ALTERNATIVE SOURCE DEMONSTRATION REPORT STATE CCR RULE

Northeastern Power Station
Bottom Ash Pond
Oologah, Oklahoma

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

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engineers | scientists | innovators

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January 2021

CHA8495

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
EPRI	Electric Power Research Institute
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
OAC	Oklahoma Administrative Code
ODEQ	Oklahoma Department of Environmental Quality
OGS	Oklahoma Geological Survey
QA	Quality Assurance
QC	Quality Control
SPLP	Synthetic Precipitation Leaching Procedure
SSL	Statistically Significant Level
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
XRD	X-Ray Diffraction

SECTION 1

INTRODUCTION AND SUMMARY

The Bottom Ash Pond (BAP) is a regulated coal combustion residual (CCR) management unit at the Northeastern Power Station in Oogolah, Oklahoma. An annual screening event and a semiannual assessment monitoring event were conducted at the BAP on March 30, 2020 and June 30, 2020 in accordance with OAC 252:517-9-6(b) and OAC: 252:517-9-6(d)(1), respectively.

The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were re-established for each Appendix B parameter in accordance with United States Environmental Protection Agency's (USEPA's) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). Confidence intervals were calculated for Appendix B parameters at the BAP compliance wells to assess whether Appendix B parameters were present at a statistically significant level (SSL) above the GWPS. An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). SSLs were identified for lithium and fluoride at SP-10 (Geosyntec, 2020). The LCL for lithium at SP-10 of 0.252 milligrams per liter (mg/L) exceeded the GWPS of 0.15 mg/L. The LCL for fluoride at SP-10 of 4.60 mg/L exceeded the GWPS of 4.40 mg/L.

1.1 CCR Rule Requirements

Oklahoma Department of Environmental Quality (ODEQ) regulations regarding assessment monitoring of CCR landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration (ASD) when an SSL is identified (OAC 252:517-9-6(g)(3)(B)). An owner or operator may:

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

Pursuant to OAC 252:517-9-6(g)(3)(B), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report to document that the SSLs identified for lithium and fluoride should not be attributed to the BAP.

1.2 Demonstration of Alternative Sources

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

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

A demonstration was conducted to show that the SSLs identified for lithium and fluoride at SP-10 were based on Type IV causes and not by a release from the BAP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

In accordance with OAC 252:517-9-6(g)(3)(B), the owner of operator of a CCR unit has 90 days from finding that any of the constituents listed in Appendix B have been detected at an SSL exceeding the GWPS to demonstrate that a source other than the CCR unit caused the SSL. The methodology used to evaluate the SSLs identified for lithium and fluoride and the proposed alternative sources are described below.

2.1 Site Setting

2.1.1 Regional Geology

The generalized stratigraphic column of the regional geology in the Site vicinity is summarized below:

Series	Group	Formation
Desmoinesian	Marmaton	Oolagah
		Labette
		Fort Scott Limestone
	Cherokee	Senora
		Boggy
		Savanna

The Site is underlain by the Oologah Formation. The Oologah Formation is characterized as a dark gray argillaceous limestone with a small amount of fissile shale (Oakes et al., 1952). The limestone is typically dense to moderately crystalline, unjointed, and thinly to massively bedded. The Oologah Formation is approximately 80 to 100 feet thick and is subdivided into three members, the Altamont Limestone, the Bandera Shale, and the Pawnee Limestone (in descending order) as described below:

- *Altamont Limestone*. Grayish orange pink to medium gray limestone, mudstone, wackestones and locally packstones. The texture varies from thin and somewhat wavy to medium planar and is influenced by the presence of fossil algal material. The bedding of the upper portion of the member is typically thinner than the lower portion (Oklahoma Geological Survey [OGS], 2005). The thickness of the Altamont Limestone typically ranges from approximately 65 to 100 feet.
- *Bandera Shale*. Medium dark gray to dark gray, well-laminated to fissile shale. The nearest published thickness of this member is approximately 2-feet about 13 miles south of the Site (OGS, 2005; Woodruff and Cooper, 1928).
- *Pawnee Limestone*. Medium gray, slightly wavy, thin to medium bedded limestone. The bedding is typically 2 to 4-inches thick but can reach 12 inches in thickness. The Pawnee

Limestone contains abundant fossil debris and varies in thickness from approximately 19 to 22 feet (OGS, 2005).

The Ologah Formation is underlain by the Labette Formation, a grayish-brown to dark gray, laminated clayshale. The clayshale contains some zones of weakly calcareous shale, and multiple horizons of sandy shale to sandstone. The thickness of the Labette Formation typically ranges from approximately 120 to 180 feet. A zone of alternating shale and sandstone (Peru Sandstone) or shale and limestone (Sageeyah Limestone) may be present near the top of the Labette Formation. This member (if present) does not typically contain fossils and varies in thickness up to 20 feet south of the Site (OGS, 2005).

The Labette Formation is underlain by the Fort Scott Formation which consists of three members, in descending order: the Higginsville Limestone; the Little Osage Shale; and the Blackjack Creek Limestone. The Fort Scott Formation limestone consists primarily of a light gray, thin to medium, wavy-bedded fossiliferous wackestone and mudstone (OGS, 2004).

2.1.2 Site Geology

Two soil borings (BAP-B1 and BAP-B2) were advanced in the vicinity of the BAP by Geosyntec staff in early 2019 to clarify the Site geology. The locations of these borings are shown on **Figure 1**. The deeper of those boring (BAP-B1) was advanced to 186 ft below ground surface (bgs). Detailed discussion of these borings, supplemented by boring logs and photologs, was provided in the 2019 ASD completed for lithium at SP-10 (Geosyntec, 2019). The borings and associated mineralogical analyses of rock samples indicated that limestone is present at depths to at least 72 ft bgs. This limestone unit is underlain by a shale unit. The following is a general summary of the geologic units encountered at BAP-B1:

Geologic Unit	Depth (ft bgs)	Elevation (ft amsl)[1]
Unconsolidated Soil	0 to 3	625.8 to 622.8
Limestone (Ologah Formation)	3 to 100	622.8 to 525.8
Shale (Labette Formation)	100 to 181	525.8 to 444.8
Limestone (Fort Scott Formation)	181 to 186	444.8 to 439.8

Note: 1. ft amsl = feet above mean sea level

The wells within the CCR compliance network (SP-1, SP-2, SP-4, SP-5R, SP-10, and SP-11) monitor the upper limestone unit (Ologah Limestone), which was determined to contain the shallow aquifer at the site. Monitoring well SP-10 is screened from 40.25-50.75 ft bgs. Based on the BAP-B1 boring log and logs for other borings near the BAP, the screened interval may be inclusive of the Altamont limestone member (upper portion of the Ologah Formation) and the

Pawnee member (lower portion of the Oologah Formation). At several boring locations, thin horizons of shale (1-2 inches thick) were identified from elevations of approximately 25 to 75 ft bgs. A 2-inch thick shale horizon was found to occur around 46 ft bgs in multiple boring logs. This shale horizon may be the Bandera Shale.

Boring BAP-B2 was advanced in the vicinity of SP-10, the monitoring well containing SSLs for lithium and fluoride, and SP-9, its paired deeper well. A thin (approximately 2-inch) shale horizon was observed at 46 ft bgs, which is within the screened interval of SP-10. This horizon is underlain by interbedded shale and limestone. As described in the 2019 ASD (Geosyntec, 2019), samples were collected from four intervals at boring BAP-B2 for laboratory analysis, as summarized below:

Sample Depth (ft bgs)	Sample ID	Description
32.0-32.4	SP-10-LOG-1	Upper limestone
46.0-47.0	SP-10-LOG-2	Shale lens within the screened interval of SP-10
46.0-47.0	SP-10-LOG-3	Limestone within screened interval of SP-10
72.0-72.4	SP-10-LOG-4	Limestone within the screened interval of SP-9

X-ray diffraction (XRD) analysis of samples confirmed that limestone is present at depths to at least 72 ft bgs. The analyses also confirmed the horizon observed at 46 ft bgs is a shale lens comprised of primarily 2:1 high activity clay minerals illite and smectite. The mineralogy results of these samples are provided in **Table 1**.

2.2 Lithium

An ASD was previously generated for lithium which identified the shale lenses present within the screened interval at SP-10 as the likely alternative source (Geosyntec, 2019). A supplemental September 2019 memorandum from AEP to ODEQ (AEP, 2019) provided results documenting lower concentrations of lithium in the BAP sediment and BAP pore water than those observed at SP-10. The sediment leached 0.001 mg/L of lithium, and the pore water was found to contain 0.003 mg/L of lithium (AEP, 2019). These concentrations are two orders of magnitude below the lithium LCL at SP-10 (0.252 mg/L) and the lithium GWPS (0.15 mg/L).

As discussed in the 2019 memorandum, a review of the major ion chemistry of the BAP in contrast to SP-10 groundwater chemistry illustrates very different chemical compositions of these two sample types (**Figure 2**). SP-10 groundwater samples plot in a tight cluster on a Piper diagram, displaying a predominantly sodium/potassium-chloride composition which is clearly distinct from BAP samples, which have more cation variation and very little chloride. If a release from the BAP had occurred, the major ion chemistry of SP-10 groundwater would be expected to deviate from a sodium/potassium-chloride type and approach the more calcium-bicarbonate/sulfate dominant BAP samples on the Piper diagram. In contrast, the most recent SP-10 sample (March 2020) plots furthest away from the BAP samples (greater chloride component), showing no indication of BAP influences at SP-10.

Further, statistical analysis of lithium concentrations at SP-10 over time did not demonstrate a statistically significant positive trend (**Figure 3**). Lithium concentrations appear to have stabilized since the comparatively higher concentrations observed in 2017. The three most recent samples have contained the lowest levels of lithium observed at SP-10 since routine sampling began in 2017. These results suggest that the lines of evidence provided in the 2019 ASD are still valid, concluding that the BAP is not the source of lithium at SP-10.

2.3 Fluoride

Solid and liquid phase samples collected from the BAP in July 2019 and included in the 2019 memorandum (AEP, 2019) indicate that fluoride concentrations within the BAP are less than groundwater concentration at SP-10 as well as the fluoride GWPS. Fluoride in pore water was not detected above the method detection limit (0.083 mg/L). Furthermore, extractable fluoride from the BAP sediments was measured at 0.458 mg/L via SPLP extraction. A surface water sample collected from the BAP in January 2019 had a reported fluoride concentration of 0.34 mg/L. The analytical laboratory reports for these samples are provided in **Attachment A**.

These concentrations of fluoride are an order of magnitude below the fluoride LCL at SP-10 (4.60 mg/L) and the GWPS (4.40 mg/L). Since January 2019 (the date of the BAP sampling) there have been no notable changes in coal handling or sourcing at the plant that would have affected the composition of the ash or pond water in the BAP. Therefore, the BAP is not the source of fluoride at SP-10.

As discussed in Section 2.3, **Figure 2** illustrates the distinct geochemical compositions of SP-10 groundwater and the BAP. These results do not support a mixing scenario between the BAP and SP-10 to account for SP-10 groundwater compositions. Statistical analysis of fluoride concentrations at SP-10 over time did not demonstrate a statistically significant positive trend (**Figure 4**), with variable concentrations over time since routine groundwater sampling began in 2017.

Geologic samples collected from a shale lens and limestone section of the BAP-B2 rock core were submitted to TestAmerica, Inc. for analysis of total fluoride. The rock core samples were mechanically crushed and extracted with deionized water. The concentration of fluoride in the contact water (as determined by USEPA Method 9056A) was converted back to a solid phase concentration. Using this method, extractable fluoride was identified within the rock cores at a concentration of 1.6 milligrams per kilogram (mg/Kg) in the limestone sample and 4.3 mg/Kg in the shale sample. These results suggest that fluoride at the Site is associated with the shale lenses, which were previously noted within the screened interval at SP-10 (Geosyntec, 2019).

According to XRD mineralogy results (**Table 1**), shale lenses within the shallow limestone aquifer near SP-10 are predominantly composed of clay minerals such as kaolinite (2 wt.%), chlorite (3 wt. %), illite (38 wt.%), and mixed layer illite-smectite (24 wt.%). Multiple laboratory studies have demonstrated that kaolinite and smectite are able to sorb fluoride, with the maximum sorption capacity controlled primarily by pH (Kau et al., 1997; Agarwal et al., 2002). Sorption capacity in

kaolinite and smectite is greatest under mildly acidic conditions (pH 4-6) and decreases with increasing pH above 7 SU (Agarwal et al., 2002). SP-10 groundwater had an average pH of 8.6 SU during the recent sampling events, suggesting that desorption from these clay minerals provides an alternative source for fluoride at SP-10.

2.4 Proposed Alternative Sources

Low concentrations of lithium and fluoride in the BAP and BAP sediments, including pore water, suggest that the BAP is not the source of these exceedances. As described in a previous ASD (Geosyntec, 2019), the release of lithium from the clay minerals in the shale lens located at 46 ft bgs within the screened interval of SP-10 is the likely source of lithium in groundwater at that location. Analytical results suggest that naturally occurring fluoride is also associated with the shale lenses and is contributing to aqueous fluoride at SP-10.

2.5 Sampling Requirements

As the ASD described above supports the position that the identified SSLs are not due to a release from the BAP, the unit will remain in the assessment monitoring program. Groundwater sampling at the unit will continue in accordance with OAC 252:517-9-6 on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with OAC 252:517-9-6(g)(3)(B) and supports the position that the SSLs of lithium and fluoride at SP-10 identified during the first semi-annual assessment monitoring event of 2020 were not due to a release from the BAP. The identified SSLs were, instead, attributed to natural variation in the underlying lithology, including the presence of shale lenses containing lithium and fluoride within the screened interval at SP-10. Therefore, no further action is warranted, and the BAP will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment B**.

SECTION 4

REFERENCES

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Oklahoma Geological Survey (OGS), 2004. *Geologic Map of the Sageeyah 7.5' Quadrangle*, *Rodgers County, Oklahoma*.

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

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TABLES

Table 1: X-Ray Diffraction Laboratory Analysis Results
Northeastern Plant Bottom Ash Pond

Geosyntec Consultants

Sample ID	SP-10-LOG 1	SP-10-LOG 2	SP-10-LOG 4	SP-10-LOG 4
Depth (ft bgs)	32-32.4	46	46	72-72.4
Description	Upper Limestone	Shale within screened interval of SP-10	Limestone within screened interval of SP-10	Limestone within screened interval of SP-9
Quartz	1	20	3	6
Albite	ND	4	ND	ND
Microcline	ND	1	ND	ND
Calcite	95	2	93	91
Ferroan Dolomite	4	ND	ND	2
Siderite	ND	1	ND	ND
Pyrite	ND	5	1	ND
Kaolinite	ND	2	1	<0.5
Chlorite	ND	3	<0.5	ND
Illite/Mica	ND	38	1	1
Mixed-Layered Illite/Smectite	ND	24	1	<0.5
% Illite Layers in ML I/S	*N/A*	*75*	*75*	*BDL*

Notes:
Results are shown as percentage of the bulk material.
ND - not detected
N/A: not applicable
BDL: below detection limit

FIGURES

Legend

- Out of Network Wells
- In Network Wells
- Soil Borings
- Bottom Ash Pond
- Impoundment

Notes
- Aerial imagery obtained from ESRI

500 250 0 500 Feet

Soil Boring and Monitoring Well Locations Map

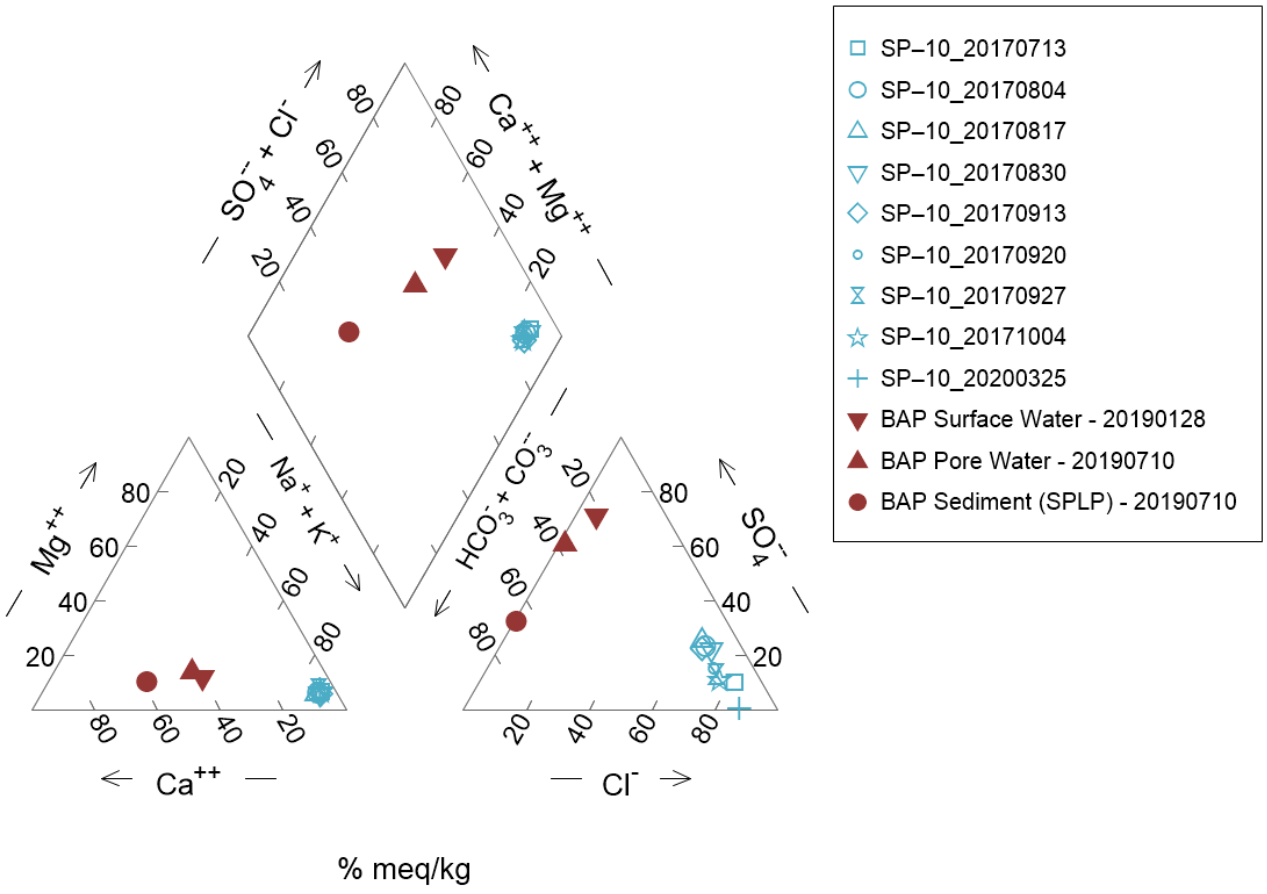
AEP Northeastern Power Plant - Bottom Ash Pond
Oologah, Oklahoma

Geosyntec consultants

Columbus, Ohio | January 25, 2021

Figure 1

P:\Projects\AEP\Legal Department - ASD Review\Northeastern\BAP\2020-11 F ASD Investigation\Figures_Tables\AEP-Northeastern_BAP_Soil Boring Locations.mxd. HDuff. 1/25/2021. Project/Phase/Task.



Notes: SPLP – Synthetic Precipitation Leaching Procedure.

Piper Diagram – SP-10 and BAP Samples
Northeastern Bottom Ash Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure **2**

Columbus, Ohio | January 19, 2021

internal info: path, date revised, author

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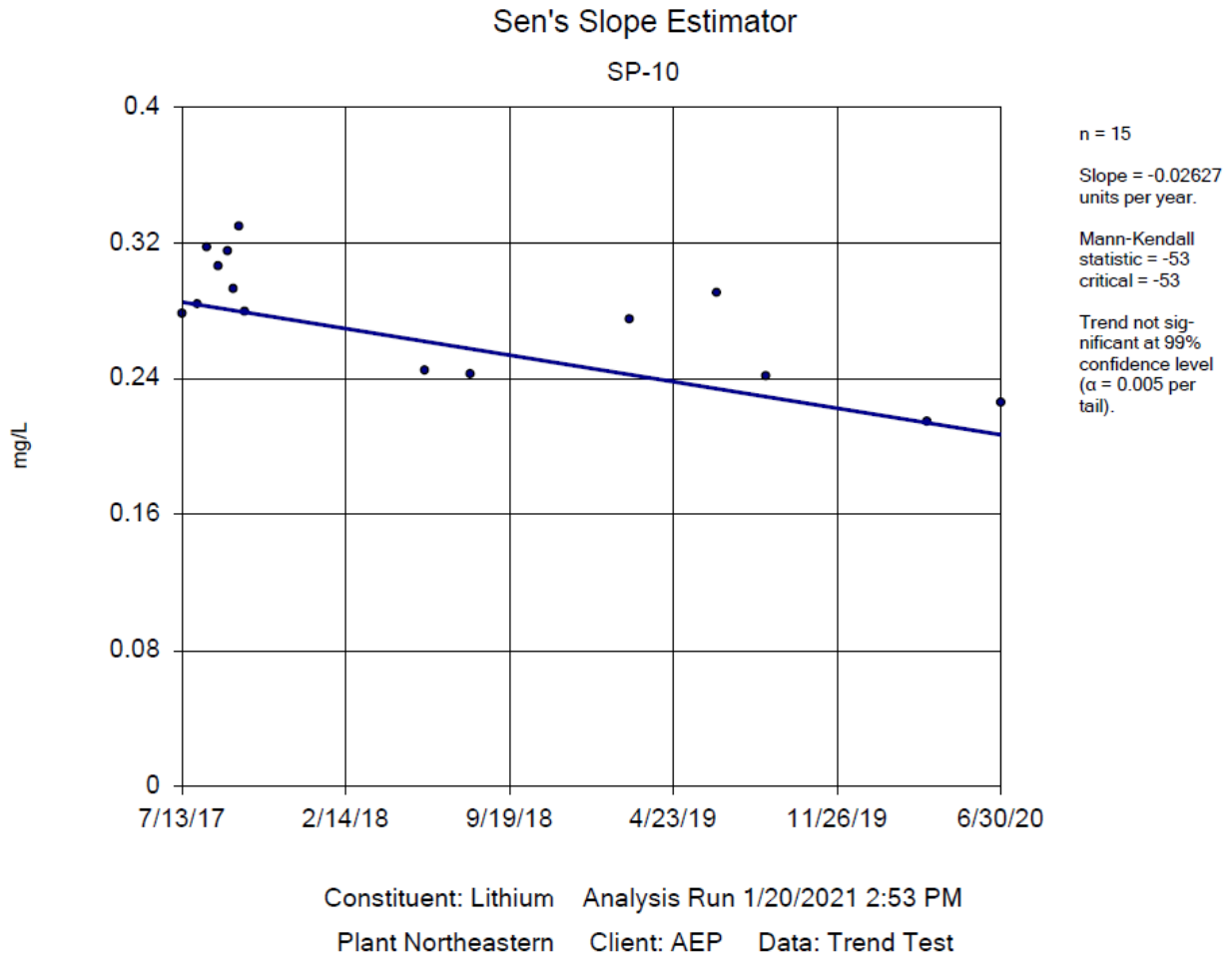

Lithium Trend Test – SP-10
Northeastern Bottom Ash Pond

Geosyntec consultants	AMERICAN ELECTRIC POWER	Figure 3
Columbus, Ohio	January 20, 2021	

internal info: path, date revised, author

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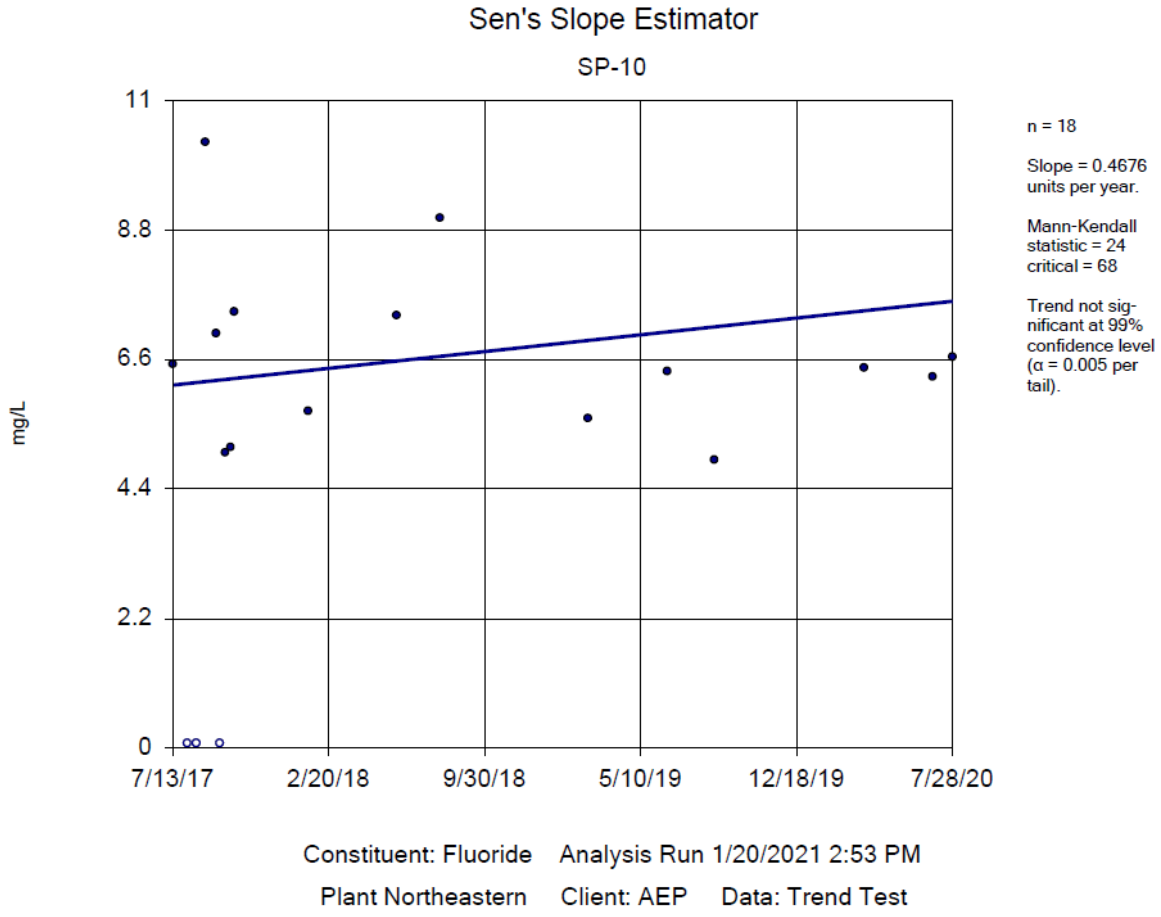
Hollow symbols indicate censored values.



Fluoride Trend Test – SP-10
Northeastern Bottom Ash Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 4

Columbus, Ohio | January 20, 2021

internal info: path, date revised, author

ATTACHMENT A
Analytical Laboratory Reports

502 North Allen Ave.
Shreveport, LA 71101
Phone: (318) 673-3802
Fax: (318) 673-3960

AEP ANALYTICAL CHEMISTRY SERVICES
Analysis Report

Report ID : 40115
Date Received: 07/12/2019

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 226939
Cust Sample ID: Sediment
Sample Desc.: BAP Sediment SPLP

Collected Date: 07/10/2019
Location: NE BAP Sediment Sample

By: BW
Matrix: Liquid

SPLP (226939)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Aluminum	0.777	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Antimony	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Barium	0.352	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Boron	0.389	mg/L	0.01	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Calcium	24.3	mg/L	0.01	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Copper	0.004	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Iron	0.1	mg/L	0.01	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Lithium	0.001	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Magnesium	2.44	mg/L	0.01	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Manganese	0.01	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Molybdenum	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Nickel	< 0.025	mg/L	0.025	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Potassium	0.703	mg/L	0.01	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Silver	< 0.001	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Sodium	14.9	mg/L	0.01	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Strontium	0.327	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Thallium	< 0.005	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Tin	0.011	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Titanium	0.012	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB

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Report ID : 40115
Date Received: 07/12/2019

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Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

Vanadium	0.023	mg/L	0.001	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB
Zinc	0.067	mg/L	0.005	1	EPA 1312/6010B 1996	07/25/2019 21:45		JDB

Water (226939)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
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Alkalinity, Carbonate	< 5	mg/L	5	1	SM 2320 B-2011	08/06/2019 15:30	H1	JTD
Alkalinity, Total	101.24	mg/L	5	1	SM 2320 B-2011	08/06/2019 15:30	H1	JTD
Chloride	0.839	mg/L	0.219	1	EPA 300.0	08/04/2019 5:20		GB
Fluoride	0.458	mg/L	0.083	1	EPA 300.0	08/04/2019 5:20		GB
Sulfate	38	mg/L	0.140	1	EPA 300.0	08/04/2019 5:20		GB

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Analysis Report

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Date Received: 07/12/2019

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 226940
Cust Sample ID: Liquid portion
Sample Desc.: BAP Sediment

Collected Date: 07/10/2019
Location: NE BAP Sediment Sample

By: BW
Matrix: Liquid

Metals (226940)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Aluminum	0.076	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Barium	0.083	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Boron	0.754	mg/L	0.01	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Calcium	85.7	mg/L	0.01	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Copper	0.004	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Iron	< 0.01	mg/L	0.01	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Lithium	0.003	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Magnesium	17.4	mg/L	0.01	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Manganese	0.032	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Molybdenum	0.027	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Nickel	< 0.025	mg/L	0.025	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Potassium	6.94	mg/L	0.01	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Selenium	0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Silver	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Sodium	99.9	mg/L	0.01	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Strontium	1.22	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Thallium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Tin	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Titanium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB

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Fax: (318) 673-3960

AEP ANALYTICAL CHEMISTRY SERVICES
Analysis Report

Report ID : 40115
Date Received: 07/12/2019

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

Vanadium	0.006	mg/L	0.001	1	EPA 6010B 1996	07/25/2019 21:37		JDB
Zinc	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/25/2019 21:37		JDB

Water (226940)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Alkalinity, Bicarbonate	399.2	mg/L	5	1	SM 2320 B-2011	08/06/2019 15:30	H1	JTD
Alkalinity, Carbonate	< 5	mg/L	5	1	SM 2320 B-2011	08/06/2019 15:30	H1	JTD
Alkalinity, Total	399.2	mg/L	5	1	SM 2320 B-2011	08/06/2019 15:30	H1	JTD
Chloride	14	mg/L	0.219	1	EPA 300.0	08/04/2019 5:58		GB
Fluoride	< 0.083	mg/L	0.083	1	EPA 300.0	08/04/2019 5:58		GB
Sulfate	514	mg/L	0.140	1:10	EPA 300.0	08/04/2019 6:16		GB

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Quality Control Data

* Quality control units are the same as reported analytical results

Date	Parameter	Sample ID	Blank Value *	Standard			Spike			Surrogate % Recovery	Duplicate % Difference	Tech
				Value *	Recovery*	%	Value *	Recovery*	%			
8/6/2019	Alkalinity, Total			50	50.84	101.7						JTD
8/6/2019	Alkalinity, Total	227498	<5	50	52.62	105.2	50	47.14	94.3		2.5	JTD
7/25/2019	Aluminum	227041.1	<0.005	2	2.0229733	101.1	2	2.2242	111.2		0.0	JDB
7/25/2019	Aluminum	226939.1	<0.005	2	2.0229733	101.1	2	2.071639	103.6		0.4	JDB
7/25/2019	Antimony	227041.1	<0.005	0.8	0.8092462	101.2	0.8	0.7671843	95.9		0.5	JDB
7/25/2019	Antimony	226939.1	<0.005	0.8	0.8092462	101.2	0.8	0.8159776	102.0		0.2	JDB
7/25/2019	Arsenic	227041.1	<0.005	0.8	0.8086795	101.1	0.8	0.7758421	97.0		0.0	JDB
7/25/2019	Arsenic	226939.1	<0.005	0.8	0.8086795	101.1	0.8	0.8086275	101.1		0.1	JDB
7/25/2019	Barium	226939.1	<0.001	0.2	0.2080557	104.0	0.2	0.209543	104.8		0.1	JDB
7/25/2019	Barium	227041.1	<0.05	0.2	0.2080557	104.0	0.2	0.1829767	91.5		0.4	JDB
7/25/2019	Beryllium	226939.1	<0.001	0.2	0.2122779	106.1	0.2	0.2142832	107.1		0.3	JDB
7/25/2019	Beryllium	227041.1	<0.001	0.2	0.2122779	106.1	0.2	0.1992329	99.6		0.4	JDB
7/25/2019	Boron	226939.1	<0.01	0.3	0.2995651	99.9	0.3	0.2984183	99.5		0.7	JDB
7/25/2019	Boron	227041.1	<0.5	0.3	0.2995651	99.9	0.3	0.2855333	95.2		0.5	JDB
7/25/2019	Cadmium	227041.1	<0.001	0.2	0.2069934	103.5	0.2	0.1836838	91.8		0.6	JDB
7/25/2019	Cadmium	226939.1	<0.001	0.2	0.2069934	103.5	0.2	0.2061243	103.1		0.5	JDB
7/25/2019	Calcium	226939.1	<0.01	1	1.0087505	100.9	1	1.0243667	102.4		0.9	JDB
7/25/2019	Chromium	226939.1	<0.001	0.4	0.4116387	102.9	0.4	0.4125529	103.1		0.4	JDB
7/25/2019	Chromium	227041.1	<0.001	0.4	0.4116387	102.9	0.4	0.3867339	96.7		0.3	JDB
7/25/2019	Cobalt	226939.1	<0.005	0.2	0.2043482	102.2	0.2	0.2054714	102.7		0.4	JDB
7/25/2019	Cobalt	227041.1	<0.005	0.2	0.2043482	102.2	0.2	0.1839347	92.0		0.4	JDB
7/25/2019	Copper	227041.1	<0.001	0.3	0.3066399	102.2	0.3	0.2963301	98.8		0.1	JDB
7/25/2019	Copper	226939.1	<0.001	0.3	0.3066399	102.2	0.3	0.3109092	103.6		0.1	JDB
7/25/2019	Iron	227041.1	<0.5	3	3.1158893	103.9	150	159.28837	106.2		0.8	JDB
7/25/2019	Iron	226939.1	<0.01	3	3.1158893	103.9	3	3.1231158	104.1		1.0	JDB
7/25/2019	Lead	226939.1	<0.005	1	1.0430644	104.3	1	1.0416574	104.2		0.4	JDB
7/25/2019	Lead	227041.1	<0.005	1	1.0430644	104.3	1	0.9320653	93.2		0.6	JDB
7/25/2019	Lithium	227041.1	<0.001	0.2	0.2119096	106.0	0.2	0.2353987	117.7		0.1	JDB
7/25/2019	Lithium	226939.1	<0.001	0.2	0.2119096	106.0	0.2	0.2163799	108.2		0.4	JDB
7/25/2019	Magnesium	226939.1	<0.01	2	2.0868175	104.3	2	2.0877567	104.4		0.2	JDB
7/25/2019	Magnesium	227041.1	<0.5	2	2.0868175	104.3	2	1.9791333	99.0		0.6	JDB
7/25/2019	Manganese	227041.1	<0.001	0.2	0.2072869	103.6	0.2	0.16684	83.4		0.7	JDB

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Analysis Report

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Date Received: 07/12/2019

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7/25/2019	Manganese	226939.1	<0.001	0.2	0.2072869	103.6	0.2	0.2077536	103.9		0.2	JDB
7/25/2019	Molybdenum	226939.1	<0.005	0.2	0.2067657	103.4	0.2	0.2076129	103.8		0.4	JDB
7/25/2019	Molybdenum	227041.1	<0.005	0.2	0.2067657	103.4	0.2	0.197727	98.9		0.5	JDB
7/25/2019	Nickel	227041.1	<0.025	0.5	0.5192594	103.9	0.5	0.46183	92.4		0.6	JDB
7/25/2019	Nickel	226939.1	<0.025	0.5	0.5192594	103.9	0.5	0.5209379	104.2		0.6	JDB
7/25/2019	Potassium	226939.1	<0.01	10	9.3692109	93.7	10	9.4631223	94.6		0.2	JDB
7/25/2019	Potassium	227041.1	<0.01	10	9.3692109	93.7	10	11.11754	111.2		0.3	JDB
7/25/2019	Selenium	227041.1	<0.005	2	1.9998495	100.0	2	1.991203	99.6		0.7	JDB
7/25/2019	Selenium	226939.1	<0.005	2	1.9998495	100.0	2	1.9816300	99.1		0.8	JDB
7/25/2019	Silver	227041.1	<0.001	0.075	0.0712930	95.1	0.075	0.0708639	94.5		0.2	JDB
7/25/2019	Silver	226939.1	<0.001	0.075	0.0712930	95.1	0.075	0.0714285	95.2		0.1	JDB
7/25/2019	Sodium	226939.1	<0.01	3	3.1384831	104.6	3	2.4693667	82.3		0.1	JDB
7/25/2019	Sodium	227041.1	<0.5	3	3.1384831	104.6	3	2.3746333	79.2		0.0	JDB
7/25/2019	Strontium	226939.1	<0.001	0.2	0.2059899	103.0	0.2	0.2081687	104.1		0.4	JDB
7/25/2019	Thallium	226939.1	<0.005	0.4	0.4152040	103.8	0.4	0.4171124	104.3		0.0	JDB
7/25/2019	Thallium	227041.1	<0.005	0.4	0.4152040	103.8	0.4	0.3682771	92.1		1.2	JDB
7/25/2019	Tin	226939.1	<0.005	0.7	0.6995446	99.9	0.7	0.6930628	99.0		0.2	JDB
7/25/2019	Tin	227041.1	<0.005	0.7	0.6995446	99.9	0.7	0.644164	92.0		0.2	JDB
7/25/2019	Titanium	227041.1	<0.005	0.2	0.2109341	105.5	0.2	0.2098874	104.9		0.2	JDB
7/25/2019	Titanium	226939.1	<0.005	0.2	0.2109341	105.5	0.2	0.2124567	106.2		0.1	JDB
7/25/2019	Vanadium	226939.1	<0.001	0.3	0.3076519	102.6	0.3	0.3104754	103.5		0.4	JDB
7/25/2019	Vanadium	227041.1	<0.001	0.3	0.3076519	102.6	0.3	0.2997157	99.9		0.6	JDB
7/25/2019	Zinc	226939.1	<0.005	0.2	0.2091679	104.6	0.2	0.2081374	104.1		0.3	JDB
7/25/2019	Zinc	227041.1	<0.005	0.2	0.2091679	104.6	0.2	0.1851907	92.6		0.1	JDB

On 7/30/2019, Jill asked for us to add Chloride, Fluoride, and Sulfate.

Code	***Code Description***
H1	Sample analysis performed past holding time

Jonathan Barnhill
Quality Assurance Officer

08-Aug-19
Report Date

JOB 7-15-19

Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Shreveport Chemical Laboratory (SCL)
502 N. Allen Ave.
Shreveport , LA 71101
Contacts: Jonathan Barnhill (318-673-3803)

Project Name: NE BAP Sediment sample
Contact Name: Bryan White
Contact Phone: 8-719-0873
Sampler(s): BRYAN WHITE

Analysis Turnaround Time (in Calendar Days) - **RUSH**

Site Contact:

Date:

For Lab Use Only:
COC/Order #: 4/0115

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Sampler(s) Initials	Li							Sample Specific Notes:
BAP Sediment	7-10-19	1600	grab	solid/water	1L		X							SPLP on the sediment particles, also run Li analysis of pore water
	JOB 7-15-19													

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____; F= filter in field

Special Instructions/QC Requirements & Comments: **Submit results to Jill Parker-Witt**

Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
William Matthew Stephens	AEP-PSO	7/11/19 10:05		
Relinquished by:	Company:	Date/Time:	Received by:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Date/Time:
				7/12/19 14:34

SHREVEPORT CHEMICAL LABORATORY

502 N. Allen Ave.
Shreveport, LA 71101
Phone 318-673-3802
FAX 318-673-3960

PROJECT R

Container Type					Delivery Type				
Ice Chest	Bag	Action Pak	PCB Mailer	Bottle	UPS	FEDEX	US Mail	Walk in	Shuttle
(Other) Box					Other				
					Tracking #				

Client: Bryan White
Received By: JTD
Received Date: 7/12/19
Open Date:

Sample Matrix: DGA | PCB Oil | Water | Oil | Soil
Solid | (Liquid) | Other

Container Temp Read: 28 (Thermometer Serial #F04103)
Correction Factor: +1.2
Corrected Temp: 29.2

Project I.D.

Were samples received on ice? YES NO

Did container arrive in good condition? (YES) NO

Was sample documentation received? (YES) NO

Was documentation filled out properly? (YES) JTD 7/12/19 NO Date and time for collection not filled

Were samples labeled properly? (YES) NO

Were correct containers used? (YES) NO

Were the pH's of samples appropriately checked? YES (NO) N/A

Total number of sample containers: 1

Was any corrective action taken? NO

Person Contacted: Jill Parker W.T.F
Date & Time: 7-12-19 1520

Comments: Informed Jill that No Date and time was entered for collection she said she would contact the sampler and get that information. JDB 7-12-19

Form REP-703
Rev. 1, 11/2013

Dolan Chemical Laboratory
4001 Bixby Road
Groveport, OH 43125
T: 614-836-4221, Audinet 210-4221
F: 614-836-4168, Audinet 210-4168
http://aepenv/labs

Water Analysis

Location: Northeastern Station ***Report Date: 2/6/2019***

Bottom Ash Pond

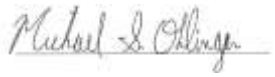
Sample was not collected in the correct container for Hg

Sample Number: 190311-001 **Date Collected: 01/28/2019 11:03** **Date Received: 1/29/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Antimony, Sb	0.51	ug/L		0.2	0.04	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Arsenic, As	2.34	ug/L		0.2	0.06	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Barium, Ba	203	ug/L		0.2	0.04	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Beryllium, Be	< 0.04	ug/L	U	0.2	0.04	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Cadmium, Cd	0.02	ug/L	J	0.1	0.02	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Chromium, Cr	3.40	ug/L		0.4	0.08	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Cobalt, Co	0.176	ug/L		0.1	0.04	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Lead, Pb	0.329	ug/L		0.2	0.04	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Mercury, Hg	0.004	ug/L	J	0.005	0.002	JAB	01/31/2019	EPA 245.7-2005, Rev. 2.0
Molybdenum, Mo	20.1	ug/L		4	0.8	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Selenium, Se	4.5	ug/L		0.4	0.06	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Thallium, Tl	< 0.2	ug/L	U	1	0.2	GES	02/04/2019 13:52	EPA 200.8-1994, Rev. 5.4
Boron, B	0.709	mg/L		0.1	0.02	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Calcium, Ca	78.5	mg/L		0.3	0.04	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Lithium, Li	< 0.009	mg/L	U	0.03	0.009	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	13.6	mg/L		0.05	0.01	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Potassium, K	5.66	mg/L		0.5	0.2	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Sodium, Na	106	mg/L		0.2	0.06	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Strontium, Sr	0.981	mg/L		0.005	0.0008	DAM	02/04/2019 15:54	EPA 200.7-1994, Rev. 4.4
Alkalinity, as CaCO3	137	mg/L		10	3	GES	01/30/2019	SM 2320B-2011
Bromide, Br	0.328	mg/L		0.2	0.04	CRJ	01/31/2019 14:10	EPA 300.1-1997, Rev. 1.0
Surrogate recovery high due to chlorate being in the as-rec'd sample.								
Chloride, Cl	25.2	mg/L		0.04	0.01	CRJ	01/31/2019 14:10	EPA 300.1-1997, Rev. 1.0
Surrogate recovery high due to chlorate being in the as-rec'd sample.								
Fluoride, F	0.34	mg/L		0.06	0.01	CRJ	01/31/2019 14:10	EPA 300.1-1997, Rev. 1.0
Surrogate recovery high due to chlorate being in the as-rec'd sample.								
Residue, Filterable, TDS	704	mg/L		40	10	KAL	02/01/2019	SM 2540C-2011
Sulfate, SO4	341	mg/L		2	0.3	CRJ	02/01/2019 03:35	EPA 300.1-1997, Rev. 1.0
Hydrogen Ion (pH)	7.57	s.u.		0.1	0.02	GES	01/30/2019	SM 4500-H B-2011
pH was analyzed beyond the 15 minute hold period.								

Sample was not collected in the correct container for Hg

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit
J: Analyte was positively identified, though the quantitation was below Reporting Limit.



Michael Ohlinger, Chemist

Email msohlinger@aep.com *Tel.*

Fax 614-836-4168 *Audinet 8-210-*

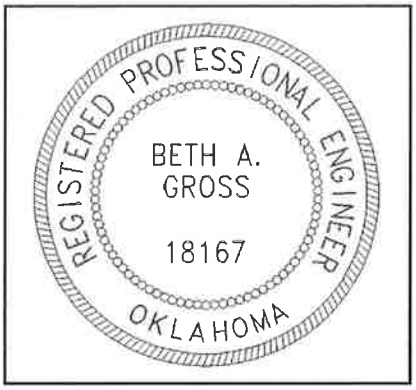
ATTACHMENT B
Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Bottom Ash Pond CCR management area at the Northeastern Power Station and that the requirements of OAC 252:517-9-6(g)(3)(B) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature



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

Oklahoma Firm Certificate of
Authorization No. 1996
Exp. 6/30/2022

18167	Oklahoma	Jan 26, 2021
License Number	Licensing State	Date