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March 26, 2018

Tennessee Valley Authority
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Chattanooga, Tennessee 37402

Engineer's Certification of Fault Area Demonstration
New CCR Landfill
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 New CCR Landfill is in compliance with the Fault Area location requirements specified in the Final CCR Rule at 40 CFR §257.62. Presented below is the project background, summary of findings, limitations and certification.

2.0 BACKGROUND

During active fault movement, earth displacement where the ground may be bent or warped typically occurs within a zone spanning 200 feet from the fault line. 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 danger 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

TVA intends to construct a new CCR landfill at the PAF facility to provide long-term disposal capacity for CCR materials (fly ash, boiler slag, and gypsum) produced by the facility.

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.

Based upon a review of the documented sources as presented above, fault lines in relation to the proposed New CCR Landfill 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 the New CCR Landfill at the TVA Paradise Fossil Plant 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 the New CCR Landfill due to fault movement.

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4.0 CERTIFICATION

I, Michael Brian Cole, being a Registered 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 the accepted practice of engineering and that the information contained herein is accurate as of the date of my signature below. I further certify, for the above-referenced CCR Unit, that the Fault Area Demonstration for CCR dated March 26, 2018 meets the requirements of 40 CFR § 257.62(a).

M. Brian Cole
Printed Name

3/26/18
Date

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ATTACHMENTS: Fault Area for CCR - New CCR Landfill

COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

TENNESSEE VALLEY AUTHORITY – PARADISE FOSSIL PLANT
NEW CCR LANDFILL
DRAKESBORO, KENTUCKY

FAULT AREA DEMONSTRATION FOR CCR
NEW CCR LANDFILL

Prepared for

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

March 26, 2018 – Rev 0

Prepared by

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FIGURES

1.0 INTRODUCTION

1.1 OBJECTIVE

The purpose of this demonstration is to document 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.

1.2 RULE REQUIREMENTS

According to 40 CFR §257.62(a) of the EPA Final CCR Rule, new CCR landfills must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene times unless the owner or operator demonstrates that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

1.3 BACKGROUND

During active fault movement, earth displacement where the ground may be bent or warped typically occurs within a zone spanning 200 feet from the fault line. In accordance with 40 CFR §257.62(a), all new and existing CCR impoundments, new landfills, and lateral expansions must not be located within 60 meters (200 feet) of the outermost danger 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

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.

1.4 SITE BACKGROUND

Tennessee Valley Authority (TVA) owns and operates the Paradise Fossil Plant (PAF) in Drakesboro, Kentucky. The plant is located along the west bank of the Green River along 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.

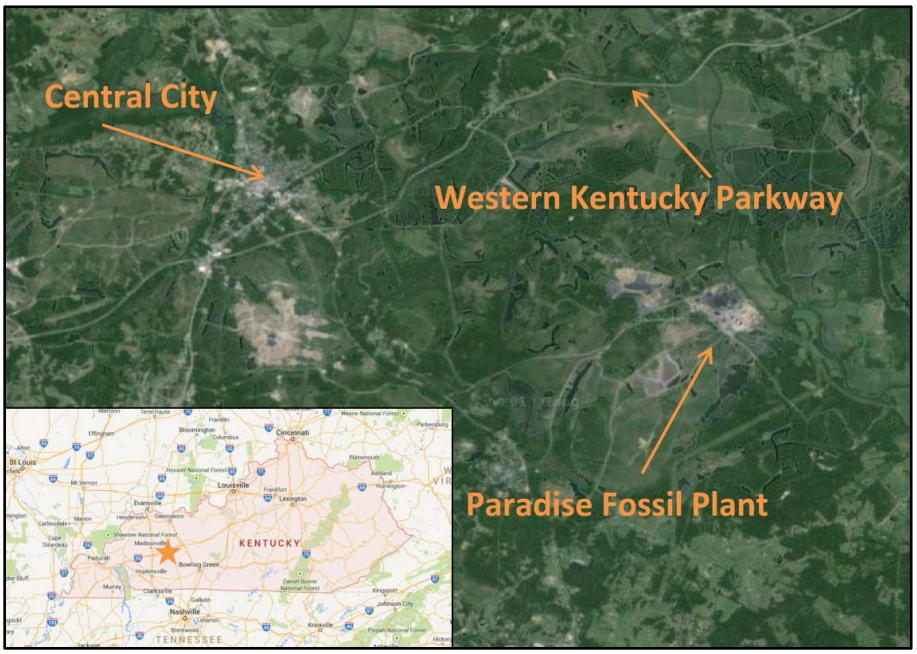

Figure 1: TVA PAF Site Location

1.5 SITE DEVELOPMENT

TVA will construct a new CCR Landfill in 8 stages. Construction of Cell 1A will commence in 2018. The proposed boundary of the proposed landfill is shown in Figure 2:

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 Plant.

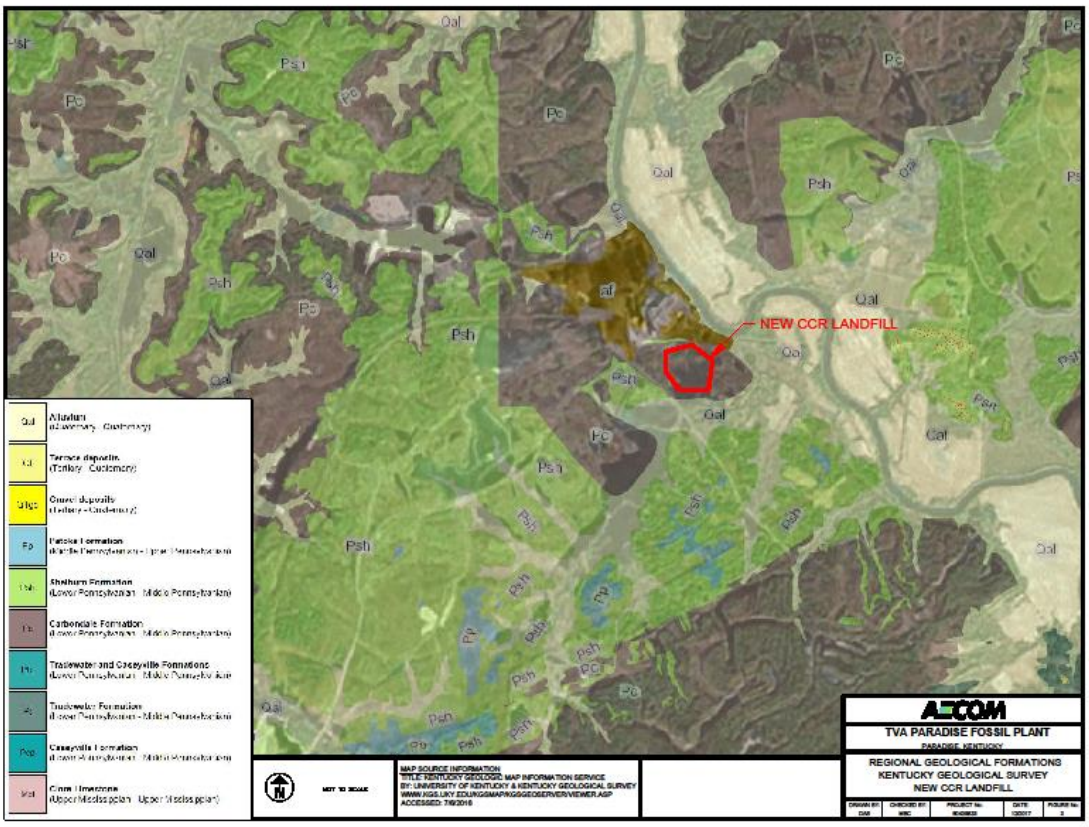

Figure 3. Regional Geological Formations, Kentucky Geological Survey

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. The spoils that underlie the proposed landfill typically extend to the deepest coal unit mined, which is Coal Seam Number 9.

3.0 SITE GEOLOGY/FAULTING

Recent geotechnical information for the proposed new CCR landfill included a Geotechnical Phase 2 Site Evaluation. The field investigation was conducted in May 2016, with associated report completed by AECOM in 2017.

The Phase 2 Site Investigation was performed from January to May 2016, and consisted of fifty five (55) borings ranging in depth from approximately 29.5 ft below ground surface (bgs) to 223.7 ft bgs. Borings were advanced through subsurface materials and into bedrock with 3¼-inch or 4 ¼-inch inner diameter hollow-stem augers. Upon encountering bedrock at eight (8) boring locations, 3.8-inch outside diameter (HQ-size) bits were used to recover intact rock cores.

Based on the conditions encountered in the borings performed during the investigations, the subsurface profile encountered during the explorations consisted of a soil layer, comprised primarily of fill, Coal Combustion Residuals (CCR) materials, and mine spoils, from the ground surface to bedrock. The bedrock is generally comprised of an upper shale unit, a sandstone unit, a lower shale unit, and the No. 9 Coal Seam. The No. 9 Coal Seam mine space is underlain by another shale unit. Unrecovered core losses were generally recorded in the rock core borings at the approximate elevation of the No. 9 coal seam. The unrecovered core losses were interpreted as voids ranging in thickness from about 5.2 to 7.9 feet, and were indicative of the presence of deep mines below the site.

3.1 SITE FAULTING

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. The borings performed by AECOM in 2016 and 2017 did not encounter conditions indicative of faulting. As such, despite the presence of major fault systems in the region, no evidence of significant faulting has been observed at the plant site.

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 emanate 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 exceed the 200 foot offset, the New Madrid Fault Zone is located approximately 150 miles (241,402 meters) from PAF and Wabash Valley Seismic Zone is approximately 225 miles (362,102 meters) from the site.

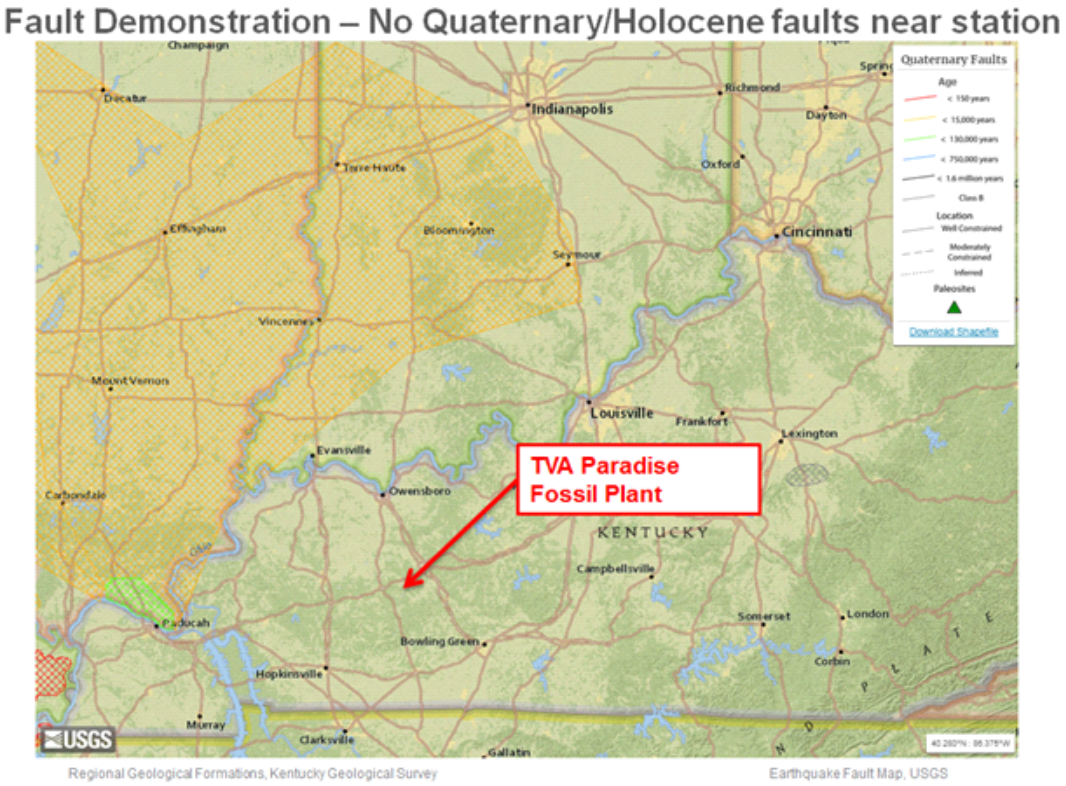

Figure 4. Earthquake Fault Map, USGS

CONCLUSIONS

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

4.0 REFERENCES

40 CFR 257.73(d) Initial Structural Stability Assessment, AECOM, 2016

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*.

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