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To:	Tennessee Valley Authority Chattanooga, TN	From:	Matthew Dagon Indianapolis, IN
File:	Updated GWPS and SSLs at the Colbert Fossil Plant Ash Disposal Area 4 CCR Unit	Date:	December 29, 2023

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**Reference: End of Year Update on Statistically Significant Levels (SSLs) (40 CFR § 257.95(g)) - CCR Rule Groundwater Monitoring - Colbert Fossil Plant, Ash Disposal Area 4 CCR Unit**

In accordance with the federal regulations for management of coal combustion residuals (CCR Rule; 40 Code of Federal Regulations [CFR] Part 257, Subpart D)<sup>1</sup>, the Tennessee Valley Authority (TVA) is currently conducting Assessment Monitoring at the Ash Disposal Area 4 CCR Unit (CCR Unit) at its Colbert Fossil Plant (COF) in Tuscumbia, Alabama. The Ash Disposal Area 4 consists of one CCR surface impoundment subject to the CCR Rule with a single-unit groundwater monitoring system with monitoring wells screened in alluvium, residuum, and bedrock.

In 2022, TVA expanded the certified groundwater monitoring system (which originally consisted of six wells in alluvium) by adding 12 additional monitoring wells in the alluvium, residuum, and bedrock to be consistent with the Alabama Department of Environmental Management (ADEM) CCR Facility Permit 17-11. In compliance with 40 CFR § 257.91, the expanded groundwater monitoring system includes one background well (CA5) and seven monitoring wells (COF-102, COF-104, COF-105, COF-108, COF-111, MC4, and MC5A) located downgradient and upgradient of the CCR Unit in the alluvium and residuum. Monitoring well COF-106 was removed from the certified monitoring system. Additionally, in the bedrock, the groundwater monitoring system includes two background wells (CA6 and COF-116BR) and eight monitoring wells (COF-111BR, COF-112BR, COF-113BR, COF-114BR, CA17B, CA30B, MC1, and MC5C) located downgradient, upgradient, or cross-gradient of the CCR Unit. The certified groundwater monitoring system was updated in December 2022.

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. GWPS for all Appendix IV parameters for the updated certified monitoring system were established in the Statistical Analysis Report dated December 19, 2023, and are provided on Tables 1 and 2.

As part of ongoing Assessment Monitoring, the second semiannual assessment monitoring event for 2023 occurred July 24-27, 2023, with the additional “resample” event occurring September 11-20, 2023. This technical memorandum presents GWPS and lower confidence bands (LCBs) that have been updated with the data collected during the second semiannual assessment monitoring event and resample event for 2023, as well as any identified SSLs after incorporating the additional data collected in 2023. The identification of SSLs was performed as a two-step process:

1. Historical sampling results (May 2018<sup>2</sup> or October 2018<sup>3</sup> through September 2023) for Appendix IV parameters from each downgradient, cross-gradient, or upgradient monitoring well were compared

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<sup>1</sup> The ADEM has adopted a state CCR rule. As the state rule has not been approved by United States Environmental Protection Agency to operate in lieu of the federal CCR Rule, TVA must comply with both the state and federal CCR regulations. This notification also complies with ADEM Admin. Code r. 335-13-15-.06 (6)(g).

<sup>2</sup> Applies to monitoring wells: CA5, COF-102, COF-104, COF-105, COF-108, COF-111, MC4, and MC5A

<sup>3</sup> Applies to monitoring wells: CA6, COF-116BR, COF-111BR, COF-112BR, COF-113BR, COF-114BR, CA17B, CA30B, MC1, and MC5C

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directly to the updated GWPS. If Appendix IV parameter concentrations were below the GWPS, no SSLs over the GWPS were identified.

2. Where the direct comparison of an Appendix IV parameter indicated a concentration greater than the GWPS, further statistical analysis was performed to identify levels statistically greater than the GWPS using procedures recommended in the United States Environmental Protection Agency's Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (EPA 530/R-09-007, March 2009). Comparisons were made against a fixed GWPS via LCBs. For each situation where an Appendix IV parameter concentration was greater than the GWPS in step 1, the 99% LCB of the fitted line in that monitoring well was calculated using CCR Rule monitoring data collected from May or October 2018 through September 2023. As recommended in the Unified Guidance where the 99% LCB exceeds the GWPS at the last sampling event, an SSL was identified for the constituent/well pair.

Based on the statistical analysis performed in 2023, there continues to be an SSL above the GWPS for arsenic at monitoring well COF-105 in the alluvium as summarized in Table 1. The SSL for arsenic identified at monitoring well COF-108 in the alluvium was not evident in the statistical analysis after inclusion of groundwater monitoring data collected in 2023. In the bedrock, SSLs above the GWPS were recorded for arsenic in monitoring well COF-114BR and molybdenum in monitoring wells COF-111BR<sup>4</sup> and COF-114BR as summarized in Table 2. The SSLs for antimony and lithium identified at monitoring well MC5C in the bedrock were not evident in the statistical analysis after inclusion of groundwater monitoring data collected during the second half of 2023. TVA will continue to conduct groundwater monitoring and reporting pursuant to 40 CFR § 257.95.

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<sup>4</sup> Monitoring well COF-111BR was decommissioned (i.e., abandoned by grouting in accordance with State requirements) in April 2023 following the January and March 2023 groundwater sampling events. A replacement well identified as COF-111BRR and an additional bedrock well (COF-108BR) will be installed in 2024 following scheduled construction activities at Ash Disposal Area 4.

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**TABLE 1: Statistically Significant Levels Above GWPS - COF Ash Disposal Area 4 CCR Unit - Alluvium/Residuum**

Appendix IV Parameter	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)	10	10	COF-105	36.2	<b>Yes</b>
			COF-108	9.7	No
			COF-111 <sup>(f)</sup>	0.0	No
Barium (µg/L)	2,000	2,000	None	NA	NA
Beryllium (µg/L)	4	4	None	NA	NA
Cadmium (µg/L)	5	5	None	NA	NA
Chromium (µg/L)	100	100	None	NA	NA
Cobalt (µg/L)	6	6	COF-102 <sup>(f)</sup>	0.0	No
			COF-104	3.3	No
			COF-105 <sup>(f)</sup>	0.0	No
Fluoride (mg/L)	4	4	None	NA	NA
Lead (µg/L)	15	15	None	NA	NA
Lithium (µg/L)	40	40	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	None	NA	NA

Applies to alluvium monitoring wells: CA5, COF-102, COF-104, COF-105, COF-108, COF-111

Applies to residuum monitoring wells: MC4, and MC5A

NA – Not applicable

(a) GWPS documented in notice dated October 15, 2018 [reported in micrograms per liter (µg/L) except fluoride (mg/L) and radium 226+228 (pCi/L)]

(b) GWPS updated as of December 19, 2023, with results from two additional sampling events collected on July 24-27, 2023, and September 11-20, 2023 [reported in µg/L except fluoride (mg/L) and radium 226+228 (pCi/L)]

(c) Downgradient wells with analytical results above updated GWPS May 2018 through September 2023 (per 40 CFR § 257.95(b) and (d))

(d) Most recent value of 99% lower confidence band (LCB) on the mean of Appendix IV groundwater sampling events between May 2018 and September 2023. Upper confidence band (UCB) not shown as it is greater than LCB [reported in µg/L]

(e) SSL: “statistically significant level” over GWPS occurs when the updated LCB value at the last sampling event exceeds the updated GWPS

(f) Negative lower confidence bands were reported as 0.0 µg/L

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**TABLE 2: Statistically Significant Levels Above GWPS - COF Ash Disposal Area 4 CCR Unit - Bedrock**

Appendix IV Parameter	GWPS (g)	GWPS (h)	Downgradient, cross-gradient, or upgradient wells with analytical results above GWPS (i)	Updated LCBs (j)	SSL LCB > GWPS (k)
Antimony (µg/L)	6	6	MC5C	1.6	No
Arsenic (µg/L)	10	10	COF-114BR	12.4	<b>Yes</b>
Barium (µg/L)	2,000	2,000	None	NA	NA
Beryllium (µg/L)	4	4	None	NA	NA
Cadmium (µg/L)	5	5	None	NA	NA
Chromium (µg/L)	100	100	None	NA	NA
Cobalt (µg/L)	6	6	COF-111BR	0.17	No
			CA17B <sup>(l)</sup>	0.0	No
Fluoride (mg/L)	4	4	None	NA	NA
Lead (µg/L)	15	15	None	NA	NA
Lithium (µg/L)	69.6	69.4	MC5C	51.2	No
Mercury (µg/L)	2	2	None	NA	NA
Molybdenum (µg/L)	100	100	COF-111BR	166	<b>Yes</b>
			COF-114BR	135	<b>Yes</b>
Radium-226+228 (pCi/L)	5	5	None	NA	NA
Selenium (µg/L)	50	50	None	NA	NA
Thallium (µg/L)	2	2	None	NA	NA

Applies to bedrock monitoring wells: CA6, COF-116BR, COF-111BR, COF-112BR, COF-113BR, COF-114BR, CA17B, CA30B, MC1, and MC5C

NA – Not applicable

- (g) GWPS established in Statistical Analysis Report dated January 6, 2023 [reported in µg/L except fluoride (mg/L) and radium 226+228 (pCi/L)]
- (h) GWPS updated as of December 19, 2023, with results from two additional sampling events collected on July 24-27, 2023, and September 11-20, 2023 [reported in µg/L except fluoride (mg/L) and radium 226+228 (pCi/L)]
- (i) Downgradient, cross-gradient, or upgradient wells with analytical results above updated GWPS October 2018 through September 2023 (per 40 CFR § 257.95(b) and (d))
- (j) Most recent value of 99% lower confidence band (LCB) on the mean of Appendix IV groundwater sampling events between October 2018 and September 2023. Upper confidence band (UCB) not shown as it is greater than LCB [reported in µg/L]
- (k) SSL: “statistically significant level” over GWPS occurs when the updated LCB value at the last sampling event exceeds the updated GWPS
- (l) Negative lower confidence bands were reported as 0.0 µg/L