2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT CLASS 2 LANDFILL CROSS GENERATING STATION

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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 2 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 April 17, 2015 (CCR Rule), specifically subsection § 257.90(e)(1) through (6).

The Class 2 Landfill ceased operations by December 31, 2015, and closure was completed by August 9, 2016 per a plan approved by the South Carolina Department of Health and Environmental Control (SCDHEC). The Class 2 Landfill was certified closed by SCDHEC on February 28, 2017. 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 Post Closure Permit #08337-1601.

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:

Statistically significant increases (SSIs) of boron, calcium, chloride, sulfate, and TDS were identified in POZ-4, POZ-6 and POZ-7 during the detection monitoring events in 2017. This necessitated the initiation of an assessment monitoring program on January 15, 2018. The statistical analysis of the downgradient wells for of the Class 2 Landfill identified a statistically significant level (SSL) of the Appendix IV constituent cobalt in well POZ-4. As a result, an assessment of corrective measures was initiated on January 14, 2019 for this unit. The assessment of corrective measures report was completed on June 12, 2019. A public meeting was held on December 3, 2019 to discuss five remedial alternatives per § 257.96(e). A remedy has been selected pursuant to § 257.97 and the remedy selection report was completed on July 27, 2020. The documents referenced above, along with their corresponding notifications were placed in the facilities operating record in accordance with § 257.105(h) and § 257.106(h) and posted on the facilities publicly available website in accordance with § 257.107(h).

At the start of the current annual reporting period (January 1, 2020), the Class 2 Landfill continued to operate under an assessment monitoring program in accordance with § 257.95. During both the February and June 2020 sampling events, cobalt was identified at SSLs in monitoring well POZ-4. At the end of the current annual reporting period (December 31, 2020), the corrective action groundwater monitoring program was in place consistent with the selected remedy (Landfill Closure with Monitored Natural Attenuation (MNA) and Enhanced Water Management) Post-closure monitoring activities are ongoing in 2021.

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 2 Landfill at the 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. The Class 2 Landfill ceased operations by December 31, 2015, and closure was completed by August 9, 2016 per a plan approved by SCDHEC. The Class 2 Landfill was certified closed on February 28, 2017. 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 Post Closure Permit #08337-1601.

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 prepored 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 closed Class 2 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, as set forth in § 257.95, is provided in this report.

2.2.1 Status of the Groundwater Monitoring and Corrective Action Program

In 2020, the assessment monitoring program was continued since it's initiation in 2018 in accordance with § 257.95. An SSL of cobalt in POZ-4 remains the only exceedance of an Appendix IV groundwater protection standard (GWPS) downgradient of the Class 2 Landfill through the end of 2020. It is worth noting that while the concentrations vary between sampling events the concentrations detected in 2020 are significantly lower than the concentrations recorded during assessment monitoring in 2019 and are in fact at the lower end of the historical range of concentrations for cobalt in POZ-4. This observation is consistent with the selected groundwater remedy.

During the 2019 Assessment of Corrective Measures and Nature & Extent evaluations, analytical results from the groundwater monitoring well installed in the uppermost aquifer at the downgradient property boundary (monitoring well CCMLF-1) showed intermittent results above the GWPS for cobalt. While off-site migration had not been confirmed, Santee Cooper notified SCDHEC and nearby residents and/or landowners that the GWPS for cobalt had been exceeded per 257.105(h)(8). To evaluate potential for

off-site migration and impacts to off-site drinking water supplies, samples were collected from both the one potable well that supplies drinking water for the surrounding residences and at multiple residential taps and analyzed for cobalt. Santee Cooper has continued to monitor this property boundary well in both the uppermost shallow and deeper aquifers and the same nearby residential potable well for cobalt through 2020. **To date, there have been no detections of cobalt (thus below the groundwater protection standard) in the nearby residents' drinking water or in the deeper aquifer.** The detections of cobalt have been confined to the uppermost aquifer. Communication with SCDHEC and the residents have been ongoing.

The remedy selection process, in accordance with § 257.97, also took place in 2020 following the public meeting held on December 3, 2019, to discuss the remedial alternatives. In accordance with § 257.97(a), a semi-annual progress report was posted to the publicly available website on January 23, 2020, detailing a summary of actions completed to date in selecting and designing the remedy as well as planned activities. The remedy selection report was finalized on July 27, 2020 and posted to the publicly available website. The selected remedial alternative is landfill closure plus monitored natural attenuation (MNA) with enhanced water management improvements.

The landfill was closed by installing a low-permeability geomembrane and clay cap and cover along with surface water controls for drainage and erosion protection. The enhanced water management improvements refer to capturing water present in the landfill at the time of closure, thereby removing as much of the source material potentially being released from the CCR unit as is feasible. The landfill closure and water management improvements were completed in August 2016 and January 2020, respectively, under the oversight of SCDHEC. The remaining component of the selected remedy is MNA, which is a viable remedial technology recognized by state and federal regulators that is applicable to inorganic compounds in groundwater. MNA is intended to reduce concentrations of cobalt in groundwater at the Class 2 Landfill boundary, thereby attaining the GWPS.

The development of the corrective action groundwater monitoring program for MNA was completed by reevaluating the current groundwater sampling plan. This evaluation concluded that the assessment monitoring protocol currently being implemented is sufficient to meet the needs of corrective action groundwater monitoring program and thus will continue to be implemented during the regularly scheduled semi-annual groundwater monitoring events.

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 § 257.95(b) and § 257.95(d)(1) and recorded the concentrations in the facility's operating record as required by § 257.95(d)(1); and
- Completed statistical evaluation to determine statistically significant exceedance of GWPS for Appendix IV in accordance with § 257.93(h)(2) (Appendix A)
- Santee Cooper continued monitoring boundary wells for cobalt and continued to collect drinking water samples from a nearby resident. **Analytical results for this off-site well continue to show cobalt below detection and thus below the groundwater protection standard.**
- Continued a characterization of the nature and extent of Appendix IV constituents identified at statistically significant levels above the GWPS in accordance with § 257.95(g)(1).
- In accordance with § 257.97(a), a semi-annual progress report was posted to the publicly available website on January 23, 2020 detailing a summary of actions completed to date in selecting and designing the remedy as well as planned activities.
- Prepared and posted the remedy selection report on July 27, 2020 in accordance with § 257.97(a). The enhanced water management improvements portion of the selected remedy were completed in January 2020 under the oversight of SCDHEC. This was completed prior to the final selection of the remedy as an interim measure during the remedy selection process.
- Initiated Groundwater Remedial Activities (within 90 days of selecting the remedy) which included a reevaluation of the current groundwater monitoring plan § 257.98(a)

2.2.3 Problems Encountered

Problems, such as damaged wells, issues with sample collection, lack of sampling, or problems with analytical testing were not encountered at the Class 2 Landfill in 2020.

2.2.4 Actions to Resolve Problems

Actions to resolve problems were not required.

2.2.5 Project Key Activities for Upcoming Year

Key activities to be completed in 2021 include the following:

- Implement the semiannual Corrective Action Groundwater Monitoring Program (MNA Sampling Protocol) consistent with § 257.98 (a)(1).
- Conduct additional nature and extent activities, if needed in accordance with § 257.95(g)(1).
- Prepare the 2021 annual report; place it in the record as required by § 257.105(h)(1), notify the Relevant State Director [§ 257.106(d)]; and post to the facility's publicly available CCR 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 2 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 17 October 2017 as required by § 257.105(h)(2).

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 the 2020 reporting period.

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 § 257.95(b) and § 257.95(d)(1), 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, and monitoring data obtained for the groundwater monitoring program for the Class 2 Landfill is presented in Table 1 of this report. In addition, as required by § 257.95(d)(3), Table 1 includes the GWPS established under § 257.95(d)(2).

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

The groundwater monitoring program remained in assessment monitoring for the duration of 2020. A summary of the history of the evolution of the monitoring programs is provided in this section.

As required by § 257.93(h) a statistical analysis of the Appendix III constituents was completed January 15, 2018. Baseline analytical data collected from background monitoring wells CBW-1 and PM-1 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 POZ-4, POZ-6, and POZ-7. Constituents with analytical results exceeding the UTLs were identified as SSIs over background for the respective Appendix III constituent. Per § 257.94(h) an Assessment Monitoring program was initiated on February 14, 2018.

The statistical analysis of Appendix IV constituents was completed, as required by § 257.93(h)(2), and it was determined that a statistically significant level of cobalt continues to be present. There is no maximum contaminant level (MCL) for cobalt and elevated levels of cobalt were not identified in the background wells, therefore, the GWPS for cobalt was set at the regional screening level (RSL). The sample concentrations from the downgradient wells for each of the detected Appendix IV constituents from the monitoring events of 2020 were compared to their respective background UTLs and GWPS

(Appendix A). A sample concentration greater than the GWPS is considered to represent an SSL. Based on previous compliance sampling event and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. During both sampling events in February and June 2020, in monitoring well POZ-4, an SSL above GWPS was identified at the Class 2 Landfill for cobalt consistent with previous results.

The development of the corrective action groundwater monitoring program for MNA was completed by reevaluating the current groundwater sampling plan. It was determined that the current assessment monitoring protocol being implemented is sufficient to meet the post-closure monitoring needs to evaluate the performance of the selected remedy and thus will continue to be implemented during the regularly scheduled semi-annual groundwater monitoring events.

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.

Other information including development of groundwater protection standards, recording groundwater monitoring results in the operating record, and the remedy selection process is discussed in preceding sections.

Additionally, an overview of the performance of the remedy implementation to date is provided. The landfill closure and water management improvements were completed in August 2016 and January 2020, respectively, under the oversight of SCDHEC. The enhanced water management improvements refer to capturing water present in the landfill at the time of closure, therefore removing as much of the source material potentially being released from the CCR unit as is feasible. Although the Class 2 Landfill has been closed since 2016, trapped water had been observed seeping from the toe drain outlets which flowed into unlined stormwater conveyances and was being managed with other site stormwater. The improvement consisted of installing a seepage collection system including discharge piping and lift stations. The water captured from the toe drains is now isolated from stormwater and is being redirected to the operational Class 3 Landfill Leachate Collection Pond before further treatment in the station's permitted wastewater treatment facility prior to discharge under NPDES permit #SC0037401.

Since the completion of the water management improvements, the uppermost shallow aquifer boundary well (CCMLF-1) has shown marked decreases in cobalt concentrations from 17.8 ug/L to 3.8 ug/L. In fact, this last sampling result in July 2020 is now below the GWPS of 6 ug/L. The adjacent deeper aquifer boundary well (CCMLF-1D) has consistently been below detection, and thus below the GWPS since monitoring of the property boundary began with the initial nature & extent activities in 2019. These property boundary wells will continue to be monitored closely in 2021. The decline in cobalt concentrations observed in the shallow aquifer boundary well CCLMF-1 indicates that the cobalt plume is contracting, and that natural attenuation is being effective in reducing cobalt concentrations in groundwater.

The only remaining monitoring well with a statistically significant level of cobalt is POZ-4. This well is located on the northeastern boundary of the CCR unit. While the concentrations have increased to 46.4 ug/L over the course of 2020 these measured concentrations are at the low end of the historical range and do not suggest continuing releases from the Class 2 Landfill. This well will be monitored closely during ongoing performance sampling activities in 2021.

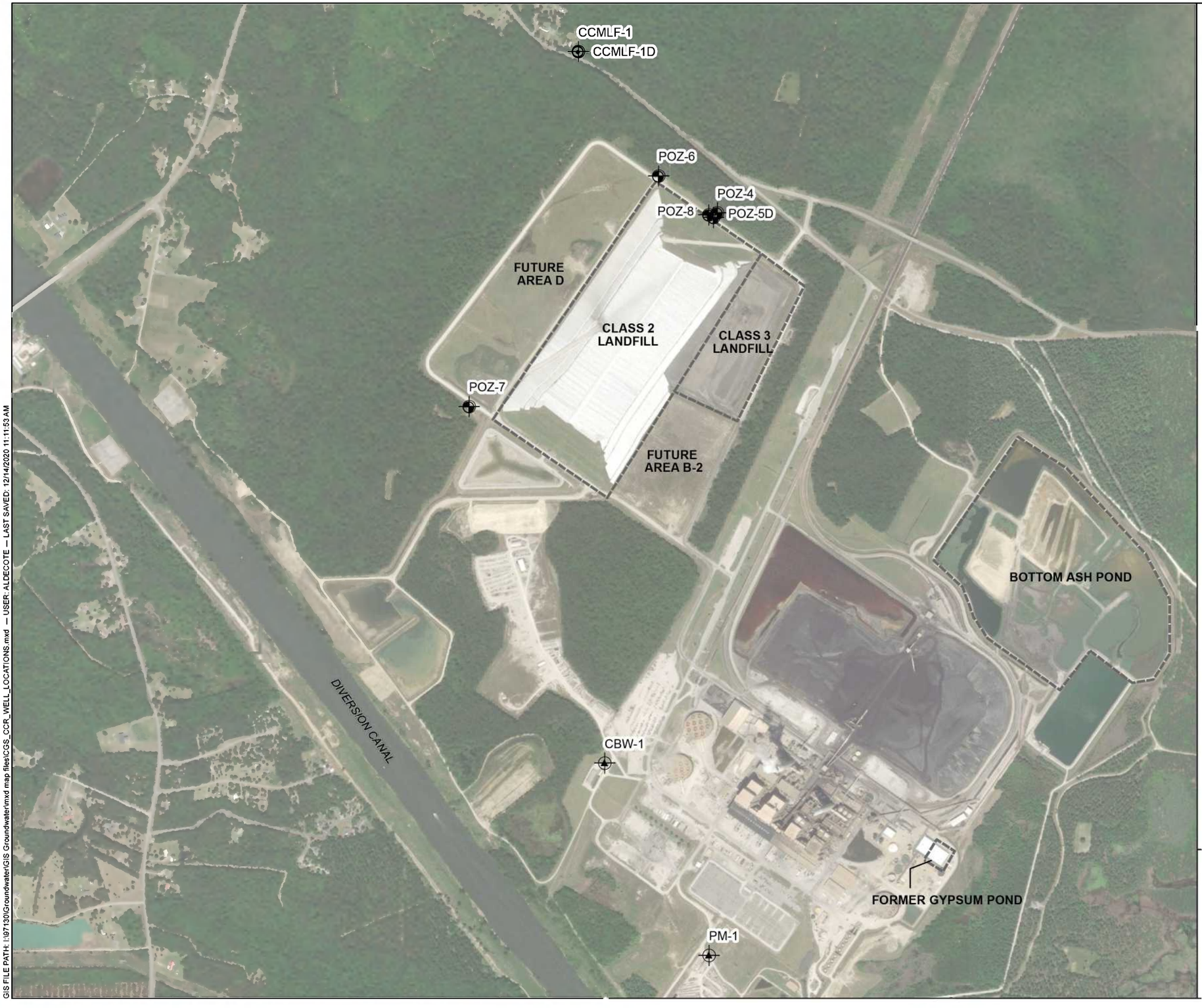
TABLES

TABLE 1 - Summary of Analytical Results
Cross Generating Station Class 2 Landfill Assessment Monitoring

					Appendix III Constituents								Appendix IV Constituents																		Field Parameters							
Well ID	Purpose	Date of Sample Event	Laboratory Sample ID Number		Boron	Calcium	Chloride	Fluoride	Fluoride	Sulfate	Total Dissolved Solids	pH	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Fluoride	Lead	Lithium	Mercury	Molybdenum	Radium 226	Radium 228	Radium 226/Radium 228 Combined Calculation	Selenium	Thallium	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	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	pCi/L	pCi/L	pCi/L	ug/L	ug/L	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		EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 300.0	SM 4500 FC	EPA 6020B	EPA 6010D	EPA 7470	EPA 6010D	EPA 903.1 Mo	EPA 904.0	EPA 903.1 Mod	EPA 6020B	EPA 6020B								
				GWPS/US EPA MCL/RSL	—	—	—	4	4	—	—	—	6	10	2000	4	5	100	6	4	4	15	40	2	100	—	—	5	50	2	—	—	—	—	—	SM2580		—
Site Background Wells																																						
PM-1	Background	2/24/2020	AE66534		<15	11	12.7		<0.10	8.36	120	4.92	<5.0	<5.0	72.5	<0.50	<0.50	<5.0	1		<0.10	<1.0	<10	<0.20	<10	0.532	0.00527	0.538	<10.0	<1.0	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	<5.0	<5.0	76.6	<0.50	<0.50	<5.0	1	<0.10		<1.0	<5	<0.20	<10	0.547	0.836	1.38	<10.0	<1.0	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	1	1	2	2	2	2	2	2	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	<5.0	<5.0	41.3	<0.50	<0.50	<5.0	0.82		0.19	2.7	<10	<0.20	<10	0.727	1.33	2.06	<10.0	<1.0	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	<5.0	<5.0	43.3	<0.50	<0.50	<5.0	0.8	0.2		2.6	<5	<0.20	<10	0.493	0.647	1.14	<10.0	<1.0	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	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Class 2 Landfill Wells																																						
POZ-4	CMA/NE	1/10/2020	AE63795									6.31							15.7												5.49	77.24	6.31	1261	19	25	6.53	0.34
POZ-4	Duplicate	1/10/2020	AE63796																15.8																			
POZ-4	Assessment	2/25/2020	AE66538		15		303		0.1	69.9	1005	6.19	<5.0	<5.0	255	<0.50	<0.50	<5.0	21.7		0.1	<1.0	<10	<0.20	<10	0.463	0.749	1.21	<10.0	<1.0	3.46	79.27	6.19	1520	19.14	82	0	2.37
POZ-4	Assessment	6/21/2020	AE75389		15	307	396	0.12		96.2	1489	6.2		<5.0	152	<0.50	<0.50	<5.0	46.4	0.12		<1.0				0.514	1.61	2.13	<10.0		5.46	77.27	6.2	1760	24.37	38	0	0.63
POZ-4	total samples				2	1	2	1	1	2	2	3	1	2	2	2	2	2	4	1	1	2	1	1	1	2	2	2	2	1	3	3	3	3	3	3	3	3
POZ-6	CMA/NE	1/10/2020	AE63797									6.56							1.8												6.51	77.33	6.56	2004	19.6	-16.9	9.17	1.64
POZ-6	Assessment	2/26/2020	AE66540		45		245		<0.10		420	1432	6.57	<5.0	<5.0	44.4	<0.50	<0.50	<5.0	0.79		<0.10	<1.0	<10	<0.20	<10	0.619	0.706	1.33	<10.0	<1.0	5.13	78.71	6.57	2050	18.7	35	3.3	2.36
POZ-6	Assessment	6/24/2020	AE75391		47	420	279	<0.10			449	1918	6.51		<5.0	50.5	<0.50	<0.50	<5.0	3.4	<0.10		<1.0				0.378	0.0814	0.46	<10.0		6.09	77.75	6.51	2050	26.81	1	8.7	0.75
POZ-6	total samples				2	1	2	1	1	2	2	3	1	2	2	2	2	2	4	1	1	2	1	1	1	2	2	2	2	1	3	3	3	3	3	3	3	3
POZ-7	Assessment	2/26/2020	AE66541		<15		30.8		<0.10	<2.0	93.75	5.18	<5.0	<5.0	148	0.72	<0.50	<5.0	1.8		<0.10	<1.0	<10	<0.20	<10	1.19	0.268	1.19	<10.0	<1.0	3.45	78.57	5.18	131	18.02	144	0.9	2.07
POZ-7	Duplicate	2/26/2020	AE66542		<15		30.7		<0.10	<2.0	76.25		<5.0	<5.0	147	0.79	<0.50	<5.0	1.8		<0.10	<1.0	<10	<0.20	<10	0.925	0.959	1.88	<10.0	<1.0								
POZ-7	Assessment	6/24/2020	AE75392		<15	18.5	34.2	<0.10		<2.0	137.5	5.51		<5.0	159	0.63	<0.50	<5.0	0.96	<0.10		<1.0				0.979	0.101	1.08	<10.0		4.69	77.33	5.51	144	28.56	189	0	1.5
POZ-7	Duplicate	6/24/2020	AE75393		<15	21.7	36.4	<0.10		<2.0	143.8			<5.0	159	0.57	<0.50	<5.0	0.88	<0.10		<1.0				0.47	0.764	1.23	<10.0									
POZ-7	total samples				4	2	4	2	2	4	4	2	2	4	4	4	4	4	4	2	2	4	2	2	2	4	4	4	4	2	2	2	2	2	2	2	2	2
POZ-8	CMA/NE	1/10/2020	AE63794									6.86							<0.50												6.31	76.96	6.86	947	18.5	-40.2	7.19	0.45
POZ-8	CMA/NE	2/26/2020	AE66543									6.3							<5				85								4.36	78.77	6.3	3940	18.71	-38	22.7	0.75
POZ-8	CMA/NE	6/23/2020	AE75394		20		966				66.5	3484	6.63	<5.0		503		<0.50	<5.0			<0.50		<1.0						<10.0		5.66	77.47	6.63	3240	24.97	-98	0	0.6
POZ-8	total samples				1	0	1	0	0	1	1	3	0	1	1	0	1	1	3	0	0	1	1	1	0	0	0	0	0	1	0	3	3	3	3	3	3	3	3
CCMLF-1	CMA/NE	1/10/2020	AE63799									5.37							17.8												4.29	77.61	5.37	276	18.9	108	6.83	0.75
CCMLF-1	CMA/NE	3/3/2020	AE66530									5.22							8.3												3.25	77.61	5.22	176	19.33	97	0	0.86
CCMLF-1	Duplicate	3/3/2020	AE67921																8.1																			
CCMLF-1	CMA/NE	7/1/2020	AE75371									5.96							3.8												4.64	76.22	5.96	168	23.76	36	6	0.84
CCMLF-1	total samples				0	0	0	0	0	0	0	3	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3
CCMLF-1D	CMA/NE	1/10/2020	AE63800									6.84							<0.50												4.15	77.62	6.84	244	18.6	-45.7	5.58	0.41
CCMLF-1D	CMA/NE	3/3/2020	AE66531									6.93							<0.50												3.03	77.62	6.93	315	18.94	-64	14.3	0.91
CCMLF-1D	CMA/NE	7/1/2020	AE75372									6.92							<0.50												4.37	76.28	6.92	331	22.65	-135	3	0.94
CCMLF-1D	total samples				0	0	0	0	0	0	0	3	0	1	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3

All groundwater samples collected from the monitoring wells for Assessment Monitoring in 2020 for the constituents listed in Appendix III and Appendix IV 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
- PROPERTY BOUNDARY WELL
- CLASS 2 LANDFILL WELL
- CCR BOUNDARY

NOTES

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

N

0 1,000 2,000
SCALE IN FEET

SANTEE COOPER
CROSS GENERATING STATION
PINEVILLE, SOUTH CAROLINA

DECEMBER 2020

LOCATION OF CLASS 2 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 11:11:53 AM

Appendix A – Statistical Analysis

HALEY & ALDRICH, INC.
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TECHNICAL MEMORANDUM

July 20, 2020
File No. 132892-011

SUBJECT: 2020 Semi-annual Groundwater Assessment Monitoring Data
Statistical Evaluation
Cross Generating Station
Class 2 Landfill

Pursuant to Title 40 Code of Federal Regulations (40 CFR) § 257.93 and § 257.95 (Rule), this memorandum summarizes the statistical evaluation of the analytical results for the February 2020 semi-annual assessment monitoring groundwater sampling event for the Cross Generating Station (CGS) Class 2 Landfill. The statistical evaluation discussed in this memorandum was conducted to determine if Appendix IV groundwater monitoring constituents have been detected in downgradient wells at statistically significant levels (SSL) above background or upgradient wells consistent with the requirements in 40 CFR § 257.95.

Utilizing interwell statistical evaluations, data from the groundwater sampling event for the downgradient monitoring wells were compared to the Groundwater Protection Standard (GWPS) established from the background dataset for the upgradient monitoring wells (PM-1 and CBW-1) for detected Appendix IV constituents. GWPS for each of the Appendix IV constituents have been set equal to the highest value of the maximum contaminant level (MCL), regional screening level (RSL), or background concentration. The results of the assessment monitoring statistical evaluation are discussed below and provided in Table I.

Statistical Evaluation of Appendix IV Constituents

The Rule provides four specific options for statistical evaluation of groundwater quality data collected at a coal combustion residual (CCR) unit (40 CFR §257.93(f) (1-4)). The statistical method used for these evaluations, tolerance limit (TL), was certified by Haley & Aldrich, Inc. on October 14, 2017. The TL method, as determined applicable for this sampling event, was used to evaluate potential SSLs above GWPS. GWPS for each constituent listed in Appendix IV were computed as upper tolerance limits (UTL), and a minimum 95 percent confidence coefficient and 95 percent coverage. The most recent groundwater sampling result from each compliance well was compared to the GWPS to determine if a SSL existed.

STATISTICAL EVALUATION

An interwell statistical evaluation was used to identify SSLs. An interwell evaluation compares the most recent values from downgradient compliance wells to a background dataset composed of upgradient

well data. Because the CCR unit has transitioned into assessment monitoring, no statistical evaluations were conducted on Appendix III (detection monitoring) semi-annual assessment monitoring data.

The parametric TL method was used to complete statistical evaluations of the referenced dataset. The TL procedure is one in which a concentration limit for each constituent is established from the distribution of the background data, with a minimum 95 percent confidence level. The upper endpoint of a tolerance interval is called the UTL. Depending on the data distribution, parametric or non-parametric TL procedures are used to evaluate groundwater monitoring data using this method. Parametric TLs utilize normally distributed data or data normalized via a transformation of the sample background data used to construct the limit. If the data are non-normal and a transformation is not indicated, non-parametric procedures (order statistics or bootstrap methods) are used to calculate the TL. If all the background data are non-detect, a maximum reporting limit may serve as an appropriate UTL.

These statistical evaluations were conducted using the background dataset for all detected Appendix IV constituents using parametric TL. If an Appendix IV constituent concentration from the February 2020 sampling event was above the GWPS, the lower confidence limit (LCL) for the downgradient well constituent was used to evaluate if a SSL was indicated. The LCL is the lower end of the confidence interval range, which is an estimated concentration range intended to contain the true mean or median of the population from which the sample is drawn. The confidence interval range is designed to locate the true population mean or median with a high degree of statistical confidence, or conversely, with a low probability of error.

The UTLs were calculated from the background well dataset using Chemstat software after testing for outlier sample results that would warrant removal from the dataset 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 using box plots and distribution plots for the downgradient sample data. No sample data were identified as outliers that warranted removal from the dataset.

BACKGROUND DISTRIBUTIONS

The groundwater analytical results for each sampling event from the background sample location (PM-1 and CBW-1) were combined to calculate the UTL for each detected Appendix IV constituent. The variability and distribution of the pooled dataset was evaluated to determine the method for UTL calculation. 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.

RESULTS OF APPENDIX IV DOWNGRADIENT STATISTICAL COMPARISONS

The sample concentrations from the downgradient wells for each of the detected Appendix IV constituents from the February 2020 assessment monitoring event were compared to their respective

GWPS (Table I). A sample concentration greater than the GWPS is considered to represent a SSL. Based on previous compliance sampling events and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. Based on this statistical evaluation an SSL above GWPS was identified at the Class 2 Landfill for cobalt consistent with previous results.

Tables:

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

TABLES

Cross Class 2 Landfill

Summary of Assessment Monitoring Statistical Evaluation – February 2020

Prepared: July 20, 2020

																		Inter-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*	February 2020 Concentrations	Detect?	Upper Tolerance Limit	Background Limit (Higher of MCL/RSL or Upper Tolerance Limit)	SSL
CCR Appendix-IV: Antimony, Total (mg/L)																								
CBW-1	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA			0.025	0.025	
PM-1	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA						
POZ-4	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA	0.005	N			FALSE
POZ-6	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA	0.005	N			FALSE
POZ-7	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA	0.005	N			FALSE
CCR Appendix-IV: Arsenic, Total (mg/L)																								
CBW-1	3/14	79%	0.005-0.005	0.00593	0.005	0.009955	0.016	0.000008602	0.002933	0.4943	0.01	mg/L	Y	1	0	Yes	No	NA	Non-parametric			0.016	0.016	
PM-1	2/14	86%	0.005-0.005	0.00484	0.005	0.005	0.0042	1.932E-07	0.0004396	0.09091	0.01	mg/L	N	0	0	NA	NA	NA						
POZ-4	1/13	92%	0.003-0.005	0.0047	0.005	0.005	0.0031	5.367E-07	0.0007326	0.1559	0.01	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			FALSE
POZ-6	1/13	92%	0.003-0.005	0.00476	0.005	0.005	0.0039	3.726E-07	0.0006104	0.1282	0.01	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			FALSE
POZ-7	0/13	100%	0.003-0.005	0.00469	0.005	0.005		5.641E-07	0.0007511	0.1601	0.01	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			FALSE
CCR Appendix-IV: Barium, Total (mg/L)																								
CBW-1	14/14	0%	-	0.0441	0.0429	0.05209	0.061	0.00002784	0.005276	0.1197	2	mg/L	N	0	0	No	No	Stable	Non-parametric			0.103	2.000	
PM-1	14/14	0%	-	0.0824	0.08025	0.101	0.103	0.00009314	0.009651	0.1171	2	mg/L	N	0	0	No	No	Stable						
POZ-4	13/13	0%	-	0.11	0.083	0.2148	0.255	0.003077	0.05547	0.5046	2	mg/L	N	0	0	No	No	Stable		0.255	Y			FALSE
POZ-6	13/13	0%	-	0.0526	0.0452	0.0784	0.1	0.0002584	0.01607	0.3058	2	mg/L	N	0	0	No	No	Decreasing		0.044	Y			FALSE
POZ-7	13/13	0%	-	0.26	0.251	0.3374	0.389	0.003066	0.05537	0.2132	2	mg/L	N	0	0	No	No	Stable		0.148	Y			FALSE
CCR Appendix-IV: Beryllium, Total (mg/L)																								
CBW-1	1/13	92%	0.0005-0.0005	0.00051	0.0005	0.000552	0.00063	1.3E-09	0.00003606	0.0707	0.004	mg/L	N	0	0	NA	NA	NA	Non-parametric			0.00063	0.004	
PM-1	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.004	mg/L	N	0	0	NA	NA	NA						
POZ-4	8/12	33%	0.0005-0.0005	0.00072	0.00053	0.001231	0.00139	9.189E-08	0.0003031	0.4209	0.004	mg/L	N	0	0					0.0005	N			FALSE
POZ-6	0/12	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.004	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			FALSE
POZ-7	8/12	33%	0.0005-0.0005	0.000679	0.000675	0.0009103	0.000935	2.901E-08	0.0001703	0.2509	0.004	mg/L	N	0	0					0.0007	Y			FALSE
CCR Appendix-IV: Cadmium, Total (mg/L)																								
CBW-1	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.005	mg/L	N	0	0	NA	NA	NA	NA			0.0005	0.005	
PM-1	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.005	mg/L	N	0	0	NA	NA	NA						
POZ-4	2/13	85%	0.0005-0.0005	0.000532	0.0005	0.000684	0.00081	7.764E-09	0.00008811	0.1658	0.005	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			FALSE
POZ-6	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.005	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			FALSE
POZ-7	1/13	92%	0.0005-0.0005	0.000508	0.0005	0.00054	0.0006	7.692E-10	0.00002774	0.05463	0.005	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			FALSE
CCR Appendix-IV: Chromium, Total (mg/L)																								
CBW-1	1/13	92%	0.005-0.005	0.00569	0.005	0.0086	0.014	0.000006231	0.002496	0.4385	0.1	mg/L	N	0	0	NA	NA	NA	Non-parametric			0.0140	0.100	
PM-1	0/13	100%	0.005-0.005	0.005	0.005	0.005		1.807E-20	1.344E-10	2.688E-08	0.1	mg/L	N	0	0	NA	NA	NA						
POZ-4	0/13	100%	0.005-0.005	0.005	0.005	0.005		1.807E-20	1.344E-10	2.688E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			FALSE
POZ-6	0/13	100%	0.005-0.005	0.005	0.005	0.005		1.807E-20	1.344E-10	2.688E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			FALSE
POZ-7	1/13	92%	0.005-0.005	0.00507	0.005	0.00536	0.0059	6.231E-08	0.0002496	0.04924	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			FALSE
CCR Appendix-IV: Cobalt, Total (mg/L)																								
CBW-1	14/14	0%	-	0.00115	0.001	0.002035	0.0034	4.446E-07	0.0006668	0.578	0.006	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric			0.0034	0.006	
PM-1	14/14	0%	-	0.000912	0.00091	0.001	0.001	4.342E-09	0.0000659	0.07229	0.006	mg/L	N	0	0	No	No	Stable						
POZ-4	16/16	0%	-	0.0988	0.0744	0.201	0.21	0.005142	0.07171	0.7261	0.006	mg/L	Y	15	0	No	No	Stable		0.0217	Y			TRUE
POZ-6	13/13	0%	-	0.00309	0.00314	0.00628	0.0082	0.000004324	0.002079	0.6736	0.006	mg/L	Y	1	0	No	No	Stable		0.0008	Y			FALSE
POZ-7	8/13	38%	0.0005-0.0005	0.00105	0.00095	0.0022	0.0028	4.493E-07	0.0006703	0.6374	0.006	mg/L	N	0	0	No	No	Stable		0.0018	Y			FALSE
CCR Appendix-IV: 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	Non-parametric			0.300	4.00	
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						
POZ-4	5/13	62%	0.1-0.1	0.112	0.1	0.164	0.17	0.0006192	0.02488	0.2216	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.100	Y			FALSE
POZ-6	4/13	69%	0.1-0.1	0.114	0.1	0.15	0.15	0.0004923	0.02219	0.1949	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.100	N			FALSE
POZ-7	6/13	54%	0.1-0.1	0.108	0.1	0.13	0.13	0.0001526	0.01235	0.1147	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.100	N			FALSE
CCR Appendix-IV: Lead, Total (mg/L)																								
CBW-1	14/14	0%	-	0.00362	0.0031	0.006287	0.011	0.000004634	0.002153	0.5953	0.015	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric			0.0110	0.015	
PM-1	0/14	100%	0.001-0.0025	0.00121	0.001	0.0025		2.967E-07	0.0005447	0.4486	0.015	mg/L	N	0	0	NA	NA	NA						
POZ-4	0/13	100%	0.001-0.0025	0.00123	0.001	0.0025		3.173E-07	0.0005633	0.4577	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			FALSE
POZ-6	0/13	100%	0.001-0.0025	0.00123	0.001	0.0025		3.173E-07	0.0005633	0.4577	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			FALSE
POZ-7	0/13	100%	0.001-0.0025	0.00123	0.001	0.0025		3.173E-07	0.0005633	0.4577	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			FALSE
CCR Appendix-IV: Lithium, Total (mg/L)																								
CBW-1	0/14	100%	0.01-0.01	0.01	0.01	0.01		5.004E-20	2.237E-10	2.237E-08	0.04	mg/L	N	0	0	NA	NA	NA	NA			0.010	0.040	
PM-1	0/14	100%	0.01-0.01	0.01	0.01	0.01		5.004E-20	2.237E-10	2.237E-08	0.04	mg/L	N	0	0	NA	NA	NA						
POZ-4	8/12	33%	0.01-0.01	0.0133	0.0114	0.02045	0.021	0.00001687	0.004107	0.309	0.04	mg/L	N	0	0					0.010	N			FALSE
POZ-6	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.04	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
POZ-7	1/12	92%	0.01-0.01	0.0108	0.01	0.0145	0.02	0.000008333	0.002887	0.2665	0.04	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
CCR Appendix-IV: Mercury, Total (mg/L)																								
CBW-1	0/14	100%	0.0002-0.001	0.000257	0.0002	0.00048		4.571E-08	0.0002138	0.8315	0.002	mg/L	N	0	0	NA	NA	NA				0.0010	0.0020	
PM-1	0/14	100%	0.0002-0.001	0.000257	0.0002	0.00048		4.571E-08	0.0002138	0.8315	0.002	mg/L	N	0	0	NA	NA	NA						
POZ-4	0/12	100%	0.0002-0.001	0.000267	0.0002	0.00056		5.333E-08	0.0002309	0.866	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.0002	N			FALSE
POZ-6	0/12	100%	0.0002-0.001	0.000267	0.0002	0.00056		5.333E-08	0.0002309	0.866	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.0002	N			FALSE
POZ-7	2/12	83%	0.0002-0.001	0.000286	0.0002	0.0006579	0.000378	5.328E-08	0.0002308	0.808	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.0002	N			FALSE

Cross Class 2 Landfill

Summary of Assessment Monitoring Statistical Evaluation – February 2020

Prepared: July 20, 2020

CCR Appendix-IV: Molybdenum, Total (mg/L)																						
CBW-1	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA		0.010	0.10	
PM-1	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA					
POZ-4	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
POZ-6	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
POZ-7	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
CCR Appendix-IV: Radium-226 & 228 (pCi/L)																						
CBW-1	6/13	54%	4-4	3.97	4	5.722	6.34	2.143	1.464	0.3688	5	pCi/L	Y	3	0	Yes	No	Stable	Non-parametric			16.3	16.3	
PM-1	7/13	46%	4-4	4.76	4	10.77	16.3	14.8	3.847	0.808	5	pCi/L	Y	2	0	Yes	No	Stable						
POZ-4	5/12	58%	4-4	3.79	4	5.245	6.29	1.783	1.335	0.3524	5	pCi/L	Y	1	0	Yes	No	Stable	Non-parametric	1.210	Y			FALSE
POZ-6	4/12	67%	4-4	3.62	4	4.378	4.78	1.206	1.098	0.3032	5	pCi/L	N	0	0	Yes	No	Decreasing	Non-parametric	1.330	Y			FALSE
POZ-7	9/12	25%	4-4	3.94	4.07	5.109	5.39	1.175	1.084	0.2754	5	pCi/L	Y	1	0	Yes	No	Stable	Non-parametric	1.190	Y			FALSE
CCR Appendix-IV: Selenium, Total (mg/L)																						
CBW-1	0/14	100%	0.01-0.02	0.0114	0.01	0.02		0.00001319	0.003631	0.3177	0.05	mg/L	N	0	0	NA	NA	NA	NA		0.020	0.050	
PM-1	0/14	100%	0.01-0.02	0.0114	0.01	0.02		0.00001319	0.003631	0.3177	0.05	mg/L	N	0	0	NA	NA	NA					
POZ-4	0/13	100%	0.01-0.02	0.0115	0.01	0.02		0.0000141	0.003755	0.3255	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
POZ-6	0/13	100%	0.01-0.02	0.0115	0.01	0.02		0.0000141	0.003755	0.3255	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
POZ-7	0/13	100%	0.01-0.02	0.0115	0.01	0.02		0.0000141	0.003755	0.3255	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			FALSE
CCR Appendix-IV: Thallium, Total (mg/L)																						
CBW-1	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA		0.001	0.002	
PM-1	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA					
POZ-4	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			FALSE
POZ-6	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			FALSE
POZ-7	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			FALSE

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Statistical Evaluation
Cross Generating Station
Class 2 Landfill

Pursuant to Title 40 Code of Federal Regulations (40 CFR) § 257.93 and § 257.95 (Rule), this memorandum summarizes the statistical evaluation of the analytical results for the June 2020 semi-annual assessment monitoring groundwater sampling event for the Cross Generating Station (CGS) Class 2 Landfill. The statistical evaluation discussed in this memorandum was conducted to determine if Appendix IV groundwater monitoring constituents have been detected in downgradient wells at statistically significant levels (SSL) above background or upgradient wells consistent with the requirements in 40 CFR § 257.95.

Utilizing interwell statistical evaluations, data from the groundwater sampling event for the downgradient monitoring wells were compared to the Groundwater Protection Standard (GWPS) established from the background dataset for the upgradient monitoring wells (PM-1 and CBW-1) for detected Appendix IV constituents. GWPS for each of the Appendix IV constituents have been set equal to the highest value of the maximum contaminant level (MCL), regional screening level (RSL), or background concentration. The results of the assessment monitoring statistical evaluation are discussed below and provided in Table I.

Statistical Evaluation of Appendix IV Constituents

The Rule provides four specific options for statistical evaluation of groundwater quality data collected at a coal combustion residual (CCR) unit (40 CFR §257.93(f) (1-4)). The statistical method used for these evaluations, tolerance limit (TL), was certified by Haley & Aldrich, Inc. on October 14, 2017. The TL method, as determined applicable for this sampling event, was used to evaluate potential SSLs above GWPS. GWPS for each constituent listed in Appendix IV were computed as upper tolerance limits (UTL), and a minimum 95 percent confidence coefficient and 95 percent coverage. The most recent groundwater sampling result from each compliance well was compared to the GWPS to determine if a SSL existed.

STATISTICAL EVALUATION

An interwell statistical evaluation was used to identify SSLs. An interwell evaluation compares the most recent values from downgradient compliance wells to a background dataset composed of upgradient

well data. Because the CCR unit has transitioned into assessment monitoring, no statistical evaluations were conducted on Appendix III (detection monitoring) semi-annual assessment monitoring data.

The parametric TL method was used to complete statistical evaluations of the referenced dataset. The TL procedure is one in which a concentration limit for each constituent is established from the distribution of the background data, with a minimum 95 percent confidence level. The upper endpoint of a tolerance interval is called the UTL. Depending on the data distribution, parametric or non-parametric TL procedures are used to evaluate groundwater monitoring data using this method. Parametric TLs utilize normally distributed data or data normalized via a transformation of the sample background data used to construct the limit. If the data are non-normal and a transformation is not indicated, non-parametric procedures (order statistics or bootstrap methods) are used to calculate the TL. If all the background data are non-detect, a maximum reporting limit may serve as an appropriate UTL.

These statistical evaluations were conducted using the background dataset for all detected Appendix IV constituents using parametric TL. If an Appendix IV constituent concentration from the June 2020 sampling event was above the GWPS, the lower confidence limit (LCL) for the downgradient well constituent was used to evaluate if a SSL was indicated. The LCL is the lower end of the confidence interval range, which is an estimated concentration range intended to contain the true mean or median of the population from which the sample is drawn. The confidence interval range is designed to locate the true population mean or median with a high degree of statistical confidence, or conversely, with a low probability of error.

The UTLs were calculated from the background well dataset using Chemstat software after testing for outlier sample results that would warrant removal from the dataset 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 using box plots and distribution plots for the downgradient sample data. No sample data were identified as outliers that warranted removal from the dataset.

BACKGROUND DISTRIBUTIONS

The groundwater analytical results for each sampling event from the background sample location (PM-1 and CBW-1) were combined to calculate the UTL for each detected Appendix IV constituent. The variability and distribution of the pooled dataset was evaluated to determine the method for UTL calculation. 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.

RESULTS OF APPENDIX IV DOWNGRADIENT STATISTICAL COMPARISONS

The sample concentrations from the downgradient wells for each of the detected Appendix IV constituents from the June 2020 assessment monitoring event were compared to their respective GWPS

(Table I). A sample concentration greater than the GWPS is considered to represent a SSL. Based on previous compliance sampling events and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. Based on this statistical evaluation an SSL above GWPS remains at the Class 2 Landfill for cobalt. While an SSL for cobalt was identified, the concentrations detected are significantly lower than the values recorded during assessment monitoring in 2019. The concentrations recorded in 2020 are at the low end of the historical range for cobalt at the Class 2 Landfill. The performance of the selected remedy in achieving GWPS will continue to be evaluated during subsequent semiannual sampling events.

Tables:

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

TABLES

Cross Class 2 Landfill

Detection Monitoring Statistical Analysis Summary

Prepared: October 23, 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*	Inter-well Analysis					
																				June 2020 Concentrations	Detect?	Upper Tolerance Limit	Background Limit (Higher of MCL/RSL or Upper Tolerance Limit)	Exceedance above Background at Individual Well	SSL
CCR Appendix-IV: Antimony, Total (mg/L)																									
CBW-1	0/13	100%	0.005-0.025	0.00654	0.005	0.013		0.00003077	0.005547	0.8484	0.006	mg/L	N	0	1	NA	NA	NA	NA						
PM-1	0/13	100%	0.005-0.025	0.00654	0.005	0.013		0.00003077	0.005547	0.8484	0.006	mg/L	N	0	1	NA	NA	NA				0.025	0.025		
POZ-4	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA	NS				N	FALSE
POZ-6	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA	NS				N	FALSE
POZ-7	0/12	100%	0.005-0.025	0.00667	0.005	0.014		0.00003333	0.005774	0.866	0.006	mg/L	N	0	1	NA	NA	NA	NA	NS				N	FALSE
CCR Appendix-IV: Arsenic, Total (mg/L)																									
CBW-1	3/15	80%	0.005-0.005	0.00587	0.005	0.00949	0.016	0.000008046	0.002836	0.4831	0.01	mg/L	Y	1	0	Yes	No	NA	Non-parametric			0.016	0.016		
PM-1	2/15	87%	0.005-0.005	0.00485	0.005	0.005	0.0042	1.812E-07	0.0004257	0.08784	0.01	mg/L	N	0	0	NA	NA	NA							
POZ-4	1/14	93%	0.003-0.005	0.00472	0.005	0.005	0.0031	5.018E-07	0.0007084	0.15	0.01	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			N	FALSE
POZ-6	1/14	93%	0.003-0.005	0.00478	0.005	0.005	0.0039	0.000000348	0.0005899	0.1234	0.01	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			N	FALSE
POZ-7	0/14	100%	0.003-0.005	0.00471	0.005	0.005		5.275E-07	0.0007263	0.1541	0.01	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			N	FALSE
CCR Appendix-IV: Barium, Total (mg/L)																									
CBW-1	15/15	0%	-	0.044	0.043	0.05141	0.061	0.00002589	0.005088	0.1155	2	mg/L	N	0	0	No	No	Stable	Non-parametric			0.103	2.000		
PM-1	15/15	0%	-	0.082	0.0802	0.1009	0.103	0.00008876	0.009421	0.1148	2	mg/L	N	0	0	No	No	Stable							
POZ-4	14/14	0%	-	0.113	0.0865	0.2114	0.255	0.002967	0.05447	0.4823	2	mg/L	N	0	0	No	No	Stable		0.152	Y			N	FALSE
POZ-6	14/14	0%	-	0.0524	0.0456	0.0766	0.1	0.0002388	0.01545	0.2948	2	mg/L	N	0	0	No	No	Decreasing		0.051	Y			N	FALSE
POZ-7	14/14	0%	-	0.253	0.2505	0.3331	0.389	0.003555	0.05963	0.2361	2	mg/L	N	0	0	No	No	Stable		0.159	Y			N	FALSE
CCR Appendix-IV: Beryllium, Total (mg/L)																									
CBW-1	1/14	93%	0.0005-0.0005	0.000509	0.0005	0.0005455	0.00063	1.207E-09	0.00003474	0.06822	0.004	mg/L	N	0	0	NA	NA	NA	Non-parametric			0.00063	0.004		
PM-1	0/15	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.004	mg/L	N	0	0	NA	NA	NA							
POZ-4	8/13	38%	0.0005-0.0005	0.000703	0.00052	0.001216	0.00139	8.796E-08	0.0002966	0.4217	0.004	mg/L	N	0	0					0.0005	N			N	FALSE
POZ-6	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.004	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			N	FALSE
POZ-7	9/13	31%	0.0005-0.0005	0.000675	0.00063	0.000908	0.000935	2.677E-08	0.0001636	0.2424	0.004	mg/L	N	0	0					0.0006	Y			N	FALSE
CCR Appendix-IV: Cadmium, Total (mg/L)																									
CBW-1	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.005	mg/L	N	0	0	NA	NA	NA	NA			0.0005	0.005		
PM-1	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.005	mg/L	N	0	0	NA	NA	NA							
POZ-4	2/14	86%	0.0005-0.0005	0.000529	0.0005	0.0006735	0.00081	7.238E-09	0.00008508	0.1607	0.005	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			N	FALSE
POZ-6	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.005	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			N	FALSE
POZ-7	1/14	93%	0.0005-0.0005	0.000507	0.0005	0.000535	0.0006	7.143E-10	0.00002673	0.0527	0.005	mg/L	N	0	0	NA	NA	NA	NA	0.0005	N			N	FALSE
CCR Appendix-IV: Chromium, Total (mg/L)																									
CBW-1	1/14	93%	0.005-0.005	0.00564	0.005	0.00815	0.014	0.000005786	0.002405	0.4263	0.1	mg/L	N	0	0	NA	NA	NA	Non-parametric			0.0140	0.100		
PM-1	0/14	100%	0.005-0.005	0.005	0.005	0.005		1.251E-20	1.118E-10	2.237E-08	0.1	mg/L	N	0	0	NA	NA	NA							
POZ-4	0/14	100%	0.005-0.005	0.005	0.005	0.005		1.251E-20	1.118E-10	2.237E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			N	FALSE
POZ-6	0/14	100%	0.005-0.005	0.005	0.005	0.005		1.251E-20	1.118E-10	2.237E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			N	FALSE
POZ-7	1/14	93%	0.005-0.005	0.00506	0.005	0.005315	0.0059	5.786E-08	0.0002405	0.0475	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	N			N	FALSE
CCR Appendix-IV: Cobalt, Total (mg/L)																									
CBW-1	15/15	0%	-	0.00113	0.001	0.00193	0.0034	4.212E-07	0.000649	0.5743	0.006	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric			0.0034	0.006		
PM-1	15/15	0%	-	0.000917	0.00091	0.001	0.001	4.554E-09	0.00006749	0.07356	0.006	mg/L	N	0	0	No	No	Stable							
POZ-4	17/17	0%	-	0.0957	0.065	0.2004	0.21	0.004982	0.07058	0.7377	0.006	mg/L	Y	16	0	No	No	Stable		0.0464	Y			Y	TRUE
POZ-6	14/14	0%	-	0.00311	0.00317	0.00612	0.0082	0.000003998	0.002	0.6431	0.006	mg/L	Y	1	0	No	No	Stable		0.0034	Y			N	FALSE
POZ-7	9/14	36%	0.0005-0.0005	0.00104	0.000955	0.00215	0.0028	4.153E-07	0.0006445	0.6167	0.006	mg/L	N	0	0	No	No	Stable		0.0010	Y			N	FALSE
CCR Appendix-IV: 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	Non-parametric			0.300	4.00		
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							
POZ-4	6/14	57%	0.1-0.1	0.113	0.1	0.1635	0.17	0.0005758	0.024	0.2126	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.120	Y			N	FALSE
POZ-6	4/14	71%	0.1-0.1	0.113	0.1	0.15	0.15	0.0004681	0.02164	0.1917	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.100	N			N	FALSE
POZ-7	6/14	57%	0.1-0.1	0.107	0.1	0.13	0.13	0.0001451	0.01204	0.1124	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.100	N			N	FALSE
CCR Appendix-IV: Lead, Total (mg/L)																									
CBW-1	15/15	0%	-	0.00355	0.0031	0.005925	0.011	0.000004372	0.002091	0.5892	0.015	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric			0.0110	0.015		
PM-1	0/15	100%	0.001-0.0025	0.0012	0.001	0.0025		2.786E-07	0.0005278	0.4398	0.015	mg/L	N	0	0	NA	NA	NA							
POZ-4	0/14	100%	0.001-0.0025	0.00121	0.001	0.0025		2.967E-07	0.0005447	0.4486	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			N	FALSE
POZ-6	0/14	100%	0.001-0.0025	0.00121	0.001	0.0025		2.967E-07	0.0005447	0.4486	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			N	FALSE
POZ-7	0/14	100%	0.001-0.0025	0.00121	0.001	0.0025		2.967E-07	0.0005447	0.4486	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N			N	FALSE
CCR Appendix-IV: Lithium, Total (mg/L)																									
CBW-1	0/15	100%	0.005-0.01	0.00967	0.01	0.01		0.000001667	0.001291	0.1336	0.04	mg/L	N	0	0	NA	NA	NA	NA			0.010	0.040		
PM-1	0/15	100%	0.005-0.01	0.00967	0.01	0.01		0.000001667	0.001291	0.1336	0.04	mg/L	N	0	0	NA	NA	NA							
POZ-4	8/12	33%	0.01-0.01	0.0133	0.0114	0.02045	0.021	0.00001687	0.004107	0.309	0.04	mg/L	N	0	0					NS				N	FALSE
POZ-6	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.04	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-7	1/12	92%	0.01-0.01	0.0108	0.01	0.0145	0.02	0.000008333	0.002887	0.2665	0.04	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
CCR Appendix-IV: Mercury, Total (mg/L)																									
CBW-1	0/15	100%	0.0002-0.001	0.000253	0.0002	0.00044		4.267E-08	0.0002066	0.8154	0.002	mg/L	N	0	0	NA	NA	NA	NA			0.0010	0.0020		
PM-1	0/15	100%	0.0002-0.001	0.000253	0.0002	0.00044		4.267E-08	0.0002066	0.8154	0.002	mg/L	N	0	0	NA	NA	NA							
POZ-4	0/12	100%	0.0002-0.001	0.000267	0.0002	0.00056		5.333E-08	0.0002309	0.866	0.002	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-6	0/12	100%	0.0002-0.001	0.000267	0.0002	0.00056		5.333E-08	0.0002309	0.866	0.002	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-7	2/12	83%	0.0002-0.001	0.000286	0.0002	0.0006579	0.000378	5.328E-08	0.0002308	0.808	0.002	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE

Cross Class 2 Landfill

Detection Monitoring Statistical Analysis Summary

Prepared: October 23, 2020

CCR Appendix-IV: Molybdenum, Total (mg/L)																									
CBW-1	0/13	100%	0.01-0.01	0.01	0.01	0.01		7.228E-20	2.688E-10	2.688E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA			0.010	0.10		
PM-1	0/13	100%	0.01-0.01	0.01	0.01	0.01		7.228E-20	2.688E-10	2.688E-08	0.1	mg/L	N	0	0	NA	NA	NA							
POZ-4	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-6	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-7	0/12	100%	0.01-0.01	0.01	0.01	0.01		5.914E-20	2.432E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
CCR Appendix-IV: Radium-226 & 228 (pCi/L)																									
CBW-1	7/14	50%	4-4	3.77	4	5.67	6.34	2.549	1.597	0.4239	5	pCi/L	Y	3	0	Yes	No	Stable	Non-parametric			16.3	16.3		
PM-1	8/14	43%	4-4	4.52	4	10.31	16.3	14.48	3.805	0.8418	5	pCi/L	Y	2	0	Yes	No	Stable							
POZ-4	6/13	54%	4-4	3.66	4	5.15	6.29	1.846	1.359	0.371	5	pCi/L	Y	1	0	Yes	No	Stable	Non-parametric	2.130	Y			N	FALSE
POZ-6	5/13	62%	4-4	3.38	4	4.342	4.78	1.875	1.369	0.4052	5	pCi/L	N	0	0	Yes	No	Decreasing	Non-parametric	0.460	Y			N	FALSE
POZ-7	10/13	23%	4-4	3.72	4	5.084	5.39	1.705	1.306	0.3513	5	pCi/L	Y	1	0	Yes	No	Stable	Non-parametric	1.080	Y			N	FALSE
CCR Appendix-IV: Selenium, Total (mg/L)																									
CBW-1	0/15	100%	0.01-0.02	0.0113	0.01	0.02		0.00001238	0.003519	0.3105	0.05	mg/L	N	0	0	NA	NA	NA	NA			0.020	0.050		
PM-1	0/15	100%	0.01-0.02	0.0113	0.01	0.02		0.00001238	0.003519	0.3105	0.05	mg/L	N	0	0	NA	NA	NA							
POZ-4	0/14	100%	0.01-0.02	0.0114	0.01	0.02		0.00001319	0.003631	0.3177	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			N	FALSE
POZ-6	0/14	100%	0.01-0.02	0.0114	0.01	0.02		0.00001319	0.003631	0.3177	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			N	FALSE
POZ-7	0/14	100%	0.01-0.02	0.0114	0.01	0.02		0.00001319	0.003631	0.3177	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N			N	FALSE
CCR Appendix-IV: Thallium, Total (mg/L)																									
CBW-1	0/13	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA			0.001	0.002		
PM-1	0/13	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA							
POZ-4	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-6	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE
POZ-7	0/12	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	NS				N	FALSE

Notes: NS= Not sampled