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Mr. David M. Heger
Senior Counsel
AES US Services, LLC
One Monument Circle, Suite 701A
Indianapolis, Indiana 46204-2901

Re: **2019 CCR Annual Groundwater Monitoring and Corrective Action Report**
Indianapolis Power & Light Company
Petersburg Generating Station – Ash Pond System
Indianapolis, Indiana
ATC Project No. 170LF00706

Dear Mr. Heger:

ATC Group Services LLC (ATC) has prepared this 2019 CCR Annual Groundwater Monitoring and Corrective Action Report for the ash pond system at Indianapolis Power & Light Company's (IPL) Petersburg Generating Station located outside Petersburg, Pike County, Indiana. This report has been prepared to comply with reporting requirements described in the United States Environmental Protection Agency's (USEPA) Coal Combustion Residuals (CCR) Rule § 257.90(e). This annual report documents the status of the groundwater monitoring and corrective action program for the ash pond system and summarizes information required by § 257.90(e)(1) through § 257.90(e)(5).

Federal CCR Rule § 257.90(e) specifies the following:

> *For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2019, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has*

prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1).

The following key actions have been completed in 2019 to comply with the CCR Rule:

- Statistically Significant Level (SSL) notification pursuant to § 257.95(g) was completed in January 2019.
- In accordance with § 257.96(a), an assessment of corrective measures was initiated in April 2019. A certified Demonstration for 60-Day Extension – Corrective Measures Assessment pursuant to § 257.96(a) was issued in July 2019 (Attachment A). A Corrective Measures Assessment (CMA) report was completed and placed in the facility's operating record in September 2019, with an amended version posted to the facility's publicly available website in October 2019.
- Nature and extent (N&E) characterization were initiated with installation of monitoring wells as required by § 257.95(g)(1).
- Semi-annual assessment monitoring sampling events were conducted pursuant to § 257.95(b) and § 257.95(d)(1). Subsequent SSLs evaluation of 2019 data were performed within 90-days of completing each sampling event pursuant to § 257.93(h)(2).
- An Alternative Source Demonstration was successfully completed pursuant to § 257.95(g)(3)(ii).

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

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

§ 257.90(e)(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

IPL operates the Petersburg Station located approximately four miles north of Petersburg, Indiana. It is located at 6925 North State Road 57, Petersburg, Indiana. A Site Location Map is provided as Figure 1. A map showing the location of each CCR management unit, associated upgradient and downgradient CCR monitoring wells, and N&E monitoring equipment installed in 2019 is provided as Figure 2.

§ 257.90(e)(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

The CCR groundwater monitoring system at the Petersburg Ash Pond System consists of seventeen (17) monitoring wells: three (3) upgradient monitoring wells MW-2R, MW-3, and MW-4C and fourteen

(14) downgradient monitoring wells; AP-1R, AP-2A, AP-2BO, AP-3, AP-3A, AP-4A, AP-4B, AP-4I, AP-5, AP-5A, AP-6A, AP-6B, AP-7, and AP-8.

To characterize the N&E of the release and any relevant site condition that may affect the remedy ultimately selected, as required by § 257.95(g)(1), additional investigation activities were initiated. These investigation activities included the installation of additional downgradient monitoring wells to characterize the N&E of the release as well as the installation of additional piezometers to evaluate site conditions that may affect the remedy ultimately selected. Five (5) N&E wells (AP-9A, AP-10A, MW-19B, MW-19I, and MW-19A) and two piezometers (P-4 2019 and IAPZ-1) were installed. Monitoring Wells MW-19B, MW-19I and MW-19B were installed at the facility boundary pursuant to § 257.95(g)(1)(iii). These wells were installed to characterize the nature and extent of the contamination plume and to support the CMA.

The location of the CCR groundwater monitoring well network and N&E wells/piezometers are depicted on Figure 2. No monitoring wells were abandoned during this reporting period.

§ 257.90(e)(3) In addition to all the monitoring data obtained under § 257.90 through § 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

Table 1 provides a summary of the number of samples collected at each CCR monitoring well and N&E well, sampling dates, and designation of whether samples were required by the detection or assessment monitoring program during 2019 for the CCR groundwater monitoring system. Groundwater elevation data is provided in Table 2. Assessment Monitoring groundwater analytical results for the May 2019 sampling event is summarized in Table 3. Assessment Monitoring groundwater results for the November 2019 sampling event were not finalized in 2019 and therefore are not included with this report. Groundwater analytical results for the August 2019 N&E sampling event is summarized in Table 4.

§ 257.90(e)(4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels);

Pursuant to § 257.94(e)(2), 257.94(e)(3) and 257.95(b), the facility established an Assessment Monitoring Program in accordance with the requirements of § 257.95 on July 16, 2018 as denoted in the 2018 Annual Groundwater Monitoring and Corrective Action report. IPL Petersburg continues assessment monitoring in accordance with § 257.95.

A statistical evaluation of the 2018 analytical data was performed in order to determine whether there was a SSL of an Appendix IV constituent detected above the relevant GWPS in accordance with § 257.95(g) and 257.93(h). This evaluation was completed in January 2019. GWPS were developed pursuant to § 257.95(d)(2) and (h) and exceedances of the established GWPS were identified. Appendix IV constituents that exceeded the GWPS include cadmium, cobalt, and molybdenum. Completion of a notification identifying the Appendix IV constituents that exceeded GWPS in

accordance with § 257.95(g) was completed in January 2019 and was placed in the facility's CCR operating record pursuant to § 257.95(g).

A statistical evaluation of the May 2019 analytical data was performed in order to determine whether there was a SSL of an Appendix IV constituent detected above the relevant groundwater protection standards (GWPS) in accordance with § 257.95(g) and 257.93(h). This evaluation was completed in September 2019. Based on this evaluation, it was determined that there were no new Appendix IV constituent SSLs; therefore, an additional notification was not triggered pursuant to 40 CFR 257.95(g) as no new SSLs were identified.

§ 257.90(e)(5) Other information required to be included in the annual report as specified in § 257.90 through § 257.98.

Table 5 summarizes the groundwater protection standards established in accordance with § 257.95(d)(2) and § 257.95(h).

Pursuant to 40 CFR 257.94(e)(2), an Alternative Source Demonstration was initiated to evaluate whether a source other than the facility was causing the identified SSL in monitoring well AP-8. A successful demonstration was completed (Attachment B) in October 2019. Cadmium and cobalt exceedances for AP-8 were determined to be from an alternative source other than the CCR unit.

Projected key activities for the upcoming year include the following:

- Assessment monitoring sampling events in accordance with § 257.95.
- Finalize November 2019 analytical data. Completion of statistical evaluation of November 2019 analytical data to determine whether there is a SSL above GWPS for Appendix IV constituents in accordance with § 257.95(g) and 257.93(h). Perform SSL evaluations of final 2020 assessment monitoring analytical data.
- Continue N&E work pursuant to § 257.95(g).
- Conduct public meeting to discuss the results of the corrective measures assessment at least 30 days prior to the selection of remedy pursuant to § 257.96(e).
- Prepare semi-annual report(s) describing progress in selecting and designing the remedy pursuant to § 257.97(a).
- Following remedy selection, if feasible, prepare and certify final report describing the selected remedy and how it meets the standards specified in § 257.97(b).

We appreciate the opportunity to assist with IPL's CCR Rule groundwater monitoring program at Petersburg Station's ash pond system. Please contact either of the undersigned at 317.849.4990 if you have any questions regarding this report.

Sincerely,

Kendra Reininga	Mark E. Breting, L.P.G.	Robert T. Duncan, L.P.G.
Staff Geologist	Senior Project Geologist	Senior Project Geologist

Copies: Ms. Nysa Hogue
Mr. Erwin Leidolf

TABLES

Table 1
Well Sampling Summary
Multiunit Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Identification	Date Installed	Upgradient/Background, Downgradient, or Nature & Extent	Number of Samples	Sample Date	Pace Laboratory Project Number	Detection or Assessment Monitoring Program
AP-1R	4/5/2016	Downgradient	2	5/15/2019	50225263	Assessment
				11/5/2019	50241051	
AP-2A	6/11/2014	Downgradient	2	5/15/2019	50225263	Assessment
				11/5/2019	50241051	
AP-2BO	4/5/2016	Downgradient	2	5/15/2019	50225263	Assessment
				11/5/2019	50241051	
AP-3	6/9/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-3A	5/13/2015	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-4A	6/16/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-4I	6/16/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-4B	6/17/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-5	6/17/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-5A	5/12/2015	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-6A	6/17/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-6B	6/18/2014	Downgradient	2	5/14/2019	50225140	Assessment
				11/4/2019	50241051	
AP-7	6/10/2014	Downgradient	2	5/15/2019	50225261	Assessment
				11/5/2019	50241051	
AP-8	6/10/2014	Downgradient	2	5/15/2019	50225261	Assessment
				11/4/2019	50241051	
MW-2 (2R)	MW-2 - 1986 MW-2R - 2/1/2017	Upgradient	3	5/16/2019	50225552	Assessment
				11/6/2019	50241029	
MW-3	1986	Upgradient	2	5/16/2019	50225552	Assessment
				11/6/2019	50241029	
MW-4C	9/29/1992	Upgradient	2	5/16/2019	50225552	Assessment
				11/6/2019	50241029	
AP-9A	5/30/2019	Nature & Extent	2	8/23/2019	50234059	Assessment
				11/5/2019	50241026	

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Multiunit Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Identification	Date Installed	Upgradient/Background, Downgradient, or Nature & Extent	Number of Samples	Sample Date	Pace Laboratory Project Number	Detection or Assessment Monitoring Program
AP-10A	8/2/2019	Nature & Extent	2	8/23/2019	50234059	Assessment
				11/5/2019	50241026	
MW-19B	8/1/2019	Nature & Extent	2	8/23/2019	50234059	Assessment
				11/5/2019	50241026	
MW-19I	8/1/2019	Nature & Extent	2	8/23/2019	50234059	Assessment
				11/5/2019	50241026	
MW-19A	8/1/2019	Nature & Extent	2	8/23/2019	50234059	Assessment
				11/5/2019	50241026	

Table 2
Groundwater Elevation Data
Petersburg Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station, Petersburg, Indiana
ATC Project No. 170LF00706

Monitoring Well/Piezometer Location	Gauging Date	TOC Elevation (ft-MSL)	Depth to Water (ft)	Water Elevation (ft-MSL)
AP-1R	1/18/2019	443.08	28.08	415.00
	2/19/2019		18.18	424.9
	3/12/2019		25.80	417.28
	4/9/2019		24.52	418.56
	5/12/2019		24.26	418.82
	7/25/2019		30.27	412.81
	8/29/2019		33.40	409.68
	11/3/2019		35.80	407.28
AP-2A	1/18/2019	437.87	25.48	412.39
	2/19/2019		14.20	423.67
	3/12/2019		25.90	411.97
	4/9/2019		21.66	416.21
	5/12/2019		21.69	416.18
	7/25/2019		27.55	410.32
	8/29/2019		30.46	407.41
	11/3/2019		32.40	405.47
AP-2BO	1/18/2019	436.86	24.35	412.51
	2/19/2019		12.99	423.87
	3/12/2019		20.44	416.42
	4/9/2019		20.53	416.33
	5/12/2019		20.54	416.32
	7/25/2019		26.41	410.45
	8/29/2019		29.27	407.59
	11/3/2019		31.19	405.67
AP-3	3/12/2019	421.59	4.84	416.75
	5/12/2019		4.42	417.17
	7/25/2019		10.40	411.19
	8/29/2019		13.45	408.14
	11/3/2019		15.40	406.19
AP-3A	5/12/2019	421.56	5.20	416.36
	7/25/2019		11.21	410.35
	8/29/2019		14.25	407.31
	11/3/2019		16.30	405.26

Table 2
Groundwater Elevation Data
Petersburg Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station, Petersburg, Indiana
ATC Project No. 170LF00706

Monitoring Well/Piezometer Location	Gauging Date	TOC Elevation (ft-MSL)	Depth to Water (ft)	Water Elevation (ft-MSL)
AP-4A	5/12/2019	421.69	4.79	416.90
	7/25/2019		11.28	410.41
	8/29/2019		14.56	407.13
	11/3/2019		16.43	405.26
AP-4I	5/12/2019	421.82	4.85	416.97
	7/25/2019		11.37	410.45
	8/29/2019		14.61	407.21
	11/3/2019		16.52	405.30
AP-4B	5/12/2019	421.72	4.79	416.93
	7/25/2019		11.29	410.43
	8/26/2019		14.56	407.16
	11/3/2019		16.48	405.24
AP-5	5/12/2019	422.01	5.22	416.79
	7/25/2019		11.70	410.31
	8/26/2019		14.81	407.20
	11/3/2019		16.45	405.56
AP-5A	5/12/2019	422.52	5.67	416.85
	7/25/2019		12.10	410.42
	8/26/2019		15.16	407.36
	11/3/2019		16.76	405.76
AP-6A	5/12/2019	424.33	6.78	417.55
	7/25/2019		13.55	410.78
	8/26/2019		16.77	407.56
	11/3/2019		18.45	405.88
AP-6B	5/12/2019	424.4	6.73	417.67
	7/25/2019		13.50	410.90
	8/26/2019		16.76	407.64
	11/3/2019		18.45	405.95
AP-7	5/12/2019	434.62	10.24	424.38
	7/25/2019		11.96	422.66
	8/26/2019		11.96	422.66
	11/3/2019		11.80	422.82

Table 2
Groundwater Elevation Data
Petersburg Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station, Petersburg, Indiana
ATC Project No. 170LF00706

Monitoring Well/Piezometer Location	Gauging Date	TOC Elevation (ft-MSL)	Depth to Water (ft)	Water Elevation (ft-MSL)
AP-8	1/18/2019	444.20	3.73	440.47
	2/19/2019		3.40	440.80
	3/12/2019		3.42	440.78
	4/9/2019		3.12	441.08
	5/12/2019		2.82	441.38
	7/25/2019		3.68	440.52
	8/26/2019		3.93	440.27
	11/3/2019		4.53	439.67
MW-2 (2R)	1/18/2019	455.00	13.28	441.72
	2/19/2019		11.02	443.98
	3/12/2019		10.91	444.09
	4/9/2019		10.22	444.78
	5/12/2019		10.02	444.98
	7/25/2019		13.61	441.39
	8/29/2019		15.20	439.80
	11/3/2019		17.36	437.64
MW-3	1/18/2019	450.71	9.58	441.13
	2/19/2019		9.10	441.61
	3/12/2019		8.93	441.78
	4/9/2019		8.81	441.90
	5/12/2019		8.77	441.94
	7/25/2019		9.76	440.95
	8/29/2019		9.66	441.05
	11/3/2019		9.74	440.97
MW-4C	1/18/2019	454.44	5.56	448.88
	2/19/2019		5.62	448.82
	3/12/2019		5.40	449.04
	4/9/2019		5.27	449.17
	5/12/2019		5.03	449.41
	7/25/2019		5.45	448.99
	8/29/2019		5.06	449.38
	11/3/2019		5.13	449.31
AP-9A	7/25/2019	436.83	26.54	410.29
	8/29/2019		29.45	407.38
	11/3/2019		31.25	405.58

Table 2
Groundwater Elevation Data
Petersburg Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station, Petersburg, Indiana
ATC Project No. 170LF00706

Monitoring Well/Piezometer Location	Gauging Date	TOC Elevation (ft-MSL)	Depth to Water (ft)	Water Elevation (ft-MSL)
AP-10A	11/3/2019	422.41	17.27	405.14
MW-19B	8/29/2019	421.51	15.36	406.15
	11/3/2019		16.24	405.27
MW-19I	8/291/19	421.28	15.25	406.03
	11/3/2019		16.05	405.23
MW-19A	8/29/2019	421.41	15.35	406.06
	11/3/2019		16.16	405.25
P-4	5/12/2019	450.77	32.59	418.18
	7/25/2019		38.37	412.40
	11/3/2019		28.12	422.65
IAPZ-1	8/12/2019	422.41	23.13	399.28

Notes:
TOC = Top of Casing
*Suspect data point; possible field transcription error
ft-MSL = feet above Mean Sea Level
ft-bgs = feet below ground surface

Table 3
Summary of Monitoring Results - May 2019 (Semi-Annual CCR Wells Event)
Multiunit Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Well ID		AP-1R	AP-2A	AP-2BO	AP-3	AP-3A	AP-4A	AP-4I	AP-4B	AP-5	AP-5A	AP-6A
Lab ID		5.01225E+11	50225263002	50225263003	50225140001	50225140002	50225140003	50225140004	50225140005	50225140006	50225140007	50225140008
Sample Date		5/15/2019	5/15/2019	5/15/2019	5/14/2019	5/14/2019	5/14/2019	5/14/2019	5/14/2019	5/14/2019	5/14/2019	5/14/2019
Static Water Elevation (ft MSL)		418.82	416.18	416.32	417.17	416.36	416.90	416.97	416.93	416.79	416.85	417.55
Field Parameters												
Temperature	°C	19.04	18.28	15.96	14.14	15.84	15.73	15.57	14.19	15.48	16.49	15.06
Dissolved Oxygen, Field	mg/L	0.24	0.19	0.20	0.67	0.05	0.00	0.15	1.79	1.00	0.27	0.14
Conductivity, Field	µS/cm	2076.10	2195.94	2407.24	2167.09	2632.25	2488.96	2518.79	829.50	1814.14	2338.27	2166.75
ORP, Field	mV	-131.46	-150.22	-109.94	13.23	-145.19	-116.15	-77.45	4.84	-51.77	-106.00	-102.31
pH, Field	Std. Units	6.95	7.50	7.22	6.76	7.14	6.95	7.07	6.62	6.99	6.96	6.97
Analytical Data												
Antimony, Total	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic, Total	mg/L	1.4	3.8	2.1	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium, Total	mg/L	60.9	46.0	30.6	21.8	36.4	30.5	29.3	87.5	28.8	25.2	26.4
Beryllium, Total	mg/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium, Total	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chromium, Total	mg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Cobalt, Total	mg/L	<1.0	1.1	2.8	1.1	<1.0	<1.0	2.2	<1.0	1.7	<1.0	<1.0
Lead, Total	mg/L	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Lithium, Total	mg/L	<20.0	77.9	<20.0	<20.0	<20.0	43.6	<20.0	<20.0	21.3	<20.0	<20.0
Mercury, Total	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Molybdenum, Total	mg/L	18.9	2200	268	<10	929	265	89.3	<10	138	196	<10
Selenium, Total	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	9.7	<1.0	<1.0	<1.0
Thallium, Total	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium-Combined	pCi/L	1.52	1.43	1.75	1.17	1.61	1.78	1.32	1.24	2.77	1.67	1.31
Boron, Total	mg/L	11700	21600	19600	7090	26400	23500	11700	1060	7220	16900	13700
Calcium, Total	mg/L	458000	608000	615000	528000	678000	582000	660000	180000	450000	617000	551000
Chloride	mg/L	76.8	113	112	46.5	117	118	64.3	21.4	34.9	43.4	34.0
Fluoride	mg/L	<0.10	0.11	<0.10	0.12	<0.10	<0.10	0.17	0.11	0.19	<0.10	<0.10
pH	SU	7.0	7.3	7.2	7.0	7.1	7.1	7.2	6.8	7.1	7.0	7.1
Solids, Dissolved	mg/L	1880	2370	2410	2060	2730	2720	2440	829	1800	2560	2410
Sulfate	mg/L	939	1430	1490	976	1330	1360	1710	214	886	1360	1240

Notes:
ft MSL: Elevation, feet mean sea level
°C: Degrees celcius
uS/cm: microsiemen per centimeter
umhos/cm: micromhos per centimeter
mV: millivolt
Std. Units: standard units
mg/L: milligram per liter
ug/L: microgram per liter
pCi/L: picoCurie per liter
Static water elevation listed for a well may have been collected on a date different than date of well sampling.

Table 3
Summary of Monitoring Results - May 2019 (Semi-Annual CCR Wells Event)
Multiunit Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Well ID	AP-6B	AP-7	AP-8	MW-2R	MW-3	MW-4C
Lab ID	50225140009	50225261001	50225261002	50225552001	50225552002	50225552003
Sample Date	5/14/2019	5/15/2019	5/15/2019	5/16/2019	5/16/2019	5/16/2019
Static Water Elevation (ft MSL)	417.67	424.38	441.38	444.98	441.94	449.41
Field Parameters						
Temperature	13.39	14.01	14.13	16.15	16.75	14.70
Dissolved Oxygen, Field	0.66	0.07	0.02	0.10	0.07	0.31
Conductivity, Field	1075.21	1120.35	943.16	2013.82	2264.90	2117.22
ORP, Field	12.87	-84.66	43.22	-84.76	-45.01	0.37
pH, Field	6.79	6.61	5.33	6.83	7.22	6.84
Analytical Data						
Antimony, Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic, Total	<1.0	2.5	5.9	8.3	12.9	<1.0
Barium, Total	23.6	69.2	16.8	35.5	28.6	26.2
Beryllium, Total	<0.20	<0.20	1.9	<0.20	<0.20	<0.20
Cadmium, Total	<2.0	<2.0	7.0	<2.0	<2.0	<2.0
Chromium, Total	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Cobalt, Total	<1.0	<1.0	295	3.3	2.0	1.0
Lead, Total	<10.0	<10.0	<10.0	<10.0	47.8	<10.0
Lithium, Total	<20.0	<20.0	38.5	616	1260	316
Mercury, Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Molybdenum, Total	<10	<10	<10.0	11.2	338	<10.0
Selenium, Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thallium, Total	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium-Combined	<0.5	0.814	0.688	1.19	0.745	0.788
Boron, Total	1410	288	1080	2020	1620	3870
Calcium, Total	236000	219000	136000	428000	422000	496000
Chloride	10.1	4.9	12.8	35.0	78.0	36.7
Fluoride	0.11	0.12	0.45	<0.10	0.19	0.11
pH	6.9	6.8	5.6	7.0	7.4	7.0
Solids, Dissolved	1010	989	940	2230	2020	2350
Sulfate	382	306	587	1260	1090	1140

Notes:
ft MSL: Elevation, feet mean sea level
°C: Degrees celcius
uS/cm: microsiemen per centimeter
umhos/cm: micromhos per centimeter
mV: millivolt
Std. Units: standard units
mg/L: milligram per liter
ug/L: microgram per liter
pCi/L: picoCurie per liter
Static water elevation listed for a well may have been collected on a date different than date of well sampling.

Table 4
Summary of Monitoring Results - August 2019
(N and E Well Event)
Multiunit Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Well ID		AP-9A	AP-10A	MW-19A	MW-19I	MW-19B
Pace Lab ID		50234059004	50234059005	50234059001	50234059003	50234059002
Sample Date		8/23/2019	8/23/2019	8/23/2019	8/23/2019	8/23/2019
Static Water Elevation (ft MSL)		NA	NA	406.06	405.23	405.27
Field Parameters						
Temperature	°C	20.34	17.52	17.52	19.29	22.76
Dissolved Oxygen, Field	mg/L	0.15	0.12	0.97	2.15	1.04
Conductivity, Field	µS/cm	2926.8	2716.1	2500.5	736.58	748.81
ORP, Field	mV	-32.1	-72.3	-42.9	33.1	51.60
pH, Field	Std. Units	7.07	7.18	6.96	6.99	6.93
Analytical Data						
Antimony, Total	ug/L	<1.0	<1.0	<1.0	<1.0	1.0
Arsenic, Total	ug/L	2.6	3.7	3.8	6.0	13.2
Barium, Total	ug/L	62.7	63.5	78.5	109	168
Beryllium, Total	ug/L	<0.20	<0.20	0.25	<0.20	0.67
Boron, Total	ug/L	29500	27700	24700	630	1040
Cadmium, Total	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0
Calcium, Total	ug/L	684000	664000	612000	127000	163000
Chromium, Total	ug/L	NA	NA	NA	NA	NA
Cobalt, Total	ug/L	1.6	3.7	6.1	4.2	13.2
Lead, Total	ug/L	<10.0	10.1	<10.0	<10.0	28.1
Lithium, Total	ug/L	22.6	<20.0	<20.0	<20.0	<20.0
Mercury, Total	ug/L	NA	NA	NA	NA	NA
Molybdenum, Total	ug/L	2300	957	1050	<10.0	<10.0
Selenium, Total	ug/L	<1.0	<1.0	<1.0	2.0	1.0
Thallium, Total	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0
Radium-Combined	ug/L	1.34	1.49	1.78	1.37	4.10
Chloride	mg/L	133	147	103.0	11.6	12.8
Fluoride	mg/L	0.24	0.10	<0.10	0.15	0.12
pH	SU	7.2	7.1	7.1	7.4	7.4
Solids, Dissolved	mg/L	2740	2610	2390	430	436
Sulfate	mg/L	1720	1570	1520	61.9	115

Notes:
ft MSL: Elevation, feet mean sea level
°C: Degrees celcius
uS/cm: microsiemen per centimeter
umhos/cm: micromhos per centimeter
mV: millivolt
Std. Units: standard units
mg/L: milligram per liter
ug/L: microgram per liter
pCi/L: picoCurie per liter

Static water elevation listed for a well may have been collected on a date different than date of well sampling.

NA = Not Analyzed

Table 5
Groundwater Protection Standards
Multiunit Ash Pond System
Indianapolis Power and Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Parameter	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium 226/228 Combined
Units	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	pCi/L
GWPS	6	12.9	2000	4	5	100	6	4	47.8	2907.3	2	660	50	2	5

Notes:
ug/L = micrograms per liter (ppb)
mg/L = milligrams per liter (ppm)
pCi/L = picoCuries per liter
GWPS = Groundwater Protection Standard

FIGURES

H:\2019\IPL\PETERSBURG\170LF00706\170LF00706-SITE LOCATION MAP.DWG, 11X17P

LEGEND:

- IPL PROPERTY BOUNDARY
- APPROXIMATE LIMITS OF CCR SURFACE IMPOUNDMENT
- APPROXIMATE LIMITS OF NON CCR SURFACE IMPOUNDMENT
- RESTRICTED WASTE SITE (RWS) TYPE I LANDFILL BOUNDARY
- PERMITTED EXPANSION AREA BOUNDARY

NOTE:
7.5 MINUTE (1:24,000) USGS QUADRANGLE MAPS
1980 SANDY HOOK, IN
1980 MONROE CITY, IN

KNOX CO
DAVIESS CO
PIKE CO
WHITE RIVER
EAST FORK OF WHITE RIVER
KNOX CO
PIKE CO
RIVER
ASH POND C
ASH POND B
ASH POND A'
ASH POND A
ASH POND D
RWS TYPE I AREA
LANDFILL EXPANSION AREA
PETERSBURG GENERATING STATION
CONRAIL
Anderson-Chappell Ch
Cem
Strip Mines
Oil Well
BLACKBURN RD
Oil Well
Arda
Creek
W A S H I N G
N
1,000 0 500 1,000
SCALE: 1" = 1,000'

SITE LOCATION MAP

IPL PETERSBURG GENERATING STATION
ASH POND SYSTEM
PETERSBURG, INDIANA

Figure: 1
Scale: AS SHOWN
Date: 12/19

Project Number: 170LF00706	Drn. By: JG
Drawing File: SEE TOP LEFT	Ckd. By: KR
ATC	App'd By:
	Ckd. Date:

H:\2019\IPL\PETERSBURG\170LF00706\170LF00706-CCR GW MONITORING SYSTEM MAP.DWG, 11X17P

LEGEND:

- MW-1 — CCR MONITORING WELL (Well Identification)
- MW-1 — NATURE AND EXTENT MONITORING WELL (Well Identification)
- IAPZ-1 — NATURE AND EXTENT PIEZOMETER (Well Identification)
- IPL PROPERTY BOUNDARY
- APPROXIMATE LIMITS OF CCR SURFACE IMPOUNDMENT

AP-6B
AP-6B
AP-7
AP-5A
AP-5
ASH POND C
AP-8
AP-4A
AP-4I
AP-4B
ASH POND B
MW-19A
MW-19I
MW-19B
AP-3A
AP-3
AP-10A
ASH POND A'
AP-2A
AP-9A
AP-2B0
MW-4C
ASH POND A
P-4-2019
IAPZ-1
ASH POND D
AP-1R
MW-3
MW-2R

N

600 0 200 400 600

SCALE: 1" = 600'

GROUNDWATER MONITORING SYSTEM
CCR NETWORK WELLS AND N AND E WELLS

IPL PETERSBURG GENERATING STATION
ASH POND SYSTEM
PETERSBURG, INDIANA

Figure: 2
Scale: AS SHOWN
Date: 1/20

Project Number: 170LF00706	Drn. By: AK
Drawing File: SEE TOP LEFT	Ckd. By: KR
ATC	App'd By:
	Ckd. Date:

ATTACHMENT A

Demonstration for 60-Day Extension – Corrective Measures Assessment

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

July 2019
Project No. 133274-003

SUBJECT: **Demonstration for 60-Day Extension – Corrective Measures Assessment (CMA)**
Indianapolis Power & Light (IPL) – Petersburg Generating Station
Ash Ponds A, A' & C
Pike County, Indiana

Pursuant to CFR Title 40 Chapter 257 Subpart D §257.96(a) (CCR Rule), I certify that IPL has demonstrated the need for an additional 60-days beyond the regulatory time period of 90 days to complete the assessment of corrective measures for Ash Ponds A, A' & C due to site-specific conditions and the evaluation of remedial treatment alternatives in support of an informed CMA process.

In the case of the assessment for Ash Ponds A, A' & C, the site has complex hydrogeology and nature and extent (N&E) investigations are ongoing in support of the CMA process. Nature and extent information is an important component of the CMA. This supplemental N&E work has experienced delays due to high river levels preventing drilling access. IPL is also in the process of reviewing possible groundwater remedies and is evaluating potential closure strategies as well as implementation of critical steps in the groundwater treatment and remedy assessment process. Based on these site-specific conditions and related groundwater treatment alternatives evaluations in support of the CMA by IPL, a 60-day extension is needed to complete the CMA process.

This certification as submitted, is to the best of my knowledge, accurate and complete.

Signed:_____

Certifying Engineer

Print Name:	Steven F. Putrich, P.E.
Indiana License No.:	PE11200566
Title:	CCR Practice Lead, Senior Consulting Engineer
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal

ATTACHMENT B

Demonstration That Source Other Than CCR Unit Caused Contamination

ALTERNATIVE SOURCE DEMONSTRATION

CADMIUM & COBALT AT MONITORING WELL AP-8
ASH PONDS A, A', AND C
INDIANAPOLIS POWER & LIGHT COMPANY
PETERSBURG GENERATING STATION

PETERSBURG, INDIANA

ATC PROJECT NUMBER 170LF00706

OCTOBER 8, 2019

PREPARED FOR:

MR. DAVID M. HEGER, SENIOR COUNSEL
AES US SERVICES, LLC
ONE MONUMENT CIRCLE, SUITE 701A
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October 8, 2019

Mr. David M. Heger
Senior Counsel
AES US Services, LLC
One Monument Circle, Suite 701A
Indianapolis, Indiana 46204-2901

Re: **Alternative Source Demonstration**
40 CFR Part 257.95 Groundwater Assessment Monitoring Program
Cadmium and Cobalt at Monitoring Well AP-8
Ash Pond System
Petersburg Generating Station
Indianapolis Power & Light Company
Petersburg, Indiana
ATC Project Number 170LF00706

Dear Mr. Heger:

In accordance with federal regulations for coal combustion residual (CCR) landfills and surface impoundments (40 CFR Part 257, commonly known as the CCR Rule), ATC Group Services (ATC) has prepared this Alternate Source Demonstration for the multi-unit groundwater monitoring system installed at Indianapolis Power & Light Company's (IPL) Petersburg Generating Station's Ash Ponds A, A', and C. This Alternate Source Demonstration has been prepared to comply with CCR Rule Groundwater Assessment Monitoring regulations at § 257.95(g)(3). According to § 257.95(g)(3), the facility 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.

This demonstration addresses Appendix IV (assessment monitoring) parameters cadmium and cobalt. Cadmium and cobalt concentrations at monitoring well AP-8 exceed corresponding groundwater protection standards. Based on a review of the geology, hydrogeology, historic surface and underground coal mining and seep groundwater quality results, the GWPS exceedances for cadmium and cobalt in well AP-8 are not attributable to the Ash Pond System because historical surface and underground coal mining has resulted in acid mine drainage/mining impacts, including elevated cadmium and cobalt concentrations in AP-8, to groundwater in upgradient areas to the monitoring well.

1.0 Background

IPL operates the Petersburg Generating Station located at 6925 N State Road 57 Petersburg, Indiana. A site location map is provided as Figure 1. There are two separate CCR units at the Station, the RWS Type I Landfill (Landfill) and the multi-unit Ash Pond System consisting of five ash ponds. Ash ponds A, A', and C are subject to 40 CFR Part 257.

The Petersburg Generating Station Ash Pond System Closure & Post-Closure Plan dated August 4, 2014[1], was approved by the Indiana Department of Environmental Management (IDEM) on December 31, 2014. To support the Ash Pond Closure Plan, IPL installed a groundwater monitoring system and initiated a groundwater monitoring program in 2014. In 2016 and early 2017, the facility initiated a separate groundwater monitoring program to comply with § 257.90 and monitoring proceeded under dual programs. With approval from IDEM in 2017, the facility transitioned to a single § 257.90 groundwater monitoring program and began evaluating groundwater monitoring data for statistically significant increases (SSIs) to comply with § 257.90(b).

The CCR multi-unit groundwater monitoring system at the Petersburg Ash Pond System consists of seventeen (17) monitoring wells. There are three (3) upgradient wells (MW-2R, MW-3, and MW-4C) and fourteen (14) downgradient monitoring wells (AP-1R, AP-2A, AP-2BO, AP-3, AP-3A, AP-4A, AP-4B, AP-4I, AP-5, AP-5A, AP-6A, AP-6B, AP-7, and AP-8). Nested groundwater monitoring wells are installed in five (5) downgradient locations (AP-2A/B, AP-3/3A, AP-4A/I/B, AP-5/5A, and AP-6A/B). The wells were installed between 1986 and 2017 and are installed in unconsolidated deposits overlying bedrock. Groundwater quality data from the upgradient wells are used to establish statistical limits that are based on interwell comparisons.

To determine if a SSI over background level occurred the Statistical Analysis of August 2017 Groundwater Quality Data report dated January 15, 2018 was prepared. Results from that report and unsuccessful demonstration of Alternative Sources resulted in IPL Petersburg Generating Station entering into the Assessment Monitoring Program as required by 40 CFR § 257.94(e)(3) on July 16, 2018. Assessment monitoring was performed in May and September 2018, respectively. Subsequently, a determination of groundwater protection standards (GWPS) was completed. The GWPS was established for each Appendix IV parameter by using the greater of the USEPA Maximum

[1] Cardno ATC, Proposed Closure and Post-Closure Plans, Ash Pond System. Petersburg Generating Station, August 4, 2014.

Contaminant Level (MCL), the USEPA National Minimum Criteria (Phase One, Part One, Disposal of Coal Combustion Residuals from Electric Utilities; effective August 29, 2018), or the background prediction limit.

Groundwater quality was compared to groundwater protection standards by calculating the 95% lower confidence limit (LCL) on the mean of the four most recent Appendix IV results. For monitoring well AP-8, the calculated 95% LCL for cadmium and cobalt were at levels above the Groundwater Protections Standards. Cadmium was not detected in the remaining Ash Pond monitoring wells, nor was it detected in the Ash Pond background wells. Cobalt had not been detected in any of the other Ash Pond monitoring wells including the background monitoring wells prior to the May 2019 sampling event. Following a change in laboratory analytical services and the resulting lower reporting limit, cobalt was detected in monitoring wells AP-2A, AP-2BO, AP-3, AP-4I, AP-5, MW-2R, MW-3, and MW-4C during the May 2019 groundwater sampling event. The results for cobalt in AP-8 are two orders of magnitude greater than the results for the other wells.

1.1 Alternate Source Demonstration

Federal CCR Rule § 257.95(g)(3) specifies the following:

. . . the owner or operator must either: (i) Initiate an assessment of corrective measures as required by § 257.96; or (ii) 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.

The alternate source demonstration for cadmium and cobalt exceedances is based on the following:

- AP-8 is the only Ash Pond monitoring well where cobalt and cadmium exceed the GWPS;
- Cadmium is not detected in any of the other Ash Pond monitoring wells;
- Cobalt had not been detected in the other monitoring wells until May 2019 when the reporting limit was lowered. The May 2019 detections are two orders of magnitude lower than the results for AP-8;
- The field pH result for AP-8 is 5.33 standard units (S.U.) and has historically ranged from 5.04 to 5.65 S.U. as reported in the annual groundwater reports. The pH results in AP-8 are atypical of pH results from coal ash ponds in general, and when compared to pH results for the other Ash Pond monitoring wells which range from 6.5 to 7.3 S.U.;
- Monitoring well AP-8 is completed at the top of the sub-cropping bedrock with the well screen straddling fine-grained cohesive soils and weathered Pennsylvanian sandstone from EL 424 to EL 434. The other Ash Pond wells are

completed in outwash sand and gravel or alluvial sand and fine-grained material (AP-7). At AP-8, the outwash sand and gravel or alluvial sand are not present because of the location of the monitoring well relative to bedrock topography as the bedrock at this location is at a higher elevation than the top of the outwash deposits;

- Uphill, hydraulically upgradient, and adjacent to AP-8 is an abandoned coal mine slope entry into the Gladstone Underground Coal Mine that was active from approximately 1920 through 1930. The underground coal mine and associated mine seeps provide the alternate source of the elevated cobalt and cadmium observed in monitoring well AP-8.

2.0 Site Geology and Hydrogeology

2.1 Geology

Petersburg Generating Station is located approximately three miles northeast of Petersburg, Pike County, Indiana. Bedrock is assigned to the Carbondale Group of the Pennsylvanian System and includes sandstone, shale, limestone, clay and coal of the Petersburg and Linton Formations. The uppermost named coal in the vicinity of Ash Ponds is the Springfield Coal (Coal V) of the Petersburg Formation. The Springfield Coal has been extensively mined in the uplands area adjacent to the east and south of AP-8 and is believed to subcrop along the alignment of the train tracks adjacent and east of the Ash Ponds.

Physiographically, the Petersburg Generating Station lies within the Wabash Lowlands of the Southern Hills and Lowlands Region[2]. The area was glaciated by at least one of the pre-Wisconsin glacial events resulting in modified topography of the bedrock. The region includes several streams including the White River and East Fork of the White River. Tributary valleys to the larger streams may include thick lake deposits. Outside the stream valleys the topography consists of rolling hills of low relief. Near the edge of the major river valleys the upland areas are capped by aeolian deposits of sand and silt (loess). The aeolian deposits are believed to have been mostly deposited during the Wisconsin Glaciation. Loess deposits can be up to six feet thick.

The Ash Pond sits on top of the floodplain of the White River on fine-grained alluvial deposits of clay and silty clay. Underlying the fine-grained alluvial deposits under most of the Ash Pond is an up to 60-ft thick outwash sand and gravel deposit associated with the

[2] Gray,H.H.,2000, Physiographic Divisions of Indiana, Indiana University, Indiana Geological Survey Special Report 61

White River and East Fork White River. The eastern boundary of the Ash pond is under lain by mostly fine-grained alluvium that may include sand not associated with the outwash and bedrock.

2.2 Hydrogeology

The Petersburg Generating Station Lies within the West Fork White River Basin. Several aquifer systems have been identified in the southern portion of the West Fork White River Basin. Aquifer Systems that meet definitions identified by Beaty[3] others within and adjacent to the Ash Pond System at the IPL Petersburg Generating Station include: Pennsylvanian Carbondale Group Bedrock Aquifer, the White River Outwash Aquifer System, the Lacustrine and Backwater Deposits Aquifer System, and lastly the Dissected Till and Residuum Aquifer System.

The most productive aquifers in the basin are outwash deposits that are adjacent to major streams in the basin. Least productive are the weathered bedrock residuum, thin till deposits, and lacustrine and backwater deposits occupying many tributary stream valleys and the Pennsylvanian interbedded shales and sandstones.

The Dissected Till and Residuum Aquifer System is present in the southern half of the West Fork White River Basin in which the IPL Petersburg site is located. The unconsolidated deposits in the upland area do not appear to include any remnants of Pre-Wisconsin till, but weathered bedrock particularly fine-grained sandstone has been described in boring logs. The unconsolidated materials in the upland area appear to be dominated by silt and sand that is believed to be aeolian in genesis. The Dissected Till and Residuum Aquifer System is poorly connected to the Outwash system through fine-grained alluvial material and fill at the toe of the upland area. This Aquifer System is monitored at the Restricted Waste Landfill in the upland area adjacent to the Ash Ponds.

The White River and Tributaries Outwash Aquifer System is composed of large volumes of sand and gravel, deposited by runoff from melting glaciers, filling the major stream valleys (White River and West Fork White River are relevant examples) in vertical and lateral accretionary deposits. Sedimentation occurred when glaciers supplied sediment loads greater than the stream could transport. The White River and Tributaries Outwash Aquifer System is the most prolific aquifer system in the valley. The outwash aquifer system contrasts with the adjacent clay-rich or bedrock aquifer systems. Most of the aquifer system thickness ranges from 50 to 100 feet thick with the top of the aquifer at

[3] Beaty, J.E. (editor),2002, Groundwater Resources in the White and West Fork White River Basin, Indiana, Indiana Department of Natural Resources Division of Water, Water Resource Assessment 2002-6.

approximately EL 402 under the ash ponds and approximately EL 418 adjacent to the White River. At the IPL Generating Station, the aquifer ranges from being absent (0-ft thick) along the east side of the ash ponds to greater than 60-ft thick adjacent to the White River. Regionally this aquifer system is mostly unconfined, however, there is a confining layer over most of the aquifer at the IPL Petersburg Generating Station and the aquifer becomes confined during prolonged high river stages.

Schrader and Herring's[4] *Bedrock Aquifer Systems of Pike County, Indiana* map identifies a map unit identified as Underground Mine Areas. INDR describes this unit as areas where coal seams have been removed by underground mining methods leaving approximately 50% of the coal, thus providing potential storage for "substantial" amounts of water in larger mines. The description includes the statement that there are no records of wells completed in this map unit. IDNR speculates that yields of a few hundred gallons per minute are possible. No data on water quality was reported, but groundwater from the mined areas is expected to be "mineralized". The Underground Mine Areas map unit includes a mapped area adjacent to the AP-8 location.

3.0 Historical Coal Mining

Historical coal mining of the Springfield (Coal V), both surface and underground, has been documented adjacent to the AP-8 monitoring well location. Named underground mines include the Rogers Mine (mined from 1890 -1924) and the Gladstone Mine (1920-1930). Surface mines include the Miracle #1 Pit (1979-1981), Redman #1 Pit (1980-1981), Regal #7 (1978-1979), Redman # 2 (1979-1980), Redman #3 (1979-1980), and Unknown Mine #63 (1970-1971). Note borrow area activities in this time frame may have been mistaken for surface mining and Unknown Mine # 63 (1970-1971)[5]. Select mine names are shown on Figure 1.

Several hydrogeologic and geotechnical studies have been conducted at the IPL Petersburgh Generating Station. Work completed between 1993 through 1995 as part of the Permit Application for Major Modification to Operating Permit No 63-2: Construction Permit SW 280 included discussions of historic coal mining in the area[6,7,8].

[4] Schrader, G.P. and Herring W.C., 2003, Bedrock Aquifer Systems of Pike County, Indiana: Indiana Department of Natural Resources, Division of Water, Resource Assessment Section, Map.
[5] IDNR, 2019, Coal Mine Information System Map Viewer: http://dnrmaps.dnr.in.gov/apps/cmis.htm

[6] Stone & Webster, 1994, Landfill Permit Application – Major Modification To: Operating Permit No. 63-2, Construction Permit SW 280, Stone & Webster Engineering Corporation, Boston, Massachusetts.
[7] Stone & Webster, 1995, Hydrogeologic and Sulfate Contamination Study, Petersburg Generating Station Landfill, Indianapolis Power and Light Company, Stone & Webster Engineering Corporation, Boston, Massachusetts.

The J.F. New (1993) report, as part of the historic coal mine discussion, identified several seeps associated with the historic coal mining along the west side of the upland area and east of the railroad tracks. The largest of the seeps was identified as Seep # 4 and was interpreted as an open shaft associated with the historic Rogers underground mine: mined from 1890-1924 (IDNR, 2019). The shaft opening/seep is still present and afforded an access point from which a water sampling could be collected. Note that the IDNR Coal Mine Information System maps show the Rogers underground mine and Gladstone mine to be adjacent to each. In addition, both mines were completed in the Springfield Coal.

Acid Mine Drainage (AMD), from coal mining, and related impacts to water quality in southwest Indiana is well documented[9,10,11,12,13]. Pyrite is commonly found in coal deposits in southwest Indiana. The pyrite can occur as coarse-grained masses, euhedral forms, acicular forms, coarse-grained masses, framboids and pylyframboids. The framboidal forms have more surface area per volume of material and are more reactive[14] than other forms of pyrite found in coal. The geochemistry of AMD in southwestern Indiana is based primarily on the interactions of pyrite with oxygen, water, and bacteria[15]. Reactive sulfide minerals containing other metals may also be present in coal and overburden rocks. Metal-bearing phases are more soluble under acidic conditions than under neutral conditions: pyrite weathering leads to high levels of

[8] New, J.F, 1993, Environmental Study of the Petersburg Generating Station, Petersburgh, Indiana, J.F. New & Associates, Inc., Walkerton, Indiana
[9] Comer, J.B.(Editor), 2012, Effects of Abandoned Mine Land Reclamation on Ground and Surface Water Quality, Research and Case Histories from Indiana, Indiana University, Indiana Geological Survey Special Report 72, 352 p.
[10] Branam, T.D. and Harper, D., 1994, Tabulated Analytical Data for Water Samples from the Friar Tuck Site: Indiana Geological Survey Open-File Report 94-13, 169 p, 7 fig.
[11] Harper, D.H., Branam, T.D., Olyphant, G.A., 2001, Characterization of Groundwater in the Coal-Mine Aquifers of Indiana: Indiana Geological Survey Special Report.
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dissolved metals in drainages from mined land[16]. Smith (2012) documented cadmium in AMD surface water samples from four wetlands constructed to treat the AMD: cadmium results ranged from non-detect to 30.4 µg/L. Cobalt analysis was not included in this study, but a study conducted in Pennsylvania detected cobalt in all 140 samples collected from coal mine drainage sources[17].

The Indiana Geological & Water Survey Indiana Coal Quality Database[18,19] includes chemical analysis results from the Petersburg Formation Springfield Coal from the Redman Pit No. 1 mine (IGS Coal Database ID iCQD-AA-787 Sample ID 194858)located less than 1 mile to the east of AP-8. Chemical results for the mine include constituents of concern cobalt (3 ppm whole coal basis) and cadmium (1.6 ppm whole coal basis)[20]. These results provide evidence that coal is a potential source for the cobalt and cadmium detected in AP-8 above GWPS.

AMD/mining impacts to groundwater quality from the underground mining (Rogers Mine and Gladstone Mine) are believed to be the source of cadmium and cobalt in the anomalous water quality results in AP-8. Figure 1 shows the location of the slope entry into the Gladstone Mine: the location is adjacent to monitoring well AP-8. As described above, a collapse feature or improperly abandoned air shaft associated with the Rogers mine is located northeast of AP-8 and AP-7 (Seep #4, Stone and Webster, 1995). Seep #4[21] is shown on Figure 1.

The assessment of natural variation in groundwater chemical composition and identification of an alternate source or sources of impacts to groundwater quality represent complex issues at the site. Past investigations have concluded that groundwater quality at the site is affected by historical surface and underground mining of the Springfield Coal.

[16] Smith, R.T., 2012, Metal Removal in Acid Mine Drainage Treatment Wetlands: Research and Case Histories from Indiana, Indiana University, Indiana Geological Survey Special Report 72, pages 225-257.
[17] Cravotta C.A.III, 2007, Dissolved Metals and Associated Constituents in Abandoned Coal-Mine Discharges, Pennsylvania, USA, Part 1: Constituent Quantities and Correlations, United States Geological Survey, in Applied Geochemistry 23 (2008) pages 166-202.
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[19] Mastalerz, M., Drobniak, A., and Irwin, P., 2005, Indiana Coal Quality Database: Indiana Geological Survey Open-File Study 05-02
[20] Drobniak, A., Mastalerz, M, and Johnson, M.R., 2018, Indiana Coal Quality Database: Indiana Geological and Water Survey Digital Information 21, https://igws.indiana.edu/IGSMap/DI21_ICQD
[21] Note the water sample collected on May 15, 2019 identified the sample location as Seep 1: the seep is identified as Seep 4 in historic documents that were reviewed after the seep sample had been collected. To be consistent with historical documents, the seep is identified as Seep 4 in this ASD.

To test the hypothesis that the AMD/mining impacts from the historic Rogers Mine could be a potential source of the cadmium and chromium detected in AP-8, a water sample from Seep #4 was collected on May 15, 2019. Seep #4 represents groundwater from the historic underground Rogers Mine and would be representative of the impact of the underground mining on groundwater at AP-8. Analysis included major cations and anions and the CCR Rule Appendix III and Appendix IV parameters. The Laboratory Report is included in Appendix. Sample results for the May 2019 sample events for AP-8 and Seep 4 are summarized in Table 1.

The spring of 2019 was characterized by above normal rainfall with rainfall totals from January 2019 through May 2019 being 11.66 inches above average at the Petersburg, Indiana monitoring location. The above average rainfall influence on the geochemistry of the acid seep was expected to result in dilution of the dissolved material in the effluent from Seep 4, and likely to have resulted in higher water levels in the abandoned underground coal mine resulting in more reducing conditions within the mine at the time of sample collection and reduced AMD activity as high water cut off oxygen from the atmosphere slowing the redox reactions driving AMD in the area of the Seep 4. Note that Seep 4 is located in a natural drainage and is directly connected to the historic underground mine works. These conditions would result in quicker responses to changes in redox conditions from increased water levels associated with the abnormal elevated precipitation and expected flooding of the old mine works when compared to the slower impacts to a groundwater flow dominated conditions at AP-8. The effects of dilution and lower AMD activity on the water quality at Seep 4 help explain the lower concentrations of cadmium, cobalt and sulfate in the Seep 4 sample compared to the AP-8 sample.

High water in Seep 4 prevented access to the primary outlet of the seep. However, a sample was collected from the margins of the seep. It is also notable that iron flocculants appeared to be suspended in the water column and iron precipitates were noted in on the bottom of the seep. The suspended iron floc may indicate active oxidation and precipitation of iron and other metals was occurring in the seep at the time of the sampling. The iron precipitates accumulated on the surface below the water line indicate past accumulation of precipitated metals. The apparent changes in redox conditions as water upwelled into the seep are from the underground mine and associated precipitation of metals in the seep and dilution from above average precipitation combine for lower metal results in the seep sample. Dilution is likely the main reason for lower metals results in the seep sample when compared to AP-8 results.

The major cations and anions from AP-8 and Seep 4 were compared and are presented on Trilinear and Stiff diagrams (Figures 2 and 3). The Trilinear diagram shows AP-8 and Seep 4 have similar water quality characteristics and plot on similar positions on the diagram. The Stiff diagram patterns for AP-8 and Seep 4 reinforce interpretation that the groundwater at AP-8 and water from Seep 4 have similar water chemistry. The Trilinear diagram and Stiff diagram plots indicate similar origins of the groundwater for AP-8 and Seep 4 locations.

Monitoring well AP-8 May 2019 groundwater results and the Seep 4 May 2019 results are summarized in Table 1. Cadmium and cobalt were both detected in the seep sample, but at lower concentrations detected in the samples from monitoring well AP-8. As noted earlier in this section, the spring of 2019 was notably wet resulting in dilution lower results of cadmium and cobalt when compared to the results from monitoring well AP-8.

Both the major cations and anion results and the detection of cadmium and cobalt in the seep sample indicate impacts to groundwater from the underground mining. The similarity of the seep results to the AP-8 groundwater results indicate the cadmium and cobalt detects in AP-8 are the results of impacts from historic mining activities unrelated to the ash pond.

Previous studies at the IPL Generating Station have shown historic mining activities unrelated to the landfill have negatively impacted water quality in the area resulting in acidic (low pH) conditions[22 and 23]. These reports demonstrated an alternate source for the lower pH in ash pond system monitoring well AP-8 and further support the alternate source demonstration that impacts from mining to groundwater chemistry as an alternative source for the cadmium and cobalt.

[22] New, J.F. and Associates, 1993, Environmental Study of the Petersburg Generating Station, Petersburg, Indiana, J.F. New and Associates, Walkerton, Indiana.
[23] Stone and Webster, 1995, Hydrogeologic and Sulfate Contamination Study, Indianapolis Power & Light Company, Stone and Webster Engineering Corporation, Boston, Massachusetts.

5.0 Conclusions and Recommendations

Appendix IV parameters cadmium and cobalt calculated 95% LCLs were at levels above the Groundwater Protections Standards (GWPS) for monitoring well AP-8: Cadmium LCL of 7 µg/L is above the GWPS of 5 µg/L and Cobalt LCL of 283 µg/L is above the GWPS of 6 µg/L.

As part of this ASD, ATC has reviewed the geology and hydrogeology of Pike County, Indiana and the IPL Petersburg Generating Station and the historic coal mining activities adjacent to the Ash Ponds at the IPL Petersburg Generating Station. ATC collected water samples from a seep impacted by acid mine drainage and compared those water quality results to groundwater quality results from monitoring well AP-8.

The alternate source demonstration for cadmium and cobalt exceedances included the following observations:

- AP-8 is the only Ash Pond Monitoring well where cobalt and cadmium exceed the GWPS;
- Cadmium is not detected in any of the other Ash Pond monitoring wells;
- Cobalt had not been detected in the other monitoring wells until May 2019 when the reporting limit was lowered. The May 2019 detections are two orders of magnitude lower than the results for AP-8;
- The field pH result for AP-8 is 5.33 standard units (S.U.) and has historically ranged from 5.04 to 5.65 S.U. as reported in the annual groundwater reports. The pH results in AP-8 are atypical of pH results from coal ash ponds in general, and when compared to pH results for the other Ash Pond monitoring wells which range from 6.5 to 7.3 S.U.;
- Monitoring well AP-8 is completed at the top of the sub-cropping bedrock with the well screen straddling fine-grained cohesive soils and weathered Pennsylvanian sandstone from EL 424 to EL 434. The other Ash Pond wells are completed in outwash sand and gravel or alluvial sand and fine-grained material (AP-7);
- Uphill, hydraulically upgradient, and adjacent to AP-8 is an abandoned coal mine slope entry into the Gladstone Underground Coal Mine that was active from approximately 1920 through 1930. The underground coal mine and associated mine seeps provide the alternate source of the elevated cobalt and cadmium observed in monitoring well AP-8. As noted, the Gladstone Mine and the Rogers Mine both were completed in the Springfield Coal and are located adjacent to

each other. Seep # 4 is associated with the Rogers Mine, but provided a water sample location to show the impacts from underground mining to water quality associated with both the Rogers and Gladstone underground coal mines.

Based on a review of the geology, hydrogeology, historic surface and underground coal mining and seep groundwater quality results, the GWPS exceedances for cadmium and cobalt in well AP-8 are not attributable to the Ash Pond System because historical surface and underground coal mining has resulted in acid mine drainage/mining impacted conditions in upgradient areas to the monitoring well.

We appreciate the opportunity to assist with IPL's CCR Rule groundwater monitoring program at the Petersburg Generating Station ash pond system. Please contact any of the undersigned at 317.849.4990 if you have any questions regarding this report.

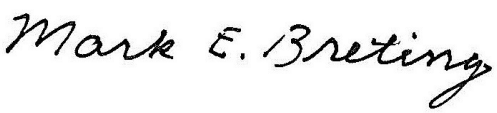
Sincerely,

ATC Group Services LLC

Robert T. Duncan, L.P.G.
Senior Project Geologist

Martin Brungard, P.E.
Senior Project Engineer

John R. Noel, L.P.G.
Principal Geologist



Mark E. Breting, L.P.G.
Senior Project Geologist

Copies:

Nysa Hogue

TABLES

Table 1
Laboratory Test Results Summary
Indianapolis Power & Light Company
Petersburg Generating Station
Petersburg, Indiana
ATC Project No. 170LF00706

Well	Date	Antimony, Total	Arsenic, Total	Barium, Total	Beryllium, Total	Boron, Total	Cadmium, Total	Calcium, Total	Chloride	Chromium, Total	Cobalt, Total	Fluoride	Lead, Total	Lithium, Total	Mercury	Molybdenum, Total	Radium-226	Radium-228	Selenium, Total	Sulfate	Thallium, Total	Total Dissolved Solids
AP-8	5/15/2019	<1.0	5.9	16.8	1.9	1080	7.0	136000	12.8	<10.0	295	0.45	<10.0	38.5	<2.0	<10.0	0.505	0.183	<1.0	587	<1.0	940
Seep-1	5/15/2019	<1.0	2.2	41.7	0.20	1130	2.0	157000	3.5	<10.0	2.8	0.35	<10.0	21.2	<2.0	27.1	0.352	0.403	<1.0	282	<1.0	743

Table 2
Sping 2019 Rainfall Summary
Petersburg Indiana
170LF00706

Month	Rain, Melted Snow, ETC. (in)[1]	Average[2]	Difference Above Average
Jan	5.68	2.95	2.73
February	7.20	2.72	4.48
March	5.65	4.06	1.59
April	5.96	4.21	1.75
May	6.27	5.16	1.11
Total Above Average			11.66

References

1) NOAA.GOV:
https://gis.ncdc.noaa.gov/maps/ncei/summaries/monthly?&extent=-18396252.471276224:1995923.68256476:-5872809.757036278:6897677.432435241&srid=102100

2) U.S. Climate Data:
https://www.usclimatedata.com/climate/petersburg/indiana/united-states/usin0529

FIGURES

LEGEND:

- APPROXIMATE LIMITS OF SOLID WASTE BOUNDARY
- PROPERTY BOUNDARY
- APPROXIMATE LIMITS OF EXISTING WETLAND
- STREAM
- LIMITS OF DISTURBANCE
- MW-1C — LANDFILL MONITORING WELL — Well Identification
- AP-1 — ASH POND SYSTEM GROUNDWATER MONITORING WELL — Well Identification
- MW-17 — PROPOSED MONITORING WELL — Well Identification
- TP-1 — TEMPORARY PIEZOMETER — Well Identification
- AP-11A — PIEZOMETER — Piezometer Identification
- SEEP-1 — SEEP SAMPLE POINT — Point Identification
- COAL SAMPLE ID 194858

TEMPORARY IMPACTS PERMISSIBLE ONLY WITHIN BUFFER. (REQUIRES WETLAND DEMARCATION AND FULL WETLAND AVOIDANCE)
NO IMPACTS PERMISSABLE
TEMPORARY IMPACTS PERMISSIBLE
WETLAND MITIGATION
WETLAND- A-PEM
WETLAND- B-PEM
MINE #200700 1979-1981
HOIST SHAFT
SLOPE ENTRY GLADSTONE MINE
ROGERS MINE 1979-1981
REDMAN #2 PIT 1979-1980
GLADSTONE 1920-1930
REGAL #7 PIT 1978-1979
UNKNOWN MINE #65 1965-1966
UNKNOWN MINE #63 1970-1971
REDMAN #3 PIT 1979-1980
UNKNOWN MINE #58 1930-1935
RWS III LANDFILL
CHURCH MINE 1936-1951
SAND HILL MINE 1938-1967
UNKNOWN MINE #63 1942-1959
PETERSBURG GENERATING STATION
POND A
POND A'
POND B
POND C
POND D
MW-2 (ABANDONED ON 01/31/2017)
MW-2R OFFSET
SR 57

N

1,000 0 250 500 750 1,000
SCALE: 1" = 1,000'

Drn. By:	BH
Ckd. By:	RD
App'd By:	
Ckd. Date:	

Project Number: 170LF00706
Drawing File: SEE LOWER LEFT

ATC

EXISTING CONDITIONS - 2016 AERIAL PHOTOGRAPHY

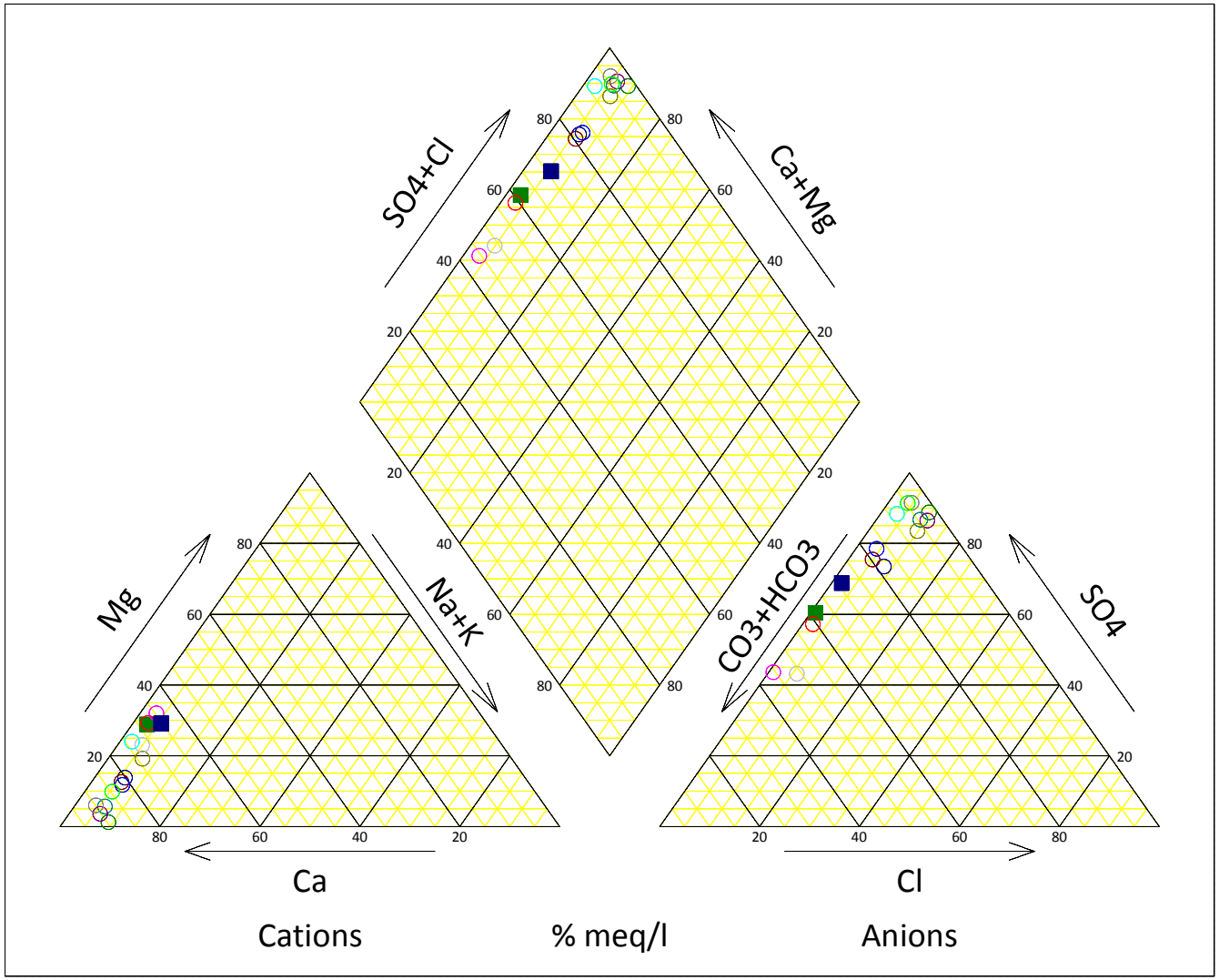
ALTERNATE SOURCE DEMONSTRATION
DAMIUM AND COBALT MONITORING WELL AP-8
PETERSBURG GENERATION STATION
PETERSBURG, INDIANA

Date: 9/19
Scale: AS SHOWN
Figure: 1

H:\2019\IPL\PETERSBURG\170LF00706\170LF00706-EXISTING CONDITIONS 11X17.DWG, FIG1

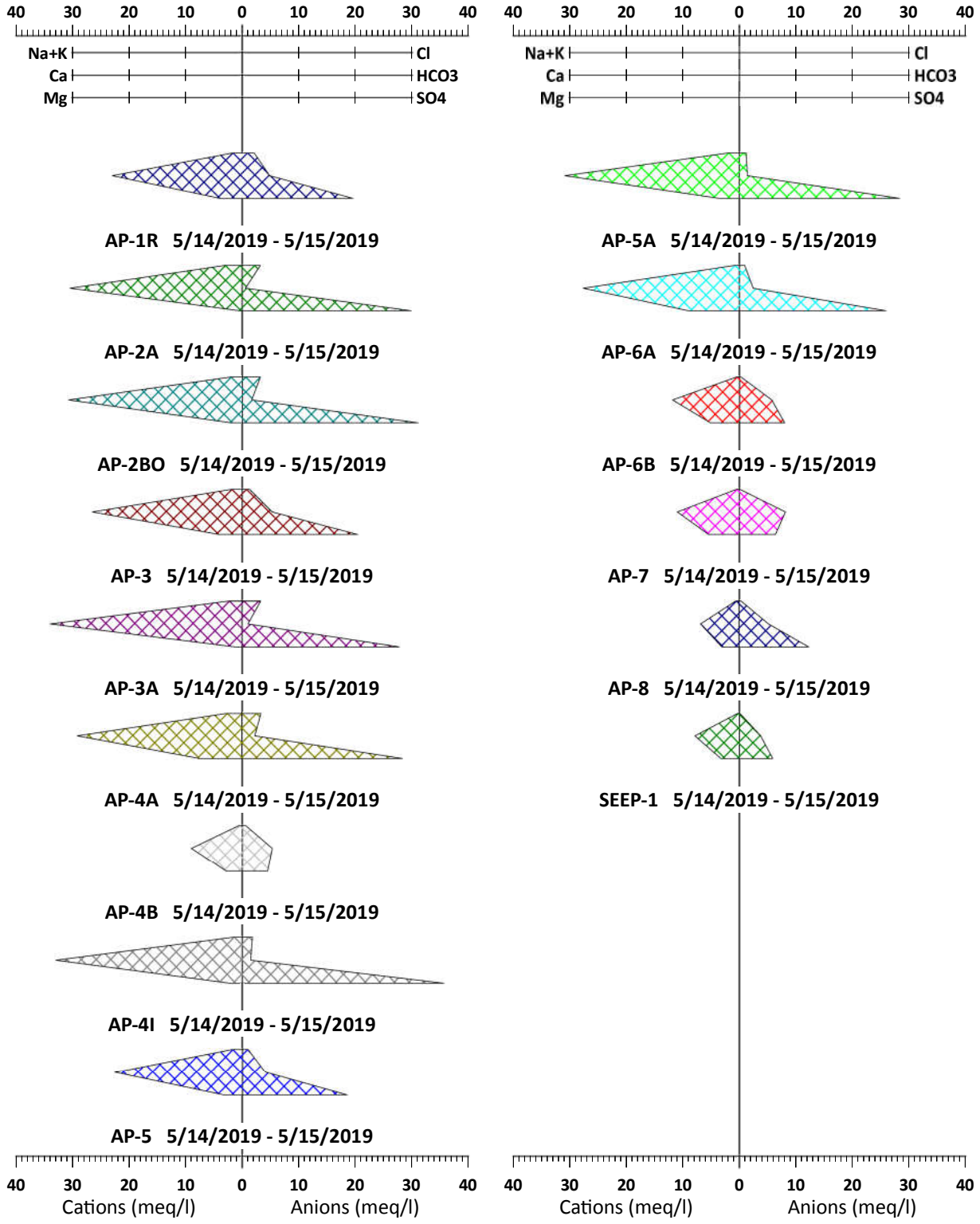
Figure 2
Trilinear Diagram
Petersburg Generating Station

SEEP-1	5/14/2019 -	5/15/2019
AP-1R	5/14/2019 -	5/15/2019
AP-2A	5/14/2019 -	5/15/2019
AP-2BO	5/14/2019 -	5/15/2019
AP-3	5/14/2019 -	5/15/2019
AP-3A	5/14/2019 -	5/15/2019
AP-4A	5/14/2019 -	5/15/2019
AP-4B	5/14/2019 -	5/15/2019
AP-4I	5/14/2019 -	5/15/2019
AP-5	5/14/2019 -	5/15/2019
AP-5A	5/14/2019 -	5/15/2019
AP-6A	5/14/2019 -	5/15/2019
AP-6B	5/14/2019 -	5/15/2019
AP-7	5/14/2019 -	5/15/2019
AP-8	5/14/2019 -	5/15/2019



Prepared by: ATC Group Services LLC

Figure 3
Stiff Diagram
Petersburg Generating Station



Prepared by: ATC Group Services LLC

APPENDIX A

Pace Analytical Seep Sample Laboratory Report
May 15, 2019 Sample Event

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

June 11, 2019

Mr. Rob Duncan
ATC Group Services, LLC
7988 Centerpoint Drive
Indianapolis, IN 46256

RE: Project: Petersburg Surface Water
Pace Project No.: 50225297

Dear Mr. Duncan:
Enclosed are the analytical results for sample(s) received by the laboratory on May 16, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Donna S. Spyker

Donna Spyker
donna.spyker@pacelabs.com
(317)228-3100
Project Manager

Enclosures

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

CERTIFICATIONS

Project: Petersburg Surface Water
Pace Project No.: 50225297

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

Indiana Certification IDs

7726 Moller Road, Indianapolis, IN 46268
Illinois Certification #: 200074
Indiana Certification #: C-49-06
Kansas/NELAP Certification #: E-10177
Kentucky UST Certification #: 80226
Kentucky WW Certification #: 98019
Michigan Department of Environmental Quality, Laboratory #9050
Ohio VAP Certification #: CL0065
Oklahoma Certification #: 2018-101
Texas Certification #: T104704355
West Virginia Certification #: 330
Wisconsin Certification #: 999788130
USDA Soil Permit #: P330-16-00257

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SAMPLE SUMMARY

Project: Petersburg Surface Water
Pace Project No.: 50225297

Lab ID	Sample ID	Matrix	Date Collected	Date Received
50225297001	**Seep-1**	Water	05/15/19 13:10	05/16/19 09:37
50225297002	**Seep-1 Dup**	Water	05/15/19 13:10	05/16/19 09:37

Pace Analytical Services, LLC
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(317)228-3100

SAMPLE ANALYTE COUNT

Project: Petersburg Surface Water
Pace Project No.: 50225297

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
50225297001	**Seep-1**	EPA 9056	NPW	3	PASI-I
		EPA 6010	KJE	13	PASI-I
		EPA 6010	JPK	3	PASI-I
		EPA 6020	DMT	6	PASI-I
		EPA 7470	FRW	1	PASI-I
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2310B	SCM	1	PASI-I
		SM 2320B	SLB	1	PASI-I
		SM 2540C	MLS	1	PASI-I
		HACH 8146	TPD	1	PASI-I
50225297002	**Seep-1 Dup**	EPA 9056	NPW	3	PASI-I
		EPA 6010	KJE	13	PASI-I
		EPA 6010	JPK	3	PASI-I
		EPA 6020	DMT	6	PASI-I
		EPA 7470	FRW	1	PASI-I
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		SM 2310B	SCM	1	PASI-I
		SM 2320B	SLB	1	PASI-I
		SM 2540C	MLS	1	PASI-I
		HACH 8146	TPD	1	PASI-I

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Petersburg Surface Water
Pace Project No.: 50225297

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50225297001	**Seep-1**					
EPA 9056	Chloride	3.5	mg/L	0.25	05/24/19 17:43	
EPA 9056	Fluoride	0.35	mg/L	0.10	05/24/19 17:43	
EPA 9056	Sulfate	282	mg/L	25.0	05/29/19 07:11	
EPA 6010	Aluminum	275	ug/L	200	05/19/19 11:37	
EPA 6010	Barium	41.7	ug/L	10.0	05/19/19 11:37	
EPA 6010	Boron	1130	ug/L	100	05/19/19 11:37	
EPA 6010	Calcium	157000	ug/L	1000	05/19/19 11:37	
EPA 6010	Iron	11500	ug/L	100	05/19/19 11:37	
EPA 6010	Lithium	21.2	ug/L	20.0	05/19/19 11:37	
EPA 6010	Magnesium	40300	ug/L	1000	05/19/19 11:37	
EPA 6010	Manganese	2340	ug/L	10.0	05/19/19 11:37	
EPA 6010	Molybdenum	27.1	ug/L	10.0	05/19/19 11:37	
EPA 6010	Sodium	7720	ug/L	1000	05/19/19 11:37	
EPA 6010	Manganese, Dissolved	1750	ug/L	10.0	05/24/19 03:54	
EPA 6020	Arsenic	2.2	ug/L	1.0	05/29/19 11:27	
EPA 6020	Cobalt	2.8	ug/L	1.0	05/29/19 11:27	
EPA 903.1	Radium-226	0.352 ± 0.285 (0.159) C:NA T:88%	pCi/L		06/07/19 15:24	
EPA 904.0	Radium-228	0.403 ± 0.408 (0.849) C:84% T:78%	pCi/L		06/04/19 12:33	
SM 2310B	Acidity, Total	19.0	mg/L	10.0	05/24/19 10:39	
SM 2320B	Alkalinity, Total as CaCO3	229	mg/L	2.0	05/24/19 11:31	
SM 2540C	Total Dissolved Solids	743	mg/L	10.0	05/21/19 06:55	
50225297002	**Seep-1 Dup**					
EPA 9056	Chloride	3.5	mg/L	0.25	05/24/19 18:19	
EPA 9056	Fluoride	0.35	mg/L	0.10	05/24/19 18:19	
EPA 9056	Sulfate	281	mg/L	25.0	05/29/19 07:30	
EPA 6010	Barium	39.5	ug/L	10.0	05/19/19 11:39	
EPA 6010	Boron	1160	ug/L	100	05/19/19 11:39	
EPA 6010	Calcium	159000	ug/L	1000	05/19/19 11:39	
EPA 6010	Iron	6690	ug/L	100	05/19/19 11:39	
EPA 6010	Magnesium	40600	ug/L	1000	05/19/19 11:39	
EPA 6010	Manganese	2380	ug/L	10.0	05/19/19 11:39	
EPA 6010	Molybdenum	24.4	ug/L	10.0	05/19/19 11:39	
EPA 6010	Sodium	8040	ug/L	1000	05/19/19 11:39	
EPA 6010	Manganese, Dissolved	1680	ug/L	10.0	05/24/19 03:56	
EPA 6020	Arsenic	1.3	ug/L	1.0	05/29/19 11:32	
EPA 6020	Cobalt	2.8	ug/L	1.0	05/29/19 11:32	
EPA 903.1	Radium-226	0.322 ± 0.381 (0.599) C:NA T:89%	pCi/L		06/07/19 15:24	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

SUMMARY OF DETECTION

Project: Petersburg Surface Water
Pace Project No.: 50225297

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
50225297002	**Seep-1 Dup**					
EPA 904.0	Radium-228	0.490 ± 0.436 (0.892) C:81% T:74%	pCi/L		06/04/19 12:33	
SM 2310B	Acidity, Total	24.0	mg/L	10.0	05/24/19 10:47	
SM 2320B	Alkalinity, Total as CaCO3	230	mg/L	2.0	05/24/19 11:31	
SM 2540C	Total Dissolved Solids	762	mg/L	10.0	05/21/19 06:55	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Petersburg Surface Water
Pace Project No.: 50225297

Sample: Seep-1 **Lab ID: 50225297001** Collected: 05/15/19 13:10 Received: 05/16/19 09:37 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
9056 IC Anions	Analytical Method: EPA 9056							
Chloride	**3.5**	mg/L	0.25	1		05/24/19 17:43	16887-00-6	
Fluoride	**0.35**	mg/L	0.10	1		05/24/19 17:43	16984-48-8	
Sulfate	**282**	mg/L	25.0	100		05/29/19 07:11	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Aluminum	**275**	ug/L	200	1	05/18/19 12:32	05/19/19 11:37	7429-90-5	
Barium	**41.7**	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:37	7440-39-3	
Boron	**1130**	ug/L	100	1	05/18/19 12:32	05/19/19 11:37	7440-42-8	
Cadmium	ND	ug/L	2.0	1	05/18/19 12:32	05/19/19 11:37	7440-43-9	
Calcium	**157000**	ug/L	1000	1	05/18/19 12:32	05/19/19 11:37	7440-70-2	
Chromium	ND	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:37	7440-47-3	
Iron	**11500**	ug/L	100	1	05/18/19 12:32	05/19/19 11:37	7439-89-6	
Lead	ND	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:37	7439-92-1	
Lithium	**21.2**	ug/L	20.0	1	05/18/19 12:32	05/19/19 11:37	7439-93-2	
Magnesium	**40300**	ug/L	1000	1	05/18/19 12:32	05/19/19 11:37	7439-95-4	
Manganese	**2340**	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:37	7439-96-5	
Molybdenum	**27.1**	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:37	7439-98-7	
Sodium	**7720**	ug/L	1000	1	05/18/19 12:32	05/19/19 11:37	7440-23-5	
6010 MET ICP, Lab Filtered	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Aluminum, Dissolved	ND	ug/L	200	1	05/23/19 20:45	05/24/19 03:54	7429-90-5	
Iron, Dissolved	ND	ug/L	100	1	05/23/19 20:45	05/24/19 03:54	7439-89-6	
Manganese, Dissolved	**1750**	ug/L	10.0	1	05/23/19 20:45	05/24/19 03:54	7439-96-5	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 200.2							
Antimony	ND	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:27	7440-36-0	
Arsenic	**2.2**	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:27	7440-38-2	
Beryllium	ND	ug/L	0.20	1	05/28/19 10:47	05/29/19 11:27	7440-41-7	
Cobalt	**2.8**	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:27	7440-48-4	
Selenium	ND	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:27	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:27	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	2.0	1	05/22/19 21:10	05/23/19 12:23	7439-97-6	
2310B Acidity, Total	Analytical Method: SM 2310B							
Acidity, Total	**19.0**	mg/L	10.0	1		05/24/19 10:39		
2320B Alkalinity	Analytical Method: SM 2320B							
Alkalinity, Total as CaCO3	**229**	mg/L	2.0	1		05/24/19 11:31		
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**743**	mg/L	10.0	1		05/21/19 06:55		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Petersburg Surface Water
Pace Project No.: 50225297

Sample: Seep-1 **Lab ID: 50225297001** Collected: 05/15/19 13:10 Received: 05/16/19 09:37 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Iron, Ferrous	Analytical Method: HACH 8146							
Iron, Ferrous	ND	mg/L	0.20	1		05/17/19 11:26		H3,N2

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Petersburg Surface Water
Pace Project No.: 50225297

Sample: Seep-1 Dup **Lab ID: 50225297002** Collected: 05/15/19 13:10 Received: 05/16/19 09:37 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
9056 IC Anions	Analytical Method: EPA 9056							
Chloride	**3.5**	mg/L	0.25	1		05/24/19 18:19	16887-00-6	
Fluoride	**0.35**	mg/L	0.10	1		05/24/19 18:19	16984-48-8	
Sulfate	**281**	mg/L	25.0	100		05/29/19 07:30	14808-79-8	
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Aluminum	ND	ug/L	200	1	05/18/19 12:32	05/19/19 11:39	7429-90-5	
Barium	**39.5**	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:39	7440-39-3	
Boron	**1160**	ug/L	100	1	05/18/19 12:32	05/19/19 11:39	7440-42-8	
Cadmium	ND	ug/L	2.0	1	05/18/19 12:32	05/19/19 11:39	7440-43-9	
Calcium	**159000**	ug/L	1000	1	05/18/19 12:32	05/19/19 11:39	7440-70-2	
Chromium	ND	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:39	7440-47-3	
Iron	**6690**	ug/L	100	1	05/18/19 12:32	05/19/19 11:39	7439-89-6	
Lead	ND	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:39	7439-92-1	
Lithium	ND	ug/L	20.0	1	05/18/19 12:32	05/19/19 11:39	7439-93-2	
Magnesium	**40600**	ug/L	1000	1	05/18/19 12:32	05/19/19 11:39	7439-95-4	
Manganese	**2380**	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:39	7439-96-5	
Molybdenum	**24.4**	ug/L	10.0	1	05/18/19 12:32	05/19/19 11:39	7439-98-7	
Sodium	**8040**	ug/L	1000	1	05/18/19 12:32	05/19/19 11:39	7440-23-5	
6010 MET ICP, Lab Filtered	Analytical Method: EPA 6010 Preparation Method: EPA 3010							
Aluminum, Dissolved	ND	ug/L	200	1	05/23/19 20:45	05/24/19 03:56	7429-90-5	
Iron, Dissolved	ND	ug/L	100	1	05/23/19 20:45	05/24/19 03:56	7439-89-6	
Manganese, Dissolved	**1680**	ug/L	10.0	1	05/23/19 20:45	05/24/19 03:56	7439-96-5	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 200.2							
Antimony	ND	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:32	7440-36-0	
Arsenic	**1.3**	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:32	7440-38-2	
Beryllium	ND	ug/L	0.20	1	05/28/19 10:47	05/29/19 11:32	7440-41-7	
Cobalt	**2.8**	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:32	7440-48-4	
Selenium	ND	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:32	7782-49-2	
Thallium	ND	ug/L	1.0	1	05/28/19 10:47	05/29/19 11:32	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470							
Mercury	ND	ug/L	2.0	1	05/22/19 21:10	05/23/19 12:25	7439-97-6	
2310B Acidity, Total	Analytical Method: SM 2310B							
Acidity, Total	**24.0**	mg/L	10.0	1		05/24/19 10:47		
2320B Alkalinity	Analytical Method: SM 2320B							
Alkalinity, Total as CaCO3	**230**	mg/L	2.0	1		05/24/19 11:31		
2540C Total Dissolved Solids	Analytical Method: SM 2540C							
Total Dissolved Solids	**762**	mg/L	10.0	1		05/21/19 06:55		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS

Project: Petersburg Surface Water
Pace Project No.: 50225297

Sample: Seep-1 Dup **Lab ID: 50225297002** Collected: 05/15/19 13:10 Received: 05/16/19 09:37 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Iron, Ferrous	Analytical Method: HACH 8146							
Iron, Ferrous	ND	mg/L	0.20	1		05/17/19 11:29		H3,N2

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
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(317)228-3100

QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 502117 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2316949 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	0.25	05/24/19 13:08	
Fluoride	mg/L	ND	0.10	05/24/19 13:08	
Sulfate	mg/L	ND	0.25	05/24/19 13:08	

LABORATORY CONTROL SAMPLE: 2316950

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	1.2	1.1	87	80-120	
Fluoride	mg/L	0.5	0.44	88	80-120	
Sulfate	mg/L	2.5	2.3	90	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2316951 2316952

Parameter	Units	50225285001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	22.2	12.5	12.5	34.3	34.3	96	97	80-120	0	15	
Fluoride	mg/L	0.29	0.5	0.5	0.72	0.73	88	88	80-120	0	15	
Sulfate	mg/L	88.8	25	25	115	114	104	102	80-120	0	15	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 501884 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2315899 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	2.0	05/23/19 11:57	

LABORATORY CONTROL SAMPLE: 2315900

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.2	103	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2315901 2315902

Parameter	Units	50225396026 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	ND	5	5	4.9	4.9	99	97	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 500924
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2311523 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Aluminum	ug/L	ND	200	05/19/19 11:33	
Barium	ug/L	ND	10.0	05/19/19 11:33	
Boron	ug/L	ND	100	05/19/19 11:33	
Cadmium	ug/L	ND	2.0	05/19/19 11:33	
Calcium	ug/L	ND	1000	05/19/19 11:33	
Chromium	ug/L	ND	10.0	05/19/19 11:33	
Iron	ug/L	ND	100	05/19/19 11:33	
Lead	ug/L	ND	10.0	05/19/19 11:33	
Lithium	ug/L	ND	20.0	05/19/19 11:33	
Magnesium	ug/L	ND	1000	05/19/19 11:33	
Manganese	ug/L	ND	10.0	05/19/19 11:33	
Molybdenum	ug/L	ND	10.0	05/19/19 11:33	
Sodium	ug/L	ND	1000	05/19/19 11:33	

LABORATORY CONTROL SAMPLE: 2311524

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Aluminum	ug/L	10000	10100	101	80-120	
Barium	ug/L	1000	988	99	80-120	
Boron	ug/L	1000	1040	104	80-120	
Cadmium	ug/L	1000	1010	101	80-120	
Calcium	ug/L	10000	10200	102	80-120	
Chromium	ug/L	1000	1010	101	80-120	
Iron	ug/L	10000	10200	102	80-120	
Lead	ug/L	1000	969	97	80-120	
Lithium	ug/L	1000	997	100	80-120	
Magnesium	ug/L	10000	10100	101	80-120	
Manganese	ug/L	1000	1000	100	80-120	
Molybdenum	ug/L	1000	966	97	80-120	
Sodium	ug/L	10000	9970	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2311525 2311526

Parameter	Units	50225297002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Aluminum	ug/L	ND	10000	10000	10500	10300	104	102	75-125	1	20	
Barium	ug/L	39.5	1000	1000	1040	1010	100	97	75-125	3	20	
Boron	ug/L	1160	1000	1000	2210	2220	105	106	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2311525 2311526

Parameter	Units	50225297002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Cadmium	ug/L	ND	1000	1000	1030	1010	103	101	75-125	2	20	
Calcium	ug/L	159000	10000	10000	162000	166000	32	69	75-125	2	20	P6
Chromium	ug/L	ND	1000	1000	1000	980	100	98	75-125	2	20	
Iron	ug/L	6690	10000	10000	16600	16600	99	100	75-125	0	20	
Lead	ug/L	ND	1000	1000	935	916	94	92	75-125	2	20	
Lithium	ug/L	ND	1000	1000	1050	1030	103	101	75-125	2	20	
Magnesium	ug/L	40600	10000	10000	49400	50200	88	96	75-125	1	20	
Manganese	ug/L	2380	1000	1000	3400	3300	101	91	75-125	3	20	
Molybdenum	ug/L	24.4	1000	1000	995	975	97	95	75-125	2	20	
Sodium	ug/L	8040	10000	10000	18000	17900	100	99	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(317)228-3100

QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 502045 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET Dissolved
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2316746 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Aluminum, Dissolved	ug/L	ND	200	05/24/19 03:40	
Iron, Dissolved	ug/L	ND	100	05/24/19 03:40	
Manganese, Dissolved	ug/L	ND	10.0	05/24/19 03:40	

LABORATORY CONTROL SAMPLE: 2316747

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Aluminum, Dissolved	ug/L	20000	19800	99	80-120	
Iron, Dissolved	ug/L	20000	19200	96	80-120	
Manganese, Dissolved	ug/L	2000	1940	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2316748 2316749

Parameter	Units	50225297002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Aluminum, Dissolved	ug/L	ND	10000	10000	10100	10000	101	100	75-125	1	20	
Iron, Dissolved	ug/L	ND	10000	10000	9420	9460	94	95	75-125	0	20	
Manganese, Dissolved	ug/L	1680	1000	1000	2590	2570	90	88	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(317)228-3100

QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 502741 Analysis Method: EPA 6020
QC Batch Method: EPA 200.2 Analysis Description: 6020 MET
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2320366 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	ug/L	ND	1.0	05/29/19 07:30	
Arsenic	ug/L	ND	1.0	05/29/19 07:30	
Beryllium	ug/L	ND	0.20	05/29/19 07:30	
Cobalt	ug/L	ND	1.0	05/29/19 07:30	
Selenium	ug/L	ND	1.0	05/29/19 07:30	
Thallium	ug/L	ND	1.0	05/29/19 07:30	

LABORATORY CONTROL SAMPLE: 2320367

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	43.2	108	80-120	
Arsenic	ug/L	40	37.8	95	80-120	
Beryllium	ug/L	40	39.9	100	80-120	
Cobalt	ug/L	40	39.9	100	80-120	
Selenium	ug/L	40	38.8	97	80-120	
Thallium	ug/L	40	40.1	100	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2320368 2320369

Parameter	Units	50226036001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	ND	40	40	43.7	43.8	109	109	75-125	0	20	
Arsenic	ug/L	0.94	40	40	39.4	38.3	96	93	75-125	3	20	
Beryllium	ug/L	ND	40	40	42.3	41.9	106	105	75-125	1	20	
Cobalt	ug/L	1.2	40	40	39.1	39.1	95	95	75-125	0	20	
Selenium	ug/L	ND	40	40	40.7	40.0	101	99	75-125	2	20	
Thallium	ug/L	ND	40	40	40.7	40.8	102	102	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(317)228-3100

QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 502362 Analysis Method: SM 2310B
QC Batch Method: SM 2310B Analysis Description: 2310B Acidity, Total
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2318343 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Acidity, Total	mg/L	ND	10.0	05/24/19 10:24	

SAMPLE DUPLICATE: 2318344

Parameter	Units	50225297002 Result	Dup Result	RPD	Max RPD	Qualifiers
Acidity, Total	mg/L	24.0	21.0	13	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 502329 Analysis Method: SM 2320B
QC Batch Method: SM 2320B Analysis Description: 2320B Alkalinity
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2318247 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Alkalinity, Total as CaCO3	mg/L	ND	2.0	05/24/19 11:31	

LABORATORY CONTROL SAMPLE: 2318248

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Alkalinity, Total as CaCO3	mg/L	50	49.7	99	90-110	

SAMPLE DUPLICATE: 2318249

Parameter	Units	50225281006 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	373	377	1	20	

SAMPLE DUPLICATE: 2318250

Parameter	Units	50225319007 Result	Dup Result	RPD	Max RPD	Qualifiers
Alkalinity, Total as CaCO3	mg/L	377	390	3	20	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 501353 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2313757 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	10.0	05/21/19 06:45	

LABORATORY CONTROL SAMPLE: 2313758

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	300	305	102	80-120	

SAMPLE DUPLICATE: 2313759

Parameter	Units	50225281003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1180	1190	1	10	

SAMPLE DUPLICATE: 2313760

Parameter	Units	50225297002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	762	749	2	10	

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 500979 Analysis Method: HACH 8146
QC Batch Method: HACH 8146 Analysis Description: Iron, Ferrous
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 2311744 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron, Ferrous	mg/L	ND	0.20	05/17/19 11:14	H3,N2

LABORATORY CONTROL SAMPLE: 2311745

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Ferrous	mg/L	1	0.95	95	90-110	H3,N2

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2311746 2311747

Parameter	Units	50225297001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Iron, Ferrous	mg/L	ND	1	1	1.1	1.1	101	104	90-110	2	20	H3,N2

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REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Petersburg Surface Water
Pace Project No.: 50225297

Sample: Seep-1 **Lab ID: 50225297001** Collected: 05/15/19 13:10 Received: 05/16/19 09:37 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.352 ± 0.285 (0.159) C:NA T:88%**	pCi/L	06/07/19 15:24	13982-63-3	
Radium-228	EPA 904.0	**0.403 ± 0.408 (0.849) C:84% T:78%**	pCi/L	06/04/19 12:33	15262-20-1	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Petersburg Surface Water
Pace Project No.: 50225297

Sample: Seep-1 Dup **Lab ID: 50225297002** Collected: 05/15/19 13:10 Received: 05/16/19 09:37 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	**0.322 ± 0.381 (0.599) C:NA T:89%**	pCi/L	06/07/19 15:24	13982-63-3	
Radium-228	EPA 904.0	**0.490 ± 0.436 (0.892) C:81% T:74%**	pCi/L	06/04/19 12:33	15262-20-1	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL - RADIOCHEMISTRY

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 343818 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 1672997 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.780 ± 0.371 (0.635) C:84% T:85%	pCi/L	06/04/19 12:25	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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(317)228-3100

QUALITY CONTROL - RADIOCHEMISTRY

Project: Petersburg Surface Water
Pace Project No.: 50225297

QC Batch: 343817 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 50225297001, 50225297002

METHOD BLANK: 1672996 Matrix: Water
Associated Lab Samples: 50225297001, 50225297002

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.111 ± 0.268 (0.517) C:NA T:79%	pCi/L	06/07/19 15:24	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
7726 Moller Road
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(317)228-3100

QUALIFIERS

Project: Petersburg Surface Water
Pace Project No.: 50225297

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-I	Pace Analytical Services - Indianapolis
PASI-PA	Pace Analytical Services - Greensburg

ANALYTE QUALIFIERS

H3	Sample was received or analysis requested beyond the recognized method holding time.
N2	The lab does not hold NELAC/TNI accreditation for this parameter but other accreditations/certifications may apply. A complete list of accreditations/certifications is available upon request.
P6	Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.

Pace Analytical Services, LLC
7726 Moller Road
Indianapolis, IN 46268
(317)228-3100

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Petersburg Surface Water
Pace Project No.: 50225297

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
50225297001	**Seep-1**	EPA 9056	502117		
50225297002	**Seep-1 Dup**	EPA 9056	502117		
50225297001	**Seep-1**	EPA 3010	500924	EPA 6010	501181
50225297002	**Seep-1 Dup**	EPA 3010	500924	EPA 6010	501181
50225297001	**Seep-1**	EPA 3010	502045	EPA 6010	502307
50225297002	**Seep-1 Dup**	EPA 3010	502045	EPA 6010	502307
50225297001	**Seep-1**	EPA 200.2	502741	EPA 6020	502935
50225297002	**Seep-1 Dup**	EPA 200.2	502741	EPA 6020	502935
50225297001	**Seep-1**	EPA 7470	501884	EPA 7470	502064
50225297002	**Seep-1 Dup**	EPA 7470	501884	EPA 7470	502064
50225297001	**Seep-1**	EPA 903.1	343817		
50225297002	**Seep-1 Dup**	EPA 903.1	343817		
50225297001	**Seep-1**	EPA 904.0	343818		
50225297002	**Seep-1 Dup**	EPA 904.0	343818		
50225297001	**Seep-1**	SM 2310B	502362		
50225297002	**Seep-1 Dup**	SM 2310B	502362		
50225297001	**Seep-1**	SM 2320B	502329		
50225297002	**Seep-1 Dup**	SM 2320B	502329		
50225297001	**Seep-1**	SM 2540C	501353		
50225297002	**Seep-1 Dup**	SM 2540C	501353		
50225297001	**Seep-1**	HACH 8146	500979		
50225297002	**Seep-1 Dup**	HACH 8146	500979		

Pace Analytical

CHAIN-OF-CUSTODY / Analytical Request Document

50225297

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page : 1 Of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	ATC Group Services, LLC	Report To:	Duncan, Rob	Attention:	
Address:	7988 Centerpoint Drive	Copy To:		Company Name:	
Suite 100, Indianapolis, IN 46256				Address:	
Email:	robert.duncan@atcgs.com	Purchase Order #:		Pace Quote:	
Phone:	(317)649-2936 Fax:	Project Name:	Petersburg Surface Water	Pace Project Manager:	donna.spyker@pacelabs.com,
Requested Due Date:		Project #:		Pace Profile #:	6246/8

Regulatory Agency	
State / Location	IN

SAMPLE ID
One Character per box.
(A-Z, 0-9 / , -)
Sample Ids must be unique

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other	Analyses Test Y/N	IN Metals, Total	IN Metals, Lab Filtered	IN Chloride, Fluoride, Sulfate	IN Alkalinity/Acidity/Ferrous	IN TDS	IN Rad-226	IN Rad-228	Ra, Ca, Mg, B total	Residual Chlorine (Y/N)	
	Requested Analysis Filtered (Y/N)																	Y	Y	Y	Y	Y	Y	Y	Y			
1	Seep-1	WT		5/15/19	13:10	5/15/19	13:10												1	1	1	1	1	1	1			001
2	(B) Seep-1 Dup	WT		5/15/19	13:10	5/15/19	13:10												1	1	1	0	1	1	1			If possible do alk/Ac/Ferrous
3		WT																										
4																												
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	Robert Duncan	5/16/19	9:37	Jason Hurd	5-16	937	2.1	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Robert J. Duncan

SIGNATURE of SAMPLER: Robert J. Duncan DATE Signed: 5/16/2019

TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

Pace Analytical

SAMPLE CONDITION UPON RECEIPT FORM

Project #: 50225297

Date/Time and Initials of person examining contents: ZL 5/16/19 16:10

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☒ Client ☐ Commercial ☐ Pace ☐ Other _____

Tracking #: _____

Custody Seal on Cooler/Box Present: ☐ Yes ☒ No **Seals Intact:** ☐ Yes ☒ No

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other _____

Thermometer: 1 2 3 4 5 6 A B C D (E) F Ice Type: ☒ Wet ☐ Blue ☐ None | Samples collected today and on ice: ☐ Yes ☐ No ☒ N/A

Cooler Temperature: 2.1 / 2.1 Ice Visible in Sample Containers?: ☐ Yes ☒ No ☐ N/A

(Initial/Corrected) Temp should be above freezing to 6°C If temp. is Over 6°C or under 0°C, was the PM Notified?: ☐ Yes ☐ No ☒ N/A

All discrepancies will be written out in the comments section below.

	Yes	No		Yes	No	N/A
Are samples from West Virginia? Document any containers out of temp.		✓	All containers needing acid/base pres. Have been checked?: **exceptions: VOA, coliform, LLHg, O&G, and any container with a septum cap or preserved with HCl.** All containers needing preservation are found to be in compliance with EPA recommendation (<2, >9, >12) unless otherwise noted.	✓		
USDA Regulated Soils? (ID, NY, WA, OR,CA, NM, TX, OK, AR, LA, TN, AL, MS, NC, SC, GA, FL, or Puerto Rico)		✓				
Chain of Custody Present:	✓		Circle: (HNO3) H2SO4 NaOH NaOH/ZnAc			
Chain of Custody Filled Out:	✓		Dissolved Metals field filtered?:		✓	
Short Hold Time Analysis (<72hr)?: Analysis:		✓	Headspace Wisconsin Sulfide			✓
Time 5035A TC placed in Freezer or Short Holds To Lab:				Present	Absent	N/A
			Residual Chlorine Check (SVOC 625 Pest/PCB 608)			✓
			Residual Chlorine Check (Total/Amenable/Free Cyanide)			✓
Rush TAT Requested:		✓	Headspace in VOA Vials (>6mm):			✓
Containers Intact?:	✓		Trip Blank Present?:		✓	
Sample Label (IDs/Dates/Times) Match COC?: Except TCs, which only require sample ID	✓		Trip Blank Custody Seals?:		✓	

Comments:

Sample Container Count

WO# : 50225297

50225297

CLIENT: ATC

COC PAGE 1 of 1

COC ID# _____

Project # 50225297

Sample Line Item	DG9H	VG9H	AG0U	AG1H	AG1U	AG2U	AG3S	WGFU	SP5T	BP1U	BP2N	BP2S	BP2U	BP3B	BP3N	BP3S	BP3U	SBS Bulk Kit R	BP1N	Matrix S (Soil/Wa Aqueous	pH <2	pH >9	pH>12
1													2		2		1		2	WT	✓		
2													1								✓		
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Container Codes

Glass

DG9B	40mL Na Bisulfate amber vial	AG0U	100mL unpreserved amber glass
DG9H	40mL HCL amber voa vial	AG1H	1 liter HCL amber glass
DG9M	40mL MeOH clear vial	AG1S	1 liter H2SO4 amber glass
DG9P	40mL TSP amber vial	AG1T	1 liter Na Thiosulfate amber glass
DG9S	40mL H2SO4 amber vial	AG1U	1liter unpreserved amber glass
DG9T	40mL Na Thio amber vial	AG2N	500mL HNO3 amber glass
DG9U	40mL unpreserved **amber** vial	AG2S	500mL H2SO4 amber glass
VG9H	40mL HCL clear vial	AG2U	500mL unpreserved amber glass
VG9T	40mL Na Thio. clear vial	AG3S	250mL H2SO4 glass amber
VG9U	40mL unpreserved **clear** vial	AG3U	250mL unpreserved amber glass
VGFX	40mL w/hexane wipe vial	BG1H	1 liter HCL clear glass
VSG	Headspace septa vial & HCL	BG1S	1 liter H2SO4 clear glass
WGKU	8oz unpreserved clear jar	BG1T	1 liter Na Thiosulfate clear glass
WGFU	4oz clear soil jar	BG1U	1 liter unpreserved glass
JGFU	4oz unpreserved amber wide	BG3H	250mL HCl Clear Glass
		BG3U	250mL Unpreserved Clear Glass

Plastic / Misc.

BP1A	1 liter NaOH, Asc Acid plastic	BP3U	250mL unpreserved plastic
BP1N	1 liter HNO3 plastic	BP3Z	250mL NaOH, Zn Ac plastic
BP1S	1 liter H2SO4 plastic		
BP1U	1 liter unpreserved plastic	AF	Air Filter
BP1Z	1 liter NaOH, Zn, Ac	C	Air Cassettes
BP2A	500mL NaOH, Asc Acid plastic	R	Terra core kit
BP2N	500mL HNO3 plastic	SP5T	120mL Coliform Na Thiosulfate
BP2O	500mL NaOH plastic	U	Summa Can
BP2S	500mL H2SO4 plastic	ZPLC	Ziploc Bag
BP2U	500mL unpreserved plastic		
BP2Z	500mL NaOH, Zn Ac		
BP3B	250mL NaOH plastic		
BP3N	250mL HNO3 plastic		
BP3S	250mL H2SO4 plastic		