



Memorandum from the Office of the Inspector General

September 25, 2014

Christopher R. Church, LP 3R-C

REQUEST FOR MANAGEMENT DECISION – EVALUATION 2014-15056 – REVIEW OF
TVA'S NUCLEAR GROUNDWATER PROTECTION PROGRAM

Attached is the subject final report for your review and management decision. You are responsible for determining the necessary actions to take in response to our findings. Please advise us of your management decision within 60 days from 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 that you recommend be withheld.

If you have any questions or wish to discuss our findings, please contact Heather R. Kulisek, Manager, Evaluations, at (423) 785-4815 or Gregory R. Stinson, Director, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the audit.

Robert E. Martin

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

HRK:FAJ
Attachment
cc (Attachment):

William D. Johnson, WT 7B-K
Dwain K. Lanier, MR 3K-C
Justin C. Maierhofer, WT 7B-K
Richard W. Moore, ET 4C-K
R. Windle Morgan, WT 4D-K
Ricardo G. Perez, LP 3R-C
Robert E. Richie Jr., BR 3C-C
John W. Underwood, BR 3C-C
TVA Board of Directors
OIG File No. 2014-15056



Office of the Inspector General

Evaluation Report

To the Vice President,
Operations Support

REVIEW OF TVA'S NUCLEAR GROUNDWATER PROTECTION PROGRAM

Audit Team
Heather R. Kulisek
Meghan H. Petty

Evaluation 2014-15056
September 25, 2014

ABBREVIATIONS

ANI	American Nuclear Insurers
CY	Calendar Year
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
GPI	Groundwater Protection Initiative
GWPP	Groundwater Protection Program
NEI	Nuclear Energy Institute
NPG	Nuclear Power Group
NRC	Nuclear Regulatory Commission
OIG	Office of the Inspector General
PER	Problem Evaluation Report
REMP	Radiological Environmental Monitoring Program
SPP	Standard Programs and Processes
TVA	Tennessee Valley Authority

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Evaluation 2014-15056 – Review of TVA’s Nuclear Groundwater Protection Program

EXECUTIVE SUMMARY

Why the OIG Did This Evaluation

Based on the findings of our previous review, 2009-12991–TVA’s Groundwater Monitoring at Coal Combustion Products Disposal Areas, we evaluated the Tennessee Valley Authority’s (TVA) Nuclear Power Group (NPG) Groundwater Protection Program (GWPP). Groundwater contamination can result from routine nuclear plant activities such as wet storage of spent fuel, leaks from liquid waste pipelines and tanks, and leaks of contaminated cooling water. NPG’s GWPP was designed to prevent, detect, and mitigate impacts associated with potential subsurface and/or groundwater contamination. The objectives of our review were to determine if NPG’s GWPP (1) performed required monitoring and reporting and (2) completed required corrective actions based on monitoring results.

What the OIG Found

While NPG’s GWPP performed required reporting, we could not verify the monitoring requirements in TVA’s NPG Standard Programs and Processes were followed. Our review also found corrective actions were taken to address the leaks and spills at TVA’s nuclear plants reported to the NRC for the time frame of our review. However, we found opportunities for programmatic improvements. There were instances where programmatic weaknesses were identified several times over the last 5 years and were not remedied. External assessments also noted deficiencies in the program that were downgraded or excluded when NPG performed its fleet self-assessment. In addition, there is not a formal process in place to ensure recommendations and/or action items made by external consultants are addressed.

What the OIG Recommends

We recommend the Vice President, Functional Area and Outage Governance:

- Develop and implement a process that includes:
 1. Appropriately classifying and addressing recommendations and/or action items identified in external assessments.
 2. Requiring documentation of deviations from recommendations to correct deficiencies identified by external assessments.



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EXECUTIVE SUMMARY

3. Capturing outstanding site and fleet deficiencies within periodic fleet self-assessments.
 - Require sites to revisit outstanding programmatic weaknesses to develop a remediation plan and establish a time frame for completion; if no action is planned, document the reasons.
 - Incorporate the Senior Manager, Chemistry Oversight, in the remediation efforts for deficiencies identified by external consultants and industry groups to ensure issues are appropriately addressed, lessons learned and best practices are shared among NPG sites, and implemented at a fleet level when needed.

TVA Management’s Comments

TVA management agreed with the findings and recommendations and provided various contextual and clarifying comments, which we evaluated and incorporated into the final report as appropriate.

Auditor’s Response

The OIG (Office of the Inspector General) concurs with TVA management’s response.

BACKGROUND

Groundwater contamination can result from routine nuclear plant activities such as wet storage of spent fuel, leaks from liquid waste pipelines and tanks, and leaks of contaminated cooling water. Radionuclides¹ of concern for groundwater impacts are typically Strontium 89/90, Cobalt 60, Radiocaesium, and Tritium. After a radioactive spill or leak, Tritium is generally the first radionuclide to be identified in groundwater because Tritium is chemically bound and travels with water.

The Safe Drinking Water Act, administered by the United States Environmental Protection Agency (EPA), sets limits to public exposure to contaminants in drinking water. EPA regulations establish maximum permissible levels of contaminants in water delivered by a public water system. According to the Nuclear Regulatory Commission (NRC), while leaks and spills involving Tritium have occurred at many commercial power reactors in the United States, no drinking water supply has exceeded the allowable level for Tritium specified in EPA's Safe Drinking Water Act.

Nuclear plants are required by the NRC operating licenses to implement a program for controlling and monitoring the potential impact of radioactive effluents² on the environment through the radiological environmental monitoring program (REMP). REMP requires sampling of environmental pathways including waterborne pathways at required intervals and annual reporting.³ Reporting levels for radioactivity concentrations in environmental samples are specified in REMP and include reporting levels for Tritium in water consistent with the EPA maximum permissible levels. If the reporting levels specified in REMP are exceeded, the licensee is required to prepare and submit a report to the NRC that identifies the problem and defines its corrective actions.

In response to groundwater contamination events and public concern for such events, United States commercial nuclear power plants signed a voluntary agreement in 2006 to adhere to higher standards for groundwater monitoring than NRC regulations require. The Nuclear Energy Institute (NEI) collaborated with nuclear industry professionals to develop the Groundwater Protection Initiative (GPI), NEI 07-07. According to NEI, GPI helps licensees to improve the (1) management of situations involving inadvertent radiological releases that get into groundwater and (2) communication with external stakeholders to enhance

¹ Radionuclides are atoms with unstable nuclei that emit gamma rays and/or subatomic particles such as alpha or beta particles when they decay. These emissions constitute radiation and can pose a danger to health. Radionuclides occur naturally and can be artificially produced.

² Radioactive materials are produced during normal reactor operations and released into the environment in liquid and gas forms (effluents). Nuclear plants are required to design equipment to keep levels of radioactive materials released as low as reasonably achievable and to monitor the amount of effluents released.

³ Each site submits Annual Radiological Environmental Operating Reports and Annual Radioactive Effluent Release Reports to the NRC to summarize REMP program activities, provide results from monitoring samples, and document deviations from planned effluent releases to the environment.

trust and confidence on the part of local communities, states, the NRC, and the public in the nuclear industry's commitment to a high standard of public radiation safety and protection of the environment. The GPI also requires plants to set time frames for risk assessments, hydrology reviews, and well monitoring reviews.

The Tennessee Valley Authority's (TVA) NPG Standard Programs and Processes (SPP) define the essential elements of the Groundwater Protection Program (GWPP) in NPG-SPP-05.15, Fleet Groundwater Protection Program. The manner in which to address and informally communicate radioactive spill and leak events to outside agencies is described in NPG-SPP-05.14, Guide for Communicating Inadvertent Radiological Spills/Leaks to Outside Agencies. The primary elements of the GWPP are prevention, early detection, and mitigation of impacts associated with potential subsurface and/or groundwater contamination. Unmonitored spills or leaks from a source containing radioactive materials that exceed 100 gallons (or are likely to exceed 100 gallons) and have the potential to enter groundwater, or a confirmed result of an off-site groundwater or surface water sample that exceeds reporting levels as part of the REMP program, are required to be reported using this procedure.

OBJECTIVE, SCOPE, AND METHODOLOGY

Based on the findings of our previous review, 2009-12991 – TVA's Groundwater Monitoring at Coal Combustion Products Disposal Areas,⁴ we evaluated the Nuclear Power Group's (NPG) GWPP. The objectives of our review were to determine if NPG's GWPP (1) performed required monitoring and reporting, and (2) completed required corrective actions based on monitoring results. The scope of our review for groundwater monitoring results included Calendar Year (CY) 2012 and CY2013. Due to the infrequency of events, the scope was expanded to include CY2009 through CY2013 for corrective actions related to spills and leaks and our review of industry assessments.

To achieve our objectives, we interviewed key TVA personnel for groundwater monitoring at TVA corporate and nuclear sites to:

- Determine TVA's processes and procedures for monitoring groundwater.
- Clarify details related to the fleet self-assessment completed by TVA's NPG.
- Identify opportunities for program improvement.

⁴ The objectives of this review were to determine whether TVA has (1) performed groundwater monitoring as prescribed by the permits and (2) found levels of constituents monitored that exceeded regulatory limits and, if so, implemented any required corrective actions. During our review, we found that in some instances, TVA was not performing monitoring as prescribed by the permits. Additionally, exceedances were found at eight of the nine fossil plants where monitoring is being conducted. TVA has two plants in Tennessee (Cumberland and Gallatin Fossil Plants) that have constituents that exceeded health-based limits and are working through the corrective action process described in Tennessee Rule 1200-1-7.

In addition, we reviewed:

- Regulations, industry guidance, and SPPs to determine monitoring and reporting requirements.
- Well testing results for the most recent 2 years to determine whether required monitoring was performed as required.
- Decommissioning files and annual reports submitted to the NRC to identify spills and leaks occurring within the past 5 years.
- Problem Evaluation Reports (PERs) related to spills and leaks to determine whether required corrective actions were completed.
- 2013 Groundwater Fleet Self-Assessment to identify planned improvements.
- Prior assessments of groundwater protection by American Nuclear Insurers (ANI), Electric Power Research Institute (EPRI), NEI, and external consultants to determine if recommendations and/or action items were addressed.

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

While NPG's GWPP performed required reporting, we could not verify all the monitoring requirements in TVA's NPG SPPs were followed. Our review also found corrective actions were taken to address the leaks and spills at TVA's nuclear plants reported to the NRC for the time frame of our review. However, we found opportunities for programmatic improvements. There were instances where programmatic weaknesses were identified several times over the last 5 years and were not remedied. External assessments also noted deficiencies in the program that were downgraded or excluded when NPG performed its fleet self-assessment. In addition, there is not a formal process in place to ensure recommendations and/or action items made by external consultants are addressed.

WHILE NPG PERFORMED REQUIRED REPORTING, WE COULD NOT VERIFY ALL THE MONITORING WAS COMPLETED

Our review of documentation found that NPG's GWPP was following the reporting monitoring requirements prescribed in NPG-SPP-05.14, Guide for Communicating Inadvertent Radiological Spills/Leaks to Outside Agencies ; however, we could not verify that the monitoring requirements in NPG-SPP-05.15, Fleet Ground Water Protection Program were followed. Specifically,

Browns Ferry Nuclear Plant could not provide the data for CY2012 testing results for the testing done on hard-to-detect radionuclides.⁵

Between CY2009 and CY2013, there were two reportable exceedances. Sequoyah Nuclear Plant exceeded on-site reporting levels for Tritium in much of 2013 from a previously identified leakage. In addition, a Tritium leak at Browns Ferry was identified in 2010. In both instances, the exceedance was properly reported according to TVA's SPP to communicate to the NRC through an event notification report and Tritium levels were reported in subsequent annual reports to the NRC. Public notification was also provided as TVA procedures require.

TVA's NPG-SPP-05.15, Fleet Ground Water Protection Program, requires sites to establish a groundwater sampling schedule for radionuclides and provides guidance on sampling frequency and radionuclides to be included in site-level procedures. The site-level procedures establish testing schedules for Tritium and other radionuclides in monitoring wells. Based on the monitoring results we reviewed for CY2012 through CY2013, all of the sites performed the Tritium testing required in site procedures.

Site procedures also require the wells with the highest Tritium concentration (and those that have met other criteria) should be sampled for hard-to-detect radionuclides. Browns Ferry was unable to provide us the CY2012 testing results for hard-to-detect radionuclides; therefore, we could not confirm all of the testing for hard-to-detect radionuclides had been completed. Specifically, the well with the highest Tritium concentration should have been tested for hard-to-detect radionuclides at least once in CY2012. In addition, two other wells, which met the criteria for an increase in the Tritium concentration of 50 percent or more, should also have been tested for hard-to-detect radionuclides in CY2012.

NUCLEAR POWER GROUP'S GROUNDWATER PROTECTION PROGRAM TOOK CORRECTIVE ACTION FOR LEAKS AND SPILLS

Our review also found corrective actions were taken to address the leaks and spills at TVA's nuclear plants reported to the NRC for the time frame of our review. Leaks and spills are inadvertent releases of liquid effluents into the environment. We reviewed annual reports to the NRC to identify leaks and spills reported between CY2009 and CY2013. We identified 9 leaks and spills with radioactive activity at TVA nuclear plants—3 at Browns Ferry, 3 at Sequoyah, and 3 at Watts Bar Nuclear Plant. For each leak or spill, we identified and reviewed pertinent PERs to ascertain whether there were planned corrective actions to remedy the leak or spill. We found planned actions were complete for all the PERs we reviewed.

⁵ Hard-to-detect radionuclides include Strontium-89, Strontium-90, Iron-5, Nickel-63 and Gross Alpha.

NUCLEAR POWER GROUP'S GROUNDWATER PROTECTION PROGRAM HAS OUTSTANDING PROGRAMMATIC WEAKNESSES

Our review of prior assessments of the NPG's GWPP by ANI, EPRI, NEI, and external consultants found fleet and site-level deficiencies that are unaddressed. We identified six programmatic weaknesses that were identified in multiple reports between 2009 and 2013 (see Appendix A for more detail about the deficiencies). For the purposes of this review, we considered programmatic weaknesses to be those issues that impacted two or more sites and remained outstanding for at least one site in the most recent year for which reports were available. Outstanding recommendations and deficiencies affect not only TVA's compliance with GPI but also indicate indifference toward improving the program.

- *Longstanding Issues at Multiple Sites* – Two programmatic weaknesses were present at two sites for a number of years. The Assess Storm Drain Integrity recommendation identified in 2009 at Watts Bar and Sequoyah remains pending at Watts Bar. The deficiency was closed in 2012 at Sequoyah. The Evaluation of the Potential for Unplanned and Unmonitored Releases Off-Site recommendation remains in open or pending status at Sequoyah and Watts Bar and was identified in 2008 and 2009, respectively.
- *Recommendations and Deficiencies Identified at One Site That Appears at Another* – We found three programmatic weaknesses where a recommendation or deficiency was remedied at a NPG site and, subsequently or simultaneously, a similar recommendation or deficiency was identified at another NPG site. Specifically the recommendations and deficiencies were related to:
 - Surface Water Testing for Hard-to-Detect Radionuclides.
 - Approval and Implementation of Hydrology Reports.
 - Characterization of Tritium plumes.
- *An Outstanding Deficiency at All NPG Sites* – A deficiency, Evaluate the Potential for Detectable Levels of Radioactive Materials from Planned Releases of Liquids/Airborne Materials, was identified by three industry groups (NEI, an external consultant, and EPRI) over the course of the 5-year period we reviewed. Currently, the deficiency remains outstanding. It was included in the 2013 Fleet Self-Assessment as a learning opportunity.

The 2013 EPRI Assessment at Watts Bar observed: “Currently there is limited communications between the TVA plants about groundwater protection. Sharing of lessons learned, experiences, best practices, procedures, technologies may be beneficial to the groundwater protection programs at all TVA sites.” Better communication among NPG sites and with the Senior Manager, Chemistry Oversight, could reduce the risk of having similar recurrent findings from external assessments and assist sites in remedying outstanding recommendations and deficiencies.

NUCLEAR POWER GROUP OMITTED AND DOWNGRADED FINDINGS FROM THE ELECTRIC POWER RESEARCH INSTITUTE IN ITS FLEET SELF-ASSESSMENT

We found that TVA's NPG has planned actions to improve the effectiveness of the NPG's GWPP based on a fleet self-assessment; however, several of the deficiencies identified by an EPRI assessment were excluded or downgraded in the fleet self-assessment. EPRI conducted an assessment of Watts Bar's compliance with GPI in 2013. Based on EPRI's assessment at Watts Bar, NPG conducted a fleet self-assessment in 2013 in order to identify areas for improvement to the GWPP. The omission and downgrading of findings from industry experts increases the risk of noncompliance with the requirements of the GPI.

Self-assessments within TVA's NPG are designed to identify deficiencies (compliance weaknesses, failures to meet policy or regulatory requirements, and unacceptable performance) as well as learning opportunities. Learning opportunities are recognized practices that should be evaluated for adoption at TVA. The groundwater fleet self-assessment focused on compliance with GPI and alignment with industry guidance from EPRI.⁶ We reviewed TVA's actions to remedy the deficiencies and learning opportunities from the fleet self-assessment. We determined actions were being taken to address key areas found in the fleet self-assessment. Fleet-level procedural changes resulting from the fleet self-assessment are in progress and will be revised by August 2014 in advance of the release of an internal results review report.

While the fleet self-assessment stated, "Recommendations and deficiencies from the EPRI Assessment are included in this assessment and were evaluated for applicability at the other two sites and the fleet program procedures," several of the deficiencies and learning opportunities that were identified through EPRI were excluded from the fleet self-assessment. Our comparison found that five of the eight deficiencies identified by EPRI at Watts Bar were not included in the fleet self-assessment with no documented explanation for their exclusion. Two of the three remaining deficiencies identified by EPRI were downgraded in the fleet self-assessment to learning opportunities rather than deficiencies, and all three were entered into the Corrective Action Program as Enhancements rather than Corrective Actions. Enhancement-type actions are actions that are not required to be performed to satisfactorily correct or prevent a recurrence of conditions adversely affecting regulatory compliance, plant reliability or personnel/nuclear safety. Appendix B provides details about the deficiencies and recommendations.

In addition, EPRI made fleet-level learning opportunity recommendations that were omitted from the fleet self-assessment. For example, they recommended a

⁶ The EPRI released its *Groundwater Protection Guidelines for Nuclear Power Plants* in 2007 to provide technical guidance to utilities on the necessary elements of a sound groundwater protection program in compliance with NEI 07-07.

single repository for groundwater related documentation, a periodic review of groundwater data by a qualified hydrogeologist, and assigning a corporate sponsor to act as advocate and coordinator.

We also found a discrepancy in the overall compliance status reported in the NPG fleet self-assessment as compared to EPRI's assessment with no documented explanation for the discrepancy. NPG's fleet self-assessment states, "Overall the Fleet Ground Water Program meets the NEI 07-07 initiative with some deficiencies identified in program implementation." However, the EPRI assessment found that the Watts Bar GWPP "is currently not in full compliance with NEI 07-07, Groundwater Protection Initiative."

THERE IS NO FORMAL PROCESS FOR MONITORING ACTION ITEMS IDENTIFIED IN EXTERNAL ASSESSMENTS

We found there was not a formal process in place to ensure outstanding recommendations and deficiencies from external assessments identified above were tracked and completed. Four of the assessments reviewed during our evaluation identified issues with the remediation of recommendations and/or action items. The responsibility for addressing the recommendations and/or action items falls to sites where there is limited groundwater expertise. Without a formalized process to ensure recommendations and/or action items are tracked and completed, there is an increased risk that the GWPP may not be in compliance with GPI.

NEI observed in its 2009 assessment of Watts Bar and Browns Ferry that PERs were closed with no action taken to resolve the deficiencies. Similarly, in 2009 Sequoyah was asked by ANI to formally evaluate recommendations from a 2007 hydrology report. ANI closed its deficiency in 2012 stating actions items related to these recommendations were entered into the Corrective Action Program. EPRI also noted this issue in its 2013 assessment at Watts Bar. It stated Watts Bar should document follow up on previous inspections, audits, and assessments.

The responsibility for entering and tracking actions in the Corrective Action Program falls to NPG sites. Fleet-level corrective actions are handled by the Senior Manager, Chemistry Oversight. There is no requirement in TVA's NPG SPPs related to Groundwater or the Corrective Action Program that each item listed in an external assessment be included as a PER in the Corrective Action Program. In an interview, TVA management acknowledged difficulty in tracking actions taken toward remedying prior external findings and recommendations.

One of EPRI's learning opportunities identified in 2013 was to "evaluate assigning a corporate sponsor to act as an advocate and coordinator." EPRI noted most multi-station utilities have an individual assigned at corporate to advocate for the groundwater protection program and coordinate programs between sites, ensuring groundwater protection and environmental stewardship

are maintained at the level to which the nuclear industry is committed. TVA's groundwater program is not designed in this manner, but relies on site-level groundwater contacts to address recommendations appropriately. However, we found limited groundwater expertise at NPG nuclear sites. Of the individuals designated as groundwater contacts in 2009, none remained as a contact at the time of our review. According to TVA management, the current groundwater contacts at two of the sites are novices in their area of responsibility. An external consultant's report from 2011 recommended training on NEI requirements for all NPG sites. There is no indication that the recommended training was implemented.

The lack of a formal process to track and monitor the actions at a fleet level may have contributed to recurrent programmatic weaknesses discussed in a prior finding and outstanding recommendations. In addition, limited groundwater expertise at the sites may impair proper handling of corrective actions and could lead to noncompliance with GPI.

RECOMMENDATIONS

We recommend the Vice President, Functional Area and Outage Governance:

- Develop and implement a process that includes:
 1. Appropriately classifying and addressing recommendations and/or action items identified in external assessments.
 2. Requiring documentation of deviations from recommendations to correct deficiencies identified by external assessments.
 3. Capturing outstanding site and fleet deficiencies within periodic fleet self-assessments.
- Require site to revisit outstanding programmatic weaknesses to develop a remediation plan and establish a time frame for completion; if no action is planned, document the reasons.
- Incorporate the Senior Manager, Chemistry Oversight, in the remediation efforts for deficiencies identified by external consultants and industry groups to ensure issues are appropriately addressed, lessons learned and best practices are shared among NPG sites, and implemented at a fleet level when needed.

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

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

The following is a description of the recommendations and deficiencies identified as programmatic weaknesses.

Assess Storm Drain Integrity

The integrity assessment should consider inspection for debris, line breaks, or any discontinuity that would contribute to the potential for an unplanned and unmonitored release of radioactive material to groundwater. In 2009, American Nuclear Insurers (ANI) reported a need for storm drain (and yard drain) integrity assessments at Watts Bar Nuclear Plant and Sequoyah Nuclear Plant. Sequoyah closed the deficiency in 2012; however, the deficiency was pending as of 2013 at Watts Bar. The 2013 Fleet Self-Assessment does not identify this weakness in the groundwater program.

Evaluation of the Potential for Unplanned and Unmonitored Releases Off-Site

In 2008, ANI advised Watts Bar to conduct an evaluation to ensure fundamental elements of the Electric Power Research Institute (EPRI) Groundwater Guideline and ANI Guideline 07-01, *Potential for Unmonitored and Unplanned Off-Site Releases of Radioactive Material* were incorporated into the groundwater evaluations at the site. Sequoyah was advised similarly in a 2009 ANI Inspection Report. The recommendations at both sites are pending as of 2013. The 2013 Fleet Self-Assessment does not identify this weakness in the groundwater program.

Surface Water Testing for Hard-to-Detect Radionuclides

Nuclear Power Group (NPG) sites have each been advised by ANI to include surface waters in sampling protocols within the period we reviewed. In 2007, Sequoyah was advised to test its yard pond and yard drain systems, and in 2010, it was advised to test its sanitary sewage tank. Recommendations were closed in 2010 and 2012, respectively. Browns Ferry Nuclear Plant was advised to test its storm drain and sewage system in 2010, closing the recommendations in 2011. While Watts Bar was advised in 2008 to test its sanitary sewage in hard-to-detect radionuclides sampling and the recommendation was closed in 2011, the site was again advised in 2013 by ANI to include storm water discharge, yard holding pond, and sanitary sewage in hard-to-detect radionuclides sampling when Tritium analysis indicate contamination due to plant related radionuclides. The 2013 Fleet Self-Assessment contains a learning opportunity to improve clarity in defining the exact requirements for surface water collection points for early leak detection.

Approval and Implementation of Hydrology Reports

Hydrology reports identify groundwater flow and gradients. The Groundwater Protection Initiative, Nuclear Energy Institute (NEI) 07-07, requires sites establish the frequency for periodic reviews of site hydrology. The Tennessee Valley Authority established a 5-year update cycle. However, prior assessments repeatedly noted sites did not comply with this cycle or had not implemented the most recent findings from the hydrology into its safety plan, as required. The

Brown's Ferry 2009 NEI assessment noted hydrology reports should include a statement on whether any updates to the safety plan are necessary. A 2009 ANI Inspection Report from Sequoyah notes the site had not formally evaluated or dispositioned recommendations made in its 2007 hydrology report. The recommendation was not cleared until 2012. EPRI cited Watts Bar in 2013 for not updating the hydrology report since August 2004. The update was scheduled for 2009, but was canceled. NEI requested the update to be completed as soon as practical in its 2009 assessment. EPRI recommended a 2011 Groundwater Investigation Report from 2011 to be approved as final as soon as possible and for the site's safety plan to be evaluated based on its results. Watts Bar input the deficiency noted by EPRI as an Enhancement in the Corrective Action Plan. In the 2013 Fleet Self-Assessment, each site was noted as being deficient in identifying needed updates to its safety plans based on recent hydrology reports.

Characterization of Tritium Plumes

NPG sites were cited by ANI within the period we reviewed for having incomplete characterization of the Tritium plumes at the facilities. In 2007, ANI requested Sequoyah characterize on-site plumes horizontally and vertically, including maximum concentrations and areas actually or potentially affected by earlier leaks. In 2009, ANI made a recommendation that Watts Bar recharacterize the tritium plumes. ANI recommendations were closed in 2012 at Sequoyah and in 2011 at Watts Bar. However, a similar recommendation was made to Browns Ferry in 2010 to periodically characterize and track the tritium plume that exists there. This recommendation is pending until progress allows a more complete characterization. This issue does not arise in the 2013 Fleet Self-Assessment.

Evaluate the Potential for Detectable Levels of Licensed Material Resulting From Planned Releases of Liquids and/or Airborne Materials

In the 2009 NEI assessments of all NPG sites, it was noted that the sites did not meet the objective to "evaluate the potential for detectable levels of licensed material resulting from planned releases of liquids and/or airborne materials." The recommended correction was to "prepare written evaluation of the potential contribution to groundwater radionuclide concentrations from planned releases." In 2011, an external consultant noted this as an area for further evaluation to reduce risk at all NPG sites. The issue was also identified in 2013 as a deficiency in EPRI's assessment of Watts Bar. This deficiency is currently categorized in the Corrective Action Program as a fleet-wide enhancement.

The following is a list of the five areas where deficiencies were identified by the Electric Power Research Institute at Watts Bar Nuclear Plant and were not included in the fleet self-assessment.

- Identify potential pathways for groundwater migration from on-site locations to off-site locations through groundwater.
- Assess system, component structures and work practices for risk to groundwater including leak detection capabilities and enhancements, spill and leak detection mechanisms and enhancements, and long-term preventative maintenance programs to minimize the potential for licensed material to reach groundwater.
- Use the hydrology and geology studies developed under the Groundwater Protection Initiative, Objective 1.1, consider placement of groundwater monitoring wells down gradient from the plant but within the boundary defined by the site license.
- Consider, as appropriate, placing sentinel wells closer to systems, structures, and components that have the highest potential for inadvertent releases that could reach groundwater or systems, structures, and components where leak detection capability is limited.
- Establish sampling and analysis protocols, including analytical sensitivity requirements for groundwater and soil.

The two areas where deficiencies were identified by the Electric Power Research Institute and, subsequently, downgraded in the fleet self-assessment to learning opportunities rather than deficiencies are described below.

- Evaluate the potential for detectable levels of licensed material resulting from planned releases of liquids and/or airborne materials.
- The Groundwater Protection Program/Underground Piping and Tanks Integrity Program Interface and coordination are not being conducted in accordance with applicable site procedural requirements.

In addition, there was one deficiency that was entered as an enhancement rather than corrective action related to completing periodic reviews of site hydrogeologic studies according to established frequency.