

Annual Groundwater Monitoring Report

Kentucky Power Company

Mitchell Plant

Landfill

Moundsville, WV

January 2022

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An **AEP** Company

BOUNDLESS ENERGYSM

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I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for the landfill at Kentucky Power Company's, a wholly owned subsidiary of American Electric Power Company (AEP), Mitchell 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 31st.

In general, the following activities were completed in 2021:

- The unit was in Detection monitoring at the beginning and end of 2021;
- Groundwater samples were collected on May 12, 2021 and on October 20, 2021, and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater monitoring data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Appendix III constituents were compared to prediction limits (intervals for pH) established from background data established previously. Statistical comparisons to background were made for samples collected on October 21, 2020 and May 12, 2021;
- The statistical evaluations concluded that there were statistically significant increases (SSIs) over background of three Appendix III constituents at one well (chloride, fluoride, total dissolved solids at monitoring well MW-1102F);
- Because SSIs over background of Appendix III constituents were detected at Mitchell Plant's landfill, an ASD study was conducted resulting in an August 2021 ASD report;
- Statistical analysis of the groundwater samples collected and analyzed for all Appendix III constituents during the sampling event on October 20, 2021 will be completed in 2022.

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;
- 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 (Attached as Appendix 1);
- Statistical comparison of monitoring data to determine if there have been one or more SSIs over background levels (Attached as Appendix 2, where applicable);

- A discussion of whether any alternate source demonstrations were performed, and the conclusions (Attached as Appendix 3, where applicable);
- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as Appendix 4, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement regarding the rationale for the installation/decommission (Attached as Appendix 5, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, 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

A figure that depicts the PE-certified groundwater monitoring network, the monitoring well locations, and their corresponding identification is provided in Appendix 1.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2021. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mitchell Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

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

In response to initially significant increases in concentrations of boron, chloride, sulfate, and total dissolved solids detected in groundwater samples at monitoring well MW-1102F during the October 21, 2020 sampling event, resamples for these constituents were collected at the well on March 17, 2021. During the resampling, the sampling team inadvertently sampled the well for all Appendix III constituents instead of only boron, chloride, sulfate, and total dissolved solids. In response to initially significant increases in concentrations of chloride, fluoride, and total dissolved solids detected in groundwater samples at monitoring well MW-1102F during the May 12, 2021 sampling event, resamples for these constituents were collected at the well on October 12, 2021. Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality and detection monitoring. Static water elevation data from

each monitoring event also are shown in Appendix 1, along with the groundwater velocities, groundwater flow direction, and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis of the detection monitoring samples collected on October 21, 2020 was completed on May 18, 2021. The evaluation concluded that SSIs of chloride and total dissolved solids over background levels were detected in one monitoring well (MW-1102F). Statistical analysis of the detection monitoring samples collected on May 12, 2021 was completed on December 14, 2021. The evaluation concluded that SSIs of chloride, fluoride, and total dissolved solids over background levels were detected at MW-1102F. Memoranda with the results of the statistical evaluations are provided in Appendix 2.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event on October 20, 2021. A statistical evaluation of these results will be completed in 2022.

VI. Alternative Source Demonstrations

Because SSIs over background were detected during the October 21, 2020 sampling event, an alternative source demonstration (ASD) study was conducted resulting in an August 2021 ASD report. The report concluded that the SSIs were not due to a release from the Mitchell Landfill, but were instead attributed to natural variation in groundwater quality. The report is provided in Appendix 3. An ASD study is being conducted in response to SSIs detected over background during the May 12, 2021 sampling event. This study will be completed in 2022.

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

No transition between monitoring requirements occurred in 2021; the CCR unit remained in detection monitoring over the entire year. A statement to this effect is provided in Appendix 4. The sampling frequency of twice per year will be maintained for the Appendix III constituents (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the semiannual detection monitoring schedule is necessary.

VIII. Other Information Required

The Mitchell landfill has remained in its current status of detection monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2021 and Actions Taken

No significant problems were encountered. Through the use of low-flow purging and sampling methodology, samples representative of uppermost aquifer groundwater were obtained and the schedule was met to support this annual groundwater report preparation. There were, however, dry wells encountered during sampling, but this did not affect the statistical evaluation or monitoring network at the landfill. The minimum requirement of one upgradient and three downgradient wells was still met.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2022 include the following:

- Detection monitoring on a semiannual schedule;
- Statistical evaluation of the detection monitoring results to determine any SSIs (or decreases with respect to pH);
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program. Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time groundwater was sampled in the form of annotated satellite images.

**Table 1 - Groundwater Data Summary: MW-1101F
Mitchell - LF
Appendix III Constituents**

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
6/15/2016	Background	0.042	88.3	3.87	0.22	7.4	64.3	395
8/3/2016	Background	0.380	91.0	3.30	0.21	7.4	62.1	425
9/28/2016	Background	0.054	88.6	3.73	0.26	8.7	58.1	466

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1101F
Mitchell - LF
Appendix IV Constituents**

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.21	1.64	159	0.023	0.08	0.6	0.294	0.304	0.22	0.525	0.012	< 0.002 U1	3.87	0.2	0.02 J1
8/3/2016	Background	0.14	1.46	155	0.033	0.08	0.6	0.244	1.494	0.21	0.673	0.017	< 0.002 U1	4.04	0.2	< 0.01 U1
9/28/2016	Background	0.18	1.79	142	0.029	0.12	0.8	0.231	1.561	0.26	0.511	0.016	< 0.002 U1	3.39	0.3	0.02 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1101R
Mitchell - LF
Appendix III Constituents**

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
6/15/2016	Background	0.287	6.91	8.41	1.20	8.2	76.4	741
8/3/2016	Background	0.518	5.00	10.3	1.56	8.4	76.4	750
9/28/2016	Background	0.382	6.12	13.3	1.83	8.5	43.5	43
11/16/2016	Background	1.80	19.4	15.2	2.29	8.6	32.2	801
2/14/2017	Background	0.501	2.23	15.4	2.40	8.6	32.0	806
4/12/2017	Background	0.360	4.02	14.4	2.17	8.7	39.2	798
5/24/2017	Background	0.380	1.91	15.1	2.41	8.7	28.6	793
7/25/2017	Background	0.415	1.76	15.8	2.61	8.7	28.7	788
10/11/2017	Detection	0.394	1.87	16.9	2.59	8.7	29.1	784
1/11/2018	Detection	--	1.75	--	--	7.9	28.8	--
4/10/2018	Detection	0.344	1.75	16.5	2.62	8.5	29.0	790
8/29/2018	Detection	0.371	2.42	16.3	2.45	9.0	29.7	783
5/1/2019	Detection	0.376	1.90	16.9	2.62	10.5	28.7	809
6/12/2019	Detection	0.371	2.03	16.2	2.38	8.8	27.4	822
10/23/2019	Detection	0.389	1.81	17.2	2.70	8.7	28.4	820
5/6/2020	Detection	0.364	2.17	15.1	2.46	8.2	23.9	828
10/21/2020	Detection	0.409	2.42	16.6	2.57	9.1	28.5	845
5/12/2021	Detection	0.349	2.46	16.8	2.47	8.3	27.5	856
10/20/2021	Detection	0.359	2.6	16.9	2.60	8.6	24.6	850

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1101R
Mitchell - LF
Appendix IV Constituents**

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.82	8.11	185	0.031	0.03	1.1	0.650	0.493	1.20	1.22	0.002	0.003 J1	31.8	0.5	0.05 J1
8/3/2016	Background	1.10	10.8	149	0.023	0.03	1.0	0.363	0.4776	1.56	0.674	0.012	< 0.002 U1	32.9	0.5	0.02 J1
9/28/2016	Background	0.92	11.1	149	0.01 J1	0.02	0.7	0.301	0.565	1.83	0.550	0.009	< 0.002 U1	26.2	0.5	0.01 J1
11/16/2016	Background	0.67	14.2	125	0.01 J1	0.02 J1	0.595	0.143	1.808	2.29	0.292	0.026	< 0.002 U1	20.6	0.4	< 0.01 U1
2/14/2017	Background	0.69	15.3	102	0.01 J1	0.02 J1	0.512	0.160	1.661	2.40	0.327	0.012	< 0.002 U1	34.0	0.4	0.02 J1
4/12/2017	Background	0.84	12.4	117	0.02 J1	0.02 J1	0.824	0.333	0.19	2.17	0.634	0.010	0.002 J1	16.7	0.5	< 0.01 U1
5/24/2017	Background	0.66	15.7	102	0.01 J1	0.01 J1	0.526	0.299	0.759	2.41	0.298	< 0.0002 U1	< 0.002 U1	14.8	0.3	< 0.01 U1
7/25/2017	Background	0.62	14.5	91.3	0.01 J1	0.01 J1	0.377	0.126	0.977	2.61	0.235	0.009	< 0.002 U1	18.3	0.3	0.02 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1102F
Mitchell - LF
Appendix III Constituents**

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
6/15/2016	Background	0.109	4.34	12.4	0.56	8.0	37.2	523
8/3/2016	Background	0.280	5.48	11.9	0.58	8.2	35.9	535
10/3/2016	Background	0.160	5.45	11.8	0.60	8.1	29.5	519
11/15/2016	Background	0.117	4.87	11.7	0.56	8.1	27.4	551
2/14/2017	Background	0.109	5.04	11.3	0.53	8.2	29.9	521
4/12/2017	Background	0.109	4.67	11.3	0.53	8.3	30.6	530
5/24/2017	Background	0.118	5.31	13.7	0.56	8.3	31.8	521
7/26/2017	Background	0.202	5.41	11.4	0.57	8.3	31.5	519
10/10/2017	Detection	0.278	4.79	12.4	0.57	8.4	32.3	526
1/11/2018	Detection	--	4.47	--	--	7.9	32.1	--
4/10/2018	Detection	0.109	4.40	13.4	0.63	8.2	33.2	539
8/28/2018	Detection	0.247	4.48	14.1	0.64	8.6	33.8	549
5/1/2019	Detection	0.126	4.69	15.2	0.66	9.5	37.6	577
6/12/2019	Detection	0.110	4.36	14.9	0.74	8.2	38.0	574
10/23/2019	Detection	0.114	4.46	16.3	0.68	8.3	38.8	564
1/31/2020	Detection	--	--	16.3	--	8.2	--	--
5/6/2020	Detection	0.129	4.33	16.0	0.69	8.8	33.8	574
7/15/2020	Detection	--	--	16.0	--	8.4	--	--
10/21/2020	Detection	0.147	3.81	17.3	0.76	9.0	39.2	580
3/17/2021	Detection	0.113	4.10	18.2	0.84	9.6	38.8	585
5/12/2021	Detection	0.114	4.08	18.2	0.79	8.9	38.4	584
10/12/2021	Detection	--	--	18.3	0.79	8.3	--	610
10/20/2021	Detection	0.121	4.3	18.5	0.82	8.3	35.9	590

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1102F
Mitchell - LF
Appendix IV Constituents**

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.71	9.37	214	< 0.005 U1	0.04	0.4	0.096	0.352	0.56	0.335	0.003	< 0.002 U1	28.1	0.3	< 0.01 U1
8/3/2016	Background	0.69	8.16	212	< 0.005 U1	0.02 J1	0.4	0.090	0.881	0.58	0.183	0.006	< 0.002 U1	25.8	0.3	0.01 J1
10/3/2016	Background	0.64	8.45	194	0.005 J1	0.01 J1	0.5	0.286	0.972	0.60	0.298	0.002	< 0.002 U1	23.9	0.3	< 0.01 U1
11/15/2016	Background	0.63	8.49	212	0.005 J1	0.008 J1	0.435	0.074	1.859	0.56	0.141	0.003	< 0.002 U1	22.9	0.3	< 0.01 U1
2/14/2017	Background	0.62	8.66	197	0.006 J1	0.006 J1	0.411	0.049	1.015	0.53	0.131	0.004	< 0.002 U1	21.4	0.3	0.02 J1
4/12/2017	Background	0.56	7.68	191	0.005 J1	0.01 J1	0.399	0.079	0.1825	0.53	0.135	0.005	< 0.002 U1	19.3	0.3	0.01 J1
5/24/2017	Background	0.60	8.76	229	0.01 J1	0.02	0.807	0.203	0.3252	0.56	0.335	< 0.0002 U1	< 0.002 U1	20.0	0.4	0.01 J1
7/26/2017	Background	0.54	7.58	205	< 0.004 U1	0.01 J1	0.323	0.072	0.942	0.57	0.121	0.007	< 0.002 U1	34.7	0.3	0.03 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1102R**Mitchell - LF****Appendix III Constituents**

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
6/15/2016	Background	0.339	3.49	219	2.97	8.2	47.8	1,470
8/3/2016	Background	0.467	4.05	217	2.98	8.3	44.9	1,450
10/3/2016	Background	0.332	5.33	213	2.96	8.3	35.1	1,530

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

- -: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1102R
Mitchell - LF
Appendix IV Constituents**

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/15/2016	Background	2.01	2.64	292	0.02 J1	0.35	0.5	0.799	0.71	2.97	0.558	0.015	< 0.002 U1	68.7	0.9	0.01 J1
8/3/2016	Background	1.71	3.57	356	0.128	0.14	3.0	1.75	1.217	2.98	2.82	0.021	0.007 J1	66.0	1.2	0.03 J1
10/3/2016	Background	1.73	3.37	441	0.307	0.17	3.9	3.01	2.828	2.96	7.24	0.028	0.007	51.4	1.9	0.03 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1103F

**Mitchell - LF
Appendix III Constituents**

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
6/15/2016	Background	0.355	3.01	243	3.11	8.3	0.5	1,390
8/2/2016	Background	0.402	2.99	247	3.20	8.3	0.3	1,420
10/3/2016	Background	0.321	3.12	242	3.34	8.4	< 0.04 U1	1,380
11/16/2016	Background	0.323	2.97	240	2.96	8.4	0.2	1,370
2/15/2017	Background	0.303	2.82	240	3.07	8.5	0.2	1,400
4/11/2017	Background	0.304	2.57	234	3.05	8.6	0.4	1,400
5/23/2017	Background	0.346	2.88	237	3.23	8.5	0.4	1,370
7/26/2017	Background	0.343	2.76	240	3.24	8.5	0.3	1,370
10/11/2017	Detection	0.328	3.09	247	3.17	8.6	0.5	1,390
4/11/2018	Detection	0.286	2.58	239	3.16	8.3	0.5	1,390
8/29/2018	Detection	0.332	2.76	244	3.03	8.6	0.4	1,380
5/2/2019	Detection	0.342	2.95	245	3.13	9.1	0.8	1,360
6/12/2019	Detection	0.329	2.96	233	3.55	8.3	0.9	1,410
10/23/2019	Detection	0.336	3.44	242	3.25	8.5	0.8	1,440
5/6/2020	Detection	0.358	3.48	235	2.96	8.9	0.8	1,420
10/21/2020	Detection	0.332	3.05	237	3.07	8.8	0.8	1,440
5/12/2021	Detection	0.294	3.50	247	2.96	9.1	1.2	1,440
10/20/2021	Detection	0.299	3.3	241	3.08	8.5	0.77	1,450

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1103F
Mitchell - LF
Appendix IV Constituents**

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.16	8.03	639	0.029	0.02	1.0	0.351	1.1	3.11	0.674	0.012	< 0.002 U1	10.1	0.2	0.01 J1
8/2/2016	Background	0.14	7.01	704	0.026	0.01 J1	0.9	0.299	0.899	3.20	0.479	0.016	< 0.002 U1	2.61	0.2	< 0.01 U1
10/3/2016	Background	0.04 J1	5.80	558	0.01 J1	0.03	0.4	0.180	1.026	3.34	0.313	0.016	< 0.004 U1	2.66	0.1 J1	0.01 J1
11/16/2016	Background	0.10	7.71	723	0.01 J1	0.009 J1	0.471	0.159	1.57	2.96	0.218	0.015	< 0.002 U1	2.57	0.1	< 0.01 U1
2/15/2017	Background	0.03 J1	7.67	631	0.009 J1	0.008 J1	0.336	0.147	1.416	3.07	0.213	0.016	< 0.002 U1	2.81	0.09 J1	0.03 J1
4/11/2017	Background	0.07	8.46	618	0.006 J1	0.006 J1	0.262	0.102	2.183	3.05	0.088	0.015	< 0.002 U1	3.19	0.1	< 0.01 U1
5/23/2017	Background	0.03 J1	7.85	688	0.006 J1	0.007 J1	0.260	0.149	1.214	3.23	0.194	0.006	< 0.002 U1	2.80	0.06 J1	< 0.01 U1
7/26/2017	Background	0.02 J1	6.81	562	< 0.004 U1	0.007 J1	0.112	0.136	1.798	3.24	0.103	0.015	< 0.002 U1	5.46	0.07 J1	0.02 J1

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1104R

Mitchell - LF

Appendix III Constituents

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
6/21/2016	Background	0.431	39.4	485	1.18	7.9	162	2,390

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

- -: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: MW-1104R
Mitchell - LF
Appendix IV Constituents**

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/21/2016	Background	0.66	4.35	182	0.570	0.18	3.4	4.36	0.153	1.18	9.41	0.014	< 0.09 U1	42.3	2.3	0.133

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.
- -: Not analyzed
J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1502R

**Mitchell - LF
Appendix III Constituents**

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
6/20/2016	Background	0.268	71.5	33.4	0.18	7.3	155	474
8/9/2016	Background	0.160	95.4	34.0	0.17	7.3	187	547
9/27/2016	Background	0.376	103	39.7	0.1 J1	7.4	183	560
11/9/2016	Background	0.214	87.3	25.4	0.1 J1	7.4	186	551
2/15/2017	Background	0.069	90.0	167	0.16	7.5	90.1	564
4/12/2017	Background	0.075	72.2	79.5	0.16	7.6	102	507
5/23/2017	Background	0.100	73.9	52.4	0.17	7.6	118	466
7/25/2017	Background	0.158	61.7	18.8	0.20	7.3	88.6	358
10/11/2017	Detection	0.132	91.0	24.5	0.1 J1	7.3	159	535
1/11/2018	Detection	--	240	--	--	7.0	149	--
4/10/2018	Detection	0.051	78.3	196	0.19	7.4	87.6	616
8/29/2018	Detection	0.150	95.7	99.3	0.17	7.7	167	650
5/2/2019	Detection	0.1 J1	93.6	245	0.17	8.5	105	702
6/12/2019	Detection	0.127	80.7	155	0.23	7.3	114	661
10/23/2019	Detection	0.194	104	102	0.18	7.2	252	758
1/31/2020	Detection	--	--	--	--	7.4	120	474
5/6/2020	Detection	0.081	64.8	74.6	0.18	7.8	93.0	471
9/1/2020	Detection	--	--	--	--	7.2	--	--
10/21/2020	Detection	0.267	92.5	56.6	0.18	7.7	249	679
3/17/2021	Detection	0.083	94.9	274	0.24	7.9	117	759
5/12/2021	Detection	0.121	73.0	113	0.24	8.3	118	540
10/12/2021	Detection	--	--	--	--	7.4	--	--
10/20/2021	Detection	0.194	91.0	91.8	0.21	7.5	176	650

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: MW-1502R

Mitchell - LF

Appendix IV Constituents

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	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/20/2016	Background	0.22	0.28	30.6	< 0.005 U1	0.005 J1	0.3	0.082	0.143	0.18	0.064	0.002	< 0.09 U1	3.48	8.2	0.01 J1
8/9/2016	Background	0.20	0.26	34.1	< 0.005 U1	0.006 J1	0.3	0.068	1.029	0.17	0.089	0.010	< 0.002 U1	8.71	7.4	< 0.01 U1
9/27/2016	Background	0.16	0.27	38.2	< 0.005 U1	0.004 J1	0.4	0.076	0.429	0.1 J1	0.064	0.012	< 0.002 U1	8.40	8.8	< 0.01 U1
11/9/2016	Background	0.20	0.84	44.2	0.062	0.009 J1	1.44	0.507	2.497	0.1 J1	0.764	0.006	< 0.002 U1	3.19	5.3	0.03 J1
2/15/2017	Background	0.13	0.24	27.7	0.006 J1	< 0.004 U1	1.90	0.069	2.61	0.16	0.061	0.009	< 0.002 U1	1.84	4.3	0.03 J1
4/12/2017	Background	0.13	0.69	29.2	0.053	0.008 J1	1.20	0.426	0.613	0.16	0.630	0.015	0.002 J1	1.91	4.8	0.02 J1
5/23/2017	Background	0.15	0.53	32.2	0.033	< 0.005 U1	0.918	0.238	0.647	0.17	0.364	0.002	< 0.002 U1	2.46	4.7	0.01 J1
7/25/2017	Background	0.21	0.30	19.0	0.008 J1	< 0.005 U1	0.196	0.082	0.6323	0.20	0.088	0.009	< 0.002 U1	2.47	3.2	0.03 J1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1: Residence Time Calculation Summary
Mitchell Landfill**

CCR Management Unit	Monitoring Well Pair	Well Diameter (inches)	2021-03		2021-05		2021-10	
			Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	MW1101F/R ^[1]	2.0	2.5	24	2.5	24	2.6	23
	MW1102F/R ^[1]	2.0	0.9	71	0.8	73	0.7	87
	MW1103F/R ^[2]	2.0	1.7	35	1.7	35	1.7	35
	MW1104F/R ^[2]	2.0	0.7	84	0.7	83	0.8	72
	MW1501F/R ^[3]	4.0	1.9	66	2.3	53	2.3	52
	MW1502R ^[3]	4.0	NC	NC	NC	NC	NC	NC
	MW1503F/R ^[3]	4.0	1.3	91	1.3	91	1.4	90

Notes:

[1] - Sidegradient Well

[2] - Background Well

[3] - Downgradient Well

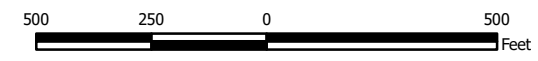
NC - No calculation can be generated



- Legend**
- ◆ Compliance Sampling Location
 - ◆ Upgradient Sampling Location
 - CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

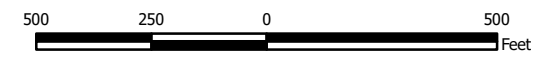


Site Layout	
Landfill - Fish Creek Aquifer	
Mitchell Power Generation Plant Marshall County, West Virginia	
Geosyntec consultants	
Columbus, Ohio	2018/01/26
Figure 1a	



Legend
 ◆ Compliance Sampling Location
 ◆ Upgradient Sampling Location
 [Dashed Line] CCR Landfill (Approximate Limits of Waste)

Notes
 - Monitoring well coordinates provided by AEP.
 - Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.



Site Layout Landfill - Rush Run Aquifer Mitchell Power Generation Plant Marshall County, West Virginia		Figure 1b
Columbus, Ohio	2018/01/26	

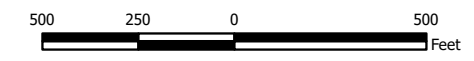


Legend

- ◆ Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- - - Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on March 16, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).



**Potentiometric Surface Map - Fish Creek
March 2021**

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec
consultants

Columbus, Ohio

2021/06/11

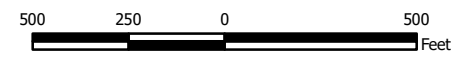
Figure
2



- Legend**
- ⊕ Groundwater Monitoring Well
 - ➔ Groundwater Flow Direction
 - Groundwater Elevation Contour
 - - - Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on March 16, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).



**Potentiometric Surface Map - Rush Run
March 2021**

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec
consultants

Figure
3

Columbus, Ohio

2021/07/01



- Legend**
- ⊕ Groundwater Monitoring Well
 - Groundwater Flow Direction
 - Groundwater Elevation Contour
 - - - Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 11, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).



**Potentiometric Surface Map - Fish Creek
May 2021**

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec
consultants

Figure

4

Columbus, Ohio

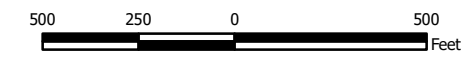
2021/09/07



- Legend**
- ◆ Groundwater Monitoring Well
 - Groundwater Flow Direction
 - Groundwater Elevation Contour
 - - - Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 11, 2021) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).



**Potentiometric Surface Map - Rush Run
May 2021**

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec
consultants

Columbus, Ohio

2021/10/29

Figure

5

APPENDIX 2 - Statistical Analyses

The memoranda summarizing the May and December 2021 statistical evaluations follow.

Memorandum

Date: May 18, 2021

To: David Miller (AEP)

Copies to: Bill Smith (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at Mitchell Plant's Landfill (LF)

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 Subpart D, "CCR rule"), the second semi-annual detection monitoring event at the Mitchell Landfill (LF), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia was completed on October 21, 2020. Based on the results, verification sampling was completed on March 17, 2021.

Background values for the LF were previously calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated February 21, 2020.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- Chloride concentrations exceeded the intrawell UPL of 15.4 mg/L in both the initial (17.3 mg/L) and second (18.2 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for chloride at MW-1102F.
- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 577 mg/L in both the initial (580 mg/L) and second (585 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for TDS at MW-1102F.

In response to the exceedances noted above, the Mitchell LF CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for chloride and TDS at MW-1102F will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mitchell LF will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

**Table 1: Detection Monitoring Data Evaluation
Mitchell - Landfill**

Analyte	Unit	Description	MW-1101R	MW-1102F		MW-1502R	
			10/21/2020	10/21/2020	3/17/2021	10/21/2020	3/17/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.525	0.280		0.265	
		Analytical Result	0.409	0.147	--	0.267	0.083
Calcium	mg/L	Intrawell Background Value (UPL)	6.91	5.71		109	
		Analytical Result	2.42	3.81	--	92.5	--
Chloride	mg/L	Intrawell Background Value (UPL)	18.1	15.4		191	
		Analytical Result	16.6	17.3	18.2	56.6	--
Fluoride	mg/L	Intrawell Background Value (UPL)	3.14	0.781		0.24	
		Analytical Result	2.57	0.76	--	0.18	--
pH	SU	Intrawell Background Value (UPL)	9.1	9.5		7.7	
		Intrawell Background Value (LPL)	7.9	7.6		7.1	
		Analytical Result	9.1	9.0	--	7.7	--
Sulfate	mg/L	Intrawell Background Value (UPL)	38.4	45.0		213	
		Analytical Result	28.5	39.2	--	249	117
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	1,600	577		744	
		Analytical Result	845	580	585	679	--

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

ATTACHMENT A

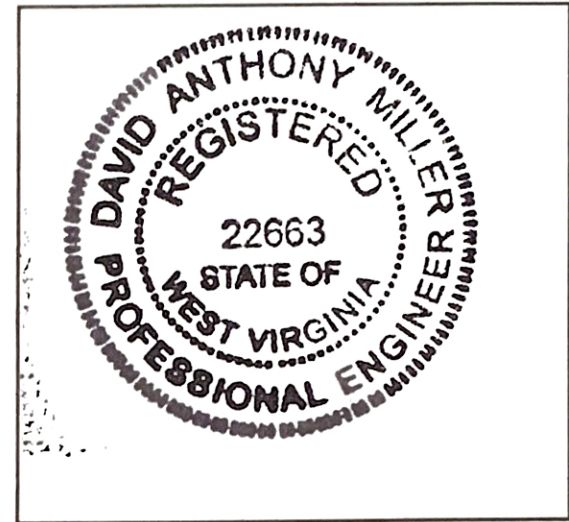
Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the February 21, 2020 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mitchell LF 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



22663
License Number

WEST VIRGINIA
Licensing State

05.18.21
Date

Memorandum

Date: December 14, 2021

To: David Miller (AEP)

Copies to: Bill Smith (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at Mitchell Plant's Landfill (LF)

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 Subpart D, "CCR rule"), the first semi-annual detection monitoring event of 2021 at the Mitchell Landfill (LF), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia was completed on May 12, 2021. Based on the results, a resample was collected on October 12, 2021.

Background values for the LF were previously calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated February 21, 2020.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- Chloride concentrations exceeded the intrawell UPL of 15.4 mg/L in both the initial (18.2 mg/L) and second (18.3 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for chloride at MW-1102F.
- Fluoride concentrations exceeded the intrawell UPL of 0.781 mg/L in both the initial (0.79 mg/L) and second (0.79 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for fluoride at MW-1102F.
- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 577 mg/L in both the initial (584 mg/L) and second (610 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for TDS at MW-1102F.

In response to the exceedances noted above, the Mitchell LF CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for chloride, fluoride, and TDS at MW-1102F will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mitchell LF will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

**Table 1: Detection Monitoring Data Evaluation
Mitchell - Landfill**

Analyte	Unit	Description	MW-1101R	MW-1102F		MW-1502R	
			5/12/2021	5/12/2021	10/12/2021	5/12/2021	10/12/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.525	0.280		0.265	
		Analytical Result	0.349	0.114	--	0.121	--
Calcium	mg/L	Intrawell Background Value (UPL)	6.91	5.71		109	
		Analytical Result	2.46	4.08	--	73.0	--
Chloride	mg/L	Intrawell Background Value (UPL)	18.1	15.4		191	
		Analytical Result	16.8	18.2	18.3	113	--
Fluoride	mg/L	Intrawell Background Value (UPL)	3.14	0.781		0.244	
		Analytical Result	2.47	0.79	0.79	0.24	--
pH	SU	Intrawell Background Value (UPL)	9.1	9.5		7.7	
		Intrawell Background Value (LPL)	7.9	7.6		7.1	
		Analytical Result	8.3	8.9	--	8.3	7.4
Sulfate	mg/L	Intrawell Background Value (UPL)	38.4	45.0		213	
		Analytical Result	27.5	38.4	--	118	--
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	1,600	577		744	
		Analytical Result	856	584	610	540	--

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

ATTACHMENT A

Certification by a Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

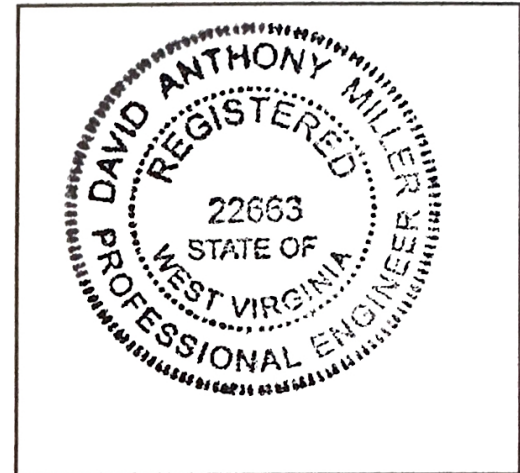
I certify that the selected statistical method, described above and in the February 21, 2020 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mitchell LF CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



22663

License Number

WEST VIRGINIA

Licensing State

12.14.21

Date

APPENDIX 3 – Alternative Source Demonstrations

The August 2021 ASD report follows.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Mitchell Plant Landfill Marshall County, West Virginia

Submitted to



1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by



engineers | scientists | innovators

941 Chatham Lane, Suite 103
Columbus, Ohio 43221

August 11, 2021

CHA8495

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LPL	Lower Prediction Limit
QC	Quality Control
SSI	Statistically Significant Increase
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

SECTION 1

INTRODUCTION AND SUMMARY

1.1 Introduction

This Alternative Source Demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for chloride and total dissolved solids (TDS) at the Mitchell Plant Landfill (LF) following the second semiannual detection monitoring event of 2020.

Following completion of four detection monitoring events, the previously calculated upper prediction limits (UPLs) for the Landfill were recalculated for each Appendix III parameter to represent background values (Geosyntec, 2020a). A lower prediction limit (LPL) was also recalculated for pH. The revised prediction limits were calculated based on a one-of-two retesting procedure in accordance with the Unified Guidance (USEPA, 2009) and the statistical analysis plan developed for the site (AEP, 2017). With this procedure, an SSI is concluded only if both samples in a series of two (the initial sample and the resample) exceed the UPL, or in the case of pH are both below the LPL or above the UPL.

The second semiannual detection monitoring event of 2020 was performed in October 2020 (initial sampling event) and March 2021 (resampling event) and the results were compared to the recalculated prediction limits. During this detection monitoring event, SSIs were identified for chloride and TDS at MW-1102F. A summary of the detection monitoring analytical results for all constituents listed in 40 CFR Part 257 Appendix III and the calculated prediction limits for comparison is provided in **Table 1**.

1.2 CCR Rule Requirements

In accordance with the United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments, Rule 40 CFR 257.94(e)(2) states the following:

The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.

The second semiannual detection monitoring event for 2020 was completed in October 2020 (initial sampling event) and March 2021 (resampling event). Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report, which examines whether the chloride and TDS SSIs cited above are from a source other than the Landfill.

1.3 **Demonstration of Alternative Sources**

An evaluation was completed to assess possible alternative sources to which identified SSIs could be attributed. Alternative sources were identified amongst five types:

- 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.

The evaluation will be conducted to identify whether the increase in chloride and TDS concentrations at MW-1102F were based on a Type IV cause (Natural Variation) and not by a release from the Landfill.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

A brief description of the site geology, ASD evaluation methodology, and the proposed alternative source are described below.

2.1 Site Geology Summary

The Mitchell LF was designed and constructed in accordance with West Virginia Department of Environmental Protection Class F Industrial Landfill requirements. The Landfill design includes several engineering controls, including a composite liner, groundwater interceptor drainage system, and a leachate collection system (CEC, 2016).

The local geology consists of sandstone units separated by sharp contacts with shale or coal seams (CEC, 2016). From top to bottom, the named sandstone units underlying the Landfill include: the Burton Sandstone, the Fish Creek Sandstone, the Rush Run Sandstone, the Jollytown Sandstone, and the Hundred Sandstone. A cross-section of the geology underlying the Landfill which was included in the groundwater monitoring network report (CEC, 2016) is provided as **Attachment A**. The Burton Sandstone was identified as a hydrostratigraphic unit that did not require monitoring because the unit is not water-bearing upgradient of the Landfill and is naturally incised or absent downgradient of the Landfill.

2.2 Groundwater Monitoring History

Groundwater at the Landfill has been monitored under the West Virginia Solid Waste Management Rule (33CSR1) since 2012, which is prior to construction of the Landfill in 2013 and the initial waste placement in 2014 (CEC, 2016). Background monitoring under the Federal CCR Rule began in 2016. Wells set within either the Fish Creek Sandstone or Rush Run Sandstone are both included in the monitoring network for the Federal program (CEC, 2016). The well of concern (MW-1102F) is set within the Fish Creek Formation. Total chloride and TDS are collected for both the state and federal monitoring programs.

While there are two background wells set within the Fish Creek Formation (MW-1103F and MW-1104F), only MW-1103F has consistently produced water during sampling completed under the Federal program. A potentiometric site map showing the location of Fish Creek Formation monitoring wells and groundwater flow directions is provided in **Figure 1**.

2.3 Proposed Alternative Source

An initial review of sampling and laboratory data did not identify any Type I (Sampling) errors. A review of the laboratory and statistical analyses did not identify any Type II (Laboratory Causes) or Type III (Statistical Evaluation) issues. An initial review of site geochemistry did not identify evidence of any Type V (Anthropogenic) impacts. Instead, the review examined whether natural

variation (a Type IV ASD) was the source of the observed chloride and TDS SSIs at well MW-1102F.

2.3.1 Comparison of Groundwater Chemistry to Landfill Leachate

A mixing model was created to illustrate how concentrations at MW-1102F would be expected to change if the groundwater at MW-1102F were influenced by leachate from the Landfill. Groundwater data at MW-1102F collected under the state program in February 2012, prior to waste placement, was used to represent initial conditions at the monitoring location. A geochemical model was used to mix this sample with leachate data collected in October 2020 at varying ratios to evaluate the changes in background groundwater geochemistry under leachate infiltration conditions. The output was compared to the reported groundwater concentrations at MW-1102F in October 2020, which was the most recent sample collected under the federal program (excluding the resampling event). The mixing model is shown in **Figure 2**.

As illustrated in **Figure 2**, measurable increases in every parameter excluding alkalinity (as HCO_3^-) would be expected if leachate were mixing with groundwater, due to the higher average concentrations of these parameters in Landfill leachate compared to groundwater at MW-1102F (**Figure 3**). These higher leachate concentrations are observed in recently collected data from the October 2020 sampling event (**Figure 3**). On average, boron, sulfate, and potassium concentrations are several orders of magnitude higher in leachate compared to the average concentration at MW-1102F, whereas the difference in concentrations for all other parameters is approximately one order of magnitude.

Slight increases in sodium and chloride concentrations are observed in recent MW-1102F data. These increases are consistent with the model output of 99% MW-1102F groundwater and 1% leachate. However, recent MW-1102F data for all other parameters included in **Figure 2** are inconsistent with, and in many cases contrary to, all model outputs. Recent potassium, calcium, and magnesium data from MW-1102F display a decrease in concentration compared to 2012 data, whereas the mixing model demonstrates that groundwater impacted with leachate from the LF would result in increasing concentrations of these constituents.

Boron is a conservative constituent, which is one that is not significantly attenuated by chemical processes during advective flow. Because boron is a conservative constituent and concentrations in the leachate are over two orders of magnitude higher in the leachate (**Figure 3**), it should also display increasing concentrations if a release from the Landfill were impacting groundwater at MW-1102F. However, recent boron data from MW-1102F deviate very little from the 2012 results and are approximately an order of magnitude below the predicted concentrations for even 1% leachate mixing.

Therefore, the inconsistency of recently collected data at MW-1102F with modeled outputs indicates that changes in chloride concentrations should not be attributed to impacts from CCR leachate.

2.3.2 Comparison to Background Concentrations

Chloride and TDS in groundwater at the Landfill are monitored using intrawell prediction limits. A comparison of the reported concentrations for chloride, sodium, and TDS between MW-1102F and background well MW-1103F shows that concentrations at the background location have consistently been more than an order of magnitude higher, including before waste was placed in the unit in 2014 (**Figure 4, Figure 5, and Figure 6**, respectively). While chloride concentrations are consistently around 250 mg/L at background well MW-1103F, concentrations at downgradient well MW-1102F have not exceeded 20 mg/L. Likewise, sodium concentrations are consistently around 500-600 mg/L at background well MW-1103F, whereas concentrations at downgradient well MW-1102F have not exceeded 250 mg/L. TDS concentrations are consistently around 1400 mg/L at background well MW-1103F, whereas concentrations at downgradient well MW-1102F have not exceeded 600 mg/L. Since TDS is a measurement of the dissolved ion concentrations in groundwater, the differences in sodium and chloride concentrations result in corresponding variability in TDS concentration. These differences in concentrations suggest there is significant natural variation in the sodium and chloride concentrations within the Fish Creek formation, which also results in variation of the TDS concentrations.

A piper diagram was created to illustrate changes in MW-1102F groundwater geochemistry over time (**Figure 7**). This diagram shows that there is very little historical variation in the geochemistry of groundwater sampled at MW-1102F. Additionally, the geochemical profile of MW-1102F groundwater is consistently distinct from that of the Landfill leachate. Therefore, the changes in chloride and TDS concentrations at MW-1102F likely represent natural variation in the dilution of higher chloride and TDS concentration groundwater from within the Fish Creek formation as it migrates through the aquifer. This conclusion was also noted in previous ASDs completed for chloride at MW-1102F (Geosyntec, 2019; Geosyntec, 2020b; Geosyntec, 2020c).

2.4 Sampling Requirements

The lines of evidence presented within this ASD support the determination that the identified SSIs for chloride and TDS are not due to a release from the Landfill. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters on a semiannual basis.

SECTION 3

CONCLUSIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the conclusion that the SSIs for chloride and TDS observed during the second semiannual sampling event of 2020 are not due to a release from the Mitchell Landfill. The observed chloride and TDS SSIs are instead attributed to natural variation. Therefore, no further action is warranted, and the Mitchell Landfill will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment B**.

SECTION 4

REFERENCES

- American Electric Power (AEP). 2017. Statistical Analysis Plan – Mitchell Plant. January 2017.
- Civil & Environmental Consultants, Inc. (CEC). 2016. CCR Groundwater Monitoring System Demonstration. Mitchell Landfill – Mitchell Power Generation Plant. March.
- Geosyntec Consultants, 2019. Alternative Source Demonstration – Federal CCR Rule. Mitchell Plant Landfill. Marshall County, West Virginia. November.
- Geosyntec Consultants, 2020a. Statistical Analysis Summary – Background Update Calculations. Mitchell Plant Landfill. Marshall County, West Virginia. February.
- Geosyntec Consultants, 2020b. Alternative Source Demonstration – Federal CCR Rule. Mitchell Plant Landfill. Marshall County, West Virginia. May.
- Geosyntec Consultants, 2020c. Alternative Source Demonstration – Federal CCR Rule. Mitchell Plant Landfill. Marshall County, West Virginia. November.
- U.S. EPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March 2009.
- U.S. EPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

TABLES

**Table 1: Detection Monitoring Data Evaluation
Mitchell - Landfill**

Analyte	Unit	Description	MW-1101R	MW-1102F		MW-1502R	
			10/21/2020	10/21/2020	3/17/2021	10/21/2020	3/17/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.525	0.280		0.265	
		Analytical Result	0.409	0.147	--	0.267	0.083
Calcium	mg/L	Intrawell Background Value (UPL)	6.91	5.71		109	
		Analytical Result	2.42	3.81	--	92.5	--
Chloride	mg/L	Intrawell Background Value (UPL)	18.1	15.4		191	
		Analytical Result	16.6	17.3	18.2	56.6	--
Fluoride	mg/L	Intrawell Background Value (UPL)	3.14	0.781		0.24	
		Analytical Result	2.57	0.76	--	0.18	--
pH	SU	Intrawell Background Value (UPL)	9.1	9.5		7.7	
		Intrawell Background Value (LPL)	7.9	7.6		7.1	
		Analytical Result	9.1	9.0	--	7.7	--
Sulfate	mg/L	Intrawell Background Value (UPL)	38.4	45.0		213	
		Analytical Result	28.5	39.2	--	249	117
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	1,600	577		744	
		Analytical Result	845	580	585	679	--

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

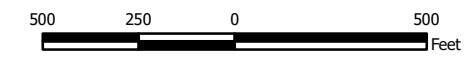
FIGURES



- Legend**
- ⊕ Groundwater Monitoring Well
 - Groundwater Flow Direction
 - Groundwater Elevation Contour
 - - - Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on October 20, 2020) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).



**Potentiometric Surface Map - Fish Creek
October 2020**

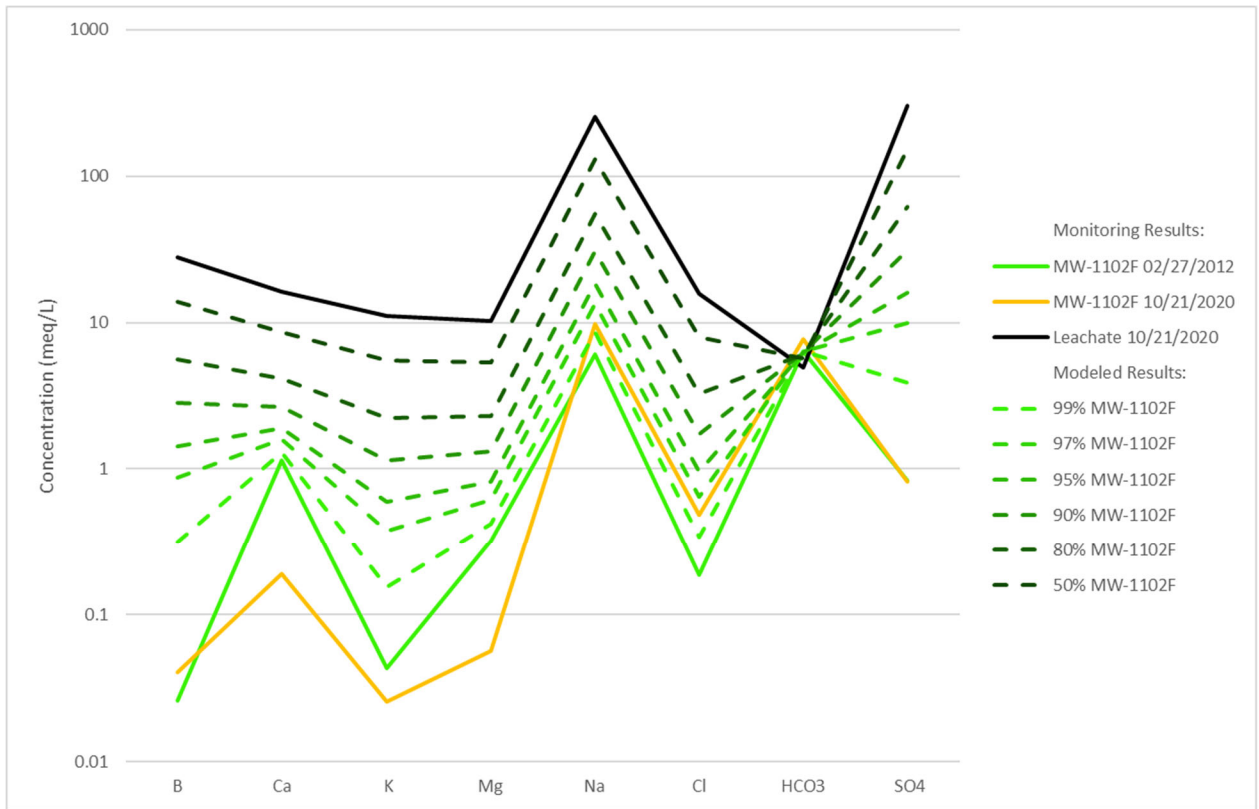
Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec
consultants

Columbus, Ohio

2020/12/29

Figure
1



Notes: The mixing model was generated using background data from MW-1102F collected on February 27, 2012 as the starting solution. Leachate data collected on October 21, 2020 was used as the opposing end-member solution. Mixing increments represent the proportion of MW-1102F groundwater in the modeled solution.

Leachate Mixing Model

Mitchell Landfill

Geosyntec
consultants

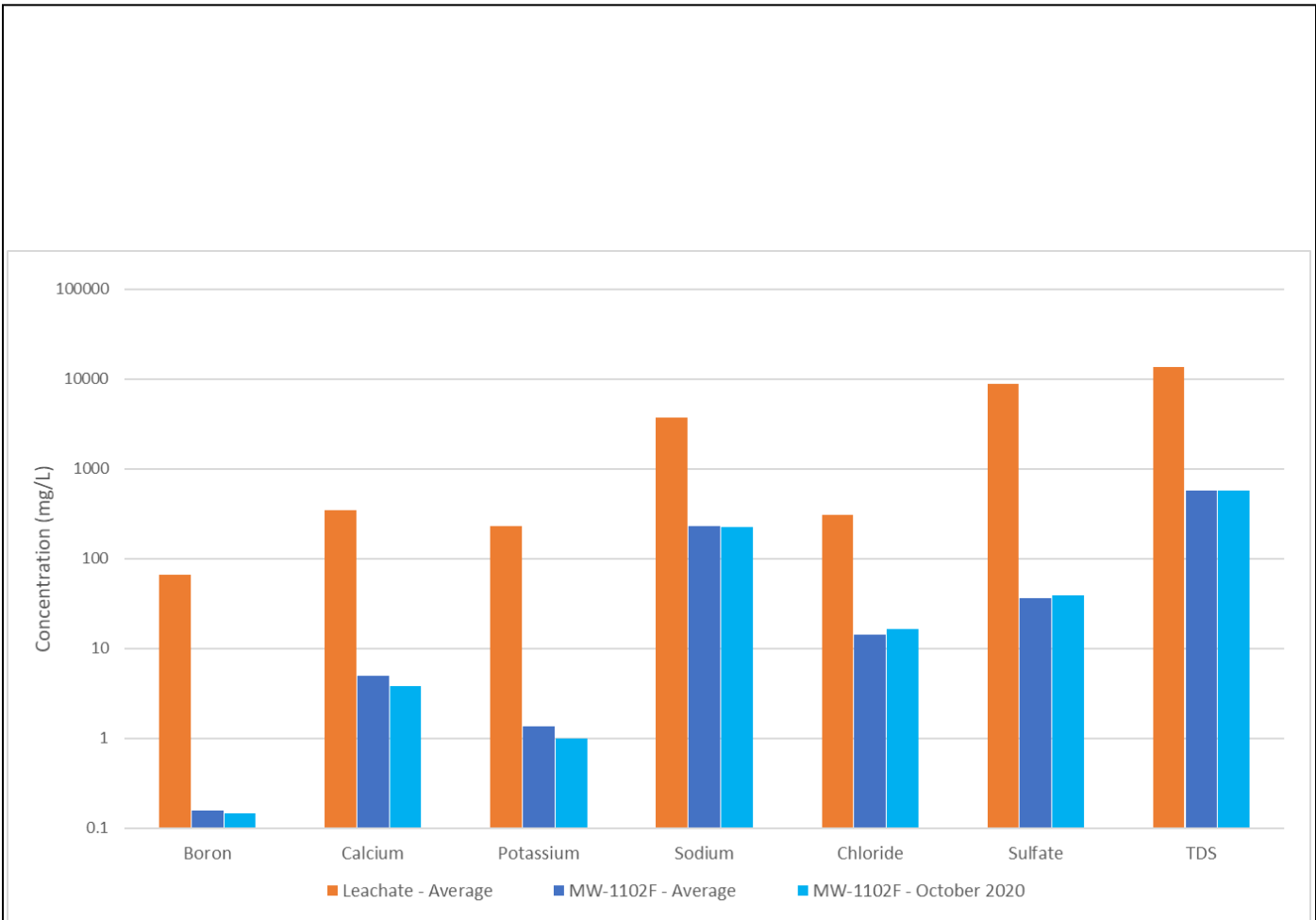


Figure

2

Columbus, Ohio

07-June-2021



Notes: The most recent MW-1102F sample was collected October 21, 2020. The average concentration for leachate and for samples collected during the Federal monitoring program at MW-1102F were calculated using data from June 2016 onwards.

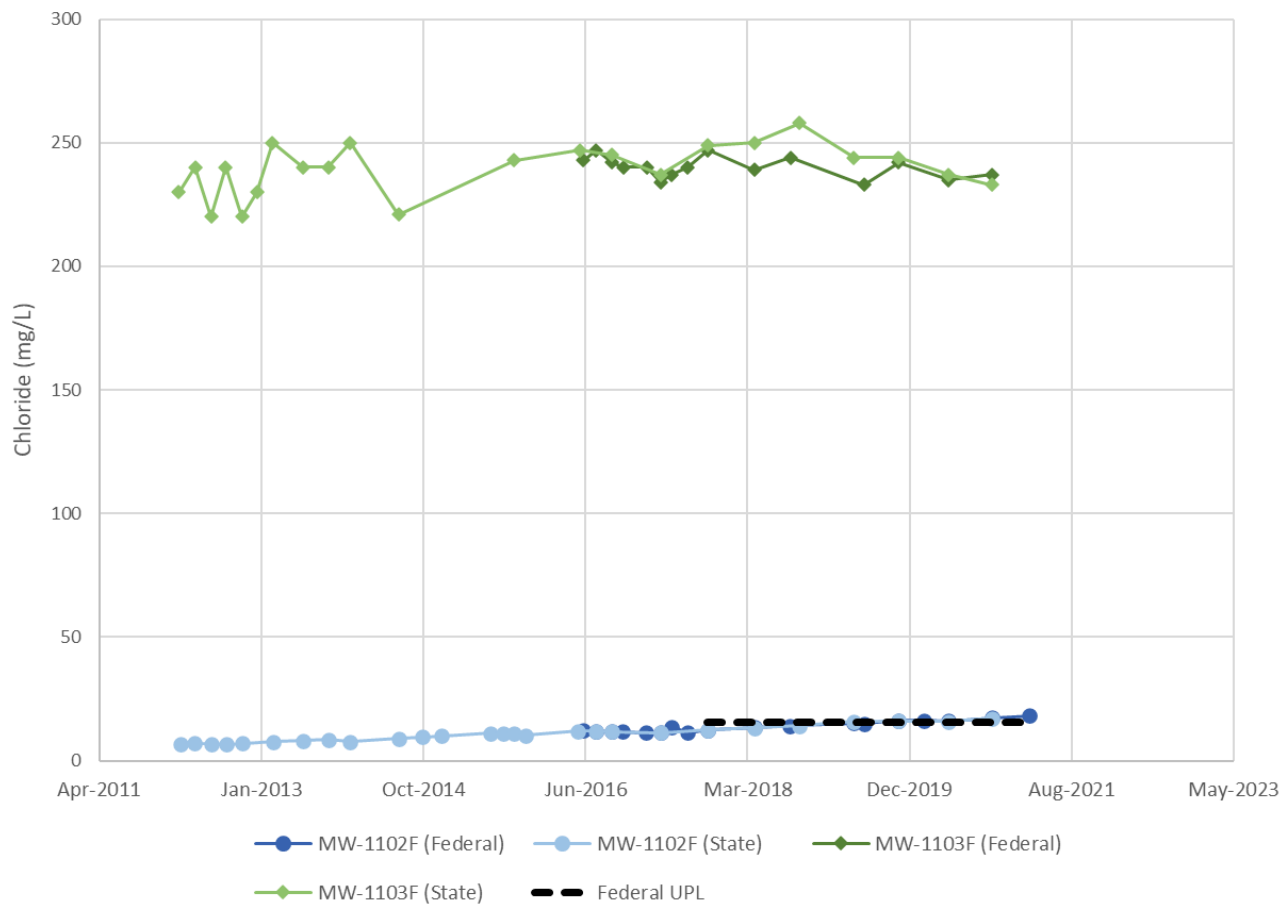
Leachate and MW-1102F Concentration Comparison
Mitchell Landfill



Figure
3

Columbus, Ohio

07-June-2021



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. Samples for chloride analysis were not filtered for the federal or state programs.

Chloride Time Series Graph

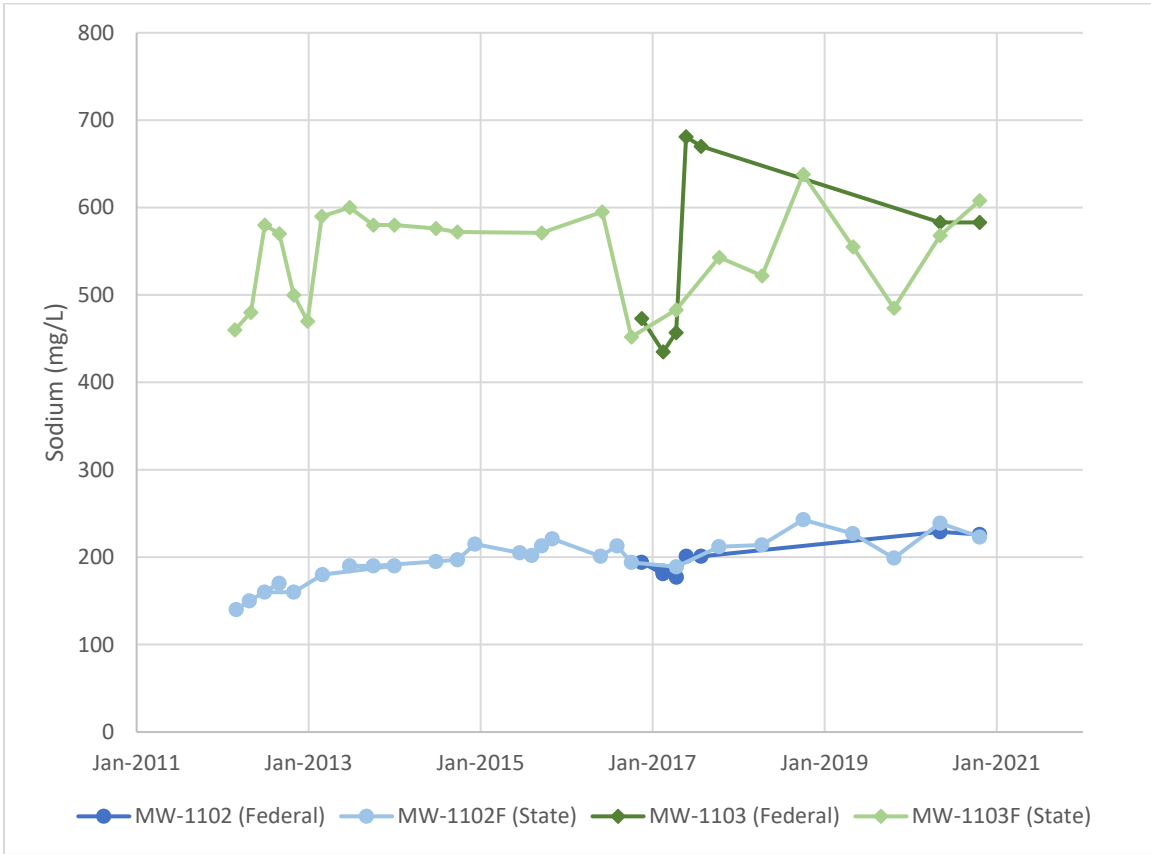
Mitchell Landfill



Figure
4

Columbus, Ohio

18-June-2021



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. Samples for sodium analysis were filtered for the state program.

Sodium Time Series Graph

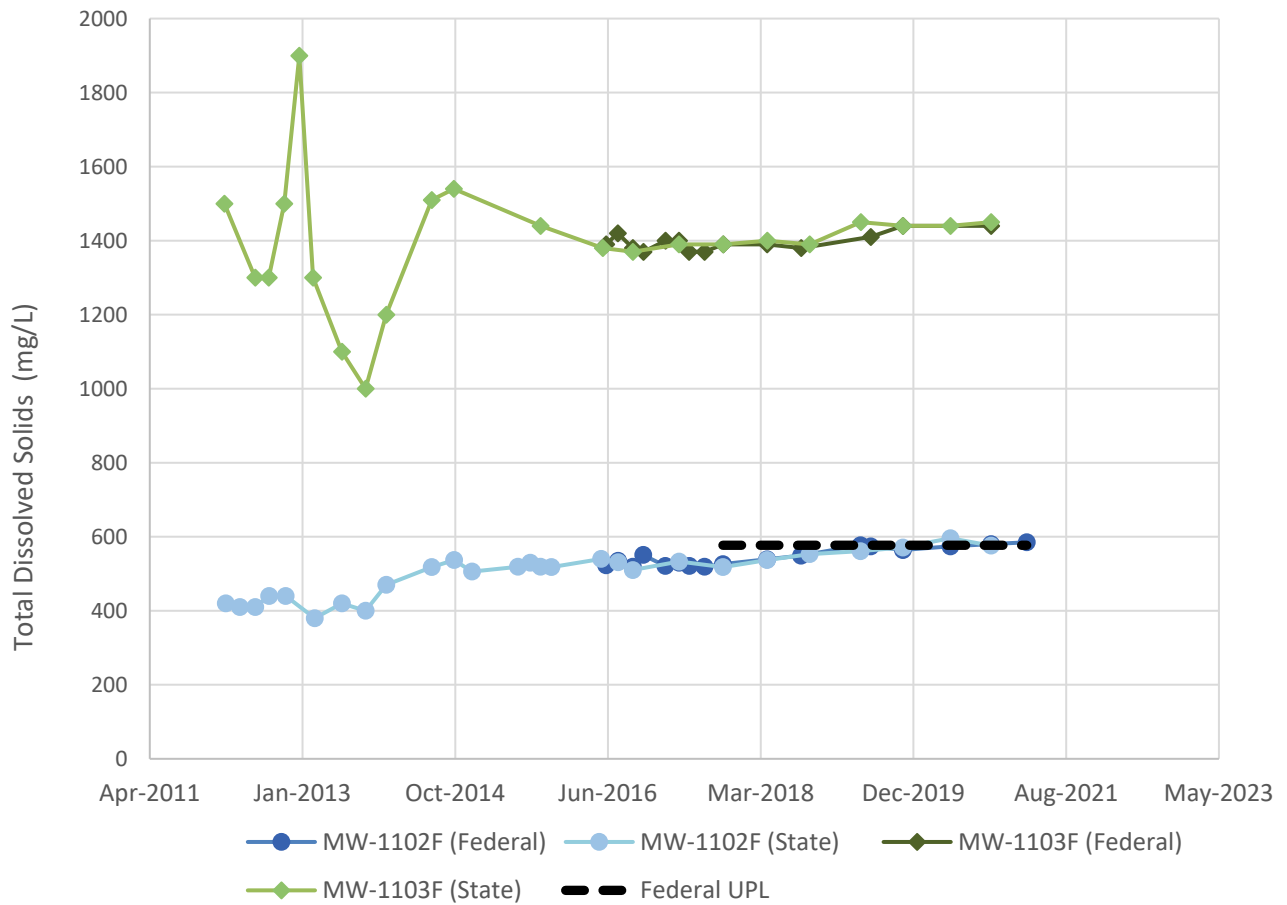
Mitchell Landfill



Figure
5

Columbus, Ohio

11-Aug-2021



Notes: Data are shown for both the federal and state monitoring programs. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation. Samples for chloride analysis were not filtered for the federal or state programs.

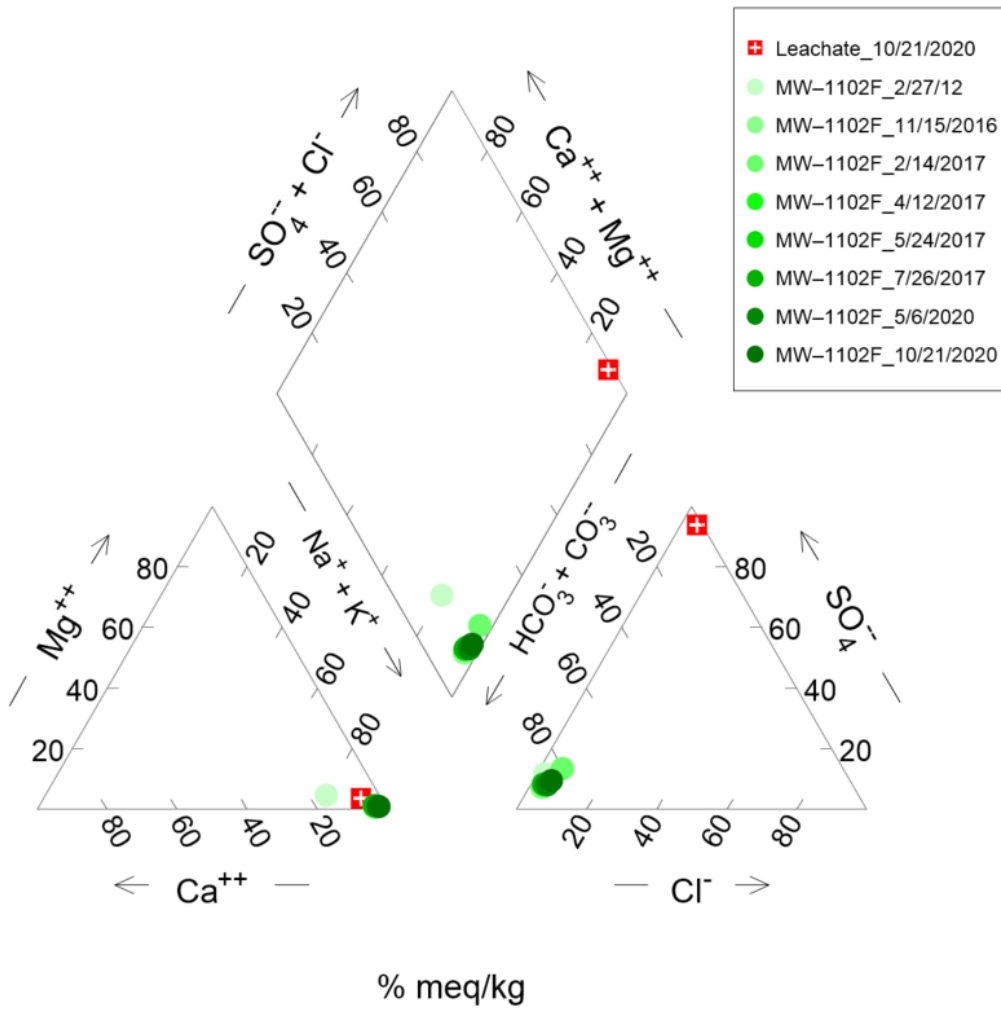
Total Dissolved Solids Time Series Graph
Mitchell Landfill



Figure
6

Columbus, Ohio

18-June-2021



Notes: Data are shown for historical MW-1102F groundwater samples and leachate samples collected in the second semiannual detection monitoring event of 2020.

Piper Diagram of Historical MW-1102F Data
Mitchell Landfill

Geosyntec
consultants



Figure
7

Columbus, Ohio

28-June-2021

ATTACHMENT A

Geologic Cross-Section

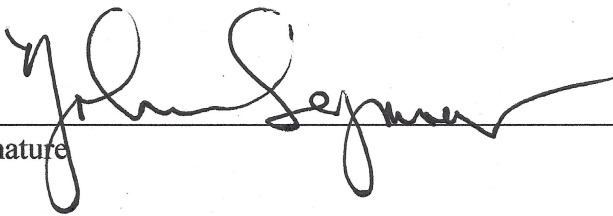
ATTACHMENT B

**Certification by a Qualified Professional
Engineer**

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

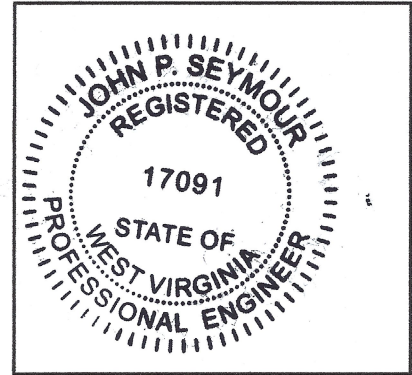
I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

John Seymour
Printed Name of Licensed Professional Engineer


Signature

017091
License Number

West Virginia
Licensing State



9/13/2021
Date

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2021; the CCR unit remained in detection monitoring. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

No monitoring wells installed or decommissioned in 2021. Well installation/decommissioning logs are not applicable at this time.