

REPORT

Annual Groundwater Monitoring Report – 2021

Active Coal Combustion Residuals Landfill Escalante Generating Station Prewitt, New Mexico

Submitted to:

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Executive Summary

This report summarizes the groundwater monitoring activities and results for the 2021 detection monitoring program for the active coal combustion residuals (CCR) landfill at Escalante Generating Station, along with the comparative statistical analysis. The active CCR landfill, which is owned and operated by Tri-State Generation and Transmission Association, Inc., is currently in detection monitoring, and no program transitions occurred in 2021.

No statistically significant increases (SSIs) were identified from the 2021 detection monitoring. Total recoverable calcium in the sample collected from TRcpc-2 during the May 2021 sampling event exceeded the non-parametric prediction limit and was therefore identified as a potential exceedance. Confirmatory resampling in October 2021 identified this as a false-positive SSI. As described in the Groundwater Monitoring System Certification (Golder 2017) and the Groundwater Statistical Method Certification (Golder 2020), the groundwater monitoring and analytical procedures for the program meet the requirements of 40 CFR 257 Subpart D (the CCR Rule), and modifications to the monitoring network and sampling program are not recommended at this time.



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1.0 INTRODUCTION

Golder Associates USA Inc. (Golder) has prepared this report to describe the 2021 groundwater monitoring activities and comparative statistical analysis for the active coal combustion residuals (CCR) landfill (the Facility) at Escalante Generating Station (the site), which is owned and operated by Tri-State Generation and Transmission Association, Inc. (Tri-State) and subject to regulation under 40 CFR 257 Subpart D (the CCR Rule). This report was written to meet the requirements of 40 CFR 257.90(e).

1.1 Facility Information

Escalante Generating Station is a 270-megawatt coal-fired electric generation facility located near Prewitt, New Mexico. The generating unit was retired in August 2020. The active CCR landfill at the site contains fly ash, bottom ash, and flue gas desulfurization solids (scrubber solids).

1.2 Purpose

The CCR Rule established specific requirements for reporting of groundwater monitoring activities and corrective action in 40 CFR 257.90. Per part (e) of 40 CFR 257.90, no later than January 31, 2018, and annually thereafter, owners or operators of CCR units must prepare an annual groundwater monitoring and corrective action report.

2.0 GROUNDWATER MONITORING PROGRAM STATUS

The groundwater monitoring system for the active CCR landfill at Escalante Generating Station consists of six monitoring wells, as shown in Figure 1 and described in the Groundwater Monitoring System Certification (Golder 2017). The two upgradient monitoring wells are TRcpc-1 and TRcpc-2. The four downgradient monitoring wells are TRcpc-15, TRcpc-16, TRcpc-17, and TRcpc-18.

2.1 Completed Key Actions in 2021

The following key actions were completed in 2021:

- The 2020 Annual Groundwater Monitoring Report was finalized and placed within the operating record and on Tri-State's publicly accessible CCR website.
- Detection monitoring sampling events were performed in the second quarter, on May 12 and 13, and in the fourth quarter, on November 2 and 3.
- Confirmatory resampling was performed on October 18 for a potential exceedance identified during the May 2021 sampling event.

2.2 Installation and Decommissioning of Monitoring Wells

No monitoring wells were installed or decommissioned for the active CCR landfill at Escalante Generating Station in 2021.

2.3 Problems and Resolutions

No problems were identified in 2021. The following problem noted in the 2020 Annual Groundwater Monitoring Report (Golder 2021) was resolved in 2021:

■ Field-measured pH was not recorded for samples collected from TRcpc-1 and TRcpc-2 during the October 2020 sampling event. Field-measured pH was recorded for each well sampled during the 2021 sampling events.



2.4 Proposed Key Activities for 2022

The following key action is expected to be completed in 2022:

Detection monitoring sampling events are planned to occur in the second and fourth quarters of 2022.

3.0 GROUNDWATER MONITORING RESULTS AND ANALYSIS

Results from the groundwater monitoring program in 2021 are described in this section.

3.1 Groundwater Flow

The groundwater elevation was measured in each well prior to purging during each sampling event. Groundwater elevations are presented in Table 1 through Table 6. Groundwater elevations from the May 2021 and November 2021 sampling events are shown in Figure 1 and Figure 2, respectively.

Based on the May 2021 and November 2021 groundwater elevations, the groundwater in the Correo Sandstone generally flows east with a localized northerly flow component under the active CCR landfill.

The groundwater flow rate was estimated with the equation $V_s = k \times i/n_e$, where:

- V_s is the groundwater flow rate, in feet per day (ft/day);
- *k* is the hydraulic conductivity, estimated to range from 0.00296 to 12.7 from site pumping test data, in ft/day;
- i is the hydraulic gradient calculated based on the difference in groundwater elevations between TRcpc-1 and TRcpc-16 and the distance between these wells, in feet per foot (ft/ft); and
- n_e is the effective porosity, estimated to be 0.33 based on historical testing results for samples of Correo Sandstone obtained on site.

Groundwater flow velocity estimates range from 0.00004 ft/day to 0.19 ft/day for the May 2021 and November 2021 sampling events.

3.2 Monitoring Data (Analytical Results)

Analytical results from detection monitoring in 2021 are shown in Table 1 through Table 6.

3.3 Samples Collected

The detection monitoring sampling events were conducted in May and November 2021. Additionally, a sample was collected from TRcpc-2 in October 2021 for confirmatory resampling associated with the detection monitoring program.

3.4 Comparative Statistical Analysis

The comparative statistical analysis is summarized below, and the results are presented in Table 7 through Table 12. A full description of the steps taken for the comparative statistical analysis can be found in the Groundwater Statistical Method Certification (Golder 2020).



3.4.1 Definitions

The following definitions are used in discussion of the comparative statistical analysis:

SSI – is a statistically significant increase and is defined as an analytical result that exceeds the parametric or non-parametric statistical limit established by the baseline statistical analysis.

- Potential exceedance is defined as an initial analytical result that exceeds the parametric or non-parametric statistical limit established by the baseline statistical analysis. Confirmatory resampling is used to determine whether the potential exceedance is a false-positive SSI or a verified SSI.
- <u>False-positive SSI</u> is defined as an analytical result that exceeds the statistical limit but can clearly be attributed to laboratory error or changes in analytical precision or is invalidated through confirmatory resampling.
- Confirmatory resampling is designated as the resampling event that occurs within 90 days of identifying an SSI over the statistical limit for determination of a verified SSI ¹.
- Verified SSI is interpreted as two consecutive SSIs (the original sample and the confirmatory resample for analytical results) for the same constituent at the same well.

3.4.2 Potential Exceedances

The total recoverable calcium concentration in the May 2021 sample collected from TRcpc-2 was greater than the non-parametric prediction limit and was therefore identified as a potential exceedance. Results of the confirmatory resampling conducted in October 2021 are discussed in Section 3.4.3.

3.4.3 False-Positive Statistically Significant Increases

Confirmatory resampling for a potential exceedance associated with the May 2021 sampling event (total recoverable calcium at TRcpc-2) occurred in October 2021. The confirmatory resampling event identified the May 2021 total recoverable calcium result at TRcpc-2 as a false-positive SSI. No further action is needed.

3.4.4 Verified Statistically Significant Increases

No verified SSIs were identified from the 2021 detection monitoring program.

4.0 PROGRAM TRANSITIONS

In the third quarter of 2017, the groundwater monitoring program for the active CCR landfill at Escalante Generating Station transitioned from the baseline period to detection monitoring. The Facility remains in detection monitoring, and no program transitions occurred in 2021.

4.1 Detection Monitoring

Samples for the detection monitoring program are collected on a semi-annual basis, beginning with the sample collected in August 2017. Tri-State plans to collect semi-annual samples for the detection monitoring program in the second and fourth quarters of 2022.

Resampling may not occur within 90 days of the sampling event that resulted in the potential exceedance because of the additional time required for activities that must occur before a potential exceedance can be identified. These include sample delivery, analytical testing, review of results, and comparative statistical analysis.



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4.2 Assessment Monitoring

The groundwater monitoring program for the active CCR landfill at Escalante Generating Station is not in assessment monitoring. Assessment monitoring has not been triggered as described in 40 CFR 257.95. As such, no alternative source demonstrations have been made under an assessment monitoring program and no actions are required.

4.3 Corrective Measures and Assessment

The groundwater monitoring program for the active CCR landfill at Escalante Generating Station does not indicate the need for corrective measures. An assessment of corrective measures, as described in 40 CFR 257.96, is not required.

5.0 RECOMMENDATIONS AND CLOSING

This report presents the groundwater monitoring activities and results for the 2021 detection monitoring program for the active CCR landfill at Escalante Generating Station, along with the comparative statistical analysis. The significant findings from the 2021 monitoring activities and comparative statistical analysis are as follows:

- One potential exceedance (for total recoverable calcium in TRcpc-2) was identified for the May 2021 sampling event. Confirmatory resampling conducted in October 2021 indicated the May 2021 result was a false-positive SSI. No other potential exceedances or false-positive SSIs were identified for the 2021 detection monitoring program.
- No verified SSIs were identified from the 2021 detection monitoring program.

As described in the Groundwater Monitoring System Certification (Golder 2017) and the Groundwater Statistical Method Certification (Golder 2020), the groundwater monitoring and analytical procedures meet the requirements of the CCR Rule, and modifications to the monitoring network and sampling program are not recommended at this time.



Signature Page

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6.0 REFERENCES

Golder (Golder Associates Inc.). 2017. Active Coal Combustion Residuals Landfill Groundwater Monitoring System Certification, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. October 13.

- Golder. 2020. Active Coal Combustion Residuals Landfill Groundwater Statistical Method Certification, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. June 29.
- Golder. 2021. Annual Groundwater Monitoring Report 2020, Active Coal Combustion Residuals Landfill, Escalante Generating Station. Report prepared for Tri-State Generation and Transmission Association, Inc. January 29.



Tables

Table 1. Sample Results Summary Table – TRcpc-1

Analytes	Units	Compliance Point (5/12/2021)	Compliance Point (11/3/2021)
Static Water Elevation	ft amsl	6860.2	6860.2
Appendix III			
Boron, Total Recoverable	mg/L	1.6	1.6
Calcium, Total Recoverable	mg/L	13	12
Chloride	mg/L	550	660
Fluoride	mg/L	1.8	1.5
pH, Field-Measured	pH units	8.2	8.4
Sulfate	mg/L	710	880
Total Dissolved Solids	mg/L	2500	2500 B

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter



Table 2. Sample Results Summary Table – TRcpc-2

Analytes	Units	Compliance Point (5/12/2021)	Confirmatory Resample (10/18/2021) ¹	Compliance Point (11/3/2021)
Static Water Elevation	ft amsl	6851.1	6850.9	6850.9
Appendix III				
Boron, Total Recoverable	mg/L	1.6		1.5
Calcium, Total Recoverable	mg/L	16	15	14
Chloride	mg/L	1100		1200
Fluoride	mg/L	2.3		1.7
pH, Field-Measured	pH units	8.0	8.0	8.2
Sulfate	mg/L	480		580
Total Dissolved Solids	mg/L	2800		2800 B

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter

B: Analyte detected in the laboratory quality control blank and the sample

1. Field-measured pH reported for informational purposes only. SSI determination for the confirmatory resample event (Table 8) only applies to parameters identified as potential exceedances for the preceding sampling event.



Table 3. Sample Results Summary Table - TRcpc-15

	_	-	
Analytes	Units	Compliance Point (5/13/2021)	Compliance Point (11/2/2021)
Static Water Elevation	ft amsl	6829.0	6828.8
Appendix III			
Boron, Total Recoverable	mg/L	1.4	1.3
Calcium, Total Recoverable	mg/L	6.4	5.9
Chloride	mg/L	500	590
Fluoride	mg/L	2.7	2.4
pH, Field-Measured	pH units	8.1	8.2
Sulfate	mg/L	200	250
Total Dissolved Solids	mg/L	1600	1700 B

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter



Table 4. Sample Results Summary Table - TRcpc-16

Analytes	Units	Compliance Point (5/13/2021)	Compliance Point (11/2/2021)
Static Water Elevation	ft amsl	6828.1	6827.9
Appendix III			
Boron, Total Recoverable	mg/L	1.5	1.4
Calcium, Total Recoverable	mg/L	4.9	4.5
Chloride	mg/L	390	480
Fluoride	mg/L	3.4	3.1
pH, Field-Measured	pH units	8.3	8.3
Sulfate	mg/L	230	250
Total Dissolved Solids	mg/L	1400	1500 B

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter



Table 5. Sample Results Summary Table – TRcpc-17

Units	Compliance Point (5/13/2021)	Compliance Point (11/2/2021)
ft amsl	6830.4	6830.3
mg/L	1.4	1.4
mg/L	17	16
mg/L	1400	1600
mg/L	2.7	2.2
pH units	8.1	8.1
mg/L	260	340
mg/L	3000	3100 B
	ft amsl mg/L mg/L mg/L mg/L pH units mg/L	Inits (5/13/2021) ft amsl 6830.4 mg/L 1.4 mg/L 17 mg/L 1400 mg/L 2.7 pH units 8.1 mg/L 260

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter



Table 6. Sample Results Summary Table – TRcpc-18

Analytes	Units	Compliance Point (5/13/2021)	Compliance Point (11/2/2021)
Static Water Elevation	ft amsl	6840.4	6840.9
Appendix III			
Boron, Total Recoverable	mg/L	0.84	0.80
Calcium, Total Recoverable	mg/L	4.3	4.7
Chloride	mg/L	320	370
Fluoride	mg/L	1.6	1.3
pH, Field-Measured	pH units	9.9	9.9
Sulfate	mg/L	180	220
Total Dissolved Solids	mg/L	1200	1200 B

NOTES:

ft amsl: feet above mean sea level

mg/L: milligrams per liter



Table 7. Statistics Summary Table – TRcpc-1

				May	2021	November 2021	
Analytes	Units	Selected Statistical Method	Statistical Limit	Compliance Point (5/12/2021)	SSI Determination	Compliance Point (11/3/2021)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.7	1.6	No	1.6	No
Calcium, Total Recoverable	mg/L	NP-PL	13	13	No	12	No
Chloride	mg/L	P-PL	692	550	No	660	No
Fluoride	mg/L	NP-PL	1.8	1.8	No	1.5	No
pH, Field-Measured	pH units	P-PL	7.2, 9.7	8.2	No	8.4	No
Sulfate	mg/L	P-PL	922	710	No	880	No
Total Dissolved Solids	mg/L	NP-PL	3200	2500	No	2500 B	No

NOTES:

P-PL: Parametric Prediction Limit NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter



Table 8. Statistics Summary Table - TRcpc-2

				May 2021		Octobe	er 2021	November 2021	
Analytes	Units	Selected Statistical Method	Statistical Limit	Compliance Point (5/12/2021)	SSI Determination	Confirmatory Resample (10/18/2021)	SSI Determination	Compliance Point (11/3/2021)	SSI Determination
Appendix III									
Boron, Total Recoverable	mg/L	NP-PL	1.6	1.6	No			1.5	No
Calcium, Total Recoverable	mg/L	NP-PL	15	16	False Positive	15	No	14	No
Chloride	mg/L	NP-PL	1200	1100	No			1200	No
Fluoride	mg/L	P-PL	2.4	2.3	No			1.7	No
pH, Field-Measured	pH units	NP-PL	7.8, 9.4	8.0	No			8.2	No
Sulfate	mg/L	P-PL	624	480	No			580	No
Total Dissolved Solids	mg/L	NP-PL	2900	2800	No			2800 B	No

NOTES:

P-PL: Parametric Prediction Limit

NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter



Table 9. Statistics Summary Table - TRcpc-15

				May	2021	November 2021	
Analytes	Units	Selected Statistical Method	Statistical Limit	Compliance Point (5/13/2021)	SSI Determination	Compliance Point (11/2/2021)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.5	1.4	No	1.3	No
Calcium, Total Recoverable	mg/L	P-PL	8.4	6.4	No	5.9	No
Chloride	mg/L	P-PL	620	500	No	590	No
Fluoride	mg/L	NP-PL	3.0	2.7	No	2.4	No
pH, Field-Measured	pH units	NP-PL	7.8, 8.8	8.1	No	8.2	No
Sulfate	mg/L	P-PL	278	200	No	250	No
Total Dissolved Solids	mg/L	NP-PL	2200	1600	No	1700 B	No

NOTES:

P-PL: Parametric Prediction Limit NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter



Table 10. Statistics Summary Table - TRcpc-16

			Statistical Limit	Мау	2021	November 2021	
Analytes	Units	Selected Statistical Method		Compliance Point (5/13/2021)	SSI Determination	Compliance Point (11/2/2021)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.6	1.5	No	1.4	No
Calcium, Total Recoverable	mg/L	P-PL	6.4	4.9	No	4.5	No
Chloride	mg/L	NP-PL	540	390	No	480	No
Fluoride	mg/L	P-PL	4.0	3.4	No	3.1	No
pH, Field-Measured	pH units	P-PL	8.0, 9.0	8.3	No	8.3	No
Sulfate	mg/L	P-PL	313	230	No	250	No
Total Dissolved Solids	mg/L	NP-PL	2200	1400	No	1500 B	No

NOTES:

P-PL: Parametric Prediction Limit NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter



Table 11. Statistics Summary Table - TRcpc-17

				May	2021	November 2021	
Analytes	Units	Selected Statistical Method	Statistical Limit	Compliance Point (5/13/2021)	SSI Determination	Compliance Point (11/2/2021)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	NP-PL	1.4	1.4	No	1.4	No
Calcium, Total Recoverable	mg/L	P-PL	22	17	No	16	No
Chloride	mg/L	NP-PL	1700	1400	No	1600	No
Fluoride	mg/L	NP-PL	2.7	2.7	No	2.2	No
pH, Field-Measured	pH units	P-PL	7.6, 9.2	8.1	No	8.1	No
Sulfate	mg/L	P-PL	398	260	No	340	No
Total Dissolved Solids	mg/L	NP-PL	3600	3000	No	3100 B	No

NOTES:

P-PL: Parametric Prediction Limit NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter



Table 12. Statistics Summary Table - TRcpc-18

				May 2021		November 2021	
Analytes	Units	Selected Statistical Method	Statistical Limit	Compliance Point (5/13/2021)	SSI Determination	Compliance Point (11/2/2021)	SSI Determination
Appendix III							
Boron, Total Recoverable	mg/L	P-PL	0.95	0.84	No	0.80	No
Calcium, Total Recoverable	mg/L	P-PL	5.3	4.3	No	4.7	No
Chloride	mg/L	NP-PL	380	320	No	370	No
Fluoride	mg/L	P-PL	2.3	1.6	No	1.3	No
pH, Field-Measured	pH units	P-PL	8.1, 12.3	9.9	No	9.9	No
Sulfate	mg/L	NP-PL	250	180	No	220	No
Total Dissolved Solids	mg/L	NP-PL	1400	1200	No	1200 B	No

NOTES:

P-PL: Parametric Prediction Limit NP-PL: Non-parametric Prediction Limit

mg/L: milligrams per liter



Figures



◆TRcpc-1 ◆TRcpc-18 6840.4

UPGRADIENT MONITORING WELL

DOWNGRADIENT MONITORING WELL

GROUNDWATER ELEVATION (MAY 2021, NOTE 1)

GROUNDWATER ELEVATIONS AT TRcpc-1 AND TRcpc-2 WERE MEASURED ON MAY 12, 2021.

GROUNDWATER ELEVATIONS AT TRcpc-15, TRcpc-16, TRcpc-17, AND TRcpc-18 WERE

MEASURED ON MAY 13, 2021.





CONSULTANT



YY-MM-DD	2022-01-01	7
SIGNED	BJP	N
REPARED	ВСВ	
VIEWED	SAH	F
PROVED	JEO	

PROJECT
ESCALANTE GENERATING STATION
ACTIVE COAL COMBUSTION RESIDUALS LANDFILL
ANNUAL GROUNDWATER MONITORING REPORT

MONITORING WELL LOCATIONS AND GROUNDWATER ELEVATIONS (MAY 2021)

PROJECT NO.	REV.	FIGURE
21453429	0	1



CONSULTANT

2022-01-01

BJP

всв

SAH

JEO

DESIGNED

PREPARED

REVIEWED

APPROVED

GOLDER

MEMBER OF WSP

MONITORING WELL LOCATIONS AND GROUNDWATER

REV.

FIGURE 2

ELEVATIONS (NOVEMBER 2021)

PROJECT NO. 21453429

◆TRcpc-18

6840.9

DOWNGRADIENT MONITORING WELL

GROUNDWATER ELEVATION (NOVEMBER 2021, NOTE 1)



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