which would encourage the workforce to embrace new initiatives, foster a fleet mentality, and increase their drive to perform.
- Implement actions to improve the CAP to increase the workforce's reliance on the program.

TVA management was provided a draft of this report for review. They did not have any comments on the report.

BACKGROUND

The Tennessee Valley Authority (TVA) began building nuclear power plants in the 1960s to respond to the rising demand for power. TVA has three nuclear plants with a total of six operating units that presently generate 30 percent of TVA's power supply. TVA has three operating nuclear plants, which include Browns Ferry, near Athens, Alabama, Sequoyah, in Soddy Daisy, Tennessee, and Watts Bar, near Spring City, Tennessee.

The performance and reliability of TVA's assets are important not only for the financial health of TVA, but failure could result in health, safety, and environmental impacts. TVA's Nuclear Power Group (NPG) maintains a set of Fleet Metrics, which consists of lists of agreed-upon indicators, owners, definitions, performance criteria, and basis. The Institute of Nuclear Power Operations (INPO) was originally created in order "to establish a program that specifies appropriate safety standards including those for management, quality assurance, and operating procedures and practices, and that conducts independent evaluations." INPO is a member of the World Association of Nuclear Operators (WANO) and represents U.S. utilities within WANO. In addition to INPO's index, INPO also tracks a number of other indicators TVA uses to trend performance.

TVA uses the INPO Index as its primary nuclear safety index. The INPO Index is the recognized industry standard for trending operations performance based on safety and reliability. It is a weighted combination of performance indicators and is a useful tool for management in trending overall station performance. The indicators used to calculate the index change periodically. The number of indicators has increased from 10 in 2010 to 12 in 2011.

The information for the other measures tracked by NPG in the Fleet Metrics book related to site events, management challenges, operational focus issues, and personnel safety issues is also submitted to INPO on a regular basis. INPO assimilates the information submitted by its members so that each utility can benchmark against other utilities.

OBJECTIVES, SCOPE, AND METHODOLOGY

This review was included in the Office of the Inspector General's (OIG) 2010 Inspection Plan and was initiated to assess the performance of TVA's NPG. This review is intended to provide an objective evaluation of the performance and certain cultural elements of TVA's NPG. The objectives of our review were to identify (1) performance trends based on the INPO reports, (2) major contributing factors affecting the performance trends, and (3) patterns of behavior that have an impact on culture.

To achieve our objectives, we interviewed key NPG personnel including site vice presidents, plant managers, engineering directors, maintenance managers, and other site and corporate management. Additionally, we obtained and analyzed plant business plans, Quality Assurance (QA) reports, Nuclear Safety Review Board (NSRB) minutes, the nuclear operating model, Fleet Metrics book, and other relevant information related to NPG's performance and documents that identified patterns of behavior. We developed and applied a framework to evaluate certain cultural elements.

The five areas that make up the framework are Alignment, Progress, Standards, Accountability, and Attitude. Each of the five areas were given one of three ratings: very supportive, somewhat supportive, or generally unsupportive[1]. A very supportive rating would demonstrate activities and actions that illustrate a positive culture for that given element, while an unsupportive rating would show a need to improve the actions and activities related to that element. The approach used in developing this framework was discussed with the TVA management that was in charge of the culture change. As to our observations about culture within NPG, we are aware that it is a common methodology to evaluate culture using a survey instrument such as the one employed by TVA's consultants McKinsey and Company. While the OIG did not conduct a formal survey, we did identify patterns through documented third-party observations and key interviews across TVA's nuclear program that highlight how well TVA is doing. We offer this information as collateral data to McKinsey's work.

In 2011, McKinsey completed an assessment of TVA's Organizational Health Index (OHI). TVA worked with McKinsey to complete a detailed review of TVA's systems, standards, controls, and culture in order to improve TVA's effectiveness. The practices that were evaluated in the OHI were assigned a quartile based upon the utility industry. We reviewed the survey results completed by McKinsey and were unable to make a comparison between OHI results and our cultural evaluation because the questions in the OHI survey did not necessarily match what we reviewed. However, both McKinsey's and the OIG's work noted NPG has improved in some areas and that other areas still need improvement.

[1] The term "very supportive," "somewhat supportive" and "generally unsupportive" are terms of art used in the OIG matrix set out as Figure 6 on page 12.

The scope of this review included performance of TVA's NPG from fiscal year (FY) 2005-2010. This review was conducted in accordance with the "Quality Standards for Inspections."

For additional details of the work performed, see the Appendix.

FINDINGS

We assessed the performance of TVA's three nuclear generating plants individually and collectively. Overall, NPG's INPO index performance declined through 2007 and has shown improvement through 2010. Through interviews and our review of documentation, we found that outages, both planned and forced, were a major contributing factor to the changes in INPO performance. The majority of the unplanned outages appear to be a result of equipment reliability issues. Factors contributing to performance improvement include a gap-based business plan and other new initiatives, including a focus on equipment reliability, within the organization.

Our review of certain NPG cultural elements found a very supportive[2] culture as it relates to:

- Alignment – NPG has adopted a fleet mentality, educating the workforce on their role and responsibilities in the organization; however, having the workforce embrace this mentality will take time.
- Progress – Site business plans, projects, and other performance initiatives have been integrated into NPG budgets and enterprise risk assessments.

However, NPG culture was somewhat supportive or generally unsupportive in the areas of:

- Standards – Some standards and expectations are not clear or have not been clearly communicated or reinforced. However, this deficiency has been identified, and NPG is working to improve in this area.
- Accountability – A lack of accountability has been to blame for issues that have arisen at the plants, but a new focus on accountability is being driven down and throughout the organization. Specific examples of this behavior include revisions made to the Corrective Action Program (CAP) and regular accountability meetings held at each of the sites. However, there are still indications that the CAP is not fully effective, and internal assessments continue to find instances where accountability is still lacking.
- Attitude – There have been efforts to improve the attitude of NPG's workforce, such as the management at Browns Ferry working to regain the trust of its

[2] The criteria for the terms "very supportive," "somewhat supportive" and "generally unsupportive" can be found in the framework in Figure 6 on page 12.

employees. However, the lack of embracing initiatives and complacency of the workforce could hinder the organization's effectiveness.

NPG PERFORMANCE DECLINED DUE TO EQUIPMENT RELIABILITY BUT HAS SHOWN IMPROVEMENT THROUGH NEW INITIATIVES

Based on the performance of all the nuclear plants, NPG's performance declined through 2007 but has shown improvement through 2010. Even with the improvement, as of 2010, NPG has not achieved its previous 2005 INPO index. Through interviews and our review of documentation, we found that outages, both planned and forced, at the plants have been a major contributing factor to the changes in the INPO performance. The majority of the unplanned outages appear to be a result of equipment reliability issues. However, in the last 3 years, NPG's INPO performance has improved with contributing factors being a gap-based business plan and other new initiatives, including a focus on equipment reliability, within the organization.

The INPO Index is made up of performance indicators that are assessed on a monthly, quarterly, and yearly basis. The indicators that made up the index in 2010 are shown in Figure 1.

Figure 1: 2010 INPO Performance Indicators

INPO Performance Indicator	Indicator Description
Safety System Performance	Monitors the availability of 3 standby safety systems[3] at each plant.
Fuel Reliability	Monitors progress in preventing defects in the metal cladding that surrounds fuel.
Chemistry Effectiveness	Indicates progress in controlling chemical parameters to retard deterioration of key plant materials and components.
Total Industry Safety Accident Rate	Captures lost time and restricted duty injuries for the total station personnel including contractors.
Unit Capability Factor	Percentage of maximum energy generation that a plant is capable of supplying to the electrical grid.
Forced Loss Rate	Percentage of energy generation during non-outage periods that a plant is not capable of supplying to the electrical grid because of unplanned energy losses.
Collective Radiation Exposure	Monitors the effectiveness of personnel radiation exposure controls.
Unplanned Automatic SCRAMs[4] (per 7,000 hrs critical)	Tracks the mean scram (automatic shutdown) rate for 1 year (7,000 hours) of operation.

The INPO Index is a weighted combination of performance indicators. Each element is calculated based on a standard industry definition. The product of each calculation is given a weighted score with the maximum obtainable being 100 points. Many of the indicators are measured over an 18- to 24-month period; therefore, something that happened 2 years ago can still affect the current INPO Index.

The following pages present information on INPO Index performance for each of TVA's three nuclear plants—Watts Bar, Sequoyah, and Browns Ferry—and NPG as a whole.

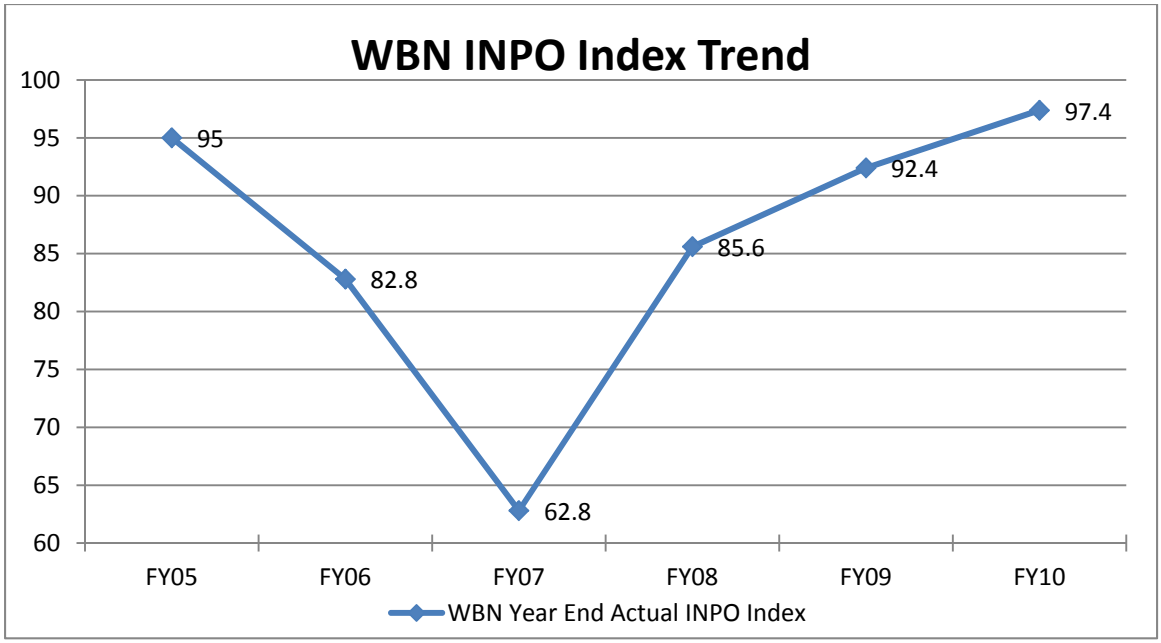
[3] The three safety systems that are monitored count as three separate indicators in the Index.

[4] SCRAM stands for safety control rod axe man. The Nuclear Regulatory Commission defines SCRAM as the sudden shutting down of a nuclear reactor, usually by rapid insertion of control rods, either automatically or manually, by the reactor operator.

Watts Bar

Watts Bar has had a positive trend with respect to the INPO index since FY 2007. However, year-to-year actual performance shown in Figure 2 varied significantly. The change between 2005 and 2007 was a 32.2 point decline.

Figure 2: Watts Bar INPO Index Performance

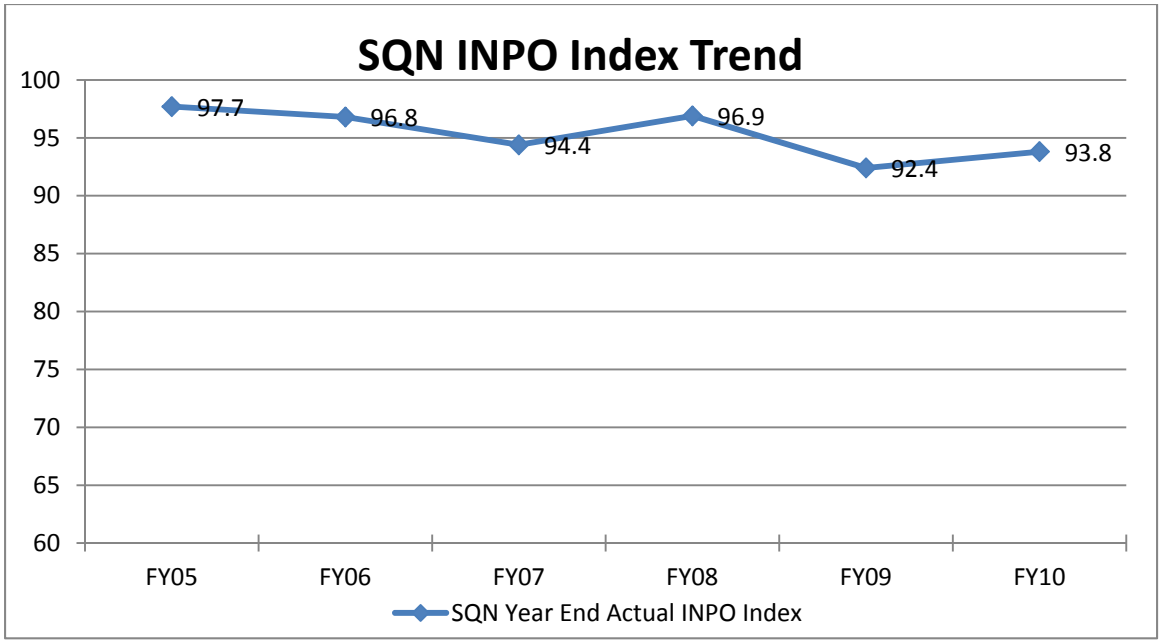


The performance indicators that led to this decline in the index were in the areas of Forced Loss Rate, Unit Capability Factor, and Collective Radiation Exposure. Watts Bar experienced two significant outages in the FY 2005 to FY 2007 time frame that affected these indicators. In 2006, a turbine rotor blade failure caused a forced outage.[5] This outage lasted for approximately 25 days. In 2007, there was a planned 80-day outage to replace a steam generator. The plant being shut down this amount of time decreased the performance in the Forced Loss Rate, Unit Capability Factor, and Collective Radiation Exposure. Although this outage was planned, it still negatively impacted the INPO performance of the plant.

[5] The root cause of the failure was determined to be operational at the high-end of approved condenser backpressure limits. To deter this from happening again, TVA has limited operation at higher backpressures.

Sequoyah
Sequoyah experienced a slightly negative trend from FY 2005 through FY 2010. Sequoyah year-end actual INPO index is shown in Figure 3. There has been a 3.9 point drop since 2005.

Figure 3: Sequoyah INPO Index Performance



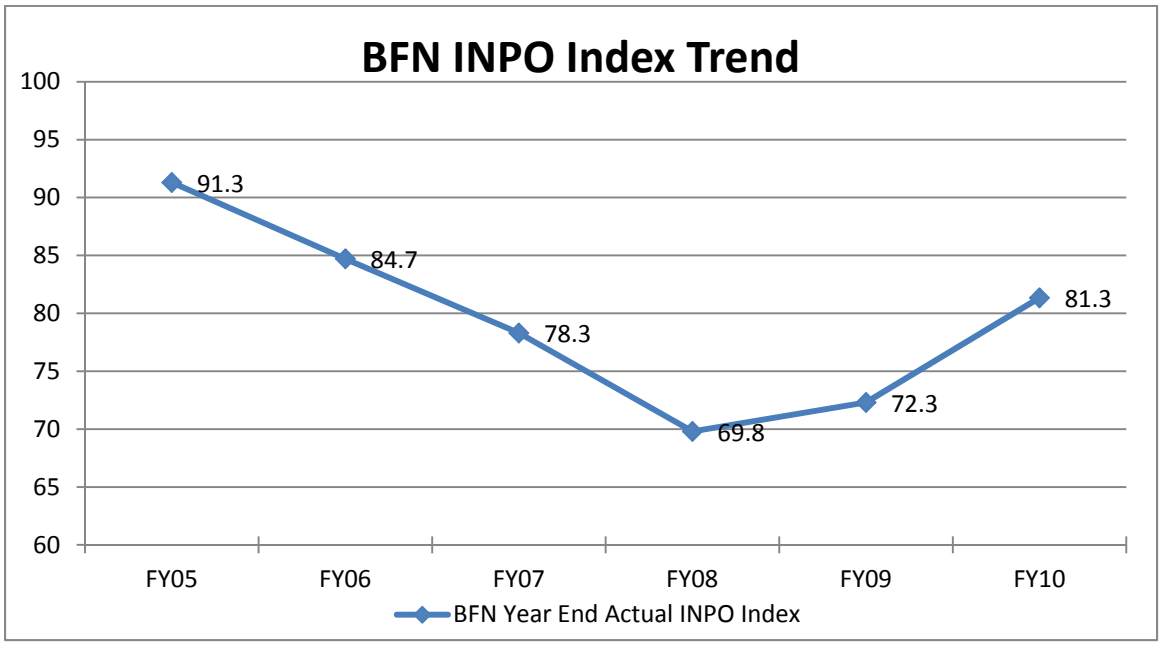
In 2007, a refueling outage contributed to the elevation of Collective Radiation Exposure. Additionally, a number of unplanned reactor Safety Control Rod Axe Man (SCRAMs) contributed to the performance decline of Unit Capability Factor. According to the most recent Sequoyah business plan, the SCRAMs were related to equipment reliability as well as human performance issues.

More recent challenges have been around the area of procedure use and adherence. During the 2010 refueling outage, the QA department identified procedural noncompliance on most jobs encountered. QA observed a direct correlation between the procedural noncompliance and a lack of line management in the field during the outage. According to the fourth quarter 2010 QA report, adherence to procedures was an “overwhelming concern” for QA during the 2010 refueling outage. Because Sequoyah’s performance has not met expectations, they have developed a site-improvement plan based on a model that uses performance monitoring to help identify gaps and to develop solutions.

Browns Ferry

Browns Ferry experienced a negative trend in the INPO index between FY 2005 and FY 2008 and has shown improvement through 2010. Figure 4 below shows Browns Ferry's year-end actual INPO index. Between FY 2005 and FY 2008, Browns Ferry experienced a 21.5 point decrease in the INPO index.

Figure 4: Browns Ferry INPO Index Performance



Performance indicators that contributed to the decline at Browns Ferry included Chemistry Effectiveness, Chemistry Performance, Collective Radiation Exposure, Emergency AC Power Unavailability, Forced Loss Rate, High Pressure Injection Unavailability, Unit Capability Factor, and Unplanned Automatic SCRAMs.

Browns Ferry experienced a number of unplanned automatic SCRAMs with the restart of Unit 1. During the first 6 months of operation, Browns Ferry Unit 1 experienced five reactor SCRAMs. The number and frequency of the SCRAMs raised many questions with the Nuclear Regulatory Commission (NRC), and the unit was added to the NRC watch list with a yellow ranking that requires additional oversight of the unit by the NRC. A previous OIG review[6] found the operating issues were due to improper installation of fittings, original plant design errors, failure to identify the correct root cause of a previous issue in a timely manner, and failure to identify a missing support during a walkdown. The SCRAMs in combination with other outages through this time frame had a significant impact on indicators such as Unplanned Automatic SCRAMs, Forced Loss Rate, Unit Capacity Factor, and Collective Radiation Exposure.

[6] Inspection 2008-11802, Review of Browns Ferry Nuclear Plant Unit 1 Operating Issues Since the Restart in May 2007.

To improve performance at Browns Ferry, in 2008 NPG initiated a Turnaround Plan. The Turnaround Plan addressed the following six focus areas: (1) Working Safe and Error Free, (2) Scheduling, Planning, and Implementing Work Efficiently, (3) Finding and Correcting Problems, (4) Fixing the Plant, (5) Leading the Organization, and (6) Staffing and Employee Development. Out of the turnaround effort, the site initiated 40 projects. Of these projects, 37 were completed as of May 2011. Of the final three projects, one has been funded and is an ongoing project, and the other two have been either funded or budgeted and are planned for completion. Based on Browns Ferry's performance increase of 9 points in 2010, the improvements made as part of the Turnaround Plan appear to have had a positive impact on the performance.

In addition to the issues with the Unit 1 restart, the NRC concluded during its routine biennial inspection in August 2007 that Browns Ferry had been "slow to effect significant improvement in equipment reliability based on the number of equipment problems and timeliness of corrective actions."

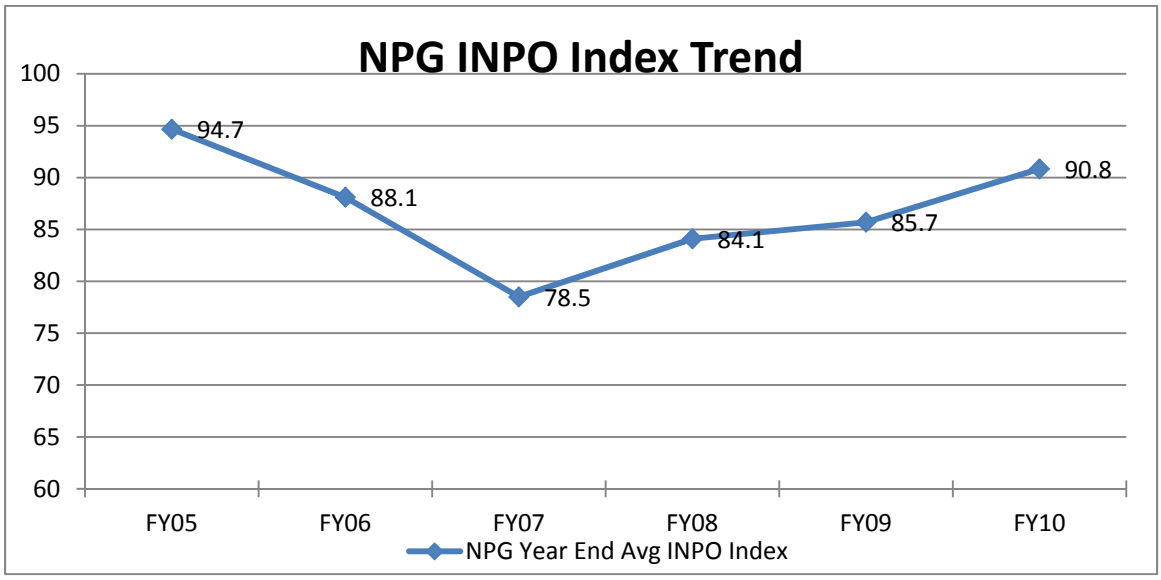
On May 10, 2011, NRC issued a "red" finding that will increase NRC oversight and inspection of Browns Ferry. This was due to a residual heat removal[7] valve failure that occurred during a refueling outage in October 2010. NPG conducted additional analysis and appealed the finding. In June 2011, the NRC denied this appeal but agreed to do further review. Upon further review, the NRC reaffirmed its denial of TVA's appeal in August 2011. This event could have impact on future performance indicators at Browns Ferry.

[7] A residual heat remover valve is one of two independent valves that are designed to help keep a reactor cool in the event of a shutdown.

NPG

Based on the performance of all the nuclear plants, NPG's performance declined through 2007 but has since shown improvement. Even with the improvement, as of 2010, NPG has not achieved its previous 2005 INPO index of 94.7. The prevailing cause being the number of plant outages, both forced and planned.

Figure 5: NPG INPO Index Performance



In the last 3 years, NPG has seen a rise in INPO performance. In 2010, NPG started to conduct gap-based business plans. The gap-based business plans include the gap analysis, initiatives, and actions to close the gaps consistent with the TVA Strategic Objectives and NPG's Focus Areas, including equipment reliability, over a 5-year period. In the 2011-2015 site business plans, NPG set a goal to be a top quartile performer by 2015. They have implemented programs such as Gaps to Excellence plans meant to raise performance. However, the current NPG culture may be hampering improvement efforts.

NPG CULTURE RESULTS

> *Culture affects everything we do and how we do it. So when performance is not up to where it should be, we examine the culture to identify the barriers and speed bumps that are getting in the way.*
> Dr. Rodger Dean Duncan[8]

Corporate culture is defined as the combined beliefs, values, ethics, procedures, and atmosphere of an organization. The culture of an organization is often expressed as "the way we do things around here" and consists of largely unspoken values, norms, and behaviors that become the natural way of doing things.[9]

Prior reviews of TVA's governance and culture have clearly established that across the company there are cultural hard spots. Since the Kingston coal ash spill in December 2008, TVA has focused on improving its culture and has experienced significant progress according to the surveys conducted by McKinsey. In 2011, McKinsey completed an assessment of TVA's Organizational Health Index (OHI). The OHI evaluated both NPG and TVA as a whole in regard to culture.[10] Due to differing methods for evaluating culture, we were unable to make a direct comparison between OHI results and our cultural evaluation. However, the OHI results, much like our cultural assessment, show the need for improvement. The OHI results for NPG show that some cultural areas have shown improvement, while other areas have lagged.

Our evaluation of cultural elements was intended to provide discrete, on-the-ground observations resulting from our work. To do our evaluation, we applied a cultural framework designed by the OIG, as seen in Figure 6. This framework was developed in response to the obvious need for the OIG to capture culture data that is presented in the course of our routine audit work but which is collateral to the primary review. The elements of culture that we reviewed were (1) Alignment, (2) Progress, (3) Standards, (4) Accountability, and (5) Attitude.

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[8] Dr. Duncan is a recognized expert in the field of change management and has extensive experience in the nuclear industry in the United States.

[9] This definition of corporate culture came from the BNET.com Business Dictionary.

[10] McKinsey has reported even better culture numbers in pulse surveys since the OHI. A pulse survey contains a subset of questions from the OHI survey and can be used to estimate or predict the OHI score.

Figure 6: Framework for Evaluating Cultural Elements

Framework for Evaluating Cultural Elements			
	Very Supportive	**Somewhat Supportive**	**Generally Unsupportive**
Alignment	• Strong organizational structure and alignment across NPG to clarify ownership and promote accountability • Site business plan aligns with NPG's focus areas which align with TVA's Strategic Plan • Standardized methods, shared benchmarking, good practices, and synchronized efficiencies are demonstrated across the fleet	• Semi-strong organizational structure and alignment across NPG to clarify ownership and promote accountability • Site business plan somewhat aligns with NPG's focus areas which somewhat align with TVA's Strategic Plan • Standardized methods, shared benchmarking, good practices, and synchronized efficiencies are generally demonstrated across the fleet	• No organizational structure and alignment across NPG to clarify ownership and promote accountability • No site business plan or the site business plan does not align with NPG's focus areas and/or TVA's Strategic Plan • Standardized methods, shared benchmarking, good practices, and synchronized efficiencies are not demonstrated across the fleet
Progress	• Initiatives and programs have been put in place to address recommendations from internal and external assessments • Site business plans, projects, and other performance initiatives have been integrated into NPG budgets and enterprise risk assessments • Structured approach to identifying opportunities for improvement	• Consideration is given to recommendations from internal and external assessments • Site business plans, projects, and other performance initiatives have been somewhat integrated into NPG budgets and enterprise risk assessments • Identify opportunities for improvement by chance	• Recommendations from internal and external assessments are ignored • Site business plans, projects, and other performance initiatives have not been integrated into NPG budgets and enterprise risk assessments • Does not identify opportunities for improvement
Standards	• Clear standards of performance exist • Standards well understood by the workforce • Standards are recognized and reinforced by management	• Clear standards of performance generally exist with some exceptions • Standards generally understood by the workforce, with some exceptions • Standards are generally recognized and reinforced by management	• Clear standards of performance generally do not exist • Standards not well understood by the workforce • Standards are not recognized or reinforced by management

Figure 6: Framework for Evaluating Cultural Elements, continued

Framework for Evaluating Cultural Elements			
	Very Supportive	**Somewhat Supportive**	**Generally Unsupportive**
Accountability	• The site has an effective Corrective Action Program (CAP) that is being utilized • Areas of responsibility have been adequately assigned • There are consequences for poor performance	• The site has a somewhat effective CAP that is being utilized • Areas of responsibility have been somewhat assigned • There are few consequences for poor performance	• The site has an ineffective CAP, and/or the program is not being utilized effectively • Areas of responsibility have not been adequately assigned • There are no consequences for poor performance
Attitude	• There is a trusting relationship between all levels of the workforce • There is a strong desire among the workforce to achieve excellence • The workforce embraces initiatives and elements of the organization's culture	• There is a somewhat trusting relationship between all levels of the workforce • There is a limited desire among the workforce to achieve excellence • The workforce somewhat embraces initiatives and elements of the organization's culture	• There is not a trusting relationship between all levels of the workforce • There is a sense of complacency among the workforce as it relates to achieving excellence • The workforce does not embrace initiatives and elements of the organizations culture

We interviewed management at the plants and reviewed documentation such as business plans, internal and external assessments, and meeting minutes. While each plant is unique with respect to operations, we found the cultural elements to be similar throughout the NPG organization. NPG has a strong, supportive culture as it relates to alignment and progress. However, based on our review, the culture surrounding standards, accountability, and attitude ranged from somewhat supportive to unsupportive. Although all elements of culture that were considered in this review were showing signs of improvement, there were opportunities for continued growth in each of the areas.

Alignment

During our review, we found NPG to have a very supportive culture as it relates to alignment. In 2009, the Chief Nuclear Officer expressed a need for a fleet focus. Initiatives taken to achieve a fleet focus included the NPG Operating Model and business plans. According to the Nuclear Operating Model, the NPG fleet focus areas include: Talent Management and Alignment, Equipment Reliability, Work Management and Outage Execution, Training, Governance and Oversight. In order to achieve alignment, the Fleet Focus areas were matched with the TVA Strategic Objectives as seen in Figure 7. NPG's focus areas aligned with four of TVA's five Strategic Objectives. The fifth objective concentrates on TVA's customers, with focus areas such as maintaining power reliability, providing competitive rates, and building trust with TVA's customers.

Figure 7: Alignment of Focus Areas

TVA Strategic Objective	NPG Focus Area
People: Build pride in TVA's performance and reputation.	• Talent Management and Alignment • Training
Financial: Adhere to a set of sound guiding financial principles to improve TVA's fiscal performance.	• Work Management and Outage Execution
Assets: Use TVA's assets to meet market demand and deliver public value.	• Equipment Reliability and Work Management
Operations: Improve performance to be recognized as an industry leader.	• Governance and Oversight

Strong organizational structure and alignment help to clarify ownership and promote accountability within an organization. The Nuclear Operating Model states:

> Alignment is doing business such that there are standardized methods, shared benchmarking, good practices, and synchronized efficiencies across the fleet. It means we run our nuclear plants as one team and one fleet and capitalize on the synergies that give the NPG a true business advantage over our competitors. It means the 'whole is greater than the sum of all the parts.'

In conjunction with the fleet mentality NPG has adopted, the nuclear sites have been communicating, challenging, and benchmarking one another. In addition, NPG is using business plans as a tool to align individual department goals with corporate strategy that focuses on key success factors. While NPG is in the process of incorporating a fleet mentality, educating the workforce on their role and their responsibilities in the organization, and having the workforce embrace this mentality, will take time.

The NPG is using their business plans as a tool to align individual department goals with corporate strategy that focuses on key success factors. This focus on the NPG rather than the individual plants has led to the plants challenging each other more, the standardization of processes, and organizational alignment throughout the organization. The business plan defines the gaps and identifies the detailed initiatives to implement NPG's five focus areas and provide a clear line of site from the individual level to the site, to the fleet, and to the company.

A member of TVA management considered reluctance from the workforce as a challenge to getting to the fleet focus mentality. Specifically, the natural desire is to want their team to be the best. The management team has had to help people understand that what is best for the fleet is best for all. Our review found that cross-fleet collaboration is getting better as managers are talking to other site managers and sites are using each other with which to compare and benchmark.

However, NPG management also expressed an opinion that TVA is far behind private industry in enabling all levels of the workforce to make decisions. The Nuclear Safety Review Board (NSRB)[11] observed at Browns Ferry in 2009 that, "in general, operators, craft workers, and first-line supervisors have not been asked to participate in the spirit and structure of the recovery process." According to the NSRB minutes, "The NSRB suggested that management should undertake efforts to engage these levels of station organization into the implementation of the improvement plans."

Alignment was rated as having a very supportive culture because TVA's NPG emphasizes a "One Team, One Fleet, One TVA" focus, NPG business plans align with TVA's strategic plan, and sites are communicating and benchmarking with one another.

Progress

Identifying opportunities for improvement and taking strides to enhance the organization are crucial components of an organization's culture. TVA's NPG has a very supportive culture as it relates to progress. Site business plans, projects, and other performance initiatives have been integrated into nuclear budgets and enterprise risk assessments to improve performance fleet-wide.

In 2010, NPG began using gap-based business plans to achieve their goals. According to the NPG business plan, the gap-based business plan for FYs 2011-2015 is based on thorough analysis and aggressive targets. NPG also created a spending plan linked to initiatives to close those gaps.

According to interviews, in the past, TVA's NPG had a reactionary culture when it came to fixing equipment issues that was so strong that it would erode programs that supported a proactive approach. However, TVA is now trying to close the gap in Equipment Reliability. In August 2010, in a presentation to TVA's Enterprise Risk Council, Long-Term Equipment Reliability was classified as having both a high likelihood of occurrence and severity. In addition, external assessments have identified equipment issues as a concern. NPG has projects funded/scheduled through FY 2015 to address these risks. Projects include (1) equipment upgrades, (2) replacement of obsolete equipment, and (3) design changes. In addition, the NPG 2011-2015 Business Plan has identified Equipment Reliability as a fleet focus area and has associated metrics to track performance.

TVA's NPG continues to progress through programs and processes such as the Corrective Action Review Board which provides a challenging management oversight environment and Integrated Trend Reports, which rolls up each department's CAP, INPO, and NRC issues, and identifies the top issue in each department, the action owner, and a remediation plan.

[11] The Nuclear Safety Review Board is an independent committee which provides senior-level oversight of TVA's nuclear program with respect to nuclear safety. The NSRB advises the Chief Nuclear Officer on the adequacy and implementation of NPG's nuclear safety policies and programs, and evaluates these policies and programs for compliance with regulatory activities.

Progress was rated as having a very supportive culture because initiatives, such as gap-based business plans, provide a structured approach to identifying opportunities for improvement and addressing recommendations from internal and external assessments, and resources have been allocated to those initiatives.

Standards

Establishing clear standards and ensuring those standards are understood and reinforced are important aspects of an organization's culture. TVA's Nuclear Operating Model defines standards for NPG that relate to human performance and accountability. NPG has a generally unsupportive culture as it relates to standards. During our assessment, we found that some standards and expectations are not clear or have not been clearly communicated or reinforced, which could lead to the standards at the nuclear plants being ineffective. However, this deficiency has been identified, and NPG is working to improve in this area. The NPG Operating Model defines the common policies, processes, and procedures that NPG views as essential for success.

Following the Kingston ash spill in 2008, TVA's Board of Directors hired the firm of McKenna Long and Aldridge LLP to, among other things, prepare a factual report on the Kingston spill. McKenna Long and Aldridge LLP found that "TVA's Byproduct Facilities operated pursuant to decades of lore, without formalized standards or procedures. As a result, Management could not effectively monitor the employees' activities pursuant to acceptable performance standards." Granted this example is outside NPG but illustrates the historical legacy issue of resistance to uniform standards.

Interviews and external assessments stated that NPG standards and processes lag the industry in some respects. Specific areas that were identified included human performance, work management, and the CAP.

In recent years, the NSRB has identified several issues related to standards. In 2009, the NSRB noted Sequoyah management has not adequately communicated nor rigorously enforced high performance standards in the workforce. There were also reports of managers circumventing procedural directions. In addition, the NSRB expressed a need to establish and enforce high standards at Browns Ferry. Specific instances were cited in which management disregarded station rules, such as, maintenance was performed without clearance when it was required, and a supervisor authorized the work to proceed in disregard of station rules. In another instance, at the end of 2010, the NSRB noted an instance at Watts Bar in which an operator did not follow a procedure, and the manager did not follow-up to ensure the crew was performing in accordance with standards and expectations. In addition, the corresponding Problem Evaluation Report (PER)[12] was closed without addressing any of the human performance errors.

[12] As part of the CAP process, PERs are used to document deficiencies and conditions adverse to quality.

As part of NPG's fleet focus on Governance and Oversight, NPG plans to (1) move the organization from being a reference and support source to fulfilling the role of providing oversight and setting standards for excellence and (2) establish common standards, processes, and programs across the fleet. At the site level, Watts Bar in its handbook acknowledges that some standards and expectations are not clear or have not been clearly communicated and reinforced, which has led to a lack of understanding, buy-in, and engagement. Therefore, they have set a goal to "effectively communicate and reinforce standards and expectations to establish the right picture of excellence..." In addition, Sequoyah has set an initiative to "continue to reinforce expectations and standards for procedure use and adherence in training" to achieve operational excellence. In summary, NPG's culture surrounding standards was rated as being generally unsupportive. This rating is due to management not adequately communicating or reinforcing standards, which has led to the workforce's lack of understanding of those standards. Additionally, programs and procedures are perceived by some to be lagging the industry.

Accountability

Assigning responsibility and establishing consequences are two of the key factors in an accountable culture. In addition, an effective CAP can assist with the assigning of responsibility and the tracking of progress. While NPG is taking strides to make accountability a priority, it still has a somewhat supportive accountability culture. Although a lack of accountability has been to blame for issues that have arisen at the plants, a new focus on accountability is being driven down and throughout the organization. Examples of initiatives that would improve accountability include revisions made to the CAP and regular accountability meetings held at each of the sites. However, there are indications that the CAP is not fully effective. In addition, internal assessments continue to find instances where accountability is still lacking.

Accountability is a core value for TVA and has become a focal point for NPG. The behaviors identified in the Nuclear Power Group Operating Model restate TVA's expectations of accountability in the workplace:

- We are serious about safety.
- We work on the right things.
- We are accountable for results.
- We follow the rules.
- We use TVA resources wisely.

In addition, the Nuclear Power Group Operating Model contains NPG's commitment to:

- Take responsibility for assigned tasks and the performance of the work group, station, NPG, and TVA.
- Surface and resolve problems and conflicts professionally.
- Initiate a proactive recovery when appropriate by monitoring progress and not waiting for disappointing results.
- Focus on ownership versus blaming when encountering setbacks.
- Demonstrate a can-do attitude by taking initiative.

The Corrective Action Program (CAP) establishes processes and responsibilities for documenting and resolving problems, including conditions adverse to quality and significant conditions adverse to quality. In 2009, NPG had an external assessment of its CAP. The assessment, and an interview, identified a lack of management involvement and engagement in the CAP. In addition, during one interview, the CAP was described as being used as a production activity rather than a quality activity to improve performance. Some departments within NPG appear to be making the CAP a priority while, according to the NSRB, other departments' CAPs remain stagnant or are declining. Using the metrics established to gauge the effectiveness of the CAP to improve the program may also encourage employees to use the program if they know it is effective.

The NSRB minutes we reviewed stated that Watts Bar personnel were not always issuing PERs when a PER was warranted. We also identified through our review of the A Level[13] PERs for all of the nuclear sites that Watts Bar had a much lower number of A Level PERs for the 2-year period between August 2008 and August 2010 when compared to the other sites. For the time period we reviewed, Watts Bar had roughly one-fifth the number of PERs that the other nuclear sites had for a similar time period.

Interviews at the plants indicated that, in the past, a lack of accountability has contributed to program and process issues. Strides have been taken to improve accountability, such as accountability meetings now being held regularly at the plants. In addition, as part of Browns Ferry's Business Plan, the initiatives to close gaps in performance are each assigned to an individual who is responsible for its successful completion, due date, budgeting/cost management, and achievement of the expected improvement.

Although efforts are being made to improve accountability, during our review of site quarterly QA reports, we have found that initiatives have been ineffective and accountability is still lacking. For example, the FY 2011 Watts Bar first quarter

[13] A PER is classified as an A Level when there is a significant condition adverse to quality and root cause analysis and recurrence control actions are required.

QA Report states, “There is a lack of accountability, inconsistent supervisory engagement, and no clear site owner or champion responsible for overall risk management.” Also, FY 2011 Sequoyah first quarter QA Report states, “Plant personnel fail to use basic human error reduction tools and accountability measures are ineffective.”

Considering that both the CAP and NPG’s accountability efforts have not been fully effective, NPG’s accountability culture was rated somewhat supportive.

Attitude

Trusting the organization, embracing initiatives, and striving for excellence are key attributes of an organization’s attitude. In an assessment of TVA issued in 2009 prompted by the Kingston Ash Spill, McKenna Long and Aldridge LLP found that TVA’s history has demonstrated that the company can be resistant to the implementation of new directives and that progress in one area can be eroded by the legacy culture still existing in other parts of the enterprise. We found that NPG has a somewhat supportive culture as it relates to attitude. NPG management is taking steps to rebuild trust. However, the lack of embracing initiatives and complacency of the workforce could hinder the organization’s effectiveness.

At Browns Ferry in particular, new management has taken strides to improve the attitude of its workforce. According to the site vice president, prior to the restart of Unit 1, Browns Ferry was considered by many to be benchmarkable for industry-best practices. The site vice president went on to say that the issues with the restart of Unit 1 damaged relationships, and management lost the trust of its workforce. After multiple management changes, Browns Ferry is finally moving toward reestablishing the trust that was lost. They are doing this by listening to the workforce and acting on their concerns. Browns Ferry management recognizes that if they are not persistent with the new culture implementation, the workforce could fall back into the old one.

In other sections of this report, we have highlighted the lack of embracing initiatives that we found during this review. For example, in the accountability section above, although accountability is both a core value of TVA and a focal point of NPG, issues remain with respect to accountability. In addition, the CAP that should be used as a quality control is still viewed by many as a production activity.

A questioning attitude is one of TVA’s principles for a strong nuclear safety culture that is outlined in TVA’s Commitment to Nuclear Safety. TVA defined a questioning attitude as challenging assumptions, investigating anomalies, and considering potential adverse consequences of planned action. However, there are indicators of complacency within NPG. There is a belief by some that people have become “comfortable” in their jobs and are not interested in change. In addition, the leadership at Sequoyah has been described as having a “palpable lack of intensity and urgency” by the NSRB. The possible effects of this attitude

were highlighted by a human performance error on June 28, 2010, at Browns Ferry Unit 3. The condition that resulted from human performance errors was identified by a trainee with a questioning attitude; however, the situation might have been avoided had others been paying attention to the developing circumstances. The NSRB stated:

> The absence of a risk review, poor scheduling, improper communication, and the lack of coordination within Operations resulted in the plant entering a 12-hour [Limiting Condition for Operation] [14] LCO shutdown statement. The event was professionally embarrassing and nearly required management to retire one or both units involved in the event.

The attitude aspect of NPG culture was rated somewhat supportive due to a sense of complacency and a lack of embracing initiatives.

RECOMMENDATIONS

We recommend the Chief Nuclear Officer:

- Increase the focus on standards within the organization by (1) evaluating adequacy of standards as compared to industry, (2) clarifying the expectations and standards that everyone should follow, and (3) reinforcing those standards throughout the organization.
- Continue to promote the fleet mentality throughout the organization and consider input from the workforce when making decisions that would directly affect their work.
- Continue efforts to be proactive in identifying opportunities that would enhance the organization.
- Work to build relationships and trust throughout NPG, which would encourage the workforce to embrace new initiatives, foster a fleet mentality, and increase their drive to perform.
- Implement actions to improve the CAP to increase the workforce's reliance on the program.

TVA management was provided a draft of this report for review. They did not have any comments on the report.

[14] The section of Technical Specification that identifies the lowest functional capability or performance level of equipment required for safe operation of the facility.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our review were to identify (1) performance trends based on the Institute of Nuclear Power Operations (INPO) reports, (2) major contributing factors affecting the performance trends, and (3) patterns of behavior that have an impact on culture. To achieve our objectives, we:

- Reviewed Nuclear Power Group (NPG) performance information to assess key performance indicators and determine trends.
- Reviewed documentation to determine if causes of the downward trends have been identified or tracked.
- Reviewed NPG and site-specific documentation to determine if plans have been developed and implemented to address downward trends in performance.
- Applied a framework to evaluate certain cultural elements.
- Reviewed site documentation and internal and external assessments to assess cultural elements of NPG.
- Interviewed NPG personnel to (1) determine the cause of any downward trends found, (2) identify any remediation efforts in place, and (3) discuss past and present corporate culture.

The scope of this review included performance of the Tennessee Valley Authority's NPG from fiscal year 2005-2010. This review was conducted in accordance with the "Quality Standards for Inspections."