Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

August 4, 2006

Mr. Stuart A. Richards, Deputy Director
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Richards:

In the Matter of the)	Docket Nos.	50-259 50-327
Tennessee Valley Authority)		50-260 50-328
		50-296 50-390
		50-391

GROUNDWATER PROTECTION – DATA COLLECTION QUESTIONNAIRE FOR BROWNS FERRY, SEQUOYAH, AND WATTS BAR NUCLEAR PLANTS

The nuclear industry, in conjunction with the Nuclear Energy Institute, has developed a questionnaire to facilitate the collection of groundwater data at commercial nuclear reactor sites. The objective of the questionnaire is to compile baseline information about the current status of site programs for monitoring and protecting groundwater and to share that information with NRC. The completed questionnaires for Browns Ferry, Sequoyah, and Watts Bar Nuclear Plants are enclosed for your information.

This submittal contains no new regulatory commitments.

Please contact Bob Alsup at (423) 751-8251 if you have questions about the enclosed information.

Sincerely,

for Glenn W. Morris
Manager, Corporate Nuclear Licensing
and Industry Affairs

Enclosure
cc: See page 2

Enclosure
cc (Enclosure):

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, Georgia 30303-8931

Ms. Eva A. Brown, Project Manager
U.S. Nuclear Regulatory Commission
MS 8G9A
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Ms. Margaret H. Chernoff, Project Manager
U.S. Nuclear Regulatory Commission
MS 8G9A
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Mr. Douglas V. Pickett, Project Manager
U.S. Nuclear Regulatory Commission
MS 8G9A
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

cc: Continued on page 3

cc: (Enclosure):

NRC Senior Resident Inspector
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, Alabama 35611-6970

NRC Senior Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379-3624

NRC Senior Resident Inspector
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381-2000

Mr. R. L. Anderson, Director
Health Physics and Low Level Waste
Nuclear Energy Institute
Suite 400
1776 I Street
Washington, D.C. 20006-3708

ENCLOSURE

Groundwater Protection – Data Collection Questionnaire for Browns Ferry, Sequoyah, and Watts Bar Nuclear Plants

Plant: Browns Ferry Nuclear (BFN)

1. **Briefly describe the program and/or methods used for detection of leakage or spills from plant systems, structures, and components that have a potential for an inadvertent release of radioactivity from plant operations into groundwater.**

   - BFN monitors four (4) on-site groundwater locations quarterly for tritium and gamma emitters to identify potential leaks from plant equipment such as storage tanks and discharge lines.
   - BFN began an investigation of tritium releases to the groundwater in 2006 (discussed in response to Question 2 below) due to identification of tritium in two of the four on-site groundwater monitoring locations. This study involved pressure testing of the three radwaste discharge lines and sampling of groundwater to identify the source of the tritium.

2. ***Briefly describe the program and/or methods for monitoring onsite groundwater for the presence of radioactivity released from plant operations.***

   - One Radiological Environmental Monitoring Program (REMP) on-site groundwater monitoring point is equipped with an automatic water sampler. Samples from the monitoring points are collected every 4 weeks and analyzed by gamma spectroscopy. A quarterly composite sample is analyzed for tritium.
   - The four on-site groundwater monitoring locations (mentioned in the answer to question 1) are sampled quarterly and analyzed for tritium and gamma emitters. These locations are not a part of BFN REMP. The purpose of these shallow monitoring points is to monitor for potential leaks from plant equipment such as storage tanks and discharge lines.
   - BFN completed field investigations to support an investigation of tritium releases to the groundwater in June 2006. This study included the following:
     (1) Redevelopment and sampling of five regional bedrock monitoring points.
     (2) Manual sampling of sixteen accessible yard drain catch basins, vaults, and manholes.
     (3) Groundwater sampling at twenty-nine Geoprobe borings.
     (4) Water level monitoring.

     Based on this study, BFN intends to include four (4) additional groundwater locations.
   - The samples are analyzed to the site's REMP LLD's.

NUCLIDE	TYPICAL MDA (pCi/l)
H-3	270
Gamma emitters	5

3. **If applicable, briefly summarize any occurrences of inadvertent releases of radioactive liquids that had the potential to reach groundwater and have been documented in accordance with 10 CFR 50.75(g).**

   - January 2001 - Tritium was detected in concentrations greater than baseline values in one of the three non-REMP on-site monitoring points located west of the Unit 3 Condenser Circulating Water conduit in the Radwaste loading area.
   - March 2005 - During sampling of the Auxiliary Decay Heat Removal (ADHR) secondary side for gamma analysis, low level radioactivity was discovered in the water sample. A leak in an elbow on the east side of the cooling tower and an overflow of the cooling tower basin due to a malfunction of the system level indicators resulted in low level radioactive water on the concrete pad and ground near the tower.
   - November 2005 - Tritium was detected in concentrations greater than baseline values in an underground cable tunnel located between the Intake and Turbine Building. Samples taken in January 2006 identified gamma emitters as well as tritium.
   - February 2006 - As a part of the tritium mitigation investigation, a soil sample was taken from underneath the Radwaste Ball Joint vault (located outside the radwaste doors). The sample indicated trace levels of Co-60 and Cs-137. This area is currently outside the Radiological Controlled Area (RCA), but was zoned inside the RCA in the 1980s for handling of radioactive drums.

   (Note: TVAN's Groundwater Protection Initiative Action Plan includes an audit of each site's 10CFR50.75 (g) files for completeness.)

4. **If applicable, briefly summarize the circumstances associated with any <u>onsite</u> or <u>offsite</u> groundwater monitoring result indicating a concentration in groundwater of radioactivity released from plant operations that exceeds the maximum contaminant level (MCL) established by the USEPA for drinking water.**

   - There have been no identified instances of radioactivity released from BFN Plant that resulted in groundwater concentrations exceeding the USEPA maximum contaminant levels for drinking water.

5. **Briefly describe any remediation efforts undertaken or planned to reduce or eliminate levels of radioactivity resulting from plant operations in soil or groundwater onsite or offsite.**

   - Low level contaminated water was discovered in the cable tray tunnel from the CCW Intake Building to the Turbine Building. The water entered the tunnel from the Condensate Transfer Tunnel through expansion joints and cracks (the cable tunnel and condensate transfer tunnel share a common concrete wall). The water came from a High Pressure Coolant Injection (HPCI) test return line break that occurred in April 2000. The cable tunnel was decontaminated at that time. In consideration for contamination

leaching from the concrete; portions of the cable tunnel have been posted as a contaminated area.

- Accessible areas of the contaminated soil from the ADHR spill (described in response to Question 3 above) were removed in January 2006.
- A leased Duratech radioactive material shipping container carrying nine Unit 1 used Control Rod Drives leaked contaminated water onto the shipping trailer and then onto the roadway in front of the plant office building within the Protected Area. The total amount of water that leaked was estimated to be less than one quart. The contaminated area was approximately three feet by three feet. The area was remediated.

Plant: Sequoyah Nuclear (SQN)

1. **Briefly describe the program and/or methods used for detection of leakage or spills from plant systems, structures, and components that have a potential for an inadvertent release of radioactivity from plant operations into groundwater.**

    - SQN monitors six on-site groundwater locations monthly for tritium and gamma emitters to identify potential leaks from plant equipment such as storage tanks and discharge lines.
    - SQN took action to investigate tritium releases to the groundwater in 2004 due to identification of tritium in four of the on-site groundwater monitoring locations. Actions taken involved adding seven geoprobe monitoring points, leak testing of the radwaste discharge line, and sampling of groundwater to identify the source of the tritium.

2. **Briefly describe the program and/or methods for monitoring onsite groundwater for the presence of radioactivity released from plant operations.**

    - One Radiological Environmental Monitoring Program (REMP) on-site groundwater monitoring point is equipped with an automatic water sampler. Samples from the monitoring points are collected every 4 weeks and analyzed by gamma spectroscopy. A quarterly composite sample is analyzed for tritium.
    - Five additional on-site groundwater monitoring locations are sampled monthly and analyzed for tritium and gamma emitters. These locations are not a part of SQN REMP. The purpose of these shallow monitoring points is to monitor for potential leaks from plant equipment such as storage tanks and discharge lines.
    - The samples are analyzed to the site's REMP Lower Limit of Detection (LLD's).

NUCLIDE	TYPICAL MDA (pCi/l)
H-3	270
Gamma emitters	5

3. **If applicable, briefly summarize any occurrences of inadvertent releases of radioactive liquids that had the potential to reach groundwater and have been documented in accordance with 10 CFR 50.75(g).**

    - Mid 1980's - Radioactivity leached through concrete wall to outside surface of concrete and to soil of outside building wall at the Condensate Demineralizer Waste Evaporator (CDWE) building. The event was logged based on interviews with Radiation Protection personnel.
    - Mid 1980's - Hose burst spraying water through door to outside environment at Unit 2 Additional Equipment Building (Upper Head Injection) building. The event was logged based on interviews with Radiation Protection personnel.

- Early 1990's - Radioactive contamination found on Auxiliary Building roof as a result of Auxiliary Building ventilation stack discharge. Origination of contamination determined to be from unfiltered fuel handling ventilation trains. The event was logged based on interviews with Radiation Protection personnel.
- May 1995 - Performance of Radiation Protection routine directive (RMD-FO-35 Environmental Monitoring Surveys) identified radioactivity in the soil at the outfall of the Unit 2 Refueling Water Storage Tank (RWST) moat drain pipe. Radioactivity in soil recorded by survey number D-95-0558 and sample gamma analysis paperwork.
- May 1997 - The conductivity probe on the inlet to the Modularized Transfer Demineralization System (MFTDS) located in the 706' elevation Railroad Bay failed. Approximately 3000 gallons of water was spilled with an estimated 600 - 1000 gallons released to the radwaste yard immediately adjacent to the Railroad Bay door. The scope of the spill and remediation was documented in the Radwaste Yard Spill Final Survey Report, dated July 31, 1997.
- January 1998 - Unit 2 Additional Equipment Building (Upper Head Injection) sump overflowed to the doorway leading to the outdoor environs. The outdoor spill pathway included asphalt and soil leading to a storm drain. The scope of the spill and remediation was documented in the Unit 2 Additional Equipment Building Sump Spill Recovery Report, dated January 22, 1998.
- April 2002 - Pre-excavation samples of the Steam Generator replacement crane foundation area identified radioactivity in the soil surrounding the Unit 1 RWST moat drain. Documentation of the issue is included in survey maps and sample gamma analysis data.
- July 2006 – An investigation to determine sources of tritium in groundwater included the evaluation of Unit 1 and 2 moat rain water. Moat water sample and analysis found detectable levels of tritium and was documented in the report RWST Moat Water as a Potential Tritium in Groundwater Source, dated July 17, 2006. The report includes the need for process improvements to prevent release of moat water to environs outside of the moats.

(Note: TVAN's Groundwater Protection Initiative Action Plan includes an audit of each site's 10CFR50.75 (g) files for completeness.)

4. **If applicable, briefly summarize the circumstances associated with any <u>onsite</u> or <u>offsite</u> groundwater monitoring result indicating a concentration in groundwater of radioactivity released from plant operations that exceeds the maximum contaminant level (MCL) established by the USEPA for drinking water.**

    - There have been no identified instances of radioactivity released from SQN that resulted in groundwater concentrations exceeding the USEPA maximum contaminant levels for drinking water.

5. **Briefly describe any remediation efforts undertaken or planned to reduce or eliminate levels of radioactivity resulting from plant operations in soil or groundwater onsite or offsite.**

- CDWE Event - Soil excavated and building wall painted with sealant. Area included in Radiation Protection quarterly surveys of outside environs (RMD-FO-35 Environmental Monitoring Surveys).
- Unit 2 Additional Equipment Building - Asphalt outside door coated with sealant. Vehicle and Porta-John toilet decontaminated. Area included in Radiation Protection quarterly surveys of outside environs (RMD-FO-35 Environmental Monitoring Surveys).
- Auxiliary Building Roof - Contamination removed and the area included in quarterly surveys of outside environs (RMD-FO-35 Environmental Monitoring Surveys).
- Railroad Bay - Asphalt and soil excavated into Low Specific Activity (LSA) boxes. Area included in Radiation Protection quarterly surveys of outside environs (RMD-FO-35 Environmental Monitoring Surveys).
- Unit 2 Additional Equipment Building - Asphalt and soil excavated into LSA boxes. Area included in Radiation Protection quarterly surveys of outside environs (RMD-FO-35 Environmental Monitoring Surveys).
- Unit 1 RWST - Soil excavated into LSA boxes. Area included in Radiation Protection quarterly surveys of outside environs (RMD-FO- 35 Environmental Monitoring Surveys).
- Units 1 and 2 RWST Moats - Corrective actions initiated to lessen the probability of rain water escape to environs outside of moats.
- Radwaste Discharge Line - Leak tested with no evidence of leaks.
- Site characterization study is being planned. The characterization will help identify groundwater movement and help identify potential leaks.

Plant: Watts Bar Nuclear (WBN)

1. **Briefly describe the program and/or methods used for detection of leakage or spills from plant systems, structures, and components that have a potential for an inadvertent release of radioactivity from plant operations into groundwater.**

    - WBN monitors six on-site Radiological Environmental Monitoring Program (REMP) groundwater locations every 31 days for gross beta, tritium and gamma emitters to identify potential leaks from plant equipment such as storage tanks and discharge lines. In addition, WBN monitors a groundwater sump weekly for tritium and gamma emitters.
    - WBN started conducting an investigation of tritium releases to the groundwater in 2003 due to identification of tritium in three of the four newly installed on-site monitoring points associated with the Department Of Energy (DOE) tritium production program site preparation activity in December 2002. This study involved pressure testing the radwaste discharge line, performing evaporation calculations of the Spent Fuel Pool and Refueling Water Storage Tank, installing and sampling of groundwater monitoring points, inspecting of drain lines, and conducting a boroscopic investigation of the Spent Fuel Pool and Fuel Transfer Canal leak collection system channels and drains.

2. **Briefly describe the program and/or methods for monitoring onsite groundwater for the presence of radioactivity released from plant operations.**

    - Six REMP on-site groundwater monitoring points are equipped with an automatic sequential sampler. Sample aliquots are taken from the monitoring points daily and collected every 31 days. The samples are composited on a quarterly base and analyzed for gross beta, gamma, and tritium.
    - In additional, WBN has 37 non-REMP monitoring points to support monitoring any potential onsite groundwater plume(s) and for the presence or increase of radioactivity.
    - The samples are analyzed to the site's REMP LLD's.

NUCLIDE	TYPICAL MDA (pCi/l)
H-3	270
Gamma emitters	5 (principle gamma emitters)
Gross Beta	1.9

3. **If applicable, briefly summarize any occurrences of inadvertent releases of radioactive liquids that had the potential to reach groundwater and have been documented in accordance with 10 CFR 50.75(g).**

   - September - December 1998 - Low level radioactive contamination was discovered in an expansion joint and underlying soil of the concrete Radwaste Pad.
   - 2003 to present - Tritium leached into the ground from the plant and was found in the site monitoring points.
   - 2004-2005 - The Radwaste Line was discovered to be leaking.

   (Note: TVAN's Groundwater Protection Initiative Action Plan includes an audit of each site's 10CFR50.75 (g) files for completeness.)

4. **If applicable, briefly summarize the circumstances associated with any <u>onsite</u> or <u>offsite</u> groundwater monitoring result indicating a concentration in groundwater of radioactivity released from plant operations that exceeds the maximum contaminant level (MCL) established by the USEPA for drinking water.**

   - There have been no instances in which radioactivity has been identified in the WBN offsite groundwater monitoring program that resulted in groundwater concentrations exceeding the USEPA maximum contaminant levels for drinking water.
   - There have been two onsite instances in which a REMP groundwater monitoring point exceeded the USEPA maximum contaminant levels for drinking water. These instances were a result of a leak in the radwaste line. The NRC and State of Tennessee were notified.

   During the first calendar quarter of 2005, groundwater samples from onsite environmental monitoring point D exceeded the Offsite Dose Calculation Manual (ODCM) limit. This groundwater onsite monitoring point is located in a down gradient position between the Yard Holding Pond (YHP) and the Intake Pump Station (IPS) for the facility. An analysis was performed on composite four-week samples as averaged over a calendar quarter. The analysis found the quarterly average tritium concentration at the monitoring point to be approximately 397,600 pCi/L which exceeds the 30,000 pCi/L ODCM concentration limit for tritium in non-drinking water pathway groundwater samples. No other radionuclides were detected by a gamma scan at monitoring point D. In response to the increased levels in monitoring point D, groundwater data has been collected from various monitoring points, including a snapshot data set of groundwater quality and water levels to evaluate the tritium concentration in monitoring point D within the broader context of site conditions. Additionally, the frequency of samples from monitoring point D was increased in order to monitor any further changes. TVA investigated possible sources of the tritium and discovered a leak at the connection of the temporary radwaste line with the permanent stainless steel radwaste line. ARCADIS, Inc., who conducted the initial groundwater investigation, was retained to assist in the investigation. TVA and ARCADIS evaluated newly collected data to determine whether additional leaks contribute to the tritium discovered at

monitoring point D. This investigation was targeted to determine whether a leak was present, or whether the existing tritium plume had migrated and was the cause of down gradient impact. The analysis of the data led the team to suspect that a new leak was present in the discharge line (in the Cooling Tower Blowdown [CTBD] Line downstream of the liquid effluent line tie-in) in a down gradient position, in addition to a contribution that occurred from a connection leak that was found and repaired in the temporary Radwaste line.

During the second calendar quarter of 2005, groundwater samples from onsite environmental monitoring, monitoring point B exceeded the ODCM limit. This groundwater onsite monitoring point is located down gradient from monitoring point D. The quarterly analysis average tritium concentration at the monitoring point was found to be approximately 80,300 pCi/L which exceeds the 30,000 pCi/L ODCM concentration limit for tritium in non-drinking water pathway groundwater samples. No other radionuclides were detected by a gamma scan at monitoring point B.

5. **Briefly describe any remediation efforts undertaken or planned to reduce or eliminate levels of radioactivity resulting from plant operations in soil or groundwater onsite or offsite.**

A number of actions have been taken to better understand the extent of the tritium in the groundwater at WBN, including retaining ARCADIS to assist in the investigation and analyze data to help determine extent and characteristics of the tritiated groundwater. Several corrective actions to plant equipment have been taken as discussed below. Data indicates that actions to reduce or eliminate the two sources of tritium have been effective. Groundwater will continue to be monitored to assess the concentrations of tritium, and actions will be taken as required to address identified problems or issues. A summary of actions taken to date is listed below:

- Soil and concrete was removed from the affected area around the Rad Waste Pad.
- Fuel Transfer Canal (FTC) - Drained and cleaned the canal to allow detailed inspection. Inspection included not only seam welds, but the Unit 1 bellows area. FTC liner has been coated.
- Liquid Effluent Line – Isolated the leaking radwaste line and provided a temporary path from plant buildings to the plant discharge (CTBD) line. Permanently replaced the leaking line with a new liquid effluent line. The new line was placed in service in May 2005.
- Groundwater Sump (GWS) - The Groundwater Sump discharge was temporarily routed to the station sump where discharges were monitored. The Groundwater Sump discharge was subsequently returned to the catch basin system and was added to the plant's list of monitored release points.
- Refueling Water Storage Tank - Investigated level loss. Installed monitoring points near foundation of the tank to determine if the tank itself is leaking. Evaporation calculations revealed that the level loss was likely due to evaporation.

- Spent Fuel Pit and Cask Loading Areas - Developed necessary level measuring techniques to determine if there was a level loss other than evaporation. Level loss is likely due to evaporation.
- CTBD Line - Inspected line for leaks during Spring 2005 outage. No leaks were identified; however, joints in the concrete pipe were sealed as a preventative measure.