



Memorandum from the Office of the Inspector General

November 7, 2019

Robert M. Deacy, Sr.

**FINAL REPORT – SPECIAL PROJECT 2019-17245 – GROUNDWATER MONITORING
AT SHAWNEE 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 Shawnee Fossil Plant to determine the quality of the program and adherence to regulatory standards. ATC stated that in their opinion, monitoring activities performed at Shawnee Fossil Plant are in adherence with guidelines for the Environmental Protection Agency. Furthermore, ATC stated the work performed appears to be of high quality and does not likely result in any discrepancies for the program. However, ATC identified an omission from a plan that did not impact groundwater monitoring. Your written comments which addressed actions taken and provided clarifying information have been included in the report (See Appendix A). See Appendix B for management's complete response. 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

DDS:FAJ
Attachments

cc (Attachments):

TVA Board of Directors
Clifford L. Beach, Jr.
Jodie A. Birdwell
Robertson D. Dickens
Joseph J. Hoagland
Jeffrey J. Lyash
Justin C. Maierhofer

Sherry A. Quirk
Ronald R. Sanders II
Michael D. Skaggs
Rebecca C. Tolene
Michael S. Turnbow
OIG File No. 2019-17245



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

November 6, 2019

Mr. Greg Stinson
Office of the Inspector General
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902

RE: **Peer Review Letter Report**
Tennessee Valley Authority – Shawnee Fossil Plant
Ash Pond 2 and Consolidated Waste Dry Stack
7900 Metropolis Lake Road
West Paducah, McCracken County, Kentucky

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 Shawnee Fossil Plant for coal combustible residual (CCR) units Ash Pond 2 and Consolidated Waste Dry Stack. ATC reviewed reports prepared from October 2017 through July 2019, 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 Shawnee Fossil Plant is located at 7900 Metropolis Road in West Paducah, McCracken County, Kentucky. The facility is located along the southern side of the Ohio River near the confluence of the Tennessee River. Construction of the facility was initiated in 1951 and all CCR units associated with the facility were in operation by 1956. The Consolidated Waste Dry Stack is located west of the powerhouse and receives dry fly ash from the plant and dredged bottom ash from Ash Pond 2. Ash Pond 2 is located on the northwestern portion of the facility property and is used for storage of fly ash and bottom ash from coal burning at the plant and clarification and treatment of sludge and plant waters and storm water runoff from the plant, the Consolidated Waste Dry Stack, and the Coal Yard Drainage Basin.

1.2 Kentucky Department of Environmental Protection (KDEP)

The KDEP has incorporated the standards from the EPA CCR rule into its regulations and requires owners and operators to comply with the CCR rule.

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 Shawnee Fossil Plant pertains to groundwater monitoring of the Ash Pond 2 and Consolidated Waste Dry Stack. 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. SAPs have been submitted for the Shawnee Fossil Plant Ash Pond 2 CCR unit in October 2017, May 2018, and February 2019. According to the most recent February 2019 SAP, downgradient wells D-11B, D-20B, D-74B, and SHF-101G and background well SHF-102G are used for monitoring under the CCR Rule. It should be noted the Consolidated Waste Dry Stack and Ash Pond 2 are monitored as a Multi-Unit since they cannot be monitored separately due to their location. However, the Consolidated Waste Dry Stack is not referenced in the SAPs. TVA has acknowledged this oversight and is working to update the SAPs to include the Consolidated Waste Dry Stack.

Baseline monitoring was performed between November 2016 and September 2017 on wells D11B, D-30B, D-74B, SHF-101G, and SHF-102G. Detection monitoring was performed in October 2017 to determine statistically significant increases (SSIs) for Appendix III constituents using baseline data. The detection monitoring identified SSIs of Appendix III constituents. Two alternate source demonstrations were performed and concluded the SSIs were not the result of an error or alternate source. Since the demonstrations were unsuccessful, TVA did not produce a report other than documenting the attempts in the annual reporting. Based on the conclusion of the alternate source demonstrations, the site was advanced to assessment monitoring and included analysis of Appendix III and Appendix IV constituents. Assessment

monitoring was initiated in June 2018. The January 2019 Annual Groundwater Monitoring and Corrective Action Report indicated a SSI for molybdenum in well D-74B.

The Ash Pond 2 and Consolidated Waste Dry Stack are currently in the assessment phase with assessment of corrective measures initiated on April 15, 2019. An Assessment of Corrective Measures report issued in July 2019 indicated plans to close the Ash Pond 2 CCR unit by October 2020 as a corrective measure. The Consolidated Waste Dry Stack will continue to operate under the CCR Rule.

2.0 Peer File Review

2.1 Reviewed Reports

ATC reviewed the following documents for the Shawnee Fossil Plant specifically prepared to address the EPA CCR Rule:

- Well Installation Diagrams for Water Quality Sampling Wells (SHF-101G, D-11B, D-30B, D-74B), August 2017, Stantec
- Sampling and Analysis Plan Revision 4, October 2017, Amec Foster Wheeler
- Statistical Method Certification for Compliance, October 16, 2017, HDR, Inc.
- Groundwater Monitoring System, October 16, 2017, AECOM
- 2017 Annual Groundwater Monitoring and Corrective Action Report, January 31, 2018, Stantec
- Sampling and Analysis Plan, May 29, 2018, Terracon
- Groundwater Quality Analytical Summary Report, Parts A and B, Sampling Dates June 5-6, 2018, October 1, 2018, Terracon
- Groundwater Quality Analytical Summary Report, Parts A and B, Sampling Dates June 25-26, 2018, October 2, 2018, Terracon
- Groundwater Quality Analytical Summary Report, Parts A and B, Sampling Dates July 17-18, 2018, October 5, 2018, Terracon
- Groundwater Quality Analytical Summary Report, Parts A and B, Sampling Dates August 7-8, 2018, October 17, 2018, Terracon
- Groundwater Quality Analytical Summary Report, Parts A and B, Sampling Dates August 27-28, 2018, October 18, 2018, Terracon
- 2018 Annual Groundwater Monitoring and Corrective Action Report, January 31, 2019, Stantec
- Sampling and Analysis Plan, February 8, 2019, Terracon
- Notification Identifying Appendix IV Constituents Memo, February 13, 2019, Stantec
- Assessment of Corrective Measures, July 15, 2019, Stantec

2.2 Reports Discussion

The October 2017, May 2018, and February 2019 SAPs were found to be thorough, complete, and are considered appropriate for the groundwater monitoring program associated with the Ash Pond 2 and the Consolidated Waste Dry Stack. Both the May 2018 and February 2019 SAPs indicate deviation from the October 2017 SAP by including an alternate sampling contractor. The SAPs include third party review of both field and laboratory procedures by TVA's quality assurance oversight consultant, Environmental Standards. Indicator parameters beyond those prescribed in Appendix III and IV of the CCR Rule are included in the analysis plans. The SAPs reference TVA's Quality Assurance Protection Plan and Technical

Instructions. As mentioned previously, the Consolidated Waste Dry Stack and Ash Pond 2 are monitored as a Multi-Unit since they cannot be monitored separately due to their location.

The Statistical Methods Certification for the Shawnee Fossil Plant outlined the proposed statistical methods for evaluating groundwater monitoring data collected at the Ash Pond 2 and the Consolidated Waste Dry Stack. The document included the required certification by a Professional Engineer licensed in the State of Kentucky. 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 also reviewed the Statistical Analysis Report included in the 2018 Annual Groundwater Monitoring and Corrective Action Report. ATC finds that the proposed methodology is compliant with the above-referenced guidance documents and industry-standard practices.

Groundwater Quality Analytical Summary Reports documenting monitoring performed between June 5, 2018 and August 28, 2018 generally followed the May 2018 SAP. There were a few discrepancies with stabilization parameters and calibration ranges; however, these discrepancies do not likely affect the analytical results. Furthermore, the reports document omission of information from the field notes during the sampling events (i.e. not indicating how purge water was disposed of, not clarifying that sampling equipment was decontaminated between sampling points, etc.); however, as noted in the reports, the omitted information appears minor and does not affect the data quality. The Consolidated Waste Dry Stack is referenced in the Annual Groundwater Monitoring Reports; however, it is not referenced in the text portion (Part A) of the Groundwater Quality Analytical Summary Reports.

ATC reviewed data trends documented in the 2018 Annual Groundwater Monitoring and Corrective Action Report submitted in January 2019. Variable trends of specific metals, anions, and total dissolved solids (TDS) were identified in several wells. The metal and anion trends appear to have some relationship to the turbidity and TDS 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.).

ATC reviewed the Assessment of Corrective Measures report issued in July 2019. The report was prepared to address the SSI for molybdenum detected in well D-74B. Both CCR and non-CCR monitoring wells were used to determine the extent of molybdenum concentrations during an initial characterization of groundwater. Additional characterization was proposed, with referenced activities including additional sampling events, installation of additional monitoring wells, supplemental investigation into the nature and estimated quantity of material released, and sampling wells installed for the purpose of evaluating and designing a remedy. TVA has also implemented operational changes as source control measures (i.e. lowering the water surface elevation in Ash Pond 2 to reduce the pressure head and reduce the rate of potential process water infiltration). It was also indicated that TVA plans to close Ash Pond 2 by October 2020. The Consolidated Waste Dry Stack will continue to operate under the CCR Rule.

Monitored natural attenuation, hydraulic containment and treatment, and enhanced in-site treatment will be considered for potential remedial technologies to address the molybdenum concentrations. The remedial alternative to address molybdenum will be selected as soon as feasible and will be documented in future semi-annual groundwater monitoring reports.

3.0 Site Visit

ATC conducted an inspection of Ash Pond 2 and the Consolidated Waste Dry Stack units on August 8, 2019 to review site and monitoring well conditions. ATC's inspection was limited to the locations of the detection/assessment monitoring well network specified in the aforementioned SAPs, and included wells D-11B, D-20B, D-74B, SHF-101G and SHF-102G. The inspection focused on the positioning of the wells relative to the CCR units, 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 condition. The positioning of the wells relative to the CCR units and their construction appeared to be adequate for assessing background groundwater chemistry and groundwater quality downgradient of the CCR units. It was noted that a discharge channel associated with Ash Pond 2 was present along the northern edge of both CCR units. Monitoring wells D-11B and SHF-101G are located on the northern side of the discharge channel between the channel and the Ohio River. Monitoring wells D-74B and D-30B were located on the southern side of the discharge channel, between the channel and the Consolidated Waste Dry Stack CCR unit. Well SHF-102G is designated as a background well to assess background groundwater quality conditions in the shallow unconsolidated aquifer. The screen intervals target a portion of the underlying aquifer designated as the Regional Gravel Aquifer (RGA). The TVA representative indicated that the hydrogeological study demonstrated a vertical (downward) gradient was present in the hydrogeological unit overlying the RGA, so the overlying unit would not have been suitable for monitoring to detect a release from the CCR units. Accordingly, the RGA was selected as the most appropriate aquifer to target for detection monitoring. A Groundwater Monitoring Plan was not available to review to determine the rationale in positioning of the wells or selecting the screen intervals in the RGA. While 40 CFR 257.91 does not specifically require that a Groundwater Monitoring Plan be developed, it does indicate several factors that should be considered in locating the groundwater monitoring wells.

The TVA representative did note that due to flooding from the Ohio River, they were unable to sample the wells this year until just recently. It was observed that several of the wells had been underwater. TVA indicated that after the flood waters had receded, they conducted a mock purge of groundwater in the wells to determine if there had been an increase in turbidity, indicating that flood water had entered the well. It was found that all wells, except D-74B, had elevated turbidity and were redeveloped prior to sampling. TVA is currently evaluating modifications to the groundwater monitoring program to include monitoring wells that would not be affected by potential future flooding events.

4.0 Conclusions

ATC performed a review of groundwater monitoring activities at the TVA Shawnee Fossil Plant to determine the quality of the program and adherence to regulatory standards for the Ash Pond 2 and Consolidated Waste Dry Stack CCR Units. As part of the review, ATC reviewed reports submitted to the EPA and performed a site visit.

Peer Review Letter Report

TVA Shawnee Fossil Plant

The only deficiency ATC identified was the omission of the Consolidated Waste Dry Stack from the SAPs and text portion (Part A) of the Groundwater Quality Analytical Summary Reports. Both CCR units are being monitored as a Multi-Unit and utilize the same well network; therefore, there is no impact on the groundwater monitoring or quality of the well network.

TVA should consider the following recommendations:

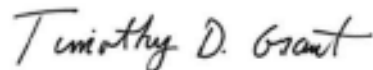
- TVA should complete the action to revise the SAP to include the Consolidated Waste Dry Stack.
- TVA should also review the SAPs for any other facilities that have Multi-Unit CCR units to ensure that the CCR units are included in the SAP.

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



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

From: "Birdwell, Jodie Allyn

Date: Wednesday, October 30, 2019 at 8:32:38 PM

To: Matthews, Jill M., Deacy, Robert Martin Sr

Cc: Beach, Clifford L Jr, Dickens, Robertson Dale, Quirk, Sherry Ann, Sanders, Ronald Reeves II, Skaggs, Michael David, Tolene, Rebecca Chunn, Turnbow, Michael S

Subject: RE: Request for Comments - Draft Special Project 2019-17245 - Groundwater Monitoring at Shawnee Fossil Plant

Ms. Matthews:

Thank you for the opportunity to review the draft report on Shawnee. We are pleased with your consultant's conclusion that we are in compliance with groundwater monitoring requirements and that our work appears to be of high quality.

We have addressed your consultant's note on page 2 that the Consolidated Waste Dry Stack was not referenced in portions of the Sampling Analysis Plan (SAP). Thank you for bringing that oversight to our attention. The Dry Stack was specifically identified elsewhere in the document—e.g., Appendix B, the Quality Assurance Project Plan—and is sampled by the monitoring network as shown on Figure 1 of the SAP. We have corrected the oversight in the document, as attached, and have reviewed all other SAPs for multi-unit well networks where a similar oversight may have occurred. All current SAPs for multi-unit systems identify each unit within that system.

In addition, we recommend changing the following statement in Section 1.2 of your report concerning Kentucky's Department of Environmental Protection (KDEP): "KDEP does not provide any regulatory oversight as long as the facility continues to comply with the EPA CCR rule." In our view, it is more accurate to say that Kentucky has incorporated the standards from the CCR rule into its regulations and requires owners and operators to comply with the CCR Rule.

We have no other comments.

Jodie Birdwell
General Manager
Generation Construction: Strategy and Engineering

Tennessee Valley Authority
1101 Market Street, LP S508
Chattanooga, TN 37402
202-213-1512 (m)
jabirdwell@tva.gov