

**ALTERNATIVE SOURCE
DEMONSTRATION REPORT
FEDERAL CCR RULE**

**H.W. Pirkey Power Plant
West Bottom Ash Pond
Hallsville, Texas**

Submitted to



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May 2021

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LIST OF ACRONYMS

| | |
|-------|---|
| AEP | American Electric Power |
| ASD | Alternative Source Demonstration |
| CCR | Coal Combustion Residuals |
| CFR | Code of Federal Regulations |
| EBAP | East Bottom Ash Pond |
| EDS | Energy Dispersive Spectroscopy |
| EPRI | Electric Power Research Institute |
| GSC | Groundwater Stats Consulting, LLC |
| GWPS | Groundwater Protection Standard |
| LCL | Lower Confidence Limit |
| MCL | Maximum Contaminant Level |
| QA | Quality Assurance |
| QC | Quality Control |
| SEM | Scanning Electron Microscopy |
| SPLP | Synthetic Precipitation Leaching Procedure |
| SSL | Statistically Significant Level |
| TCEQ | Texas Commission on Environmental Quality |
| UTL | Upper Tolerance Limit |
| USEPA | United States Environmental Protection Agency |
| VAP | Vertical Aquifer Profiling |
| WBAP | West Bottom Ash Pond |
| XRD | X-Ray Diffraction |

SECTION 1

INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address a statistically significant level (SSL) for cobalt in the groundwater monitoring network at the H.W. Pirkey Plant Western Bottom Ash Pond (WBAP), located in Hallsville, Texas, following the second semi-annual detection monitoring event of 2020. The WBAP is registered as a surface impoundment under Texas Commission on Environmental Quality (TCEQ) Industrial and Hazardous Waste Solid Waste Registration No. 33240.

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

Confidence intervals were re-calculated for Appendix IV parameters at the compliance wells to assess whether these parameters were present at a statistically significant level (SSL) above the GWPSs. An SSL was concluded if the lower confidence limit (LCL) of a parameter exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). An SSL was identified for cobalt at AD-28 at the WBAP, where the LCL of 0.0134 milligrams per liter (mg/L) exceeded the calculated GWPS of 0.0090 mg/L (Geosyntec, 2021). No other SSLs were identified.

1.1 CCR Rule Requirements

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

Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a

qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section...

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report to document that the SSL identified for cobalt at AD-28 is from a source other than the WBAP.

1.2 Demonstration of Alternative Sources

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

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

A demonstration was conducted to show that the SSL identified for cobalt at AD-28 was based on a Type IV cause and not by a release from the Pirkey WBAP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

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

2.1 Proposed Alternative Source

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

Monitoring well AD-28 is located near the southwest corner of the WBAP, as shown in **Figure 1**. Previous ASDs for cobalt at the WBAP provided evidence that cobalt is present in the aquifer media at the site and that the observed cobalt concentrations were due to natural variation (Geosyntec, 2019a; Geosyntec, 2019b; Geosyntec, 2020b; Geosyntec, 2020c). The previous ASDs discussed how the WBAP did not appear to be a source for cobalt in downgradient groundwater, based on observed concentrations of cobalt both in the ash material and in leachate from Synthetic Precipitation Leaching Procedure (SPLP) analysis (SW-864 Test Method 1312, [USEPA, 1994]) of the ash material. Cobalt was not detected in the SPLP leachate above the reporting limit of 0.01 mg/L, which is lower than the average concentration at AD-28 (**Table 1**).

A surface water sample was collected directly from the WBAP on November 4, 2020. Cobalt was detected at a concentration of 0.000501 mg/L in the WBAP sample (**Table 1**). This concentration is lower than all reported cobalt concentrations for in-network wells from the most recent sampling event, and over an order of magnitude lower than the average concentration observed at AD-28 (**Figure 2; Table 1**). Thus, the WBAP is not the likely source of cobalt at AD-28.

As noted in the previous ASDs, soil samples collected across the site, including from locations near the WBAP, identified cobalt in the aquifer solids at varying concentrations. SB-28 was advanced in the vicinity of AD-28 in April 2020 to re-log the geology at AD-28 and collect samples for laboratory analysis of total metals and mineralogy. The SB-28 field boring log, which was generated by Auckland Consulting LLC, is provided as **Attachment A**. Cobalt was identified at SB-28 at concentrations of 4.53 milligrams per kilogram (mg/kg) at 15.5-16 feet below ground surface (bgs) and 8.70 mg/kg at 40-41 feet bgs (**Table 2**). The 15.5-16 feet bgs interval at SB-28 correlates to the depth of the monitoring well screen of AD-28 (15-35 feet bgs), indicating that cobalt is present in aquifer solids within the AD-28 screened interval. Cobalt was also identified

in the aquifer solids at varying concentrations at other locations throughout the site, with the highest value of 23.5 mg/kg reported at AD-41, which is upgradient of the WBAP (**Figure 3**).

In addition to total cobalt, soil samples were submitted for mineralogical analysis to evaluate the presence of cobalt-containing minerals. X-ray diffraction (XRD) analysis of soils from SB-28 identified pyrite (an iron sulfide) in samples collected at 25-30 feet bgs and 40-41 feet bgs at concentrations up to 3% by weight (**Table 3**). Cobalt is known to undergo isomorphic substitution for iron in crystalline iron minerals such as pyrite due to their similar ionic radii of approximately 1.56 angstrom (Å) for iron vs. 1.52 Å for cobalt (Clementi and Raimondi, 1963; Krupka and Serne, 2002; Hitzman et al., 2017).

The aquifer solids at SB-28 are distinctly red in color at shallow depths, as illustrated in the photolog of soil cores provided in **Attachment B**. Red color in soils is often associated with the presence of oxidized iron-bearing minerals such as hematite and goethite. Goethite, an iron oxide mineral (FeOOH), was present at depths up to 16 ft bgs at SB-28 at up to 37% of the total aquifer solids (**Table 3**). The weathering of pyrite to goethite under oxidizing conditions is also a well-understood phenomenon, including in formations in east Texas (Senkayi et al., 1986; Dixon et al., 1982). It is likely that the pyrite weathering process is resulting in the release of isomorphically substituted cobalt from the pyrite crystal structure as it undergoes oxidative transformation to iron oxide minerals.

As described in an ASD previously generated for the Pirkey Plant's East Bottom Ash Pond (EBAP), vertical aquifer profiling (VAP) was used to collect groundwater samples from upgradient locations B-2 and B-3 during the soil boring and sample collection process (Geosyntec, 2019b). A groundwater sample was also collected from AD-30, an existing well within the WBAP groundwater monitoring network. Solid phases within these groundwater samples were separated and submitted for analysis of chemical composition and mineralogy. For the VAP samples, separation was completed using a centrifuge due to the high abundance of solids. For the groundwater sample at AD-30, the sample was filtered using a 1.5-micron filter. Based on total metals analysis, cobalt was identified both in the centrifuged solid material collected from upgradient VAP location B-3 [VAP-B3-(40-45)] and in the material retained on the filter after processing groundwater from permanent monitoring wells AD-30, B-2, and B-3 (**Table 2**). The concentrations of cobalt in the solid material retained after filtration were comparable to the bulk soil samples collected from the same locations.

The solid sample [VAP-B3-(40-45)] was submitted for mineralogical analysis via XRD and scanning electron microscopy (SEM) using an energy dispersive spectroscopic analyzer (EDS). The XRD results identified pyrite as approximately 3% of the solid phase (**Table 4**). Pyrite was identified during SEM/EDS analysis of lignite which is mined immediately adjacent to the site. Logging completed while the VAP boring was advanced identified coal at several intervals, including 45 and 48 ft bgs (**Figure 4**). Furthermore, SEM/EDS of both centrifuged solid samples [VAP-B3-(40-45) and VAP-B3-(50-55)] identified pyrite in backscattered electron micrographs by the distinctive framboidal morphology (Harris et al., 1981; Sawlowicz, 2000). Major peaks

involving iron and sulfur were identified in the EDS spectrum, which further support the identification of pyrite (**Attachment C**). While cobalt was not identified in the EDS spectrum, it is likely present at concentrations below the detection limit.

Naturally occurring cobalt is known to substitute for iron in pyrite, which is then known to weather to iron oxides. The presence of pyrite and iron oxides has been confirmed at AD-28 and across the Site. The presence of these aquifer minerals suggests that pyrite may be providing a source for aqueous cobalt in groundwater. Additionally, the pond was not identified as the source of cobalt at AD-28 based on the low concentrations of cobalt in the pond itself.

2.2 Sampling Requirements

As the ASD presented above supports the position that the identified SSL is not due to a release from the Pirkey WBAP, the unit will remain in the assessment monitoring program. Groundwater at the unit will continue to be sampled for Appendix IV parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSL for cobalt identified at AD-28 during assessment monitoring in November 2020 was not due to a release from the WBAP. The identified SSL was, instead, attributed to natural variation in the underlying geology, including the presence of pyrite and goethite in the solid aquifer material. Therefore, no further action is warranted, and the Pirkey WBAP will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment D**.

SECTION 4

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TABLES

**Table 1: Summary of Key Analytical Data
West Bottom Ash Pond - H.W. Pirkey Plant**

Geosyntec Consultants, Inc.

| Sample | Sample Date | Unit | Cobalt Concentration |
|-----------------|--------------------------|-------------|-----------------------------|
| Bottom Ash | 2/11/2019 | mg/kg | 5.8 |
| SPLP Leachate | 2/11/2019 | mg/L | <0.01 |
| WBAP Pond Water | 11/4/2020 | mg/L | 0.000501 |
| AD-28 - Average | May 2016 - November 2020 | mg/L | 0.0145 |

Notes:

mg/kg - milligram per kilogram

mg/L - milligram per liter

AD-28 - Average value was calculated using all cobalt data collected under 40 CFR 257 Subpart D.

**Table 2: Soil Cobalt and Mineralogy Data
West Bottom Ash Pond - H.W. Pirkey Plant**

Geosyntec Consultants, Inc.

| Location ID | Location | Sample Depth (ft bgs) | Cobalt (mg/kg) |
|---|--------------|--------------------------|-------------------|
| Bulk Soil Samples | | | |
| AD-28 | WBAP Network | 6-6.5 | < 2.38 |
| | | 15.5-16 | 4.53 |
| | | 25-30 | < 2.50 |
| | | 40-41 | 8.70 |
| AD-30 | WBAP Network | 7 | 1.00 |
| | | 23 | 15.0 |
| B-2 | Upgradient | 10 | 2.36 |
| | | 16 | 3.62 |
| | | 71 | 10.30 |
| | | 82 | 7.21 |
| | | 87 | 3.11 |
| B-3 | Upgradient | 10 | 1.30 |
| | | 20 | 0.59 |
| | | 97 | 1.11 |
| AD-41 | Upgradient | 15 | <1.0 |
| | | 35 | 23.5 |
| | | 95 | 1.90 |
| Solid Material Retained After Filtration | | | |
| AD-30 | WBAP Network | 15-25 | 9.3 J |
| B-2 | Upgradient | 38-48 | 4.3 J |
| B-3 | Upgradient | 29-34 | 12.0 |
| | | VAP 40-45 | 18.0 |

Notes:

mg/kg- milligram per kilogram

ft bgs - feet below ground surface

J = estimated value

For AD-28 and AD-30, samples were collected from additional boreholes advanced in the immediate area of the location identified by the well ID. Samples were not collected from the cuttings of the borings advanced for well installation. Samples at B-2, B-3, and AD-41 were collected from cores removed from the borehole during well lithology logging.

Depths for samples collected after filtration represent the screened interval for the permanent well where the sample was collected.

Table 3 - AD-28 Mineralogy Results
West Bottom Ash Pond - H. W. Pirkey Plant

| Boring ID | SB-28 (AD-28) | | | |
|------------------------------|---------------------------|-----------------------------|------------------------|-------------------------|
| Sample Depth Interval | 6-6.5 | 15.5-16 | 25-30 | 40-41 |
| Sample Location | Above Screened Interval | Within Screened Interval | | Below Screened Interval |
| Color | Red-brown to yellow-brown | Light gray, light red-brown | Brown, light red-brown | Gray to dark gray |
| Mineralogy | | | | |
| Quartz | 58% | 46% | 73% | 34% |
| Pyrite | -- | -- | 3% | 3% |
| K-Feldspar | -- | 1% | 1% | 1% |
| Siderite | -- | -- | 2% | 52% |
| Goethite | 37% | 15% | -- | -- |
| Anhydrite | -- | -- | -- | 2% |
| Clay/Mica | 5% | 38% | 21% | 8% |

Notes:

Sample depths are shown in feet below ground surface (bgs)

Well AD-28 is screened from 15-35 ft. below ground surface.

Mineralogical components are shown in relative abundance.

Table 4: B-3 X-Ray Diffraction Results
West Bottom Ash Pond - H. W. Pirkey Plant

Geosyntec Consultants, Inc.

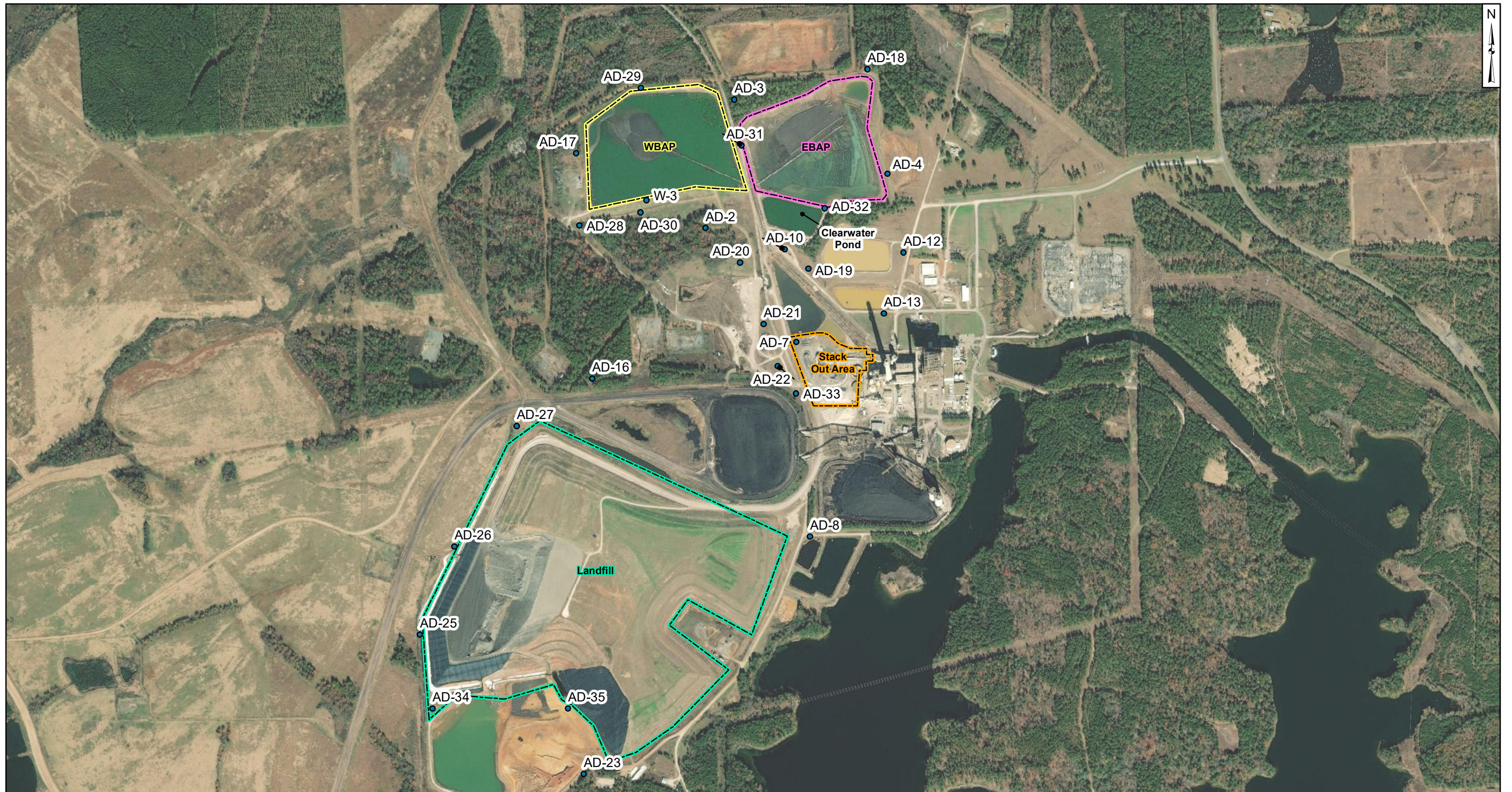
| Constituent | VAP-B3-(40-45) |
|----------------------|-----------------------|
| Quartz | 15 |
| Plagioclase Feldspar | 0.5 |
| Orthoclase | ND |
| Calcite | ND |
| Dolomite | ND |
| Siderite | 0.5 |
| Goethite | ND |
| Hematite | 2 |
| Pyrite | 3 |
| Kaolinite | 42 |
| Chlorite | 4 |
| Illite/Mica | 6 |
| Smectite | 12 |
| Amorphous | 15 |

Notes:

ND: Not detected

VAP-B3-(40-45) is the centrifuged solid material from the groundwater sample collected at that interval.

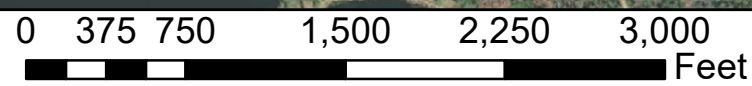
FIGURES



Legend

- Monitoring Wells
- EBAP
- Landfill
- Stack Out Area
- WBAP

Notes
 - Monitoring well coordinates provided by AEP.
 - Data provided by AEP, 2019



Site Layout

AEP Pirkey Power Plant
 Hallsville, Texas

Geosyntec
 consultants

Columbus, Ohio

2020/03/24

Figure

1



Legend

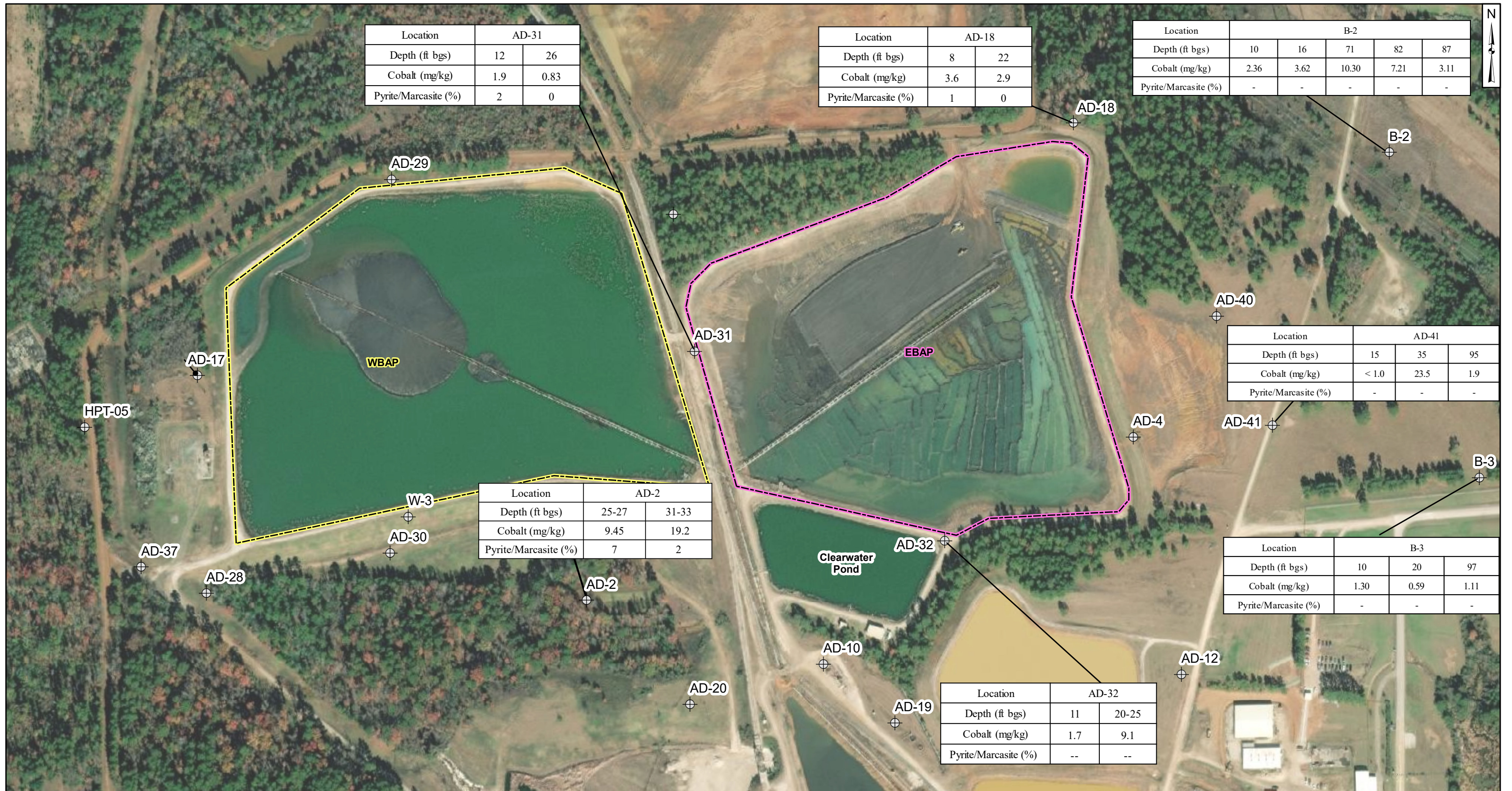
| | | |
|------------------|-------------------------|------------------|
| ⊕ Out of Network | ◆ Stackout Area | ▭ EBAP |
| ◆ EBAP | ◆ EBAP and WBAP | ▭ Stack Out Area |
| ◆ WBAP | ⊕ All CCR Unit Networks | ▭ WBAP |
| ◆ Landfill | ▲ Piezometer | |

Notes




- Monitoring well coordinates, site features, and data provided by AEP.
- AD-15 location is approximated
- B2 and B3 samples collected in March 2021
- * - Well most recently sampled November 2020
- ** - Well most recently sampled August 2019
- AD-29 included in the well network for water level measurements only



| | |
|---|------------|
| Cobalt Distribution in Groundwater | |
| AEP Pirkey Power Plant Hallsville, Texas | |
| Geosyntec consultants | |
| Columbus, Ohio | 2021/04/30 |
| Figure 2 | |



Legend

-  Monitoring Wells
-  EBAP
-  WBAP

Notes

- Monitoring well coordinates provided by AEP.
- AD-2 sample collected on April 20, 2020
- All other data provided by AEP, 2019.
- ft bgs: feet below ground surface.
- mg/kg: milligrams per kilogram.
- -- not analyzed.



Cobalt Distribution in Soil

AEP Pirkey Power Plant
Hallsville, Texas

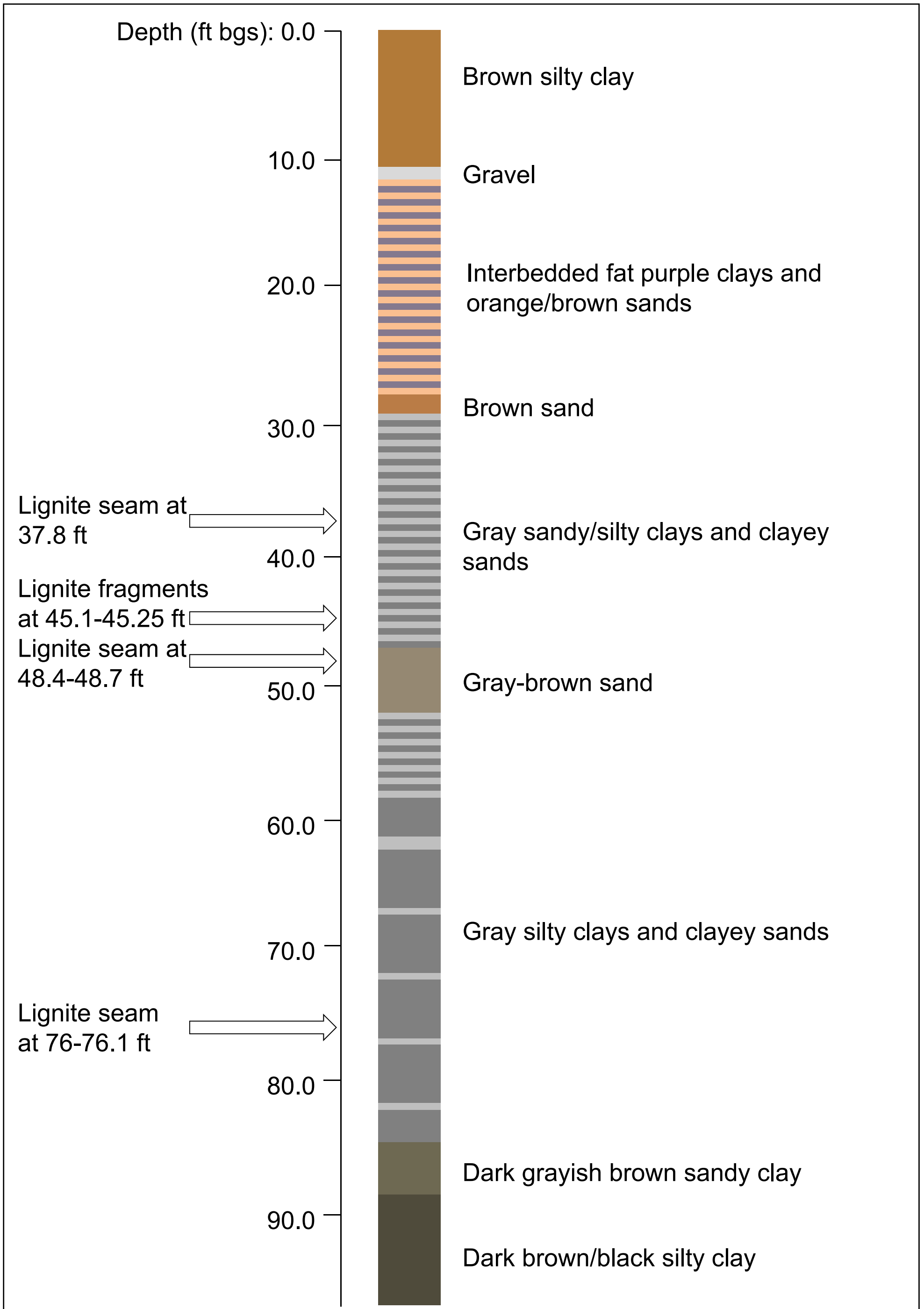
Geosyntec
consultants

Columbus, Ohio

2020/12/22

Figure

3



Notes:

- Ft = feet
- Bgs = below ground surface
- Boring completed May 2019
- Total depth of 97.5 ft bgs
- Well installed in offset boring screened at 29-34 ft bgs

B-3 Visual Boring Log

AEP Pirkey Powerplant
Hallsville, TX

Geosyntec
consultants

Figure

4

CHA8462

March 2020

ATTACHMENT A
SB-28 Boring Log

PROJECT NO. _____ PROJ. _____ BOR. NO. SB-28
 LOCATION AD-28/MW-28 - Pirkey Power Plant ELEV. _____ DATE 4/20/20

| SILTS & SANDS | | COHESIVE SOILS - CLAYS | | | COLORS | | MATERIALS | | SAND ADJ. | | CHARACTERISTICS | |
|--------------------|-------|------------------------|------------|--------------|-----------|---------------------------------|-------------------------------|----------------------|---------------------|---------------------|-----------------|--|
| CONDITION | | CONSISTENCY | | PENETROMETER | N - VALUE | | Li ... Light ... Br ... Brown | Cl ... Clay, Clayey | F ... Fine | Calc ... Calcareous | | |
| VLo ... Very Loose | 0-4 | Vso ... Very Soft | 0 - 0.25 | 0 - 0.25 | < 2 | Dk ... Dark ... Bk ... Black | Si ... Silt, Silty | M ... Medium | Lig ... Lignite | | | |
| Lo ... Loose | 4-10 | So ... Soft | 0.25 - 0.5 | 0.25 - 0.5 | 2 - 4 | G ... Grey ... Bl ... Blue | Sa ... Sand, Sandy | Co ... Coarse | Org ... Organic | | | |
| MDe ... Med. Dense | 10-30 | Mst ... Stiff | 0.5 - 1.0 | 0.5 - 1.0 | 4 - 8 | T ... Tan ... Gr ... Green | Ls ... Limestone | Si ... Silty | Lam ... Laminate | | | |
| De ... Dense | 30-50 | St ... Stiff | 1.0 - 2.0 | 1.0 - 2.0 | 8 - 15 | R ... Red ... Y ... Yellow | Gr ... Gravel | SS ... Siltstone | Sl ... Slickensided | | | |
| VDe ... Very Dense | >50 | VSt ... Very Stiff | 2.0 - 4.0 | 2.0 - 4.0 | 15 - 30 | Rd ... Reddish ... Wh ... White | SS ... Sandstone | Sh ... Shale, Shaley | SL ... Slightly | | | |
| | | H ... Hard | > 4.0 | > 4.0 | > 30 | | | | Sm(s) ... Seam(s) | | | |
| | | | | | | | | | Nod ... Nodules | | | |

| SAMPLE INTERVAL TEST ASSIGNMENT | SAMPLE NO. Recovery | DEPTH FT. | SAMPLES | STRATUM DESCRIPTION | | | | | STANDARD PENETROMETER | | | UNIFIED SOIL CLASSIFICATION | N - VALUE OR HAND PENETROMETER |
|---------------------------------|---------------------|-----------|--------------------|--------------------------|-------|--|----------------------|----------------------------------|-----------------------|----------|----------|-----------------------------|--------------------------------|
| | | | | CONDITION OR CONSISTENCY | COLOR | MINOR MATERIALS OR ADJECTIVES | PREDOMINANT MATERIAL | CHARACTERISTICS OR MODIFICATIONS | SEAT - 6" | 1st - 6" | 2nd - 6" | | |
| | | | | | | | | | | | | | |
| SM 0-2 | 4' | 0-2 | Br Lt Br | Si | Sa | Silty sand, trace clay & roots, trace fine iron ore gravel, | | | | | | moist (0-2) | |
| | | 2-10 | Rd Br, Yllw Br | Si, Gr | Cl | Clay - some silt, trace 1/4" sand, trace coarse iron ore concretions | | | | | | moist (2-5) | |
| CL 5-10 | 1.5' | | | | | - some v.f. sand, ironstone layer @ 6-6.5' | | | | | | moist (5-10) | |
| | | 10-15 | Rd Br, Lt Gr | Si Cl | Sa | clayey v.f. to f silty sand with clay in thin lenses, trace cemented clayey sand | | | | | | v. moist (10-15) | |
| | | 15-20 | Lt. br & Lt. Rd Br | | | - clay lenses @ 15' (6") - ironstone layer @ 15.5' & cemented sand to 16' | | | | | | v. moist (15-16) | |
| SM 20-25 | 3" | 16-40 | Br, Lt. Rd Br | Si | Sa | Silty sand - some ironstone - gray @ 20' | | | | | | Saturated @ 16' to 40' | |
| | | 25-30 | Gray | | | = some cemented clayey sand (only recovery @ 25-30') | | | | | | | |
| | | 30-35 | NR | | | | | | | | | | |
| | | 35-40 | NR | | | | | | | | | | |
| | | | | | | R.T. @ 40' | | | | | | | |
| | | | | | | * Split Spoon Driven from 40-41' | | | | | | | |
| SC 40-41 | 1' | 40-41 | Gray, DK Gray | Cl | Sa | clayey sand w/ lenses of cemented sand @ 41.5-41.75' trace gypsum crystals @ 40-41' | | | | | | v. moist 40-41' | |
| | | | | | | * 6-6.5' collected @ 1140 | | | | | | | |
| | | | | | | * 15.5-16' collected @ 1215 | | | | | | | |
| | | | | | | * 25-30' collected @ 1230 | | | | | | | |
| | | | | | | * 40-41' collected @ 1300 | | | | | | | |

Type ASA Dry Auger Rotary Wash
 SEEPAGE @ 16 FT. WHILE DRILLING, W.L. @ _____ FT. ON COMPL. (OR) BAILED TO _____ FT. UPON COMPLETION.
 W.L. @ _____ FT AND CAVED TO _____ FT. ON _____.

* GPS: 32.46544°, -94.49432 (18' W-NW) of AD-28/MW-28

ATTACHMENT B
SB-28 Boring Photographic Log

GEOSYNTec CONSULTANTS
Photographic Record



Client: American Electric Power

Project Number: CHA8495/12A/02

Site Name: H.W. Pirkey Plant WBAP

Site Location: Hallsville, Texas

Photograph 1

Date: 4/21/2020

Direction: N/A

Comments:
Multiple sections of core from soil boring SB-28 advanced near downgradient monitoring well AD-28 within the Western Bottom Ash Pond (WBAP) CCR unit. 5-foot pushes were used. Note the reddish color indicating the presence of oxidized iron-bearing minerals.



Photograph 2

Date: 4/21/2020

Direction: N/A

Comments:
0-5 foot interval of SB-28.

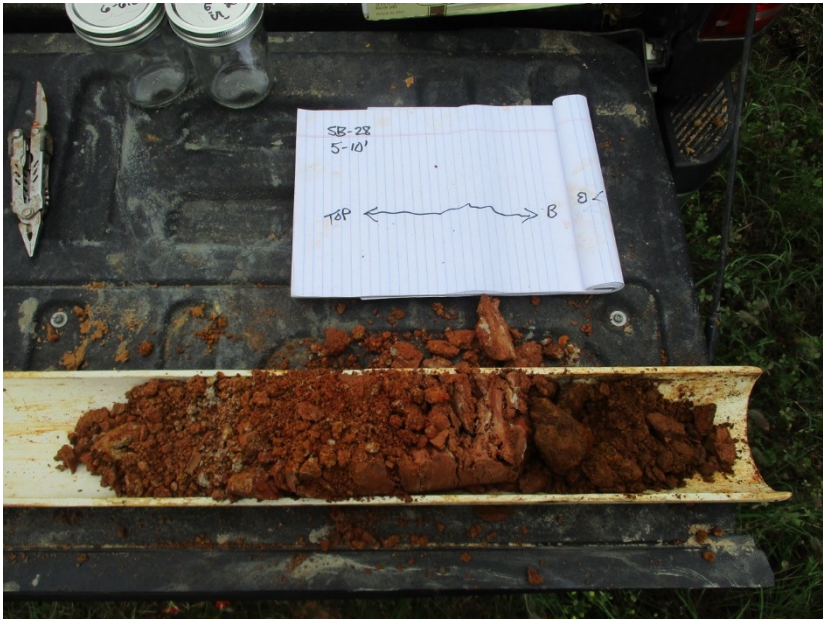


Photograph 3

Date: 4/21/2020

Direction: N/A

Comments:
5-10 foot interval of SB-28. Recovery of this interval was limited. A sample was collected from this interval from 6-6.5 ft. below ground surface (bgs).



Photograph 4

Date: 4/21/2020

Direction: N/A

Comments:
10-15 foot interval of SB-28. Recovery of this interval was limited.



Photograph 5

Date: 4/21/2020

Direction: N/A

Comments:
 15-20 foot interval of SB-28. Recovery of this interval was limited. A sample was collected from this interval from 15.5-16 ft. bgs.

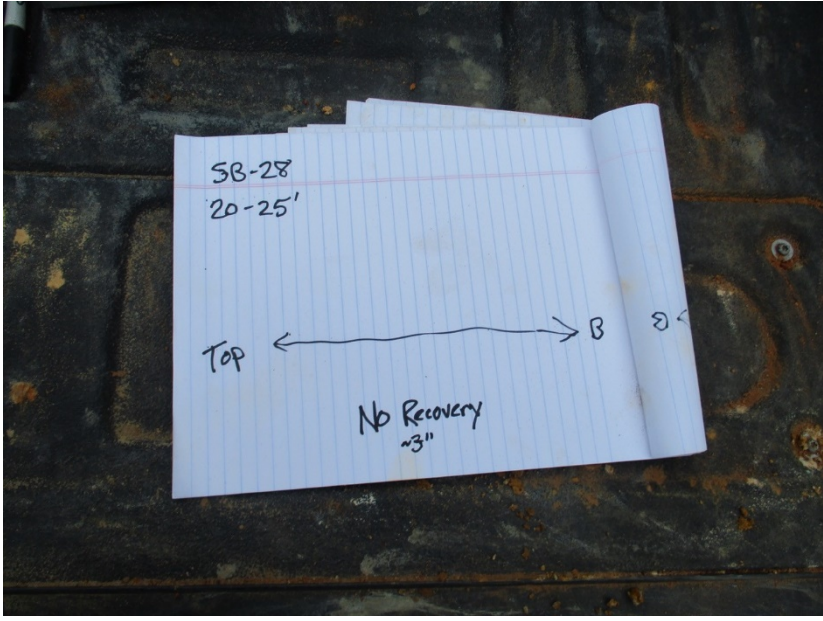


Photograph 6

Date: 4/21/2020

Direction: N/A

Comments:
 Field geologist's note indicating that very little of the 20-25 foot interval of SB-28 was recovered.



Photograph 7

Date: 4/21/2020

Direction: N/A

Comments:
25-30 foot interval of SB-28. Very little of this interval was recovered. Note the color change of the soil from red to dark brown/black. A sample was collected from this interval.



Photograph 8

Date: 4/21/2020

Direction: N/A

Comments:
Bottom of SB-28. The boring log indicates no recovery of soil from the 30-40 foot interval. A sample was collected from this interval.

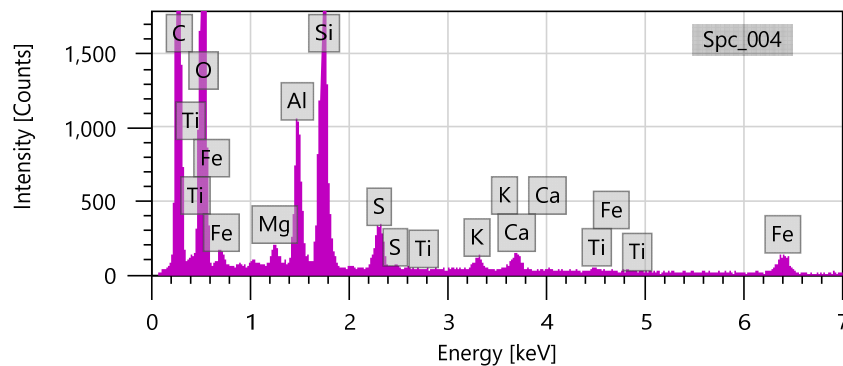
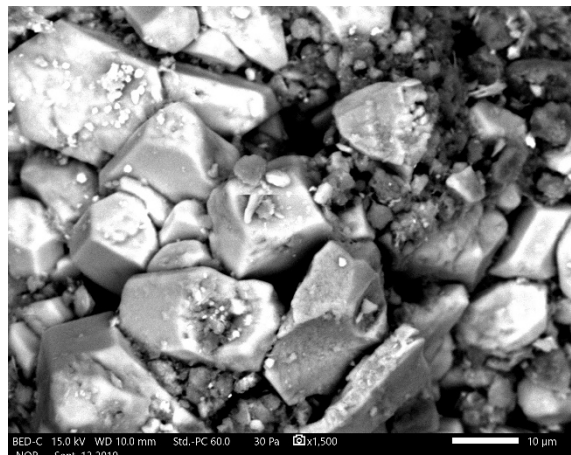
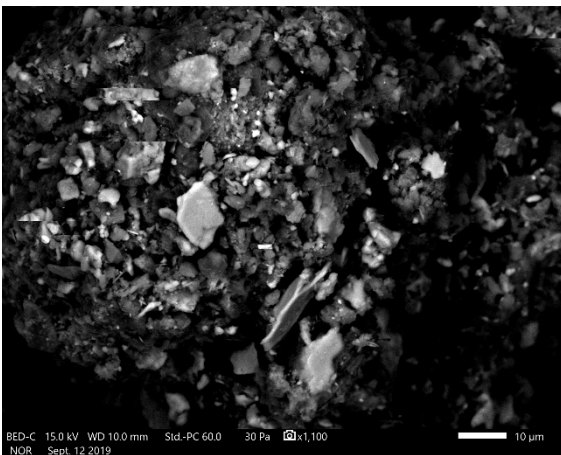
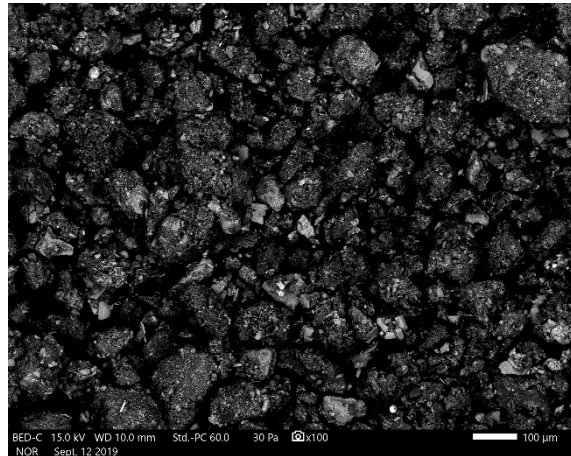
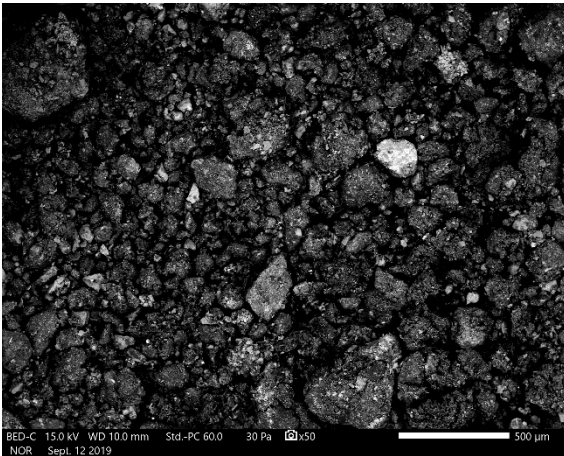


ATTACHMENT C
SEM/EDS Analysis

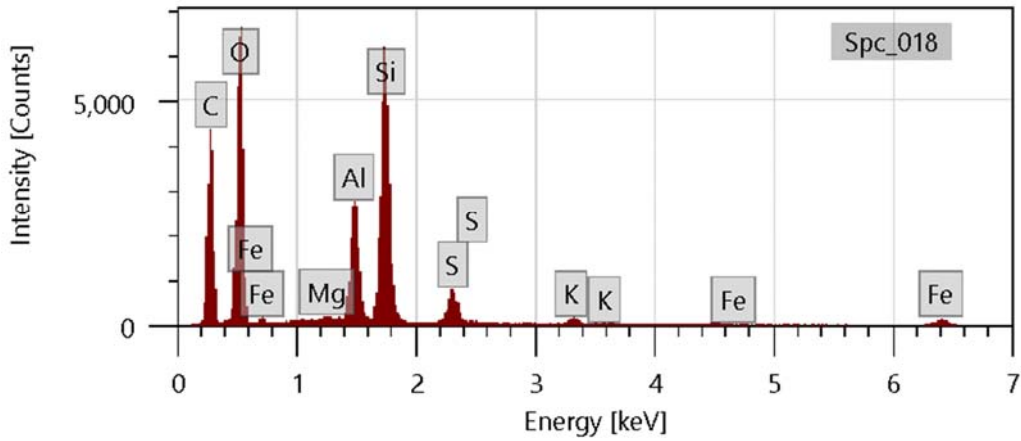
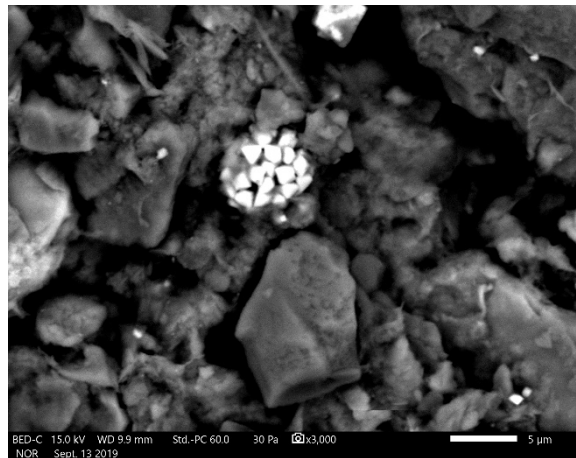
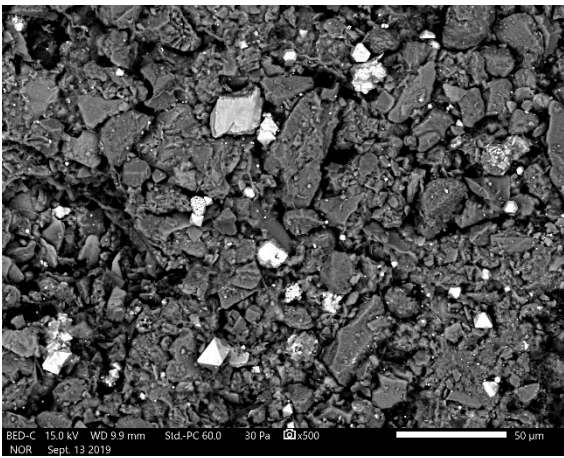
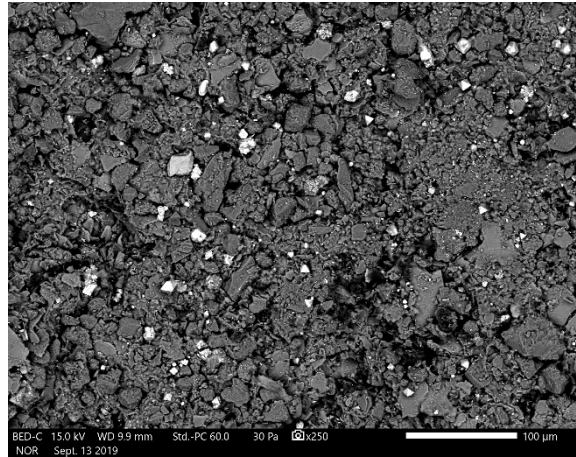
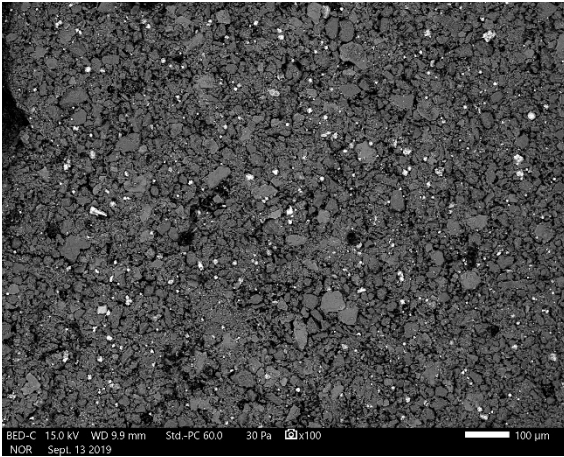
September 16, 2019

Dr. Bruce Sass
941 Chatham Lane, Suite 103, Columbus, OH 43221

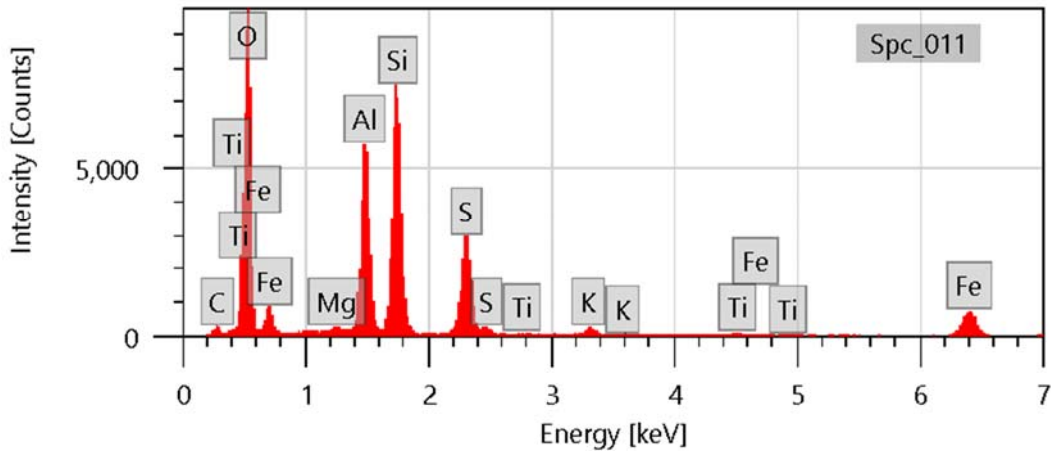
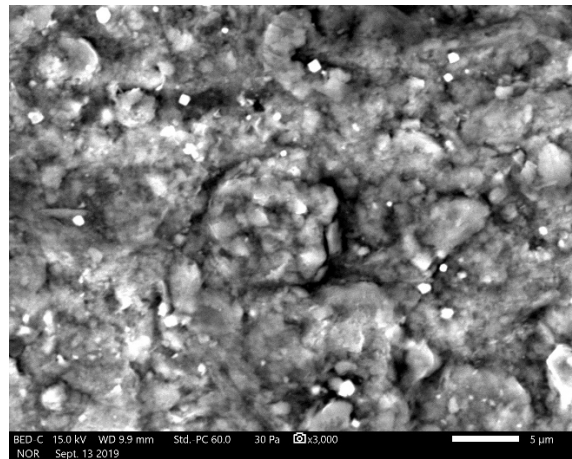
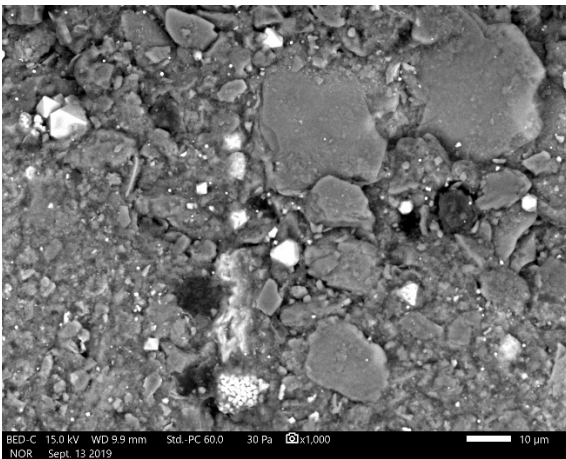
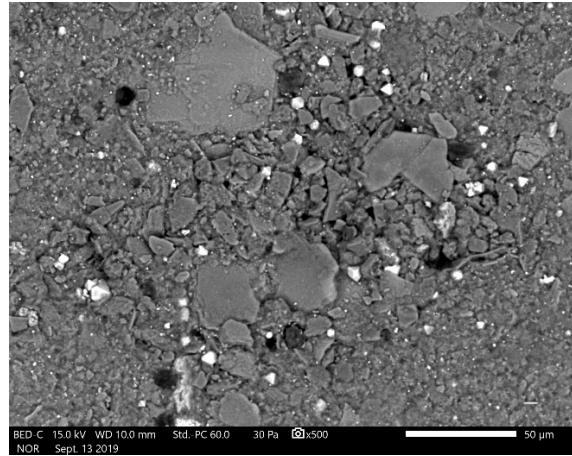
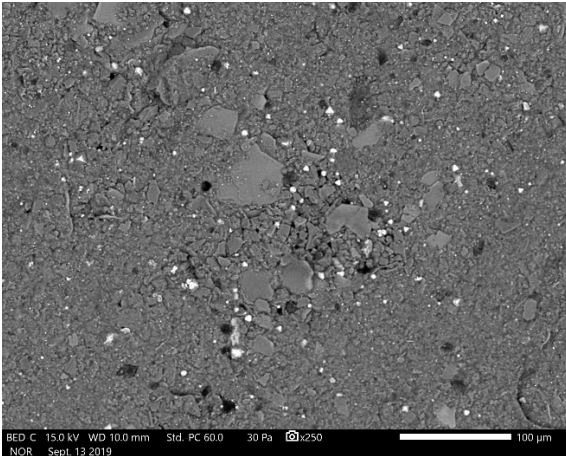
via Email: BSass@geosyntec.com



Lignite. Backscattered electron micrographs show the sample at 100X, 1,100X, and 1,500X. EDS spectrum at bottom is an area scan of the region shown in top right micrograph. Bright particles are mostly quartz and feldspar. Major peaks for carbon, oxygen, silicon, and aluminum suggest coal and clay.



Sample VAP B3 40-45. Backscattered electron micrographs show the sample at 100X, 250X, 500X, and 3000X. EDS spectrum at bottom is an area scan of the region shown at 500X. Bright particles are pyrite (framboid in bottom right micrograph). Major peaks for carbon, oxygen, silicon, and aluminum suggest coal and clay.



Sample VAP B3 50-55. Backscattered electron micrographs show the sample at 250X, 500X, 1000X, and 3000X. EDS spectrum at bottom is an area scan of the region shown at 3000X. Bright particles are mostly pyrite (framboid in bottom left micrograph); occasional particles of Fe-Ti oxide are detected. Major peaks for oxygen, silicon, and aluminum suggest clay. Large blocky particles are mostly quartz, feldspar, and clay.

ATTACHMENT D

Certification by Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

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

Beth Ann Gross

Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature



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Tallahassee, Florida 32308

Texas Registered Engineering Firm
No. F-1182

79864
License Number

Texas
Licensing State

5/28/2021
Date