2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT CLASS 3 LANDFILL CROSS GENERATING STATION

by Santee Cooper
Moncks Corner, South Carolina

January 2021

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1. Annual Groundwater Monitoring Report Summary

The South Carolina Public Service Authority (Santee Cooper) has prepared this 2020 Annual Groundwater Monitoring Corrective Action Report for Class 3 Landfill at the Cross Generating Station (CGS). This 2020 Annual Report was prepared to comply with the United States Environmental Protection Agency Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals (CCR) from Electric Utilities, 40 Code of Federal Regulations (CFR) Part 257, Subpart D dated 17 April 2015 (CCR Rule), specifically subsection § 257.90(e)(1) through (6).

The Class 3 Landfill began operations and placement of CCR in December 2015 in accordance with permits and plans approved by South Carolina Department of Health and Environmental Control (SCDHEC). The Class 3 Landfill is an existing CCR landfill that is located immediately adjacent to, and in facts abuts the eastern slope of the closed Class 2 Landfill. The Class 2 Landfill top deck and slopes are covered by an HDPE liner that serves as the bottom liner of the Class 3 Landfill. In addition to the federal CCR rule groundwater monitoring program discussed throughout, a State groundwater monitoring program is also being implemented in accordance with the SCDHEC Permit #LF3-00007.

In accordance with § 257.90(e)(6), an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit is provided below:

At the start of the current annual reporting period (January 1, 2020), the Class 3 Landfill continued to operate under a detection monitoring program in accordance with § 257.94. A statistically significant increase (SSI) of chloride was identified in monitoring well CLF1B-4 during both the February and June 2020 sampling events. However, the increasing concentration trend for chloride has been attributed to the closed Class 2 Landfill as described in the Alternate Source Demonstration (ASD). As a result, an assessment monitoring program is not required for the Class 3 Landfill. At the end of the current annual reporting period (December 31, 2020), the Class 3 Landfill remained in detection monitoring, therefore the remaining groundwater requirements (i.e. to initiate assessment monitoring, identify Appendix IV SSLs and establish groundwater protection standards, initiate and complete an assessment of corrective measures, hold a public meeting, select a corrective action remedy, and implement remedial activities) are not applicable.

To report on the activities conducted during the prior calendar year and document progress complying with the CCR Rule, the specific requirements listed in § 257.90(e)(1) through (5) are provided in the next section in bold/italic type followed by a short narrative stating how that specific requirement was met.

2. 40 CFR § 257.90 Applicability

2.1 40 CFR § 257.90(a)

All CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under § 257.90 through § 257.98.

The Class 3 Landfill at the Cross Generating Station (CGS) is subject to the groundwater monitoring and corrective action requirements set forth by the Environmental Protection Agency (EPA) in the Code of Federal Regulations Title 40 (40 CFR) § 257.90 through § 257.98. This document satisfies the

requirement under § 257.90(e) which requires the CCR Landfill Owner/Operator to prepare an Annual Report.

2.2 40 CFR § 257.90(e) - SUMMARY

Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepore an annual groundwater monitoring and corrective action report. [...] For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the focility's operating record as required by § 257.105(h)(1).

This Annual Report documents the activities completed in 2020 for the Class 3 Landfill at CGS as required by the Groundwater Monitoring and Corrective Action regulations. Groundwater sampling and analysis was conducted per the requirements of § 257.93, and the status of the groundwater monitoring program, set forth in § 257.94, is provided in this report.

2.2.1 Status of the Groundwater Monitoring and Corrective Action Program

SSIs of Appendix III constituents were identified downgradient of the Class 3 Landfill, and the notification was provided on January 15, 2018. An evaluation of alternate sources was conducted and a successful alternative source demonstration (ASD) was completed in April 2018. The ASD concluded that the closed Class 2 Landfill, located immediately upgradient of the Class 3 Landfill, was responsible for the Appendix III SSIs.

An SSI of chloride was identified in monitoring well CLF1B-4 during the June 2020 sampling event. The increasing concentration trend is consistent with the 2018 findings and is attributable to the closed Class 2 Landfill. Output from the statistical analyses are summarized in Appendix A. As a result, the Unit remains in the Detection Monitoring program as required by § 257.94(e)(2).

2.2.2 Key Actions Completed

The following key actions were completed in 2020:

- Prepared 2019 Annual Report including:
    - The Annual Report was placed in the facility's operating record pursuant to § 257.105(h)(1);
    - Pursuant to § 257.106(h)(1), the notification was sent to the relevant State Director within 30 days of the Annual Report being placed in the facility's operating record [§ 257.106(d)];
    - Pursuant to § 257.107(h)(1), the Annual Report was posted to the CCR Website within 30 days of the Annual Report being placed in the facility's operating record [§ 257.107(d)];

- Collected and analyzed two rounds of groundwater monitoring (February and June) (Table 1) in accordance with § 257.94 and recorded the concentrations in the facility's operating record as required by § 257.94(f); and
- Completed statistical evaluation to determine statistically significant increases for Appendix III constituents in accordance with § 257.93(h)(2).

2.2.3 Problems Encountered

Problems such as damaged wells or issues with sample collection or lack of sampling were not encountered at the Class 3 Landfill in 2020.

2.2.4 Actions to Resolve Problems

No problems needed resolution.

2.2.5 Project Key Activities for Upcoming Year

Key activities to be completed in 2021 include the following:

- Conduct semi-annual groundwater monitoring and subsequent statistical analysis as required by § 257.94.
- Review the ASD for the Class 3 Landfill to verify on-going validity.
- Prepare the 2021 annual report; place it in the record as required by § 257.105(h)(1), notify the state [§ 257.106(d)]; and post to website [§ 257.107(d)].

2.3 40 CFR § 257.90(e) - INFORMATION

At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

2.3.1 40 CFR § 257.90(e)(1)

A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

As required by § 257.90(e)(1), a map showing the locations of the CCR unit and associated upgradient and downgradient monitoring wells for the Class 3 Landfill is presented as Figure 1. In addition, this information is presented in the CCR Groundwater Monitoring Plan, which was placed in the facility's operating record by October 17, 2017 as required by § 257.105(h)(1).

2.3.2 40 CFR § 257.90(e)(2)

Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

Additional monitoring wells were not installed or decommissioned during 2020.

2.3.3 40 CFR § 257.90(e)(3)

In addition to all the monitoring data obtained under § 257.90 through § 257.98, a summary including the number of groundwater samples that were collected for analysis for each

background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

In accordance with § 257.94(b) and § 257.94(d), at least two independent samples from each background and downgradient monitoring well were collected and analyzed. A summary table including the sample names, dates of sample collection, reason for sample collection (detection or assessment), and monitoring data obtained for the groundwater monitoring program for the Class3 Landfill is presented in Table 1 of this report.

2.3.4 40 CFR § 257.90(e)(4)

A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

As required by § 257.93(h) a statistical analysis for Appendix III SSIs was completed by January 15, 2018. Baseline analytical data collected from background monitoring wells were combined to develop Upper Tolerance Limits (UTLs). The UTLs for each Appendix III constituent were compared to the analytical results for the downgradient monitoring wells. Constituents with analytical results exceeding the UTLs were identified as SSIs over background for the respective Appendix III constituent. This analysis indicated that statistically significant increases of boron, calcium, chloride, pH, sulfate, and total dissolved solids were present downgradient of the Class 3 Landfill. Due to the successful ASD completed in April 2018 that identified the closed Class 2 Landfill as the source of the SSIs, the Class 3 Landfill remained in Detection Monitoring in 2020. The sample concentrations at the downgradient wells for each of the Appendix III constituents from the 2020 detection monitoring sampling events were compared to their respective UTLs. A sample concentration greater than the UTL is considered to represent an SSI. Based on these comparisons and relying on an intrawell evaluation, a SSI for chloride in wells CLF1B-4 was indicated in both the February and June 2020 sampling events (Appendix A). This finding is consistent with previous evaluations described in the ASD. As a result, the ASD for the Class 3 Landfill continues to address this finding and the Class 3 Landfill remains in detection monitoring.

2.3.5 40 CFR § 257.90(e)(5)

Other information required to be included in the annual report as specified in § 257.90 through § 257.98.

Since the Class 3 Landfill remained in Detection Monitoring in 2020, no other information was required to be included in this annual report.

TABLES

TABLE 1 - Summary of Analytical Results
Cross Generating Station Class 3 Landfill Detection Monitoring

					Appendix III Constituents								Field Parameters							
Well ID	Purpose	Date of Sample Event	Laboratory Sample ID Number		Boron	Calcium	Chloride	Fluoride	Fluoride	Sulfate	Total Dissolved Solids	pH	Depth to Groundwater	Groundwater Elevation	pH	Specific Conductivity	Temperature	Oxidation Reduction Potential	Turbidity	Dissolved Oxygen
				Unit	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	SU	Feet (btoc)	Feet (msl)	SU	uS	C	mv	NTU	ppm
				Method	EPA 6020B	EPA 6020B	EPA 300.0	EPA 300.0	SM 4500 FC	EPA 300.0	SM 2540C							SM2580		
				GWPS/US EPA MCL/RSL	----	----	----	4	4	----	----	----	----	----	----	----	----	----	----	----
Site Background Wells																				
PM-1	Background	2/24/2020	AE66534		<15	11	12.7		<0.10	8.36	120	4.92	6.86	76.38	4.92	154	16.77	57	0.1	0.92
PM-1	Background	6/22/2020	AE75385		49	13.5	12.67	<0.10		8.32	112.5	5.12	7	76.24	5.12	157	24.65	78	9.1	0.71
PM-1	total samples				2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
CBW-1	Background	2/24/2020	AE66522		17	28.2	3.25		0.19	79.8	107.5	4.09	7.94	77.86	4.09	231	17.01	249	0	0.9
CBW-1	Background	6/22/2020	AE75384		18	28.4	3.44	0.2		79.9	147.5	4.48	8.19	77.61	4.48	218	25.75	324	0	0.74
CBW-1	total samples				2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
Class 3 Landfill Wells																				
CLF1B-1	Detection	2/24/2020	AE66523		<15	173	37.3		<0.10	159	558.8	6.47	5.7	78.06	6.47	973	15.26	122	0	1.2
CLF1B-1	Duplicate	2/24/2020	AE66524		<15	170	37.7		<0.10	150	570									
CLF1B-1	Detection	6/22/2020	AE75377		<15	178	33.2	<0.10		133	577.5	6.76	6.19	77.57	6.76	840	25.86	79	0	0.5
CLF1B-1	Duplicate	6/22/2020	AE75378		<15	172	32.8	0.1		132	605									
CLF1B-1	total samples				4	4	4	2	2	4	4	2	2	2	2	2	2	2	2	2
CLF1B-2	Detection	2/24/2020	AE66525		15	135	82.5		<0.10	13.9	455	6.67	4.03	78.01	6.67	784	14.57	30	1.1	1.04
CLF1B-2	Detection	6/22/2020	AE75379		<15	139	82.6	<0.10		13.5	535	7.01	4.53	77.51	7.01	717	25.74	-16	0	0.58
CLF1B-2	total samples				2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
CLF1B-3	Detection	2/24/2020	AE66526		37	125	26		<0.10	95.2	388.8	6.43	4.68	78.07	6.43	693	14.44	37	5	0.8
CLF1B-3	Detection	6/22/2020	AE75380		39	180	23.7	0.11		196	583.8	6.79	5.28	77.47	6.79	839	25.9	-23	0	0.57
CLF1B-3	total samples				2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
CLF1B-4	Detection	2/24/2020	AE66527		18	103	77.7		<0.10	14.6	371.2	6.93	4.6	78.14	6.93	651	14.68	97	2	2.3
CLF1B-4	Detection	6/23/2020	AE75381		23	117	88.2	<0.10		17.1	513.8	6.99	5.36	77.38	6.99	694	20.74	105	0	0.94
CLF1B-4	total samples				2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2
CLF1B-5	Detection	2/25/2020	AE66528		18	256	138		<0.10	230	935	6.49	2.66	78.43	6.49	1390	18.03	23	1.2	1.02
CLF1B-5	Detection	6/23/2020	AE75382		19	265	139	<0.10		228	1076	6.61	3.95	77.14	6.61	1380	22.22	2	0	0.75
CLF1B-5	total samples				2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2

All groundwater samples collected from the monitoring wells for Detection Monitoring in 2020 for the constituents listed in Appendix III of the EPA CCR Rule (40 CFR) were analyzed by South Carolina Certified laboratories: Santee Cooper Analytical Services (Certification # 08552), GEL Laboratories, LLC (Certification # 10120), Test America Laboratories Inc. Savannah (Certification # 98001), Test America Laboratories Inc. Pensacola (Certification #96026), Rogers & Callcot, Inc. (Certification # 23105001), and Pace Analytical Services LLC (Certification #99030).

FIGURES

LEGEND

- BACKGROUND WELL
- CLASS 3 LANDFILL AREA B WELL
- CCR BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI

N

0 880 1,760

SCALE IN FEET

SANTEE COOPER
CROSS GENERATING STATION
PINEVILLE, SOUTH CAROLINA

DECEMBER 2020

LOCATION OF CLASS 3 LANDFILL GROUNDWATER MONITORING WELLS FOR CCR COMPLIANCE

FIGURE 1

GIS FILE PATH: I:\97130\Groundwater\GIS Groundwater\mxd map files\CGS_CCR_WELL_LOCATIONS.mxd — USER: ALDECOTE — LAST SAVED: 12/14/2020 11:14:04 AM

Appendix A – Statistical Analysis

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Greenville, SC 29601
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TECHNICAL MEMORANDUM

July 20, 2020
File No. 131539-012

SUBJECT: 2020 Semi-annual Groundwater Detection Monitoring Data
Statistical Evaluation
Cross Generating Station
Class 3 Landfill

The South Carolina Public Service Authority (Santee Cooper) is implementing the 17 April 2015 U.S. Environmental Protection Agency (U.S. EPA) Federal Coal Combustion Residuals (CCR) Rule (40 CFR § 257 and 261) for the Cross Generating Station, located in Berkeley County, South Carolina. Santee Cooper provided Haley & Aldrich with groundwater monitoring data collected from a groundwater monitoring system that meets the requirements of 40 CFR §257.91. This memorandum documents the results of statistical tests conducted to determine if Appendix III groundwater monitoring constituents detected in downgradient wells are present at levels that exhibit a statistically significant increase (SSI) above background, or upgradient wells, consistent with the requirements in 40 CFR § 257.94.

Following baseline sampling the initial statistical analysis completed in January 2018 identified SSI's for one or more Appendix III constituent downgradient of the Class 3 Landfill. However, recognizing that the new Class 3 Landfill was constructed along the downgradient flank of the closed Class 2 Landfill, and had not received CCR prior to completing detection monitoring, Haley & Aldrich conducted an evaluation to demonstrate that a source other than the Class 3 Landfill caused the statistically significant increase over background, consistent with §257.94(e)(2).

This certified alternate source demonstration (ASD) concluded that the closed Class 2 Landfill is the source for the Appendix III SSIs detected downgradient of the two units, and as a result, the new Class 3 Landfill remained in detection monitoring, and intrawell statistical evaluations have been conducted for the Appendix III constituents since that time. The intrawell evaluation compares the most recent values from each compliance well against a background dataset composed of its own historical data. The Upper Tolerance Limit (UTL) statistical analysis was used to perform the statistical evaluation. The UTL is an accepted method under the CCR Rule and is the upper endpoint of a tolerance interval that is designed to contain a pre-specified proportion (e.g. 95 percent) of the background dataset.

Statistical Evaluation of Appendix III Constituents

The Rule, 40 CFR §257.93(f) (1-4), provides four specific options to statistically evaluate whether water quality downgradient of the CCR Unit represents an SSI of Appendix III parameters compared to background groundwater quality of the CCR Unit. The UTL was used to evaluate potential SSIs. A 95% UTL for 99% coverage was calculated to compare to downgradient groundwater analytical results for

this evaluation. Per the document *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, March 2009,* background concentrations were updated for the February 2020 semi-annual sampling event based on statistical evaluation of analytical results collected through February 2020.

UTL STATISTICAL ANALYSIS

The UTL is an accepted statistical method identified in the CCR Rule to evaluate the groundwater analytical data at CCR Units. A tolerance interval is a concentration range, with a confidence level, designed to contain a pre-specified proportion (e.g., 99 percent) of the underlying population from which the statistical sample is drawn (background). The upper endpoint of a tolerance interval is called the upper tolerance limit or UTL. Depending on the assumed distribution of background, parametric or non-parametric procedures were used to develop the UTL. Parametric tolerance limits utilize assumed distributions of the sample background data to develop the UTL, and non-parametric limits utilize order statistics or bootstrap methods to develop the UTL. The UTL was calculated using the Chemstat software from the background data after testing for outlier sample results that would warrant removal from the data set based on likely error in sampling or measurement. Both visual and statistical outlier tests for the background data were performed using Chemstat and U.S. Environmental Protection Agency's ProUCL 5.1 software, and a visual inspection of the data was performed for the downgradient sample data. No sample data were deemed as outliers that warranted removal from the data set.

RESULTS OF APPENDIX III DOWNGRADIENT STATISTICAL COMPARISONS

The Appendix III sample concentrations at the downgradient wells from the February 2020 detection monitoring sampling event was compared to their respective UTLs. A sample concentration greater than the UTL is considered to represent a SSI. Based on these comparisons and relying on an intrawell statistical evaluation, a SSI for chloride in well CLF1B-4 was indicated. This finding is consistent with previous evaluations and the increasing concentration trend for chloride described in the ASD. As a result, the ASD for the Class 3 Landfill continues to address this finding.

Tables:

Table I – Summary of Detection Monitoring Statistical Evaluation – February 2020

TABLES

Cross Class 3 Landfill

Summary of Detection Monitoring Statistical Evaluation – February 2020

Prepared: July 20, 2020

Location Id	Frequency of Detection	Percent Non-Detects	Range of Non-Detect	Mean	50th Percentile (Median)	95th Percentile	Maximum Detect	Variance	Standard Deviation	Coefficient of Variance	CCR MCL/RSL	Report Result Unit	Detection Exceedances (Y/N)	Number of Detection Exceedances	Number of Non-Detection Exceedances	Outlier Presence	Outlier Removed	Trend	Distribution Well*	February 2020 Concentration (mg/L)	Intra-well Analysis		
																					Background Limit (Upper Prediction Limit)	Background Limit (Upper Prediction Limit) ug/L	SSI
CCR Appendix-III: Boron, Total (mg/L)																							
CBW-1	14/15	7%	0.015-0.015	0.0221	0.0218	0.03074	0.032	0.00002239	0.004731	0.2145	NA	mg/L	N	0	0	No	No	Stable					
PM-1	8/14	43%	0.015-0.015	0.0164	0.0155	0.0197	0.021	0.000003565	0.001888	0.1151	NA	mg/L	N	0	0	No	No	Stable					
CLF1B-1	2/15	87%	0.015-0.015	0.0151	0.015	0.0153	0.016	6.667E-08	0.0002582	0.01714	NA	mg/L	N	0	0	No	No	Stable	Non-parametric	0.015	0.016	16	N
CLF1B-2	13/15	13%	0.015-0.015	0.018	0.016	0.02594	0.0398	0.00003835	0.006193	0.3434	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.015	0.040	39.8	N
CLF1B-3	15/15	0%	-	0.0361	0.037	0.0542	0.064	0.0001761	0.01327	0.3678	NA	mg/L	N	0	0	No	No	Increasing	Normal	0.037	0.089	89.0801	N
CLF1B-4	15/15	0%	-	0.0202	0.019	0.0278	0.0292	0.00001293	0.003597	0.178	NA	mg/L	N	0	0	Yes	No	Decreasing	Normal	0.018	0.035	34.6954	N
CLF1B-5	11/15	27%	0.015-0.015	0.0162	0.0155	0.019	0.019	0.000002309	0.00152	0.09396	NA	mg/L	N	0	0	Yes	No	Increasing	Non-parametric	0.018	0.019	19	N
CCR Appendix-III: Calcium, Total (mg/L)																							
CBW-1	15/15	0%	-	26.5	25.6	33.24	42.2	24.52	4.951	0.1871	NA	mg/L	N	0	0	Yes	No	Stable					
PM-1	16/16	0%	-	18.6	16.5	29.5	37	46.48	6.818	0.3674	NA	mg/L	N	0	0	No	No	Stable					
CLF1B-1	14/14	0%	-	177	175.5	189.7	191	59.52	7.715	0.04362	NA	mg/L	N	0	0	No	No	Stable	Normal	173.00	207.74	207742	N
CLF1B-2	14/14	0%	-	137	130.5	172.3	210	507.8	22.53	0.1644	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	135.00	210.00	210000	N
CLF1B-3	13/13	0%	-	167	177	218.2	220	1728	41.57	0.2484	NA	mg/L	N	0	0	No	No	Stable	Normal	125.00	329.16	329161	N
CLF1B-4	14/14	0%	-	101	93.7	134.5	180	631.3	25.13	0.2492	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	103.00	180.00	180000	N
CLF1B-5	15/15	0%	-	223	223	268.5	279	1377	37.11	0.1665	NA	mg/L	N	0	0	No	No	Increasing	Normal	256.00	352.84	352840	N
CCR Appendix-III: Chloride (mg/L)																							
CBW-1	16/16	0%	-	2.82	2.89	3.22	3.25	0.06815	0.261	0.09257	NA	mg/L	N	0	0	No	No	Stable					
PM-1	16/16	0%	-	12.7	12.7	13.43	13.5	0.3266	0.5715	0.04516	NA	mg/L	N	0	0	No	No	Stable					
CLF1B-1	15/15	0%	-	38.4	38.9	41.15	41.5	4.664	2.16	0.05623	NA	mg/L	N	0	0	No	No	Stable	Normal	37.30	46.62	46621.7	N
CLF1B-2	15/15	0%	-	70.3	70.9	80.82	82.5	103.5	10.18	0.1447	NA	mg/L	N	0	0	Yes	No	Increasing	Non-parametric	82.50	91.38	91377	N
CLF1B-3	15/15	0%	-	28.4	23.5	48.3	81.2	224.5	14.98	0.5267	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	26.00	38.18	38180.5	N
CLF1B-4	15/15	0%	-	53.9	51.1	69.86	77.7	64.61	8.038	0.1492	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	77.70	60.51	60512.3	Y
CLF1B-5	16/16	0%	-	115	117	141.3	151	354.8	18.84	0.1633	NA	mg/L	N	0	0	Yes	No	increasing	Normal	138.00	169.25	169249	N
CCR Appendix-III: Fluoride (mg/L)																							
CBW-1	14/14	0%	-	0.233	0.225	0.2935	0.3	0.001668	0.04084	0.1754	4	mg/L	N	0	0	No	No	Decreasing					
PM-1	0/14	100%	0.1-0.1	0.1	0.1	0.1		2.135E-18	1.461E-09	1.461E-08	4	mg/L	N	0	0	NA	NA	NA					
CLF1B-1	9/14	36%	0.1-0.1	0.126	0.12	0.177	0.19	0.000794	0.02818	0.2229	4	mg/L	N	0	0	No	No	Stable	Normal	0.10	0.24	238.505	N
CLF1B-2	6/14	57%	0.1-0.1	0.112	0.1	0.147	0.16	0.0003566	0.01888	0.1684	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.10	0.16	160	N
CLF1B-3	8/14	43%	0.1-0.1	0.119	0.12	0.15	0.15	0.0004071	0.02018	0.1692	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.10	0.20	199.326	N
CLF1B-4	3/14	79%	0.1-0.1	0.104	0.1	0.1235	0.13	0.00008791	0.009376	0.08991	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.10	0.13	130	N
CLF1B-5	3/14	79%	0.1-0.1	0.106	0.1	0.1305	0.15	0.0001956	0.01399	0.1323	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.10	0.15	150	N
CCR Appendix-III: pH, Field (pH units)																							
CBW-1	16/16	0%	-	4.29	4.32	4.5	4.5	0.01888	0.1374	0.032	NA	pH units	N	0	0	No	No	Stable					
PM-1	21/21	0%	-	5.14	5.2	5.47	5.58	0.06778	0.2603	0.05064	NA	pH units	N	0	0	No	No	Stable					
CLF1B-1	15/15	0%	-	6.57	6.58	6.722	6.82	0.01443	0.1201	0.01827	NA	pH units	N	0	0	No	No	Stable	Normal	6.47	6.1, 7.08		N
CLF1B-2	15/15	0%	-	6.89	6.89	7.083	7.09	0.01903	0.1379	0.02002	NA	pH units	N	0	0	No	No	Stable	Normal	6.67	6.52, 7.33		N
CLF1B-3	15/15	0%	-	6.69	6.71	6.856	6.94	0.0178	0.1334	0.01994	NA	pH units	N	0	0	No	No	Stable	Normal	6.43	6.29, 7.16		N
CLF1B-4	15/15	0%	-	7.15	7.18	7.373	7.38	0.02119	0.1456	0.02036	NA	pH units	N	0	0	No	No	Stable	Normal	6.93	6.68, 7.68		N
CLF1B-5	16/16	0%	-	6.66	6.695	6.778	6.83	0.01021	0.1011	0.01516	NA	pH units	N	0	0	No	No	Stable	Normal	6.49	6.35, 7.03		N
CCR Appendix-III: Sulfate (mg/L)																							
CBW-1	16/16	0%	-	78.7	75.65	96.32	115	147.2	12.13	0.1541	NA	mg/L	N	0	0	No	No	Stable					
PM-1	16/16	0%	-	13.5	10.8	25.75	26.5	38.93	6.191	0.4592	NA	mg/L	N	0	0	No	No	Decreasing					
CLF1B-1	15/15	0%	-	141	139	154.8	159	102	10.1	0.07178	NA	mg/L	N	0	0	No	No	Stable	Normal	159.00	173.86	173860	N
CLF1B-2	15/15	0%	-	14.6	13.3	20.44	22.4	8.58	2.929	0.2011	NA	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric	13.90	22.40	22400	N
CLF1B-3	15/15	0%	-	131	132	209.9	226	4137	64.32	0.4929	NA	mg/L	N	0	0	No	No	Stable	Normal	95.20	360.90	360899	N
CLF1B-4	15/15	0%	-	17.7	14.8	32.06	34.3	42.18	6.494	0.3661	NA	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric	14.60	34.30	34300	N
CLF1B-5	16/16	0%	-	150	163	246.5	278	5336	73.05	0.4857	NA	mg/L	N	0	0	No	No	Increasing	Normal	230.00	395.45	395452	N
CCR Appendix-III: Total Dissolved Solids (TDS) (mg/L)																							
CBW-1	15/16	6%	40-40	118	120	159.1	181.2	1252	35.38	0.2991	NA	mg/L	N	0	0	No	No	Stable					
PM-1	19/20	5%	40-40	133	133.1	200.3	206	1932	43.96	0.3298	NA	mg/L	N	0	0	No	No	Stable					
CLF1B-1	15/15	0%	-	588	585	649.5	651.7	1491	38.61	0.06565	NA	mg/L	N	0	0	No	No	Stable	Normal	558.80	742.95	742949	N
CLF1B-2	15/15	0%	-	468	472	538	545	2728	52.23	0.1117	NA	mg/L	N	0	0	No	No	Stable	Normal	455.00	654.66	654660	N
CLF1B-3	15/15	0%	-	853	542.9	2135	5355	1571000	1254	1.47	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	388.80	5355.00	5355000	N
CLF1B-4	15/15	0%	-	351	360	429.5	434	2884	53.7	0.153	NA	mg/L	N	0	0	No	No	Stable	Normal	371.20	540.54	540541	N
CLF1B-5	16/16	0%	-	847	826	1096	1155	24900	157.8	0.1864	NA	mg/L	N	0	0	Yes	No	Increasing	Normal	935.00	1301.50	1301500	N

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TECHNICAL MEMORANDUM

October 23, 2020
File No. 131539-012

SUBJECT: 2020 Semi-annual Groundwater Detection Monitoring Data
Statistical Evaluation
Cross Generating Station
Class 3 Landfill

The South Carolina Public Service Authority (Santee Cooper) is implementing the 17 April 2015 U.S. Environmental Protection Agency (U.S. EPA) Federal Coal Combustion Residuals (CCR) Rule (40 CFR § 257 and 261) for the Cross Generating Station, located in Berkeley County, South Carolina. Santee Cooper provided Haley & Aldrich with groundwater monitoring data collected from a groundwater monitoring system that meets the requirements of 40 CFR §257.91. This memorandum documents the results of statistical tests conducted to determine if Appendix III groundwater monitoring constituents detected in downgradient wells are present at levels that exhibit a statistically significant increase (SSI) above background, or upgradient wells, consistent with the requirements in 40 CFR § 257.94.

Following baseline sampling the initial statistical analysis completed in January 2018 identified SSI's for one or more Appendix III constituent downgradient of the Class 3 Landfill. However, recognizing that the new Class 3 Landfill was constructed along the downgradient flank of the closed Class 2 Landfill, and had not received CCR prior to completing detection monitoring, Haley & Aldrich conducted an evaluation to demonstrate that a source other than the Class 3 Landfill caused the statistically significant increase over background, consistent with §257.94(e)(2).

This certified alternate source demonstration (ASD) concluded that the closed Class 2 Landfill is the source for the Appendix III SSIs detected downgradient of the two units, and as a result, the new Class 3 Landfill remained in detection monitoring, and intrawell statistical evaluations have been conducted for the Appendix III constituents since that time. The intrawell evaluation compares the most recent values from each compliance well against a background dataset composed of its own historical data. The Upper Tolerance Limit (UTL) statistical analysis was used to perform the statistical evaluation. The UTL is an accepted method under the CCR Rule and is the upper endpoint of a tolerance interval that is designed to contain a pre-specified proportion (e.g. 95 percent) of the background dataset.

Statistical Evaluation of Appendix III Constituents

The Rule, 40 CFR §257.93(f) (1-4), provides four specific options to statistically evaluate whether water quality downgradient of the CCR Unit represents an SSI of Appendix III parameters compared to background groundwater quality of the CCR Unit. The UTL was used to evaluate potential SSIs. A 95% UTL for 99% coverage was calculated to compare to downgradient groundwater analytical results for

this evaluation. Per the document *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, March 2009,* background concentrations were updated for the February 2020 semi-annual sampling event based on statistical evaluation of analytical results collected through February 2020.

UTL STATISTICAL ANALYSIS

The UTL is an accepted statistical method identified in the CCR Rule to evaluate the groundwater analytical data at CCR Units. A tolerance interval is a concentration range, with a confidence level, designed to contain a pre-specified proportion (e.g., 99 percent) of the underlying population from which the statistical sample is drawn (background). The upper endpoint of a tolerance interval is called the upper tolerance limit or UTL. Depending on the assumed distribution of background, parametric or non-parametric procedures were used to develop the UTL. Parametric tolerance limits utilize assumed distributions of the sample background data to develop the UTL, and non-parametric limits utilize order statistics or bootstrap methods to develop the UTL. The UTL was calculated using the Chemstat software from the background data after testing for outlier sample results that would warrant removal from the data set based on likely error in sampling or measurement. Both visual and statistical outlier tests for the background data were performed using Chemstat and U.S. Environmental Protection Agency's ProUCL 5.1 software, and a visual inspection of the data was performed for the downgradient sample data. No sample data were deemed as outliers that warranted removal from the data set.

RESULTS OF APPENDIX III DOWNGRADIENT STATISTICAL COMPARISONS

The Appendix III sample concentrations at the downgradient wells from the June 2020 detection monitoring sampling event was compared to their respective UTLs. A sample concentration greater than the UTL is considered to represent a SSI. Based on these comparisons and relying on an intrawell statistical evaluation, a SSI for chloride in well CLF1B-4 was indicated. This finding is consistent with previous evaluations and the increasing concentration trend for chloride described in the ASD. As a result, the ASD for the Class 3 Landfill continues to address this finding.

Tables:

Table I – Summary of Detection Monitoring Statistical Evaluation – June 2020

TABLES

Cross Class 3 Landfill

Detection Monitoring Statistical Analysis Summary

Prepared: October 23, 2020

																				Inter-well Analysis			Intra-well Analysis	
Location Id	Frequency of Detection	Percent Non-Detects	Range of Non-Detect	Mean	50th Percentile (Median)	95th Percentile	Maximum Detect	Variance	Standard Deviation	Coefficient of Variance	CCR MCL/RSL	Report Result Unit	Detection Exceedances (Y/N)	Number of Detection Exceedances	Number of Non-Detection Exceedances	Outlier Presence	Outlier Removed	Trend	Distribution Well*	June 2020 Concentration (mg/L)	Detect?	Background Limit (Upper Prediction Limit)	SSI	Background Limit (Upper Prediction Limit)	SSI
CCR Appendix-III: Boron, Total (mg/L)																									
CBW-1	15/16	6%	0.015-0.015	0.0218	0.02175	0.03065	0.032	0.00002192	0.004682	0.2147	NA	mg/L	N	0	0	No	No	Stable				0.032			
PM-1	9/16	44%	0.015-0.02	0.0187	0.01615	0.028	0.049	0.00006934	0.008327	0.4462	NA	mg/L	N	0	0	No	No	Stable							
CLF1B-1	2/16	88%	0.015-0.015	0.0151	0.015	0.01525	0.016	6.25E-08	0.00025	0.0166	NA	mg/L	N	0	0	No	No	Stable	Non-parametric	0.015	N		N	0.016	N
CLF1B-2	13/16	19%	0.015-0.015	0.0178	0.016	0.02495	0.0398	0.00003637	0.006031	0.338	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.015	N		N	0.040	N
CLF1B-3	16/16	0%	-	0.0363	0.038	0.0535	0.064	0.0001649	0.01284	0.3541	NA	mg/L	N	0	0	No	No	Increasing	Normal	0.039	Y		Y	0.089	N
CLF1B-4	16/16	0%	-	0.0204	0.0195	0.0277	0.0292	0.00001256	0.003544	0.1739	NA	mg/L	N	0	0	Yes	No	Decreasing	Normal	0.023	Y		N	0.035	N
CLF1B-5	12/16	25%	0.015-0.015	0.0163	0.01565	0.019	0.019	0.000002655	0.001629	0.09965	NA	mg/L	N	0	0	Yes	No	Increasing	Non-parametric	0.019	Y		N	0.019	N
CCR Appendix-III: Calcium, Total (mg/L)																									
CBW-1	16/16	0%	-	26.6	25.9	32.6	42.2	23.11	4.808	0.1808	NA	mg/L	N	0	0	Yes	No	Stable				48.07			
PM-1	17/17	0%	-	18.3	16.4	29	37	45.08	6.714	0.3677	NA	mg/L	N	0	0	No	No	Stable							
CLF1B-1	15/15	0%	-	177	176	189.6	191	55.35	7.44	0.04205	NA	mg/L	N	0	0	No	No	Stable	Normal	178.00	Y		Y	207.74	N
CLF1B-2	15/15	0%	-	137	131	169.4	210	471.7	21.72	0.1583	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	139.00	Y		Y	210.00	N
CLF1B-3	14/14	0%	-	168	178.5	218.1	220	1606	40.08	0.2383	NA	mg/L	N	0	0	No	No	Stable	Normal	180.00	Y		Y	329.16	N
CLF1B-4	15/15	0%	-	102	94.5	135.9	180	603.7	24.57	0.2412	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	117.00	Y		Y	180.00	N
CLF1B-5	16/16	0%	-	226	223.5	268.5	279	1396	37.36	0.1657	NA	mg/L	N	0	0	No	No	Increasing	Normal	265.00	Y		Y	352.84	N
CCR Appendix-III: Chloride (mg/L)																									
CBW-1	17/17	0%	-	2.86	2.9	3.288	3.44	0.0865	0.2941	0.103	NA	mg/L	N	0	0	No	No	Stable				13.50			
PM-1	17/17	0%	-	12.7	12.7	13.42	13.5	0.3062	0.5534	0.04372	NA	mg/L	N	0	0	No	No	Stable							
CLF1B-1	16/16	0%	-	38.1	38.8	41.13	41.5	6.047	2.459	0.06457	NA	mg/L	N	0	0	No	No	Stable	Normal	33.20	Y		Y	46.62	N
CLF1B-2	16/16	0%	-	71.1	72.5	82.53	82.6	106.1	10.3	0.1449	NA	mg/L	N	0	0	Yes	No	Increasing	Non-parametric	82.60	Y		Y	91.38	N
CLF1B-3	16/16	0%	-	28.1	23.6	45.95	81.2	210.9	14.52	0.5159	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	23.70	Y		Y	38.18	N
CLF1B-4	16/16	0%	-	56	51.1	80.32	88.2	133.9	11.57	0.2065	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	88.20	Y		Y	60.51	Y
CLF1B-5	17/17	0%	-	117	117	141.4	151	365.6	19.12	0.1638	NA	mg/L	N	0	0	Yes	No	Increasing	Normal	139.00	Y		Y	169.25	N
CCR Appendix-III: Fluoride (mg/L)																									
CBW-1	15/15	0%	-	0.231	0.22	0.293	0.3	0.001621	0.04026	0.1745	4	mg/L	N	0	0	No	No	Decreasing				0.30			
PM-1	0/15	100%	0.1-0.1	0.1	0.1	0.1		1.983E-18	1.408E-09	1.408E-08	4	mg/L	N	0	0	NA	NA	NA							
CLF1B-1	9/15	40%	0.1-0.1	0.125	0.12	0.176	0.19	0.0007838	0.028	0.2246	4	mg/L	N	0	0	No	No	Stable	Normal	0.10	N		N	0.24	N
CLF1B-2	6/15	60%	0.1-0.1	0.111	0.1	0.146	0.16	0.000341	0.01846	0.1659	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.10	N		N	0.16	N
CLF1B-3	9/15	40%	0.1-0.1	0.119	0.12	0.15	0.15	0.0003838	0.01959	0.1651	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.11	Y		N	0.20	N
CLF1B-4	3/15	80%	0.1-0.1	0.104	0.1	0.123	0.13	0.00008286	0.009103	0.08752	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.10	N		N	0.13	N
CLF1B-5	3/15	80%	0.1-0.1	0.105	0.1	0.129	0.15	0.0001838	0.01356	0.1287	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.10	N		N	0.15	N
CCR Appendix-III: pH, Field (pH units)																									
CBW-1	17/17	0%	-	4.3	4.32	4.5	4.5	0.01974	0.1405	0.03264	NA	pH units	N	0	0	No	No	Stable				4.09, 5.58			
PM-1	22/22	0%	-	5.14	5.195	5.47	5.58	0.06457	0.2541	0.04944	NA	pH units	N	0	0	No	No	Stable							
CLF1B-1	16/16	0%	-	6.59	6.59	6.775	6.82	0.01561	0.1249	0.01897	NA	pH units	N	0	0	No	No	Stable	Normal	6.76	Y		Y	6.1, 7.08	N
CLF1B-2	16/16	0%	-	6.9	6.9	7.082	7.09	0.01868	0.1367	0.01982	NA	pH units	N	0	0	No	No	Stable	Normal	7.01	Y		Y	6.52, 7.33	N
CLF1B-3	16/16	0%	-	6.7	6.72	6.85	6.94	0.01722	0.1312	0.01959	NA	pH units	N	0	0	No	No	Stable	Normal	6.79	Y		Y	6.29, 7.16	N
CLF1B-4	16/16	0%	-	7.14	7.175	7.372	7.38	0.02137	0.1462	0.02047	NA	pH units	N	0	0	No	No	Stable	Normal	6.99	Y		Y	6.68, 7.68	N
CLF1B-5	17/17	0%	-	6.66	6.68	6.774	6.83	0.009743	0.09871	0.01482	NA	pH units	N	0	0	No	No	Stable	Normal	6.61	Y		Y	6.35, 7.03	N
CCR Appendix-III: Sulfate (mg/L)																									
CBW-1	17/17	0%	-	78.8	76.8	95.08	115	138.1	11.75	0.1492	NA	mg/L	N	0	0	No	No	Stable				115.00			
PM-1	17/17	0%	-	13.2	10.5	25.7	26.5	37.5	6.124	0.4646	NA	mg/L	N	0	0	No	No	Decreasing							
CLF1B-1	16/16	0%	-	140	137.5	154.5	159	98.83	9.941	0.07091	NA	mg/L	N	0	0	No	No	Stable	Normal	133.00	Y		Y	173.86	N
CLF1B-2	16/16	0%	-	14.5	13.4	20.3	22.4	8.079	2.842	0.196	NA	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric	13.50	Y		N	22.40	N
CLF1B-3	16/16	0%	-	135	145.5	208.8	226	4129	64.26	0.4774	NA	mg/L	N	0	0	No	No	Stable	Normal	196.00	Y		Y	360.90	N
CLF1B-4	16/16	0%	-	17.7	15.05	31.9	34.3	39.39	6.276	0.3546	NA	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric	17.10	Y		N	34.30	N
CLF1B-5	17/17	0%	-	155	165	244.4	278	5356	73.19	0.4723	NA	mg/L	N	0	0	No	No	Increasing	Normal	228.00	Y		Y	395.45	N
CCR Appendix-III: Total Dissolved Solids (TDS) (mg/L)																									
CBW-1	16/17	6%	40-40	120	120	157.6	181.2	1224	34.98	0.2915	NA	mg/L	N	0	0	No	No	Stable				270.20			
PM-1	20/21	5%	40-40	132	130	200	206	1856	43.08	0.3257	NA	mg/L	N	0	0	No	No	Stable							
CLF1B-1	16/16	0%	-	587	583.3	649.4	651.7	1398	37.4	0.06366	NA	mg/L	N	0	0	No	No	Stable	Normal	577.50	Y		Y	742.95	N
CLF1B-2	16/16	0%	-	472	474.1	537.5	545	2831	53.21	0.1128	NA	mg/L	N	0	0	No	No	Stable	Normal	535.00	Y		Y	654.66	N
CLF1B-3	16/16	0%	-	836	563.3	1905	5355	1471000	1213	1.451	NA	mg/L	N	0	0	Yes	No	Stable	Non-parametric	583.80	Y		Y	5355.00	N
CLF1B-4	16/16	0%	-	361	365.6	454	513.8	4350	65.95	0.1827	NA	mg/L	N	0	0	No	No	Stable	Normal	513.80	Y		Y	540.54	N
CLF1B-5	17/17	0%	-	860	840	1092	1155	26440	162.6	0.189	NA	mg/L	N	0	0	Yes	No	Increasing	Normal	1076.00	Y		Y	1301.50	N