



TECHNICAL MEMORANDUM

TO: Tennessee Valley Authority
FROM: Jeffrey D. Frazier
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FILE: Updated GWPS and SSLs at the Paradise
Fossil Plant, Gypsum Disposal Area CCR Units
DATE: January 5, 2024

**REFERENCE: 2023 YEAR-END UPDATE ON STATISTICALLY SIGNIFICANT LEVELS (SSLs) –
CCR RULE GROUNDWATER MONITORING – PARADISE FOSSIL PLANT, GYPSUM
DISPOSAL AREA CCR UNITS**

In accordance with the federal regulations for management of coal combustion residuals (CCR Rule; 40 CFR Part 257, Subpart D), the Tennessee Valley Authority (TVA) is currently conducting Assessment Monitoring at the Gypsum Disposal Area CCR Units at its Paradise Fossil Plant (PAF) in Paducah, Kentucky.

As required by the CCR Rule, the owner or operator of a CCR unit shall establish groundwater protection standards (GWPS) for Appendix IV parameters detected during Assessment Monitoring and determine if one or more Appendix IV parameters are detected at statistically significant levels (SSLs) above their GWPS. GWPS for all Appendix IV parameters were originally established and documented in a notice dated October 15, 2018, as required by 40 CFR § 257.95(d)(2) and are provided on Table 1.

As part of ongoing Assessment Monitoring, the second semiannual assessment monitoring event for 2023 occurred August 8 to 16, 2023, with the additional “resample” event occurring September 14 to 19, 2023. This technical memorandum presents GWPS and lower confidence bands (LCBs) that have been updated with data collected during the second semiannual monitoring event and resample event for 2023, as well as any identified SSLs after incorporating the additional data collected in 2023. The updated GWPS has been calculated using data collected at background wells (95-48A, PAF-101, and PAF-104) from November 2016 through September 2023. To statistically evaluate the Appendix IV constituents, concentration data are compared to the GWPS through the use of confidence bands. In assessment monitoring, a well is determined to be out of compliance and has an SSL when the lower confidence band (LCB), and thus the entire confidence interval, exceeds the GWPS, as discussed in the *Unified Guidance*. If the compliance data at a given well-constituent pair show evidence of a significant trend, a linear regression line will be fit to the data and a confidence band with a 99% confidence level will be constructed around the trend line. To evaluate compliance with regulatory standards, the lower edge of the confidence band and the most recent sampling event will be compared to the GWPS. If the lower edge exceeds the GWPS at that point in time (thus guaranteeing the entire vertical cross-section of the band also exceeds the GWPS at that point), a SSL will be recorded. If the lower edge of the confidence band does not exceed the GWPS, no SSL has occurred. As new sampling events are collected, the trend estimate will be updated along with the confidence band.

Based on the statistical analysis performed in 2023, there continues to be a single SSL above the GWPS for arsenic in samples collected from monitoring well PAF-116. TVA will continue to conduct groundwater monitoring and reporting pursuant to 40 CFR § 257.95.

TABLE 1: Statistically Significant Levels Above GWPS – PAF Gypsum Disposal Area CCR Units

| Appendix IV Parameter | Original GWPS (a) | Updated GWPS (b) | Downgradient wells with analytical results above GWPS (c) | Updated LCBs (d) | SSL LCB > GWPS (e) |
|------------------------|-------------------|------------------|---|------------------|--------------------|
| Antimony (µg/L) | 6 | 6 | None | NA | NA |
| Arsenic (µg/L) | 13.6 | 10.9 | PAF-116 | 13.12 | Yes |
| Barium (µg/L) | 2,000 | 2,000 | None | NA | NA |
| Beryllium (µg/L) | 50 | 4 | None | NA | NA |
| Cadmium (µg/L) | 5 | 5 | None | NA | NA |
| Chromium (µg/L) | 100 | 100 | None | NA | NA |
| Cobalt (µg/L) | 88.9 | 89.7 | None | NA | NA |
| Fluoride (mg/L) | 4 | 4 | None | NA | NA |
| Lead (µg/L) | 15 | 15 | None | NA | NA |
| Lithium (µg/L) | 165 | 177 | None | NA | NA |
| Mercury (µg/L) | 2 | 2 | None | NA | NA |
| Molybdenum (µg/L) | 100 | 100 | None | NA | NA |
| Radium-226+228 (pCi/L) | 5 | 5 | None | NA | NA |
| Selenium (µg/L) | 50 | 50 | None | NA | NA |
| Thallium (µg/L) | 2 | 2.12 | None | NA | NA |

NA – Not applicable

- (a) Original GWPS documented in notice dated October 15, 2018
- (b) GWPS updated as of September 2023, with results from two additional sampling events collected on August 8 to 16, 2023, and September 14 to 19, 2023
- (c) Downgradient wells with second semiannual 2023 results above the current GWPS using a direct-value comparison
- (d) Most recent value of 99% lower confidence band (LCB) on the mean of Appendix IV groundwater sampling events between November 2016 and September 2023. Upper confidence band (UCB) not shown as it is greater than LCB
- (e) SSL: “statistically significant level” over GWPS occurs when the updated LCB value at the last sampling event exceeds the updated GWPS