Pirkey Power Plant
FGD Stackout Area
Alternate Source Demonstration

The Pirkey FGD Stackout Area initiated an assessment monitoring program in accordance with 40 CFR 257.95 on April 3, 2018. Groundwater protection standards (GWPS) were set in accordance with 257.95(d)(2) and a statistical evaluation of the assessment monitoring data was conducted. The statistical evaluation revealed an exceedance of the beryllium GWPSs on July 11, 2019. A successful alternate source demonstration (ASD) was completed per 257.95(g)(3), therefore, the Pirkey FGD Stackout Area will remain in assessment monitoring. An alternate source demonstration is documentation that shows a source other than the CCR unit was responsible for causing the statistics to exceed the GWPS. The ASD document will explain the alternate cause of the GWPS exceedance. The successful ASD is attached.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

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

Submitted to

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October 3, 2019

CHA8462

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LIST OF ACRONYMS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EDS	Energy Dispersive Spectroscopic Analyzer
EPRI	Electric Power Research Institute
FGD	Flue Gas Desulfurization
GSC	Groundwater Stats Consulting, LLC
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
MCL	Maximum Contaminant Level
QA	Quality Assurance
QC	Quality Control
SEM	Scanning Electron Microscopy
SSL	Statistically Significant Level
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

The H.W. Pirkey Plant, located in Hallsville, Texas, has four regulated coal combustion residuals (CCR) storage units, including the Flue Gas Desulfurization (FGD) Stackout Area (Figure 1). In February 2019, a semi-annual assessment monitoring event was conducted at the FGD Stackout Area in accordance with 40 CFR 257.95(d)(1). The monitoring data were submitted to Groundwater Stats Consulting, LLC (GSC) for statistical analysis. Groundwater protection standards (GWPSs) were previously established for each Appendix IV parameter in accordance with the statistical analysis plan developed for the facility (AEP, 2017) and United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance; USEPA, 2009). The GWPS for each parameter was established as the greater of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2). To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether these parameters were present at a statistically significant level (SSL) above the GWPSs. 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). At the FGD Stackout Area, an SSL was identified for beryllium at AD-22, where the LCL of 0.00413 milligrams per liter (mg/L) was above the calculated GWPS of 0.00400 mg/L (Geosyntec, 2019). No other SSLs were identified.

1.1 CCR Rule Requirements

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

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

Pursuant to 40 CFR 257.95(g)(3)(ii), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report to document that the SSL identified for beryllium at AD-22 should not be attributed to the FGD Stackout Area.

1.2 Demonstration of Alternative Sources

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

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

A demonstration was conducted to show that the SSL identified for beryllium at AD-22 was based on a Type IV cause and not by a release from the Pirkey FGD Stackout Area.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

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

2.1 Proposed Alternative Source

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

As shown in Figure 2, beryllium concentrations at AD-22 appear to correlate with groundwater elevations in the well. These changes approximately correspond to annual cycles, with higher beryllium concentrations occurring in early spring and lower concentrations in early fall. EPRI guidance suggests evaluating major ion chemistry to assess if natural variability is due to seasonal change (EPRI, 2017). As shown in a Schoeller diagram in Figure 3, concentrations of almost all major ions tends to be higher in the early spring, with declining concentrations later in the year. A Kruskal-Wallis test, in which non-parametric analysis of variance testing for differences between seasons is completed, was performed to evaluate seasonality. The Kruskal-Wallis test found significant results at the 5% significance level (Attachment A).

Additional evidence shows that the beryllium concentration at AD-22 is correlated with seasonal changes in other constituents, including lithium and calcium (Figure 4). The correlation between beryllium and both monovalent (lithium) and divalent (calcium) cations suggests that the increases in beryllium concentration are related to cation exchange phenomenon in the native soil.

A review of the boring log for AD-22 shows that clay is present from 0.5 to 12 feet below ground surface (ft bgs), which corresponds to elevations of 343 to 354.5 feet above mean sea level (ft amsl) (Attachment B). Groundwater elevations during the background monitoring period fluctuated between approximately 344 and 351 ft amsl, resulting in variation in the amount of the clay that was in contact with groundwater. At higher groundwater elevations, more clay material is in contact with groundwater, allowing greater desorption of cations from the cation exchange sites on the clay. As shown in Figure 2, higher groundwater elevations correlated with higher beryllium concentrations.

A groundwater sample was collected from AD-22 and then passed through a 1.5-micron filter. The solid material retained on the filter was submitted for analysis of total metals and by scanning electron microscopy (SEM) using an energy dispersive spectroscopic analyzer (EDS).

The SEM/EDS analysis showed that the solid material separated from groundwater was composed of abundant clay-size particles with mainly aluminum and silicon identified in the EDS output (Attachment C). The presence of these clay particles provides evidence to support the hypothesis that elevated beryllium is due to desorption from the cation exchange sites on the clays.

The exceedance for beryllium at AD-22 was attributed to the effects of seasonal groundwater elevation changes, and the resulting cation exchange between groundwater and the confining clay above the aquifer material, on groundwater quality. Additionally, the lack of other Appendix IV exceedances and the marginal difference between the LCL for AD-22 and the GWPS provides additional evidence that the beryllium exceedance should not be attributed to the FGD Stackout Area.

2.2 Sampling Requirements

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

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.95(g)(3)(ii) and supports the position that the SSL of beryllium at AD-22 identified during assessment monitoring in February 2019 was not due to a release from the FGD Stackout Area. The identified SSL was, instead, attributed to seasonal effects on groundwater quality, which is an effect of natural variation. Therefore, no further action is warranted, and the Pirkey FGD Stackout Area will remain in the assessment monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment D.

SECTION 4

REFERENCES

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

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

Geosyntec Consultants, 2019. Statistical Analysis Summary, FGD Stackout Area. H.W. Pirkey Power Plant. Hallsville, Texas. July.

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

FIGURES

Monitoring Well Network

- Downgradient Sampling Location
- Upgradient Sampling Locatoin
- FGD Stackout Pad

Notes

- Monitoring well coordinates and water level data provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016) provided by AEP.

500 250 0 500 Feet

Site Layout
FGD Stackout Area

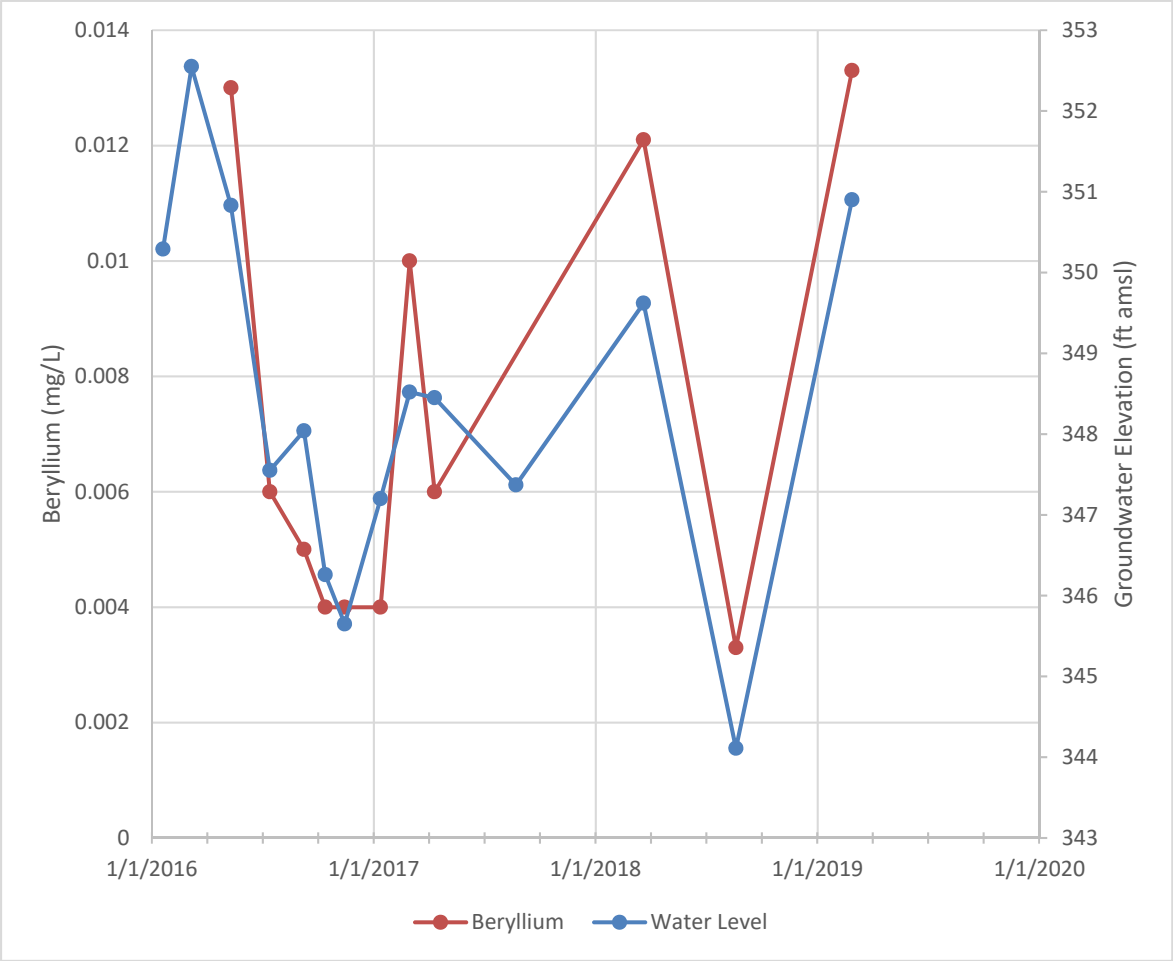
AEP Pirkey Power Plant Hallsville, Texas

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Pirkey\MXDs\AEP-Pirkey_Stacker_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.



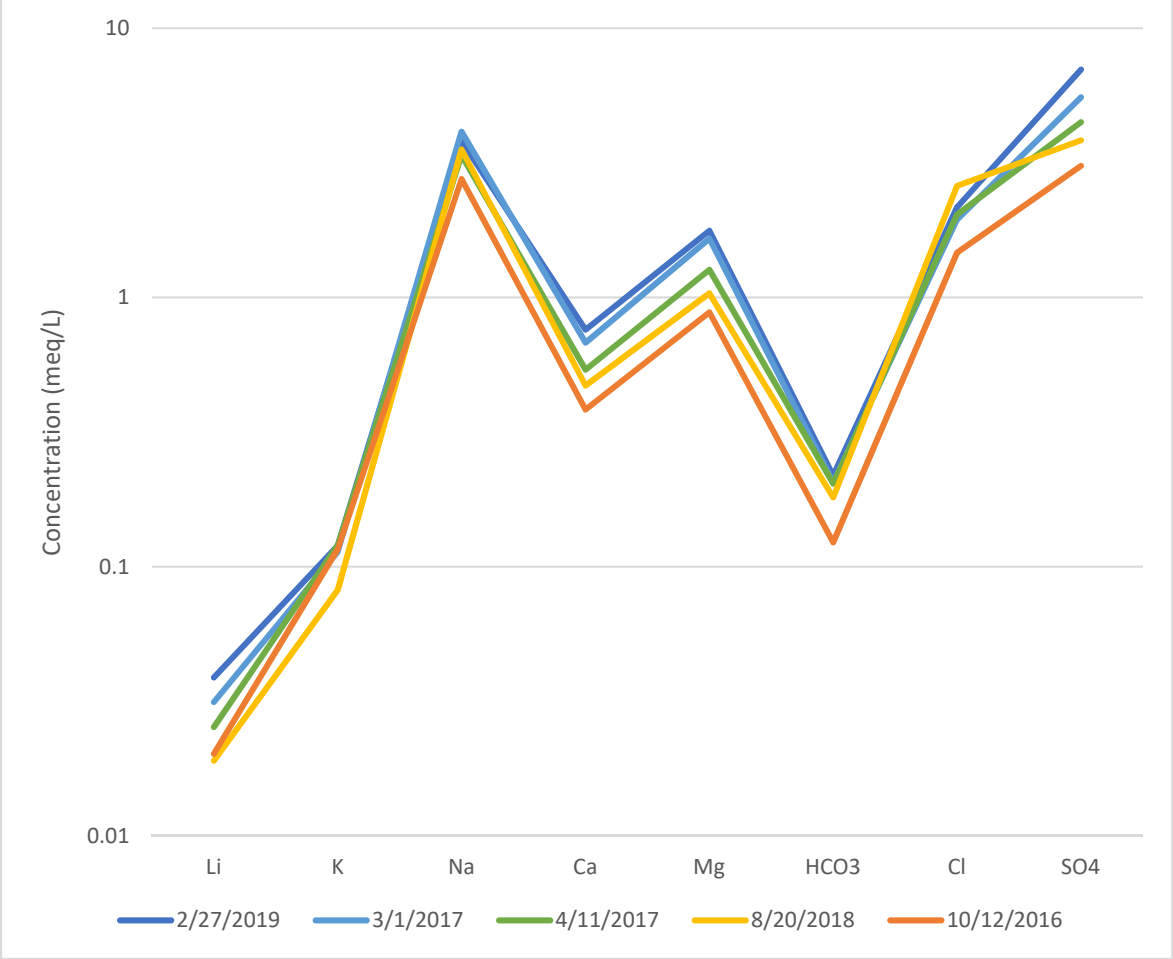
Notes: Beryllium concentrations are shown in milligrams per liter (mg/L). Groundwater elevation is shown as feet above mean sea level (ft amsl).

Beryllium v. Groundwater Elevation
Pirkey FGD Stackout Pad

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure 2

Columbus, Ohio | 23-Sep-2019

internal info: path, date revised, author



Notes: Concentrations are shown in milliequivalents per liter (meq/L).

AD-22 Schoeller Diagram
Pirkey FGD Stackout Pad

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AMERICAN ELECTRIC POWER

Columbus, Ohio

23-Sep-2019

Figure 3

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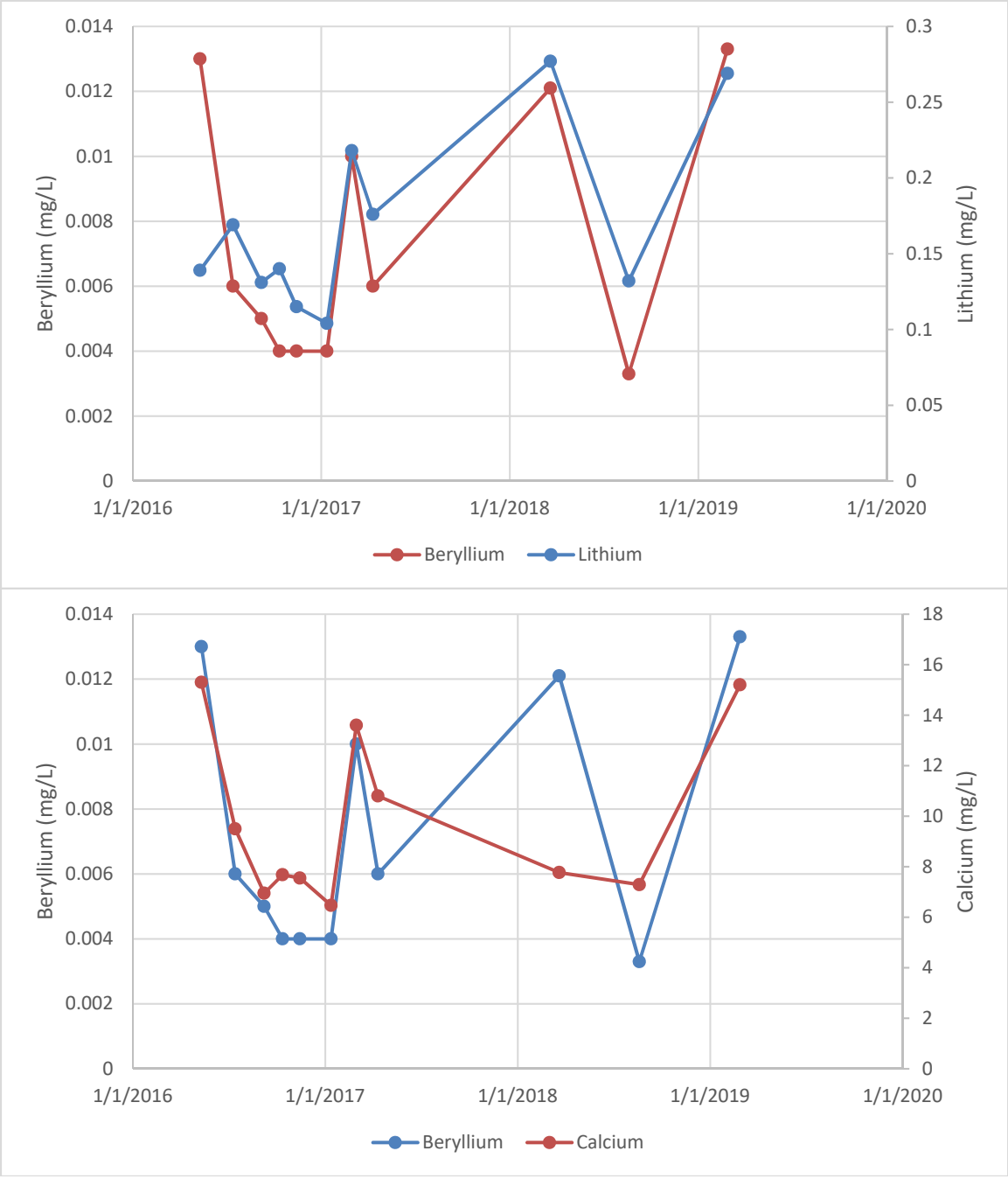

Notes: Beryllium, lithium, and calcium concentrations are shown in milligrams per liter (mg/L).

Beryllium v. Cations
Pirkey FGD Stackout Pad

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AMERICAN ELECTRIC POWER

Figure 4

Columbus, Ohio

23-Sep-2019

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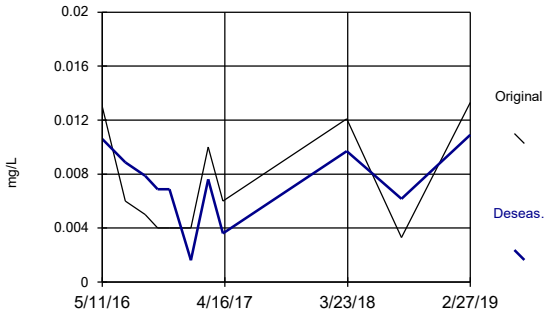
ATTACHMENT A

Statistical Evaluation - Seasonality at AD-22

Seasonality: AD-22

For the selected data, the Kruskal-Wallis test indicates SEASONALITYat the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 4.511
Tabulated Chi-Squared value = 3.841 with 1 degrees of freedom at the 5% significance level.
There were 2 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 4.408
Adjusted Kruskal-Wallis statistic (H') = 4.511



Constituent: Beryllium, total Analysis Run 9/22/2019 7:11 AM
Pirkey Stackout Client: Geosyntec Data: Pirkey Stackout

ATTACHMENT B
AD-22 Boring Log

☐ BORING ■ MONITOR WELL

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

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

FACILITY ADDRESS: Hallsville, Texas

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

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

PREPARED BY: David Bedford LOGGED BY: David Bedford

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

LONGITUDE: W94°29'41.3"

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

Cement Bentonite Filter Sand ▽ Water Level

Apex geoscience inc.

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

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

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

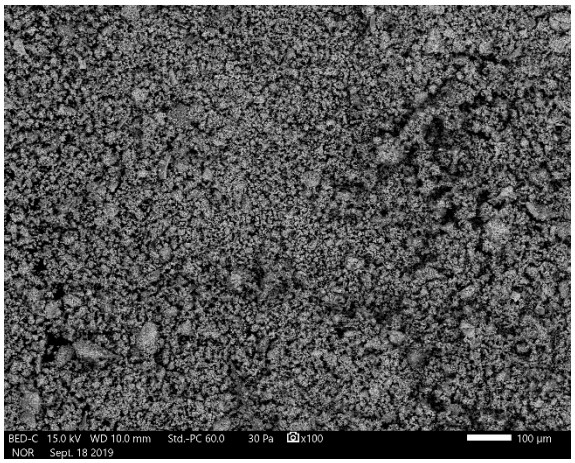
Surface Completion ☐ Flush ■ Above Ground 3'

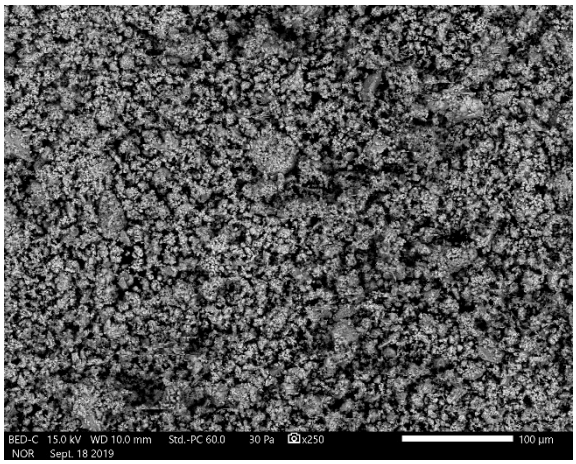
Note: This log is not to be used separate from this report.

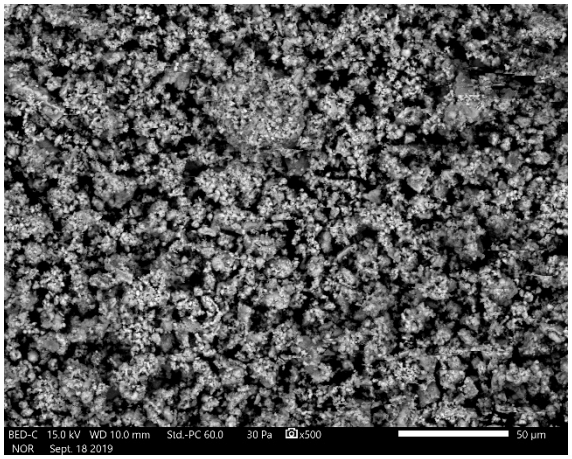
ATTACHMENT C
SEM/EDS Analysis

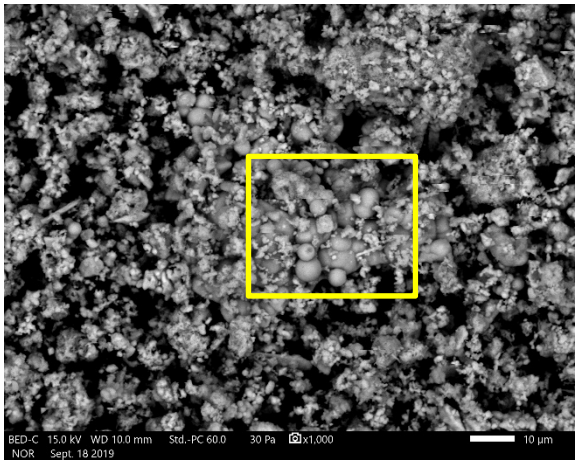
September 22, 2019

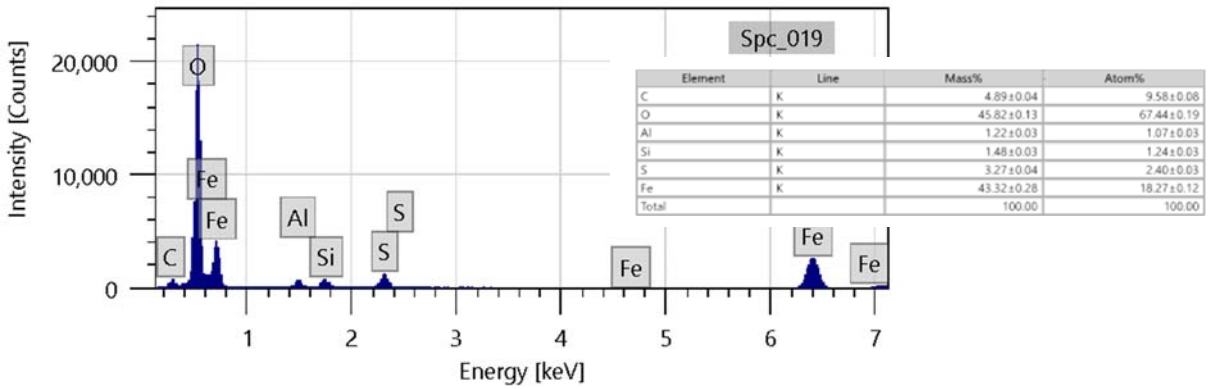
Dr. Bruce Sass
941 Chatham Lane, Suite 103, Columbus, OH 43221
via Email: BSass@geosyntec.com











Sample AD-22. Backscattered electron micrographs show the sample at 100X, 250X, 500X, and 1000 X. EDS spectrum at bottom is an area scan of the region shown in the 1000X micrograph. The analysis is shown on the right. The globular phase appears to consist mainly of iron oxide/hydroxide.

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 FGD Stackout Area CCR management area and that the requirements of 40 CFR 257.95(g)(3)(ii) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
8217 Shoal Creek Blvd., Suite 200
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Texas Registered Engineering Firm
No. F-1182

79864	Texas	10/3/2019
License Number	Licensing State	Date