Memorandum from the Office of the Inspector General

August 22, 2019

Robert M. Deacy, Sr., LP 5D-C

FINAL REPORT – SPECIAL PROJECT 2019-17234 – GROUNDWATER MONITORING AT KINGSTON FOSSIL PLANT

The Office of the Inspector General (OIG) contracted with ATC Group Services LLC (ATC), to conduct a review of groundwater monitoring activities at the Kingston Fossil Plant Peninsula Disposal Unit to determine the quality of the program and adherence to regulatory standards. ATC stated that in their opinion, monitoring activities performed at TVA Kingston Fossil Plant Peninsula Disposal Unit are in adherence with guidelines for the Environmental Protection Agency and the Tennessee Department of Environment and Conservation. Furthermore, ATC stated the work performed appears to be of high quality and does not likely result in any discrepancies for the program. All work pertaining to this review was conducted by ATC. The OIG relied on ATC's processes and procedures for quality control in the attached report.

This report is for your review and information. No response to this report is necessary. If you have any questions, please contact Deana D. Scoggins, Senior Auditor, Evaluations, at (423) 785-4822 or Gregory R. Stinson, Deputy Assistant Inspector General, Evaluations, at (865) 633-7367. We appreciate the courtesy and cooperation received from your staff during the project.

Jill M. Matthews
Deputy Inspector General Performing the Duties of the Inspector General
WT 2C-K

DDS:FAJ
Attachment
cc (Attachment):

TVA Board of Directors
Clifford L. Beach, Jr., WT 7B-K
Robertson D. Dickens, WT 9C-K
Joseph J. Hoagland, WT 9D-K
Jeffrey J. Lyash, WT 7B-K
Justin C. Maierhofer, WT 7B-K
Sherry A. Quirk, WT 7C-K
Ronald R. Sanders II, MR 5E-C
Michael D. Skaggs, WT 7B-K
Rebecca C. Tolene, WT 7B-K
Michael S. Turnbow, LP 5D-C
OIG File No. 2019-17234

ENVIRONMENTAL • GEOTECHNICAL
BUILDING SCIENCES • MATERIALS TESTING

2725 East Millbrook Road
Suite 121
Raleigh, NC 27604
Tel: 919-871-0999
Fax: 919-871-0335
www.atcgroupservices.com
N.C. Engineering License No. C-1598

August 19, 2019

Mr. Greg Stinson
Office of the Inspector General
Tennessee Valley Authority
P.O. Box 2000, EQB-1A-WBN
Spring City, Tennessee 27381

RE: **Peer Review Letter Report**
Tennessee Valley Authority – Kingston Fossil Plant
Peninsula Disposal Area
714 Swan Pond Road
Harriman, Roane County, Tennessee

Dear Mr. Stinson:

ATC Associates of North Carolina, P.C. (ATC), on behalf of the Office of the Inspector General (OIG) for the Tennessee Valley Authority (TVA), has performed a peer review of the groundwater monitoring activities performed at the TVA Kingston Fossil Plant Peninsula Disposal Area. ATC reviewed Groundwater Monitoring and Corrective Action Reports prepared in 2017 and 2018, with a focus on the following:

- Review monitoring well locations to ensure they are appropriately located to properly monitor the site and represent background conditions.
- Review analytical laboratory reports to determine and ensure there were no quality assurance/quality control (QA/QC) exceptions during analysis that would render the data unacceptable for its intended use.
- Review baseline data to determine reason for variability of the data that may result from varying sampling methods or other factors, such as turbidity.
- Review of the statistical analysis.

In addition, ATC performed a site visit to inspect the site and associated monitoring wells. A detailed outline of ATC's peer review activities along with conclusions for the site are discussed below.

1.0 Background Information

1.1 Site History

The TVA Kingston Fossil Plant is located at 714 Swan Pond Road in Harriman, Roane County, Tennessee, along the Watts Bar Reservoir on the Tennessee River. Construction of the facility

was initiated in 1951 and the facility began operation in 1954. The Peninsula Disposal Area is located at the confluence of the Emory River to the north and the Clinch River to the east and south. On December 22, 2008, an estimated 5.4 million cubic yards of coal ash spilled from the former coal ash storage dredge cell into the Emory, Clinch, and Tennessee Rivers and associated tributaries. As a result, the Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC) instated groundwater monitoring programs to monitor and mitigate impacts from the spill.

1.2 TDEC Solid Waste Regulation Rule 0400-11-01.04

TDEC manages Coal Combustion Residual (CCR) under Solid Waste regulations established in Rule 0400-11-01-.04. The Rule has established three phases for groundwater monitoring programs for CCR facilities. Phase 1 includes initial sampling followed by background monitoring for constituents identified in the initial assessment. Phase 2 includes semi-annual detection monitoring events. If groundwater concentrations are below their respective protection standards, the site will remain in Phase 2 until all constituents are statistically below their respective background concentrations. If groundwater concentrations exceed their respective protective standards, the site will advance into Phase 3. Phase 3 of groundwater monitoring requires submittal of a Groundwater Quality Assessment Plan, initiation of corrective measures, and assessment monitoring. A facility cannot return to Phase 2 until groundwater concentrations are below standards for three years or a negotiated timeframe with TDEC. The Kingston Fossil Plant Peninsula Disposal Facility was placed in Phase 3 per correspondence issued from TDEC to TVA on March 22, 2011. Monitoring wells KIF-101, G-3A, G-3B, G-4B, G-5A, G-5B, and G-6B are used for the current TDEC monitoring program.

1.3 EPA Coal Combustion Residual Rule

In April 2015, the EPA passed a rule to regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA). The CCR Rule applies to specifically identified CCR Units owned by the TVA located or operating at recently active fossil-power-generation plants. As a result, the CCR Rule applies to nine TVA facilities. The scope of the CCR Rule for the Kingston Fossil Plant pertains to groundwater monitoring of the Peninsula Disposal Area. TVA has established a Groundwater Monitoring Program to comply with the requirements of the CCR Rule.

According to the EPA, an owner or operator of a CCR Unit is required to install a system of monitoring wells, submit a Groundwater Sampling and Analysis Plan (SAP), and establish a program outlining detection monitoring, assessment monitoring, and corrective action, if needed. According to the SAP (fourth revision issued in October 2017), wells KIF-101, G-3A, G-3B, G-5A, G-5B, G-7A, G-7B, G-8B, G-9B, and G-10B are used for monitoring under the CCR Rule. Wells G-2A and G-2B are used for water level measurements only while G-1B and KIF-101 serve as background monitoring wells. Baseline sampling was performed between October 2016 and October 2017 using wells KIF-101, G-3A, G-5A, G-8A, and G-9A. The baseline data was used to determine background threshold values for each constituent. Detection monitoring was performed in October 2017 utilizing all wells in the network. The detection monitoring identified statistically significant increases (SSIs) for select constituents; however, an alternate source demonstration indicated the SSIs were not related to the Peninsula Disposal Unit. The site is currently in the detection monitoring phase.

1.4 TDEC Commissioner's Order

In August 2015, TDEC issued a Commissioner's Order to TVA directing the investigation, assessment and remediation of all coal ash disposal sites across Tennessee. The order was issued subsequently to the CCR Rule and was intended to establish procedures for assessment and remediation of CCR at TVA facilities. In addition, the Commissioner's Order establishes the process through which TDEC oversees TVA's implementation of the CCR Rule.

2.0 Peer File Review - EPA Reviewed Reports

2.1 Reviewed Reports

ATC reviewed the following documents for the Kingston Fossil Plant Peninsula Disposal Area specifically prepared to address the EPA CCR Rule:

- Closure and Post-Closure Plan Peninsula Disposal Area - Stantec, October 12, 2016
- Data Validation Reports CCR – Environmental Standards, October 2016 through August 2018
- Sampling and Analysis Plan, Revision 4 Kingston Fossil Plant – Amec Foster Wheeler, October 2017
- Statistical Methods Certification Peninsula Disposal Area – HDR, Inc., October 16, 2017
- 2017 Annual Groundwater Monitoring and Corrective Action Report TVA Kingston Fossil Plant Peninsula Area CCR Unit – Stantec, January 31, 2018
- Groundwater Quality Analytical Summary Reports, Rounds #0 through #14 of the Background Phase at the Tennessee Valley Authority's Kingston Fossil Plant – Amec Foster Wheeler, March 2018
- Groundwater Quality Analytical Summary Report, Round #1 of the Detection Monitoring Phase at the Tennessee Valley Authority's Kingston Fossil Plant – Amec Foster Wheeler, March 2018
- Groundwater Monitoring System, Revision 1 Peninsula Disposal Area – AECOM, June 13, 2018
- Report of Alternate Source Demonstration – Stantec, October 29, 2018
- Sampling and Analysis Plan Coal Combustion Residual – Terracon, December 18, 2018
- 2018 Annual Groundwater Monitoring and Corrective Action Report TVA Kingston Fossil Plant Peninsula Area CCR Unit – Stantec, January 31, 2019

2.2 Reports Discussion

Groundwater Analytical Summary Reports documenting monitoring performed between October 2016 and October 2017 generally followed the October 2017 SAP. There were a few discrepancies with stabilization parameters and calibration ranges; however, these discrepancies do not likely affect the analytical results. Detection monitoring was performed in October 2017 to determine SSIs using background data. Based on a review of the data, wells G-3A, G-5A, G-5B, and G-7B indicated SSIs for pH, boron, chloride, fluoride, sulfate, and/or total dissolved solids.

The October 2017 SAP was found to be thorough, complete, and is considered appropriate for the groundwater monitoring program associated with the Peninsula Disposal Area. The SAP includes third party review of both field and laboratory procedures by TVA's QA oversight consultant, Environmental Standards. Indicator parameters beyond those prescribed in

Appendix III and IV of the CCR Rule are included in the analysis plan. The SAP references TVA's Quality Assurance Protection Plan (QAPP) and Technical Instructions (TIs).

The Statistical Methods Certification for the Kingston Fossil Plant outlined the proposed statistical methods for evaluating groundwater monitoring data collected at the Peninsula Disposal Area. The proposed statistical methodology was developed following guidelines developed by the EPA including the following:

- USEPA, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance. Office of Resource Conservation and Recovery, Program Implementation and Information Division, USEPA, EPA 530/R-09-007, 2009.
- Singh, A. and Ashok Singh. ProUCL 5.1.002 Technical Guide Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R07/041, 2015.

ATC finds that the proposed methodology is compliant with the above-referenced guidance documents and industry-standard practices. The document included the required certification by a Professional Engineer licensed in the State of Tennessee.

ATC reviewed the October 29, 2018 Report of Alternate Source Demonstration – Peninsula Disposal Area, Kingston Fossil Plant prepared by Stantec. The report summarizes the results of an Alternate Source Demonstration (ASD) study to determine if SSIs in groundwater concentrations for select Appendix III constituents were indicative of a release from Phase 1A/1B of the Peninsula Disposal Area CCR unit or if the SSIs were unrelated to operation of the CCR unit. The report indicates that the footprint of the Phase 1A area previously was occupied by a surface impoundment that received gypsum slurry generated during flue gas desulfurization. In December 2010, a leak in the clay liner associated with the surface impoundment was discovered. TVA subsequently dewatered the surface impoundment and reconstructed the unit as a dry landfill with a composite clay/geomembrane liner and leachate collection system.

Stantec utilized historical groundwater monitoring results for Appendix III constituents that pre-dated use of the Phase 1A/1B areas for disposal of CCR waste as the primary line of evidence for the ASD. Stantec particularly focused on the occurrence of an increase in Appendix III concentrations in wells downgradient of the former surface impoundment in the year subsequent to the clay liner failure followed by overall declining concentrations. The peak concentrations pre-dated operation of the Peninsula Disposal Area CCR unit. Stantec concluded that the constituents that were responsible for the apparent SSIs were detected prior to placement of CCR in the new Peninsula Disposal Area CCR unit, and the pattern of detection was not indicative of a release from this unit. ATC concurs with Stantec's evaluation process and associated conclusions.

ATC reviewed data trends documented in the 2018 Annual Groundwater Monitoring and Corrective Action Report submitted in January 2019. Variable trends of specific metals were identified in several wells. The trends appear to have some relationship to the turbidity and total suspended solids (TSS) values. Overall, concentrations tend to be trending downward as TVA is making efforts to reduce turbidity in the samples. Temporal variations in metals concentrations can also be the result of natural changes in aquifer conditions that can occur seasonally (e.g., temperature, groundwater elevation, groundwater pH, etc.).

3.0 Peer File Review - TDEC Documents

3.1 Reviewed Reports

ATC reviewed the following documents specifically prepared to address TDEC requirements:

- Groundwater Monitoring Plan Coal Combustion Residual Disposal Facility – Peninsula Site IDL 73-0211 – TVA, July 7, 2014
- Groundwater Assessment Monitoring Reports, March 2018 through March 2019 Sampling Events – Amos Smith, P.G., May 2018 through May 2019

3.2 Reports Discussion

A revised Groundwater Monitoring Plan was submitted to TDEC on July 2, 2014 for the purpose of Phase 1A, Phase 1B & II major permit modification. The Groundwater Monitoring Plan was approved by TDEC on July 2, 2014. The purpose of the monitoring plan was to assess the quality of groundwater not impacted by the processes at the facility and to monitor groundwater quality at the downgradient compliance boundary. The monitoring program was established to be in accordance with TDEC Solid Waste regulations established in Rule 0400-11-01-.04. The monitoring system includes both upgradient and downgradient monitoring wells in both the overburden and bedrock zones. The plan discusses well installation activities and field procedures. The detection monitoring plan indicates samples will be analyzed for total suspended solids and 17 inorganic constituents with reports being submitted within 30 days of the sampling event. Data will undergo a statistical evaluation following each event to determine SSIs. If a SSI is identified and there is no demonstration to identify a source of the SSI other than the groundwater (i.e. laboratory contaminant, natural variability, etc.) then an Assessment Monitoring Program must be established. There are three Phases (1, 2, and 3) of the Assessment Monitoring Program, each of which requires differing sampling and reporting requirements.

ATC reviewed five Groundwater Assessment Monitoring Reports in which wells KIF-101, G1B, G-3A, G-3B, G-4B, G-5A, G-5B, and G-6B were sampled for inorganics. The reports documented field activities, analytical results, and trend graphs for field parameters. The field activities outlined in the reports follow the July 2014 Groundwater Monitoring Plan. After reviewing trend graphs provided in the reports, there were no apparent causes of contaminant increases between March 2018 and March 2019. Elevated levels of total dissolved solids were noted in some instances, which can be a cause of elevated groundwater concentrations. The Peninsula Disposal Area has been in Phase 3 or assessment monitoring since March 2011.

4.0 Site Visit

ATC conducted an inspection of the Peninsula Disposal Unit on June 5, 2019 to review site and monitoring well conditions. ATC's inspection was limited to the locations of the detection monitoring well network specified in the aforementioned October 2017 SAP, and included wells G-1B, G-2A and B, G-3A and B, G-5A and B, G-7A and B. G-8B, G-9B, G-10B and KIF-101. The inspection focused on the positioning of the wells relative to the CCR unit, and the condition of the well completion and surrounding area. The protective well covers were not opened during the inspection.

The monitoring wells and access roads were found to be in good to excellent condition. The positioning of the wells relative to the CCR unit and their construction appeared to be adequate for assessing background groundwater chemistry and groundwater quality downgradient of the CCR unit. However, the location of KIF-101 adjacent to a storm water drainage basin raises some concern for potential impacts that the storm water basin may have on shallow groundwater quality in this area due to the potential for infiltration of contaminants from stormwater runoff. However, these impacts are expected to be minimal. Well KIF-101 is designated as a background well to assess background groundwater quality conditions in the shallow unconsolidated aquifer.

5.0 Conclusions

ATC performed a review of groundwater monitoring activities at the TVA Kingston Fossil Plant Peninsula Disposal Unit to determine the quality of the program and adherence to regulatory standards. As part of the review, ATC reviewed reports submitted to the EPA and TDEC and performed a site visit.

In summary, it is of ATC's opinion that the monitoring activities performed at the above referenced facility are in adherence with EPA's and TDEC's guidelines. Furthermore, the work performed by TVA's consultants appears to be of high quality and does not likely result in any discrepancies for the program.

ATC appreciates the opportunity to assist you with this project. If you have questions or require additional information, please do not hesitate to contact us at (919) 871-0999.

Sincerely,

ATC Associates of North Carolina, P.C.

Timothy D. Grant

Timothy D. Grant, P.G.
Senior Project Manager

Larry M. George

Larry M. George, P.G.
Principal/Senior Project Manager