AECOM
564 White Pond Drive
Akron, OH 44320-1100
www.aecom.com

330-836-9111 tel
330-836-9115 fax

October 15, 2018

Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

Engineer's Certification of Fault Area Demonstration
Slag Ponds 2A and 2B, and Slag Stilling Pond 2C
EPA Final CCR Rule
TVA Paradise Fossil Plant
Drakesboro, Kentucky

1.0 PURPOSE

The purpose of this document is to certify that the Fault Area Demonstration for the TVA Paradise Fossil Plant (PAF) Slag Ponds 2A and 2B, and Slag Stilling Pond 2C are in compliance with the Fault Area location requirements specified in the EPA Final CCR Rule at 40 CFR §257.62.

2.0 BACKGROUND

In accordance with 40 CFR §257.62(a), all new and existing CCR impoundments, new CCR landfills, and lateral expansions must not be located within 60 meters (200 feet) of the outermost damage zone created by faults active during the Holocene Period unless the unit meets certain requirements. The Holocene Period is defined by any geologic event occurring within the past 11,700 years, the time span indicating that a fault is active.

3.0 SUMMARY OF FINDINGS

PAF is located between two subparallel, east-northeast trending fault systems: the Pennyrile Fault System located about 3 miles southeast of the plant site, and the Rough Creek Fault System situated approximately 17 miles northwest of the site. Based on a review of the United Stated Geologic Survey (USGS) website which contains information on faults and associated folds in the United States that are believed to be sources of M>6 earthquakes during the Quaternary Period (the past 1,600,000 years, including Holocene Epoch), there are no known faults of the Holocene Period located within the vicinity of PAF.

Based upon a review of the documented sources as presented above, fault lines in relation to the Slag Ponds 2A and 2B and Slag Stilling Pond 2C have not been active during the Holocene Period and are not within the specified 200 foot fault damage zone. Through the references listed below and the attached figures, AECOM has determined that Slag Ponds 2A and 2B and Slag Stilling Pond 2C at the TVA Paradise Fossil Plant meet the fault area requirements of the EPA Final CCR Rule 40 CFR §257.62. AECOM has determined that there are no reasonable expectations that faults will disrupt the integrity of Slag Ponds 2A and 2B and Slag Stilling Pond 2C due to fault movement.

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AECOM
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Akron, OH 44320-1100
www.aecom.com
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330-836-9115 fax

4.0 CERTIFICATION

I, Nicholas Golden, being a Professional Engineer in good standing in the State of Kentucky, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this certification has been prepared in accordance with generally accepted engineering practices; that the information contained herein is accurate as of the date of my signature below; and that Slag Ponds 2A and 2B and Slag Stilling Pond 2C meet the fault area requirements of the EPA Final CCR Rule 40 CFR §257.62.

SIGNATURE _____ DATE 10/15/18

ADDRESS: AECOM
564 White Pond Drive,
Akron, OH 44320

TELEPHONE: (330)-836-9111

ATTACHMENTS: Engineer's Certification of Fault Area Demonstration (40 CFR § 257.62) for Coal Combustion Residuals (CCR) Existing Surface Impoundments - Slag Ponds 2A and 2B and Slag Stilling Pond 2C

COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

TENNESSEE VALLEY AUTHORITY – PARADISE FOSSIL PLANT
SLAG PONDS 2A AND 2B, AND SLAG STILLING POND 2C
DRAKESBORO, KENTUCKY

FAULT AREA DEMONSTRATION (40 CFR §257.62) FOR COAL COMBUSTION RESIDUALS (CCR)

EXISTING SURFACE IMPOUNDMENTS

Prepared for

Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402-2801

October 15, 2018 – Rev 0

Prepared by

AECOM

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1.0 INTRODUCTION

1.1 OBJECTIVE

The purpose of this demonstration is to evaluate compliance with 40 CFR § 257.62 of the Environmental Protection Agency Final Coal Combustion Residuals Rule (EPA Final CCR Rule). This Fault Area Demonstration is based on existing published documentation from various sources, as listed in Section 5. Documentation includes construction drawings, record drawings, and any other pertinent data and/or investigations to support historical conditions and operations at Slag Ponds 2A and 2B and Slag Stilling Pond 2C at the Tennessee Valley Authority (TVA) Paradise Fossil Plant (PAF).

1.2 RULE REQUIREMENTS

40 CFR § 257.62(a) *Any new CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene Period unless the owner or operator demonstrates by October 17, 2018, that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit*.

40 CFR § 257.62(b) *The owner or operator must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of 40 CFR § 257.62.*

40 CFR § 257.62(c) *The owner or operator of an existing surface impoundment must complete the demonstration required by paragraph 40 CFR § 257.62(a) by October 17, 2018.*

1.3 BACKGROUND

In accordance with the 40 CFR § 257.62(a), all new and existing CCR impoundments, new landfills, and vertical expansions must not be located within 60 meters (200 feet) of the outermost danger zone created by faults active during the Holocene Period. The Holocene Period is defined by any geologic event occurring within the past 11,700 years, the time span indicating that a fault is active.

Providing an adequate setback distance as required by 40 CFR § 257.62(a) is an attempt to reduce the risk of CCR unit failures. Potential failures include surface breakage, cracks, and fissures between fill and confining slopes, slope failure via landslides, liquefaction induced lateral spacing and settlement of the pile, disruption of surface water and drainage control systems, and rupture of leachate collection systems. In the case that an existing CCR facility is within 200 feet of an active fault, the operator or owner of the facility must provide a demonstration recognizing that acceptable engineering practices have been incorporated into the design of the CCR unit so that the structural integrity of the CCR unit will not be disrupted.

1.4 SITE DESCRIPTION

PAF is located in Drakesboro, Kentucky along the west bank of the Green River and State Route 176. The plant sits inside the eastern border of Muhlenberg County as depicted below in **Figure 1**. The plant features three units, completed between 1963 and 1970, and three large natural-draft cooling towers. Units 1 and 2 were retired in 2017.

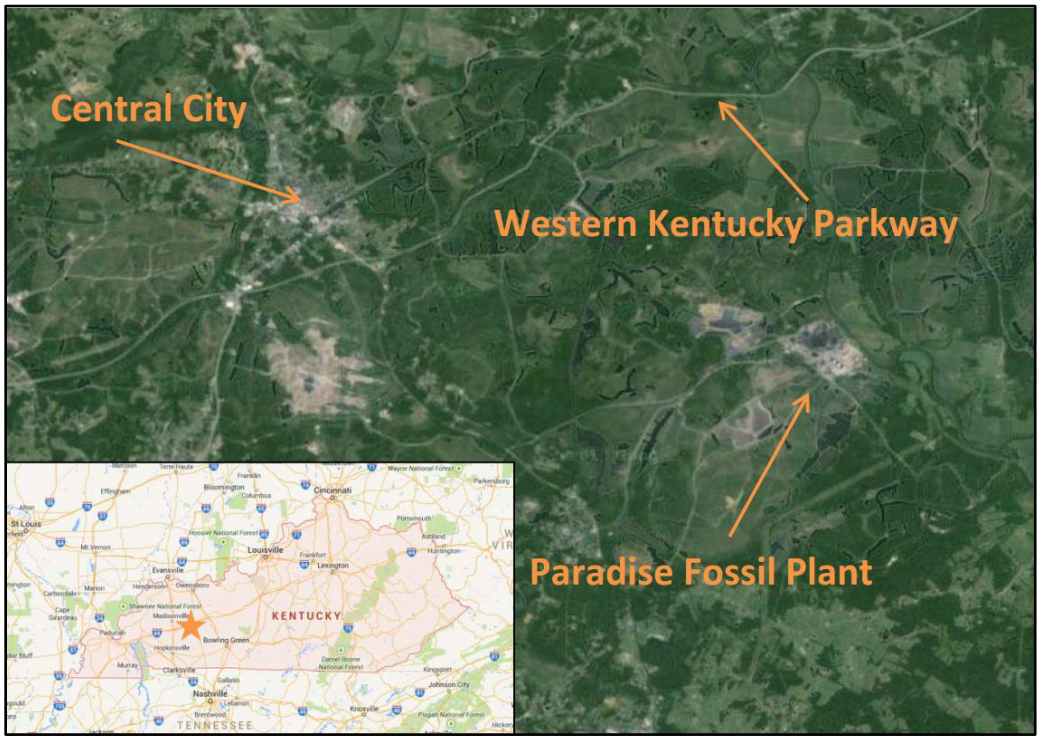


Figure 1: TVA PAF Site Location

Slag Ponds 2A and 2B and Slag Stilling Pond 2C are active and located northeast of PAF, east of the existing coal pile, and immediately west of the Green River. The ponds are hydraulically connected, separated by internal splitter dikes, and have a total surface area of approximately 32.2 acres.

Boiler slag is sluiced into the south end of Slag Pond 2A, which serves as the primary solids collection pond. Slag Pond 2A is located east of the existing coal pile and immediately west of Slag Pond 2B. Slag Pond 2A has a wetted surface area of approximately 16.5 acres. Accumulated slag is continually excavated and stockpiled for dewatering at the south end of the pond, where it is later removed for beneficial reuse. Slag Pond 2A discharges through three (3) culverts that convey water through a divider dike into the north end of Slag Pond 2B. Slag Pond 2B is located immediately east of Slag Pond 2A and has a wetted surface perimeter of

approximately 11.5 acres. After water passes through Slag Pond 2B, it is discharged through a spillway into Stilling Pond 2C. Stilling Pond 2C, having a wetted surface area of approximately 1.2 acres, sits along the southeast border of Pond 2B and to the west of the Green River. Water flowing south through Stilling Pond 2C is decanted into three 36-inch Reinforced Concrete Pipe (RCP) riser pipes which discharge through a permitted KPDES outfall into the Green River. **Figure 2** provides a current site overview.

Figure 2. Aerial View of Slag Pond Complex

2.0 REGIONAL GEOLOGY

PAF is located within the Shawnee Hills Section of the Interior Low Plateaus Physiographic Province in Northwestern Kentucky. Major geologic units in the area from the ground surface downward include Quaternary Age Alluvium and Residuum, the Upper Pennsylvanian age Sturgis Formation and the middle Pennsylvanian age Carbondale Formation. The Sturgis Formation is made up of the former Lisman and Henshaw formations. Unmined areas, particularly in the flood plain of the Green River, consist of Quaternary alluvial sands, silts, and clays. Upland areas may consist of up to 25 feet of residual material derived from the weathering of shale and sandstone bedrock materials. **Figure 3** shows the regional geologic formations surrounding PAF.

The Sturgis Formation (containing the former Lisman Formation) consists of interbedded sandstone, siltstone, shale, limestone, and coal. The contact between the Sturgis and Carbondale formation is the top of the number 11 coal seam. The Carbondale Formation underlies the Sturgis and consists of alternating sandstone, siltstone, coal, silty shale, and limestone in some areas. It is the major coal producing formation in the western Kentucky Coal Field and includes Coal Seam Numbers 6 through 11. PAF is unique in that approximately half of the site is covered by strip mining spoils and underground coal mines. Extensive underground and strip mining operations across the area occurred from the 1960s through the 1980s, which

significantly altered the topography and geology of the site and its vicinity. Much of the mining targeted Kentucky Coal Seam Number 9 of the Carbondale Formation, but almost all of the area was strip mined to at least one of the shallower coal beds. The site and surrounding area are underlain by mine spoil deposits from previous mining operations. These spoils consist of up to 100-feet of sandy silty and gravelly clay mixed with coal and occasional sandstone boulders and gravel layers.

3.0 SITE GEOLOGY/FAULTING

Recent geotechnical information for Slag Ponds 2A and 2B was gathered for a Geotechnical Exploration and Analysis for CCR Rule Compliance in December 2015 by AECOM. The raised dike was found consisting of moist, stiff, lean clay (CL) with some rock fragments. This raised dike consisted of mine spoils and varied in height from 8 to 13 feet in thickness. Below the raised dike, the original dike consisted of moist, silty, lean clay (CL) with irregular quantities of silt, sand, coal and rock fragments. The original dike appears to have also been constructed using mine spoils and varies in height from 6 to 15 feet.

3.1 SITE FAULTING

In accordance with *40 CFR § 257.62(a),* AECOM identified Holocene fault systems within proximity to the site. PAF is located between two subparallel, east-northeast trending fault systems: the Pennyrile fault system, located about 3 miles southeast of the plant site, and the Rough Creek Fault system, situated approximately 17 miles northwest of the site. Based on a review of the United States Geologic Survey (USGS) website which contains information on faults and associated folds in the United States that are believed to be sources of M>6 earthquakes during the Quaternary Period (the past 1,600,000 years including Holocene Epoch), there are no known faults of the Holocene Period located within the vicinity of PAF. Despite the presence of major fault systems in the region, no evidence of significant faulting from the Holocene Period has been observed at the plant site (TVA 2003).

The USGS information and geologic studies carried out by TVA indicate that the site and surrounding area may be subject to events primarily emanating from two Holocene fault zones– the New Madrid Seismic Zone of the central Mississippi Valley and the Wabash Valley Seismic Zone located along the border between Illinois and southwestern Indiana (See **Figure 4**). Furthermore, both fault zones exceed the 200 foot offset, the New Madrid Seismic Zone is located approximately 150 miles from PAF and the Wabash Valley Seismic Zone is approximately 225 miles from the site.

4.0 CONCLUSIONS

Based upon a review of the documented sources as presented above, fault lines in relation to Slag Ponds 2A and 2B and Slag Stilling Pond 2C have not been active during the Holocene Period and/or are not located within the specified 200 foot fault damage zone. Through the references listed below and the included figures, AECOM has determined that Slag Ponds 2A

and 2B and Slag Stilling Pond 2C at PAF meet the fault area requirements of the EPA Final CCR Rule 40 CFR §257.62. AECOM has determined that there are no reasonable expectations that faults will disrupt the integrity of Slag Ponds 2A and 2B, and Slag Stilling Pond 2C due to fault movement.

5.0 REFERENCES

- Kentucky Geological Survey, The University of Kentucky, July 6, 2016. Online Kentucky Geologic Map Information Service Map Accessed at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp

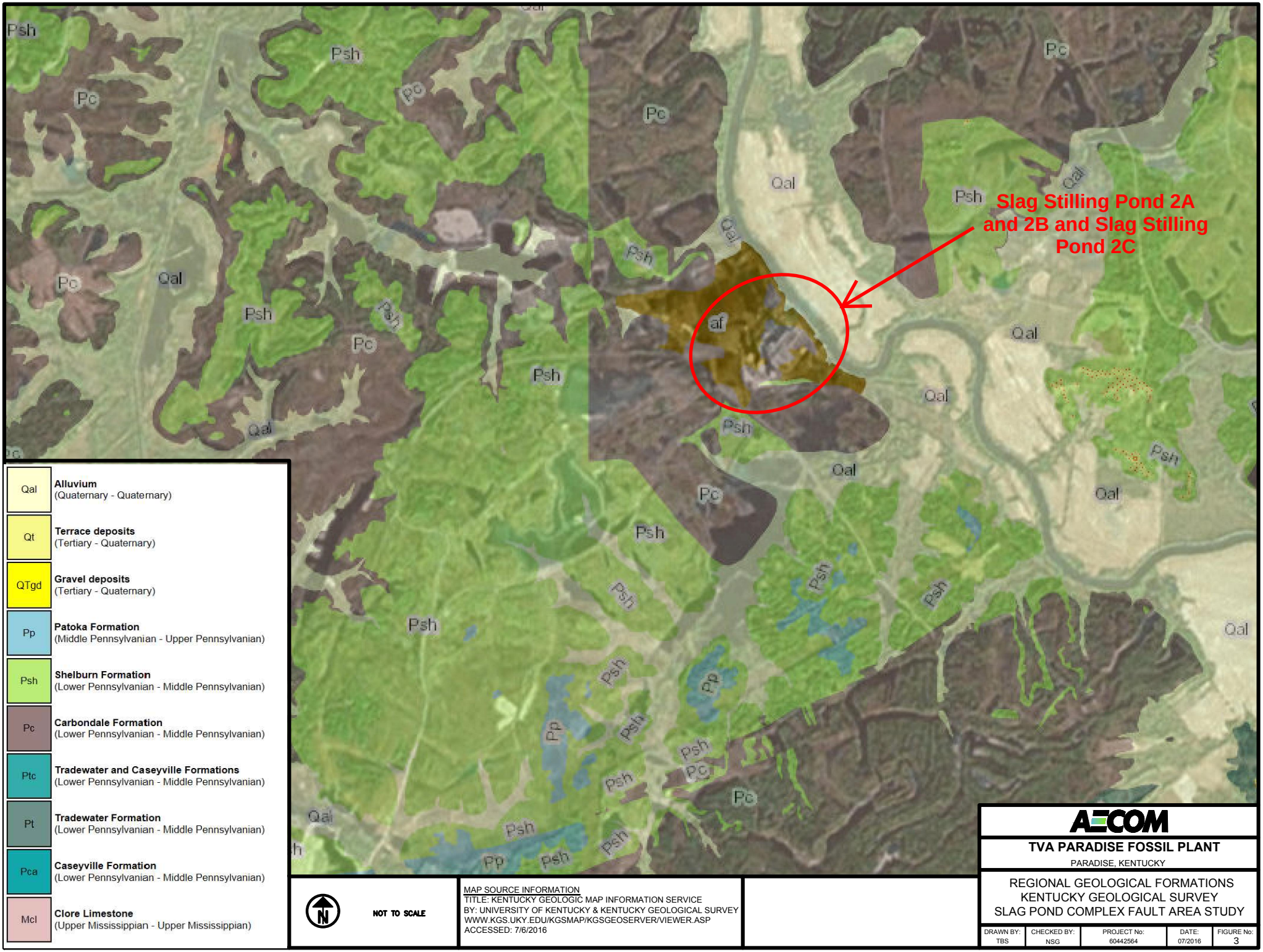
- Starn, J. Jeffrey., Robert W. Forbes, Charles J. Taylor, and Martin F. Rose, 1993, U.S. Dept. of the Interior, U.S. Geological Survey Water-Resources Investigations Report 93-4077. *Geohydrology of Parts of Muhlenberg, Ohio, Butler, McLean, Todd, and Logan Counties, Kentucky*.

- TVA 2003. Final Environmental Assessment, Installation of Flue Gas Desulfurization System on Paradise Fossil Plant Unit 3, Muhlenberg County, Kentucky, March 2003. Retrieved from http://www.tva.gov/environment/reports/paradise/index.htm (accessed December 2012).

- USEPA 2016b. Coal Combustion Residuals Impoundment Assessment Reports. Retrieved from https://www.epa.gov/coalash/coal-combustion-residuals-impoundmentassessment-reports (accessed December 2016).

- United States Geological Survey, July 6, 2016. Online Fault Map, Quaternary Faults and Folds Accessed at: http://earthquake.usgs.gov/hazards/qfaults/map/#qfaults

FIGURES



Qal	**Alluvium** (Quaternary - Quaternary)
Qt	**Terrace deposits** (Tertiary - Quaternary)
QTgd	**Gravel deposits** (Tertiary - Quaternary)
Pp	**Patoka Formation** (Middle Pennsylvanian - Upper Pennsylvanian)
Psh	**Shelburn Formation** (Lower Pennsylvanian - Middle Pennsylvanian)
Pc	**Carbondale Formation** (Lower Pennsylvanian - Middle Pennsylvanian)
Ptc	**Tradewater and Caseyville Formations** (Lower Pennsylvanian - Middle Pennsylvanian)
Pt	**Tradewater Formation** (Lower Pennsylvanian - Middle Pennsylvanian)
Pca	**Caseyville Formation** (Lower Pennsylvanian - Middle Pennsylvanian)
Mcl	**Clore Limestone** (Upper Mississippian - Upper Mississippian)

N

NOT TO SCALE

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BY: UNIVERSITY OF KENTUCKY & KENTUCKY GEOLOGICAL SURVEY
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ACCESSED: 7/6/2016

AECOM

TVA PARADISE FOSSIL PLANT
PARADISE, KENTUCKY

REGIONAL GEOLOGICAL FORMATIONS
KENTUCKY GEOLOGICAL SURVEY
SLAG POND COMPLEX FAULT AREA STUDY

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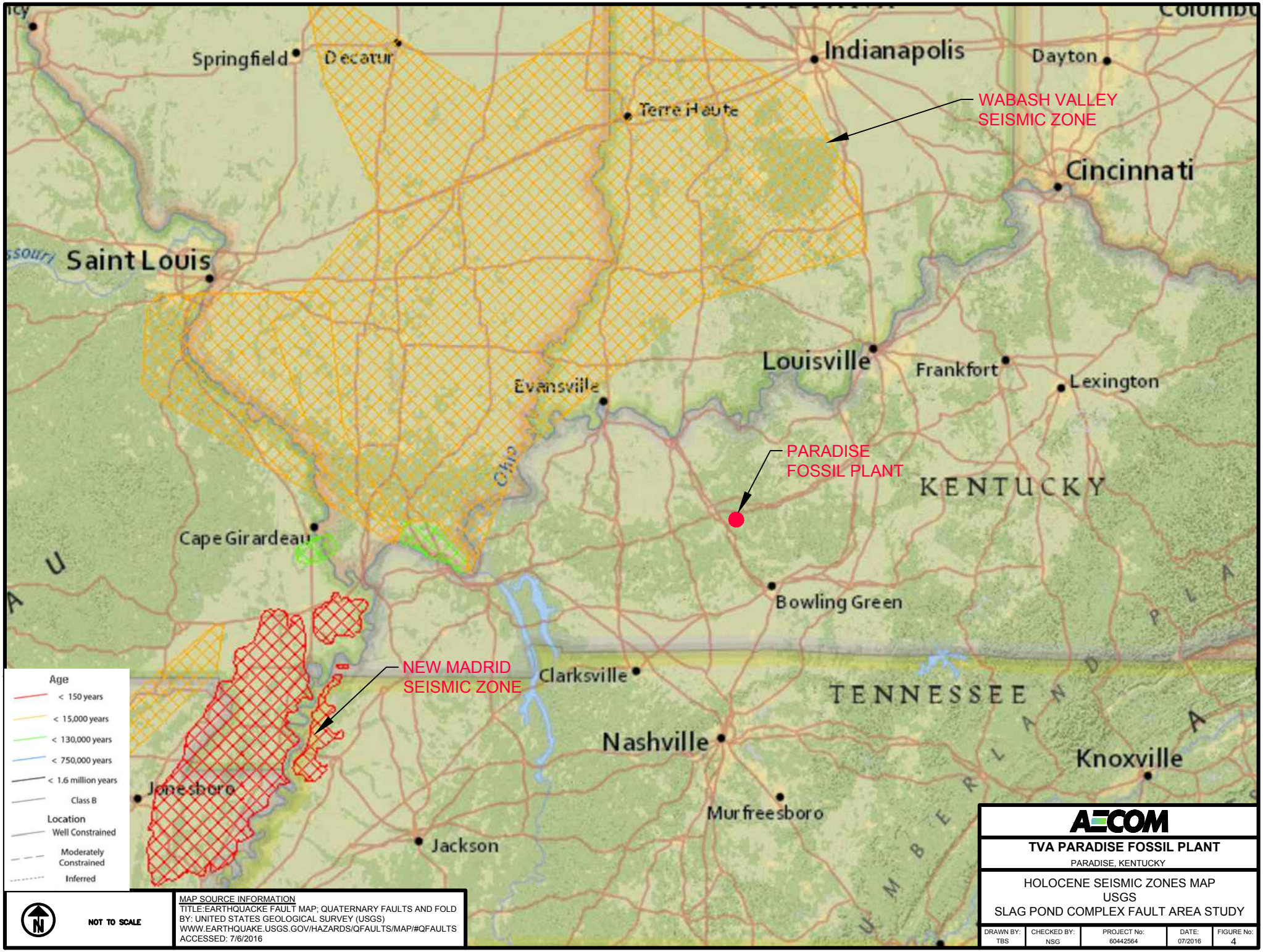
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FOSSIL PLANT
KENTUCKY
Cape Girardeau
Bowling Green
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AECOM
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PARADISE, KENTUCKY
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