

**2020 ANNUAL GROUNDWATER MONITORING
AND CORRECTIVE ACTION REPORT
ASH PONDS A AND B
WINYAH GENERATING STATION**

**by Santee Cooper
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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 Ash Ponds A and B at the Winyah Generating Station (WGS). This 2020 Annual Report was prepared to comply with the United States Environmental Protection Agency (EPA) 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).

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), Ash Ponds A and B continued to operate under an assessment monitoring program in accordance with § 257.95, which was initiated on July 16, 2018. As required by § 257.93(h)(2), statistically significant levels (SSLs) of arsenic, lithium, and molybdenum were identified in one or more downgradient wells. Therefore, an assessment of corrective measures and an evaluation of the nature and extent of contamination was initiated per § 257.95(g)(3) on April 15, 2019 and completed on September 11, 2019. A public meeting was held on December 10, 2019 to discuss six remedial alternatives per § 257.96(e). A remedy has not yet been selected pursuant to § 257.97, therefore remedial activities have not yet been initiated for this unit. Semi-annual progress reports detailing updates on the remedy selection process were completed in March and September 2020 for this unit. For the 2020 assessment monitoring events, SSLs of arsenic, lithium, and molybdenum were identified in monitoring wells WAP-9, WAP-17, WAP-18, WAP-19, and WAP-20. At the end of the current annual reporting period (December 31, 2020), Ash Ponds A and B remain in assessment monitoring.

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.

Ash Ponds A and B at WGS are 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 Unit 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 prepare 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 facility's operating record as required by § 257.105(h)(1).

This Annual Report documents the activities completed in 2020 for the A & B Ash Ponds at WGS 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 § 257.95, is provided in this report.

2.2.1 Status of the Groundwater Monitoring and Corrective Action Program

Statistically significant increases (SSI) of Appendix III constituents were identified downgradient of Ash Ponds A and B, and the notification was provided on January 15, 2018. An alternate source demonstration (ASD) was conducted by Haley & Aldrich, Inc., and a report was provided to Santee Cooper in April 2018. The review by Haley & Aldrich did not identify contributing sources that could serve as an ASD for the SSI's observed in the CCR well network. As a result, an Assessment Monitoring program was initiated as required by § 257.94(e)(2).

As required by § 257.93(h)(2), the statistical evaluation of the detected Appendix IV constituents identified statistically significant levels (SSLs) exceeding groundwater protection standards (GWPS), specifically arsenic and lithium at Ash Pond A, and arsenic, lithium, and molybdenum at Ash Pond B. Therefore, an assessment of corrective measures and an evaluation of the nature & extent of contamination was initiated per §257.95(g)(3). Additional groundwater sampling during the nature & extent evaluation showed that the extent of the SSLs is confined to the uppermost aquifer on-site and does not extend north and east of the Cooling Water Pond. This continues to be the case through 2020. An Assessment of Corrective Measures report (CMA) was completed on September 11, 2019 and is available on the publicly available CCR website. A public meeting was held on December 10, 2019 to discuss the six alternatives presented in the CMA for a remedy per § 257.96(e).

A remedy has not yet been selected pursuant to § 257.97, therefore remedial activities have not yet been initiated for this unit. Semi-annual progress reports detailing updates in completing remedy selection were completed in March and September 2020 for this unit. The path forward will include selecting the final remedy, implementing the remedy, monitoring the progress, and reporting the results. These units will remain in assessment monitoring until the final remedy is implemented.

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 exceedances of GWPS for Appendix IV in accordance with § 257.93(h)(2) (Appendix A).
- Additional characterization of nature and extent § 257.95(g)(1)
- Completed two CMA Semi-Annual Progress Reports § 257.97 (a), 257.105 (h)(12)
- Collected supplemental engineering and design data which included soil borings to delineate the bottom of ash and bottom of contaminated in-situ soil § 257.98 (a)(1)

2.2.3 Problems Encountered

Problems such as damaged wells or issues with sample collection or lack of sampling were not encountered at the A and B Ash Ponds 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 § 257.95.
- Statistical analysis of Assessment Monitoring analytical data to determine if SSLs of the detected Appendix IV constituents are present.
- Additional characterization of nature and extent as needed § 257.95(g)(1)
- Collect supplemental engineering and design data which includes ongoing soil analysis, potentially supplemented by additional soil borings and/or groundwater monitoring wells § 257.98 (a)(1)
- Update the existing groundwater model to calibrate the model to existing conditions and examine the fate and transport characteristics of arsenic in groundwater
- CMA Semi-Annual Progress Report(s) § 257.97 (a), 257.105 (h)(12)
- Selection of the remedy and preparation of Selection of Remedy Report including schedules for implementing and completing remedial activities § 257.97(d)
- Initiate Groundwater Remedial Activities within 90 days of selecting the remedy which includes a reevaluation of the current groundwater monitoring plan § 257.98 (a)
- Develop the Corrective Action Groundwater Monitoring Program § 257.98 (a)(1)
- Field implementation of the remedy with any associated additional groundwater ASD or monitoring activities, as appropriate
- 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 Ash Ponds A and B are 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;

Groundwater monitoring wells were not installed or decommissioned in 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 § 257.95(b) and § 257.95(d)(1), 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 Ash Ponds A and B is presented in Table 1 of this report. In addition, and in accordance with § 257.95(d)(3), Table 1 includes the groundwater protection standards 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

As required by § 257.93(h) a statistical analysis of the Appendix III constituents was completed by January 15, 2018. Baseline analytical data collected from background monitoring wells WBW-1 and WAP-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 WAP-9, WAP-10, WAP-17, WAP-18, and WAP-19. Constituents with analytical results exceeding the UTLs were identified as SSIs over background for the respective Appendix III constituent. This statistical analysis determined that statistically significant increases of boron, calcium, chloride, fluoride, pH, sulfate, total and dissolved solids were present downgradient of Ash Ponds A and B. An evaluation of alternate sources was initiated and completed on April 13, 2018 as provided in § 257.94(e)(2). A source causing

the SSI over background levels other than the CCR unit was not identified at that time and an Assessment Monitoring program was initiated on July 16, 2018.

The Assessment Monitoring program has been established to meet the requirements of 40 CFR § 257.95. As required by § 257.93(h)(2), the statistical evaluation of the detected Appendix IV constituents determined a statistically significant exceedance of groundwater protection standards, specifically for arsenic and lithium at Ash Pond A, and arsenic, lithium, and molybdenum at Ash Pond B. Therefore, per §257.95(g)(3), an assessment of corrective measures and an evaluation of the nature and extent of contamination was initiated on April 15, 2019. The CMA report was created considering the presence and distribution of arsenic, lithium, and molybdenum, Ash Ponds A and B's configuration and operational history, hydrogeologic setting, and the results of the evaluation of the nature and extent of contamination available at the time of the CMA.

Based on the statistical evaluation for the 2020 data, no new SSLs were identified (Appendix A). For Ash Pond A, arsenic and lithium were identified as SSLs in monitoring wells WAP-9, WAP-17, WAP-18, and WAP-19 in both 2020 monitoring events. Molybdenum was identified as an SSL in monitoring well WAP-18 in February 2020 and in WAP-17 and WAP-18 in June 2020. For Ash Pond B, arsenic and lithium were identified as SSLs in monitoring well WAP-20 in both monitoring events. Molybdenum was identified as an SSL in monitoring well WAP-20 in February 2020 only.

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.

A remedy has not yet been selected pursuant to § 257.97, therefore remedial activities have not yet been initiated for this unit. Semi-annual progress reports detailing updates in completing remedy selection were completed in March and September 2020 for this unit. Actions completed in the interim between the public meeting and final remedy selection included: reclaiming CCR material from Ash Pond A for beneficial use and/or excavating for disposal in the on-site Class 3 Landfill, delineating the bottom of ash, and delineating the bottom of any contaminated in-situ soil via laboratory analysis of soil borings. The delineations of the bottom of ash and vertical extent of soil impacts will provide additional information relevant to the selection of remedy process.

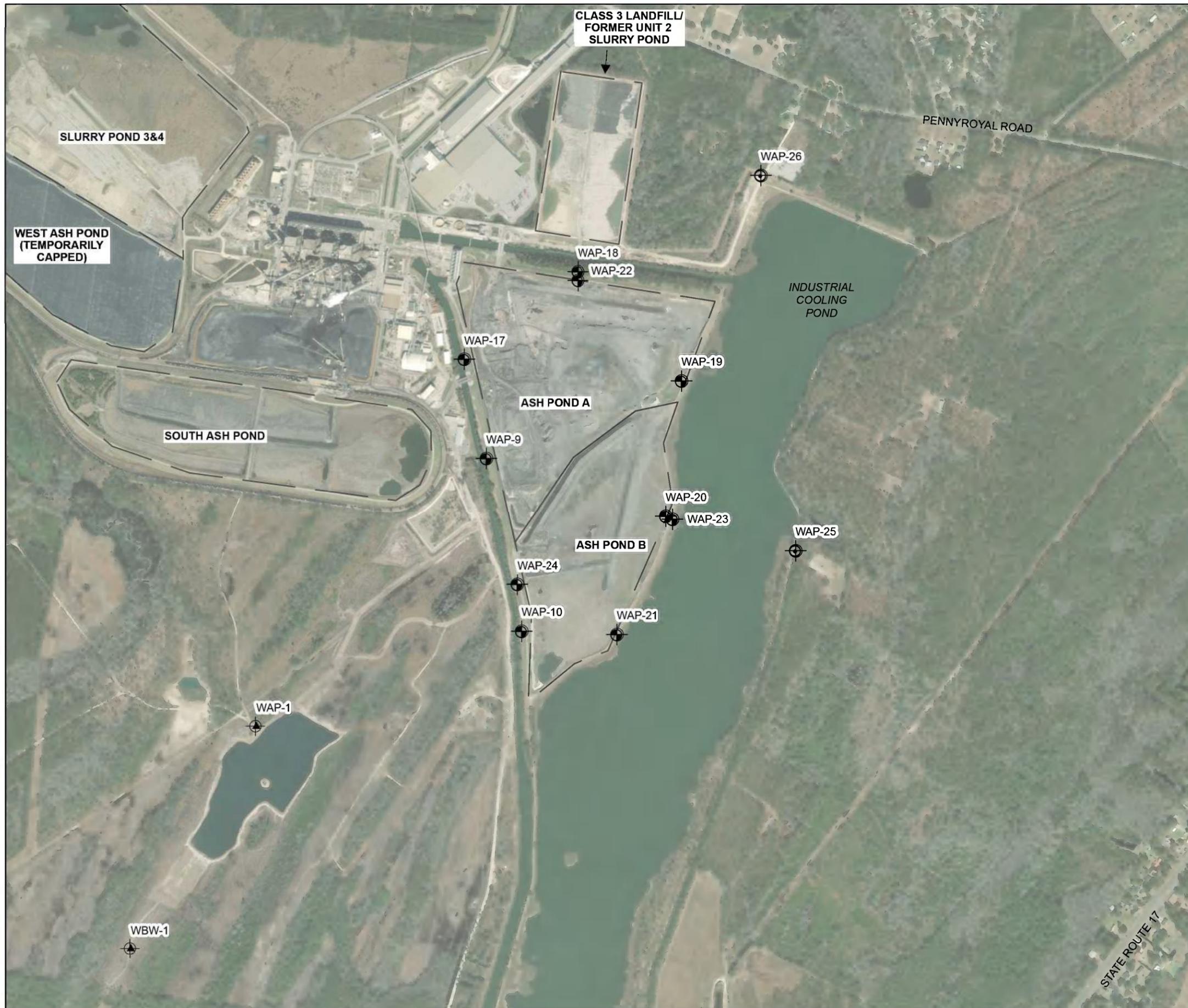
A planned activity for continuing the remedy selection process in 2021 includes updating the existing groundwater model. The groundwater model was prepared as part of the assessment of corrective measures process in 2019. The update to the model will include calibrating the model to existing conditions and providing a closer examination of the fate and transport of arsenic in groundwater. The path forward after the completion of the aforementioned activities will include selecting the final remedy, implementing the remedy, monitoring the progress, making any adjustments to the groundwater monitoring programs or remedy, if needed, and reporting the results.

TABLES

**TABLE 1 - Summary of Analytical Results
Winyah Generating Station Ash Ponds A and B Assessment Monitoring**

Well ID	Purpose	Date of Sample Event	Laboratory Sample ID Number	Appendix III Constituents										Appendix IV Constituents														Field Parameters									
				Boron	Calcium	Chloride	Fluoride	Sulfate	Total Dissolved Solids	pH	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	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		
				ug/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	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	Feet (btoc)	Feet (msl)	SU	uS	C	mv	NTU
				Method	EPA 6010D	EPA 6020B	EPA 300.0	EPA 300.0	EPA 300.0	SM 2540C		EPA 6020E	EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 6020B	EPA 300.0	EPA 6020B	EPA 5010D	EPA 7470	EPA 6010D	EPA 903.1 Mod	EPA 904.0	EPA 903.1 Mo	EPA 6020B	EPA 6020B	Feet (btoc)	Feet (msl)	SU	uS	C	mv <td>NTU</td> <td>ppm</td>	NTU	ppm	
				GWPS/US EPA NCL/BSL	—	—	—	4	—	—	—	6	10	2000	4	5	100	6	4	15	40	2	100	—	—	5	50	2	—	—	—	—	—	—	—	—	
Site Background Wells																																					
WAP-1	Background	2/3/2020	AE65493		33	2.9	9.02	<0.10	15	27.5	4.69	<5.0	<5.0	47.1	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	<10	<0.20	<10	0.952	<3.00	0.952	<10.0	<1.0	5.2	24.24	4.69	80.5	20.4	-175	6.21	0.41	
WAP-1	Background	6/2/2020	AE73494		26	2.4	8.63	<0.10	15.3	39.38	4.11	<5.0	<5.0	35.3	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	<10	<0.20	<10	0.774	0.519	1.29	<10.0	<1.0	5.01	24.43	4.11	81	22.39	115	0	0.79	
WAP-1	total samples				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WBW-1	Background	2/3/2020	AE65526		<15	<0.50	3.12	<0.10	5.34	<25	4.55	<5.0	<5.0	7.2	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	<10	<0.20	<10	0.291	1.15	1.45	<10.0	<1.0	5.37	26.6	4.55	35.6	18.4	431	6.29	0.47	
WBW-1	Background	6/1/2020	AE73527		<15	<0.50	4.34	<0.10	5.10	<25	3.97	<5.0	<5.0	12.9	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	<10	<0.20	<10	-0.0735	0.808	<MDL	<10.0	<1.0	4.95	27.02	3.97	42	25.9	219	0	0.76	
WBW-1	total samples				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Ash Pond A Wells																																					
WAP-9	Assessment	2/4/2020	AE65501			137	110	<0.10	127	711.2	5.91	<5.0		167	64.7	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	65	<0.20	11	1.47	0.38	1.85	<10.0	<1.0	9.13	18.91	5.91	1090	19.1	-216	9.21	0.41
WAP-9	Assessment	6/3/2020	AE73502		4800	148	95.6	<0.10	144	798.8	5.93	<5.0		282	68.8	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	72	<0.20	16	0.811	0.235	1.05	<10.0	<1.0	9.23	18.81	5.93	1170	25.01	-120	2.5	0.55
WAP-9	total samples				1	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WAP-17	Assessment	2/5/2020	AE65515		3500	220	115	0.22	574	1130	6.26	<5.0		98	31.7	<0.50	<0.50	<5.0	<0.50	0.22	<1.0	200	<0.20	49	0.161	0.268	0.43	<10.0	<1.0	8.32	20.95	6.26	1495	20.4	-133	6.83	0.44
WAP-17	Duplicate	2/5/2020	AE65516		3400	223	116	0.21	577	1126	6.26	<5.0		97.2	32.1	<0.50	<0.50	<5.0	<0.50	0.21	<1.0	190	<0.20	47	0.274	1.66	1.93	<10.0	<1.0	8.97	20.3	5.96	1510	24.19	32	0	0.74
WAP-17	Assessment	6/10/2020	AE73516		3600	209	76.8	0.18	535	1102	5.96	<5.0		95.6	34.6	<0.50	<0.50	<5.0	<0.50	0.18	<1.0	210	<0.20	350	0.533	0.00973	0.543	<10.0	<1.0	8.97	20.3	5.96	1510	24.19	32	0	0.74
WAP-17	Duplicate	6/10/2020	AE73517		3400	223	77.8	0.19	543	1091	5.96	<5.0		94.6	35.5	<0.50	<0.50	<5.0	<0.50	0.19	<1.0	210	<0.20	440	0.447	0.253	0.7	<10.0	<1.0	8.97	20.3	5.96	1510	24.19	32	0	0.74
WAP-17	total samples				4	4	4	4	4	4	4	2	2	4	4	2	2	2	4	4	2	4	2	4	4	4	4	2	2	2	2	2	2	2	2	2	
WAP-18	Assessment	2/4/2020	AE65517		5000	331	40.9	1.34	767	1372	6.41	<5.0		306	89	<0.50	<0.50	<5.0	0.68	1.34	<1.0	260	<0.20	300	0.296	3.17	3.46	<10.0	<1.0	23.78	19.27	6.41	1699	20.8	-135	6.58	0.4
WAP-18	Assessment	6/17/2020	AE73518		5100	275	19.6	1.48	579	1185	6.44	<5.0		330	69.5	<0.50	<0.50	<5.0	1.48	1.48	<1.0	240	<0.20	140	0.172	1.34	1.51	<10.0	<1.0	23.56	19.49	6.44	1450	21.17	-66	1.6	0.85
WAP-18	total samples				2	2	2	2	2	2	2	2	1	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WAP-19	Assessment	2/4/2020	AE65518		3600	288	116	0.58	622	1314	6.33	<5.0		256	36.1	<0.50	<0.50	<5.0	<0.50	0.58	<1.0	300	<0.20	47	0.236	1.5	1.74	<10.0	<1.0	21	22.39	6.33	1691	20	-63.1	9.18	0.39
WAP-19	Assessment	6/17/2020	AE73519		4100	306	73.3	0.17	690	1428	6.44	<5.0		104	39	<0.50	<0.50	<5.0	0.17	0.17	<1.0	260	<0.20	41	0.433	0.409	0.842	<10.0	<1.0	21.32	22.07	6.44	1880	19.95	6	4.5	0.94
WAP-19	total samples				2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WAP-22	CMA/NE	2/5/2020	AE65521								10.5		<5.0																24.35	19.02	10.5	1973	20.3	-51.6	9.38	3.17	
WAP-22	CMA/NE	6/17/2020	AE73522								6.66		<5.0																24.06	19.31	6.66	2150	21.54	-59	4.9	0.98	
WAP-22	total samples				0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2
Ash Pond B Wells																																					
WAP-10	Assessment	2/4/2020	AE65502			506	745	<0.10	689	2692	6.53	<5.0		269	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	19	<0.20	<10	1.94	1.72	3.66	<10.0	<1.0	4.47	21.64	6.53	3415	18.5	-74.5	8.37	0.63	
WAP-10	Duplicate	2/4/2020	AE65503			510	753	<0.10	695	2749	6.42	<5.0		275	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	20	<0.20	<10	1.77	0.255	2.02	<10.0	<1.0	4.67	21.44	6.42	3810	26.04	-62	1	0.6	
WAP-10	Assessment	6/10/2020	AE73503		8300	551	745	<0.10	683	2986	6.42	<5.0		5.5	281	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	23	<0.20	<10	2.64	0.731	3.37	<10.0	<1.0	4.67	21.44	6.42	3810	26.04	-62	1	0.6
WAP-10	Duplicate	6/10/2020	AE73504		8100	538	735	<0.10	681	3232	6.42	<5.0		6	292	<0.50	<0.50	<5.0	<0.50	<0.10	<1.0	22	<0.20	<10	4.65	1.19	5.84	<10.0	<1.0	4.67	21.44	6.42	3810	26.04	-62	1	0.6
WAP-10	total samples				2	4	4	4	4	4	4	2	2	4	4	2	4	4	4	4	4	4	2	4	4	4	4	4	2	2	2	2	2	2	2	2	2
WAP-20	Assessment	2/4/2020	AE65519		680	49.6	10.7	0.7	92.1	246.2	6.05	<5.0		44.6	24.4	<0.50	<0.50	<5.0	1.1	0.7	<1.0	230	<0.20	130	0.451	0.826	1.28	<10.0	<1.0	19.61	23.47	6.05	380	21.1	-41.2	9.42	0.5
WAP-20	Assessment	6/9/2020	AE73520		710	79	13	0.64	176	395	5.94	<5.0		45	35.6	<0.50	<0.50	<5.0	0.75	0.64	<1.0	320	<0.20	55	0.216	0.811	1.03	<10.0	<1.0	19.85	23.23	5.94	649	23.7	43	3.8	2.45
WAP-20	total samples				2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
WAP-21	Assessment	2/4/2020	AE65520		3200</																																

FIGURES

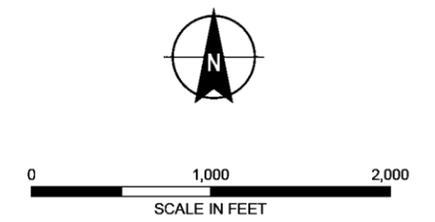


LEGEND

- BACKGROUND WELL
- PROPERTY BOUNDARY WELL
- MONITORING WELL
- CCR UNIT BOUNDARY
- PROPERTY BOUNDARY

NOTES

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



SANTEE COOPER
 WINYAH GENERATING STATION
 GEORGETOWN, SOUTH CAROLINA

**LOCATION OF ASH POND A & B
 GROUNDWATER MONITORING
 WELLS FOR CCR COMPLIANCE**

Appendix C – Statistical Analysis



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TECHNICAL MEMORANDUM

June 18, 2020
File No. 132892-013

SUBJECT: 2020 Semi-annual Groundwater Assessment Monitoring Data
Statistical Evaluation
Winyah Generating Station
Ash Pond A

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 Winyah Generating Station (WGS) Ash Pond A. The statistical evaluation discussed in this memorandum was conducted to determine if Appendix IV groundwater monitoring constituents have been detected in downgradient wells at concentrations that represent a statistically significant level (SSL) above background or upgradient wells consistent with the requirements in 40 CFR § 257.95.

Utilizing interwell evaluations, data from the semi-annual groundwater sampling events for the downgradient monitoring wells were compared to the Groundwater Protection Standard (GWPS) established from the background dataset for the upgradient monitoring well (WAP-1 and WBW-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, regional screening level, or background concentration. The Rule requires statistical evaluation of groundwater monitoring data to determine whether or not there is a statistically significant increase (SSI) above background values for each Appendix IV constituent and if one or more constituents are detected at SSLs above the GWPS. The results of the groundwater 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 background. Background levels 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 event from each compliance well was compared to the corresponding background UTL to determine if a SSL existed.

STATISTICAL EVALUATION

An interwell evaluation, which compares the most recent values from downgradient compliance wells against a background dataset composed of upgradient well data, was used. 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 methods were 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 normalized data 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 semi-annual sampling event was above the GWPS, the lower confidence limit (LCL) for the downgradient well constituent was used to evaluate if a SSL was present. The LCL is the lower end of the confident 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 (WAP-1 and WBW-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 semi-annual assessment monitoring event were compared to their respective background UTLs and GWPS (Table I). A sample concentration greater than the GWPS is considered to represent a SSL. Based on previous compliance sampling event and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. Based on this statistical evaluation SSLs above GWPS were identified at Ash Pond A (arsenic, lithium, and molybdenum) consistent with previous results.

Tables:

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

TABLES

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					
																				February 2020 Concentration	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)																									
WBW-1	0/11	100%	0.005-0.025	0.00682	0.005	0.015		0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA		0.025	0.025			
WAP-01	0/11	100%	0.005-0.025	0.00682	0.005	0.015		0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA						
WAP-09	0/11	100%	0.005-0.025	0.00682	0.005	0.015		0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA		0.005	N		N	FALSE
WAP-17	0/11	100%	0.005-0.025	0.00682	0.005	0.015		0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA		0.005	N		N	FALSE
WAP-18	0/11	100%	0.005-0.025	0.00682	0.005	0.015		0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA		0.005	N		N	FALSE
WAP-19	0/11	100%	0.005-0.025	0.00682	0.005	0.015		0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA		0.005	N		N	FALSE
CCR Appendix-IV: Arsenic, Total (mg/L)																									
WBW-1	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	0.010			
WAP-01	0/15	100%	0.003-0.005	0.00473	0.005	0.005		4.952E-07	0.0007037	0.1487	0.01	mg/L	N	0	0	NA	NA	NA	NA						
WAP-09	15/15	0%	-	0.245	0.229	0.4123	0.42	0.008738	0.09348	0.3817	0.01	mg/L	Y	15	0	No	No	Increasing	Normal		0.167	Y		Y	TRUE
WAP-17	13/13	0%	-	0.142	0.121	0.216	0.24	0.001848	0.04299	0.3034	0.01	mg/L	Y	13	0	No	No	Stable	Normal		0.098	Y		Y	TRUE
WAP-18	13/13	0%	-	0.594	0.306	1.404	1.53	0.2276	0.4771	0.8029	0.01	mg/L	Y	13	0	No	No	Stable	Normal		0.306	Y		Y	TRUE
WAP-19	13/13	0%	-	0.102	0.082	0.241	0.256	0.004869	0.06978	0.6813	0.01	mg/L	Y	13	0	No	No	Stable	Normal		0.256	Y		Y	TRUE
CCR Appendix-IV: Barium, Total (mg/L)																									
WBW-1	13/13	0%	-	0.0128	0.0147	0.0157	0.016	0.00009504	0.003083	0.24	2	mg/L	N	0	0	No	No	Stable	Non-parametric		0.094	2.0			
WAP-01	15/15	0%	-	0.0297	0.0232	0.0667	0.094	0.006045	0.02459	0.8271	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric						
WAP-09	16/16	0%	-	0.0772	0.07055	0.12	0.15	0.0005378	0.02319	0.3004	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric		0.065	Y		N	FALSE
WAP-17	14/14	0%	-	0.0549	0.05125	0.0807	0.1	0.000265	0.01628	0.2966	2	mg/L	N	0	0	No	No	Stable	Normal		0.032	Y		N	FALSE
WAP-18	13/13	0%	-	0.0925	0.092	0.1035	0.11	0.0006172	0.007856	0.08493	2	mg/L	N	0	0	No	No	Stable	Normal		0.089	Y		N	FALSE
WAP-19	13/13	0%	-	0.055	0.0535	0.08686	0.1	0.0003326	0.01824	0.3316	2	mg/L	N	0	0	No	No	Stable	Normal		0.036	Y		N	FALSE
CCR Appendix-IV: Beryllium, Total (mg/L)																									
WBW-1	0/11	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	0.004			
WAP-01	0/11	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						
WAP-09	0/11	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
WAP-17	0/11	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
WAP-18	0/11	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
WAP-19	0/11	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
CCR Appendix-IV: Cadmium, Total (mg/L)																									
WBW-1	0/12	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			
WAP-01	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						
WAP-09	0/14	100%	0.0005-0.002	0.000607	0.0005	0.001025		1.607E-07	0.0004009	0.6603	0.005	mg/L	N	0	0	NA	NA	NA	NA		0.0005	N		N	FALSE
WAP-17	0/11	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
WAP-18	0/11	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
WAP-19	0/11	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
CCR Appendix-IV: Chromium, Total (mg/L)																									
WBW-1	0/12	100%	0.005-0.005	0.005	0.005	0.005		1.478E-20	1.216E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA		0.005	0.1			
WAP-01	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						
WAP-09	0/14	100%	0.005-0.01	0.00536	0.005	0.00675		0.000001786	0.001336	0.2494	0.1	mg/L	N	0	0	NA	NA	NA	NA		0.005	N		N	FALSE
WAP-17	0/11	100%	0.005-0.005	0.005	0.005	0.005		1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA		0.005	N		N	FALSE
WAP-18	0/11	100%	0.005-0.005	0.005	0.005	0.005		1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA		0.005	N		N	FALSE
WAP-19	0/11	100%	0.005-0.005	0.005	0.005	0.005		1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA		0.005	N		N	FALSE
CCR Appendix-IV: Cobalt, Total (mg/L)																									
WBW-1	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA		0.0006	0.006			
WAP-01	1/13	92%	0.0005-0.0005	0.000507	0.0005	0.000536	0.00059	6.231E-10	0.00002496	0.04924	0.006	mg/L	N	0	0	NA	NA	NA	NA						
WAP-09	0/11	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA		0.0005	N		N	FALSE
WAP-17	0/11	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA		0.0005	N		N	FALSE
WAP-18	2/11	82%	0.0005-0.0005	0.00052	0.0005	0.00061	0.00068	2.96E-09	0.00005441	0.1046	0.006	mg/L	N	0	0	No	No	Increasing	Non-parametric		0.0007	Y		N	FALSE
WAP-19	0/11	100%	0.0005-0.0005	0.0005	0.0005	0.0005		0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA		0.0005	N		N	FALSE
CCR Appendix-IV: Fluoride (mg/L)																									
WBW-1	1/14	93%	0.1-0.1	0.1	0.1	0.1	0.1	2.135E-18	1.461E-09	1.461E-08	4	mg/L	N	0	0	No	No	NA	Non-parametric		0.140	4.0			
WAP-01	2/14	86%	0.1-0.1	0.105	0.1	0.1335	0.14	0.0001654	0.01286	0.1225	4	mg/L	N	0	0	No	No	NA	Non-parametric						
WAP-09	1/14	93%	0.1-0.1	0.101	0.1	0.1035	0.11	0.00007143	0.002673	0.02654	4	mg/L	N	0	0	No	No	NA	Non-parametric		0.100	N		N	FALSE
WAP-17	10/14	29%	0.1-0.1	0.149	0.14	0.237	0.25	0.002807	0.05298	0.3549	4	mg/L	N	0	0	No	No	Stable	Non-parametric		0.220	Y		N	FALSE
WAP-18	13/14	7%	0.1-0.1	1.11	1.13	1.922	2	0.3307	0.575	0.5194	4	mg/L	N	0	0	No	No	Increasing	Non-parametric		1.340	Y		N	FALSE
WAP-19	10/14	29%	0.1-0.1	0.216	0.175	0.437	0.58	0.02039	0.1428	0.6598	4	mg/L	N	0	0	No	No	Stable	Non-parametric		0.580	Y		N	FALSE
CCR Appendix-IV: Lead, Total (mg/L)																									
WBW-1	0/12	100%	0.001-0.01	0.002	0.001	0.005875		0.00006682	0.002585	1.292	0.015	mg/L	N	0	0	NA	NA	NA	Non-parametric		0.010	0.015			
WAP-01	4/14	71%	0.001-0.01	0.0022	0.001145	0.006464	0.00456	0.00006043	0.002458	1.116	0.015	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric						

CCR Appendix-IV: Mercury, Total (mg/L)																					
WBW-1	0/11	100%	0.0002-0.0002	0.0002	0.0002	0.0002	0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.0002	0.002	
WAP-01	0/11	100%	0.0002-0.0002	0.0002	0.0002	0.0002	0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA			
WAP-09	0/11	100%	0.0002-0.0002	0.0002	0.0002	0.0002	0	0	0	0.002	mg/L	N	0	0	No	No	Stable	Normal	0.00020	N	N
WAP-17	0/11	100%	0.0002-0.00024	0.000204	0.0002	0.00022	1.455E-10	0.00001206	0.05923	0.002	mg/L	N	0	0	No	No	Stable	Normal	0.00020	N	N
WAP-18	0/10	100%	0.0002-0.0002	0.0002	0.0002	0.0002	0	0	0	0.002	mg/L	N	0	0	Yes	No	Increasing	Non-parametric	0.00020	N	N
WAP-19	0/10	100%	0.0002-0.0002	0.0002	0.0002	0.0002	0	0	0	0.002	mg/L	N	0	0	No	No	Increasing	Normal	0.00020	N	N
CCR Appendix-IV: Molybdenum, Total (mg/L)																					
WBW-1	0/13	100%	0.01-0.05	0.0131	0.01	0.026	0.0001231	0.01109	0.8484	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.050	0.1	
WAP-01	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			
WAP-09	8/13	38%	0.01-0.01	0.0168	0.011	0.03148	0.034	0.00007351	0.008574	0.5103	0.1	mg/L	N	0	0	No	No	Stable	Normal	0.011	Y
WAP-17	12/12	0%	-	0.0496	0.047	0.0668	0.069	0.00009582	0.009789	0.1974	0.1	mg/L	N	0	0	No	No	Stable	Normal	0.049	Y
WAP-18	12/12	0%	-	0.26	0.0995	0.9755	1.3	0.1486	0.3855	1.48	0.1	mg/L	Y	6	0	Yes	No	Increasing	Non-parametric	0.300	Y
WAP-19	11/12	8%	0.05-0.05	0.0398	0.04255	0.0559	0.057	0.0001948	0.01396	0.3504	0.1	mg/L	N	0	0	No	No	Increasing	Normal	0.047	Y
CCR Appendix-IV: Radium-226 & 228 (pCi/L)																					
WBW-1	7/13	46%	4-4	3.41	4	4.306	4.33	1.724	1.313	0.3848	5	pCi/L	N	0	0	No	No	NA	Non-parametric	5.97	5.97
WAP-01	8/13	38%	4-4	3.72	4	5.832	5.97	2.316	1.522	0.4089	5	pCi/L	Y	2	0	No	No	Stable	Non-parametric		
WAP-09	10/13	23%	4-4	3.79	4.1	5.136	5.34	1.444	1.202	0.3173	5	pCi/L	Y	1	0	No	No	Stable	Non-parametric	1.850	Y
WAP-17	6/13	54%	4-4	3.41	4	4.838	5.51	2.429	1.558	0.4565	5	pCi/L	Y	1	0	Yes	No	NA	Non-parametric	0.430	Y
WAP-18	6/13	54%	4-4	3.59	4	4.322	4.46	1.157	1.076	0.3001	5	pCi/L	N	0	0	Yes	No	NA	Non-parametric	3.460	Y
WAP-19	4/13	69%	4-4	3.52	4	4.1	4.25	0.9349	0.9669	0.2746	5	pCi/L	N	0	0	No	No	NA	Non-parametric	1.740	Y
CCR Appendix-IV: Selenium, Total (mg/L)																					
WBW-1	0/12	100%	0.01-0.02	0.0117	0.01	0.02	0.00001515	0.003892	0.3336	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.020	0.05	
WAP-01	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			
WAP-09	0/15	100%	0.005-0.05	0.0137	0.01	0.029	0.000116	0.01077	0.7879	0.05	mg/L	N	0	1	NA	NA	NA	NA	0.010	N	N
WAP-17	0/11	100%	0.01-0.02	0.0118	0.01	0.02	0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N	N
WAP-18	0/11	100%	0.01-0.02	0.0118	0.01	0.02	0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N	N
WAP-19	0/11	100%	0.01-0.02	0.0118	0.01	0.02	0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N	N
CCR Appendix-IV: Thallium, Total (mg/L)																					
WBW-1	0/11	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	
WAP-01	0/11	100%	0.0001-0.001	0.000918	0.001	0.001	7.364E-08	0.0002714	0.2955	0.002	mg/L	N	0	0	NA	NA	NA	NA			
WAP-09	0/11	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	N
WAP-17	0/11	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	N
WAP-18	0/11	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	N
WAP-19	0/11	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	N



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TECHNICAL MEMORANDUM

June 18, 2020
File No. 132892-013

SUBJECT: 2020 Semi-annual Groundwater Assessment Monitoring Data
Statistical Evaluation
Winyah Generating Station
Ash Pond B

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 Winyah Generating Station (WGS) Ash Pond B. The statistical evaluation discussed in this memorandum was conducted to determine if Appendix IV groundwater monitoring constituents have been detected in downgradient wells at concentrations that represent a statistically significant level (SSL) above background or upgradient wells consistent with the requirements in 40 CFR § 257.95.

Utilizing interwell evaluations, data from the groundwater sampling events for the downgradient monitoring wells were compared to the Groundwater Protection Standard (GWPS) established from the background dataset for the upgradient monitoring well (WAP-1 and WBW-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, regional screening level, or background concentration. The Rule requires statistical evaluation of groundwater monitoring data to determine whether or not there is a statistically significant increase (SSI) above background values for each Appendix IV constituent and if one or more constituents are detected at SSLs above the GWPS. The results of the groundwater 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 background. Background levels 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 event from each compliance well was compared to the corresponding background UTL to determine if a SSL existed.

STATISTICAL EVALUATION

An interwell evaluation, which compares the most recent values from downgradient compliance wells against a background dataset composed of upgradient well data, was used. 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 methods were 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 normalized data 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 present. The LCL is the lower end of the confident 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 (WAP-1 and WBW-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 semi-annual assessment monitoring event were compared to their respective background UTLs and GWPS (Table I). A sample concentration greater than the GWPS is considered to represent a SSL. Based on previous compliance sampling event and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. Based on this statistical evaluation SSLs above GWPS were identified at Ash Pond B (arsenic, lithium, and molybdenum) consistent with previous results.

Tables:

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

TABLES

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		Exceedance above Background at Individual Well	SSL
																				February 2020 Concentration	Detect?		
CCR Appendix-IV: Antimony, Total (mg/L)																							
WBW-1	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	0.025	0.025	N	FALSE
WAP-01	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	0.005	N	N	FALSE
WAP-10	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	0.005	N	N	FALSE
WAP-20	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	0.005	N	N	FALSE
WAP-21	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	0.005	N	N	FALSE
CCR Appendix-IV: Arsenic, Total (mg/L)																							
WBW-1	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	NA	0.005	0.010	N	FALSE
WAP-01	0/15	100%	0.003-0.005	0.00473	0.005	0.005	4.952E-07	0.0007037	0.1487	0.01	mg/L	N	0	0	NA	NA	NA	NA	NA	0.005	0.010	N	FALSE
WAP-10	9/15	40%	0.005-0.005	0.0328	0.0622	0.14	0.002171	0.04659	1.42	0.01	mg/L	Y	7	0	Yes	No	Stable	Non-parametric	0.005	N	N	FALSE	
WAP-20	13/13	0%	-	0.0808	0.071	0.1292	0.00111	0.03332	0.4123	0.01	mg/L	Y	13	0	No	No	Stable	Normal	0.045	Y	Y	TRUE	
WAP-21	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	NA	0.005	0.010	N	FALSE
CCR Appendix-IV: Barium, Total (mg/L)																							
WBW-1	13/13	0%	-	0.0128	0.0147	0.0157	0.016	0.00009504	0.003083	0.24	2	mg/L	N	0	0	No	No	Stable	Non-parametric	0.094	2.000	N	FALSE
WAP-01	15/15	0%	-	0.0297	0.0232	0.0667	0.094	0.0006045	0.02459	0.8271	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.094	2.000	N	FALSE
WAP-10	15/15	0%	-	0.275	0.26	0.3498	0.396	0.001635	0.04043	0.1469	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.269	Y	N	FALSE
WAP-20	13/13	0%	-	0.0479	0.044	0.07864	0.088	0.0003842	0.0196	0.4089	2	mg/L	N	0	0	No	No	Increasing	Normal	0.024	Y	N	FALSE
WAP-21	13/13	0%	-	0.067	0.062	0.126	0.15	0.001002	0.03165	0.4723	2	mg/L	N	0	0	No	No	Decreasing	Non-parametric	0.033	Y	N	FALSE
CCR Appendix-IV: Beryllium, Total (mg/L)																							
WBW-1	0/11	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	0.001	0.004	N	FALSE	
WAP-01	0/11	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	0.001	0.004	N	FALSE	
WAP-10	0/11	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	
WAP-20	0/11	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	
WAP-21	0/11	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	
CCR Appendix-IV: Cadmium, Total (mg/L)																							
WBW-1	0/12	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	N	FALSE	
WAP-01	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	N	FALSE	
WAP-10	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	N	FALSE	
WAP-20	0/11	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	N	FALSE	
WAP-21	0/11	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	N	FALSE	
CCR Appendix-IV: Chromium, Total (mg/L)																							
WBW-1	0/12	100%	0.005-0.005	0.005	0.005	0.005	1.478E-20	1.216E-10	2.432E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.0050	0.100	N	FALSE	
WAP-01	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	0.100	N	FALSE	
WAP-10	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	0.100	N	FALSE	
WAP-20	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	0.100	N	FALSE	
WAP-21	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.005	0.100	N	FALSE	
CCR Appendix-IV: Cobalt, Total (mg/L)																							
WBW-1	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	0.0005	0.006	N	FALSE	
WAP-01	1/13	92%	0.0005-0.0005	0.000507	0.0005	0.000536	0.00059	6.231E-10	0.0002496	0.04924	0.006	mg/L	N	0	0	NA	NA	NA	0.0005	0.006	N	FALSE	
WAP-10	0/13	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	0.0005	0.006	N	FALSE	
WAP-20	12/13	8%	0.001-0.001	0.00107	0.001	0.00156	0.0018	9.485E-08	0.000308	0.2872	0.006	mg/L	N	0	0	No	No	Stable	Normal	0.011	Y	N	FALSE
WAP-21	1/13	92%	0.0005-0.01	0.00125	0.0005	0.004474	0.00079	0.00006913	0.002629	2.098	0.006	mg/L	N	0	1	NA	NA	NA	NA	0.0005	0.006	N	FALSE
CCR Appendix-IV: Fluoride (mg/L)																							
WBW-1	1/14	93%	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	No	No	NA	Non-parametric	0.140	4.00	N	FALSE	
WAP-01	2/14	86%	0.1-0.1	0.105	0.1	0.1335	0.14	0.0001654	0.01286	0.1225	4	mg/L	N	0	0	No	No	NA	Non-parametric	0.140	4.00	N	FALSE
WAP-10	2/14	86%	0.1-0.1	0.105	0.1	0.1305	0.15	0.0001962	0.01401	0.1334	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.100	N	N	FALSE
WAP-20	14/14	0%	-	0.574	0.575	0.751	0.79	0.01889	0.1374	0.2396	4	mg/L	N	0	0	No	No	Stable	Normal	0.700	Y	N	FALSE
WAP-21	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	NA	0.100	4.00	N	FALSE	
CCR Appendix-IV: Lead, Total (mg/L)																							
WBW-1	0/12	100%	0.001-0.01	0.002	0.001	0.005875	0.00006682	0.002585	1.292	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.0100	0.015	N	FALSE	
WAP-01	4/14	71%	0.001-0.01	0.0022	0.001145	0.006464	0.00456	0.00006043	0.002458	1.116	0.015	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric	0.0100	0.015	N	FALSE
WAP-10	0/14	100%	0.001-0.01	0.00186	0.001	0.005125	0.00005786	0.002405	1.295	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N	N	FALSE	
WAP-20	0/11	100%	0.001-0.0025	0.00127	0.001	0.0025	3.682E-07	0.0006068	0.4768	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N	N	FALSE	
WAP-21	0/11	100%	0.001-0.0025	0.00127	0.001	0.0025	3.682E-07	0.0006068	0.4768	0.015	mg/L	N	0	0	NA	NA	NA	NA	0.001	N	N	FALSE	
CCR Appendix-IV: Lithium, Total (mg/L)																							
WBW-1	0/13	100%	0.01-0.01	0.01	0.01	0.01	7.228E-20	2.688E-10	2.688E-08	0.04	mg/L	N	0	0	NA	NA	NA	NA	0.012	0.040	N	FALSE	
WAP-01	1/13	92%	0.01-0.01	0.0101	0.01	0.01064	0.0116	1.969E-07	0.0004438	0.04384	0.04	mg/L	N	0	0	No	No	Stable	Non-parametric	0.012	0.040	N	FALSE
WAP-10	13/13	0%	-	0.0263	0.023	0.0385	0.0466	0.00005709	0.007556	0.2873	0.04	mg/L	Y	1	0	Yes	No	Stable	Non-parametric	0.019	Y	N	FALSE
WAP-20	13/13	0%	-	0.257	0.24	0.3724	0.406	0.004537	0.06736	0.2617	0.04	mg/L	Y	13	0	No	No	Stable	Normal	0.230	Y	Y	TRUE
WAP-21	0/13	100%	0.01-0.01	0.01	0.01	0.01	7.228E-20	2.688E-10	2.688E-08	0.04	mg/L	N	0	0	NA	NA	NA	NA	0.010	0.040	N	FALSE	
CCR Appendix-IV: Mercury, Total (mg/L)																							
WBW-1	0/11	100%	0.0002-0.0002	0.0002	0.0002	0.0002	0	0	0	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.0002				

CCR Appendix-IV: Molybdenum, Total (mg/L)																							
WBW-1	0/13	100%	0.01-0.05	0.0131	0.01	0.026		0.0001231	0.01109	0.8484	0.1	mg/L	N	0	0	NA	NA	NA					
WAP-01	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		0.050	0.10	
WAP-10	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	N	N	FALSE
WAP-20	13/13	0%	-	0.164	0.136	0.3388	0.397	0.01094	0.1046	0.6397	0.1	mg/L	Y	9	0	ND	No	Stable	Normal	0.130	Y	Y	TRUE
WAP-21	0/13	100%	0.01-0.05	0.0131	0.01	0.026		0.0001231	0.01109	0.8484	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.010	N	N	FALSE
CCR Appendix-IV: Radium-226 & 228 (pCi/L)																							
WBW-1	7/13	46%	4-4	3.41	4	4.306	4.33	1.724	1.313	0.3848	5	pCi/L	N	0	0	No	No	NA					
WAP-01	8/13	38%	4-4	3.72	4	5.832	5.97	2.316	1.522	0.4089	5	pCi/L	Y	2	0	Yes	No	Stable	Non-parametric		5.97	6.0	
WAP-10	13/13	0%	-	5.37	5.63	6.784	6.91	1.598	1.264	0.2356	5	pCi/L	Y	9	0	No	No	Stable	Normal	3.660	Y	N	FALSE
WAP-20	6/13	54%	4-4	3.49	4	4.356	4.38	1.363	1.168	0.3347	5	pCi/L	N	0	0	No	No	Stable	Non-parametric	1.280	Y	N	FALSE
WAP-21	9/13	31%	4-4	3.69	4	5.292	5.67	2.674	1.635	0.4434	5	pCi/L	Y	2	0	No	No	Stable	Normal	0.941	Y	N	FALSE
CCR Appendix-IV: Selenium, Total (mg/L)																							
WBW-1	0/12	100%	0.01-0.02	0.0117	0.01	0.02		0.00001515	0.003892	0.3336	0.05	mg/L	N	0	0	NA	NA	NA					
WAP-01	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	
WAP-10	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
WAP-20	0/11	100%	0.01-0.02	0.0118	0.01	0.02		0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N	N	FALSE
WAP-21	0/11	100%	0.01-0.02	0.0118	0.01	0.02		0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N	N	FALSE
CCR Appendix-IV: Thallium, Total (mg/L)																							
WBW-1	0/11	100%	0.001-0.001	0.001	0.001	0.001		0	0	0	0.002	mg/L	N	0	0	NA	NA	NA					
WAP-01	0/11	100%	0.001-0.001	0.000918	0.001	0.001		7.364E-08	0.0002714	0.2955	0.002	mg/L	N	0	0	NA	NA	NA	NA		0.001	0.002	
WAP-10	0/11	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	N	FALSE
WAP-20	1/11	91%	0.001-0.001	0.00105	0.001	0.0013	0.0016	3.273E-08	0.0001809	0.1715	0.002	mg/L	N	0	0	No	NA	NA	Non-parametric	0.001	N	N	FALSE
WAP-21	0/11	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	N	FALSE



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TECHNICAL MEMORANDUM

October 21, 2020
File No. 132892-013

SUBJECT: 2020 Semi-annual Groundwater Assessment Monitoring Data
Statistical Evaluation
Winyah Generating Station
Ash Pond A

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 Winyah Generating Station (WGS) Ash Pond A. The statistical evaluation discussed in this memorandum was conducted to determine if Appendix IV groundwater monitoring constituents have been detected in downgradient wells at concentrations that represent a statistically significant level (SSL) above background or upgradient wells consistent with the requirements in 40 CFR § 257.95.

Utilizing interwell evaluations, data from the semi-annual groundwater sampling events for the downgradient monitoring wells were compared to the Groundwater Protection Standard (GWPS) established from the background dataset for the upgradient monitoring well (WAP-1 and WBW-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, regional screening level, or background concentration. The Rule requires statistical evaluation of groundwater monitoring data to determine whether or not there is a statistically significant increase (SSI) above background values for each Appendix IV constituent and if one or more constituents are detected at SSLs above the GWPS. The results of the groundwater 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 background. Background levels 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 event from each compliance well was compared to the corresponding background UTL to determine if a SSL existed.

STATISTICAL EVALUATION

An interwell evaluation, which compares the most recent values from downgradient compliance wells against a background dataset composed of upgradient well data, was used. 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 methods were 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 normalized data 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 semi-annual sampling event was above the GWPS, the lower confidence limit (LCL) for the downgradient well constituent was used to evaluate if a SSL was present. The LCL is the lower end of the confident 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 (WAP-1 and WBW-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 semi-annual assessment monitoring event were compared to their respective background UTLs and GWPS (Table I). A sample concentration greater than the GWPS is considered to represent a SSL. Based on previous compliance sampling event and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. Consistent with previous results, the assessment of corrective measures, the preferred remedy presented to the public in December 2019, arsenic, lithium, and molybdenum continue to be the only Appendix IV constituents present in groundwater at SSLs above GWPS.

Tables:

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

TABLES

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 Concentration	Detect?	Upper Tolerance Limit (mg/L)	GWPS (Higher of MCL/RSL or Background Limit)(mg/L)	Exceedance above Background at Individual Well
CCR Appendix-IV: Antimony, Total (mg/L)																								
WBW-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	NA	0.025	0.025			
WAP-01	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	NA					
WAP-09	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	
WAP-17	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	
WAP-18	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	
WAP-19	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	
CCR Appendix-IV: Arsenic, Total (mg/L)																								
WBW-1	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	NA	0.005	0.010			
WAP-01	0/16	100%	0.003-0.005	0.00475	0.005	0.005	4.667E-07	0.0006831	0.1438	0.01	mg/L	N	0	0	NA	NA	NA	NA	NA					
WAP-09	16/16	0%	-	0.247	0.234	0.4117	0.42	0.008242	0.09078	0.3672	0.01	mg/L	Y	16	0	No	No	Increasing	Normal	0.282	Y		Y	
WAP-17	14/14	0%	-	0.138	0.121	0.214	0.24	0.001858	0.0431	0.3114	0.01	mg/L	Y	14	0	No	No	Stable	Normal	0.096	Y		Y	
WAP-18	14/14	0%	-	0.575	0.318	1.393	1.53	0.2151	0.4638	0.8061	0.01	mg/L	Y	14	0	No	No	Stable	Normal	0.330	Y		Y	
WAP-19	14/14	0%	-	0.103	0.0899	0.2397	0.256	0.004495	0.06704	0.6539	0.01	mg/L	Y	14	0	No	No	Stable	Normal	0.104	Y		Y	
CCR Appendix-IV: Barium, Total (mg/L)																								
WBW-1	14/14	0%	-	0.0129	0.01385	0.01568	0.016	0.00008773	0.002962	0.2305	2	mg/L	N	0	0	No	No	Stable	Non-parametric	0.094	2.0			
WAP-01	16/16	0%	-	0.0301	0.0241	0.06475	0.094	0.0005661	0.02379	0.7911	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric					
WAP-09	17/17	0%	-	0.0767	0.0697	0.118	0.15	0.0005084	0.02255	0.2939	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.069	Y			
WAP-17	15/15	0%	-	0.0535	0.0505	0.07921	0.1	0.0002735	0.01654	0.3089	2	mg/L	N	0	0	No	No	Stable	Normal	0.035	Y		FALSE	
WAP-18	14/14	0%	-	0.0909	0.09155	0.103	0.11	0.00009479	0.009736	0.1071	2	mg/L	N	0	0	No	No	Stable	Normal	0.070	Y		FALSE	
WAP-19	14/14	0%	-	0.0539	0.05225	0.08576	0.1	0.0003253	0.01804	0.3349	2	mg/L	N	0	0	No	No	Stable	Normal	0.039	Y		FALSE	
CCR Appendix-IV: Beryllium, Total (mg/L)																								
WBW-1	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	NA	0.0005	0.004			
WAP-01	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	NA					
WAP-09	0/11	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	NA	NS	N		Y	
WAP-17	0/11	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	NA	NS	N		Y	
WAP-18	0/11	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	NA	NS	N		Y	
WAP-19	0/11	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	NA	NS	N		Y	
CCR Appendix-IV: Cadmium, Total (mg/L)																								
WBW-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	NA	0.0005	0.0			
WAP-01	0/15	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	NA					
WAP-09	0/15	100%	0.0005-0.002	0.0006	0.0005	0.00095	0.00000015	0.0003873	0.6455	0.005	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
WAP-17	0/11	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	NA	NS	N		Y	
WAP-18	0/11	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	NA	NS	N		Y	
WAP-19	0/11	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	NA	NS	N		Y	
CCR Appendix-IV: Chromium, Total (mg/L)																								
WBW-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	NA	NA	0.005	0.1			
WAP-01	0/15	100%	0.005-0.005	0.005	0.005	0.005	7.744E-21	8.8E-11	1.76E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA					
WAP-09	0/15	100%	0.005-0.01	0.00533	0.005	0.0065	0.000001667	0.001291	0.2421	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
WAP-17	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
WAP-18	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
WAP-19	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
CCR Appendix-IV: Cobalt, Total (mg/L)																								
WBW-1	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	NA	0.0006	0.006			
WAP-01	1/14	93%	0.0005-0.0005	0.000506	0.0005	0.0005315	0.00059	5.786E-10	0.00002405	0.0475	0.006	mg/L	N	0	0	NA	NA	NA	NA					
WAP-09	0/12	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	NA	0.0005	N		FALSE	
WAP-17	0/12	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	NA	0.0005	N		FALSE	
WAP-18	2/12	83%	0.0005-0.0005	0.000518	0.0005	0.000603	0.00068	2.724E-09	0.00005219	0.1007	0.006	mg/L	N	0	0	No	No	Increasing	Non-parametric	0.0005	N		FALSE	
WAP-19	0/12	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	NA	0.0005	N		FALSE	
CCR Appendix-IV: Fluoride (mg/L)																								
WBW-1	1/15	93%	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	No	No	NA	Non-parametric		0.140	4.0			
WAP-01	2/15	87%	0.1-0.1	0.105	0.1	0.133	0.14	0.0001552	0.01246	0.119	4	mg/L	N	0	0	No	No	NA	Non-parametric					
WAP-09	1/15	93%	0.1-0.1	0.101	0.1	0.103	0.11	0.00006667	0.002582	0.02565	4	mg/L	N	0	0	No	No	NA	Non-parametric	0.100	N		FALSE	
WAP-17	11/15	27%	0.1-0.1	0.151	0.14	0.236	0.25	0.00267	0.05167	0.3414	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.180	Y		FALSE	
WAP-18	14/15	7%	0.1-0.1	1.13	1.2	1.916	2	0.3163	0.5624	0.4968	4	mg/L	N	0	0	No	No	Increasing	Non-parametric	1.480	Y		FALSE	
WAP-19	11/15	27%	0.1-0.1	0.213	0.17	0.426	0.58	0.01908	0.1381	0.6475	4	mg/L	N	0	0	No	No	Stable	Non-parametric	0.170	Y		FALSE	
CCR Appendix-IV: Lead, Total (mg/L)																								
WBW-1	0/13	100%	0.001-0.01	0.00192	0.001	0.0055	0.000006202	0.00249	1.295	0.015	mg/L	N	0	0	NA	NA	NA	Non-parametric		0.010	0.015			
WAP-01	4/15	73%	0.001-0.01	0.00212	0.001	0.006192	0.00456	0.000005708	0.002389	1.125	0.015	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric					
WAP-09	0/15	100%	0.001-0.0025	0.00127	0.001	0.0025	3.167E-07	0.0005627	0.4443	0.015	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
WAP-17	0/11	100%	0.001-0.0025	0.00127	0.001	0.0025	3.682E-07	0.0006068	0.4768	0.015	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N		Y	
WAP-18	0/11	100%	0.001-0.0025	0.00127																				

CCR Appendix-IV: Selenium, Total (mg/L)																							
WBW-1	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	0.020	0.05			
WAP-01	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					
WAP-09	0/16	100%	0.005-0.05	0.0134	0.01	0.0275	0.0001091	0.01044	0.7772	0.05	mg/L	N	0	1	NA	NA	NA	NA	0.010	N		N	FALSE
WAP-17	0/11	100%	0.01-0.02	0.0118	0.01	0.02	0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N		N	FALSE
WAP-18	0/11	100%	0.01-0.02	0.0118	0.01	0.02	0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N		N	FALSE
WAP-19	0/11	100%	0.01-0.02	0.0118	0.01	0.02	0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N		N	FALSE
CCR Appendix-IV: Thallium, Total (mg/L)																							
WBW-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			
WAP-01	0/12	100%	0.0001-0.001	0.000925	0.001	0.001	6.75E-08	0.0002598	0.2809	0.002	mg/L	N	0	0	NA	NA	NA	NA					
WAP-09	0/11	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		Y	FALSE
WAP-17	0/11	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		Y	FALSE
WAP-18	0/11	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		Y	FALSE
WAP-19	0/11	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		Y	FALSE

Notes: NS = Not sampled



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TECHNICAL MEMORANDUM

October 21, 2020
File No. 132892-013

SUBJECT: 2020 Semi-annual Groundwater Assessment Monitoring Data
Statistical Evaluation
Winyah Generating Station
Ash Pond B

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 Winyah Generating Station (WGS) Ash Pond B. The statistical evaluation discussed in this memorandum was conducted to determine if Appendix IV groundwater monitoring constituents have been detected in downgradient wells at concentrations that represent a statistically significant level (SSL) above background or upgradient wells consistent with the requirements in 40 CFR § 257.95.

Utilizing interwell evaluations, data from the groundwater sampling events for the downgradient monitoring wells were compared to the Groundwater Protection Standard (GWPS) established from the background dataset for the upgradient monitoring well (WAP-1 and WBW-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, regional screening level, or background concentration. The Rule requires statistical evaluation of groundwater monitoring data to determine whether or not there is a statistically significant increase (SSI) above background values for each Appendix IV constituent and if one or more constituents are detected at SSLs above the GWPS. The results of the groundwater 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 background. Background levels 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 event from each compliance well was compared to the corresponding background UTL to determine if a SSL existed.

STATISTICAL EVALUATION

An interwell evaluation, which compares the most recent values from downgradient compliance wells against a background dataset composed of upgradient well data, was used. 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 methods were 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 normalized data 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 present. The LCL is the lower end of the confident 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 (WAP-1 and WBW-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 semi-annual assessment monitoring event were compared to their respective background UTLs and GWPS (Table I). A sample concentration greater than the GWPS is considered to represent a SSL. Based on previous compliance sampling event and statistical evaluations, interwell comparisons were utilized for all downgradient wells and constituents. Consistent with previous results, the assessment of corrective measures, the preferred remedy presented to the public in December 2019, arsenic and lithium continue to be the only Appendix IV constituents present in groundwater at SSLs above GWPS. Molybdenum was detected downgradient at a SSL in February 2020 but was not detected at a SSL in June 2020. Molybdenum will continue to be monitored in future semiannual sampling events.

Tables:

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

TABLES

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		Exceedance above Background at Individual Well	SSL		
																				June 2020 Concentration	Detected?			Upper Tolerance Limit (mg/L)	GWPS (Higher of MCL/RSL or Background Limit) (mg/L)
CCR Appendix-IV: Antimony, Total (mg/L)																									
WBW-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	NA						
WAP-01	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	NA		0.025	0.025			
WAP-10	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	FALSE	
WAP-20	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	FALSE	
WAP-21	0/11	100%	0.005-0.025	0.00682	0.005	0.015	0.00003636	0.00603	0.8844	0.006	mg/L	N	0	1	NA	NA	NA	NA	NA	NS	N		Y	FALSE	
CCR Appendix-IV: Arsenic, Total (mg/L)																									
WBW-1	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	NA		0.005	0.010			
WAP-01	0/16	100%	0.003-0.005	0.00475	0.005	0.005	4.667E-07	0.0006831	0.1438	0.01	mg/L	N	0	0	NA	NA	NA	NA	NA						
WAP-10	10/16	38%	0.005-0.005	0.0311	0.00606	0.14	0.002072	0.04552	1.464	0.01	mg/L	Y	7	0	Yes	No	Stable	Non-parametric	0.006	Y			N	FALSE	
WAP-20	14/14	0%	-	0.0783	0.06865	0.128	0.001117	0.03342	0.427	0.01	mg/L	Y	14	0	No	No	Stable	Normal	0.045	Y			Y	TRUE	
WAP-21	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)																									
WBW-1	14/14	0%	-	0.0129	0.01385	0.01568	0.016	0.00008773	0.002962	0.2305	2	mg/L	N	0	0	No	No	Stable	Non-parametric		0.094	2.000			
WAP-01	16/16	0%	-	0.0301	0.0241	0.06475	0.094	0.0005861	0.02379	0.7911	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric					N	FALSE
WAP-10	16/16	0%	-	0.276	0.2645	0.3465	0.396	0.001528	0.03909	0.1418	2	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.281	Y			N	FALSE
WAP-20	14/14	0%	-	0.0471	0.04145	0.07786	0.088	0.0003655	0.01912	0.4063	2	mg/L	N	0	0	No	No	Increasing	Normal	0.036	Y			N	FALSE
WAP-21	14/14	0%	-	0.0644	0.0606	0.124	0.15	0.001022	0.03197	0.4966	2	mg/L	N	0	0	No	No	Decreasing	Non-parametric	0.030	Y			N	FALSE
CCR Appendix-IV: Beryllium, Total (mg/L)																									
WBW-1	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	NA		0.0005	0.004			
WAP-01	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	NA						
WAP-10	0/11	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	NA	NS	N			Y	FALSE
WAP-20	0/11	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	NA	NS	N			Y	FALSE
WAP-21	0/11	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	NA	NS	N			Y	FALSE
CCR Appendix-IV: Cadmium, Total (mg/L)																									
WBW-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	NA		0.0005	0.005			
WAP-01	0/15	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	NA						
WAP-10	0/15	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	NA	NS	N			Y	FALSE
WAP-20	0/11	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	NA	NS	N			Y	FALSE
WAP-21	0/11	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	NA	NS	N			Y	FALSE
CCR Appendix-IV: Chromium, Total (mg/L)																									
WBW-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	NA	NA		0.0050	0.100			
WAP-01	0/15	100%	0.005-0.005	0.005	0.005	0.005	7.744E-21	8.8E-11	1.76E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA						
WAP-10	0/15	100%	0.005-0.005	0.005	0.005	0.005	7.744E-21	8.8E-11	1.76E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N			Y	FALSE
WAP-20	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N			Y	FALSE
WAP-21	0/11	100%	0.005-0.005	0.005	0.005	0.005	1.084E-20	1.041E-10	2.083E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	NA	NS	N			Y	FALSE
CCR Appendix-IV: Cobalt, Total (mg/L)																									
WBW-1	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	NA		0.0006	0.006			
WAP-01	1/14	93%	0.0005-0.0005	0.000506	0.0005	0.0005315	0.00059	5.786E-10	0.0002405	0.0475	0.006	mg/L	N	0	0	NA	NA	NA	NA					N	FALSE
WAP-10	0/14	100%	0.0005-0.0005	0.0005	0.0005	0.0005	0	0	0	0.006	mg/L	N	0	0	NA	NA	NA	NA	NA	0.0005	N			N	FALSE
WAP-20	13/14	7%	0.001-0.001	0.00105	0.001	0.00154	0.0018	9.498E-08	0.0003082	0.2937	0.006	mg/L	N	0	0	No	No	Stable	Normal	0.0008	Y			N	FALSE
WAP-21	1/14	93%	0.0005-0.01	0.0012	0.0005	0.004014	0.00079	0.00006422	0.002534	2.113	0.006	mg/L	N	0	1	NA	NA	NA	NA	0.0005	N			N	FALSE
CCR Appendix-IV: Fluoride (mg/L)																									
WBW-1	1/15	93%	0.1-0.1	0.1	0.1	0.1	0.1	1.983E-18	1.408E-09	1.408E-08	4	mg/L	N	0	0	No	No	NA	Non-parametric		0.140	4.00			
WAP-01	2/15	87%	0.1-0.1	0.105	0.1	0.133	0.14	0.0001552	0.01246	0.119	4	mg/L	N	0	0	No	No	NA	Non-parametric					N	FALSE
WAP-10	2/15	87%	0.1-0.1	0.105	0.1	0.129	0.15	0.0001838	0.01356	0.1295	4	mg/L	N	0	0	Yes	No	Stable	Non-parametric	0.100	N			N	FALSE
WAP-20	15/15	0%	-	0.578	0.58	0.748	0.79	0.01783	0.1335	0.231	4	mg/L	N	0	0	No	No	Stable	Normal	0.640	Y			N	FALSE
WAP-21	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	NA	NA	0.100	N			N	FALSE
CCR Appendix-IV: Lead, Total (mg/L)																									
WBW-1	0/13	100%	0.001-0.01	0.00192	0.001	0.0055	0.000006202	0.00249	1.295	0.015	mg/L	N	0	0	NA	NA	NA	NA	NA		0.0100	0.015			
WAP-01	4/15	73%	0.001-0.01	0.00212	0.001	0.006192	0.00456	0.00005708	0.002389	1.125	0.015	mg/L	N	0	0	Yes	No	Decreasing	Non-parametric					N	FALSE
WAP-10	0/15	100%	0.001-0.01	0.0018	0.001	0.00475	0.000005421	0.002328	1.294	0.015	mg/L	N	0	0	NA	NA	NA	NA	NA	0.001	N			N	FALSE
WAP-20	0/11	100%	0.001-0.0025	0.00127	0.001	0.0025	3.682E-07	0.0006068	0.4768	0.015	mg/L	N	0	0	NA	NA	NA	NA	NA	0.001	N			N	FALSE
WAP-21	0/11	100%	0.001-0.0025	0.00127	0.001	0.0025	3.682E-07	0.0006068	0.4768	0.015	mg/L	N	0	0	NA	NA	NA	NA	NA	0.001	N			N	FALSE
CCR Appendix-IV: Lithium, Total (mg/L)																									
WBW-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	NA		0.012	0.040			
WAP-01	1/14	93%	0.01-0.01	0.0101	0.01	0.01056	0.0116	1.829E-07	0.0004276	0.04228	0.04	mg/L	N	0	0	No	No	Stable	Non-parametric					N	FALSE
WAP-10	14/14	0%	-	0.261	0.23	0.03782	0.466	0.00005348	0.007313	0.2806	0.04	mg/L	Y	1	0	Yes	No	Stable	Non-parametric	0.023	Y			N	FALSE
WAP-20	14/14	0%	-	0.262	0.245	0.3696	0.406	0.004468	0.06684	0.2553	0.04	mg/L	Y	14	0	No	No	Stable	Normal	0.320	Y				

CCR Appendix-IV: Molybdenum, Total (mg/L)																					
WBW-1	0/14	100%	0.01-0.05	0.0129	0.01	0.024		0.0001143	0.01069	0.8315	0.1	mg/L	N	0	0	NA	NA	NA			
WAP-01	0/14	100%	0.01-0.01	0.01	0.01	0.01		5.004E-20	2.237E-10	2.237E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.050	0.10
WAP-10	0/14	100%	0.01-0.01	0.01	0.01	0.01		5.004E-20	2.237E-10	2.237E-08	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.010	N
WAP-20	14/14	0%	-	0.156	0.133	0.334	0.397	0.01094	0.1046	0.6715	0.1	mg/L	Y	9	0	No	No	Stable	Normal	0.055	Y
WAP-21	0/14	100%	0.01-0.05	0.0129	0.01	0.024		0.0001143	0.01069	0.8315	0.1	mg/L	N	0	0	NA	NA	NA	NA	0.010	N
CCR Appendix-IV: Radium-226 & 228 (pCi/L)																					
WBW-1	7/14	50%	0-4	3.17	4	4.304	4.33	2.423	1.557	0.4913	5	pCi/L	N	0	0	No	No	NA			
WAP-01	9/14	36%	4-4	3.55	4	5.82	5.97	2.561	1.6	0.4509	5	pCi/L	Y	2	0	Yes	No	Stable	Non-parametric	5.97	6.0
WAP-10	14/14	0%	-	5.22	5.485	6.773	6.91	1.759	1.326	0.2539	5	pCi/L	Y	9	0	No	No	Stable	Normal	3.370	Y
WAP-20	7/14	50%	4-4	3.31	4	4.354	4.38	1.69	1.3	0.3924	5	pCi/L	N	0	0	No	No	Stable	Non-parametric	1.030	Y
WAP-21	10/14	29%	4-4	3.52	4	5.26	5.67	2.875	1.696	0.4821	5	pCi/L	Y	2	0	No	No	Stable	Normal	1.300	Y
CCR Appendix-IV: Selenium, Total (mg/L)																					
WBW-1	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			
WAP-01	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
WAP-10	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	0.010	N
WAP-20	0/11	100%	0.01-0.02	0.0118	0.01	0.02		0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N
WAP-21	0/11	100%	0.01-0.02	0.0118	0.01	0.02		0.00001636	0.004045	0.3423	0.05	mg/L	N	0	0	NA	NA	NA	NA	0.010	N
CCR Appendix-IV: Thallium, Total (mg/L)																					
WBW-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			
WAP-01	0/12	100%	0.0001-0.001	0.000925	0.001	0.001		6.75E-08	0.0002598	0.2809	0.002	mg/L	N	0	0	NA	NA	NA	NA	0.001	0.002
WAP-10	0/11	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
WAP-20	1/11	91%	0.001-0.001	0.00105	0.001	0.0013	0.0016	3.273E-08	0.0001809	0.1715	0.002	mg/L	N	0	0	No	NA	NA	Non-parametric	0.001	N
WAP-21	0/11	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

Notes: NS = Not sampled