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October 15, 2018

Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

Engineer's Certification of Fault Area Demonstration
Peabody Ash Pond
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) Peabody Ash Pond is 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 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.

Based upon a review of the documented sources as presented above and attached to this document, fault lines in relation to the Peabody Ash Pond have not been active during the Holocene Period and are not within the EPA Final CCR Rule specified 200 foot fault damage zone. Through the references listed below and the attached figures, AECOM has determined that Peabody Ash Pond at PAF meets 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 Peabody Ash Pond due to fault movement.

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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 Peabody Ash Pond meets the requirements of 40 CFR §257.62(a).

SIGNATURE _____ DATE 10/15/18

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ATTACHMENTS: Engineer's Certification of Fault Area Demonstration (40 CFR § 257.62) for Coal Combustion Residuals (CCR) Existing Surface Impoundment - Peabody Ash Pond

COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

TENNESSEE VALLEY AUTHORITY – PARADISE FOSSIL PLANT
PEABODY ASH POND
DRAKESBORO, KENTUCKY

FAULT AREA DEMONSTRATION (40 CFR §257. 62) FOR COAL COMBUSTION RESIDUALS (CCR)

EXISTING SURFACE IMPOUNDMENT

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 Residual 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 the Peabody Ash Pond at the Tennessee Valley Authority (TVA) Paradise Fossil Plant (PAF).

1.2 RULE REQUIREMENTS

The following excerpt is taken from the EPA's CCR Rule. It pertains to the fault area assessment of an existing surface impoundment:

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 demonstrate 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 the CCR unit must complete the demonstration required by paragraph 40 CFR § 257.62(a) by October 17, 2018.*

1.3 BACKGROUND

In accordance with 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, liner system, 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, constructed between 1963 and 1970, and three large natural-draft cooling towers. Units 1 and 2 were retired in 2017.

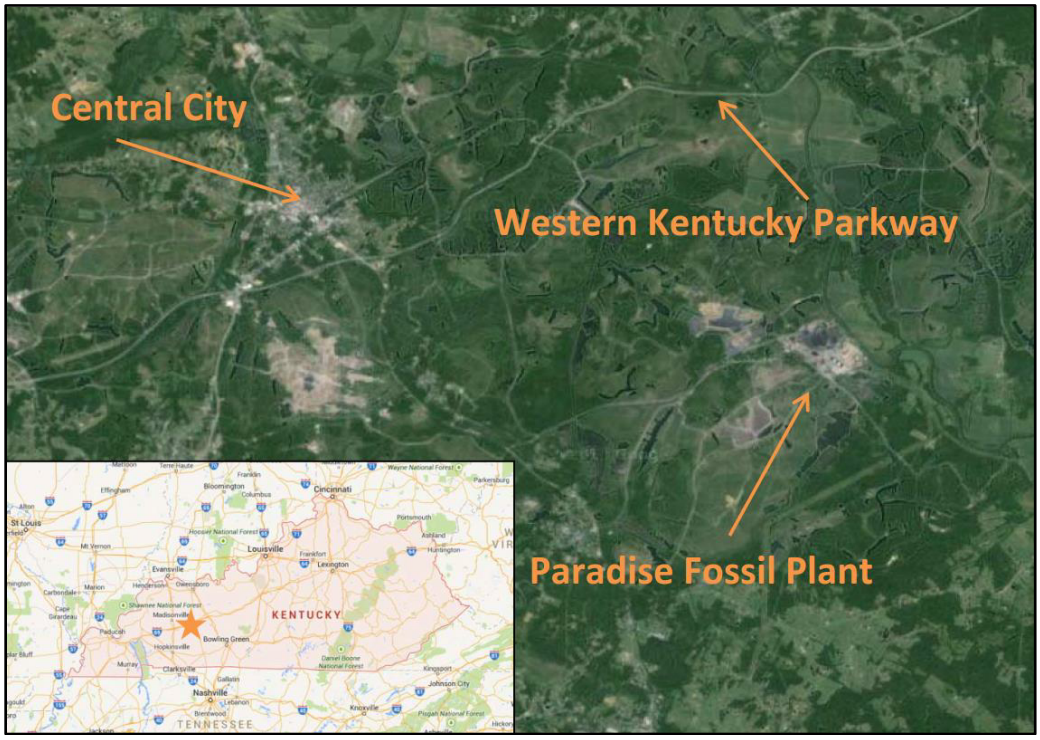


Figure 1: TVA PAF Site Location

TVA built the Peabody Ash Pond in the late 1980s. Extensive underground and strip mining operations occurred across the site from the 1960's through the 1980's, which significantly altered the topography and unconsolidated subsurface materials within the vicinity of PAF. The main plant and surrounding areas are built on fill and are primarily flat. Elevations of the PAF area from less than 400 feet MSL to over 550 MSL near the top of Peabody Ash Pond. Mining range resulted in a mining pond made by dikes along the southern and eastern sides of what today is called the Peabody Ash Pond (**Figure 2**). The impoundment has also been known as Jacob's Creek Ash Disposal Area Extension. The Peabody Ash Pond covers an approximate area of 120 acres and is used to manage process water flow and CCR waste during power generation.

Figure 2: Site Overview

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 consist of up to 25 feet of residual material derived from the weathering of shale and sandstone bedrock materials. The attached map, **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 siltly and gravelly clay mixed with coal and occasional sandstone boulders and gravel layers.

3.0 SITE GEOLOGY/FAULTING

Recent geotechnical information for Peabody Ash Pond was gathered for a Geotechnical Exploration and Analysis for the CCR Rule Compliance in December 2015 by AECOM. At that

time, four Seismic Cone Penetration Tests (CPT) performed for soundings were performed at the crest of the dike along the dam alignment. The CPT testing consisted of cone advancement and data collection, shear wave velocity testing, pore pressure and dissipation testing. The embankments of the Peabody Ash Pond dike consists of moist, stiff, lean clay (CL) with some rock fragments. The embankment materials consist of mine spoils, and the embankment was constructed in a controlled manner with compactive effort. The embankment fill extends from the crest elevation (approximately 408 feet) to elevations of approximately 400 feet to 395 feet, resulting in an embankment varying from 8 to 13 feet in thickness.

3.1 SITE FAULTING

In accordance with *40 CFR § 257.62(a)* AECOM identified historic fault systems within 3 to 17 miles 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 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 this age located within the vicinity of PAF. Despite the presence of major fault systems in the region, Pennyrile and Rough Creek respectively, no evidence of significant faulting from the Holocene period has been observed at the plant site (TVA 2003).

The U.S. Geological Survey (USGS) information and geologic studies carried out by TVA indicate that the site and surrounding area may be subject to events affecting the central portion of western Kentucky, (and thus the plant site), 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 (**Figure 4**). Site specific analyses have been performed that have determined the site meets the ASCE Standard “Minimum Design Loads for Buildings and Other Structures”. Furthermore, both fault zones are located outside of the 200 foot offset. The New Madrid Fault Zone is located approximately 150 miles from PAF, and the Wabash Valley Seismic Zone is approximately 225 miles from the site.

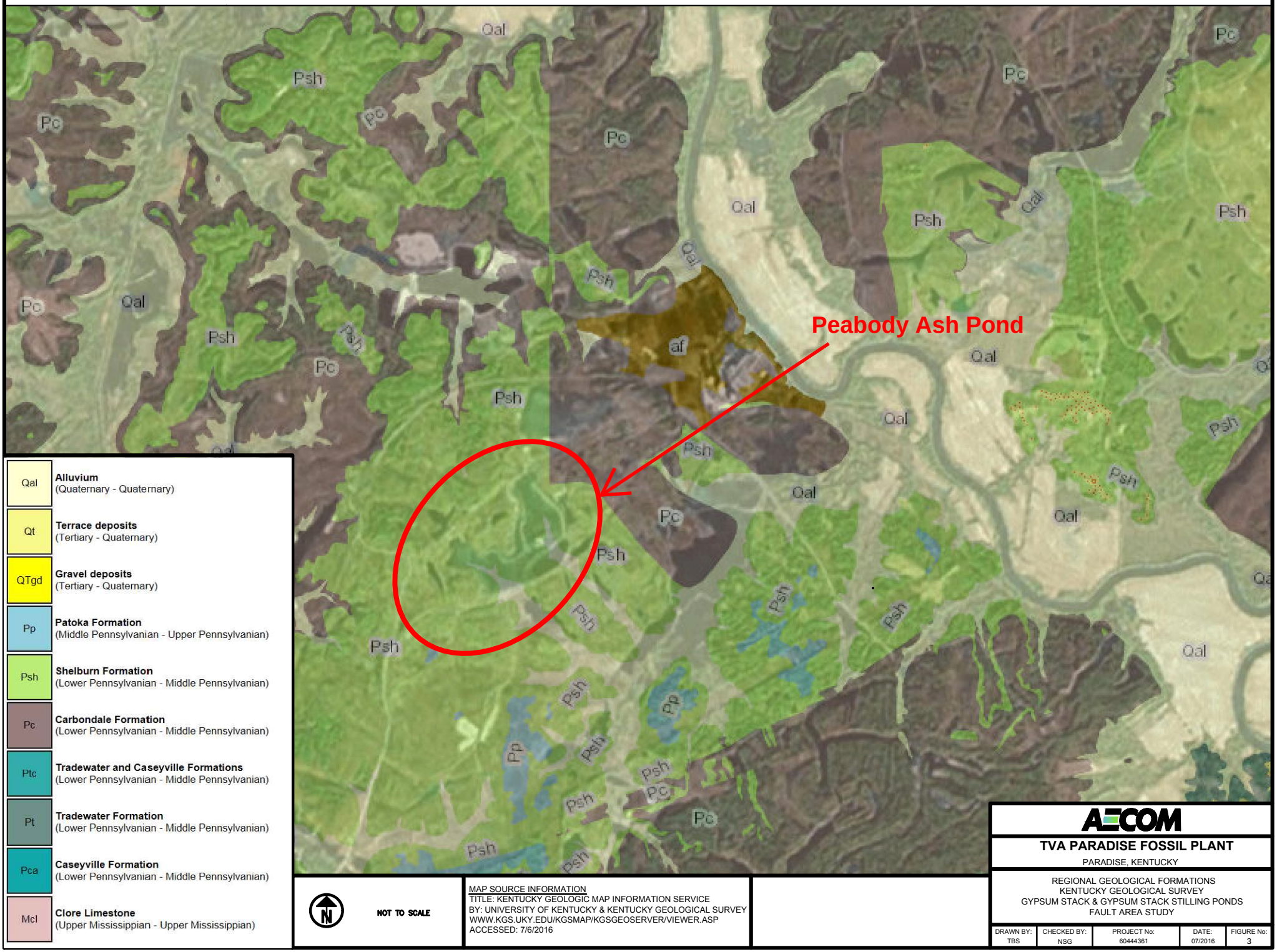
4.0 CONCLUSIONS

Based upon a review of the documented sources as presented above, fault lines in relation to the Peabody Ash Pond have not been active during the Holocene Period and/or are not in within the specified 200 foot fault damage zone. Through the references listed below and the attached figures, AECOM has determined that the Peabody Ash Pond 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 the Peabody Ash Pond due to fault movement.

5.0 REFERENCES

- 257-73(c) History of Construction at Paradise Fossil Plant Peabody Ash Pond. AECOM. 2016.
- 40 CFR 257.73(d) Initial Structural Stability Assessment, AECOM, 2016
- Final Environmental Assessment, Installation of Flue Gas Desulfurization System on Paradise Fossil Plant Unit 3, Muhlenberg County, Kentucky, TVA 2003, http://www.tva.gov/environment/reports/paradise/index.htm.
- Kentucky Geological Survey, The University of Kentucky, July 6, 2016. Online Kentucky Geologic Map Information Service Map, http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp
- Online Fault Map, Quaternary Faults and Folds, United States Geological Survey, July 6, 2016. http://earthquake.usgs.gov/hazards/qfaults/map/#qfaults
- 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*.
- USEPA 2016b. Coal Combustion Residuals Impoundment Assessment Reports. https://www.epa.gov/coalash/coal-combustion-residuals-impoundmentassessment-reports.

FIGURES


Peabody Ash Pond
Qal
Psh
Pc
af
Pp
Ptc
Pt
Pca
Mcl
Qt
QTgd
Alluvium
(Quaternary - Quaternary)
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(Tertiary - Quaternary)
Gravel deposits
(Tertiary - Quaternary)
Patoka Formation
(Middle Pennsylvanian - Upper Pennsylvanian)
Shelburn Formation
(Lower Pennsylvanian - Middle Pennsylvanian)
Carbondale Formation
(Lower Pennsylvanian - Middle Pennsylvanian)
Tradewater and Caseyville Formations
(Lower Pennsylvanian - Middle Pennsylvanian)
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ACCESSED: 7/6/2016
AECOM
TVA PARADISE FOSSIL PLANT
PARADISE, KENTUCKY
REGIONAL GEOLOGICAL FORMATIONS
KENTUCKY GEOLOGICAL SURVEY
GYPSUM STACK & GYPSUM STACK STILLING PONDS
FAULT AREA STUDY
DRAWN BY: TBS
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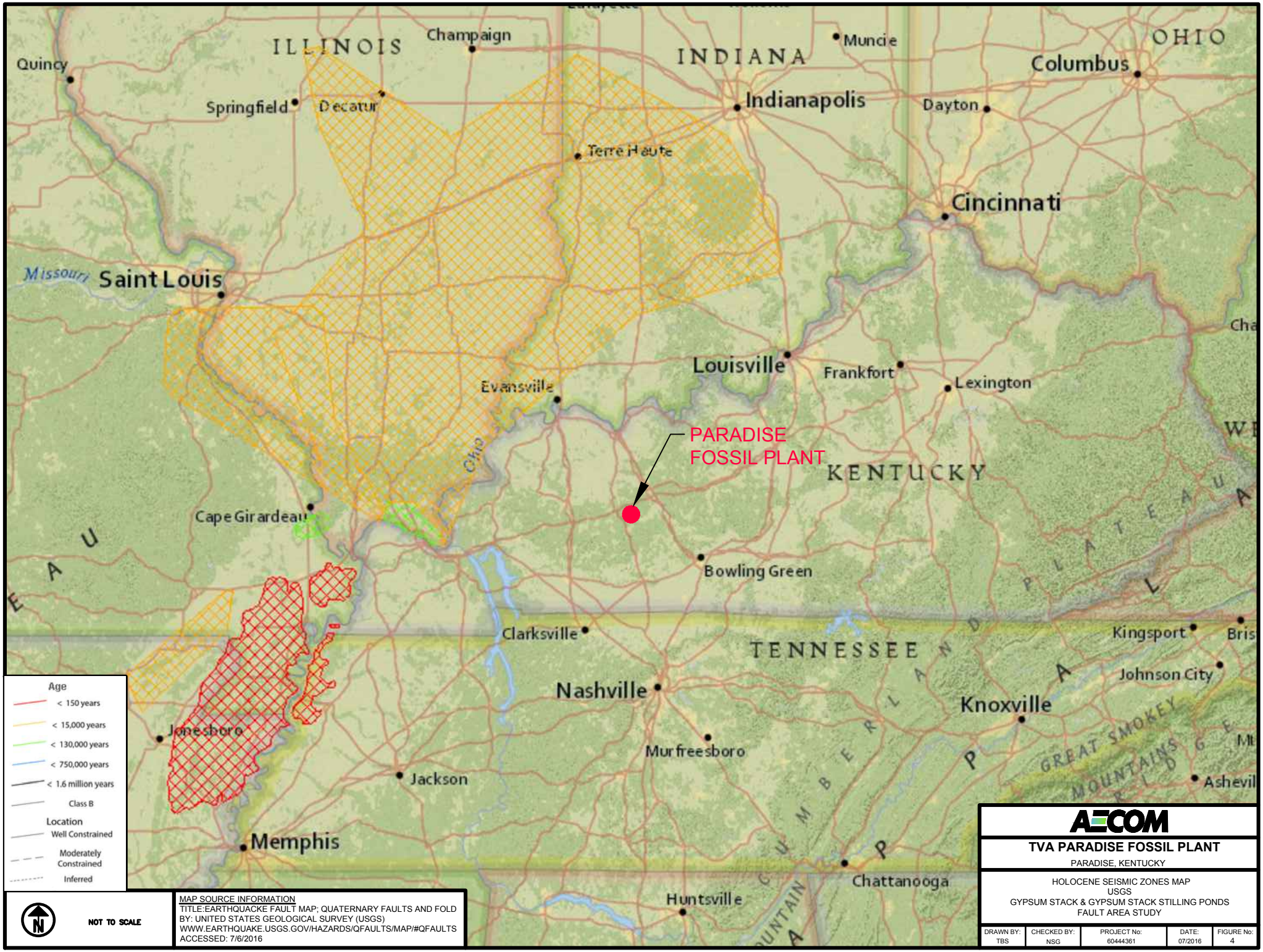
PROJECT No: 60444361
DATE: 07/2016
FIGURE No: 3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AECOM
TVA PARADISE FOSSIL PLANT
PARADISE, KENTUCKY
HOLOCENE SEISMIC ZONES MAP
USGS
GYPSUM STACK & GYPSUM STACK STILLING PONDS
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