Annual Groundwater Monitoring Report

Southwestern Electric Power Company

H. W. Pirkey Power Plant

FGD Stackout Area CCR Management Unit

Hallsville, Texas

January 2021

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SOUTHWESTERN ELECTRIC POWER COMPANY℠

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I. Summary

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Pirkey Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31, 2021.

In general, the following activities were completed:

- Groundwater samples were collected for AD-7, AD-12, AD-13, AD-22, and AD-33 in March, June, and November 2020 analyzed for Appendix III and Appendix IV constituents, as specified in 40 CFR 257.94 or 95 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Assessment Monitoring sampling was initiated on April 3, 2018;
- The unit was in Assessment monitoring at the beginning and the end of 2020;
- Statistical analysis report dated January 3, 2020 was included in last year's Annual Groundwater Monitoring Report. The following Appendix IV parameters exceeded established groundwater protection standards:
    - Beryllium at AD-7 and AD-22
    - Cobalt at AD-22

  The following Appendix III parameters exceeded background:
    - Boron at AD-33 and AD-7
    - Calcium at AD-22 and AD-7
    - Chloride at AD-22
    - Fluoride at AD-22
    - The May 2019 pH measurement at AD-22
    - Sulfate at AD-22 and AD-7
    - TDS concentrations at AD-33 and AD-7
- An alternate source for beryllium and cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on April 2, 2020.
- Statistical analysis report dated October 2, 2020 is included in **Appendix II**. The following Appendix IV parameters exceeded established groundwater protection standards:

- Beryllium at AD-7 and AD-22
- Cobalt at AD-22

The following Appendix III parameters exceeded background:

- Boron at AD-7 and AD-33
- Chloride at AD-22
- Fluoride at AD-22
- Sulfate at AD-22
- TDS concentrations at AD-7, AD-22, and AD-33

- An alternate source for beryllium and cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on December 31, 2020.
- The November 2020 data are still undergoing statistical analysis.
- Groundwater Monitoring Statistical Evaluation Reports to evaluate groundwater data were prepared and certified in accordance with 40 CFR 257.93. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009).

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

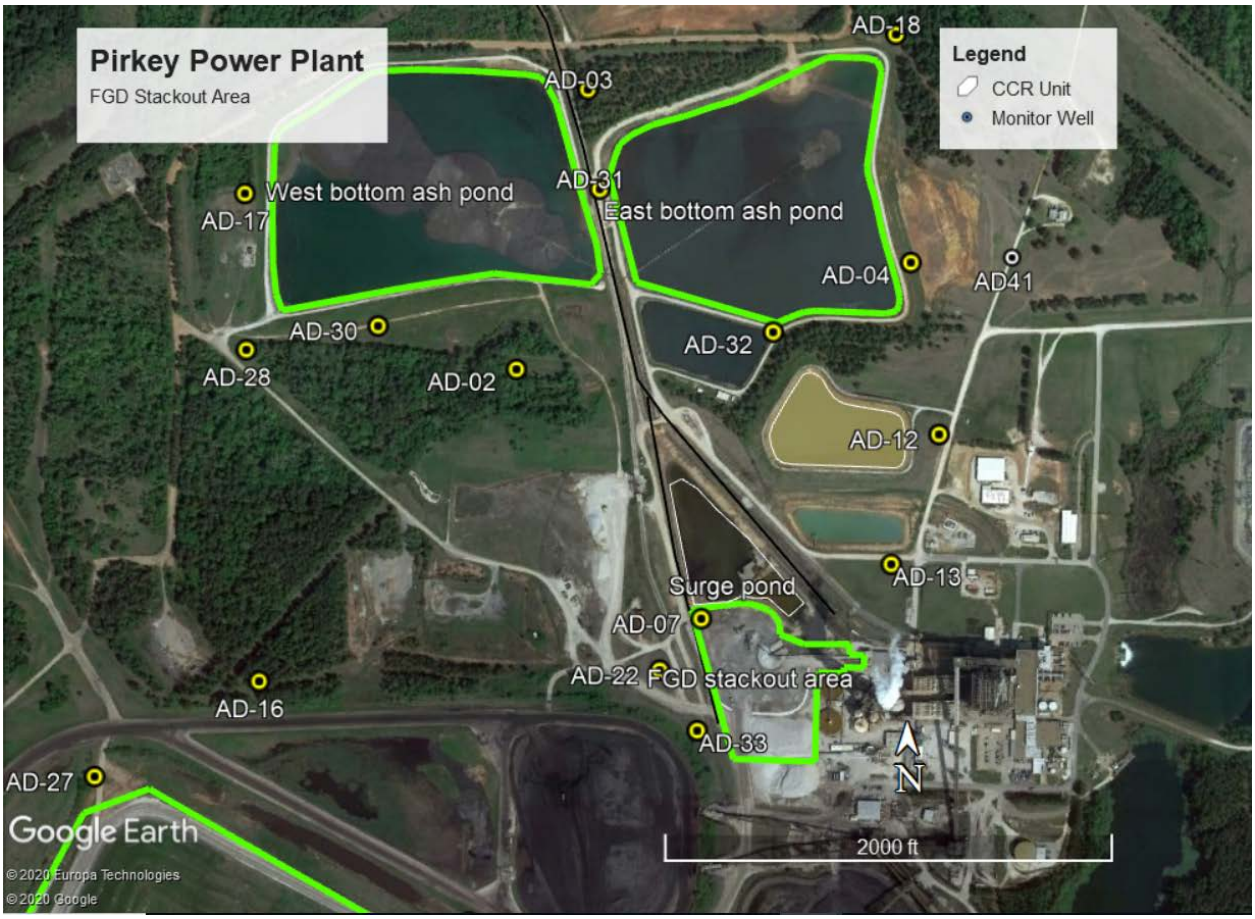
- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs is included in **Appendix I**;
- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituents detected at a statistically significant increase over background concentrations.
- Other information required to be included in the annual report such as alternate source demonstration or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification numbers.

FGD Stackout Area Monitoring Wells	
Up Gradient	Down Gradient
AD-12	AD-7
AD-13	AD-22
	AD-33



III. Monitoring Wells Installed or Decommissioned

One monitoring well (AD-7R) was installed to better understand spatial variability of constituents across the site, groundwater flow, and groundwater chemistry. The well installation reports can be found in **Appendix IV**.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix I contains tables showing the groundwater quality. Static water elevation data from each monitoring event also are shown in **Appendix I**, along with the groundwater velocity, groundwater flow direction and potentiometric maps developed after each sampling event.

As required by the assessment monitoring rules, 40 CFR 257.95 et seq., a March sampling event was conducted in accordance with 40 CFR 257.95(b). Two sampling events in June and November were conducted in accordance with 40 CFR 257.95(d)(1). Assessment monitoring will continue in 2021.

V. Statistical Evaluation of 2020 Events

Statistical analysis report dated January 3, 2020 was included in last year's Annual Groundwater Monitoring Report.

- The following Appendix IV parameters exceeded established groundwater protection standards:
    - Beryllium at AD-7 and AD-22
    - Cobalt at AD-22

  The following Appendix III parameters exceeded background:
    - Boron at AD-33 and AD-7
    - Calcium at AD-22 and AD-7
    - Chloride at AD-22
    - Fluoride at AD-22
    - The May 2019 pH measurement at AD-22
    - Sulfate at AD-22 and AD-7
    - TDS concentrations at AD-33 and AD-7

Statistical analysis report dated October 2, 2020 is included in **Appendix II**. The following Appendix IV parameters exceeded established groundwater protection standards:

- Beryllium at AD-7 and AD-22
- Cobalt at AD-22

The following Appendix III parameters exceeded background:

- Boron at AD-7 and AD-33
- Chloride at AD-22

- Fluoride at AD-22
- Sulfate at AD-22
- TDS concentrations at AD-7, AD-22, and AD-33

The second semi-annual groundwater monitoring data from November is still undergoing statistical analysis.

VI. Alternate Source Demonstration

An alternate source investigation was conducted for the SSLs above GWPSs. SSLs above the GWPS were determined for beryllium at wells AD-7 and AD-22 and cobalt at well AD-22 on January 3, 2020. An alternate source for beryllium and cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on April 2, 2020.

SSLs above the groundwater protection standard GWPS were determined for beryllium at wells AD-7 and AD-22 and cobalt at AD-22 on October 2, 2020. An alternate source for beryllium and cobalt was identified in a report (*Alternative Source Demonstration Report Federal CCR Rule*) on December 31, 2020.

The supporting information are found in **Appendix III**.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

The unit transitioned from detection monitoring to assessment monitoring on April 3, 2018.

Assessment monitoring will continue in 2021.

Regarding defining an alternate monitoring frequency, no modification of the twice-per-year detection monitoring effort is needed.

VIII. Other Information Required

No other information applies at this time.

IX. Description of Any Problems Encountered in 2020 and Actions Taken

No significant problems were encountered.

X. A Projection of Key Activities for the Upcoming Year

Key activities for next year include:

- Assessment monitoring sampling will be conducted;
- Evaluation of the assessment monitoring results from a statistical analysis viewpoint, looking for any SSLs above GWPS;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX I

Tables follow, showing the groundwater monitoring data collected, the rate and direction of groundwater flow, and a summary showing the number of samples collected per monitoring well. The dates that the samples were collected also is shown.

Table 1 - Groundwater Data Summary: AD-7
Pirkey - Stackout
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	2.39	6.58	28	0.6493 J	4.0	92	302
7/13/2016	Background	0.716	2.97	16	< 0.083 U	3.6	40	204
9/7/2016	Background	0.978	3.15	18	< 0.083 U	4.1	42	208
10/13/2016	Background	0.67	2.81	17	< 0.083 U	3.8	38	212
11/14/2016	Background	0.682	2.63	16	< 0.083 U	4.0	38	216
1/11/2017	Background	1.39	3.92	19	< 0.083 U	3.5	46	204
2/28/2017	Background	1.51	4.78	20	< 0.083 U	3.7	46	240
4/10/2017	Background	3.24	5.06	28	0.4117 J	3.6	65	322
8/24/2017	Detection	0.943	2.99	18	2.994	3.7	51	176
12/21/2017	Detection	0.718	3.26	19	< 0.083 U	--	39	176
3/21/2018	Assessment	2.47	5.37	20	< 0.083 U	3.6	90	266
8/20/2018	Assessment	1.36	3.76	33	< 0.083 U	4.3	54	180
2/27/2019	Assessment	2.10	5.20	29.9	0.50	2.9	69.1	268
5/22/2019	Assessment	0.195	5.77	28.0	0.58	3.4	91.6	334
8/12/2019	Assessment	3.54	4.20	36.7	0.30	4.0	59.6	266
3/10/2020	Assessment	1.99	4.86	28.7	0.57	3.5	88.5	254
6/2/2020	Assessment	1.93	4.98	29.1	0.58	3.3	74.4	303
11/3/2020	Assessment	4.19	4.10	38.2	0.27	3.3	60.2	236

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-7
Pirkey - Stackout
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	< 0.93 U	1.38216 J	37	8	0.87394 J	0.766043 J	52	4.344	0.6493 J	< 0.68 U	0.044	0.309	< 0.29 U	1.04661 J	< 0.86 U
7/13/2016	Background	< 0.93 U	1.18444 J	50	3	0.66774 J	1	24	0.942	< 0.083 U	< 0.68 U	0.099	0.261	< 0.29 U	< 0.99 U	1.03212 J
9/7/2016	Background	< 0.93 U	< 1.05 U	50	4	0.730872 J	0.316008 J	27	3.132	< 0.083 U	< 0.68 U	0.099	0.059	< 0.29 U	< 0.99 U	< 0.86 U
10/13/2016	Background	< 0.93 U	1.08028 J	61	4	0.858417 J	1	23	3.81	< 0.083 U	< 0.68 U	0.101	0.154	< 0.29 U	< 0.99 U	< 0.86 U
11/14/2016	Background	< 0.93 U	< 1.05 U	60	4	1	< 0.23 U	22	3.538	< 0.083 U	< 0.68 U	0.099	0.039	< 0.29 U	< 0.99 U	< 0.86 U
1/11/2017	Background	< 0.93 U	< 1.05 U	58	5	0.756968 J	< 0.23 U	31	3.77	< 0.083 U	< 0.68 U	0.101	0.02275 J	< 0.29 U	< 0.99 U	< 0.86 U
2/28/2017	Background	< 0.93 U	< 1.05 U	53	5	0.838869 J	< 0.23 U	34	3.92	< 0.083 U	< 0.68 U	0.101	0.185	< 0.29 U	< 0.99 U	< 0.86 U
4/10/2017	Background	< 0.93 U	< 1.05 U	51	7	0.723565 J	0.295188 J	44	4.35	0.4117 J	< 0.68 U	0.111	0.191	< 0.29 U	< 0.99 U	< 0.86 U
3/21/2018	Assessment	< 0.93 U	< 1.05 U	40.31	6.81	0.82 J	< 0.23 U	45.34	3.99	< 0.083 U	< 0.68 U	0.108	0.117	< 0.29 U	< 0.99 U	< 0.86 U
8/20/2018	Assessment	0.01 J	0.47	51.6	2.07	0.68	0.075	25.6	0.787	< 0.083 U	0.362	0.0877	0.006 J	< 0.02 U	1.0	0.179
2/27/2019	Assessment	< 0.4 U	2.12	42.9	7.01	0.73	0.225	41.0	4.75	0.50	1 J	0.106	0.201	< 0.4 U	7.1	< 2 U
5/22/2019	Assessment	< 0.4 U	2 J	37.8	6.47	0.6 J	< 0.8 U	46.0	4.72	0.58	0.8 J	0.0975	0.26	< 8 U	3 J	< 0.1 U
8/12/2019	Assessment	< 0.02 U	0.64	41.9	3.24	0.75	0.1 J	29.7	3.278	0.30	0.529	0.102	0.09	< 0.4 U	1.7	0.2 J
3/10/2020	Assessment	< 0.02 U	1.54	31.0	5.29	0.72	0.212	42.1	5.283	0.57	0.943	0.0781	0.179	< 0.4 U	5.5	0.2 J
6/2/2020	Assessment	< 0.02 U	1.29	38.9	5.14	0.69	0.241	39.6	4.1	0.58	0.876	0.0720	0.349	< 0.4 U	5.0	0.2 J
11/3/2020	Assessment	< 0.02 U	0.61	47.9	2.97	0.78	0.236	31.5	2.957	0.27	0.783	0.0752	0.085	< 0.4 U	2.1	0.2 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-12
Pirkey - Stackout
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.03	0.362	5	< 0.083 U	4.4	4	94
7/13/2016	Background	0.03	0.26	6	< 0.083 U	3.1	4	75
9/7/2016	Background	0.04	0.343	6	< 0.083 U	3.9	7	63
10/12/2016	Background	0.03	0.271	7	1	3.4	8	92
11/14/2016	Background	0.04	0.331	8	< 0.083 U	2.6	6	80
1/11/2017	Background	0.03	0.315	7	< 0.083 U	4.8	6	76
2/28/2017	Background	0.04	0.434	5	< 0.083 U	3.6	4	50
4/11/2017	Background	0.05	0.299	6	0.2565 J	4.7	7	72
8/23/2017	Detection	0.0495	0.245	6	0.213 J	4.8	6	52
3/21/2018	Assessment	0.01397	0.269	5	< 0.083 U	4.2	3	< 2 U
8/20/2018	Assessment	0.017	0.338	10	< 0.083 U	4.4	4	94
2/27/2019	Assessment	0.03 J	0.4 J	6.08	0.09	5.2	3.6	36
5/21/2019	Assessment	0.020	0.3 J	6.30	0.09	4.1	4.0	80
8/12/2019	Assessment	< 0.02 U	0.278	7.24	0.06 J	4.9	2.6	90
3/10/2020	Assessment	0.02 J	0.3 J	6.08	0.10	4.9	3.7	62
6/2/2020	Assessment	< 0.02 U	0.2 J	5.63	0.10	4.0	3.9	91
11/2/2020	Assessment	0.03 J	0.3 J	4.65	0.08	4.3	3.3	74

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-12
Pirkey - Stackout
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	< 0.93 U	< 1.05 U	26	0.219521 J	< 0.07 U	0.710981 J	1.58207 J	0.2073	< 0.083 U	< 0.68 U	< 0.00013 U	< 0.005 U	< 0.29 U	1.73953 J	< 0.86 U
7/13/2016	Background	< 0.93 U	< 1.05 U	23	0.190337 J	< 0.07 U	0.68835 J	1.29444 J	2.909	< 0.083 U	< 0.68 U	0.008	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
9/7/2016	Background	< 0.93 U	< 1.05 U	30	0.232192 J	< 0.07 U	0.353544 J	1.66591 J	0.881	< 0.083 U	< 0.68 U	0.01	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
10/12/2016	Background	< 0.93 U	< 1.05 U	27	0.149553 J	< 0.07 U	0.529033 J	1.56632 J	0.257	1	< 0.68 U	0.012	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
11/14/2016	Background	< 0.93 U	< 1.05 U	28	0.152375 J	< 0.07 U	0.32826 J	1.47282 J	0.767	< 0.083 U	< 0.68 U	0.013	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
1/11/2017	Background	< 0.93 U	< 1.05 U	23	0.126621 J	< 0.07 U	0.650158 J	1.09495 J	1.536	< 0.083 U	< 0.68 U	0.01	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
2/28/2017	Background	< 0.93 U	< 1.05 U	26	0.149219 J	< 0.07 U	0.325811 J	1.29984 J	0.416	< 0.083 U	< 0.68 U	0.009	< 0.005 U	< 0.29 U	< 0.99 U	0.994913 J
4/11/2017	Background	< 0.93 U	< 1.05 U	24	0.159412 J	< 0.07 U	0.416007 J	1.33344 J	0.3895	0.2565 J	< 0.68 U	0.008	0.01364 J	< 0.29 U	< 0.99 U	< 0.86 U
3/21/2018	Assessment	< 0.93 U	< 1.05 U	25.82	0.16 J	< 0.07 U	1.05	1.49 J	0.784	< 0.083 U	< 0.68 U	0.00722	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
8/20/2018	Assessment	< 0.01 U	0.11	27.8	0.159	0.01 J	0.330	1.72	1.128	< 0.083 U	0.089	0.0143	< 0.005 U	0.04 J	0.1	0.04 J
2/27/2019	Assessment	< 0.4 U	< 0.6 U	22.5	< 0.4 U	< 0.2 U	< 0.8 U	1.37	0.225	0.09	< 0.4 U	0.00688	< 0.005 U	< 8 U	< 0.6 U	< 2 U
5/21/2019	Assessment	< 0.4 U	< 0.6 U	21.7	< 0.4 U	< 0.2 U	< 0.8 U	1.15	0.201	0.09	< 0.4 U	0.00576	< 0.005 U	< 8 U	< 0.6 U	< 0.1 U
8/12/2019	Assessment	< 0.02 U	0.07 J	23.8	0.154	< 0.01 U	0.204	1.30	0.237	0.06 J	0.08 J	0.00829	< 0.005 U	< 0.4 U	0.2 J	< 0.1 U
3/10/2020	Assessment	< 0.02 U	0.09 J	21.7	0.139	0.01 J	0.2 J	1.21	3.0706	0.10	0.09 J	0.00547	< 0.002 U	< 0.4 U	0.2	< 0.1 U
6/2/2020	Assessment	< 0.02 U	0.09 J	19.0	0.132	< 0.01 U	0.208	1.02	0.799	0.10	0.09 J	0.00505	< 0.002 U	< 0.4 U	0.3	< 0.1 U
11/2/2020	Assessment	0.05 J	0.09 J	18.9	0.122	< 0.01 U	0.204	1.04	0.929	0.08	0.09 J	0.00510	< 0.002 U	< 0.4 U	0.3	< 0.1 U

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-13
Pirkey - Stackout
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.06	8.77	28	0.748 J	5.6	52	236
7/13/2016	Background	0.06	9.08	32	0.3474 J	5.6	59	192
9/7/2016	Background	0.05	8.48	23	< 0.083 U	5.2	41	228
10/13/2016	Background	0.06	7.53	26	0.6297 J	5.8	47	236
11/14/2016	Background	0.06	7.21	26	0.3114 J	6.1	47	250
1/11/2017	Background	0.04	6.14	22	< 0.083 U	5.8	37	188
2/28/2017	Background	0.07	7.88	28	< 0.083 U	5.9	56	172
4/11/2017	Background	0.08	9.11	32	0.4278 J	5.2	58	200
8/23/2017	Detection	0.07408	9.5	21	0.344 J	6.0	38	160
3/21/2018	Assessment	0.07169	10.3	25	< 0.083 U	5.9	48	176
8/20/2018	Assessment	0.065	8.40	39	0.0845 J	5.9	66	210
2/27/2019	Assessment	0.08 J	11.0	40.8	0.25	5.2	80.8	176
5/21/2019	Assessment	0.061	10.1	34.8	0.40	5.3	69.5	190
8/12/2019	Assessment	0.064	8.68	42.3	0.39	5.9	73.6	310
3/10/2020	Assessment	0.067	10.7	41.1	0.32	6.4	82.7	216
6/2/2020	Assessment	0.065	10.9	41.4	0.45	6.4	83.4	322
11/2/2020	Assessment	0.052	5.90	22.6	0.38	6.4	39.1	204

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-13
Pirkey - Stackout
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	< 0.93 U	4.25914 J	38	0.586539 J	0.293832 J	< 0.23 U	42	0.989	0.748 J	< 0.68 U	0.081	0.00969 J	< 0.29 U	< 0.99 U	1.11268 J
7/13/2016	Background	< 0.93 U	9	44	2	0.0875208 J	< 0.23 U	47	2.332	0.3474 J	< 0.68 U	0.158	0.01928 J	< 0.29 U	3.63671 J	0.928756 J
9/7/2016	Background	< 0.93 U	< 1.05 U	47	0.631177 J	0.219799 J	< 0.23 U	38	1.219	< 0.083 U	< 0.68 U	0.139	< 0.005 U	< 0.29 U	< 0.99 U	1.44332 J
10/13/2016	Background	< 0.93 U	7	43	0.963478 J	< 0.07 U	< 0.23 U	42	2.422	0.6297 J	< 0.68 U	0.142	< 0.005 U	< 0.29 U	2.59885 J	< 0.86 U
11/14/2016	Background	< 0.93 U	2.07189 J	39	0.717704 J	0.310257 J	< 0.23 U	42	1.723	0.3114 J	< 0.68 U	0.136	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
1/11/2017	Background	< 0.93 U	2.73936 J	39	0.302907 J	0.11238 J	< 0.23 U	32	1.844	< 0.083 U	< 0.68 U	0.133	0.00732 J	< 0.29 U	< 0.99 U	< 0.86 U
2/28/2017	Background	< 0.93 U	1.64435 J	34	0.290018 J	< 0.07 U	< 0.23 U	44	1.728	< 0.083 U	< 0.68 U	0.153	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
4/11/2017	Background	< 0.93 U	4.43115 J	45	0.736525 J	2	< 0.23 U	56	1.309	0.4278 J	< 0.68 U	0.156	< 0.005 U	< 0.29 U	< 0.99 U	< 0.86 U
3/21/2018	Assessment	< 0.93 U	3.23 J	42.23	0.46 J	0.86 J	< 0.23 U	39.91	2.093	< 0.083 U	< 0.68 U	0.145	< 0.005 U	< 0.29 U	3.86 J	< 0.86 U
8/20/2018	Assessment	0.01 J	5.79	40.9	0.648	< 0.005 U	0.103	48.8	1.735	0.0845 J	0.01 J	0.146	< 0.005 U	< 0.02 U	0.2	0.03 J
2/27/2019	Assessment	< 0.4 U	2.17	38.5	< 0.4 U	< 0.2 U	< 0.8 U	48.7	0.909	0.25	< 0.4 U	0.165	< 0.005 U	< 8 U	< 0.6 U	< 2 U
5/21/2019	Assessment	< 0.4 U	2 J	35.0	< 0.4 U	< 0.2 U	< 0.8 U	44.7	0.875	0.40	< 0.4 U	0.153	< 0.005 U	< 8 U	< 0.6 U	< 0.1 U
8/12/2019	Assessment	< 0.02 U	1.64	35.0	0.235	< 0.01 U	0.06 J	44.5	1.642	0.39	< 0.05 U	0.139	< 0.005 U	< 0.4 U	< 0.03 U	< 0.1 U
3/10/2020	Assessment	< 0.02 U	1.58	38.4	0.327	< 0.01 U	0.06 J	44.7	1.382	0.32	< 0.05 U	0.145	< 0.002 U	< 0.4 U	< 0.03 U	< 0.1 U
6/2/2020	Assessment	< 0.02 U	1.39	35.6	0.222	< 0.01 U	0.07 J	43.7	1.116	0.45	< 0.05 U	0.140	< 0.002 U	< 0.4 U	0.04 J	< 0.1 U
11/2/2020	Assessment	< 0.02 U	3.40	34.5	0.270	< 0.01 U	0.2 J	35.4	1.729	0.38	< 0.05 U	0.109	< 0.002 U	< 0.4 U	0.07 J	< 0.1 U

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-22
Pirkey - Stackout
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.08	15.3	76	1.266	4.0	284	672
7/14/2016	Background	0.04	9.5	52	0.3891 J	3.9	162	412
9/7/2016	Background	0.04	6.95	42	< 0.083 U	4.1	114	341
10/12/2016	Background	0.03	7.68	52	0.473 J	4.7	148	388
11/14/2016	Background	0.04	7.55	48	0.2834 J	4.4	177	362
1/12/2017	Background	0.02	6.47	51	< 0.083 U	4.2	137	344
3/1/2017	Background	0.05	13.6	69	< 0.083 U	4.1	266	624
4/11/2017	Background	0.04	10.8	72	0.5041 J	4.1	215	446
8/23/2017	Detection	0.05075	7.77	54	1.196	4.6	121	350
12/21/2017	Detection	0.06278	7.29	61	< 0.083 U	--	120	344
3/21/2018	Assessment	0.0818	15.2	79	< 0.083 U	3.9	377	656
8/20/2018	Assessment	0.031	9.43	92	< 0.083 U	4.2	184	476
2/27/2019	Assessment	0.07 J	15.2	76.7	1.33	4.9	337	584
5/22/2019	Assessment	0.073	16.5	63.3	1.06	5.1	360	506
8/12/2019	Assessment	0.03 J	8.96	79.6	0.45	4.8	198	484
3/10/2020	Assessment	0.067	12.7	73.6	1.25	3.8	364	654
6/2/2020	Assessment	0.062	13.1	74.0	1.25	3.6	369	682
11/2/2020	Assessment	0.03 J	8.60	84.0	0.28	4.8	190	468

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-22
Pirkey - Stackout
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	< 0.93 U	23	71	13	2	24	129	6.994	1.266	0.97266 J	0.139	13.41	< 0.29 U	1.97127 J	1.16089 J
7/14/2016	Background	< 0.93 U	12	48	6	0.674427 J	12	67	2.325	0.3891 J	< 0.68 U	0.169	17	< 0.29 U	< 0.99 U	0.895409 J
9/7/2016	Background	< 0.93 U	23	108	5	0.833408 J	33	54	3.412	< 0.083 U	2.72959 J	0.131	19.829	< 0.29 U	< 0.99 U	1.25036 J
10/12/2016	Background	< 0.93 U	10	54	4	0.333745 J	7	54	3.39	0.473 J	< 0.68 U	0.14	7.984	< 0.29 U	< 0.99 U	< 0.86 U
11/14/2016	Background	< 0.93 U	3.69822 J	66	4	0.596378 J	2	47	3.63	0.2834 J	< 0.68 U	0.115	8.634	< 0.29 U	< 0.99 U	< 0.86 U
1/12/2017	Background	< 0.93 U	6	67	4	0.385609 J	2	43	3.173	< 0.083 U	< 0.68 U	0.104	13.32	< 0.29 U	1.09664 J	< 0.86 U
3/1/2017	Background	< 0.93 U	1.61319 J	29	10	1	< 0.23 U	105	4.385	< 0.083 U	< 0.68 U	0.218	0.22	< 0.29 U	< 0.99 U	< 0.86 U
4/11/2017	Background	< 0.93 U	11	130	6	2	5	78	3.045	0.5041 J	1.89388 J	0.176	7.201	< 0.29 U	1.86563 J	< 0.86 U
3/21/2018	Assessment	< 0.93 U	3.56 J	24.13	12.1	1.87	< 0.23 U	121	6.22	< 0.083 U	< 0.68 U	0.277	1.206	< 0.29 U	< 0.99 U	< 0.86 U
8/20/2018	Assessment	0.02 J	5.18	22.7	3.30	0.46	0.829	62.9	3.088	< 0.083 U	0.386	0.132	1.448	0.07 J	2.5	0.162
2/27/2019	Assessment	< 0.4 U	6.30	17.0	13.3	1.55	0.8 J	123	5.99	1.33	0.5 J	0.269	0.642	< 8 U	16.7	< 2 U
5/22/2019	Assessment	< 0.4 U	5.89	16.7	12.5	1.52	< 0.8 U	129	6.71	1.06	< 0.4 U	0.288	0.837	< 8 U	5.9	0.2 J
8/12/2019	Assessment	< 0.02 U	2.19	15.3	3.38	0.44	0.2 J	57.5	3.088	0.45	0.1 J	0.151	0.325	< 0.4 U	2.0	0.2 J
3/10/2020	Assessment	< 0.02 U	4.26	18.2	10.1	1.41	0.398	108	7.68	1.25	0.346	0.222	1.58	< 0.4 U	10.5	0.2 J
6/2/2020	Assessment	< 0.02 U	3.53	14.4	8.00	1.43	0.376	101	4.334	1.25	0.261	0.185	0.171	< 0.4 U	10.7	0.3 J
11/2/2020	Assessment	< 0.02 U	1.92	20.4	2.39	0.47	0.2 J	60.0	3.338	0.28	0.2 J	0.101	0.184	< 0.4 U	2.4	0.1 J

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AD-33
Pirkey - Stackout
Appendix III Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/11/2016	Background	0.126	2.44	8	< 0.083 U	4.1	56	326
7/14/2016	Background	0.173	1.69	16	< 0.083 U	3.1	108	176
9/7/2016	Background	0.152	1.81	10	< 0.083 U	3.6	64	176
10/12/2016	Background	0.162	1.39	9	0.357 J	3.4	46	180
11/14/2016	Background	0.182	1.63	8	< 0.083 U	3.1	54	190
1/12/2017	Background	0.144	1.26	10	< 0.083 U	4.3	58	168
2/28/2017	Background	0.14	1.25	7	< 0.083 U	3.9	51	146
4/10/2017	Background	0.114	1.29	9	< 0.083 U	3.4	49	178
8/23/2017	Detection	0.07952	1.06	9	0.67 J	4.4	40	132
12/21/2017	Detection	0.09993	0.946	--	--	--	--	--
3/21/2018	Assessment	0.115	1.42	7	< 0.083 U	4.4	58	160
8/21/2018	Assessment	0.098	1.09	12	< 0.083 U	3.6	48	156
2/27/2019	Assessment	0.134	1.73	8.89	0.25	3.3	62.8	146
5/22/2019	Assessment	0.111	1.65	8.57	0.23	4.1	60.4	204
8/12/2019	Assessment	0.097	1.03	8.85	0.19	4.2	44.3	156
3/10/2020	Assessment	0.132	1.61	8.81	0.25	4.0	64.5	172
6/2/2020	Assessment	0.112	1.49	8.89	0.28	3.9	63.1	206
11/2/2020	Assessment	0.115	0.980	8.49	0.16	3.9	44.8	162

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AD-33
Pirkey - Stackout
Appendix IV Constituents

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/11/2016	Background	< 0.93 U	2.53645 J	60	2	< 0.07 U	4	12	1.303	< 0.083 U	< 0.68 U	< 0.00013 U	0.288	< 0.29 U	< 0.99 U	< 0.86 U
7/14/2016	Background	< 0.93 U	4.91616 J	64	2	< 0.07 U	9	12	4.28	< 0.083 U	< 0.68 U	0.029	0.707	< 0.29 U	< 0.99 U	1.19199 J
9/7/2016	Background	< 0.93 U	67	163	4	0.984692 J	125	33	3.461	< 0.083 U	14	0.048	1.826	0.736517 J	1.61343 J	< 0.86 U
10/12/2016	Background	< 0.93 U	2.15866 J	59	1	< 0.07 U	4	10	2.208	0.357 J	< 0.68 U	0.027	0.145	< 0.29 U	< 0.99 U	1.56738 J
11/14/2016	Background	< 0.93 U	1.46353 J	52	1	< 0.07 U	1	9	1.953	< 0.083 U	< 0.68 U	0.024	0.197	< 0.29 U	< 0.99 U	< 0.86 U
1/12/2017	Background	< 0.93 U	1.12979 J	56	1	< 0.07 U	2	9	2.596	< 0.083 U	< 0.68 U	0.027	0.36	< 0.29 U	< 0.99 U	< 0.86 U
2/28/2017	Background	< 0.93 U	1.069 J	55	1	< 0.07 U	< 0.23 U	9	0.942	< 0.083 U	< 0.68 U	0.026	0.41	< 0.29 U	< 0.99 U	< 0.86 U
4/10/2017	Background	< 0.93 U	< 1.05 U	55	1	< 0.07 U	3	10	9.024	< 0.083 U	< 0.68 U	0.027	0.341	< 0.29 U	< 0.99 U	< 0.86 U
3/21/2018	Assessment	< 0.93 U	1.78 J	57.26	1.4	0.15 J	4.64	10.42	1.643	< 0.083 U	< 0.68 U	0.02669	0.825	< 0.29 U	< 0.99 U	< 0.86 U
8/21/2018	Assessment	0.01 J	0.65	43.8	0.905	0.04	0.147	7.72	6.32	< 0.083 U	0.151	0.0178	0.745	< 0.02 U	1.7	0.05 J
2/27/2019	Assessment	< 0.4 U	1 J	49.5	1 J	< 0.2 U	< 0.8 U	10.5	2.235	0.25	< 0.4 U	0.0262	0.464	< 8 U	3 J	< 2 U
5/22/2019	Assessment	< 0.4 U	< 0.6 U	52.4	1 J	< 0.2 U	< 0.8 U	10.5	1.178	0.23	< 0.4 U	0.0245	0.481	< 8 U	1 J	< 0.1 U
8/12/2019	Assessment	< 0.02 U	0.41	38.6	1.00	0.04 J	0.1 J	7.02	1.141	0.19	0.1 J	0.0233	0.564	< 0.4 U	1.1	< 0.1 U
3/10/2020	Assessment	< 0.02 U	0.63	45.3	1.18	0.06	0.1 J	9.67	2.479	0.25	0.208	0.0197	2.45	< 0.4 U	2.0	< 0.1 U
6/2/2020	Assessment	< 0.02 U	0.61	41.3	1.15	0.05 J	0.2 J	8.78	1.477	0.28	0.2 J	0.0188	2.52	< 0.4 U	2.1	< 0.1 U
11/2/2020	Assessment	< 0.02 U	0.39	45.1	0.858	0.04 J	0.1 J	7.86	1.443	0.16	0.2 J	0.0175	4.30	< 0.4 U	1.1	< 0.1 U

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
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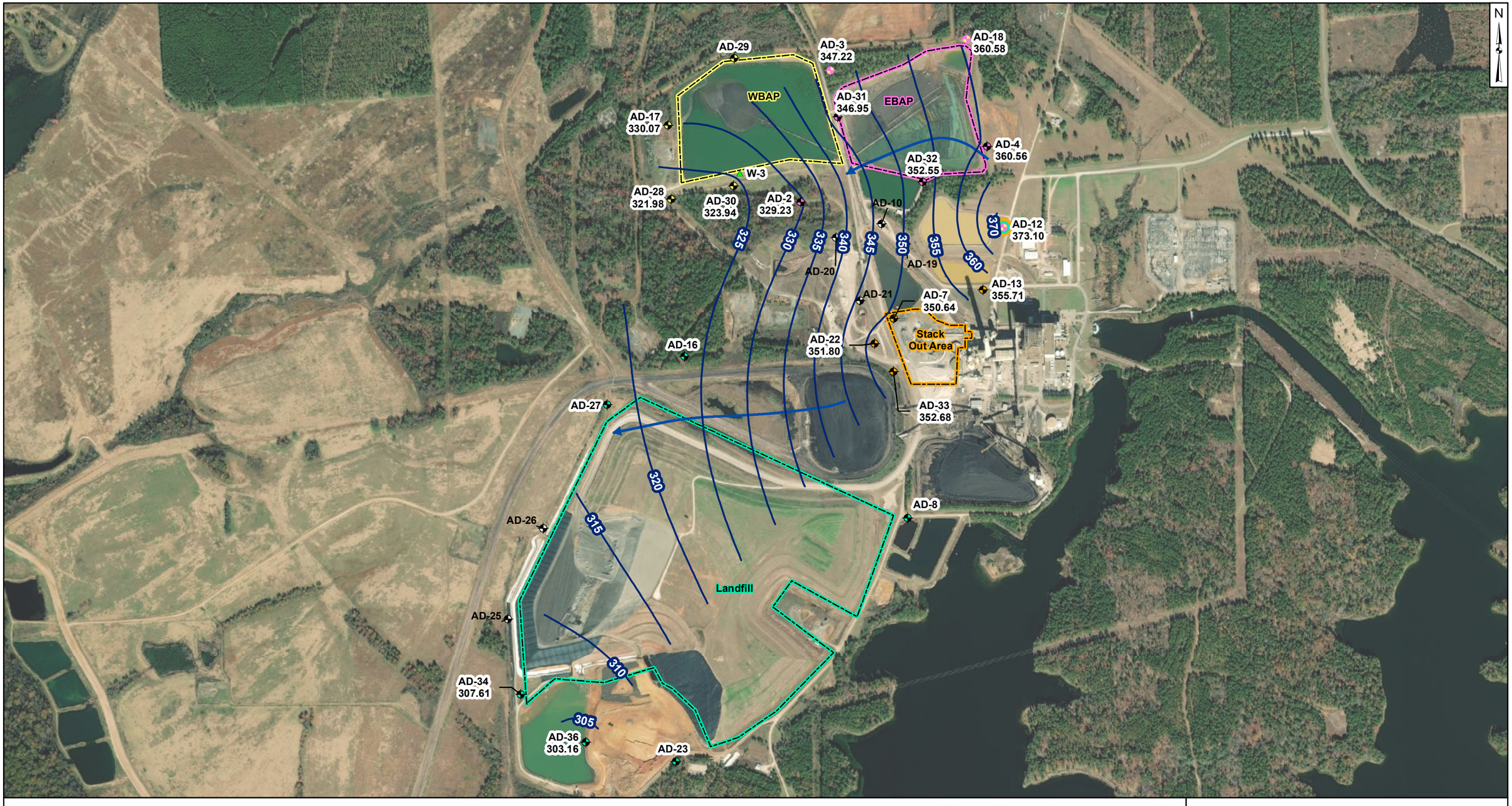
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1: Residence Time Calculation Summary
Pirkey Plant - Stackout Area

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2020-03		2020-06		2020-11	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Stack Out Area	AD-7 [2]	4.0	8.7	13.9	12.1	10.0	9.0	13.6
	AD-12 [1]	4.0	35.1	3.5	20.1	6.0	26.9	4.5
	AD-13 [1]	4.0	32.3	3.8	41.3	2.9	19.0	6.4
	AD-22 [2]	2.0	24.2	2.5	13.3	4.6	9.5	6.4
	AD-33 [2]	2.0	14.2	4.3	8.2	7.4	9.6	6.3

Notes:
[1] - Background Well
[2] - Downgradient Well



Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Groundwater Elevation Contour
- Approximate Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on March 10-11, 2020) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3, AD-16, AD-27, and AD-29 were not gauged in March 2020.
- AD-34 is an artesian well.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer March 2020

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2020/06/12

Figure **1**

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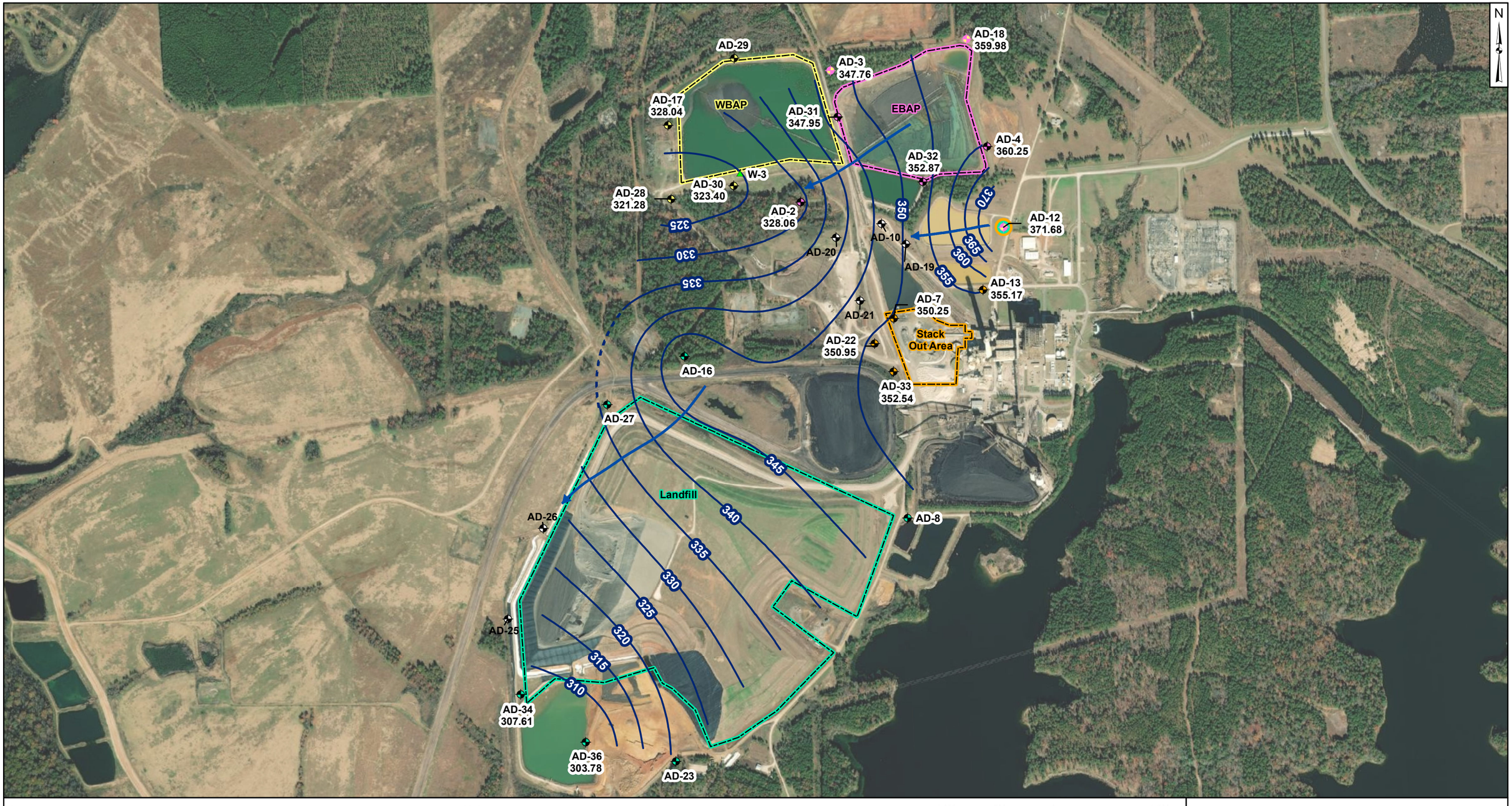

Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Grondwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on June 2 - 3, 2020) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3, AD-8, AD-16, AD-23, AD-27, and AD-29 were not gauged in June 2020.
- AD-34 is an artesian well.
- AD-35 was abandoned November 13, 2018. AD-36 was installed April 24, 2019.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer
June 2020

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2020/11/13

Figure **2**

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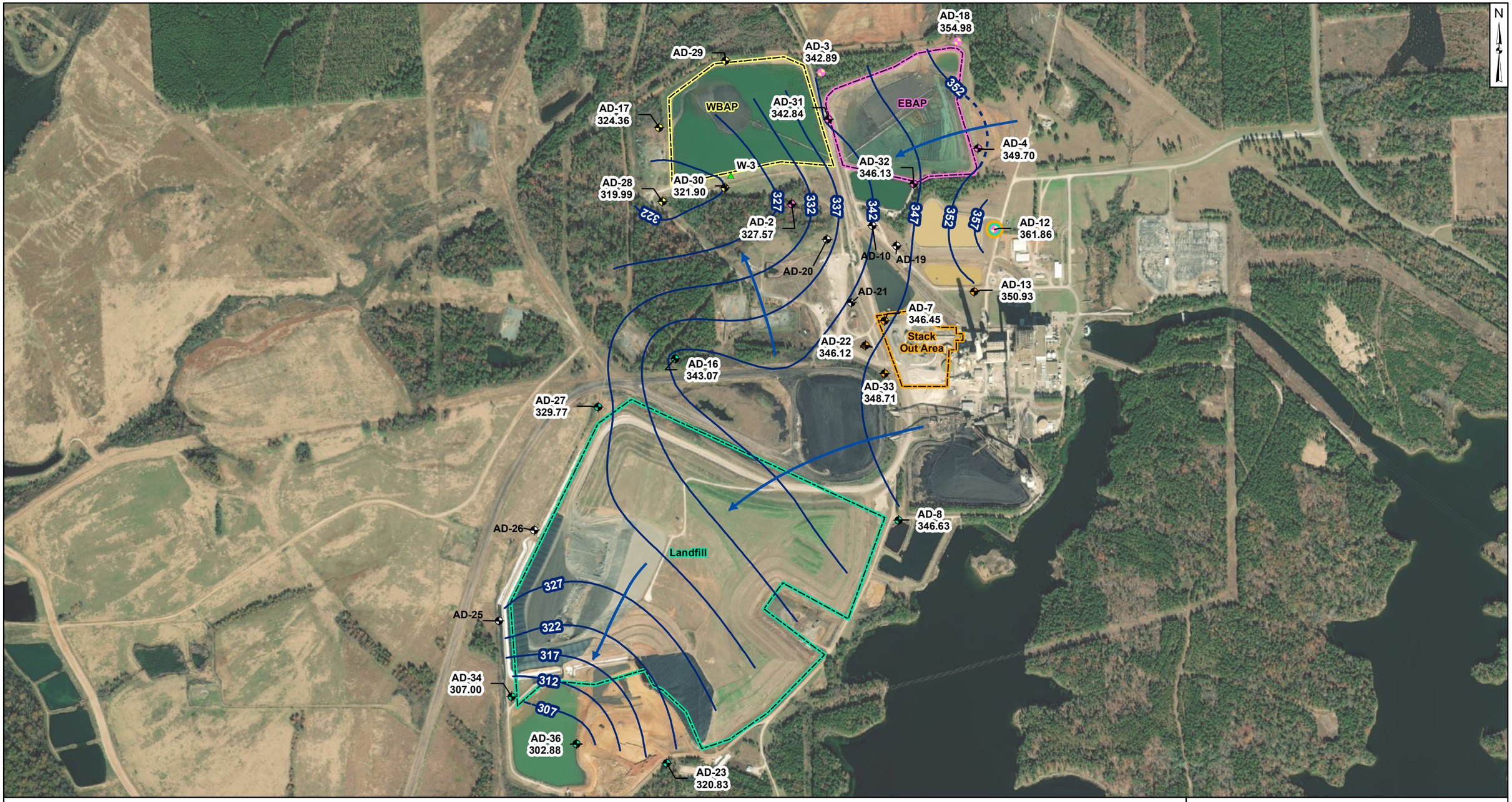

Legend

Groundwater Monitoring Wells

- Out of Network
- EBAP
- WBAP
- Landfill
- Stackout Area
- EBAP and WBAP

- All CCR Unit Networks
- Piezometer
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Grondwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on November 2-4, 2020) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- East and West Bottom Ash Ponds have compacted cohesive soil from elevation 344 to 347 ft. msl (Sargent and Lundy, 1984; AMEC, 2011).
- Clearwater pond base elevation is 344 ft. msl (Sargent and Lundy, 1983).
- W-3 and AD-29 were not gauged in November 2020.

1,000 500 0 1,000 Feet

Potentiometric Contours - Uppermost Aquifer
November 2020

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2021/01/06

Figure **3**

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APPENDIX II

Where applicable, show in this appendix the results from statistical analyses, and a description of the statistical analysis method chosen. These statistical analyses are to be conducted separately for each constituent in each monitoring well.

STATISTICAL ANALYSIS SUMMARY
FLUE GAS DESULFURIZATION (FGD) STACKOUT AREA
H.W. Pirkey Plant
Hallsville, Texas

Submitted to

AMERICAN ELECTRIC POWER

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Submitted by

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October 2, 2020

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
FGD	Flue Gas Desulfurization
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Flue Gas Desulfurization (FGD) Stackout Area, an existing CCR unit at the Pirkey Power Plant located in Hallsville, Texas.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, chloride, and sulfate at the FGD Stackout Area. An alternative source was not identified at the time, so the FGD Stackout Area has been in assessment monitoring since. Groundwater protection standards (GWPS) were set in accordance with 40 CFR 257.95(d)(2) and a statistical evaluation of the assessment monitoring data was conducted. During the most recent assessment monitoring event, completed in August 2019, statistically significant levels (SSLs) for beryllium and cobalt were identified (Geosyntec, 2019). A successful alternative source demonstration (ASD) was prepared per 40 CFR 257.95(g)(3); therefore, the FGD Stackout Area remained in assessment monitoring. Two assessment monitoring events were conducted at the FGD Stackout Area in March and June 2020, in accordance with 40 CFR 257.95. The results of these assessment events are documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact data usability.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. SSLs were identified for beryllium and cobalt. Thus, either the unit will move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

FGD STACKOUT AREA EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) (March 2020) and 257.95(d)(1) (June 2020). Samples from both sampling events were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during these assessment monitoring events are presented in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.26 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the FGD Stackout Area were conducted in accordance with the January 2017 Statistical Analysis Plan (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained in March and August 2020 were screened for potential outliers. No outliers were identified for these events.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Tolerance limits were calculated parametrically with 95% coverage and 95% confidence for arsenic, barium, chromium, and combined radium. Non-parametric tolerance limits were

calculated for beryllium, cobalt, fluoride, and lithium due to apparent non-normal distributions and for antimony, cadmium, lead, mercury, molybdenum, selenium, and thallium due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). For mercury at AD-22, earlier values were higher than recent values and so the confidence interval was calculated using only the most recent eight samples to better reflect recent conditions.

Seasonal patterns were observed for beryllium, cobalt, and combined radium at AD-7 and for beryllium, cadmium, cobalt, combined radium, and lithium at AD-22. For these well/parameter pairs, Kruskal Wallis tests were performed to test whether differences between the results from different seasons were statistically significant. Statistically significant differences were found for all pairs identified above except lithium at AD-22. Where the Kruskal-Wallis test found significant seasonal effects, the data for these well/parameter pairs was deseasonalized so that the resulting confidence limits correctly account for seasonality as a predictable pattern rather than random variation or a release.

An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

The following SSLs was identified at the Pirkey FGD Stackout Area:

- The deseasonalized LCL for beryllium exceeded the GWPS of 0.00400 mg/L at AD-7 (0.00439 mg/L) and at AD-22 (0.00635 mg/L).

- The deseasonalized LCL for cobalt exceeded the GWPS of 0.056 mg/L at AD-22 (0.0727 mg/L).

As a result, the Pirkey FGD Stackout Area will either move to an assessment of corrective measures or an alternative source demonstration will be conducted to evaluate if the unit can remain in assessment monitoring.

2.2.3 Evaluation of Potential Appendix III SSIs

While SSLs were identified, a review of the Appendix III results were also completed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the June 2020 assessment monitoring event from each compliance well were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.0845 mg/L at AD-7 (1.93 mg/L) and AD-33 (0.112 mg/L).
- Chloride concentrations exceeded the interwell UPL of 40.8 mg/L at AD-22 (74.0 mg/L).
- Fluoride concentrations exceeded the interwell UPL of 1.00 mg/L at AD-22 (1.25 mg/L).
- Sulfate concentrations exceeded the interwell UPL of 80.8 mg/L at AD-22 (369 mg/L)
- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 291 mg/L at AD-7 (303 mg/L), the intrawell UPL of 651 mg/L at AD-22 (682 mg/L), and the intrawell UPL of 203 mg/L at AD-33 (206 mg/L).

While the prediction limits were calculated for a one-of-two retesting procedure, SSIs were conservatively assumed if the June 2020 sample was above the UPL or below the LPL. Based on these results, concentrations of Appendix III constituents appear to be above background concentrations.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the March and June 2020 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. SSLs were identified for beryllium and cobalt. Appendix III parameters were compared to calculated prediction limits, with exceedances identified for boron, chloride, fluoride, sulfate, and TDS.

Based on this evaluation, the Pirkey FGD Stackout Area CCR unit will either move to an assessment of corrective measures or an ASD will be conducted to evaluate if the unit can remain in assessment monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – H.W. Pirkey Plant. January 2017.

Geosyntec Consultants. 2019. Statistical Analysis Summary – Flue Gas Desulfurization (FGD) Stackout Area, H.W. Pirkey Plant, Hallsville, Texas. December 10, 2019.

TABLES

Table 1 - Groundwater Data Summary
Pirkey Plant - Stackout Pad

Parameter	Unit	AD-7		AD-12		AD-13		AD-22		AD-33	
		3/10/2020	6/2/2020	3/10/2020	6/2/2020	3/10/2020	6/2/2020	3/10/2020	6/2/2020	3/10/2020	6/2/2020
Antimony	µg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Arsenic	µg/L	1.54	1.29	0.09 J	0.09 J	1.58	1.39	4.26	3.53	0.63	0.61
Barium	µg/L	31.0	38.9	21.7	19.0	38.4	35.6	18.2	14.4	45.3	41.3
Beryllium	µg/L	5.29	5.14	0.139	0.132	0.327	0.222	10.1	8.00	1.18	1.15
Boron	mg/L	1.99	1.93	0.02 J	0.05 U	0.067	0.065	0.067	0.062	0.132	0.112
Cadmium	µg/L	0.72	0.69	0.01 J	0.05 U	0.05 U	0.05 U	1.41	1.43	0.06	0.05 J
Calcium	mg/L	4.86	4.98	0.3 J	0.2 J	10.7	10.9	12.7	13.1	1.61	1.49
Chloride	mg/L	28.7	29.1	6.08	5.63	41.1	41.4	73.6	74.0	8.81	8.89
Chromium	µg/L	0.212	0.241	0.2 J	0.208	0.06 J	0.07 J	0.398	0.376	0.1 J	0.2 J
Cobalt	µg/L	42.1	39.6	1.21	1.02	44.7	43.7	108	101	9.67	8.78
Combined Radium	pCi/L	5.283	4.1	3.0706	0.799	1.382	1.116	7.68	4.334	2.479	1.477
Fluoride	mg/L	0.57	0.58	0.10	0.10	0.32	0.45	1.25	1.25	0.25	0.28
Lead	µg/L	0.943	0.876	0.09 J	0.09 J	0.2 U	0.2 U	0.346	0.261	0.208	0.2 J
Lithium	mg/L	0.0781	0.0720	0.00547	0.00505	0.145	0.140	0.222	0.185	0.0197	0.0188
Mercury	µg/L	0.179	0.349	0.005 U	0.005 U	0.005 U	0.005 U	1.58	0.171	2.45	2.52
Molybdenum	µg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Selenium	µg/L	5.5	5.0	0.2	0.3	0.2 U	0.04 J	10.5	10.7	2.0	2.1
Sulfate	mg/L	88.5	74.4	3.7	3.9	82.7	83.4	364	369	64.5	63.1
Thallium	µg/L	0.2 J	0.2 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.3 J	0.5 U	0.5 U
Total Dissolved Solids	mg/L	254	303	62	91	216	322	654	682	172	206
pH	SU	3.5	3.3	4.9	4.0	6.4	6.4	3.8	3.6	4.0	3.9

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.
J: Estimated value. Parameter was detected in concentrations below the reporting limit.

Table 2: Groundwater Protection Standards
Pirkey Plant - Stackout

Geosyntec Consultants, Inc.

Constituent Name	MCL	CCR Rule-Specified	Calculated UTL
Antimony, Total (mg/L)	0.006		0.005
Arsenic, Total (mg/L)	0.01		0.007
Barium, Total (mg/L)	2		0.051
Beryllium, Total (mg/L)	0.004		0.002
Cadmium, Total (mg/L)	0.005		0.001
Chromium, Total (mg/L)	0.1		0.002
Cobalt, Total (mg/L)	n/a	0.006	0.056
Combined Radium, Total (pCi/L)	5		3.00
Fluoride, Total (mg/L)	4		1
Lead, Total (mg/L)	n/a	0.015	0.005
Lithium, Total (mg/L)	n/a	0.04	0.17
Mercury, Total (mg/L)	0.002		0.000025
Molybdenum, Total (mg/L)	n/a	0.1	0.005
Selenium, Total (mg/L)	0.05		0.005
Thallium, Total (mg/L)	0.002		0.002

Notes:
Grey cell indicates calculated UTL is higher than MCL or CCR Rule-specified value.
MCL = Maximum Contaminant Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3 - Appendix III Data Summary
Pirkey Plant - Stackout Pad

Geosyntec Consultants, Inc.

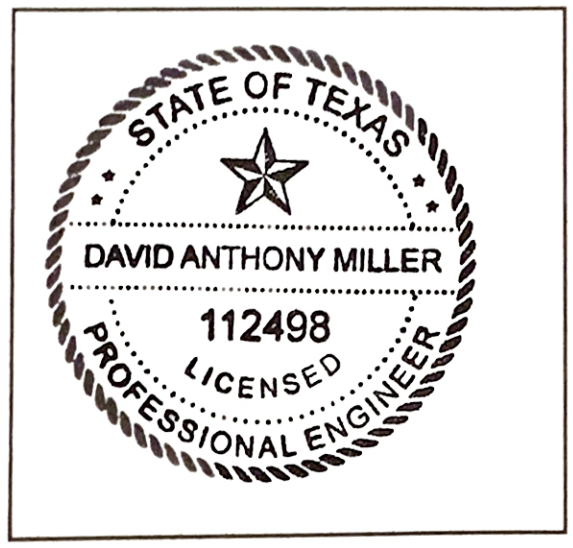
Analyte	Unit	Description	AD-7	AD-22	AD-33
			6/2/2020	6/2/2020	6/2/2020
Boron	mg/L	Interwell Background Value (UPL)	0.0845		
		Analytical Result	**1.93**	0.062	**0.112**
Calcium	mg/L	Intrawell Background Value (UPL)	5.32	15.2	2.29
		Analytical Result	4.98	13.1	1.49
Chloride	mg/L	Interwell Background Value (UPL)	40.8		
		Analytical Result	29.1	**74.0**	8.89
Fluoride	mg/L	Interwell Background Value (UPL)	1.00		
		Analytical Result	0.58	**1.25**	0.28
pH	SU	Intrawell Background Value (UPL)	4.5	4.9	4.7
		Intrawell Background Value (LPL)	3.0	3.6	2.7
		Analytical Result	3.3	3.6	3.9
Sulfate	mg/L	Interwell Background Value (UPL)	80.8		
		Analytical Result	74.4	**369**	63.1
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	291	651	203
		Analytical Result	**303**	**682**	**206**

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A
Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Pirkey FGD Stackout Area CCR management area and that the requirements of 40 CFR 257.93(f) have been met.



DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

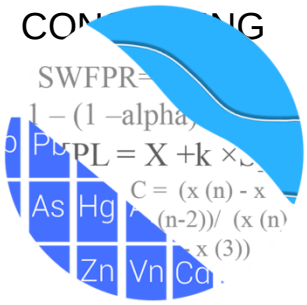
Signature

112498	TEXAS	10.02.2020
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS CONSULTING



September 17, 2020

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Pirkey Stackout
Assessment Monitoring Event – June 2020

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the Assessment Monitoring Event statistical analysis of groundwater data through June 2020 for American Electric Power Inc.'s Pirkey Stackout. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** AD-12 and AD-13
- **Downgradient wells:** AD-22, AD-33, and AD-7

Data were sent electronically to Groundwater Stats Consulting, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC. The analysis was reviewed by Dr. Jim Loftis, Civil & Environmental Engineering professor emeritus at Colorado State University and Senior Advisor to Groundwater Stats Consulting.

The CCR Assessment Monitoring program consists of the following constituents:

- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium

Time series plots and box plots for Appendix IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B).

Background Screening

Prior to constructing statistical limits, background data are screened through time series plots for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Values identified as outliers are flagged with (o) and displayed in a lighter font and disconnected symbol on the time series graphs. A summary of flagged outliers and excluded values is included as Figure C.

For the current analysis all data through June 2020 were screened, including data at downgradient wells. For the downgradient well data that are used to construct confidence intervals, a regulatory conservative approach is taken in that values that are marginally high relative to the rest of the data are retained unless there is particular justification for excluding them. In particular, for the 9/7/16 observations, the values were very high for several constituents at the same time, suggesting a likely systematic error. Therefore, those values were flagged. Additionally, reported mercury values in well AD-22 prior to April 2017 were unusually high compared to recently reported measurements and were, therefore, flagged with an "L" and deselected prior to constructing confidence intervals. The most recent 8 observations, which are consistently stable, are used to represent present-day groundwater quality conditions.

Several outliers were flagged as a result of changes in reporting limits. The reporting limit during the February and May 2019 events for molybdenum at all wells (except for well AD-7 in February) was 0.04 mg/L, compared to the previous reporting limit of 0.002 mg/L. The resulting nondetects reported at 0.04 mg/L are censored at much higher levels than the rest of the data and, therefore, are flagged as outliers. The reporting limit (practical quantitation limit) for the February 2019 event for thallium also increased from the historical reporting limit of 0.002 mg/L to 0.01 mg/L for all wells. However, since no detections were present above the method detection limit of 0.002 mg/L, the historical

reporting limit of 0.002 mg/L was used for historic nondetects, and the nondetects with a reporting limit of 0.01 mg/L were flagged as outliers.

Summary of Statistical Methods

Assessment monitoring for Appendix IV parameters involves the comparison of a confidence interval for each parameter at each downgradient well against the corresponding Ground Water Protection Standard (GWPS). If, and only if, the entire confidence interval exceeds the GWPS, the well/constituent is considered to exceed its standard. The GWPS is determined for each parameter as the largest of the Maximum Contaminant Levels (MCLs), CCR Rule-Specified levels, or background limits determined from tolerance limits on pooled upgradient well data.

Prior to computing tolerance limits on upgradient well data or confidence intervals on downgradient well data, the distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric tolerance limits and confidence intervals as appropriate, based on the following criteria.

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).
- When data contain <15% nondetects in background, the reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory. There is no replacement of historical reporting limits with the most recent reporting limit. For several constituents, the most recent reporting limits are significantly lower than those reported historically. This is the most conservative approach for tolerance limits and confidence intervals at this site.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric tolerance limits and confidence intervals are used on data containing greater than 50% nondetects.

Evaluation of Appendix IV Parameters – June 2020

When data followed a normal or transformed-normal distribution, parametric tolerance limits were used to calculate background limits for Appendix IV parameters using pooled upgradient well data through June 2020 with a target of 95% confidence and 95%

coverage (Figure D). Nonparametric tolerance limits are constructed when data do not follow a normal or transformed-normal distribution or when there are greater than 50% nondetects. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These background limits were then compared to the Maximum Contaminant Levels (MCLs) and CCR Rule-Specified levels to determine the highest limit for use as the GWPS in the confidence interval comparisons (Figure E).

Confidence intervals were then constructed on downgradient wells with data through June 2020 for each of the Appendix IV parameters using either parametric or nonparametric intervals depending on the data distribution and percentage of nondetects, similar to the logic used to construct tolerance limits as discussed above (Figure F). Each confidence interval was compared with the corresponding GWPS from Figure E. Only when the entire confidence interval is above the GWPS is the well/constituent pair considered to exceed its respective standard. Both a tabular summary and graphical presentation of the confidence interval results follow this letter. Exceedances were noted for the following well/constituent pairs:

- Beryllium: AD-22
- Cobalt: AD-22

Seasonal patterns were observed on the time series plots in well AD-22 for beryllium, cadmium, cobalt, combined radium 226 + 228, and lithium; and in well AD-7 for beryllium, cobalt, and combined radium 226 + 228. The Kruskal-Wallis test was used to evaluate seasonality for these well/constituent pairs and confirmed seasonality for all those listed above except for lithium in well AD-22 (Figure G). When seasonal patterns are observed, data are deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation or a release. This procedure includes subtracting the seasonal mean from each value within a given season, and adding the overall mean to each observation. Confidence intervals were constructed with deseasonalized values, and the results follow this letter (Figure H). The GWPS was exceeded by the following well/constituent pairs:

- Beryllium: AD-22 and AD-7
- Cobalt: AD-22

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for Pirkey Stackout. If you have any questions or comments, please feel free to contact us.

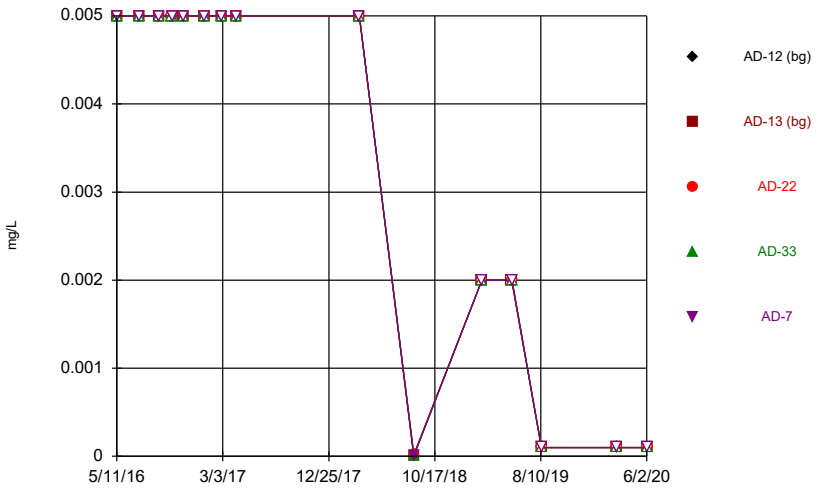
For Groundwater Stats Consulting,

Andrew T. Collins
Project Manager

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

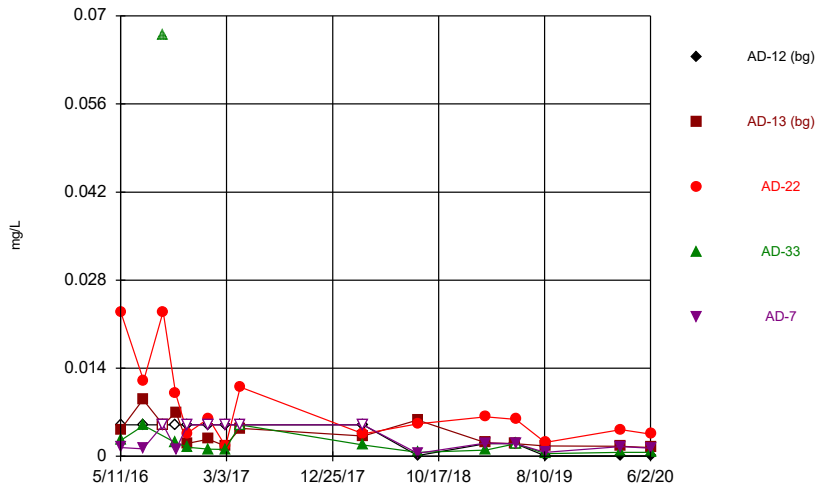
Time Series



Constituent: Antimony, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

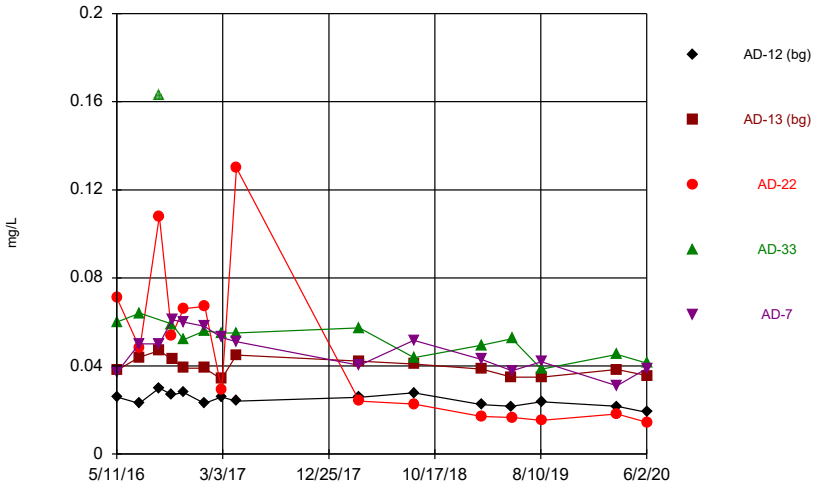
Time Series



Constituent: Arsenic, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

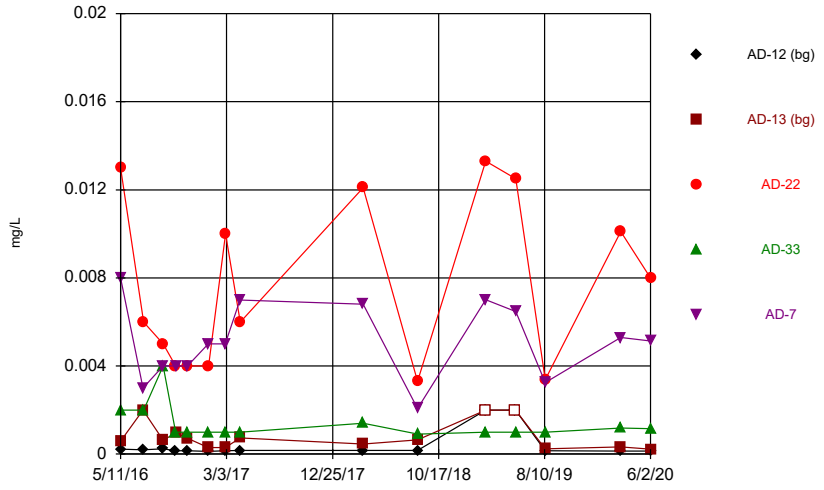
Time Series



Constituent: Barium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

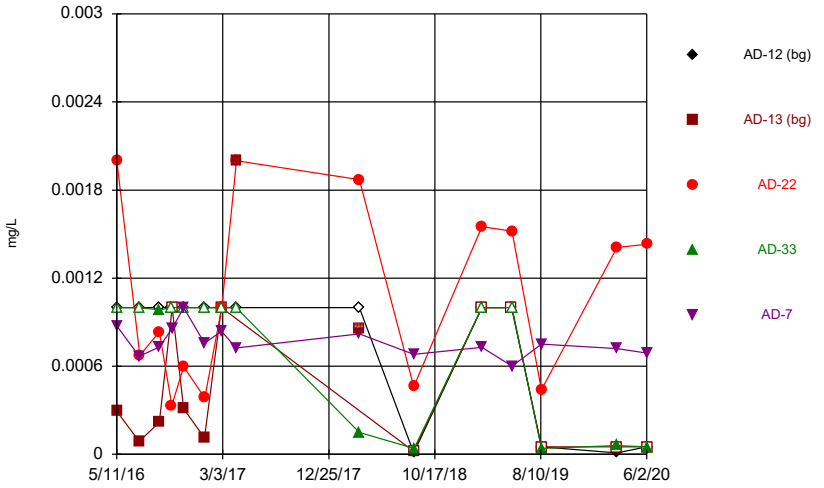
Time Series



Constituent: Beryllium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

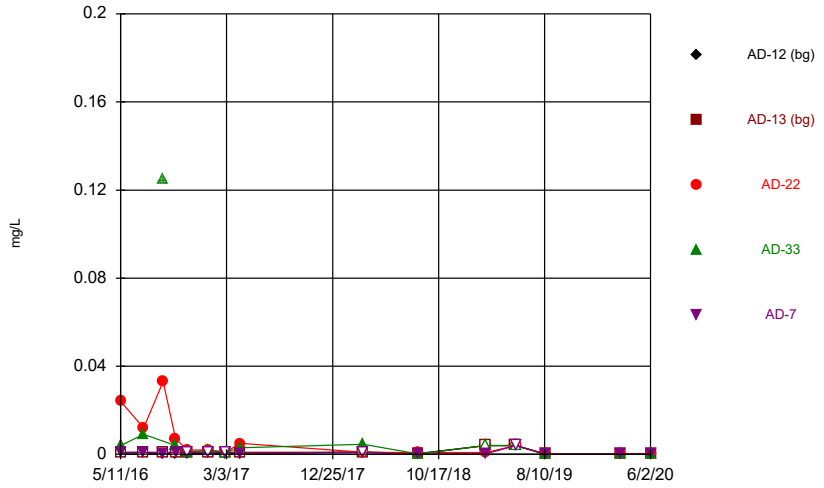
Time Series



Constituent: Cadmium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

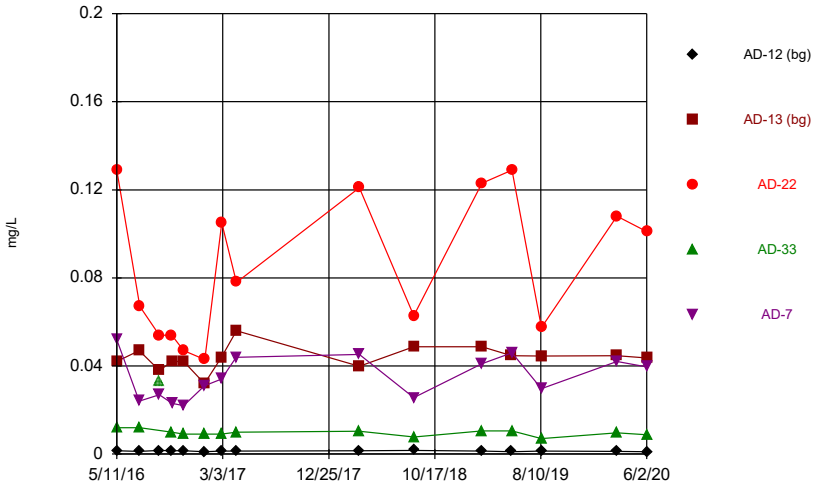
Time Series



Constituent: Chromium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

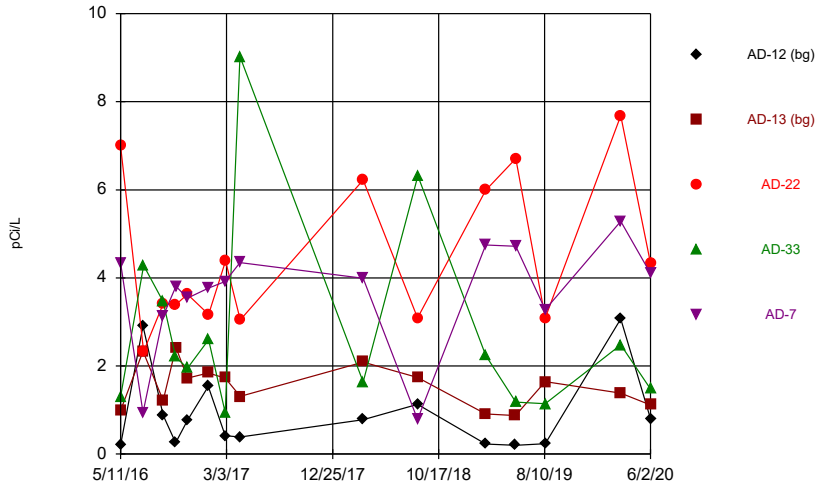
Time Series



Constituent: Cobalt, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

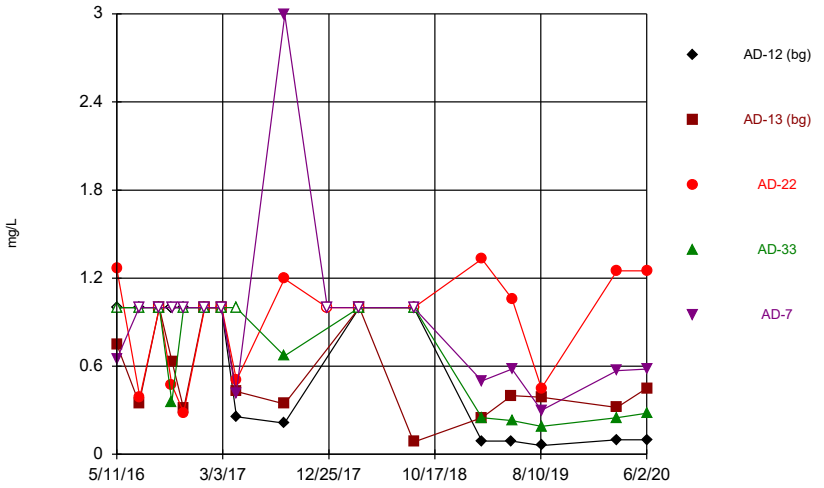
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

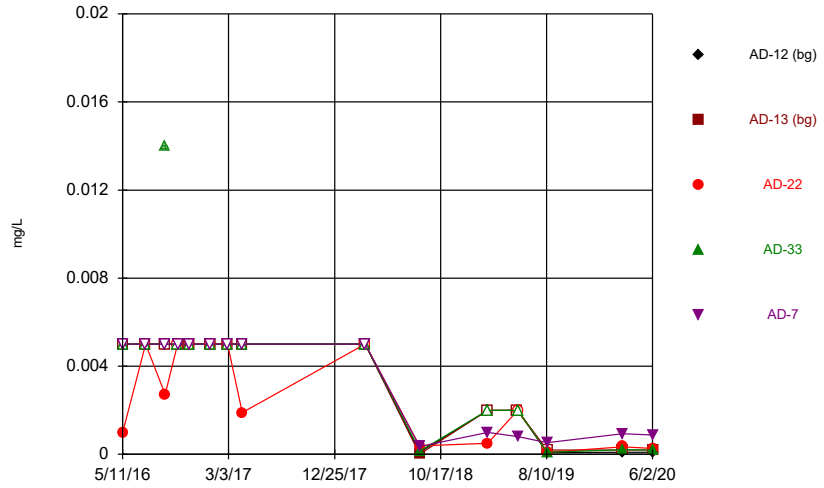
Time Series



Constituent: Fluoride, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

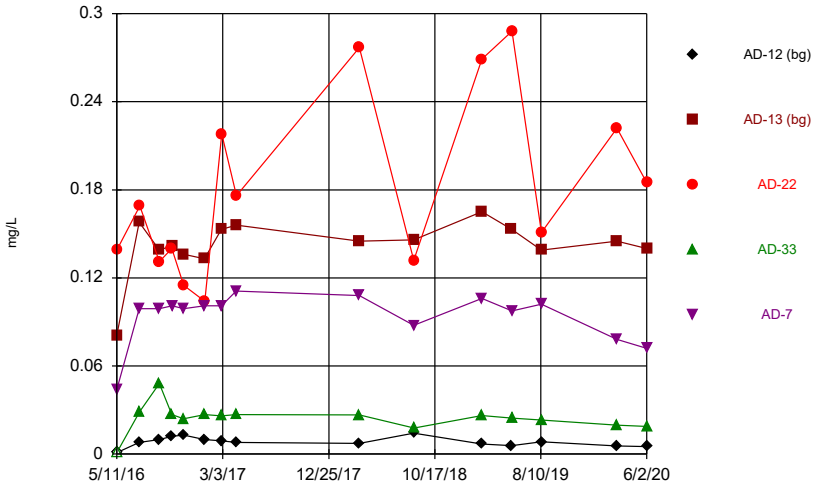
Time Series



Constituent: Lead, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

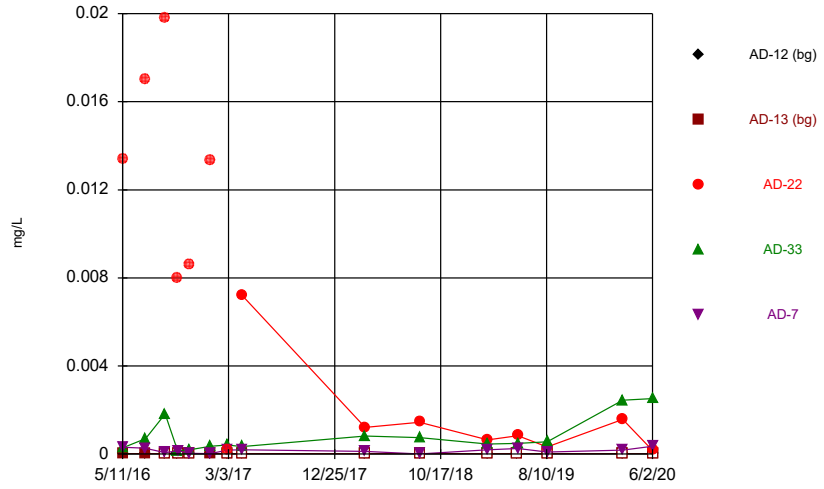
Time Series



Constituent: Lithium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

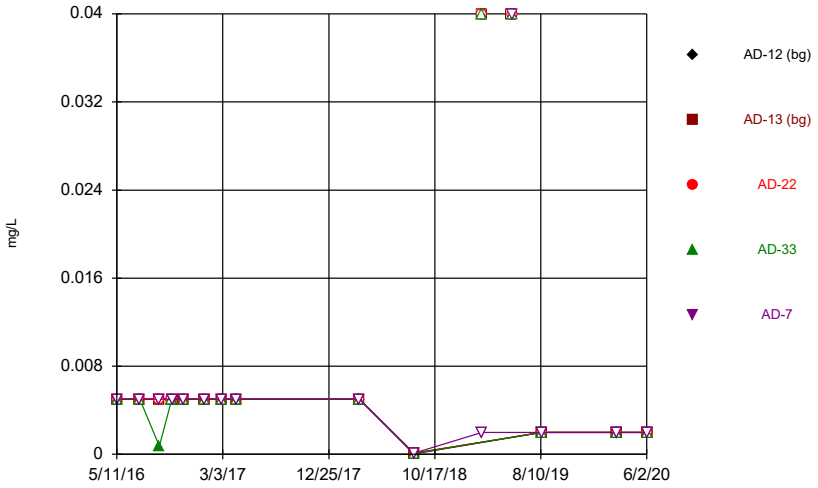
Time Series



Constituent: Mercury, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

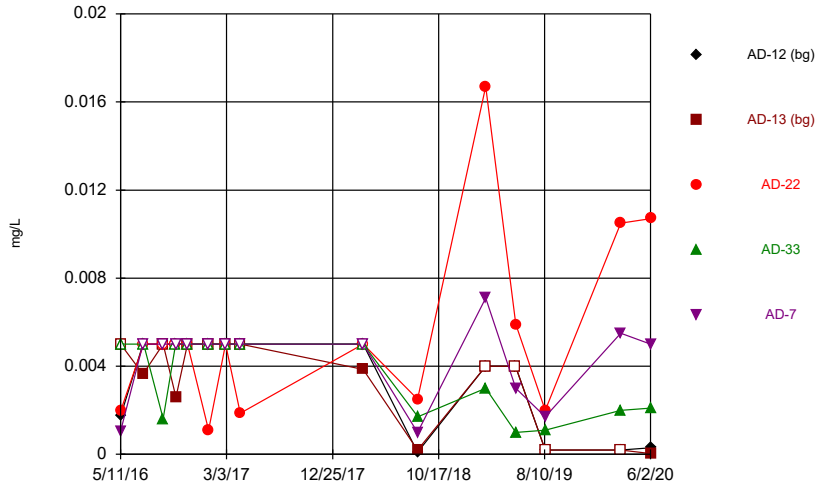
Time Series



Constituent: Molybdenum, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

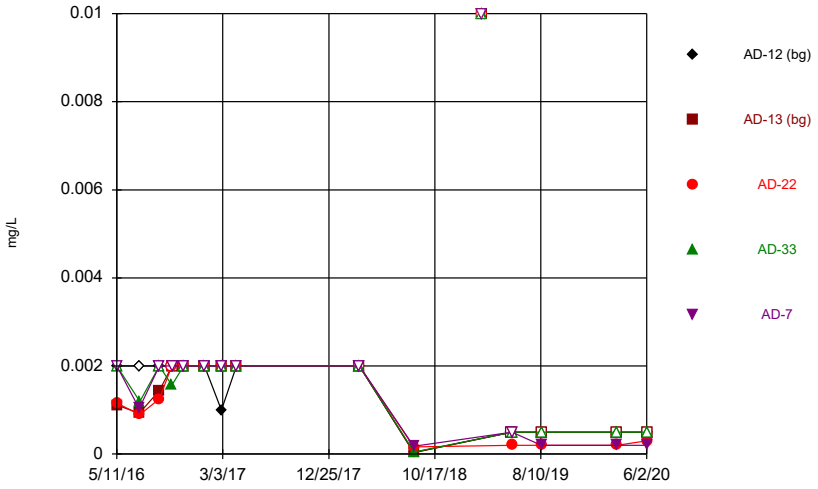
Time Series



Constituent: Selenium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

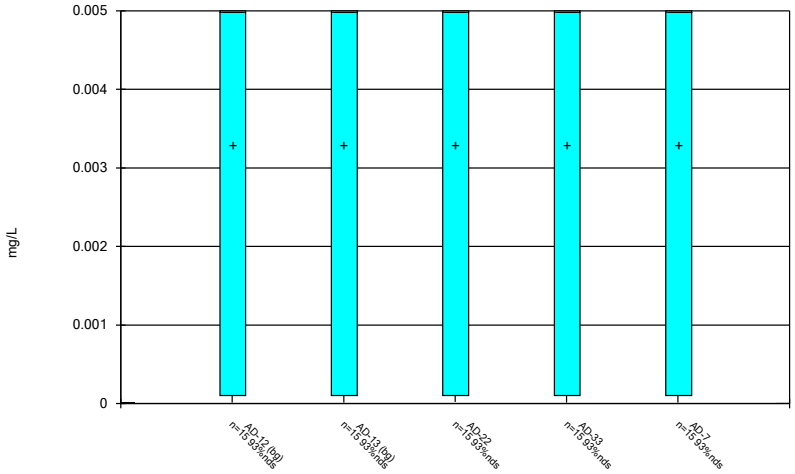
Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



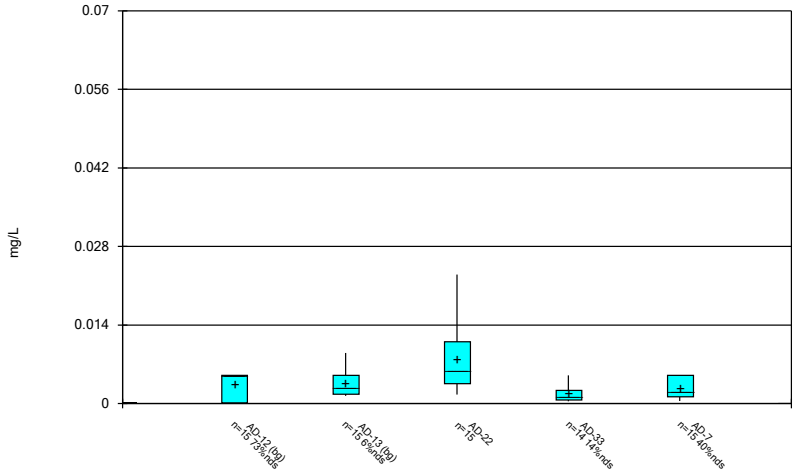
Constituent: Thallium, total Analysis Run 9/17/2020 10:30 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



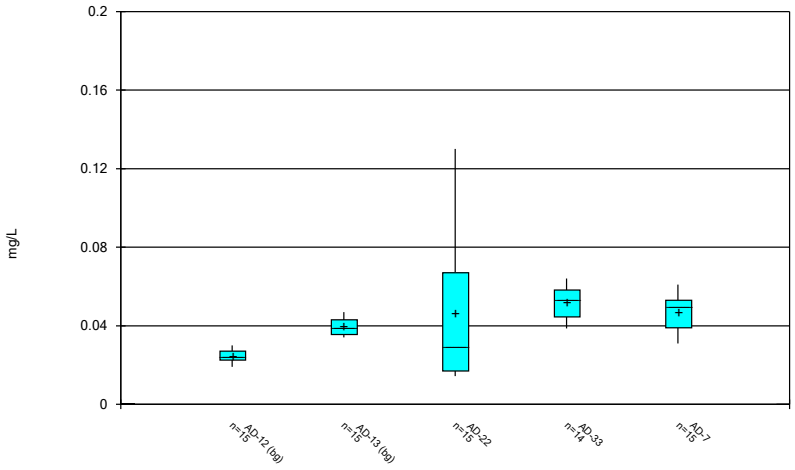
Constituent: Antimony, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



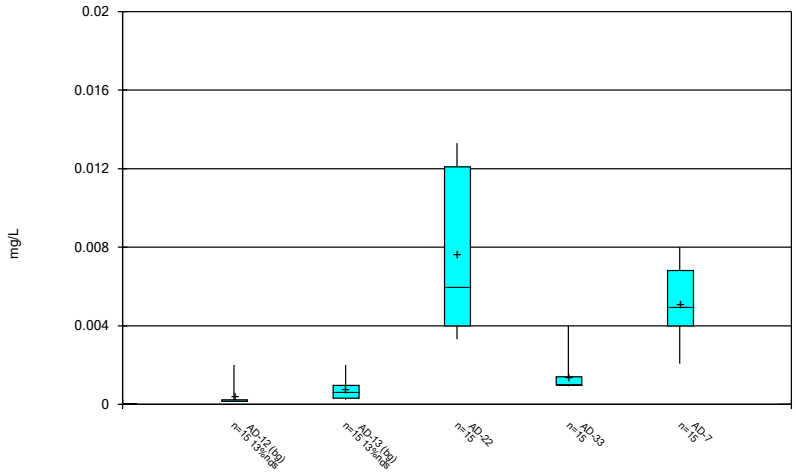
Constituent: Arsenic, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



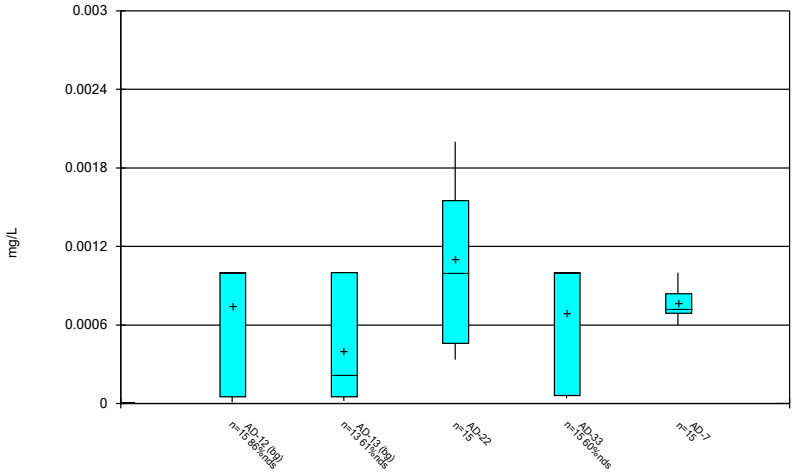
Constituent: Barium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



Constituent: Beryllium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

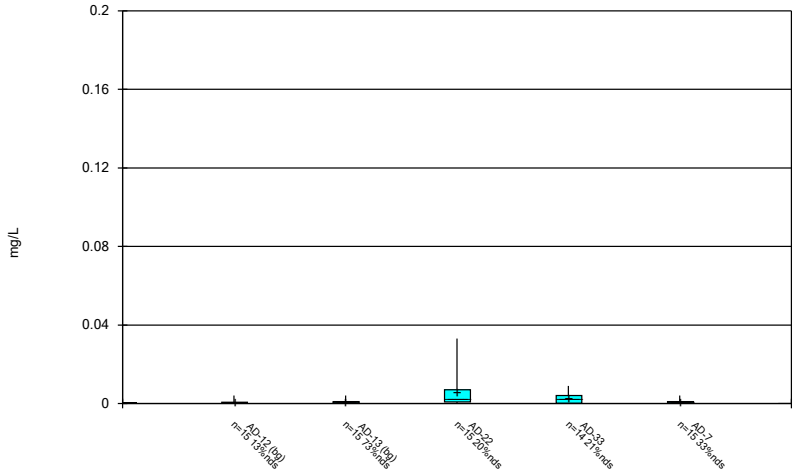
Box & Whiskers Plot



Constituent: Cadmium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

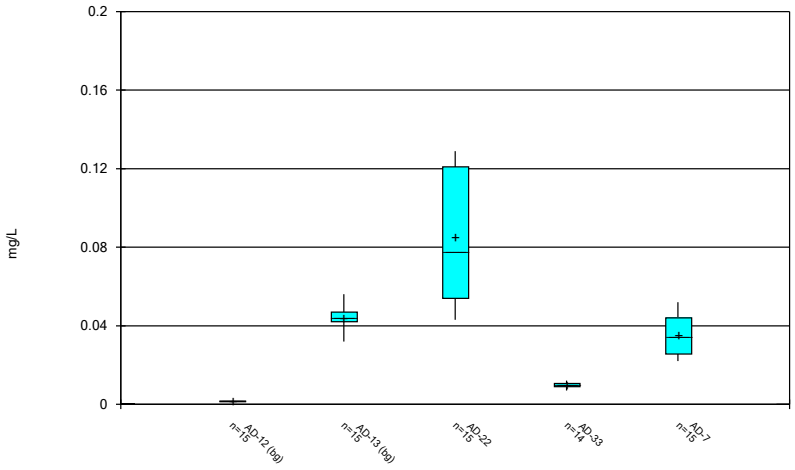
Box & Whiskers Plot



Constituent: Chromium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

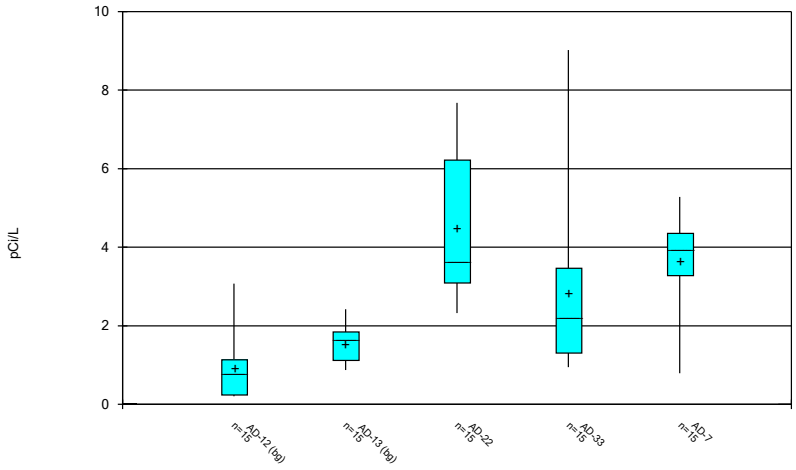
Box & Whiskers Plot



Constituent: Cobalt, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

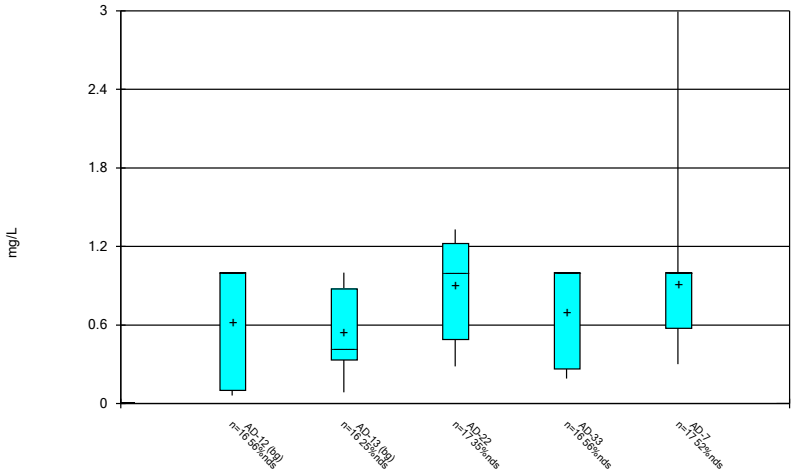
Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

Box & Whiskers Plot



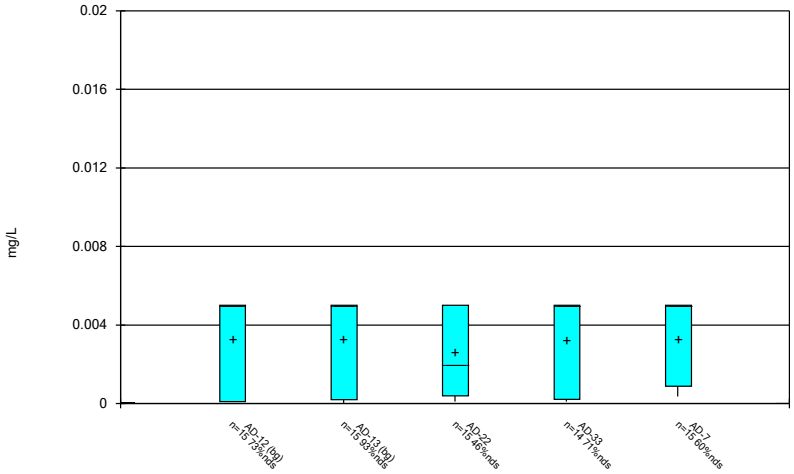
Constituent: Combined Radium 226 + 228 Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



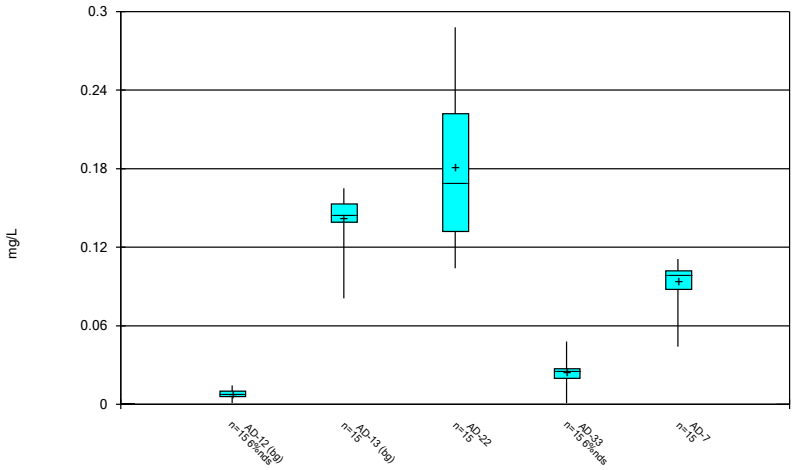
Constituent: Fluoride, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



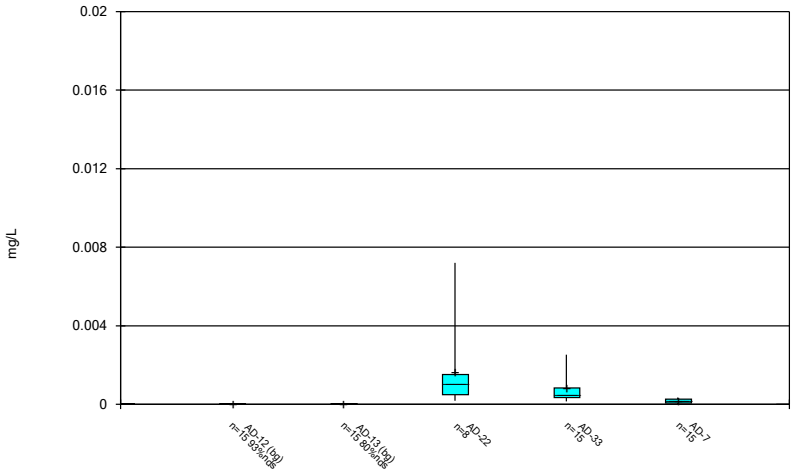
Constituent: Lead, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



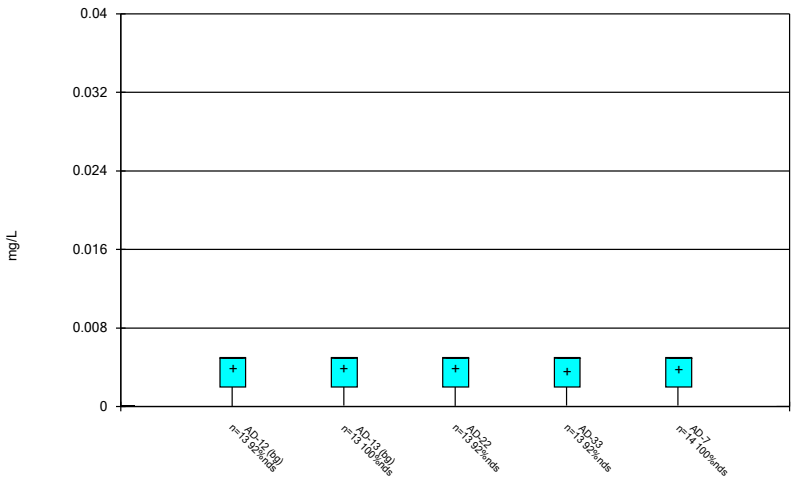
Constituent: Lithium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



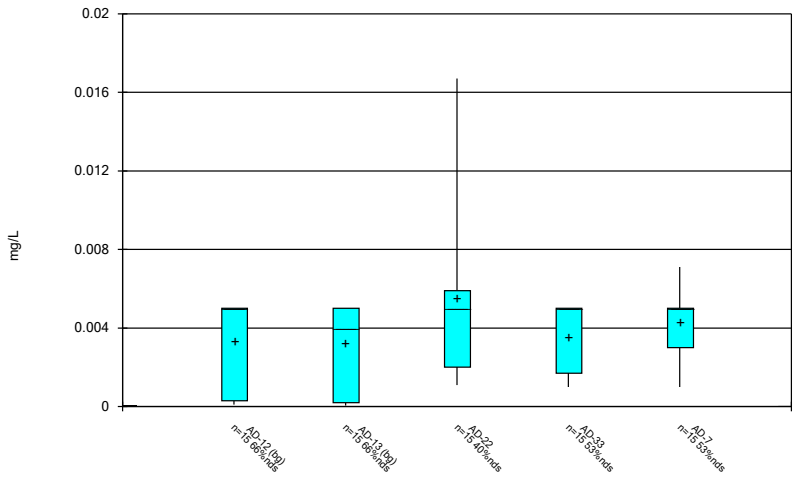
Constituent: Mercury, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



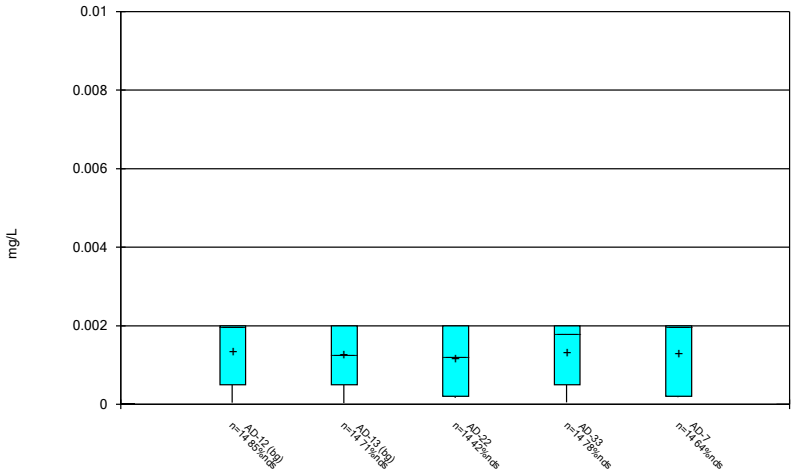
Constituent: Molybdenum, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



Constituent: Selenium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Box & Whiskers Plot



Constituent: Thallium, total Analysis Run 9/17/2020 10:15 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Excluded Values Summary

Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 9/17/2020, 10:24 AM

	AD-33 Arsenic, total (mg/L)	AD-33 Barium, total (mg/L)	AD-13 Cadmium, total (mg/L)	AD-33 Chromium, total (mg/L)	AD-33 Cobalt, total (mg/L)	AD-33 Lead, total (mg/L)	AD-22 Mercury, total (mg/L)	AD-12 Molybdenum, total (mg/L)	AD-13 Molybdenum, total (mg/L)	AD-22 Molybdenum, total (mg/L)
5/11/2016							0.01341 (L)			
7/14/2016							0.017 (L)			
9/7/2016	0.067 (o)	0.163 (o)		0.125 (o)	0.033 (o)	0.014 (o)	0.019829 (L)			
10/12/2016							0.007984 (L)			
11/14/2016							0.008634 (L)			
1/12/2017							0.01332 (L)			
3/1/2017							0.00022 (L)			
4/11/2017			0.002 (o)							
3/21/2018			0.00086 (J,o)							
2/27/2019								<0.04 (o)	<0.04 (o)	<0.04 (o)
5/21/2019								<0.04 (o)	<0.04 (o)	
5/22/2019										<0.04 (o)

	AD-33 Molybdenum, total (mg/L)	AD-7 Molybdenum, total (mg/L)	AD-12 Thallium, total (mg/L)	AD-13 Thallium, total (mg/L)	AD-22 Thallium, total (mg/L)	AD-33 Thallium, total (mg/L)	AD-7 Thallium, total (mg/L)
5/11/2016							
7/14/2016							
9/7/2016							
10/12/2016							
11/14/2016							
1/12/2017							
3/1/2017							
4/11/2017							
3/21/2018							
2/27/2019	<0.04 (o)		<0.01 (o)	<0.01 (o)	<0.01 (o)	<0.01 (o)	<0.01 (o)
5/21/2019							
5/22/2019	<0.04 (o)	<0.04 (o)					

Tolerance Limit Summary Table

Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 8/31/2020, 1:53 PM

Constituent	Upper Lim.	Lower Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	0.005	n/a	n/a	30	n/a	n/a	93.33	n/a	n/a	0.2146	NP Inter(NDs)
Arsenic, total (mg/L)	0.007024	n/a	n/a	30	0.002283	0.002136	40	Kaplan-Meier	No	0.05	Inter
Barium, total (mg/L)	0.05071	n/a	n/a	30	0.03213	0.00837	0	None	No	0.05	Inter
Beryllium, total (mg/L)	0.002	n/a	n/a	30	n/a	n/a	13.33	n/a	n/a	0.2146	NP Inter(normality)
Cadmium, total (mg/L)	0.001	n/a	n/a	28	n/a	n/a	75	n/a	n/a	0.2378	NP Inter(NDs)
Chromium, total (mg/L)	0.001732	n/a	n/a	30	-8.25	0.8522	43.33	Kaplan-Meier	ln(x)	0.05	Inter
Cobalt, total (mg/L)	0.056	n/a	n/a	30	n/a	n/a	0	n/a	n/a	0.2146	NP Inter(normality)
Combined Radium 226 + 228 (pCi/L)	3.008	n/a	n/a	30	1.238	0.7976	0	None	No	0.05	Inter
Fluoride, total (mg/L)	1	n/a	n/a	32	n/a	n/a	40.63	n/a	n/a	0.1937	NP Inter(normality)
Lead, total (mg/L)	0.005	n/a	n/a	30	n/a	n/a	83.33	n/a	n/a	0.2146	NP Inter(NDs)
Lithium, total (mg/L)	0.165	n/a	n/a	30	n/a	n/a	3.333	n/a	n/a	0.2146	NP Inter(normality)
Mercury, total (mg/L)	0.000025	n/a	n/a	30	n/a	n/a	86.67	n/a	n/a	0.2146	NP Inter(NDs)
Molybdenum, total (mg/L)	0.005	n/a	n/a	26	n/a	n/a	96.15	n/a	n/a	0.2635	NP Inter(NDs)
Selenium, total (mg/L)	0.005	n/a	n/a	30	n/a	n/a	66.67	n/a	n/a	0.2146	NP Inter(NDs)
Thallium, total (mg/L)	0.002	n/a	n/a	28	n/a	n/a	78.57	n/a	n/a	0.2378	NP Inter(NDs)

PIRKEY STACKOUT GWPS				
Constituent Name	**MCL**	**CCR-Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (mg/L)	0.006		0.005	0.006
Arsenic, Total (mg/L)	0.01		0.007	0.01
Barium, Total (mg/L)	2		0.051	2
Beryllium, Total (mg/L)	0.004		0.002	0.004
Cadmium, Total (mg/L)	0.005		0.001	0.005
Chromium, Total (mg/L)	0.1		0.0017	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.056	0.056
Combined Radium, Total (pCi/L)	5		3	5
Fluoride, Total (mg/L)	4		1	4
Lead, Total (mg/L)	0.015		0.005	0.015
Lithium, Total (mg/L)	n/a	0.04	0.17	0.17
Mercury, Total (mg/L)	0.002		0.000025	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.005	0.1
Selenium, Total (mg/L)	0.05		0.005	0.05
Thallium, Total (mg/L)	0.002		0.002	0.002

**Grey cell indicates Background Limit is higher than MCL or CCR-Rule Specified Level*

**MCL = Maximum Contaminant Level*

**CCR = Coal Combustion Residual*

**GWPS = Groundwater Protection Standard*

Confidence Intervals Summary Table - Significant Results

Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 9/17/2020, 10:27 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium, total (mg/L)	**AD-22**	**0.009637**	**0.004719**	**0.004**	**Yes**	**15**	**0.007645**	**0.003828**	**0**	**None**	**ln(x)**	**0.01**	**Param.**
Cobalt, total (mg/L)	**AD-22**	**0.1039**	**0.06069**	**0.056**	**Yes**	**15**	**0.08529**	**0.03223**	**0**	**None**	**ln(x)**	**0.01**	**Param.**

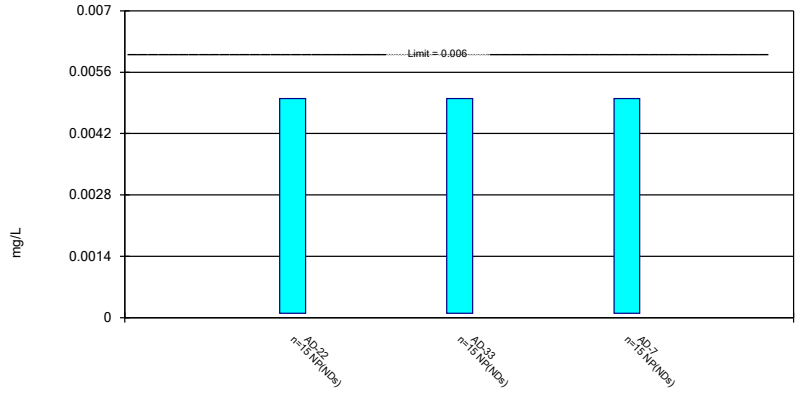
Confidence Intervals Summary Table - All Results

Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 9/17/2020, 10:27 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	AD-22	0.005	0.0001	0.006	No	15	0.003288	0.00225	93.33	None	No	0.01	NP (NDs)
Antimony, total (mg/L)	AD-33	0.005	0.0001	0.006	No	15	0.003287	0.002251	93.33	None	No	0.01	NP (NDs)
Antimony, total (mg/L)	AD-7	0.005	0.0001	0.006	No	15	0.003287	0.002251	93.33	None	No	0.01	NP (NDs)
Arsenic, total (mg/L)	AD-22	0.01026	0.003594	0.01	No	15	0.008081	0.006787	0	None	ln(x)	0.01	Param.
Arsenic, total (mg/L)	AD-33	0.002362	0.0008009	0.01	No	14	0.001811	0.001479	14.29	None	ln(x)	0.01	Param.
Arsenic, total (mg/L)	AD-7	0.005	0.00108	0.01	No	15	0.00278	0.001921	40	None	No	0.01	NP (normality)
Barium, total (mg/L)	AD-22	0.05967	0.02152	2	No	15	0.04676	0.03601	0	None	ln(x)	0.01	Param.
Barium, total (mg/L)	AD-33	0.05764	0.0475	2	No	14	0.05209	0.007502	0	None	x^3	0.01	Param.
Barium, total (mg/L)	AD-7	0.05298	0.04051	2	No	15	0.04696	0.009146	0	None	sqrt(x)	0.01	Param.
Beryllium, total (mg/L)	**AD-22**	**0.009637**	**0.004719**	**0.004**	**Yes**	**15**	**0.007645**	**0.003828**	**0**	**None**	**ln(x)**	**0.01**	**Param.**
Beryllium, total (mg/L)	AD-33	0.002	0.000905	0.004	No	15	0.001376	0.0008065	0	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	AD-7	0.006231	0.003906	0.004	No	15	0.005069	0.001715	0	None	No	0.01	Param.
Cadmium, total (mg/L)	AD-22	0.001456	0.000627	0.005	No	15	0.0011	0.0006127	0	None	x^(1/3)	0.01	Param.
Cadmium, total (mg/L)	AD-33	0.001	0.00005	0.005	No	15	0.0006883	0.0004547	60	None	No	0.01	NP (NDs)
Cadmium, total (mg/L)	AD-7	0.0008252	0.0006941	0.005	No	15	0.0007627	0.0001001	0	None	ln(x)	0.01	Param.
Chromium, total (mg/L)	AD-22	0.004705	0.0005068	0.1	No	15	0.00624	0.009734	20	Kaplan-Meier	ln(x)	0.01	Param.
Chromium, total (mg/L)	AD-33	0.002969	0.0002839	0.1	No	14	0.002656	0.002524	21.43	Kaplan-Meier	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	AD-7	0.0004389	0.0001532	0.1	No	15	0.0008153	0.0009626	33.33	Kaplan-Meier	ln(x)	0.01	Param.
Cobalt, total (mg/L)	**AD-22**	**0.1039**	**0.06069**	**0.056**	**Yes**	**15**	**0.08529**	**0.03223**	**0**	**None**	**ln(x)**	**0.01**	**Param.**
Cobalt, total (mg/L)	AD-33	0.01069	0.008684	0.056	No	14	0.009685	0.001413	0	None	No	0.01	Param.
Cobalt, total (mg/L)	AD-7	0.04137	0.02815	0.056	No	15	0.03509	0.009769	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-22	5.422	3.266	5	No	15	4.498	1.736	0	None	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-33	3.509	1.46	5	No	15	2.816	2.227	0	None	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-7	4.468	3.296	5	No	15	3.648	1.264	0	None	x^3	0.01	Param.
Fluoride, total (mg/L)	AD-22	1.044	0.4482	4	No	17	0.9089	0.3463	35.29	Kaplan-Meier	x^3	0.01	Param.
Fluoride, total (mg/L)	AD-33	1	0.25	4	No	16	0.7017	0.3643	56.25	Kaplan-Meier	No	0.01	NP (NDs)
Fluoride, total (mg/L)	AD-7	1	0.57	4	No	17	0.9168	0.5919	52.94	Kaplan-Meier	No	0.01	NP (NDs)
Lead, total (mg/L)	AD-22	0.005	0.000346	0.015	No	15	0.002613	0.002141	46.67	None	No	0.01	NP (normality)
Lead, total (mg/L)	AD-33	0.005	0.0002	0.015	No	14	0.00319	0.002247	71.43	None	No	0.01	NP (NDs)
Lead, total (mg/L)	AD-7	0.005	0.0008	0.015	No	15	0.003301	0.00216	60	None	No	0.01	NP (NDs)
Lithium, total (mg/L)	AD-22	0.2147	0.1381	0.17	No	15	0.1811	0.06046	0	None	ln(x)	0.01	Param.
Lithium, total (mg/L)	AD-33	0.029	0.0188	0.17	No	15	0.0244	0.00947	6.667	None	No	0.01	NP (normality)
Lithium, total (mg/L)	AD-7	0.104	0.09074	0.17	No	15	0.09375	0.01733	0	None	x^6	0.01	Param.
Mercury, total (mg/L)	AD-22	0.003088	0.0002845	0.002	No	8	0.001677	0.002289	0	None	ln(x)	0.01	Param.
Mercury, total (mg/L)	AD-33	0.001023	0.0003243	0.002	No	15	0.0008215	0.0007847	0	None	ln(x)	0.01	Param.
Mercury, total (mg/L)	AD-7	0.000233	0.00009001	0.002	No	15	0.0001615	0.0001055	0	None	No	0.01	Param.
Molybdenum, total (mg/L)	AD-22	0.005	0.002	0.1	No	13	0.003928	0.001741	92.31	None	No	0.01	NP (NDs)
Molybdenum, total (mg/L)	AD-33	0.005	0.0007365	0.1	No	13	0.003603	0.001911	92.31	None	No	0.01	NP (NDs)
Molybdenum, total (mg/L)	AD-7	0.005	0.002	0.1	No	14	0.003793	0.001746	100	None	No	0.01	NP (NDs)
Selenium, total (mg/L)	AD-22	0.005043	0.001657	0.05	No	15	0.005549	0.004187	40	Kaplan-Meier	ln(x)	0.01	Param.
Selenium, total (mg/L)	AD-33	0.005	0.001613	0.05	No	15	0.003501	0.001717	53.33	Kaplan-Meier	No	0.01	NP (NDs)
Selenium, total (mg/L)	AD-7	0.005	0.0017	0.05	No	15	0.00429	0.001765	53.33	Kaplan-Meier	No	0.01	NP (NDs)
Thallium, total (mg/L)	AD-22	0.002	0.0002	0.002	No	14	0.001169	0.0008233	42.86	None	No	0.01	NP (normality)
Thallium, total (mg/L)	AD-33	0.002	0.0005	0.002	No	14	0.001344	0.0007651	78.57	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	AD-7	0.002	0.0002	0.002	No	14	0.001308	0.0008556	64.29	None	No	0.01	NP (NDs)

Non-Parametric Confidence Interval

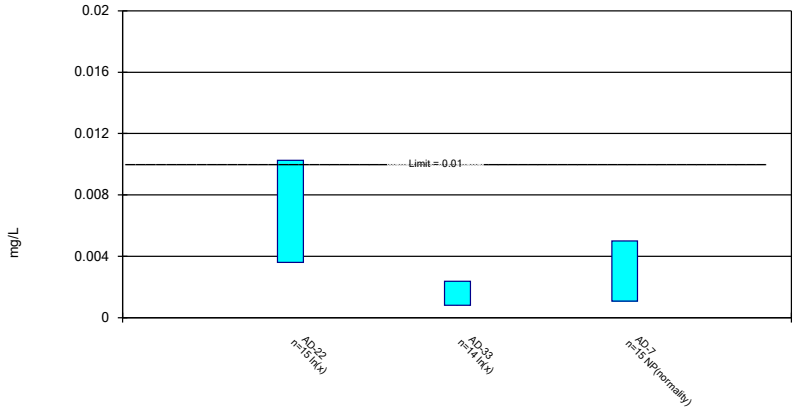
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Antimony, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric and Non-Parametric (NP) Confidence Interval

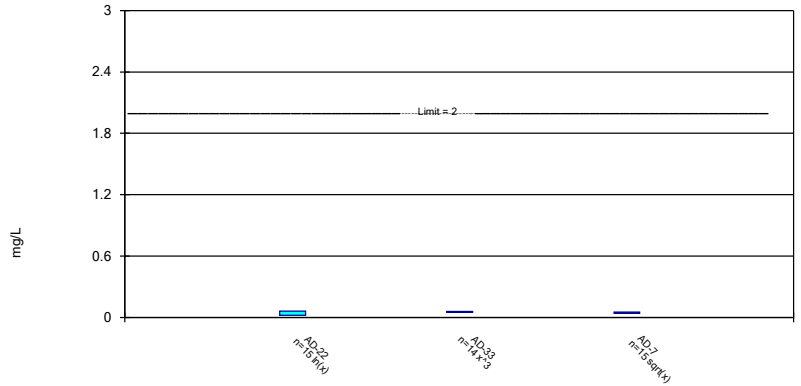
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric Confidence Interval

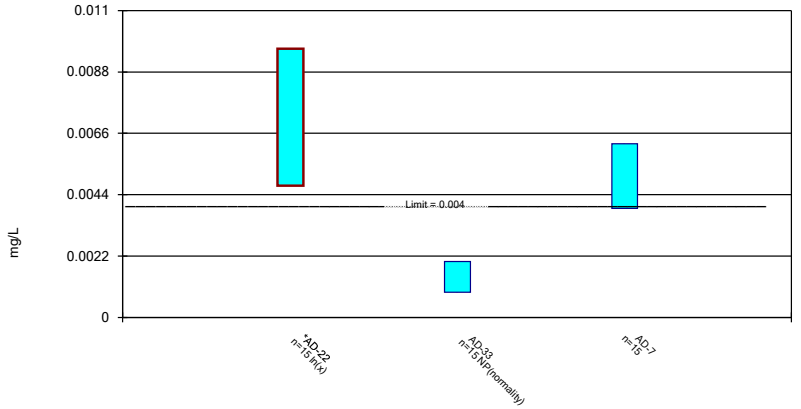
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Barium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric and Non-Parametric (NP) Confidence Interval

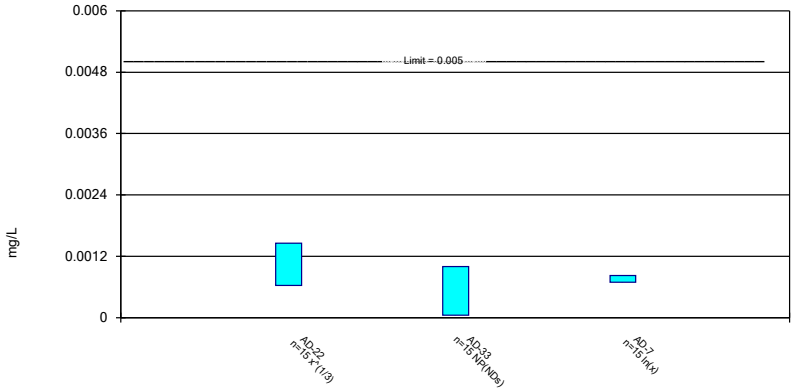
Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Beryllium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric and Non-Parametric (NP) Confidence Interval

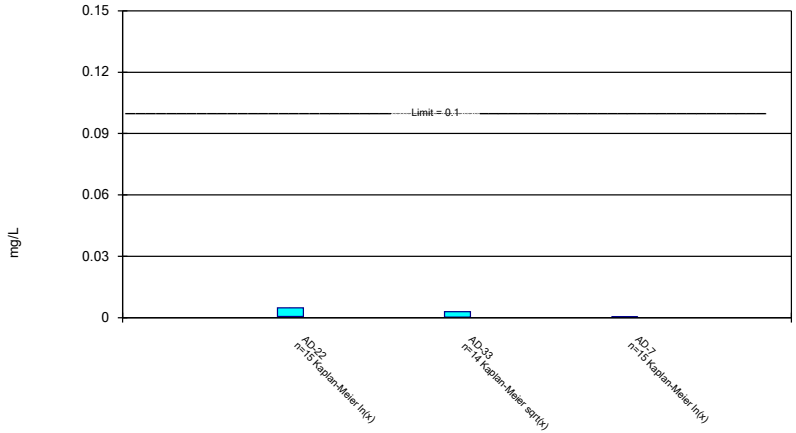
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cadmium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric Confidence Interval

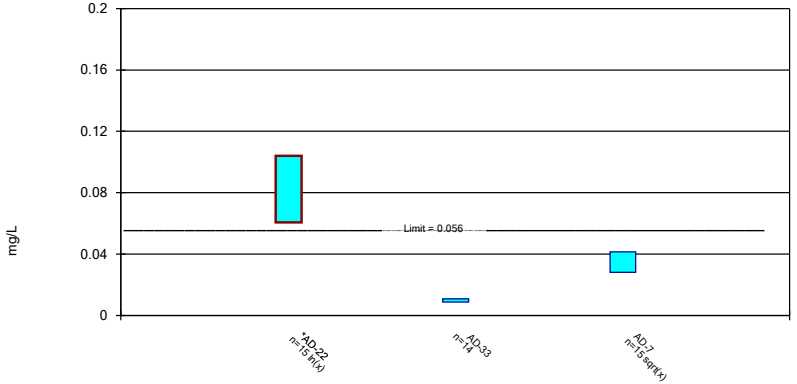
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Chromium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric Confidence Interval

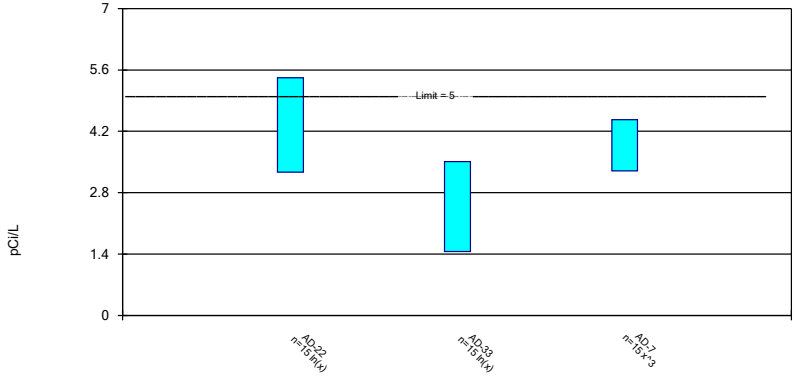
Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Cobalt, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric Confidence Interval

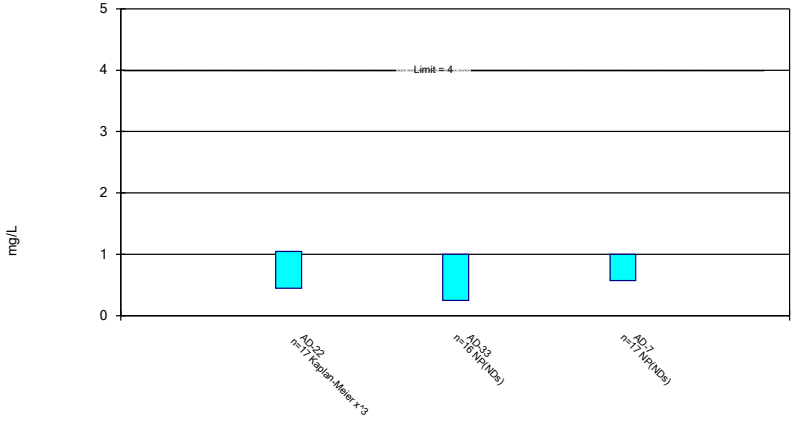
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228 Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric and Non-Parametric (NP) Confidence Interval

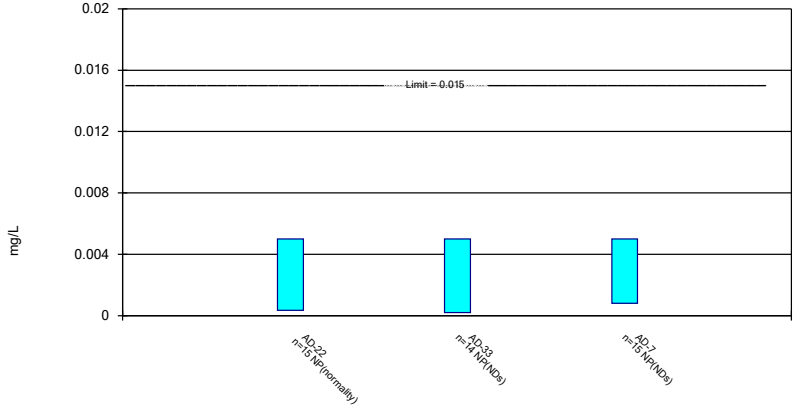
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Fluoride, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Non-Parametric Confidence Interval

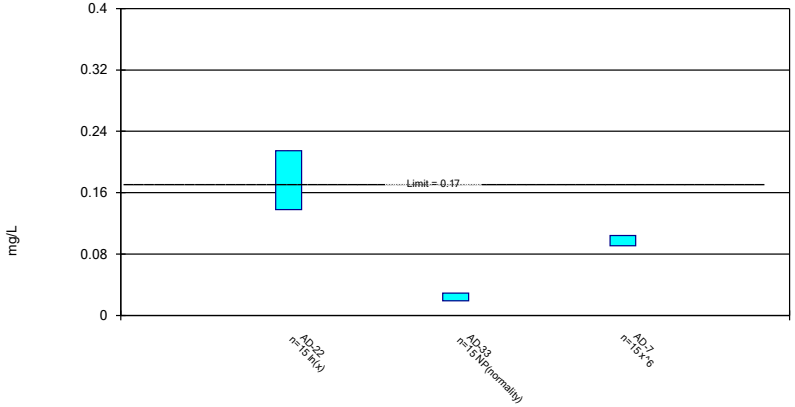
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Lead, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric and Non-Parametric (NP) Confidence Interval

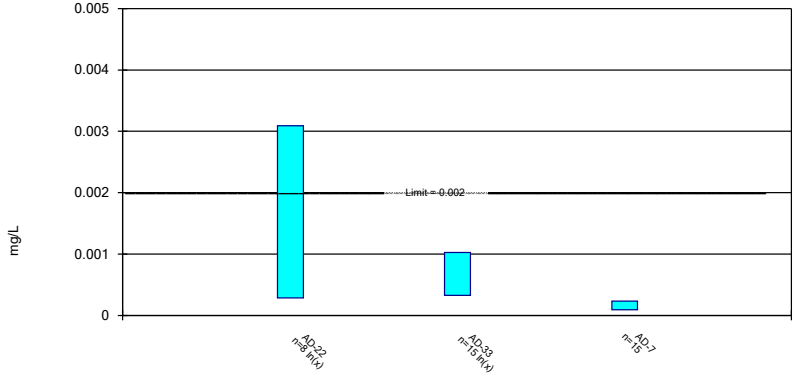
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Lithium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Parametric Confidence Interval

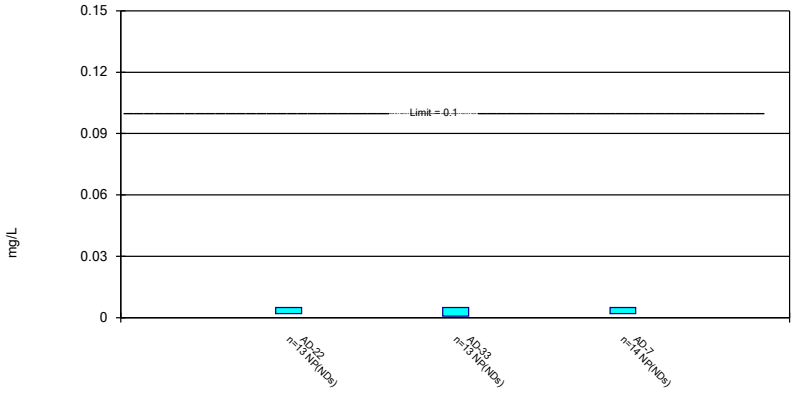
Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Mercury, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

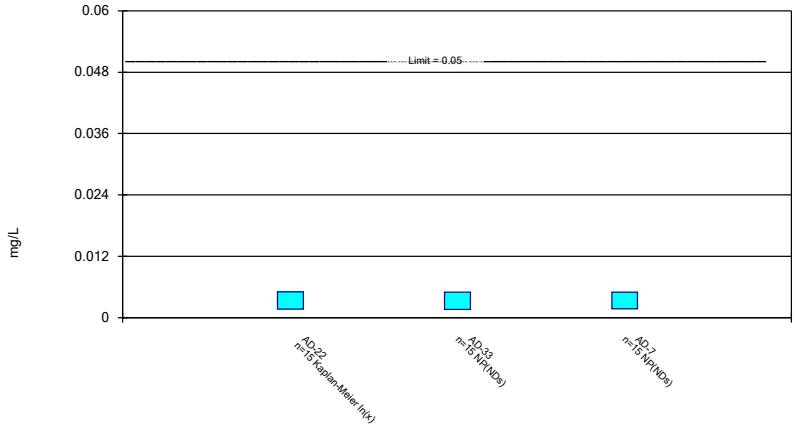


Constituent: Molybdenum, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

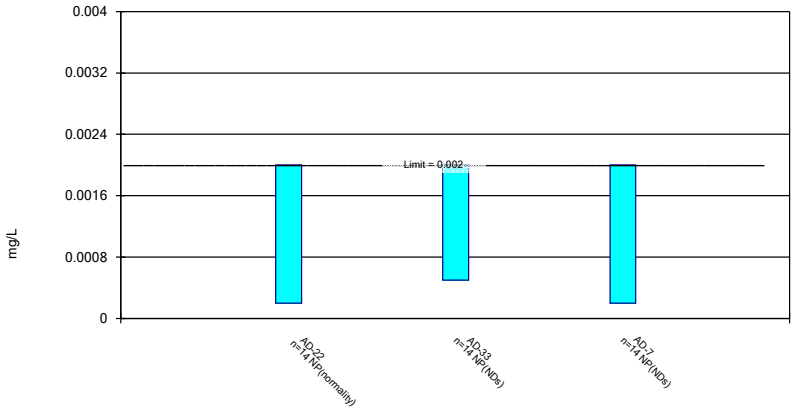


Constituent: Selenium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.27 Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Thallium, total Analysis Run 9/17/2020 10:26 AM View: Appendix IV
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

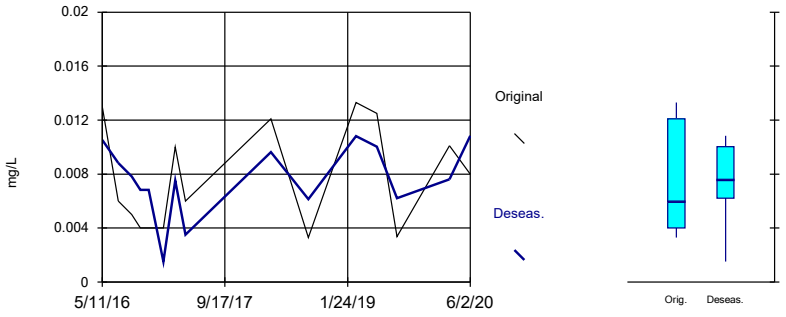
Seasonality Summary Table - All Results

Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 9/17/2020, 9:50 AM

Constituent	Well	Sig.	K.-W.	Chi-Sq.	df	N	Alpha
Beryllium, total (mg/L)	**AD-22**	**Yes**	**6.841**	**3.841**	**1**	**15**	**0.05**
Beryllium, total (mg/L)	**AD-7**	**Yes**	**9.135**	**3.841**	**1**	**15**	**0.05**
Calcium, total (mg/L)	**AD-22**	**Yes**	**5.794**	**3.841**	**1**	**17**	**0.05**
Cobalt, total (mg/L)	**AD-22**	**Yes**	**5.376**	**3.841**	**1**	**15**	**0.05**
Cobalt, total (mg/L)	**AD-7**	**Yes**	**9.054**	**3.841**	**1**	**15**	**0.05**
Combined Radium 226 + 228 (pCi/L)	**AD-22**	**Yes**	**4.339**	**3.841**	**1**	**15**	**0.05**
Combined Radium 226 + 228 (pCi/L)	**AD-7**	**Yes**	**7.714**	**3.841**	**1**	**15**	**0.05**
Lithium, total (mg/L)	AD-22	No	3.429	3.841	1	15	0.05

Seasonality: AD-22

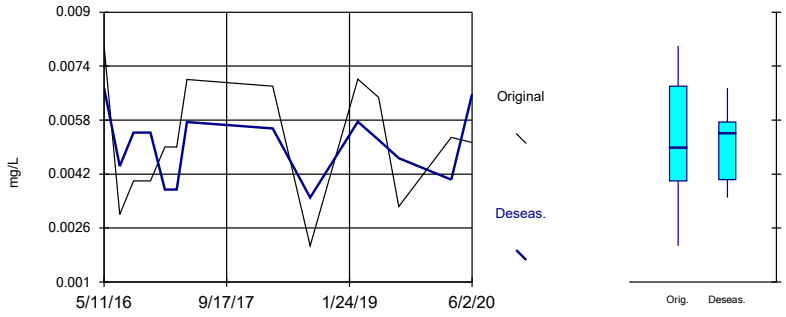
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 6.841
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 6.78
Adjusted Kruskal-Wallis statistic (H') = 6.841



Constituent: Beryllium, total Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-7

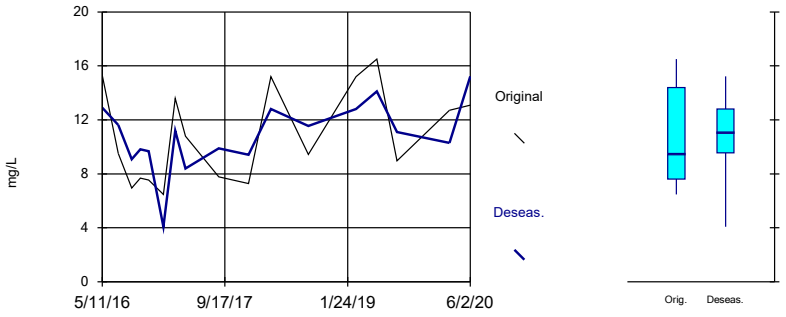
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 9.135
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 9.054
Adjusted Kruskal-Wallis statistic (H') = 9.135



Constituent: Beryllium, total Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-22

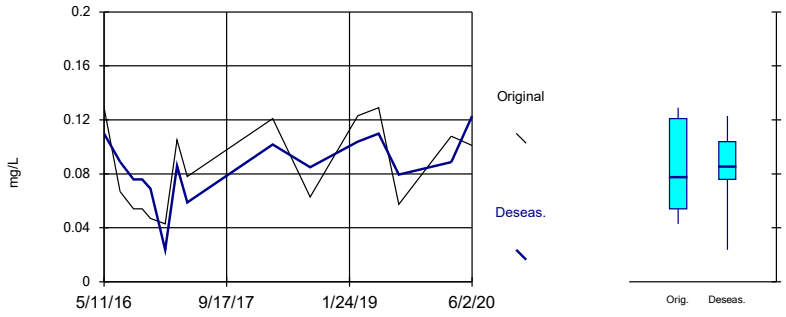
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 5.794
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 5.787
Adjusted Kruskal-Wallis statistic (H') = 5.794



Constituent: Calcium, total Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-22

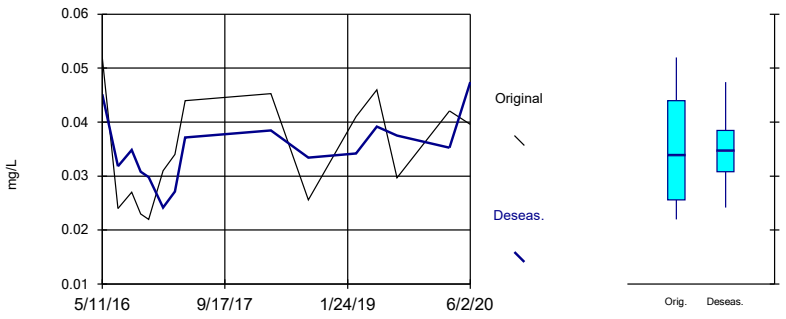
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 5.376
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 5.357
Adjusted Kruskal-Wallis statistic (H') = 5.376



Constituent: Cobalt, total Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-7

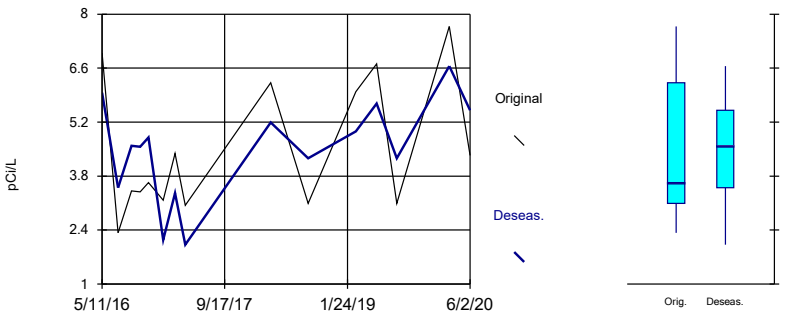
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 9.054
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 0 groups of ties in the data, so no adjustment to the Kruskal-Wallis statistic (H) was necessary.



Constituent: Cobalt, total Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-22

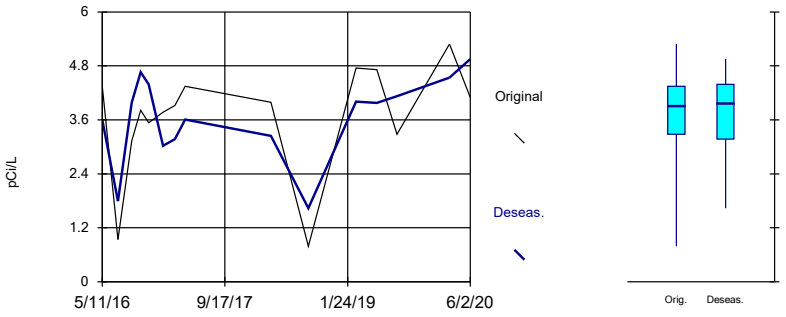
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 4.339
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 0 groups of ties in the data, so no adjustment to the Kruskal-Wallis statistic (H) was necessary.



Constituent: Combined Radium 226 + 228 Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-7

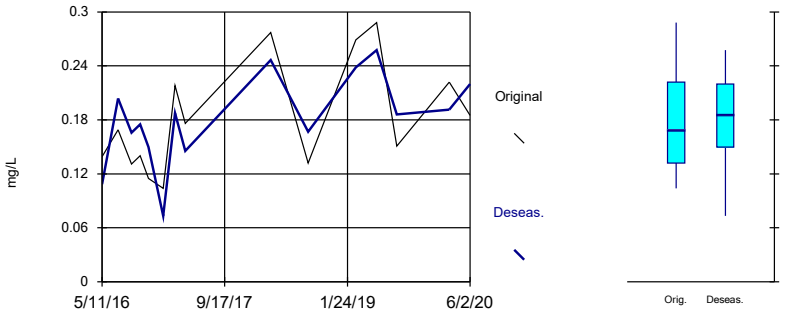
For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 7.714
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 0 groups of ties in the data, so no adjustment to the Kruskal-Wallis statistic (H) was necessary.



Constituent: Combined Radium 226 + 228 Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Seasonality: AD-22

For the selected data, the Kruskal-Wallis test indicates NO SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 3.429
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 0 groups of ties in the data, so no adjustment to the Kruskal-Wallis statistic (H) was necessary.



Constituent: Lithium, total Analysis Run 9/17/2020 9:50 AM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Deseasonalized Confidence Intervals Summary Table - Significant Results

Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 8/31/2020, 2:15 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium, total (mg/L)	**AD-22**	**0.009479**	**0.006352**	**0.004**	**Yes**	**15**	**0.007645**	**0.002669**	**0**	**None**	**x^2**	**0.01**	**Param.**
Beryllium, total (mg/L)	**AD-7**	**0.005752**	**0.004385**	**0.004**	**Yes**	**15**	**0.005069**	**0.001009**	**0**	**None**	**No**	**0.01**	**Param.**
Cobalt, total (mg/L)	**AD-22**	**0.1018**	**0.07269**	**0.056**	**Yes**	**15**	**0.08529**	**0.02423**	**0**	**None**	**x^2**	**0.01**	**Param.**

Deseasonalized Confidence Intervals Summary Table - All Results

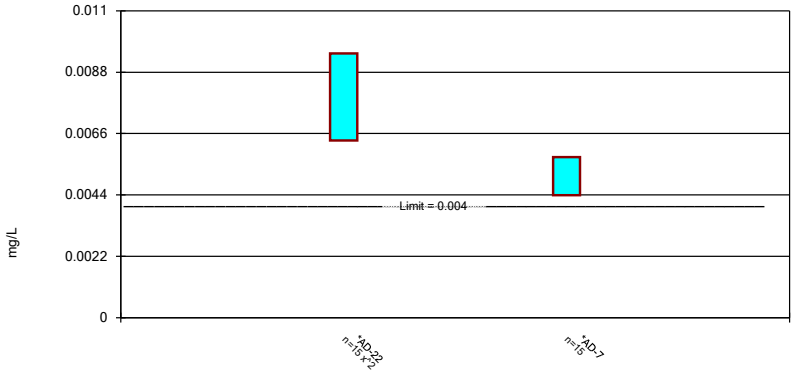
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout Printed 8/31/2020, 2:14 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Beryllium, total (mg/L)	**AD-22**	**0.009479**	**0.006352**	**0.004**	**Yes**	**15**	**0.007645**	**0.002669**	**0**	**None**	**x^2**	**0.01**	**Param.**
Beryllium, total (mg/L)	**AD-7**	**0.005752**	**0.004385**	**0.004**	**Yes**	**15**	**0.005069**	**0.001009**	**0**	**None**	**No**	**0.01**	**Param.**
Cadmium, total (mg/L)	AD-22	0.001411	0.0007892	0.005	No	15	0.0011	0.000459	0	None	No	0.01	Param.
Cobalt, total (mg/L)	**AD-22**	**0.1018**	**0.07269**	**0.056**	**Yes**	**15**	**0.08529**	**0.02423**	**0**	**None**	**x^2**	**0.01**	**Param.**
Cobalt, total (mg/L)	AD-7	0.03908	0.03075	0.056	No	15	0.03509	0.006178	0	None	x^(1/3)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-22	5.424	3.775	5	No	15	4.498	1.313	0	None	x^2	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	AD-7	4.313	3.249	5	No	15	3.648	0.96	0	None	x^3	0.01	Param.

Sanitas™ v.9.6.26d Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

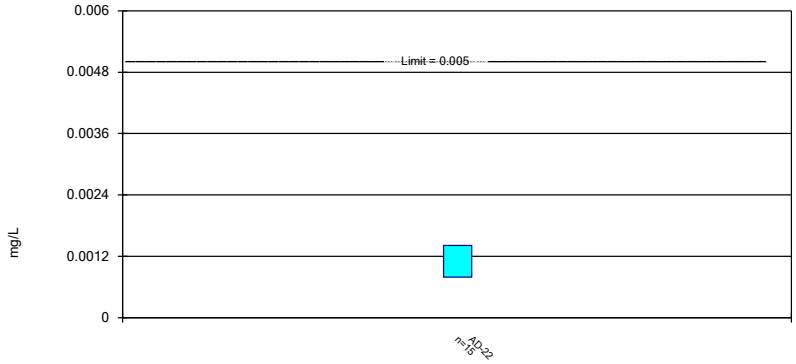


Constituent: Beryllium, total, Alt. Values Analysis Run 8/31/2020 2:12 PM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.26d Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

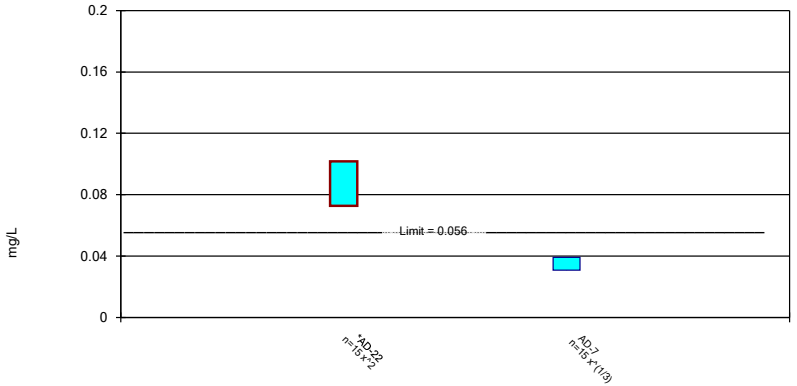


Constituent: Cadmium, total, Alt. Values Analysis Run 8/31/2020 2:12 PM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.26d Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

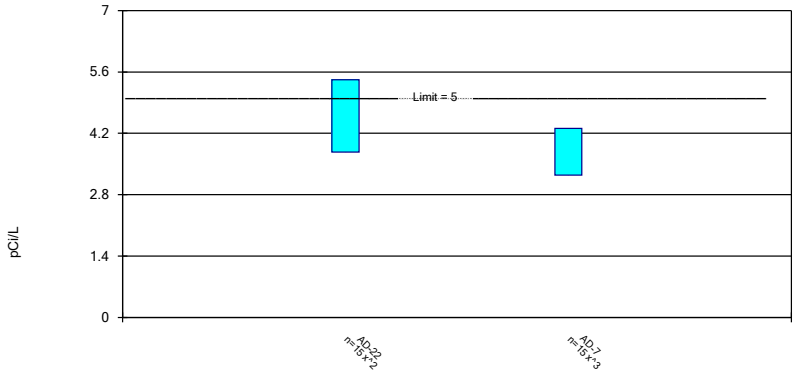


Constituent: Cobalt, total, Alt. Values Analysis Run 8/31/2020 2:13 PM View: Seasonality
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

Sanitas™ v.9.6.26d Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Combined Radium 226 + 228, Alt. Values Analysis Run 8/31/2020 2:13 PM View: Seasonalit
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

APPENDIX III

Alternate source demonstrations are included in this appendix. Alternate sources are sources or reasons that explain that statistically significant increases over background or statistically significant levels above the groundwater protection standard are not attributable to the CCR unit.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

H.W. Pirkey Power Plant Flue Gas Desulfurization (FGD) Stackout Area Hallsville, Texas

Submitted to

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Columbus, Ohio 43215-2372

Submitted by

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April 2, 2020

CHA8495

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ATTACHMENTS

Attachment A March 2020 Boring Logs
Attachment B AD-22 Boring Log and Well Installation Diagram
Attachment C Certification by a Qualified Professional Engineer

LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EBAP	East Bottom Ash Pond
EPRI	Electric Power Research Institute
FGD	Flue Gas Desulfurization
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
MCL	Maximum Contaminant Level
QA	Quality Assurance
QC	Quality Control
SPLP	Synthetic Precipitation Leaching Profile
SSL	Statistically Significant Level
SU	Standard Unit
TCEQ	Texas Commission on Environmental Quality
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
WBAP	West Bottom Ash Pond
XRD	X-Ray Diffraction

SECTION 1

INTRODUCTION AND SUMMARY

The H.W. Pirkey Plant, located in Hallsville, Texas, has four regulated coal combustion residuals (CCR) storage units, including the Flue Gas Desulfurization (FGD) Stackout Area (Figure 1). In August 2019, a semi-annual assessment monitoring event was conducted at the FGD Stackout Area in accordance with 40 CFR 257.95(d)(1). The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were previously established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the unit (AEP, 2017) and United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or for constituents without an MCL, the risk-based level specified in 40 CFR 257.95(h)(2). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether these parameters were present at a statistically significant level (SSL) above the GWPSs. Seasonal patterns were observed on the time series plots of beryllium and cobalt in wells AD-22 and AD-7 and for combined radium 226+228 in well AD-7 (Geosyntec, 2020). To correctly account for seasonality, confidence intervals for these wells and constituents were constructed using deseasonalized values. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). The following SSLs were identified at the Pirkey FGD Stackout Pad:

- The deseasaonalized LCL for beryllium exceeded the GWPS of 0.004 mg/L at AD-7 (0.00603 mg/L) and AD-22 (0.00447 mg/L); and,
- The deseasonalized LCL for cobalt exceeded the GWPS of 0.0560 mg/L at AD-22 (0.0727 mg/L).

No other SSLs were identified (Geosyntec, 2020).

1.1 CCR Rule Requirements

USEPA regulations regarding assessment monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration when an SSL is identified (40 CFR 257.95(g)(3)(ii)). An owner or operator may:

> *Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling,*

> *analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section….*

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report to document that the SSLs identified for beryllium and cobalt is from a source other than the WBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which the identified SSL could be attributed. Alternative sources were identified amongst five types, based on methodology provided by EPRI (2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the SSLs identified for beryllium and cobalt were based on a Type IV cause and not by a release from the Pirkey FGD Stackout Area.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The Federal CCR Rule allows the owner or operator 90 days from the determination of an SSL to demonstrate that a source other than the CCR unit caused the SSL. The methodology used to evaluate the SSLs identified for beryllium and cobalt and the proposed alternative sources are described below.

2.1 Proposed Alternative Source

An initial review of site geochemistry, site historical data, and laboratory quality assurance/quality control (QA/QC) data did not identify ASDs due to Type I (sampling), Type II (laboratory), or Type III (statistical evaluation) issues. As described below, the SSL has been attributed to natural variation associated with seasonal effects, which is a Type IV (natural variation) issue.

2.1.1 Beryllium

SSLs were identified for beryllium at AD-7 and AD-22 using deseasonalized statistics (Geosyntec, 2020). According to the Unified Guidance, "seasonal correction should be done both to minimize the chance of mistaking a seasonal effect for evidence of contaminated groundwater, and also to build more powerful background to compliance point tests. Problems can arise, for instance, from measurement variations associated with changing recharge rates during different seasons" (USEPA, 2009).

The seasonal effects observed in the statistical analysis occur in roughly annual cycles, with higher beryllium concentrations occurring in early spring and lower concentrations in early fall. For example, beryllium concentrations in 2019 at AD-22 were 0.0133 milligrams per liter (mg/L) in March 2019, in contrast to 0.00338 mg/L in September 2019. A previous ASD for the Stackout Pad showed that beryllium concentrations at AD-22 appear to correlate with groundwater elevations in the well (Geosyntec, 2019a). This relationship still holds true at AD-22 and also appears to be present at AD-7 (Figure 2). Beryllium concentrations at AD-7 and AD-22 are both correlated with seasonal changes in other constituents, including calcium (Figure 3) and lithium (Figure 4). The correlation between beryllium and both monovalent (lithium) and divalent (calcium) cations suggests that the increases in beryllium concentration are related to cation exchange behavior with clay minerals present in the native soil.

Five soil borings (SP-B1 through SP-B5) were advanced in the area of the Stackout Pad in March 2020 to investigate the distribution of clays in the subsurface geology. The soil boring locations are shown on Figure 1. Boring SP-B1 was advanced upgradient of the Stackout Pad to represent unimpacted conditions. SP-B2 and SP-B4 were advanced adjacent to AD-7 and AD-22, respectively, to re-log the geology at each well location. The boring logs are provided in Attachment A.

Generally, clay materials were identified in the seasonally saturated zones above the permanent water table. At AD-7, which was relogged by SP-B2, the depth to water fluctuated between approximately 9 and 15 feet below ground surface (ft bgs), with silty clay present from approximately 2.5-6.9 ft bgs before transitioning to clay until 18.8 ft bgs (Figure 5). At AD-22, which was relogged by SP-B4, the depth to water fluctuated between approximately 3 and 12 ft bgs. Clay was identified from approximately 1.5 ft bgs to 13.3 ft bgs, where it transitioned to a clayey silt (Figure 6).

Soil samples were collected from the seasonal water table and within the screened interval during the re-logging of AD-7 and AD-22 for analysis of mineralogy via X-ray diffraction (XRD). The XRD analysis confirmed the presence of clays within the seasonal water table and sand within the screened interval, as summarized in Table 1. The clay fraction of the uppermost samples collected from within the seasonal water table were further analyzed to identify the type of clays present. Smectite-type clays, which are 2:1-layer clays with significant cation exchange properties, make up the majority of the clay minerals present at those intervals.

Sorption and desorption of beryllium from smectite-type clays is well documented (Boschi and Willenbring, 2016a; You, et al., 1989). Desorption was found to be affected by pH, with 75% of beryllium desorbed from a smectite-type clay as pH changed from 6.0 standard units (SU) to 3.0 SU (Boschi and Willenbring, 2016b). The pH values recorded at AD-7 and AD-22 for samples collected under the Federal CCR Rule ranged from 2.9 to 4.1 SU and 3.9 to 5.1 SU, respectively, suggesting that conditions are favorable for beryllium desorption from smectite-type clays. The presence of these exchangeable clays provides further evidence that the exceedances of beryllium at AD-22 and AD-7 can be attributed to the effects of seasonal groundwater elevation changes, and the resulting cation exchange between groundwater and the exchangeable clay within the seasonal water table, on groundwater quality.

2.1.2 Cobalt

An SSL was identified for cobalt at AD-22 using deseasonalized statistics (Geosyntec, 2020). Similar to beryllium, the cobalt concentrations at AD-22 appear to correlate with seasonal changes in groundwater elevation (Figure 7). The cobalt concentrations are also well correlated with changes in other cations, including calcium and lithium (Figure 8). The concentration ratio between cobalt and calcium is consistent at both upgradient and downgradient locations (Figure 9), suggesting that the cobalt can be attributed to a natural mechanism which is consistent across the site.

While the seasonal increase in beryllium was attributed to desorption from smectite-type clay minerals, cobalt sorption to clay fractions is not favorable. However, cobalt is known to readily adsorb to iron oxides (Borggaard, 1987; McLaren, et al., 1986). Both the boring log for SP-B4, which was advanced to re-log AD-22 (Attachment A), and the original boring log for AD-22 (Attachment B) indicate the presence of iron ore material in the aquifer solids. Additionally, XRD analysis confirmed the presence of goethite, a pure iron oxide (FeOOH), present at low concentrations both within the seasonal water table and the screened interval at AD-22 (Table 1).

The presence of well-defined goethite suggests amorphous iron oxides are also likely present within these soils and provide reactive cation exchange sites with cobalt. These amorphous iron oxides, while likely present, are not easily identifiable with XRD, due to the non-crystalline nature of these iron phases. Seasonal increases in cobalt concentrations are likely associated with greater contact between groundwater and these iron oxides as the water table rises and saturates more of the aquifer solids.

While goethite was identified in the seasonally saturated zone, siderite and pyrite, both reduced iron-bearing minerals, were identified deeper, within the saturated screened interval at AD-22 (Table 1). The weathering of siderite and pyrite to goethite under oxidizing conditions is a well-understood phenomenon, including in formations in east Texas (Senkayi, et al., 1986; Dixon, et al., 1982). A review of geochemical conditions at AD-22 shows that pyrite and goethite are both able to form under different conditions, with recent conditions favoring goethite (Figure 10). Cobalt is known to substitute for iron in both siderite and pyrite due to their similar ionic radii (Gross, 1965; Hitzman, et al., 2017; Krupka and Serne, 2002). The proposed substitution of cobalt for iron in the crystal lattice of pyrite has been documented in other ASDs prepared for the Pirkey Plant's East Bottom Ash Pond (EBAP; Geosyntec, 2019b) and West Bottom Ash Pond (WBAP; Geosyntec, 2019c). The contribution of cobalt to groundwater via dissolution of siderite or pyrite is not likely to change seasonally, as they are present within the screened interval where the aquifer materials are continuously saturated.

As described above, the ratio between the observed calcium and concentrations is consistently on the order of 100:1 at all groundwater monitoring wells in the network (Figure 9). A sample was collected of the solid FGD sludge material which is accumulated on the Stackout Pad. The solid phase sample was leached using both USEPA's Synthetic Precipitation Leaching Profile (SPLP) testing procedure (SW-846 Test Method 1312) and Texas Commission on Environmental Quality's (TCEQ's) 7-Day Distilled Water Leachate Test Procedure (30 TAC Chapter 335 Subchapter R Appendix 4). While cobalt concentrations in both of the leached samples are consistent with those observed in the groundwater samples, the leached calcium concentrations are approximately two to three orders of magnitude higher. However, calcium concentrations in groundwater are generally consistent between AD-22 and upgradient well AD-13 (Figure 11). The different ratio between calcium and cobalt in the leached FGD sludge material (about 45,000:1) as compared to the ratio for groundwater partnered with the similarity between upgradient and downgradient calcium concentrations provide additional lines of evidence that the exceedances observed at the FGD Stackout Pad are not due to a release from the unit.

2.1.3 Conceptual Site Model

The seasonal fluctuations in beryllium concentrations at AD-7 and AD-22 and cobalt at AD-22 can be attributed to variations in the amount of the aquifer solids that are in contact with groundwater as the water table elevation changes. When the water table is higher, more clay material is in contact with groundwater, allowing greater desorption of cations (including beryllium) from the cation exchange sites on the clay. In the case of cobalt, more iron oxides are in contact with groundwater as the water table rises, allowing greater desorption from both

amorphous and mineral phases. Thus, the observed SSLs were attributed to natural variation associated with seasonal desorption of beryllium and cobalt as the amount of aquifer solids that are saturated increases.

2.2 Sampling Requirements

As the ASD described above supports the position that the identified SSLs are not due to a release from the Pirkey FGD Stackout Area, the unit will remain in the assessment monitoring program. Groundwater at the unit will continue to be sampled for Appendix IV parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSLs of beryllium at AD-7 and AD-22 and the SSL of cobalt at AD-22 identified during assessment monitoring in August 2019 were not due to a release from the FGD Stackout Area. The identified SSLs were, instead, attributed to natural variation related to seasonal desorption of beryllium and cobalt from the aquifer solids. Therefore, no further action is warranted, and the Pirkey FGD Stackout Area will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment C.

SECTION 4

REFERENCES

AEP, 2017. Statistical Analysis Plan – H.W. Pirkey Power Plant. Hallsville, Texas. January.

Borggaard, O.K. 1987. Influence of iron oxides on cobalt adsorption by soils. *Eur. J. Soil Sci.*, 38, 229-238.

Bosci, V., and Willenbring, J.K. 2016a. The effect of pH, organic ligand chemistry, and mineralogy on the sorption of beryllium over time. *Environ. Chem.*, 13, 711-722.

Boschi, V., and Willenbring, J.K. 2016b. Beryllium desorption from minerals and organic ligands over time. *Chem. Geo.*, 439, 52-58.

Dixon, J.B., Hossner, L.R., Senkayi, A.L., and Egashira, K. 1982. Mineral properties of lignite overburden as they relate to mine spoil reclamation. In: J.A. Kittrick, D.S. Fanning, L. R. Hossner, editors, Acid Sulfate Weathering, *SSSA Spec. Publ. 10*. SSSA, Madison, WI. p. 169-191.

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Site. 3002010920. October.

Geosyntec Consultants, 2019a. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. Flue Gas Desulfurization (FGD) Stackout Area. Hallsville, Texas. October.

Geosyntec Consultants, 2019b. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. East Bottom Ash Pond. Hallsville, Texas. October.

Geosyntec Consultants, 2019c. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. West Bottom Ash Pond. Hallsville, Texas. October.

Geosyntec Consultants, 2020. Statistical Analysis Summary, Flue Gas Desulfurization (FGD) Stackout Area. H.W. Pirkey Power Plant. Hallsville, Texas. January.

Gross, G.A. 1965. Geology of iron deposits in Canada – Volume 1: General geology and evaluation of iron deposits. Economic Geology Report No. 22 – Geological Survey of Canada.

Hitzman, M.W., Bookstrom, A.A., Slack, J.F., and Zientek, M.L., 2017. Cobalt – Styles of Deposits and the Search for Primary Deposits. USGS Open File Report 2017-1155.

Krupka, K.M. and Serne, R.J., 2002. Geochemical Factors Affecting the Behavior of Antimony, Cobalt, Europium, Technetium, and Uranium in Vadose Sediments. Pacific Northwest National Lab, PNNL-14126. December.

McLaren, R.G., Lawson, D.M., and Swift, R.S. 1986. Sorption and desorption of cobalt by soils and soil components. *J. Soil. Sci*., 37, 413-426.

Senkayi, A.L., Dixon, J.B., and Hossner, L.R. 1986. Todorokite, goethite, and hematite: alteration products of siderite in East Texas lignite overburden. *Soil Science*, 142, 36-43.

USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09/007. March.

You, C.-F., Lee, T., and Li-Y.-H. 1989. The partition of Be between soil and water. *Chem. Geol*., 77, 105-118.

TABLES

Table 1: X-Ray Diffraction Results
FGD Stackout Pad - H. W. Pirkey Plant

Geosyntec Consultants, Inc.

Boring Location	SP-B2			SP-B4		
Associated Well	AD-7			AD-22		
Depth (ft bgs)	10-12	16-18	27-29	6-8	18-20	22-24
Sample Location	Within Seasonal Water Table	Below Seasonal Water Table	Within Screened Interval	Within Seasonal Water Table	Below Seasonal Water Table	Within Screened Interval
Quartz	39	37	79	28	47.5	95
Plagioclase Feldspar	-	1	-	<0.5	<0.5	1
K-Feldspar	<0.5	1	-	1	0.5	-
Goethite	1	2	0.5	1	-	2
Hematite	-	-	0.5	-	-	-
Chlorite	-	-	-	1	-	-
Siderite		-			10	-
Pyrite	-	-	-	-	2	-
Clays	*	59	20	*	40	2
Kaolinite	9			13		
Illite/Mica	1			2		
Smectite	50			43		
Mixed-Layered Illite/Smectite	-			11		

Notes:

-: not detected

Mineral constituents are reported in percentage.

Values shown as less than indicate the mineral constituent is present but below the quantification limit.

*The clay fraction at SP-B2-10-12 and SP-B4-6-8 were further analyzed to characterize the types of clays present, as listed below.

FIGURES

Legend

- Downgradient Monitoring Well
- Upgradient Monitoring Well
- 2020 Soil Borings
- Stackout Pad

Notes

- Soil boring locations are approximate.
- Monitoring well locations are provided by AEP.

500 250 0 500 Feet

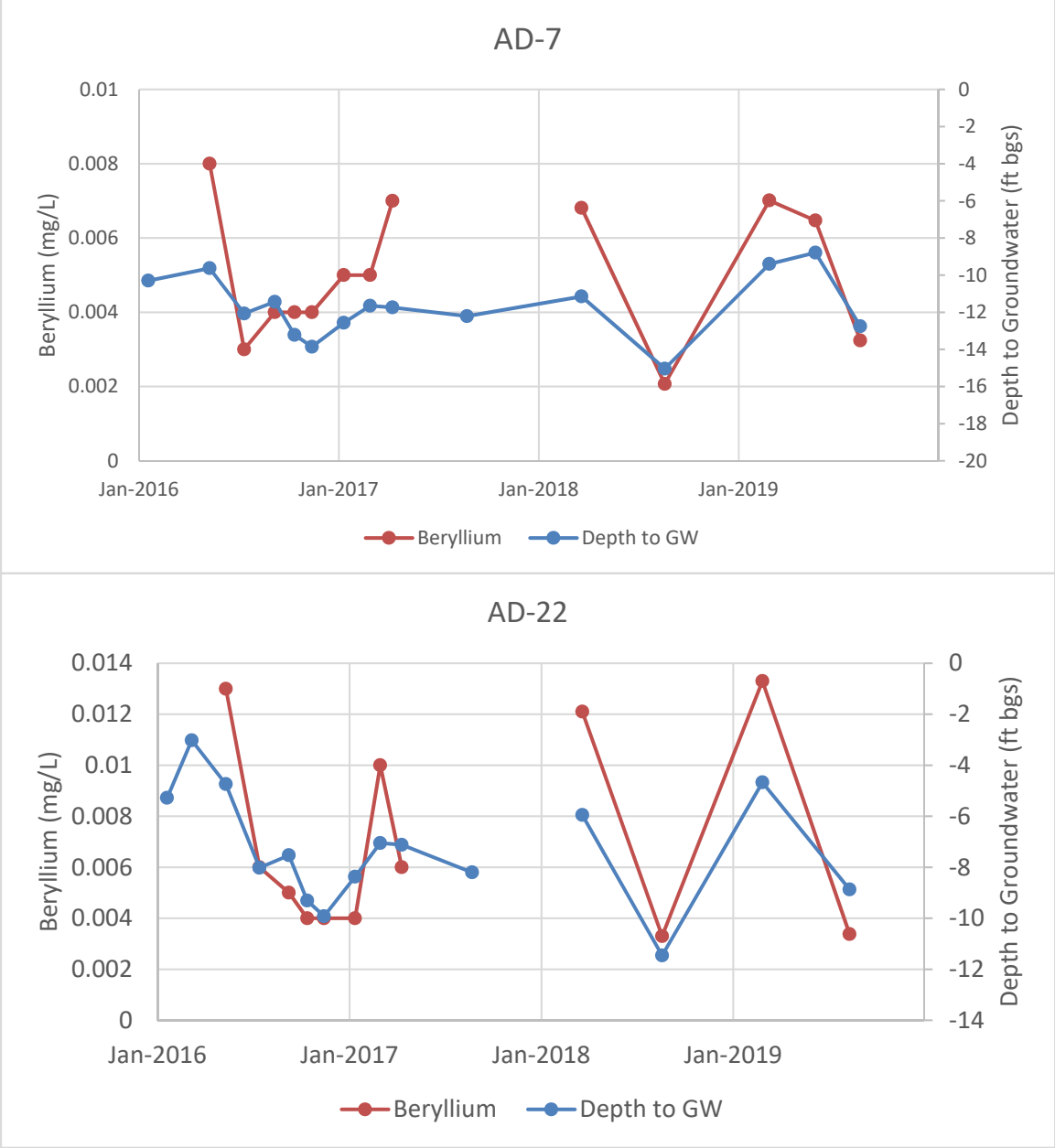
March 2020 Soil Borings

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 1

Columbus, Ohio | 2020/03/27

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\Mike's GIS Files\Pirkey\MXDs\AEP-Pirkey_Stacker_Site_Layout.mxd. BAres. 3/27/2020. Project/Phase/Task.



Notes: Beryllium concentrations are shown in milligrams per liter (mg/L). Depth to water is shown as feet below ground surface (ft bgs). The gap in beryllium data represents the time period in which detection monitoring took place and samples were not analyzed for beryllium.

Beryllium v. Depth to Groundwater
Pirkey FGD Stackout Pad

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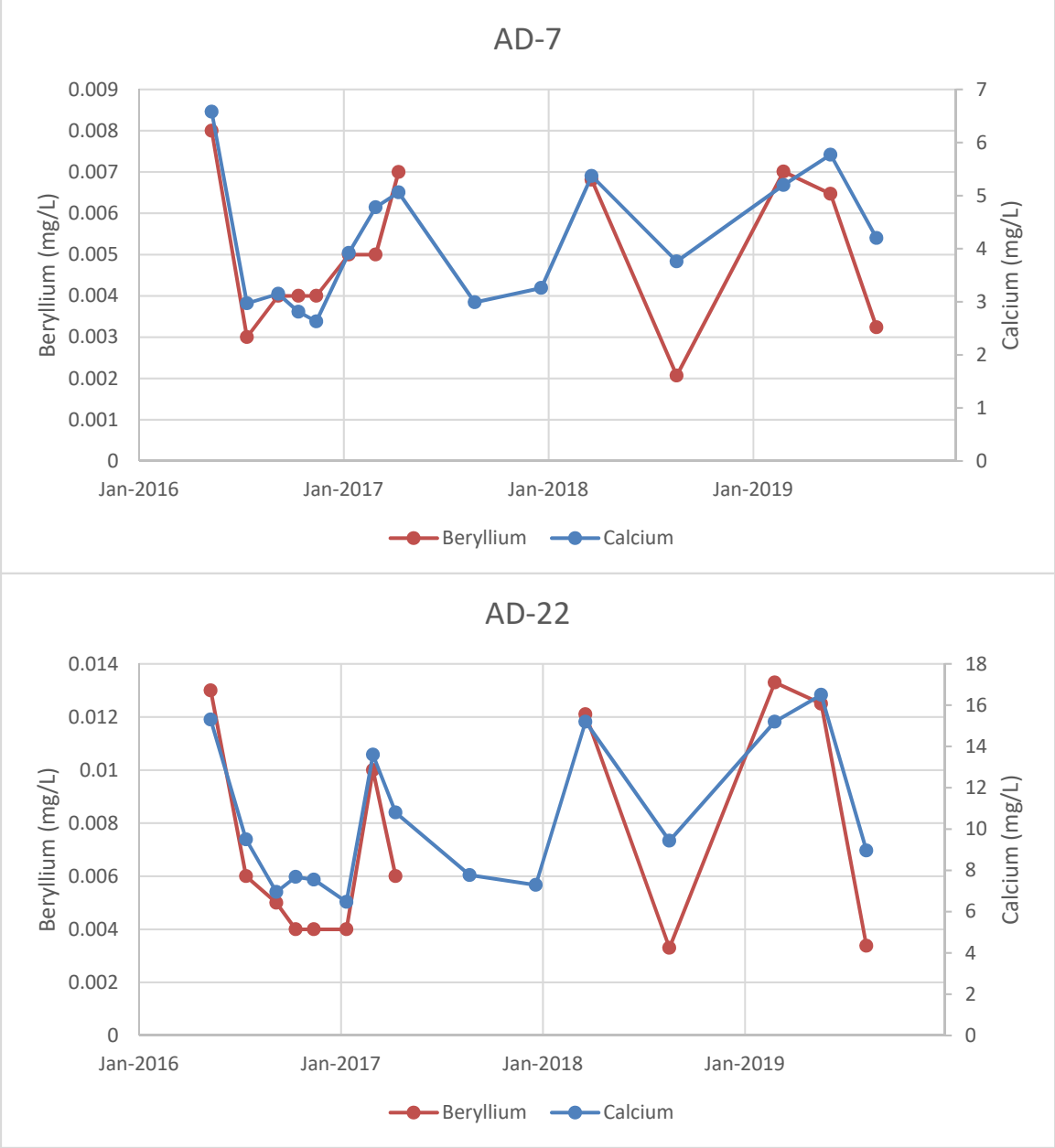
Columbus, Ohio | 12-Mar-2020

Figure 2



Notes: Beryllium and calcium concentrations are shown in milligrams per liter (mg/L). The gaps in beryllium data represent the time period in which detection monitoring took place and samples were not analyzed for beryllium.

Beryllium v. Calcium Concentrations
Pirkey FGD Stackout Pad

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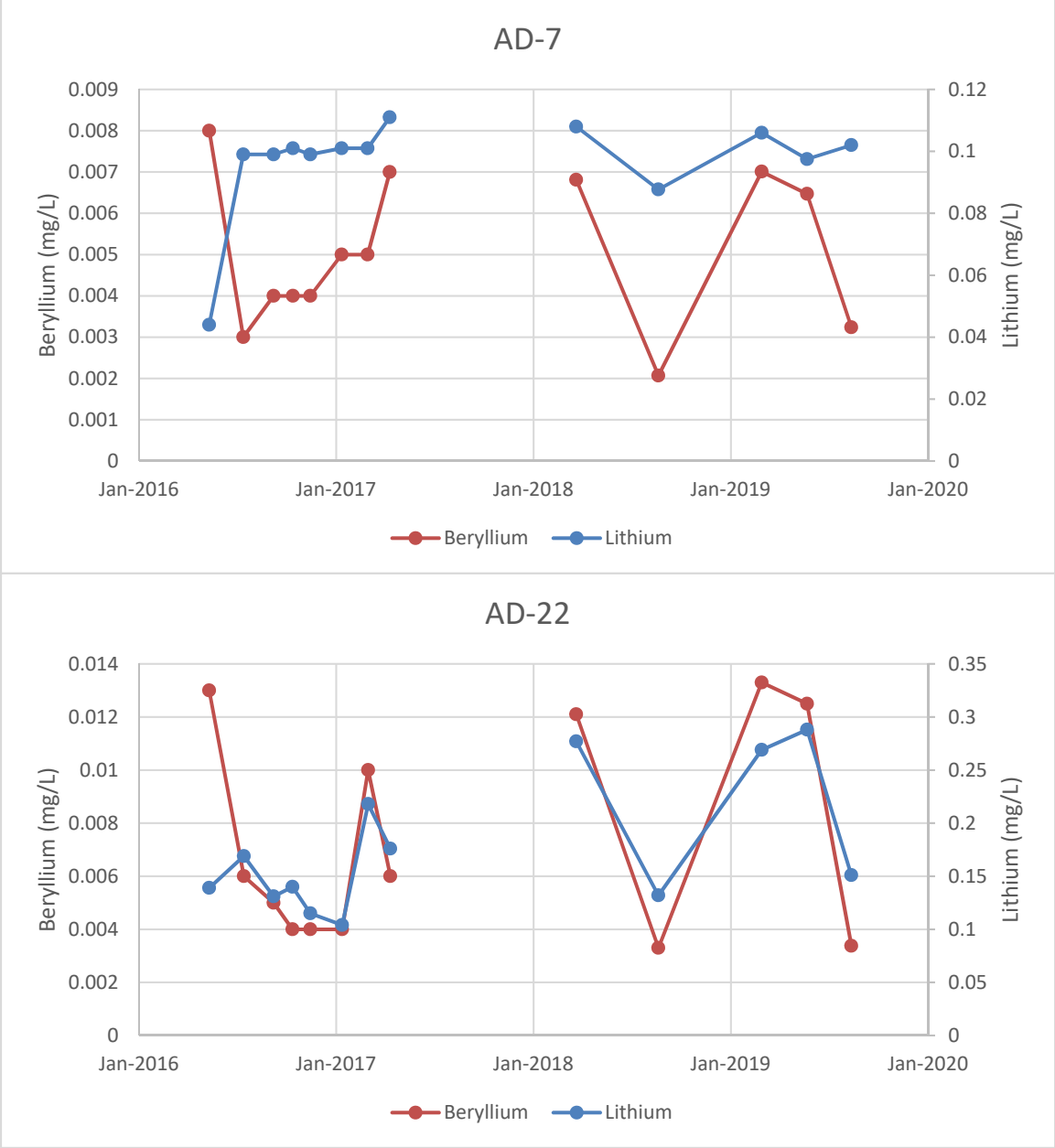
Figure
3

Columbus, Ohio

09-Mar-2020

internal info: path, date revised, author



Notes: Beryllium and lithium concentrations are shown in milligrams per liter (mg/L). The gaps in data represents the time period in which detection monitoring took place and samples were not analyzed for beryllium or lithium.

Beryllium v. Lithium Concentrations
Pirkey FGD Stackout Pad

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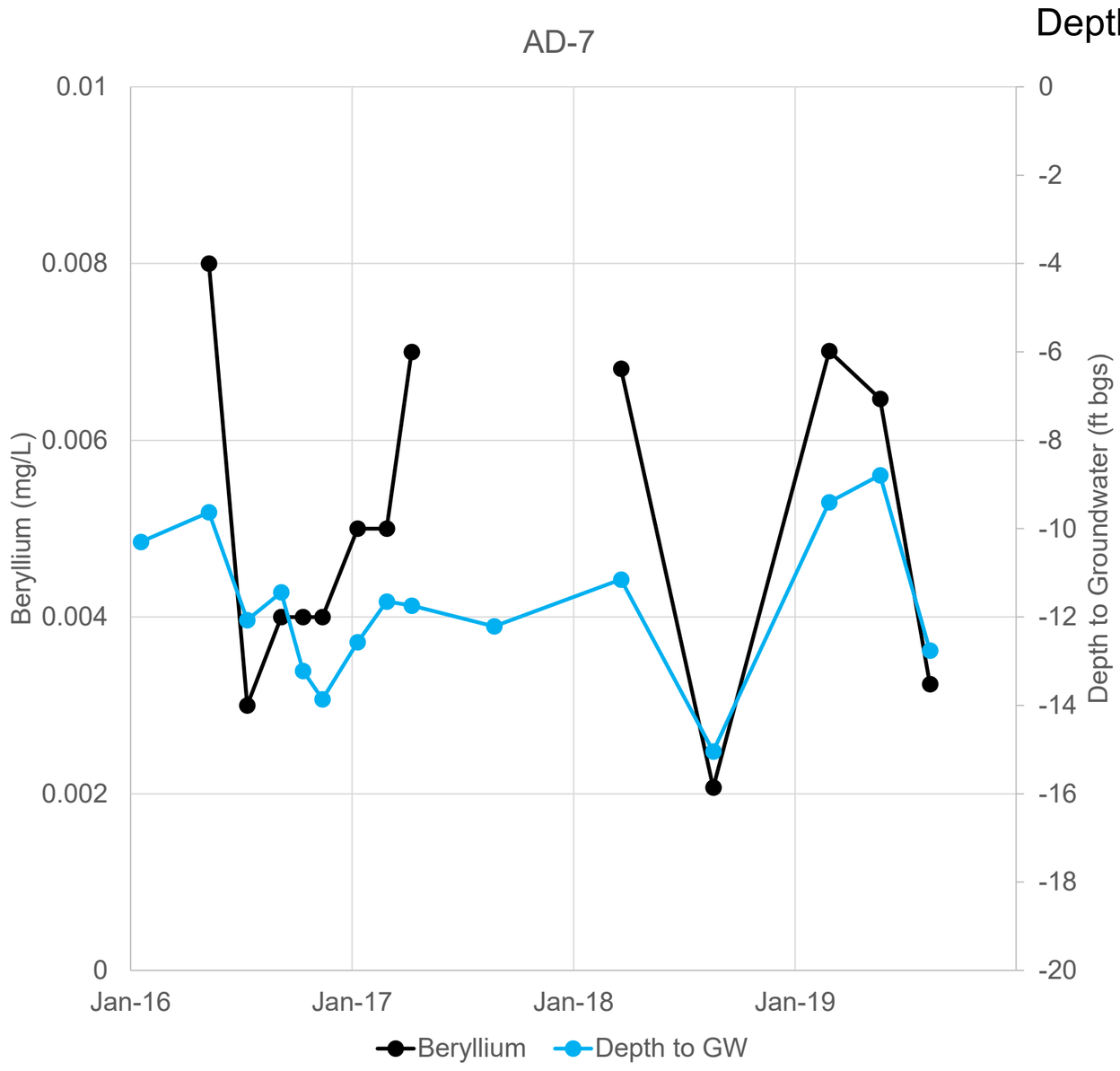
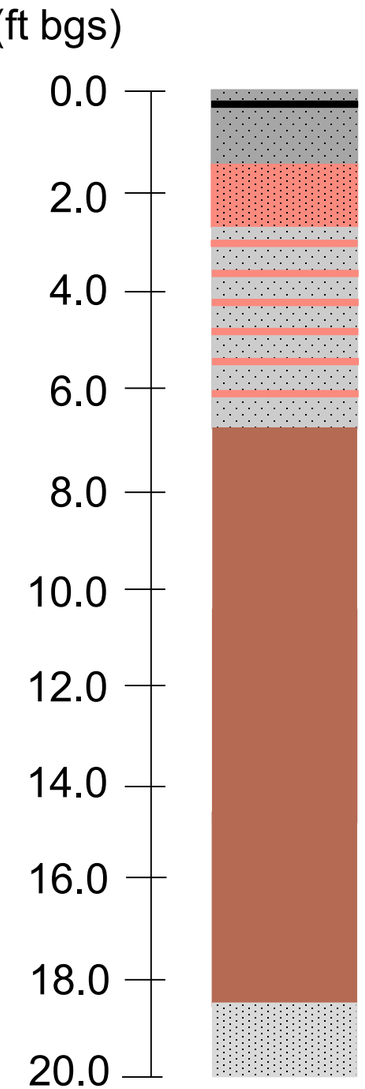
Figure
4

Columbus, Ohio

09-Mar-2020

internal info: path, date revised, author





Silt (Fly Ash)

Brittle grey fly ash with coal dust layer

Silt

1.7’ Brittle red silt

Silty clay

2.6’ Mottled grey/red silty clay

Clay

6.9’ Greyish maroon clay

Clay

10.0’ Stiff greyish maroon clay

Clayey silty sand

18.8’ Light grey very fine grained clayey silty sand

Notes:
- AD-7 was re-logged with SP-B2
-A sample was collected for analysis of mineralogy from 10-12 ft bgs.
-The full boring log is available in Attachment A.

internal info: Path, date revised, author

AD-7 Seasonal Water Table Geology

Pirkey FGD Stackout Pad

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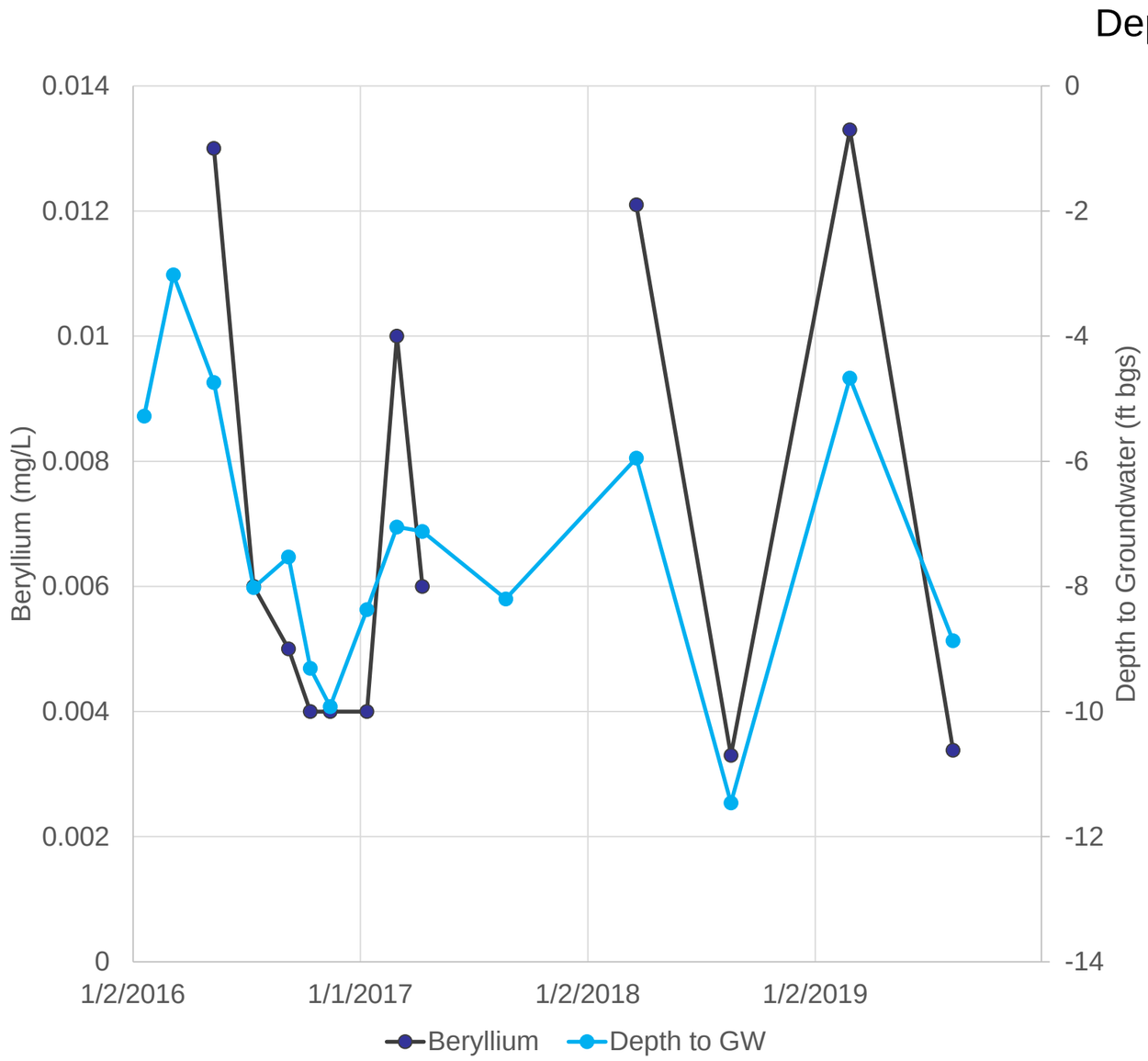
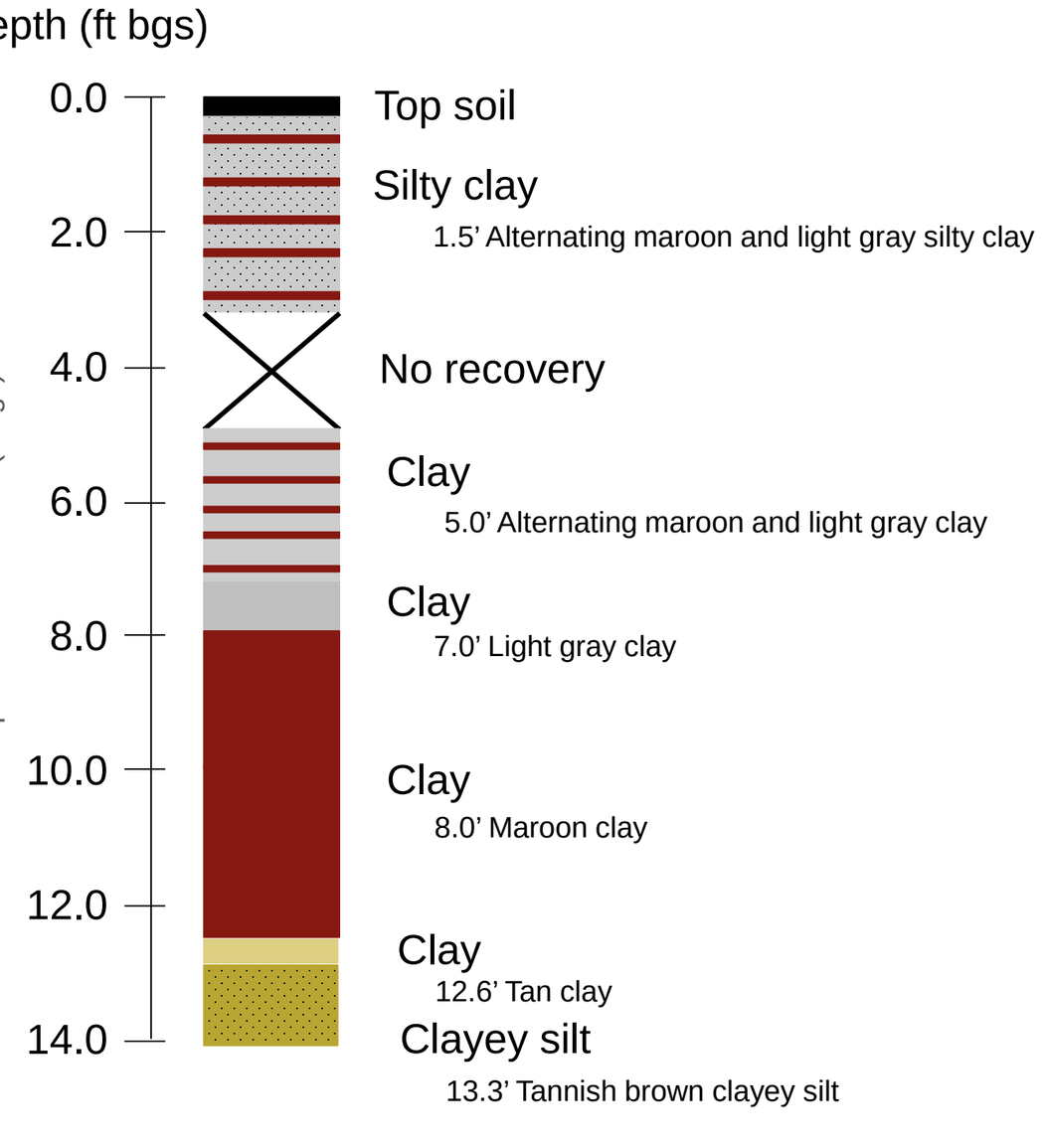
Figure **5**

Columbus, OH

13-Mar-2020





Notes:
-AD-22 was re-logged with SP-B4
-A sample was collected for analysis of mineralogy from 6-8 ft bgs.
-The full boring log is available in Attachment A.

internal info: Path, date revised, author

AD-22 Seasonal Water Table Geology
Pirkey FGD Stackout Pad

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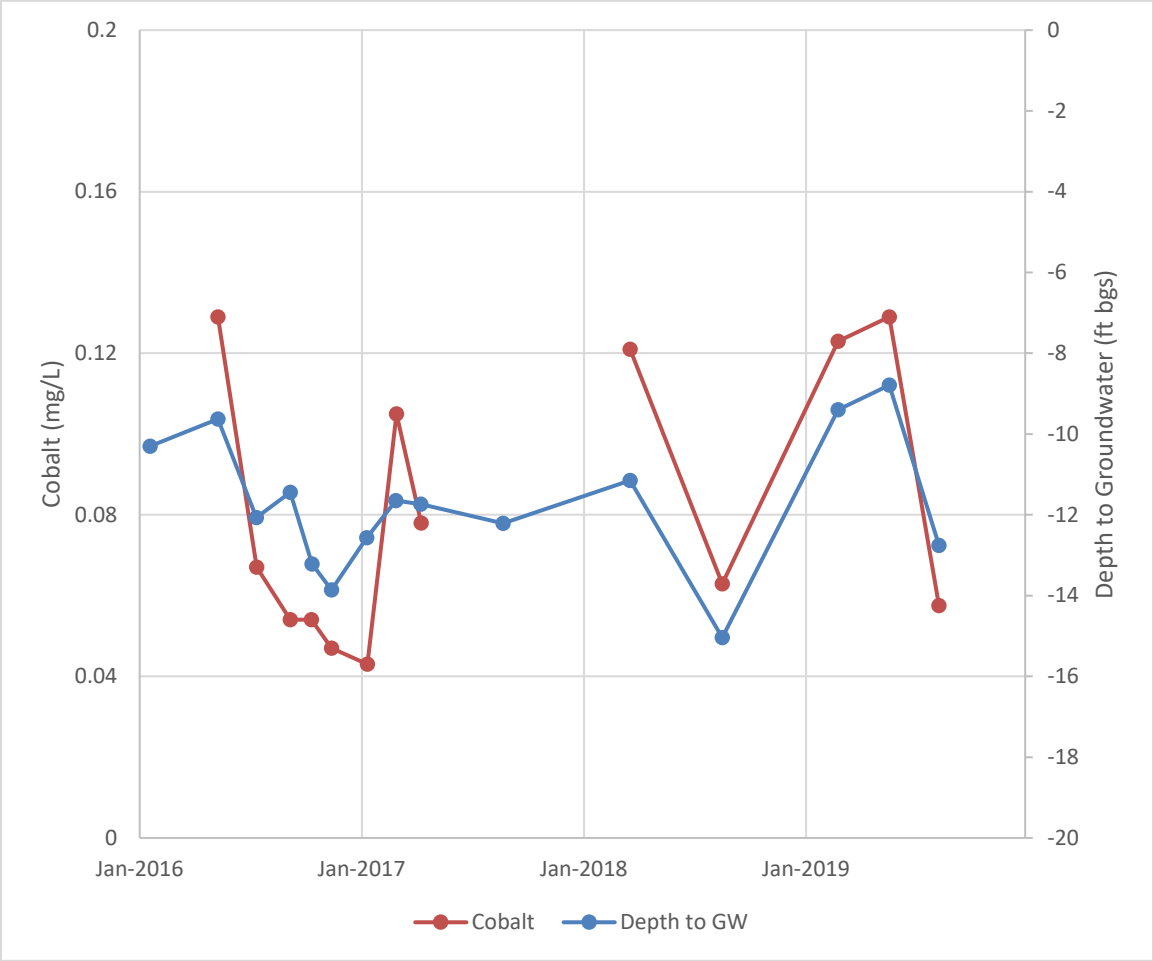
Columbus, OH | 13-Mar-2020



Notes: Cobalt concentrations are shown in milligrams per liter (mg/L). Depth to water is shown as feet below ground surface (ft bgs). The gap in cobalt data represents the time period in which detection monitoring took place and samples were not analyzed for cobalt.

AD-22 Cobalt v. Depth to Groundwater
Pirkey FGD Stackout Pad

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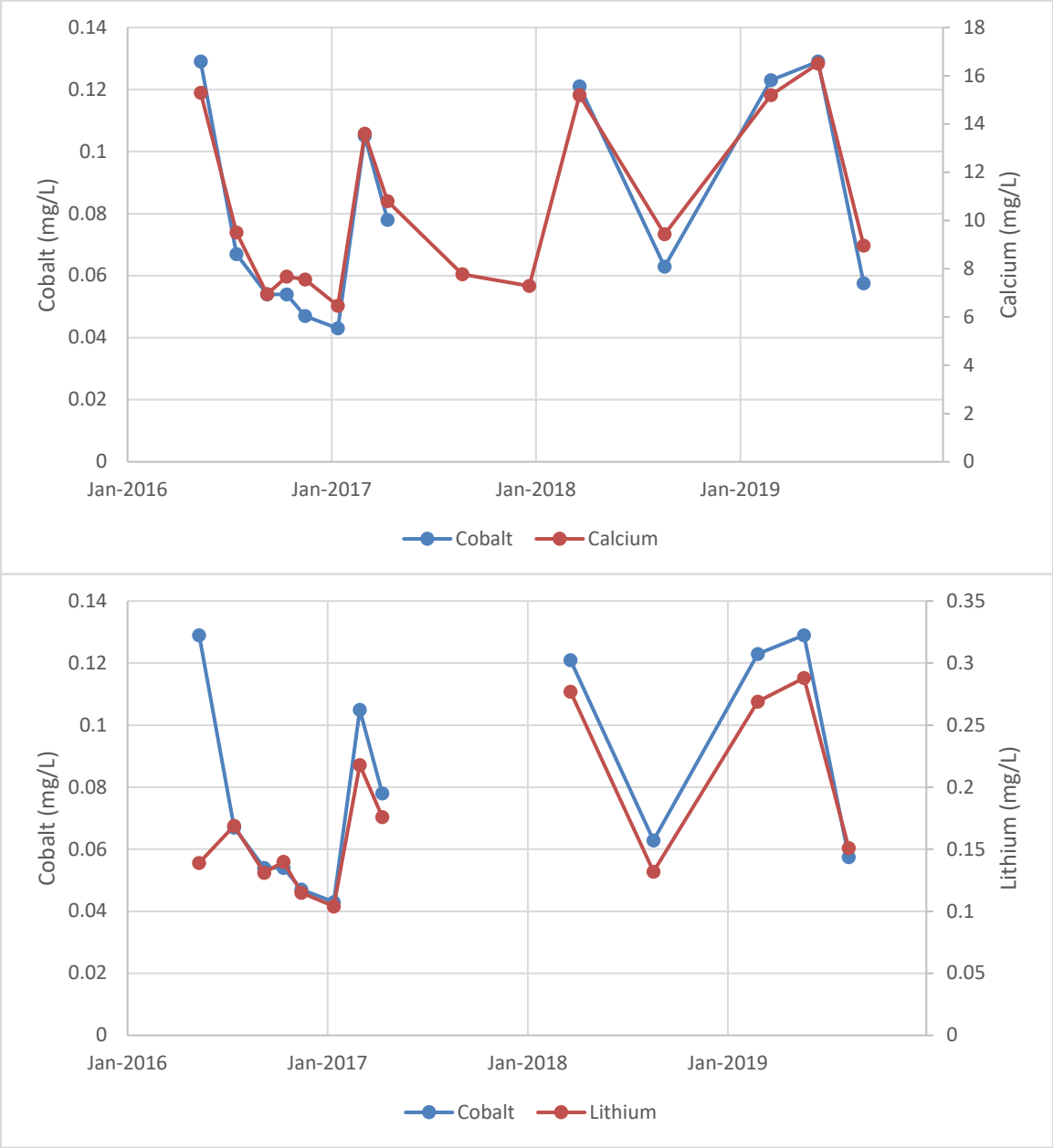
Figure 7

Columbus, Ohio

12-Mar-2020

internal info: path, date revised, author



Notes: Cobalt, calcium, and lithium concentrations are shown in milligrams per liter (mg/L). The gaps in cobalt and lithium data represent the time period during which detection monitoring took place and samples were not analyzed for cobalt and lithium.

AD-22 Cobalt v. Calcium and Lithium
Pirkey FGD Stackout Pad

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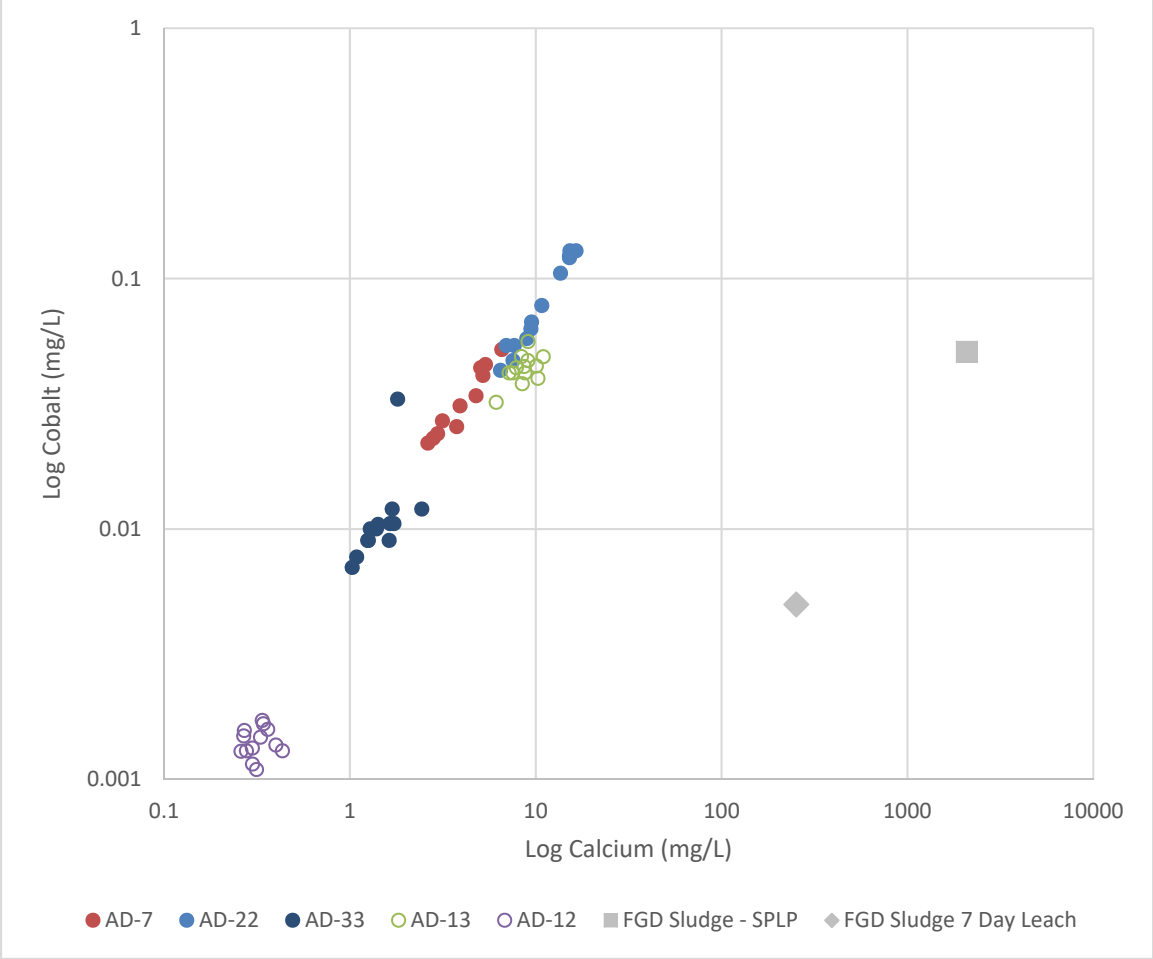
Figure
8

Columbus, Ohio

09-Mar-2020

internal info: path, date revised, author



Notes: Cobalt and calcium concentrations are shown in milligrams per liter (mg/L). Upgradient wells are shown with hollow circles. 'FGD Sludge-SPLP' and 'FGD Sludge 7 Day Leach' present the leached concentrations of cobalt and calcium using the Synthetic Precipitation Leaching Procedure (SW-846 Test Method 1312) and the 7-Day Distilled Water Leachate Test Procedure (30 TAC Chapter 335 R4), respectively.

Cobalt and Calcium Concentration Distribution

Pirkey FGD Stackout Pad

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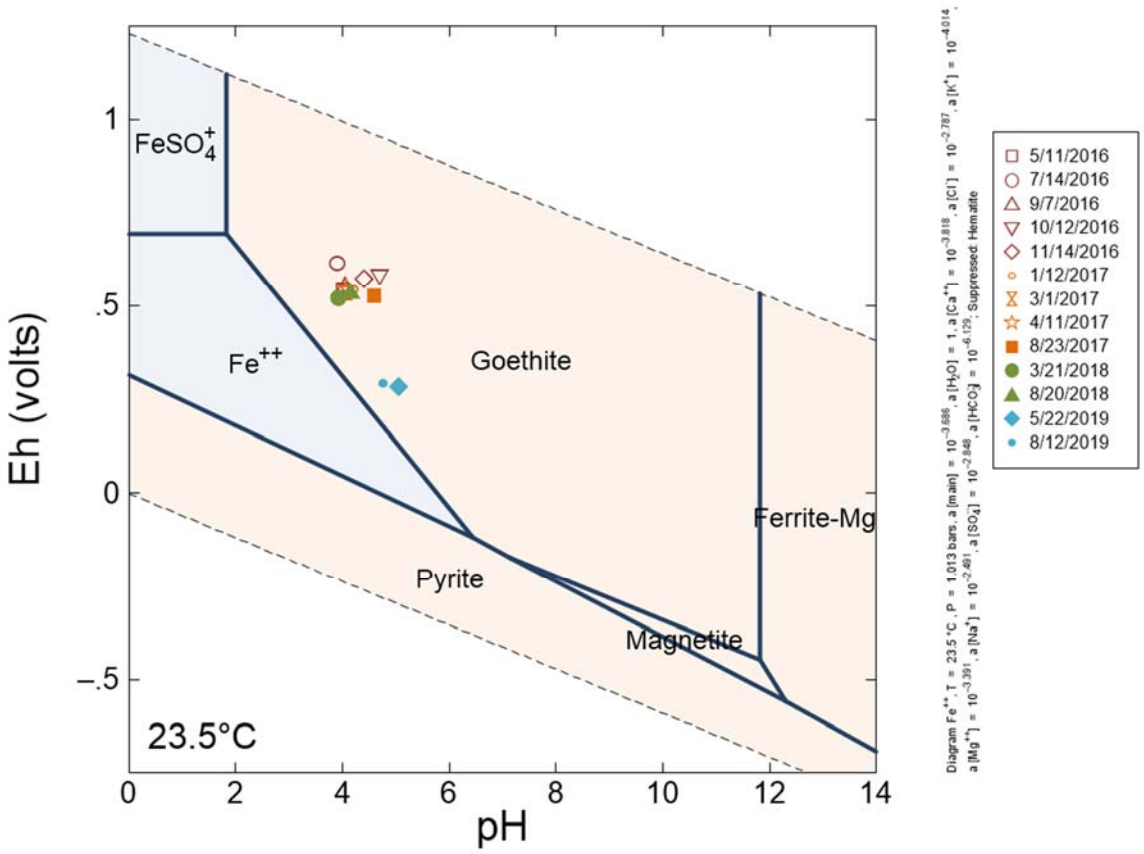
Columbus, Ohio

12-Mar-2020

Figure 9

internal info: path, date revised, author



Notes: Average groundwater concentrations of major cations and anions were used to establish baseline conditions for the diagram. Eh and pH values for sampling dates at AD-22 are shown on the diagram.

AD-22 Eh-pH Diagram
Pirkey FGD Stackout Pad

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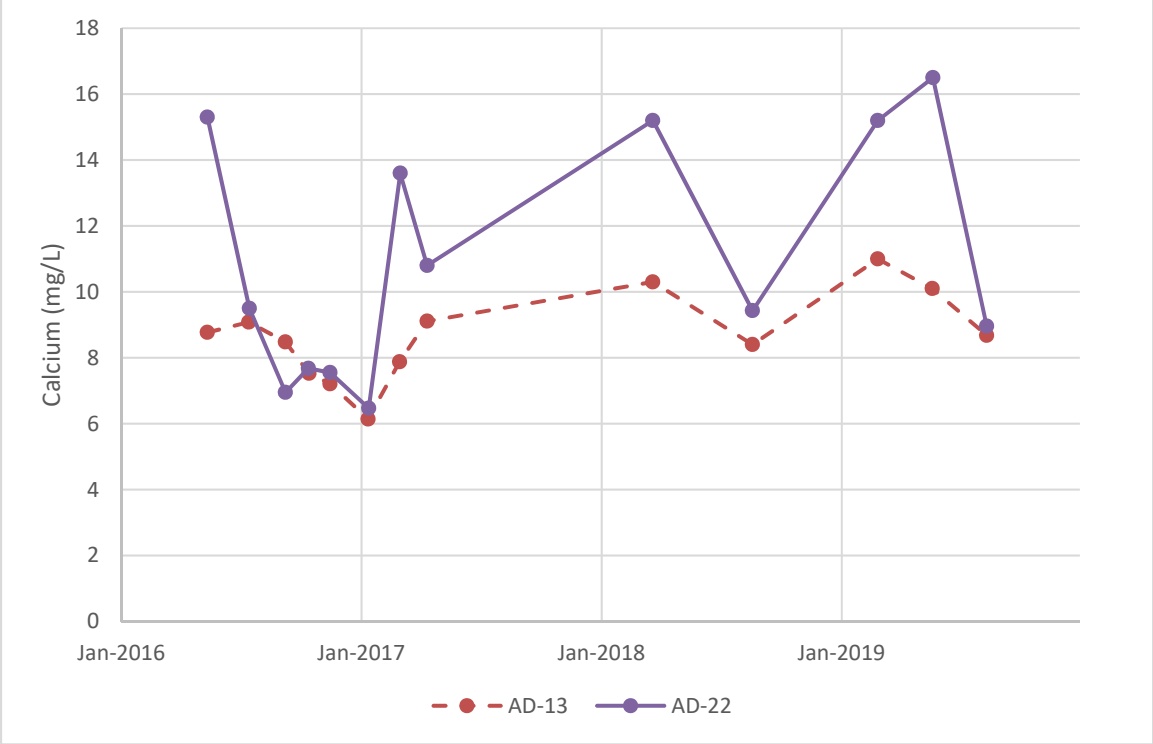
Columbus, Ohio | 24-Mar-2020

internal info: path, date revised, author



Notes: Calcium concentrations are shown in milligrams per liter (mg/L). AD-13 is shown with a dashed line because it is an upgradient location.

Calcium Time Series Graph
Pirkey FGD Stackout Pad

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Columbus, Ohio | 30-Mar-2020

ATTACHMENT A
March 2020 Boring Logs

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B1

Project Location: Hallsville, TX

Boring Date: 3/2/2020

Depth Scale Feet	Water Table	Soil Profile Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.4': Top soil with vegetation, black silt	
		0.4'-2.1': Brown silt, fine grained, little cohesion, dry	
		2.1'-4.3': Light maroon and gray clay, low plasticity, moderate stiffness (pp. 3.5); light brown silt/iron ore	
		4.3'-10.0': Maroon clay, low plasticity, high stiffness (pp. 4.0-5.0), iron ore (brown/red silt pockets throughout), moist at 8.5'	
5			
10	▽	10.0'-15.0': Dark maroon clay, wet, moderate plasticity, moderate stiffness (pp. 2.5-3.0), red/brown silt pockets (iron ore)	
15		15.0'-15.5': Dark maroon and red/brown clayey silt; low cohesion; wet	
		15.5'-20.0': Light gray and red/brown clayey silt, wet, low cohesion, iron ore present	
20		20.0'-21.8': Dark maroon and red/brown clayey silt; good cohesion; wet	
		21.8'-24.0': Black silty clay, high stiffness (pp. >5.0), low plasticity	
		24.0'-24.5': Black silty clay, low stiffness (pp. 2.0), moderate plasticity	
25		24.5'-30.0': Dark gray/dark green fine grained sand, well sorted, trace silt; wet	
30		Samples collected at 10-12'; 16-18'; 27-29'	
		TD at 30' bgs	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 7822 DT

Drilling Contractor: Best Drilling

Driller: Ramon Gutierrez

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B2

Project Location: Hallsville, TX

Boring Date: 3/2/2020

Soil Profile

Depth Scale Feet	Water Table	Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.2': Gray silt, dry, brittle (fly ash)	
		0.2'-0.4': Black, coal dust, strong odor	
		0.4'-1.7': Gray silt, dry, brittle (fly ash)	
		1.7'-2.6': red silt, brittle, dry	
		2.6'-6.5': Gray and red silty clay, high stiffness (pp. 4.0-5.0), low plasticity, iron ore/mottling present	
5		6.5'-6.9': Light gray, red and tan clay, low stiffness (pp. 1.5), moderate plasticity	
		6.9'-10.0': Light gray and maroon clay, moderate stiffness (pp. 3.5), low plasticity, iron ore/mottling present; moist near 9'	
10	▼	10.0'-15.0': Light gray and maroon clay, moderate/high stiffness (pp. 3.5-4.5), low plasticity, iron ore/mottling present; wet	
15		15.0'-18.5': Maroon and light gray clay, moderate/high stiffness (pp. 3.0-4.0), low plasticity; wet	
		18.5'-18.8': Red/brown silt, trace clay, good cohesion	
		18.8'-20.5': Light gray clayey silty sand, very fine grained, moderate sorting, mottling present; wet	
20		20.5'-23.4': Light gray and orange clayey silty sand, very fine grained; mottling present, moderate sorting; wet	
		23.4'-25.0': Maroon and orange silty clay, low stiffness (pp. 0.5), high plasticity; wet	
25		25.0'-29.0': Same as above; interchanging between silty clay and clayey silt throughout interval, iron ore/mottling present throughout	
		29.0'-29.5': Black clay, moderate stiffness (pp.3.0), low plasticity	
		29.5'-30.0': Gray fine grained sand, well sorted; wet	
30		Samples collected at 10-12'; 16-18'; 27-29'	
		TD at 30' bgs	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 3230 DT

Drilling Contractor: C&S

Driller: DJ Diduch

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B3

Project Location: Hallsville, TX

Boring Date: 3/2/2020

Depth Scale Feet	Water Table	Soil Profile Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.4': Top soil, Black silt with vegetation	
		0.4'-0.7': Brown silt, moist, low cohesion	
		0.7'-2.0': Maroon and light gray silty clay, moderate stiffness (pp.2.5), moderate plasticity, iron ore/mottling present	
		2.0'-2.2': Brown silt, dry, brittle	
		2.2'-5.6': Maroon and ligh gray clay, high stiffness (pp. 4.0), low plasticity	
5		5.6'-6.0': Orange silt, no cohesion, dry	
		6.0'-13.5': Maroon clay, high stiffness (pp >4.5), low plasticity; moist at 9'; wet at 12'	
10	▼		
		13.5'-13.6': Brown/orange silt (iron ore), no cohesion	
		13.6'-17.5': Gray and orange clayey silt, good cohesion; iron ore present; wet	
15			
		17.5'-20.2': Maroon and orange silty clay, low stiffness(pp. 0.5), moderate plasticity; iron ore present; wet	
20		20.2'-21.1': Brown silt, no cohesion; wet	
		21.1'-22.7': Brown fine grained sand, well sorted; wet	
		22.7'-25.0': Maroon and orange silty clay, low stiffness (pp. 0.5), low plasticity; iron ore present; wet	
25			
30		Samples collected at 10-12'; 15-17'; 22-24'	
		TD at 25' bgs; refusal	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 3230 DT

Drilling Contractor: C&S

Driller: DJ Diduch

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B4

Project Location: Hallsville, TX

Boring Date: 3/3/2020

Soil Profile

Depth Scale Feet	Water Table	Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.4': Top soil, black silt, vegetation	
		0.4'-0.7': Brown clayey silt, good cohesion	
		0.7'-1.5': Red and light gray silty clay, moderate stiffness (pp. 2.5), high plasticity	
		1.5'-3.7': Maroon and light gray clay, high stiffness (pp. 4.5-5.0), low plasticity; iron ore present 3.1'-3.7'	
		3.7'-5.0': NO RECOVERY	
5		5.0'-7.0': Maroon and light gray clay, high stiffness (pp. 4.5-5.0), low plasticity; iron ore present throughout	
		7.0'-8.0': Light gray clay with iron ore, moderate stiffness (pp.2.5-3.0), moderate plasticity	
		8.0'-10.0': Maroon clay, moderate stiffness (pp. 3.5), moderate plasticity; iron ore present; moist at 9'	
10	▽	10.0'-12.6': Maroon clay, moderate stiffness (pp. 3.5), moderate plasticity; iron ore present; wet at 12'	
		12.6'-13.3': Tan clay, low stiffness (pp.1.5), high plasticity; wet	
		13.3'-18.5': Tan and brown clayey silt, moderate cohesion; iron ore present; wet	
15			
		18.5'-20.3': Maroon silty clay, low stiffness (pp. 1.0), moderate plasticity; iron ore; wet	
20		20.3'-21.1': Dark gray/black clay, trace silt, low stiffness (pp. 1.5), high plasticity; wet	
		21.1'-21.3': Dark gray silt, good cohesion; wet	
		21.3'-21.9': Dark gray silty clay, low stiffness (pp. 1.5), high plasticity; wet	
		21.9'-22.3': Dark gray silt, moderate cohesion; wet	
		22.3'-22.7': light brown silt; low cohesion; wet	
		22.7'-24.4': Dark gray and dark green silty clay, moderate/high stiffness (pp.3.5), moderate plasticity; wet, glauconite present	
		24.4'-27.8': Dark green/gray fine grained sand, well sorted; wet; glauconite present	
25		27.8'-30.0': Red and orange fine grained sand, well sorted, with iron ore; wet	
30			
		Samples collected at 6-8'; 18-20'; 28-30'	
		TD at 30' bgs; refusal	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 3230 DT

Drilling Contractor: C&S

Driller: DJ Diduch

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Project Location:____ Hallsville, TX

Boring/Well Name:_____ SP-B5

Boring Date:__ 3/5/2020

Soil Profile

Depth Scale Feet	Water Table	Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.6': Top soil, black silt, vegetation	
		0.6'-0.9': Brown clayey silt, good cohesion	
		0.9'-2.4': Red and gray silty clay, moderate/high stiffness (pp. 3.5), high plasticity; iron ore present	
		2.4'-5.0': NO RECOVERY	
5		5.0'-8.6': Maroon and gray clay, moderate/high stiffness (pp. 3.5), low plasticity; iron ore present; moist	
	▼	8.6'-10.0': Light gray and maroon clay, moderate/low stiffness (pp.2.0), high plasticity; iron ore present; wet	
10		10.0'-12.0': Maroon and gray clay, high stiffness (pp. 4.0), moderate plasticity, iron ore present; wet	
		12.0'-12.9': Iron ore with maroon clay, high stiffness (pp.4.0), moderate plasticity; wet	
		12.9'-15.0': Maroon clay, high stiffness (pp.4.0), high plasticity; iron ore present; wet	
15		15.0'-18.4': Light gray and orange clayey silt, good cohesion; iron ore present; wet	
		18.4'-18.6': Dark maroon iron ore; wet	
		18.6'-20.0': Orange and gray clayey silt, good cohesion; iron ore present; wet	
		20.0'-21.2': Maroon and orange clayey silt, good cohesion; iron ore present; wet	
20		21.2'-22.3': Black clay, trace silt, low stiffness (pp.1.0), high plasticity; wet	
		22.3'-22.6': Black clay, high stiffness (pp.4.5), moderate plasticity	
		22.6'-22.9': Black silt, no cohesion; wet	
		22.9'-23.4': Black clay, trace silt, moderate stiffness (pp.2.5), high plasticity; wet	
		23.4'-25.0': Dark gray and green fine grained sand; well sorted; wet; glauconite present	
25		Samples collected at 6-8'; 16-18'; 23-25'	
		TD at 25' bgs; refusal	
		*PID readings not collected	
30			
35			

Drill Rig Geoprobe 3230 DT

Drilling Contractor:___ C&S

Driller:_ DJ Diduch

Geosyntec Consultants

ATTACHMENT B

AD-22 Boring Log and Well Installation Diagram

☐ BORING ■ MONITOR WELL

APEX PROJECT NO.: 110-089 BORING NUMBER: ____ MONITOR WELL NUMBER: AD-22

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/16/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATTITUDE: N 32°27'03.3" Datum: WGS-84 WELL LOCATION: Triangle- South side Quansit Hut

LONGITUDE: W94°29'41.3"

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1			0-0.5	SC	Clayey sand, light brown, very fine grained	None	Moist
2			0.5-12	CL	Lean clay, light brown mottled with light gray	None	Slightly Moist
3							
4					Few iron ore (small) pebbles in clayey sandy streaks		
5							
6							
7							
8							
9							
10							
11							
12							
13			▽	12-20	SC	Clayey sand, grayish brown with orangish brown streaks, very fine grained	None	Slightly Wet
14					Slightly wet @ 12.5' from seepage		
15					Large amount of iron ore 15-17'		
16							
17							
18							
19					Very firm 18-18.5'		
20							
21				20-25	SC	(Dense crystalline rock 21-21.1'), light brown clayey sand, greenish black, mica, black clay streaks, very fine grained, wet @ 20'	None	Wet
22							
23							
24							
25							
26				25-30	SM	Sand, greenish brown (1') grading to orangish brown, silty, very fine grained	None	Wet
27							
28							
29							
30							
31					Boring Terminated at 30'		
32							
33							
34							
35							
36							
37							
38							
39							
40							

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

Total Depth: 30 feet Riser Interval: +3 (ags)-10'

Filter Sand (Size/Interval): 8-30' Screen Interval: 10-30'

Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-8' Water level: 12.5'

Surface Completion ☐ Flush ■ Above Ground 3'

Note: This log is not to be used separate from this report.

ATTACHMENT C
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Pirkey FGD Stackout Area CCR management area and that the requirements of 40 CFR 257.95(g)(3)(ii) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
2039 Centre Pointe Blvd, Suite 103
Tallahassee, Florida 32308

Texas Registered Engineering Firm
No. F-1182

79864	Texas	4/2/2020
License Number	Licensing State	Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

H.W. Pirkey Power Plant Flue Gas Desulfurization (FGD) Stackout Area Hallsville, Texas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, OH 43221

December 2020

CHA8495

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ATTACHMENTS

Attachment A March 2020 Boring Logs
Attachment B AD-22 Boring Log and Well Installation Diagram
Attachment C Certification by a Qualified Professional Engineer

LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EBAP	East Bottom Ash Pond
EPRI	Electric Power Research Institute
FGD	Flue Gas Desulfurization
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
MCL	Maximum Contaminant Level
QA	Quality Assurance
QC	Quality Control
SPLP	Synthetic Precipitation Leaching Profile
SSL	Statistically Significant Level
SU	Standard Unit
TCEQ	Texas Commission on Environmental Quality
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
WBAP	West Bottom Ash Pond
XRD	X-Ray Diffraction

SECTION 1

INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address statistically significant levels (SSLs) for beryllium and cobalt in the groundwater monitoring network at the H.W. Pirkey Plant Flue Gas Desulfurization (FGD) Stackout Area, located in Hallsville, Texas, following the first semiannual detection monitoring event of 2020. The FGD Stackout Pad is registered as a waste pile under Texas Commission on Environmental Quality (TCEQ) Industrial and Hazardous Waste Solid Waste Registration No. 33240.

The H.W. Pirkey Plant has four regulated coal combustion residuals (CCR) storage units, including the FGD Stackout Pad Area (**Figure 1**). In June 2020, a semi-annual assessment monitoring event was conducted at the FGD Stackout Area in accordance with 40 CFR 257.95(d)(1). The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the unit (AEP, 2017) and United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or, for constituents without an MCL, the risk-based level specified in 40 CFR 257.95(h)(2). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Confidence intervals were re-calculated for Appendix IV parameters at the compliance wells to assess whether these parameters were present at a statistically significant level (SSL) above the GWPSs. Seasonal patterns were observed for beryllium, cobalt, and combined radium at AD-7 and for beryllium, cadmium, cobalt, combined radium, and lithium at AD-22 (Geosyntec, 2020a). To correctly account for seasonality, confidence intervals for these wells and constituents were constructed using deseasonalized values. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). The following SSLs were identified at the Pirkey FGD Stackout Pad:

- The deseasonalized LCL for beryllium exceeded the GWPS of 0.00400 mg/L at AD-7 (0.00439 mg/L) and AD-22 (0.00635 mg/L); and

- The deseasonalized LCL for cobalt exceeded the GWPS of 0.0560 mg/L at AD-22 (0.0727 mg/L).

No other SSLs were identified (Geosyntec, 2020a).

1.1 CCR Rule Requirements

USEPA regulations regarding assessment monitoring programs for CCR landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration when an SSL is identified (40 CFR 257.95(g)(3)(ii)). An owner or operator may:

> *Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section….*

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report to document that the SSLs identified for beryllium at AD-7 and AD-22 and cobalt at AD-22 are from a source other than the FGD Stackout Area.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which the identified SSL could be attributed. Alternative sources were identified amongst five types, based on methodology provided by EPRI (2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the SSLs identified for beryllium and cobalt were based on a Type IV cause and not by a release from the Pirkey FGD Stackout Area.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The Federal CCR Rule allows the owner or operator 90 days from the determination of an SSL to demonstrate that a source other than the CCR unit caused the SSL. The methodology used to evaluate the SSLs identified for beryllium and cobalt and the proposed alternative source are described below.

2.1 Proposed Alternative Source

An initial review of site geochemistry, site historical data, and laboratory quality assurance/quality control (QA/QC) data did not identify ASDs due to Type I (sampling), Type II (laboratory), or Type III (statistical evaluation) issues. Groundwater sampling, laboratory analysis, and statistical evaluations were generally completed in accordance with draft TCEQ guidance for groundwater monitoring (TCEQ, 2020). As described below, the SSL has been attributed to natural variation associated with seasonal effects, which is a Type IV (natural variation) issue.

2.1.1 Beryllium

SSLs were identified for beryllium at AD-7 and AD-22 using deseasonalized statistics (Geosyntec, 2020a). According to the Unified Guidance, "seasonal correction should be done both to minimize the chance of mistaking a seasonal effect for evidence of contaminated groundwater, and also to build more powerful background to compliance point tests. Problems can arise, for instance, from measurement variations associated with changing recharge rates during different seasons" (USEPA, 2009).

The seasonal effects observed in the statistical analysis occur in roughly annual cycles, with somewhat higher beryllium concentrations occurring in early spring and lower concentrations in early fall. For example, beryllium concentrations in 2020 at AD-22 were 0.0101 milligrams per liter (mg/L) in March 2020, in contrast to 0.0080 mg/L in June 2020. Previous ASDs for the Stackout Pad showed that beryllium concentrations at AD-22 and AD-7 appear to correlate with groundwater elevations at the wells (Geosyntec, 2019; Geosyntec, 2020b). This relationship still holds true at both AD-22 and AD-7 (**Figure 2**). Beryllium concentrations at AD-7 and AD-22 are both correlated with seasonal changes in other constituents, including calcium (**Figure 3**) and lithium (**Figure 4**). The correlation between beryllium and both monovalent (lithium) and divalent (calcium) cations suggests that the variability in observed beryllium concentrations are related to cation exchange behavior with clay minerals present in the native soil.

Soil borings which were advanced in March 2020 found that clay materials were identified in the seasonally saturated zones above the permanent water table (Geosyntec, 2020b). At AD-7, which was relogged by SP-B2, the depth to water fluctuated between approximately 9 and 15 feet below ground surface (ft bgs). Silty clay was identified from approximately 2.5-6.9 ft bgs before

transitioning to clay until 18.8 ft bgs (**Figure 5**). At AD-22, which was relogged by SP-B4, the depth to water fluctuated between approximately 3 and 12 ft bgs. Clay was identified from approximately 1.5 ft bgs to 13.3 ft bgs, where it transitioned to a clayey silt (**Figure 6**). Analysis by X-ray diffraction (XRD) confirmed the presence of clays within the seasonal water table and sand within the screened interval, as summarized in **Table 1**. The clay fraction of the uppermost samples collected from within the seasonal water table were further analyzed to identify the type of clays present. Smectite-type clays, which are 2:1-layer clays with characteristic cation exchange capacity, make up the majority of the clay minerals present at those intervals.

Sorption and desorption of beryllium from smectite-type clays is well documented (Boschi and Willenbring, 2016a; You, et al., 1989). Desorption was found to be affected by pH, with 75% of beryllium desorbed from a smectite-type clay as pH decreased from 6.0 standard units (SU) to 3.0 SU (Boschi and Willenbring, 2016b). The pH values recorded at AD-7 and AD-22 for samples collected under the Federal CCR Rule ranged from 2.9 to 4.1 SU and 3.9 to 5.1 SU, respectively, suggesting that conditions are favorable for beryllium desorption from smectite-type clays. The presence of these exchangeable clays provides further evidence that the exceedances of beryllium at AD-22 and AD-7 can be attributed to the effects of seasonal groundwater elevation changes, and the resulting cation exchange between groundwater and the exchangeable clay within the seasonal water table, on groundwater quality.

2.1.2 Cobalt

An SSL was identified for cobalt at AD-22 using deseasonalized statistics (Geosyntec, 2020a). As shown in a previous ASD (Geosyntec, 2020b), the cobalt concentrations at AD-22 also appear to correlate with seasonal changes in groundwater elevation (**Figure 7**). The cobalt concentrations are also well correlated with changes in other cations, including calcium and lithium (**Figure 8**), suggesting natural variability associated with interactions with the aquifer solids.

The concentration ratio between calcium and cobalt is consistently on the order of 1000:1 at both upgradient and downgradient locations (**Figure 9**). A sample was collected of the solid FGD sludge material which is accumulated on the Stackout Pad. The solid phase sample was leached using both USEPA's Synthetic Precipitation Leaching Profile (SPLP) testing procedure (SW-846 Test Method 1312) and TCEQ's 7-Day Distilled Water Leachate Test Procedure (30 TAC 335.521 Appendix 4). While cobalt concentrations in both of the leached samples are consistent with those observed in the groundwater samples, the leached calcium concentrations are approximately two to three orders of magnitude higher. However, calcium concentrations in groundwater are generally consistent between AD-22 and upgradient well AD-13 (**Figure 10**). The different ratio between calcium and cobalt in the leached FGD sludge material (about 45,000:1) as compared to the ratio for groundwater indicate that dissolved calcium concentrations at AD-22 would be significantly higher if the groundwater at this location were affected by leachate. The similarity between upgradient and downgradient calcium concentrations, provides an additional line of evidence that the exceedances observed at the FGD Stackout Pad are not due to a release from the unit.

Siderite and pyrite, both reduced iron-bearing minerals, were identified below the seasonal water table (within the saturated zone) at AD-22. Cobalt is known to undergo isomorphic substitution for iron in both siderite and pyrite (Gross, 1965; Hitzman, et al., 2017; Krupka and Serne, 2002). This is due to the similarity of their ionic radii (approximately 1.56 angstrom (Å) for iron vs. 1.52 Å for cobalt [Clementi and Raimondi, 1963). The proposed substitution of cobalt for iron in the crystal lattice of pyrite has been documented in other ASDs prepared for the Pirkey Plant's East Bottom Ash Pond (EBAP; Geosyntec, 2020c) and West Bottom Ash Pond (WBAP; Geosyntec, 2020d).

Goethite (an iron oxide) was identified within the seasonally saturated zone and the screened interval at AD-22 (**Table 1**). The weathering of siderite and pyrite to goethite under oxidizing conditions is a well-understood phenomenon, including in formations in east Texas (Senkayi, et al., 1986; Dixon, et al., 1982) and may have occurred within the seasonally saturated zone. A review of geochemical conditions at AD-22 shows that the conditions observed at AD-22 are favorable for goethite formation (**Figure 11**). During weathering from reduced to oxidized iron minerals, cobalt would be released from the mineral structure. The contribution of cobalt to groundwater via dissolution of siderite or pyrite within the saturated aquifer is not likely to change seasonally. However, the mobilization of cobalt which was released during weathering of siderite or pyrite to goethite in the seasonally saturated zone may explain the variability in aqueous cobalt concentrations and their correlation with the groundwater elevation.

2.1.3 Conceptual Site Model

The seasonal fluctuations in beryllium concentrations at AD-7 and AD-22 and cobalt at AD-22 can be attributed to variations in the amount of the aquifer solids that are in contact with groundwater as the water table elevation changes. When the water table is higher, more clay material is in contact with groundwater, allowing greater desorption of cations (including beryllium) from the cation exchange sites on the clay. In the case of cobalt, more iron oxides are in contact with groundwater as the water table rises, allowing for the release of cobalt from mineral phases where it has isomorphically substituted for iron. Thus, the observed SSLs were attributed to natural variation associated with seasonal desorption of beryllium and cobalt as the amount of aquifer solids that are saturated increases.

2.2 Sampling Requirements

As the ASD described above supports the position that the identified SSLs are not due to a release from the Pirkey FGD Stackout Area, the unit will remain in the assessment monitoring program. Groundwater at the unit will continue to be sampled for Appendix IV parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSL of beryllium at AD-7 and cobalt at AD-22 identified during assessment monitoring in June 2020 were not due to a release from the FGD Stackout Area. The identified SSLs were, instead, attributed to natural variation related to seasonal desorption or dissolution of beryllium and cobalt from the aquifer solids. Therefore, no further action is warranted, and the Pirkey FGD Stackout Area will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment C.**

SECTION 4

REFERENCES

AEP, 2017. Statistical Analysis Plan – H.W. Pirkey Power Plant. Hallsville, Texas. January.

Borggaard, O.K. 1987. Influence of iron oxides on cobalt adsorption by soils. *Eur. J. Soil Sci.*, 38, 229-238.

Bosci, V., and Willenbring, J.K. 2016a. The effect of pH, organic ligand chemistry, and mineralogy on the sorption of beryllium over time. *Environ. Chem*., 13, 711-722.

Boschi, V., and Willenbring, J.K. 2016b. Beryllium desorption from minerals and organic ligands over time. *Chem. Geo*., 439, 52-58.

Clementi, E., and Raimdoni, D. L. 1963. Atomic screening constants from SCF functions. *J. Chem. Phys.,* 38, 2686-

Dixon, J.B., Hossner, L.R., Senkayi, A.L., and Egashira, K. 1982. Mineral properties of lignite overburden as they relate to mine spoil reclamation. In: J.A. Kittrick, D.S. Fanning, L. R. Hossner, editors, Acid Sulfate Weathering, *SSSA Spec. Publ. 10*. SSSA, Madison, WI. p. 169-191.

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Site. 3002010920. October.

Geosyntec Consultants, 2019. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. Flue Gas Desulfurization (FGD) Stackout Area. Hallsville, Texas. October.

Geosyntec Consultants, 2020a. Statistical Analysis Summary, Flue Gas Desulfurization (FGD) Stackout Area. H.W. Pirkey Power Plant. Hallsville, Texas. October.

Geosyntec Consultants, 2020b. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. Flue Gas Desulfurization (FGD) Stackout Area. Hallsville, Texas. April.

Geosyntec Consultants, 2020c. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. East Bottom Ash Pond. Hallsville, Texas. April.

Geosyntec Consultants, 2020d. Alternative Source Demonstration Report – Federal CCR Rule. H.W. Pirkey Power Plant. West Bottom Ash Pond. Hallsville, Texas. April.

Gross, G.A. 1965. Geology of iron deposits in Canada – Volume 1: General geology and evaluation of iron deposits. Economic Geology Report No. 22 – Geological Survey of Canada.

Hitzman, M.W., Bookstrom, A.A., Slack, J.F., and Zientek, M.L., 2017. Cobalt – Styles of Deposits and the Search for Primary Deposits. USGS Open File Report 2017-1155.

Krupka, K.M. and Serne, R.J., 2002. Geochemical Factors Affecting the Behavior of Antimony, Cobalt, Europium, Technetium, and Uranium in Vadose Sediments. Pacific Northwest National Lab, PNNL-14126. December.

McLaren, R.G., Lawson, D.M., and Swift, R.S. 1986. Sorption and desorption of cobalt by soils and soil components. *J. Soil. Sci*., 37, 413-426.

Senkayi, A.L., Dixon, J.B., and Hossner, L.R. 1986. Todorokite, goethite, and hematite: alteration products of siderite in East Texas lignite overburden. *Soil Science*, 142, 36-43.

TCEQ, 2020. Coal Combustion Residuals Groundwater Monitoring and Corrective Action Draft Technical Guideline No. 32. Topic: Coal Combustion Residuals (CCR) Groundwater Monitoring and Corrective Action. Waste Permits Division. May 2020.

USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09/007. March.

You, C.-F., Lee, T., and Li-Y.-H. 1989. The partition of Be between soil and water. *Chem. Geol*., 77, 105-118.

TABLES

Table 1: X-Ray Diffraction Results
FGD Stackout Pad - H. W. Pirkey Plant

Geosyntec Consultants, Inc.

Boring Location	SP-B2			SP-B4		
Associated Well	AD-7			AD-22		
Depth (ft bgs)	10-12	16-18	27-29	6-8	18-20	28-30
Sample Location	Within Seasonal Water Table	Below Seasonal Water Table	Within Screened Interval	Within Seasonal Water Table	Below Seasonal Water Table	Within Screened Interval
Quartz	39	37	79	28	47.5	95
Plagioclase Feldspar	-	1	-	<0.5	<0.5	1
K-Feldspar	<0.5	1	-	1	0.5	-
Goethite	1	2	0.5	1	-	2
Hematite	-	-	0.5	-	-	-
Chlorite	-	-	-	1	-	-
Siderite		-			10	-
Pyrite	-	-	-	-	2	-
Clays	*	59	20	*	40	2
Kaolinite	9			13		
Illite/Mica	1			2		
Smectite	50			43		
Mixed-Layered Illite/Smectite	-			11		

Notes:

-: not detected

Mineral constituents are reported in percentage.

Values shown as less than indicate the mineral constituent is present but below the quantification limit.

*The clay fraction at SP-B2-10-12 and SP-B4-6-8 were further analyzed to characterize the types of clays present, as listed below.

FIGURES

Legend

- Downgradient Monitoring Well
- Upgradient Monitoring Well
- 2020 Soil Borings
- Stackout Pad

Notes

- Soil boring locations are approximate.
- Monitoring well locations are provided by AEP.

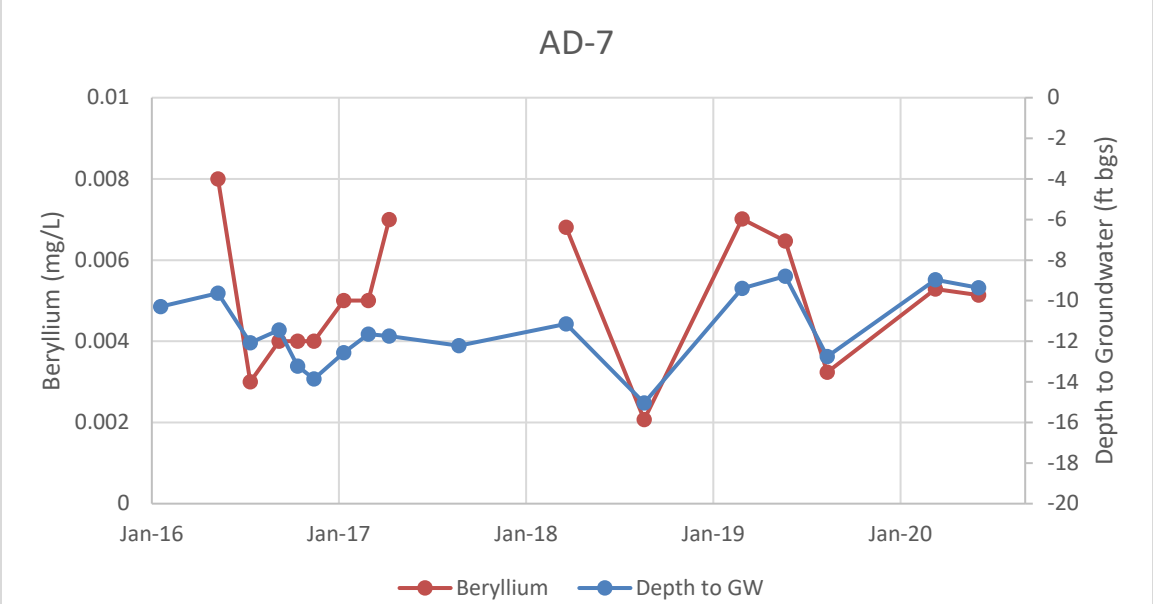
500 250 0 500 Feet

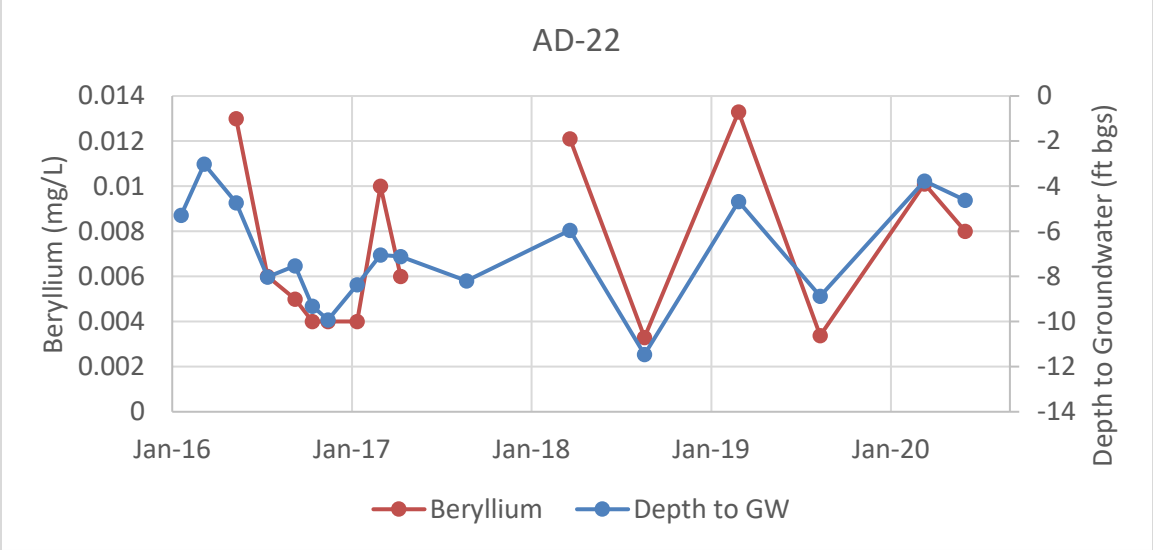
Site Layout

AEP Pirkey Power Plant
Hallsville, Texas

Geosyntec consultants	AMERICAN ELECTRIC POWER	Figure 1
Columbus, Ohio	2020/03/27	

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\Mike's GIS Files\Pirkey\MXDs\AEP-Pirkey_Stacker_Site_Layout.mxd. BAres. 3/27/2020. Project/Phase/Task.





Notes: Beryllium concentrations are shown in milligrams per liter (mg/L). Depth to water is shown as feet below ground surface (ft bgs). The gap in beryllium data represents the time period in which detection monitoring took place and samples were not analyzed for beryllium.

Beryllium v. Depth to Groundwater
Pirkey FGD Stackout Pad

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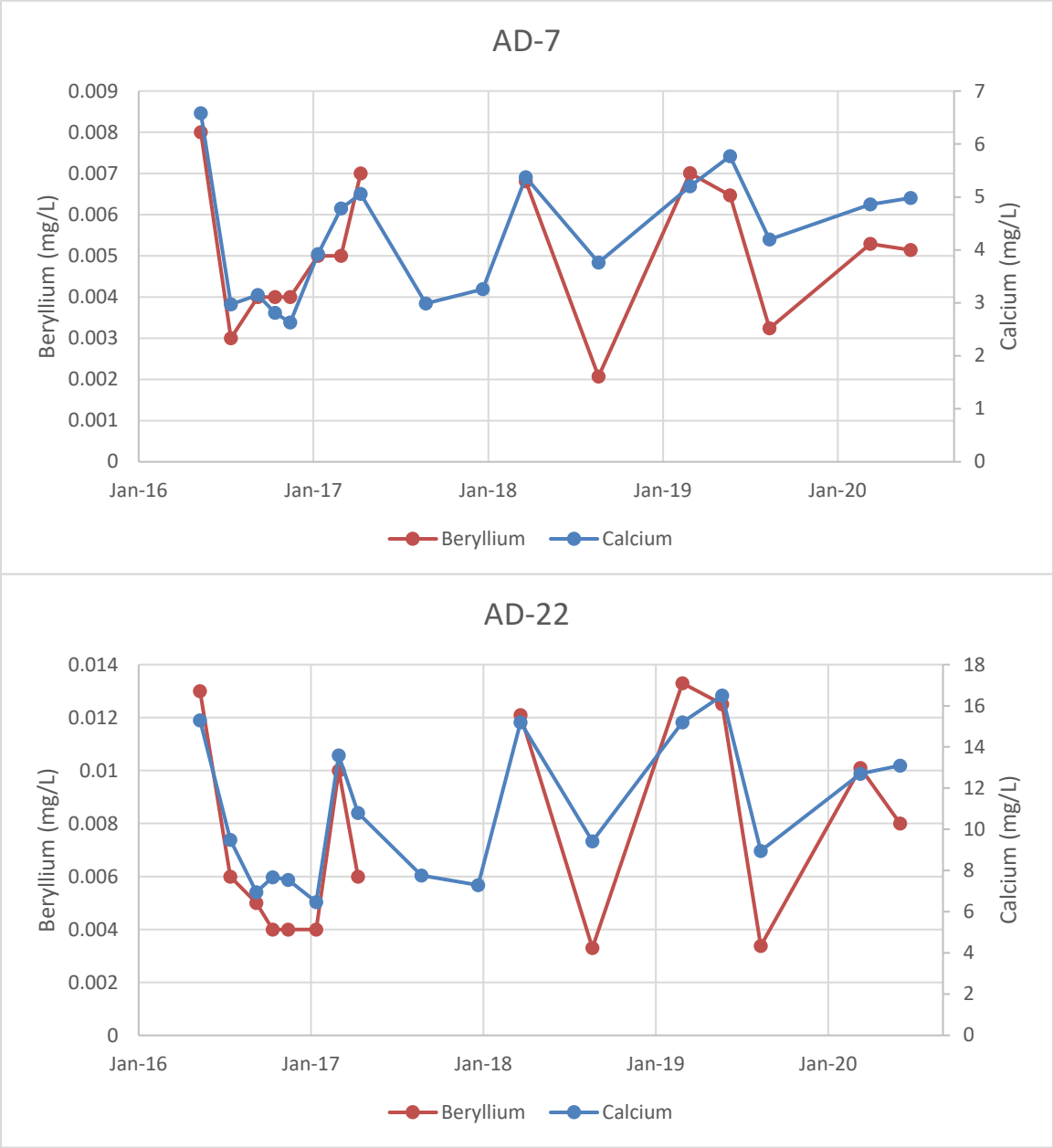
Columbus, Ohio | 2-Nov-2020

Figure **2**



Notes: Beryllium and calcium concentrations are shown in milligrams per liter (mg/L). The gaps in beryllium data represent the time period in which detection monitoring took place and samples were not analyzed for beryllium.

Beryllium v. Calcium Concentrations
Pirkey FGD Stackout Pad

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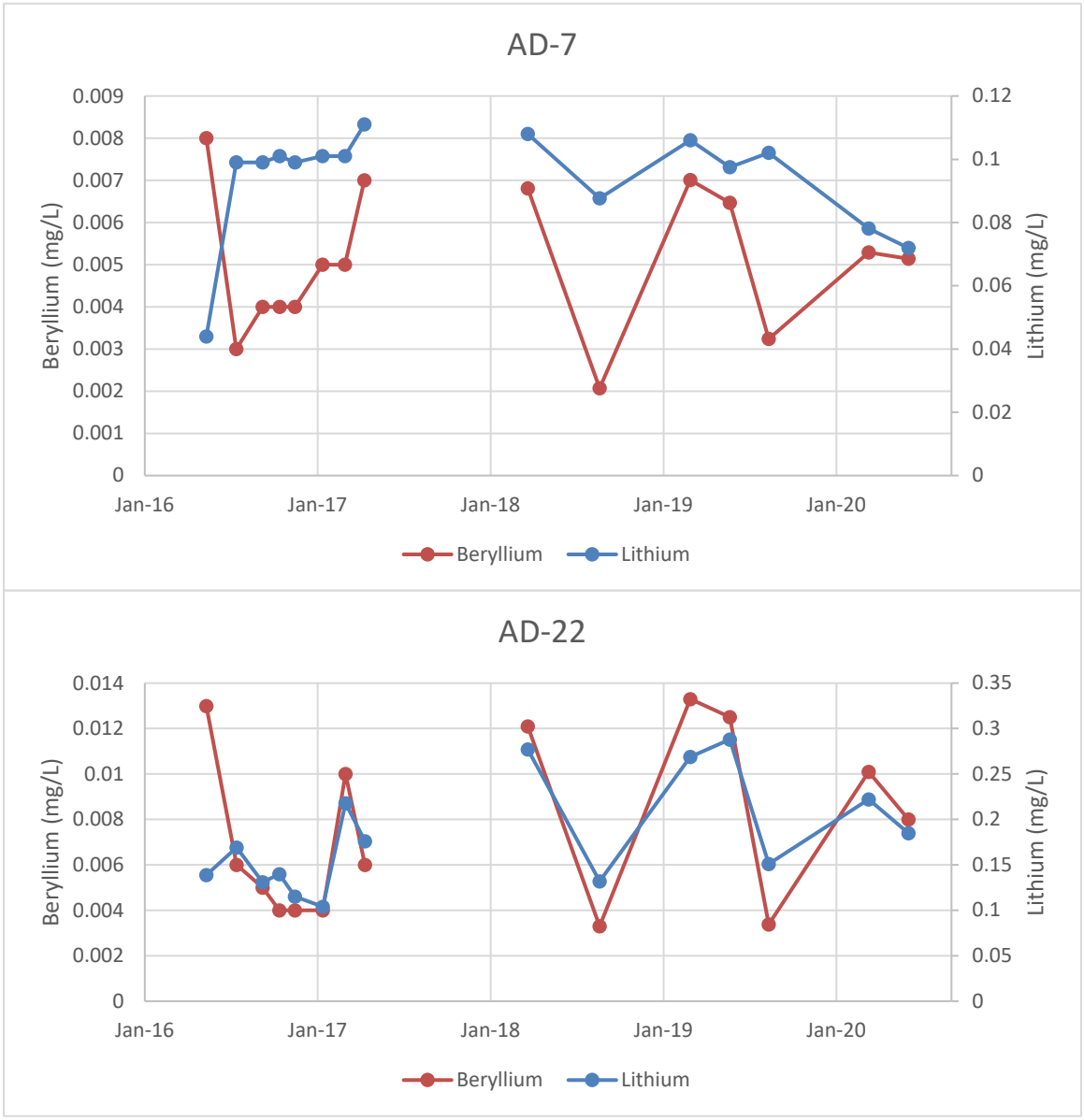
Figure
3

Columbus, Ohio

02-Nov-2020

internal info: path, date revised, author



Notes: Beryllium and lithium concentrations are shown in milligrams per liter (mg/L). The gaps in data represents the time period in which detection monitoring took place and samples were not analyzed for beryllium or lithium.

Beryllium v. Lithium Concentrations
Pirkey FGD Stackout Pad

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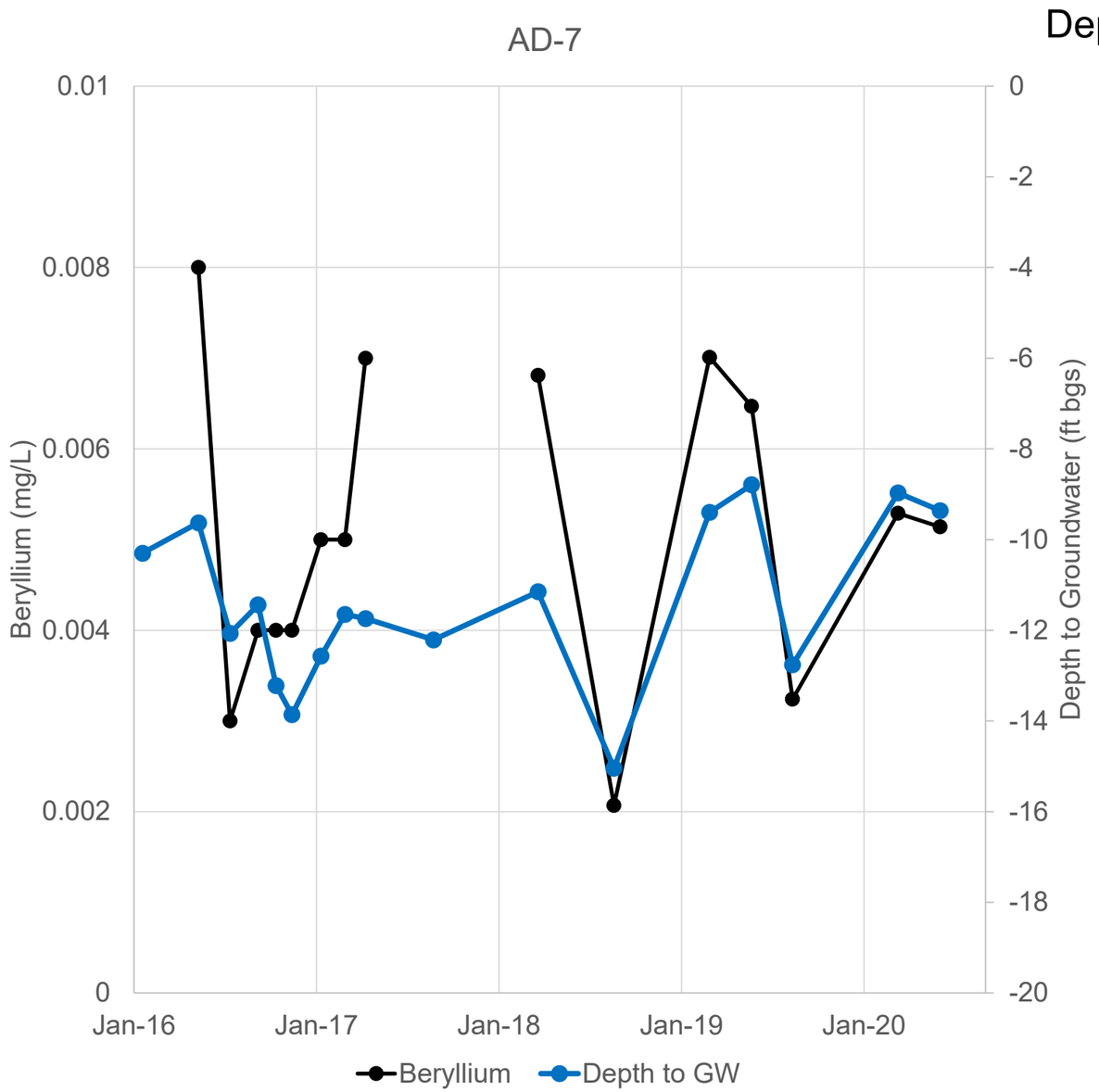
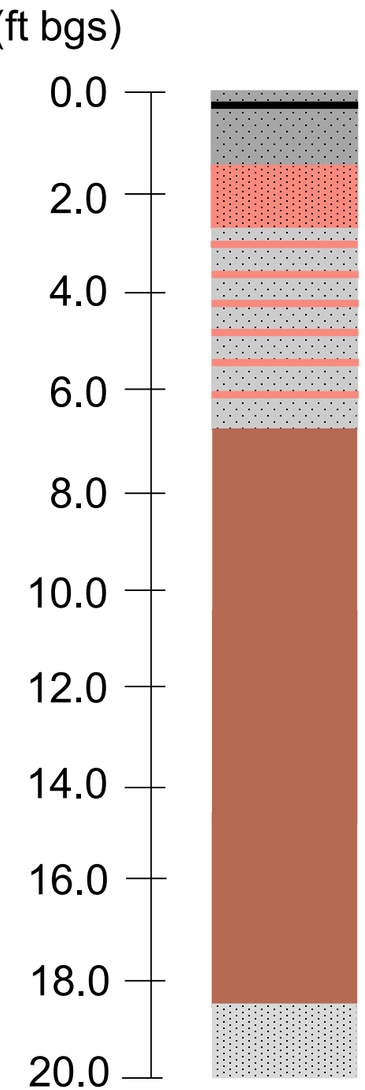
Figure
4

Columbus, Ohio

02-Nov-2020

internal info: path, date revised, author





Silt (Fly Ash)

Brittle grey fly ash with coal dust layer

Silt

1.7’ Brittle red silt

Silty clay

2.6’ Mottled grey/red silty clay

Clay

6.9’ Greyish maroon clay

Clay

10.0’ Stiff greyish maroon clay

Clayey silty sand

18.8’ Light grey very fine grained clayey silty sand

Notes:
-A sample was collected for analysis of mineralogy from 10-12 ft bgs.
-The full boring log is available in Attachment A.

internal info: Path, date revised, author

AD-7 Seasonal Water Table Geology

H.W. Pirkey Plant – FGD Stackout Pad

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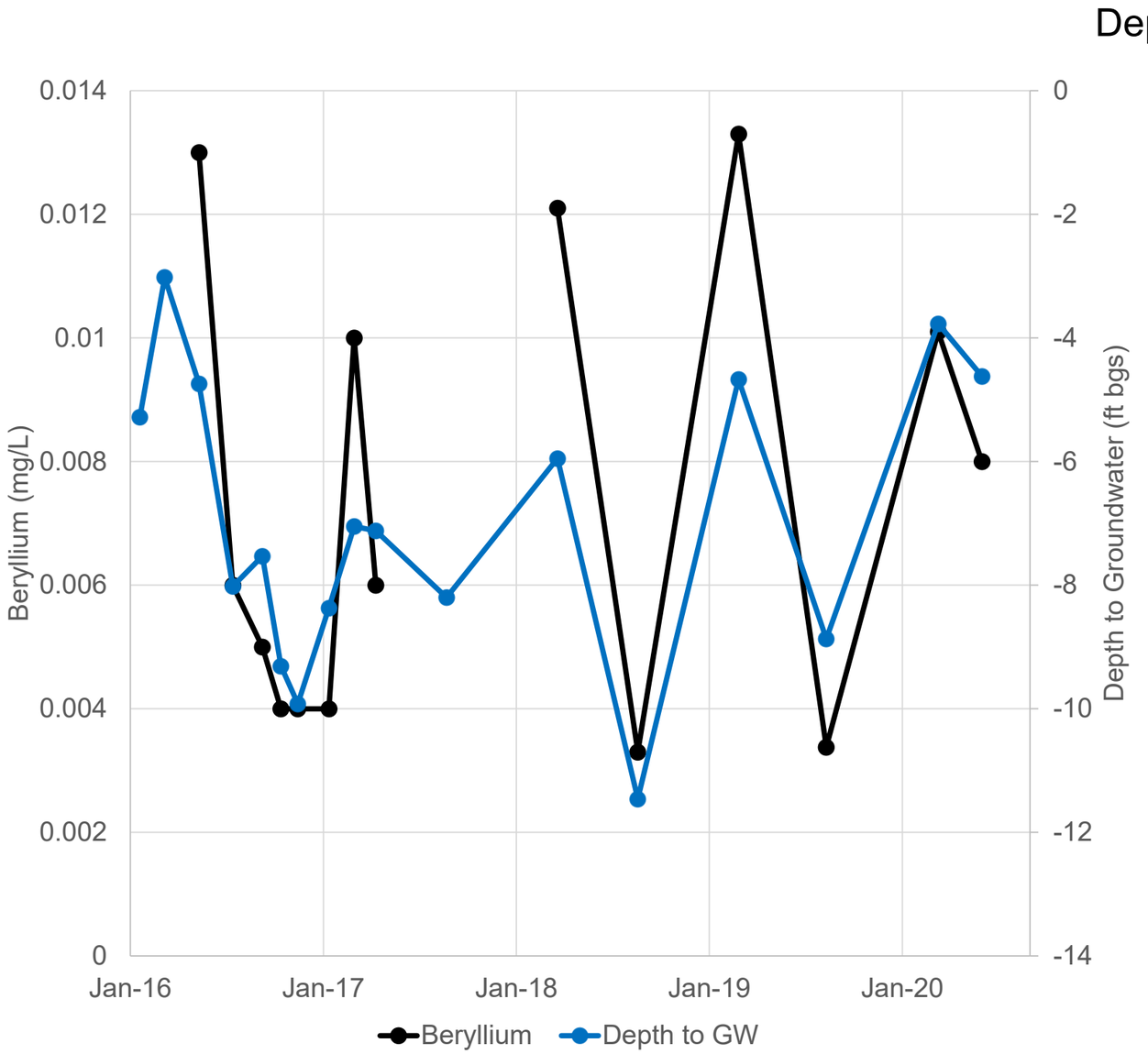
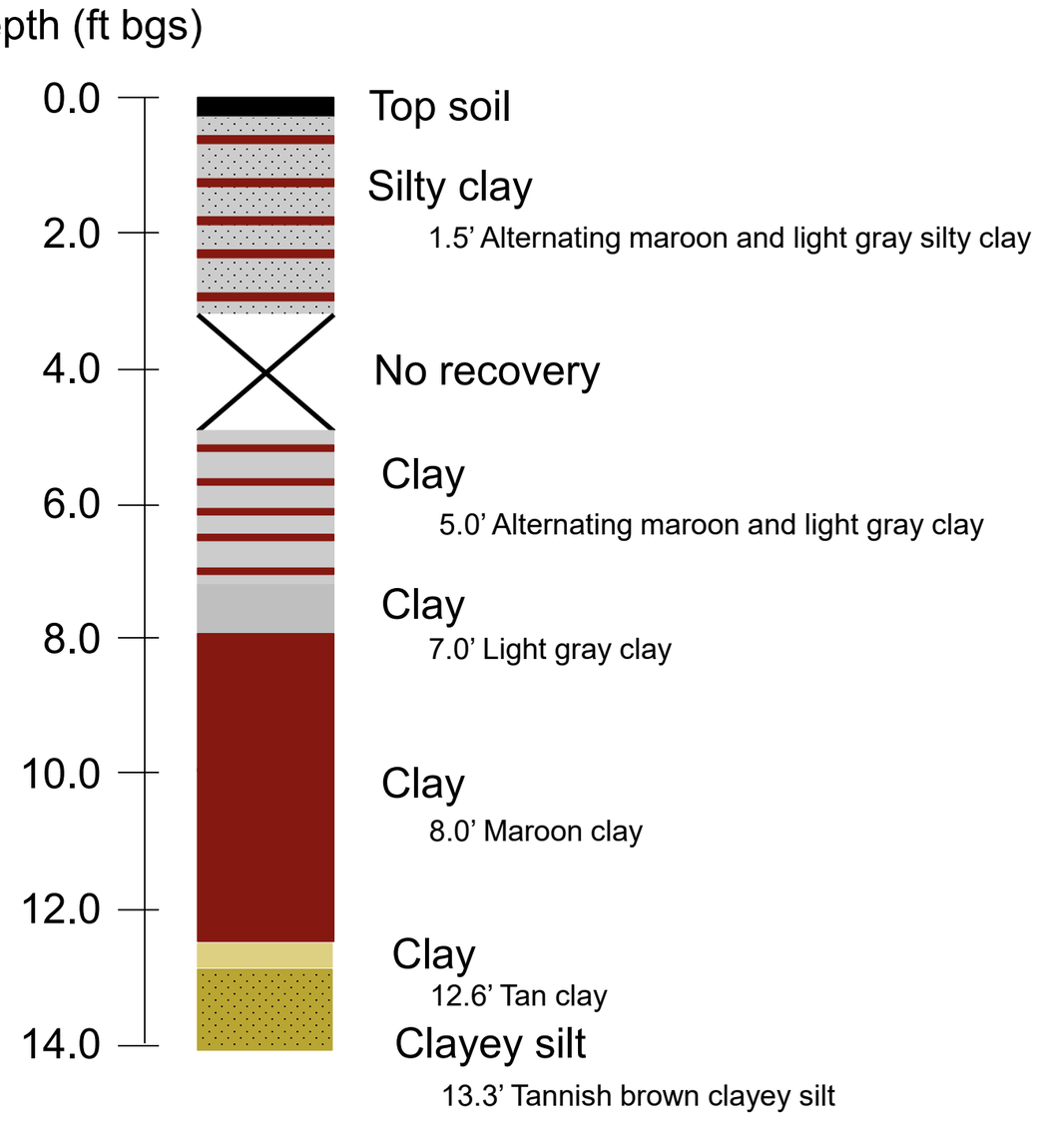
Figure **5**





Notes:
-A sample was collected for analysis of mineralogy from 6-8 ft bgs.
-The full boring log is available in Attachment A.

AD-22 Seasonal Water Table Geology
H. W. Pirkey Plant – FGD Stackout Pad

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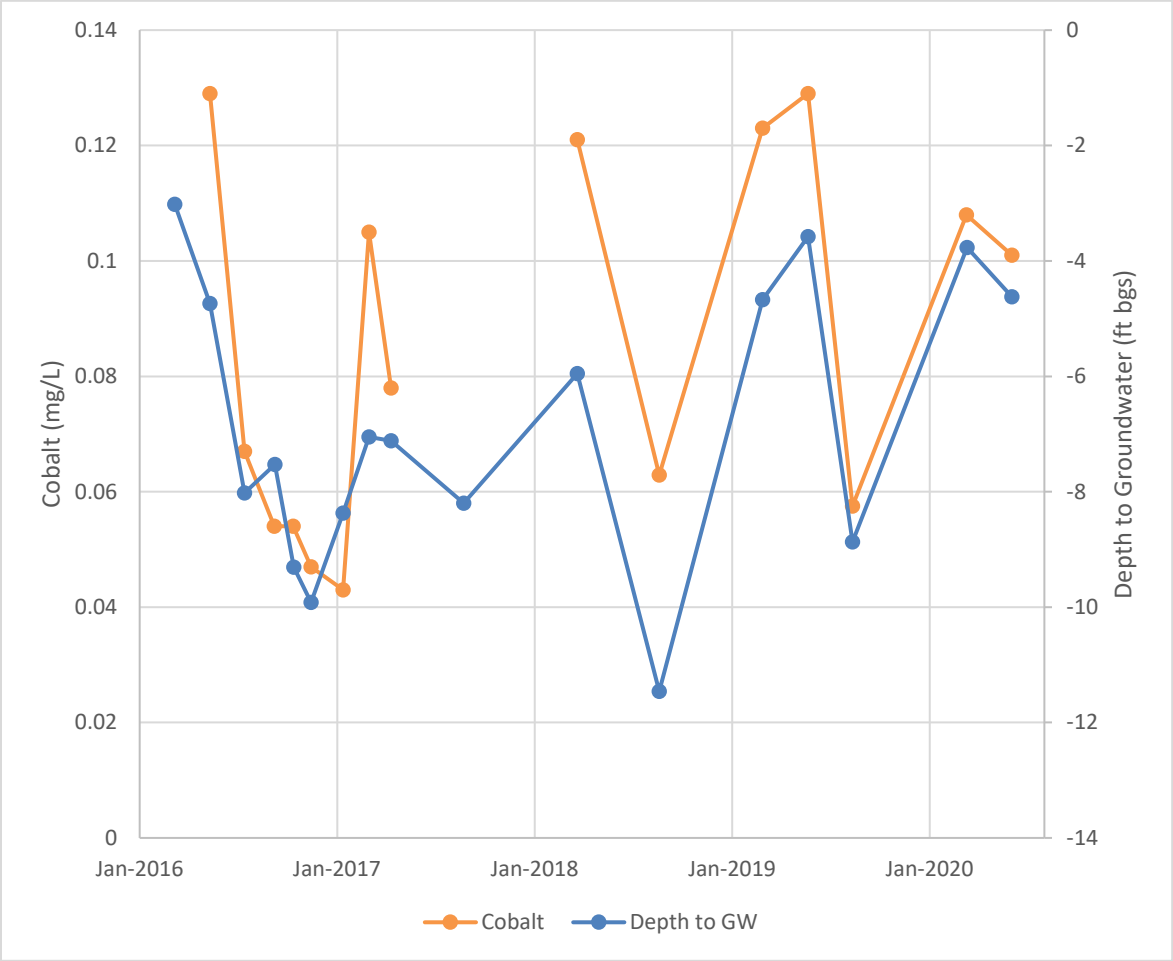
Columbus, OH | 02-Nov-2020

Figure **6**

Internal info: Path, date revised, author



Notes: Cobalt concentrations are shown in milligrams per liter (mg/L). Depth to water is shown as feet below ground surface (ft bgs). The gap in cobalt data represents the time period in which detection monitoring took place and samples were not analyzed for cobalt.

AD-22 Cobalt v. Depth to Groundwater
Pirkey FGD Stackout Pad

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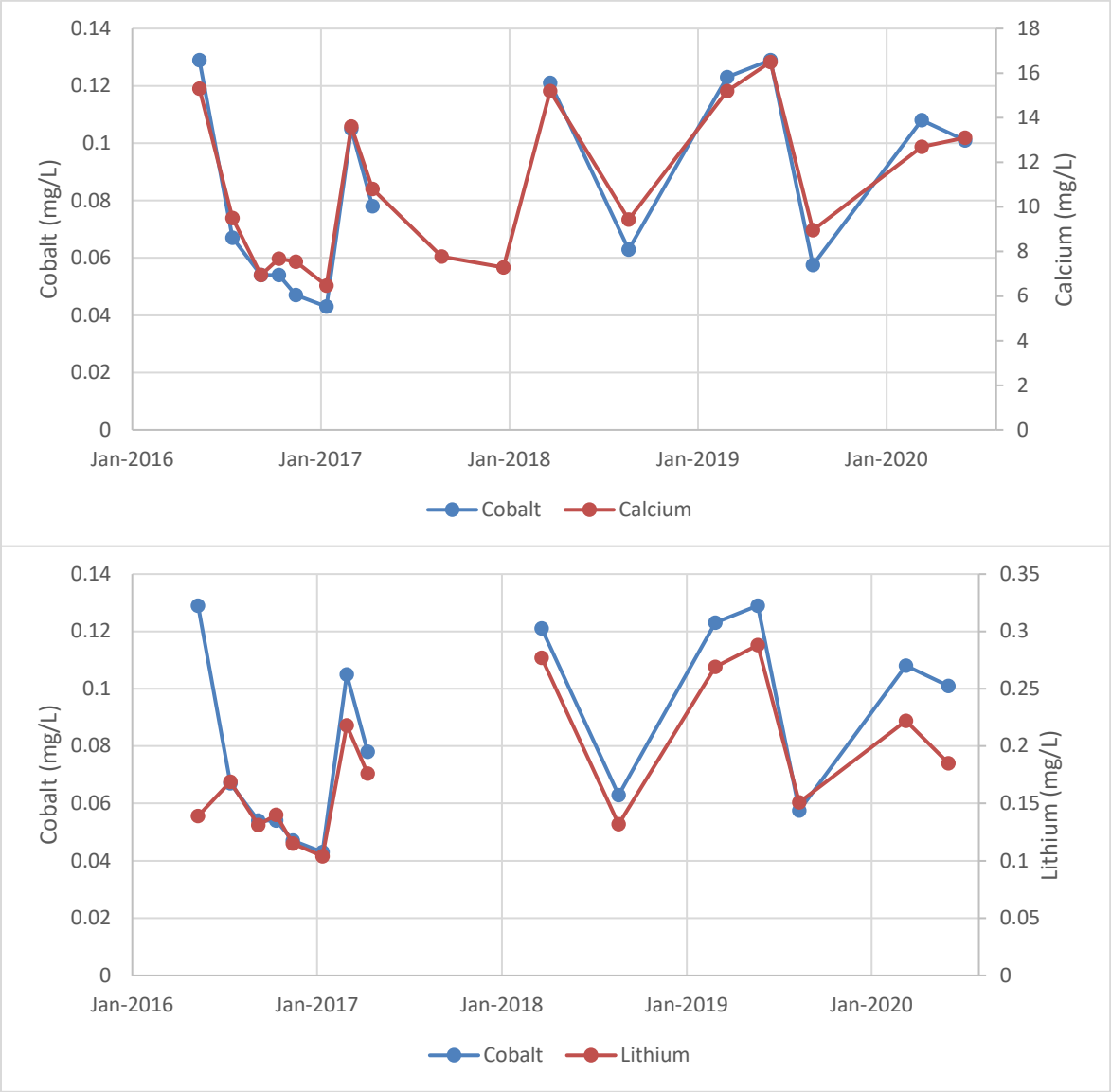
Figure 7

Columbus, Ohio

16-Nov-2020

internal info: path, date revised, author



Notes: Cobalt, calcium, and lithium concentrations are shown in milligrams per liter (mg/L). The gaps in cobalt and lithium data represent the time period during which detection monitoring took place and samples were not analyzed for cobalt and lithium.

AD-22 Cobalt v. Calcium and Lithium
Pirkey FGD Stackout Pad

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Figure 8

Columbus, Ohio

16-Nov-2020

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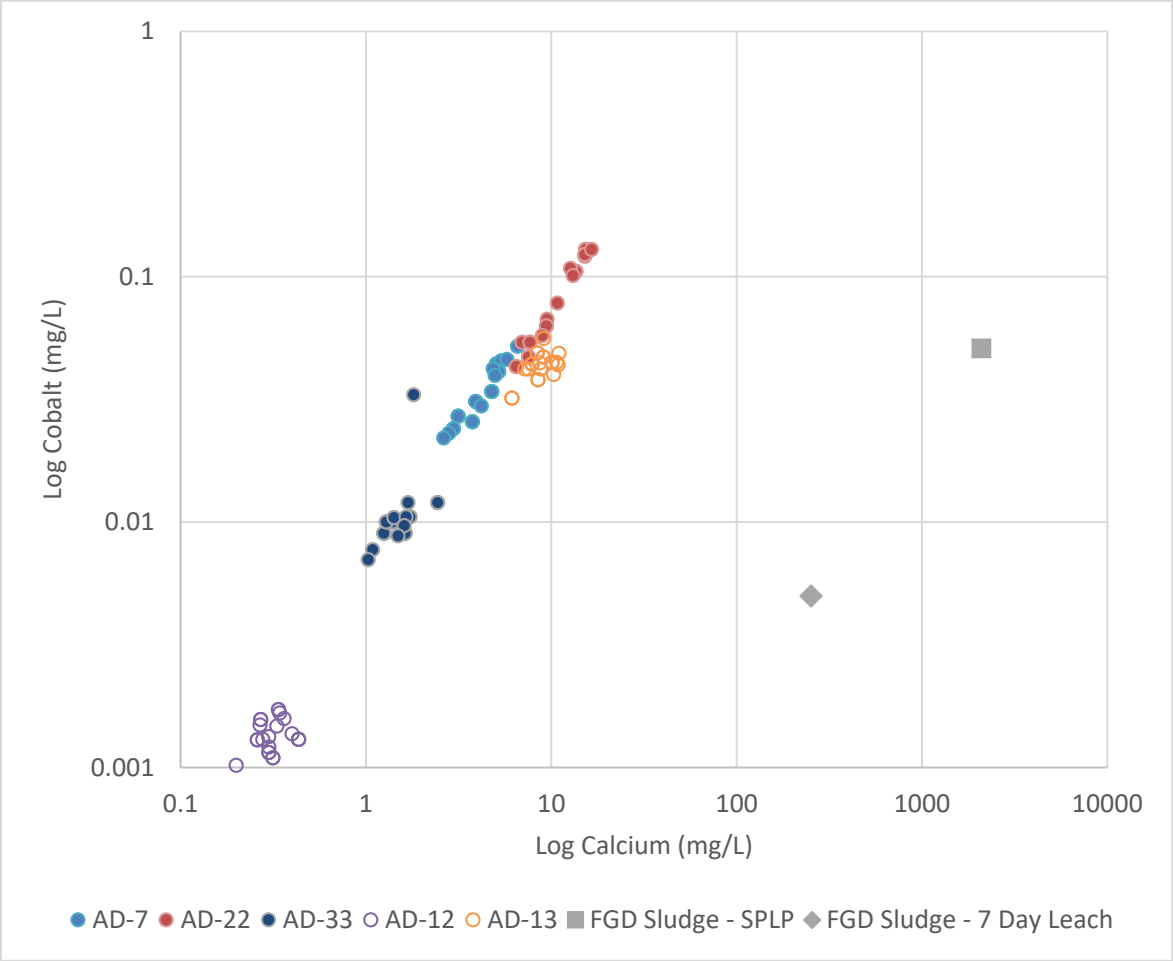

Notes: Cobalt and calcium concentrations are shown in milligrams per liter (mg/L). Upgradient wells are shown with hollow circles. 'FGD Sludge-SPLP' and 'FGD Sludge 7 Day Leach' present the leached concentrations of cobalt and calcium using the Synthetic Precipitation Leaching Procedure (SW-846 Test Method 1312) and the 7-Day Distilled Water Leachate Test Procedure (30 TAC 335.521 Appendix 4), respectively.

Cobalt and Calcium Concentration Distribution

Pirkey FGD Stackout Pad

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Figure 9

Columbus, Ohio

18-Dec-2020

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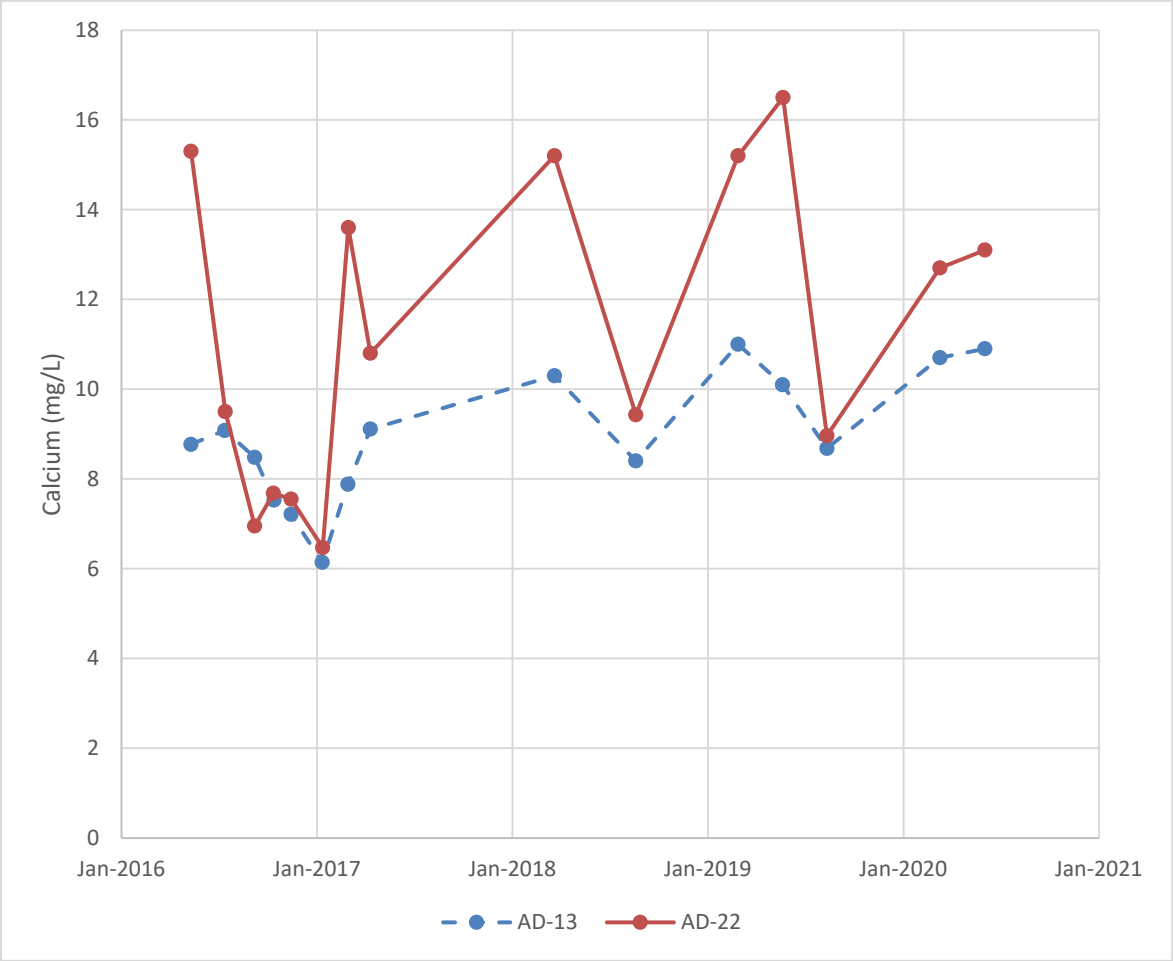

Notes: Calcium concentrations are shown in milligrams per liter (mg/L). AD-13 is shown with a dashed line because it is an upgradient location.

Calcium Time Series Graph
Pirkey FGD Stackout Pad

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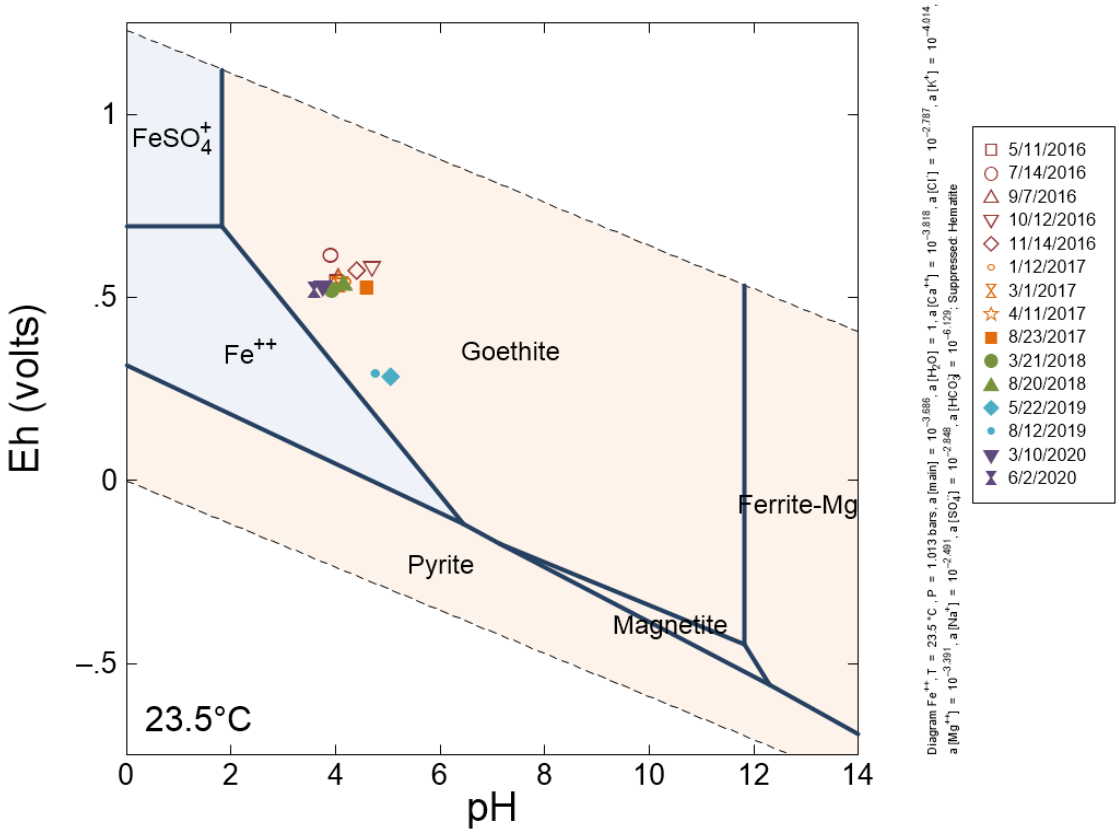
Figure **10**

Columbus, Ohio

15-Dec-2020



Notes: Average groundwater concentrations of major cations and anions at AD-22 were used to establish baseline conditions for the diagram. Eh and pH values for sampling dates at AD-22 are shown on the diagram.

AD-22 Eh-pH Diagram
Pirkey FGD Stackout Pad

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Columbus, Ohio | 15-Dec2020

Figure 11

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ATTACHMENT A
March 2020 Boring Logs

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B1

Project Location: Hallsville, TX

Boring Date: 3/2/2020

Soil Profile

Depth Scale Feet	Water Table	Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.4': Top soil with vegetation, black silt	
		0.4'-2.1': Brown silt, fine grained, little cohesion, dry	
		2.1'-4.3': Light maroon and gray clay, low plasticity, moderate stiffness (pp. 3.5); light brown silt/iron ore	
		4.3'-10.0': Maroon clay, low plasticity, high stiffness (pp. 4.0-5.0), iron ore (brown/red silt pockets throughout), moist at 8.5'	
5			
10	▽	10.0'-15.0': Dark maroon clay, wet, moderate plasticity, moderate stiffness (pp. 2.5-3.0), red/brown silt pockets (iron ore)	
15		15.0'-15.5': Dark maroon and red/brown clayey silt; low cohesion; wet	
		15.5'-20.0': Light gray and red/brown clayey silt, wet, low cohesion, iron ore present	
20		20.0'-21.8': Dark maroon and red/brown clayey silt; good cohesion; wet	
		21.8'-24.0': Black silty clay, high stiffness (pp. >5.0), low plasticity	
		24.0'-24.5': Black silty clay, low stiffness (pp. 2.0), moderate plasticity	
25		24.5'-30.0': Dark gray/dark green fine grained sand, well sorted, trace silt; wet	
30		Samples collected at 10-12'; 16-18'; 27-29'	
		TD at 30' bgs	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 7822 DT

Drilling Contractor: Best Drilling

Driller: Ramon Gutierrez

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B2

Project Location: Hallsville, TX

Boring Date: 3/2/2020

Soil Profile

Depth Scale Feet	Water Table	Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.2': Gray silt, dry, brittle (fly ash)	
		0.2'-0.4': Black, coal dust, strong odor	
		0.4'-1.7': Gray silt, dry, brittle (fly ash)	
		1.7'-2.6': red silt, brittle, dry	
		2.6'-6.5': Gray and red silty clay, high stiffness (pp. 4.0-5.0), low plasticity, iron ore/mottling present	
5		6.5'-6.9': Light gray, red and tan clay, low stiffness (pp. 1.5), moderate plasticity	
		6.9'-10.0': Light gray and maroon clay, moderate stiffness (pp. 3.5), low plasticity, iron ore/mottling present; moist near 9'	
10	▼	10.0'-15.0': Light gray and maroon clay, moderate/high stiffness (pp. 3.5-4.5), low plasticity, iron ore/mottling present; wet	
15		15.0'-18.5': Maroon and light gray clay, moderate/high stiffness (pp. 3.0-4.0), low plasticity; wet	
		18.5'-18.8': Red/brown silt, trace clay, good cohesion	
		18.8'-20.5': Light gray clayey silty sand, very fine grained, moderate sorting, mottling present; wet	
20		20.5'-23.4': Light gray and orange clayey silty sand, very fine grained; mottling present, moderate sorting; wet	
		23.4'-25.0': Maroon and orange silty clay, low stiffness (pp. 0.5), high plasticity; wet	
25		25.0'-29.0': Same as above; interchanging between silty clay and clayey silt throughout interval, iron ore/mottling present throughout	
		29.0'-29.5': Black clay, moderate stiffness (pp.3.0), low plasticity	
		29.5'-30.0': Gray fine grained sand, well sorted; wet	
30		Samples collected at 10-12'; 16-18'; 27-29'	
		TD at 30' bgs	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 3230 DT

Drilling Contractor: C&S

Driller: DJ Diduch

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B3

Project Location: Hallsville, TX

Boring Date: 3/2/2020

Depth Scale Feet	Water Table	Soil Profile Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.4': Top soil, Black silt with vegetation	
		0.4'-0.7': Brown silt, moist, low cohesion	
		0.7'-2.0': Maroon and light gray silty clay, moderate stiffness (pp.2.5), moderate plasticity, iron ore/mottling present	
		2.0'-2.2': Brown silt, dry, brittle	
		2.2'-5.6': Maroon and ligh gray clay, high stiffness (pp. 4.0), low plasticity	
5		5.6'-6.0': Orange silt, no cohesion, dry	
		6.0'-13.5': Maroon clay, high stiffness (pp >4.5), low plasticity; moist at 9'; wet at 12'	
10	▼		
		13.5'-13.6': Brown/orange silt (iron ore), no cohesion	
		13.6'-17.5': Gray and orange clayey silt, good cohesion; iron ore present; wet	
15			
		17.5'-20.2': Maroon and orange silty clay, low stiffness(pp. 0.5), moderate plasticity; iron ore present; wet	
20		20.2'-21.1': Brown silt, no cohesion; wet	
		21.1'-22.7': Brown fine grained sand, well sorted; wet	
		22.7'-25.0': Maroon and orange silty clay, low stiffness (pp. 0.5), low plasticity; iron ore present; wet	
25			
30		Samples collected at 10-12'; 15-17'; 22-24'	
		TD at 25' bgs; refusal	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 3230 DT

Drilling Contractor: C&S

Driller: DJ Diduch

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Boring/Well Name: SP-B4

Project Location: Hallsville, TX

Boring Date: 3/3/2020

Depth Scale Feet	Water Table	Soil Profile Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.4': Top soil, black silt, vegetation	
		0.4'-0.7': Brown clayey silt, good cohesion	
		0.7'-1.5': Red and light gray silty clay, moderate stiffness (pp. 2.5), high plasticity	
		1.5'-3.7': Maroon and light gray clay, high stiffness (pp. 4.5-5.0), low plasticity; iron ore present 3.1'-3.7'	
		3.7'-5.0': NO RECOVERY	
5		5.0'-7.0': Maroon and light gray clay, high stiffness (pp. 4.5-5.0), low plasticity; iron ore present throughout	
		7.0'-8.0': Light gray clay with iron ore, moderate stiffness (pp.2.5-3.0), moderate plasticity	
		8.0'-10.0': Maroon clay, moderate stiffness (pp. 3.5), moderate plasticity; iron ore present; moist at 9'	
10	▽	10.0'-12.6': Maroon clay, moderate stiffness (pp. 3.5), moderate plasticity; iron ore present; wet at 12'	
		12.6'-13.3': Tan clay, low stiffness (pp.1.5), high plasticity; wet	
		13.3'-18.5': Tan and brown clayey silt, moderate cohesion; iron ore present; wet	
15			
		18.5'-20.3': Maroon silty clay, low stiffness (pp. 1.0), moderate plasticity; iron ore; wet	
20		20.3'-21.1': Dark gray/black clay, trace silt, low stiffness (pp. 1.5), high plasticity; wet	
		21.1'-21.3': Dark gray silt, good cohesion; wet	
		21.3'-21.9': Dark gray silty clay, low stiffness (pp. 1.5), high plasticity; wet	
		21.9'-22.3': Dark gray silt, moderate cohesion; wet	
		22.3'-22.7': light brown silt; low cohesion; wet	
		22.7'-24.4': Dark gray and dark green silty clay, moderate/high stiffness (pp.3.5), moderate plasticity; wet, glauconite present	
		24.4'-27.8': Dark green/gray fine grained sand, well sorted; wet; glauconite present	
25		27.8'-30.0': Red and orange fine grained sand, well sorted, with iron ore; wet	
30			
		Samples collected at 6-8'; 18-20'; 28-30'	
		TD at 30' bgs; refusal	
		*PID readings not collected	
35			

Drill Rig: Geoprobe 3230 DT

Drilling Contractor: C&S

Driller: DJ Diduch

Geosyntec Consultants

Soil Boring Log

Project: AEP Pirkey

Project Location:____ Hallsville, TX

Boring/Well Name:_____ SP-B5

Boring Date:__ 3/5/2020

Soil Profile

Depth Scale Feet	Water Table	Description	PID*
		pp= pocket penetrometer	
0		0.0'-0.6': Top soil, black silt, vegetation	
		0.6'-0.9': Brown clayey silt, good cohesion	
		0.9'-2.4': Red and gray silty clay, moderate/high stiffness (pp. 3.5), high plasticity; iron ore present	
		2.4'-5.0': NO RECOVERY	
5		5.0'-8.6': Maroon and gray clay, moderate/high stiffness (pp. 3.5), low plasticity; iron ore present; moist	
	▼	8.6'-10.0': Light gray and maroon clay, moderate/low stiffness (pp.2.0), high plasticity; iron ore present; wet	
10		10.0'-12.0': Maroon and gray clay, high stiffness (pp. 4.0), moderate plasticity, iron ore present; wet	
		12.0'-12.9': Iron ore with maroon clay, high stiffness (pp.4.0), moderate plasticity; wet	
		12.9'-15.0': Maroon clay, high stiffness (pp.4.0), high plasticity; iron ore present; wet	
15		15.0'-18.4': Light gray and orange clayey silt, good cohesion; iron ore present; wet	
		18.4'-18.6': Dark maroon iron ore; wet	
		18.6'-20.0': Orange and gray clayey silt, good cohesion; iron ore present; wet	
		20.0'-21.2': Maroon and orange clayey silt, good cohesion; iron ore present; wet	
20		21.2'-22.3': Black clay, trace silt, low stiffness (pp.1.0), high plasticity; wet	
		22.3'-22.6': Black clay, high stiffness (pp.4.5), moderate plasticity	
		22.6'-22.9': Black silt, no cohesion; wet	
		22.9'-23.4': Black clay, trace silt, moderate stiffness (pp.2.5), high plasticity; wet	
		23.4'-25.0': Dark gray and green fine grained sand; well sorted; wet; glauconite present	
25		Samples collected at 6-8'; 16-18'; 23-25'	
		TD at 25' bgs; refusal	
		*PID readings not collected	
30			
35			

Drill Rig Geoprobe 3230 DT

Drilling Contractor:___ C&S

Driller:_ DJ Diduch

Geosyntec Consultants

ATTACHMENT B

AD-22 Boring Log and Well Installation Diagram

☐ BORING ■ MONITOR WELL

APEX PROJECT NO.: 110-089 BORING NUMBER: ____ MONITOR WELL NUMBER: AD-22

FACILITY NAME: AEP- Pirkey Power Plant FACILITY ID NO.: N/A

FACILITY ADDRESS: Hallsville, Texas

DRILLING COMPANY/METHOD/RIG: Apex Geoscience Inc. / Hollow-stem Augers/ CME-55 Track Rig

DRILLER: Ed Wilson, Apex Geoscience Inc. COMPLETION DATE: 12/16/2010

PREPARED BY: David Bedford LOGGED BY: David Bedford

LATTITUDE: N 32°27'03.3" Datum: WGS-84 WELL LOCATION: Triangle- South side Quansit Hut

LONGITUDE: W94°29'41.3"

DEPTH (FEET)	PID (PPM)	SAMPLE INTERVAL	WELL LOG AND COMPLETION DETAILS	USCS CODE	SOIL DESCRIPTION AND COMMENTS	Odor	Moisture
1			0-0.5	SC	Clayey sand, light brown, very fine grained	None	Moist
2			0.5-12	CL	Lean clay, light brown mottled with light gray	None	Slightly Moist
3							
4					Few iron ore (small) pebbles in clayey sandy streaks		
5							
6							
7							
8							
9							
10							
11							
12							
13			▽	12-20	SC	Clayey sand, grayish brown with orangish brown streaks, very fine grained	None	Slightly Wet
14					Slightly wet @ 12.5' from seepage		
15					Large amount of iron ore 15-17'		
16							
17							
18							
19					Very firm 18-18.5'		
20							
21				20-25	SC	(Dense crystalline rock 21-21.1'), light brown clayey sand, greenish black, mica, black clay streaks, very fine grained, wet @ 20'	None	Wet
22							
23							
24							
25							
26				25-30	SM	Sand, greenish brown (1') grading to orangish brown, silty, very fine grained	None	Wet
27							
28							
29							
30							
31					Boring Terminated at 30'		
32							
33							
34							
35							
36							
37							
38							
39							
40							

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

Total Depth: 30 feet Riser Interval: +3 (ags)-10'

Filter Sand (Size/Interval): 8-30' Screen Interval: 10-30'

Grout (Type/Interval): Grout from 0-2'; Bentonite from 2-8' Water level: 12.5'

Surface Completion ☐ Flush ■ Above Ground 3'

Note: This log is not to be used separate from this report.

ATTACHMENT C
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Pirkey FGD Stackout Area CCR management area and that the requirements of 40 CFR 257.95(g)(3)(ii) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Gross
Signature

Geosyntec Consultants
2039 Centre Pointe Blvd, Suite 103
Tallahassee, Florida 32308

Texas Registered Engineering Firm
No. F-1182

79864	Texas	12/31/2020
License Number	Licensing State	Date

APPENDIX IV

Reports documenting monitoring well plugging and abandonment or well installation are included in the appendix.

STATE OF TEXAS WELL REPORT for Tracking #540556

Owner:	**American Electric Power Company**	Owner Well #:	**AD-7R**
Address:	**502 N. Allen Street Shreveport, LA 71101**	Grid #:	**35-37-1**
		Latitude:	**32° 27' 43.7" N**
Well Location:	**2400 Farm Road 3251 Hallsville, TX 75650**	Longitude:	**094° 29' 18.3" W**
Well County:	**Harrison**	Elevation:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **3/3/2020** Drilling End Date: **3/3/2020**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**8.25**	**0**	**31.5**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**18**	**31.5**	**Sand**	**20/40**

Annular Seal Data: **No Data**

Seal Method: **Poured**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **C&S Lease**

1873 FM 1252 E
Kilgore, TX 75663

Driller Name: **Buford E. Collier** License Number: **50089**

Apprentice Name: **David Diduch** Apprentice Number: **60297**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**1.5**	**Top soil, vegetation, black silt, gravel, light gray/red/brown clayey silt**
1.5	**10**	**Red/light gray clay, low plasticity, high stiffness, iron ore present, trace silt,**
10	**15**	**Maroon/light gray clay, high stiffness, low plasticity, iron ore, wet**
15	**20**	**Black silty clay, low-moderate plasticity, wet, Maroon/orange clayey silt, wet, good cohesion, iron ore, gray/orange clayey silt, iron ore present, wet, good cohesion**
20	**24.6**	**Black clayey silt, Dark gray fine grained sand, trace clay, wet, black silty clay, low-moderate plasticity, moderate to low stiffness**
24.6	**31.5**	**Dark gray fine grained sand, wet, well sorted, orange fine grained sand, wet, well sorted, tan fine grained sand, wet, well sorted, iron present**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Riser**	**New Plastic (PVC)**	**40**	**0**	**20**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**20**	**30**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540