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September 30, 2016

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

Initial Inflow Design Flood Control System Plan
Peabody Ash Pond
EPA Final CCR Rule
TVA Paradise Fossil Plant
Drakesborow, Kentucky

1.0 PURPOSE

This letter documents AECOM's certification of the initial inflow design flood control system plan for the TVA Paradise Fossil Plant's Peabody Ash Pond. Based on the assessment, the Peabody Ash Pond complies with the inflow design flood control requirements in the Final CCR Rule 40 CFR 257.82.

2.0 INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

As described in 40 CFR 257.82(c), an inflow design flood control system plan must be prepared to document how the inflow design flood control system has been designed and constructed to manage the design storm required by the hazard classification. Based on the Hazard Potential Classification, Peabody Ash Pond has been assigned a significant hazard potential classification rating. Thus, the 1,000 year storm event was selected from §257.82(a)(3) as the inflow design storm flood event based upon a hazard potential classification.

3.0 SUMMARY OF FINDINGS

The attached plan presents the analysis of the inflow design flood control system for the Peabody Ash Pond. The resulting water surface elevations are shown in the following table. The plan and results show that the impoundment meets the requirements set forth in 40 CFR 257.82(a) and (b).

Plant	Facility	Inflow Design Storm	Water Surface Elevation (feet)	Minimum Embankment Elevation (feet)
PAF	Peabody Ash Pond	1,000-year storm	407.1	407.4

AECOM

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Nicholas S. Golden PE, being a Professional Engineer in good standing in the State of Kentucky do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below; and
3. that the inflow design flood control system plan for the TVA Paradise Fossil Plant's Peabody Ash Pond meets the requirements specified in 40 CFR 257.82(a), (b), and (c)(1).

SIGNATURE _____ DATE 9/30/16

ADDRESS: AECOM
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ATTACHMENTS: Initial Inflow Design Flood Control System Plan

COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

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

INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN (40 CFR §257.82) FOR COAL COMBUSTION RESIDUALS (CCR)

EXISTING SURFACE IMPOUNDMENT

Prepared for

TVA

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

September 30, 2016 - Rev0

Prepared by

AECOM

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1.0 BACKGROUND

This plan outlines compliance to **Rule § 257.82** of the EPA Final CCR Rule.

The owner or operator of an existing CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in **Rule §257.82 (a),** which is directly stated below for clarity.

Rule §257.82(a)(1): The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood.

Rule §257.82(a)(2): The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood.

Rule §257.82(a)(3): The inflow design flood is:

(i): For a high hazard potential CCR surface impoundment, the probable maximum flood;

(ii): For a significant hazard potential CCR surface impoundment, the 1,000-year flood;

(iii): For a low hazard potential CCR surface impoundment, the 100-year flood; or

(iv): For an incised CCR surface impoundment, the 25-year flood.

According to **Rule §257.82(b)**, discharge from the CCR unit must be handled in accordance with the surface water requirements under **§257.3-3.**

Section **§257.82(c)(1)** states that the owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs **(c)(3)** and **(4)**. The plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of the section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record.

Section **§257.82(c)(2)** allows amendments to the written inflow design flood control system plan at any time and requires amendments to the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect. The revised plan must be placed in the facility's operating record.

Section **§257.82(c)(3)** requires that the initial inflow design flood control system plan be completed no later than October 17, 2016.

Section **§257.82(c)(4)** states that the owner or operator must prepare periodic inflow design flood control system plans every five years.

Section **§257.82(c)(5)** requires a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of **Rule §257.82**.

According to **Rule §257.82(d)**, the owner or operator must comply with recordkeeping, notification, and internet requirements specified elsewhere in the Rule.

1.1 SITE LOCATION

Tennessee Valley Authority (TVA) owns and operates the Paradise Fossil Plant (PAF) in Drakesboro, Kentucky. The plant is located along the southwestern side of the Green River along State Route 176. The Peabody Ash Pond is an active Coal Combustion Residual (CCR) impoundment that manages process water flow and CCR waste during power generation. Peabody Ash Pond is located in the southeast corner of the Paradise Facility. The pond currently serves as a waste water treatment and fly ash pond. An internal divider dike separates the main pond from the stilling pond located on the north end of the impoundment.

Figure 1: Site Overview

1.2 SITE HISTORY

The Peabody Ash Pond first existed as a mining pond. TVA converted the pond to a fly ash pond and raised the earth dikes from 400' to 408'. In September 1997, Peabody Ash Pond was put into service. In addition, a drainage ditch was added to convey process water and stormwater from the Gypsum Disposal Area to the Peabody Ash Pond.

2.0 EXISTING CONDITIONS - §257.82(a)(1)

Under existing conditions, the drainage area for the Peabody Ash Pond is approximately 1028 acres. The following areas are included in the Peabody drainage area:

- Dry Ash Storage Area 1
- Dry Ash Storage Area 2
- Metal Cleaning Waste Ponds A & B
- Office Trailer Complex
- Gypsum Disposal Area and Stilling Ponds 1 & 2
- Hydroditch and surrounding areas

The Peabody Ash Pond receives sluiced fly ash flows via an 8000-foot ditch that enters the pond near the southwest corner of the impoundment. Decant water flows to the stilling pond through an open channel in the internal divider dike. From the stilling pond, decant water is discharged to Jacob's Creek to the north of the impoundment via three RCP riser structures located in the stilling pond. The discharge is authorized by Kentucky Pollutant Discharge Elimination System (KYPDES) permit no. KY0004201 at Outfall No. 001.

3.0 METHODS / DESIGN CRITERIA

AECOM was contracted by the Tennessee Valley Authority (TVA) to conduct a hydrologic and hydraulic modeling analysis of the Peabody Ponds for compliance with the new Federal Register Coal Combustion Residual regulations (40CFR Part 257.82). A Hazard Potential Classification Assessment was previously completed for the Peabody Ponds. The impoundment was determined to be a "significant" hazard. Based on this classification, the regulations require that the ponds safely store and convey the 1000-yr storm event in addition to normal process flow conditions (40 CFR Part 257.82(a)(3)(ii)).

To assess the capacity of the ponds to store and convey the storm flows, a hydraulic model was created in HEC-HMS. HEC-HMS is a deterministic model and as such, assumes boundary conditions, initial conditions, and parameters of the model elements are exactly known. The model incorporates model element characteristics and meteorological data to calculate infiltration losses, runoff, and reservoir storage and flow conditions. The model was developed based upon Aerial LiDAR data and plans provided by TVA. The following table shows the storm that was analyzed.

The following table shows the storms that were analyzed. The 6-hour, 1000-year precipitation depth was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 2, Version 3.

Table 1: Rainfall Depth for Analyzed Storm

Reoccurrence Interval	Storm Duration	Rainfall Depth	Storm Distribution
1,000 year	6 hour	7.14 inches	SCS Type II

The Soil Conservation Service (SCS) Type II distribution for average conditions was selected for Paradise Fossil Plant in Drakesboro, Kentucky. SCS Curve Number method was used for estimating infiltration losses. SCS Unit hydrograph was used to transform precipitation into runoff for each subbasin. The pond routing method used was an outflow curve.

A base flow of 52 cfs or 33.6 MGD is considered for normal operating conditions, based on the Paradise Fossil Plant Wastewater Flow Schematic Rev 9-11. The normal operating water surface elevation of the Peabody Ponds is 405 ft. All structure dimensions and invert elevations are modeled using the best available information under current operating conditions of the PAF Plant. Existing topographic and survey information for the Peabody Ash Pond Complex was provided by TVA. Drainage areas, volumes, and other site geometry were determined using the AutoCAD Civil 3D software package in conjunction with survey data provided by TVA.

A detailed H&H modeling summary of the Peabody Ash Pond is provided in **Appendix A**. Computer model outputs provided demonstrate performance of the existing pond during the design storm event.

4.0 CALCULATION RESULTS - §257.82(a)(2)

The followings results represent the 1000-yr 6-hr storm being run through the existing Peabody Ponds with existing outlet structures in use. Inflow and outflow hydrographs can be found **Appendix A**.

The principal outlet structure for Peabody Ash Pond consists of three 48-inch diameter RCP riser structures with CMP skimmers located within the northeast corner of the stilling pond. The vertical risers transition into horizontal outlet pipes that discharge into Jacob's Creek approximately 360 feet to the northeast. The emergency spillway is a rip-rap overflow in a depressed section of the eastern dike with a minimum elevation of 407.4. The dikes surrounding Peabody Ash Pond have an elevation of 408.00.

Table 2: Peabody Ash Pond Estimated Peak Inflow and Estimated Peak Pool Elevation

Reoccurrence Interval	Storm Duration	Peak Inflow	Peak Pool Elevation	Notes
1,000 year	6 hour	2320 cfs	407.1 ft	0.3 ft. of freeboard remaining

5.0 CONCLUSIONS

The modeling results indicate the ponds would not overtop during a 1000-year, 6-hour design storm. The inflow design flood control system adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood. Discharge is handled in accordance with the surface water requirements under Final CCR Rule 40 CFR 257.82.

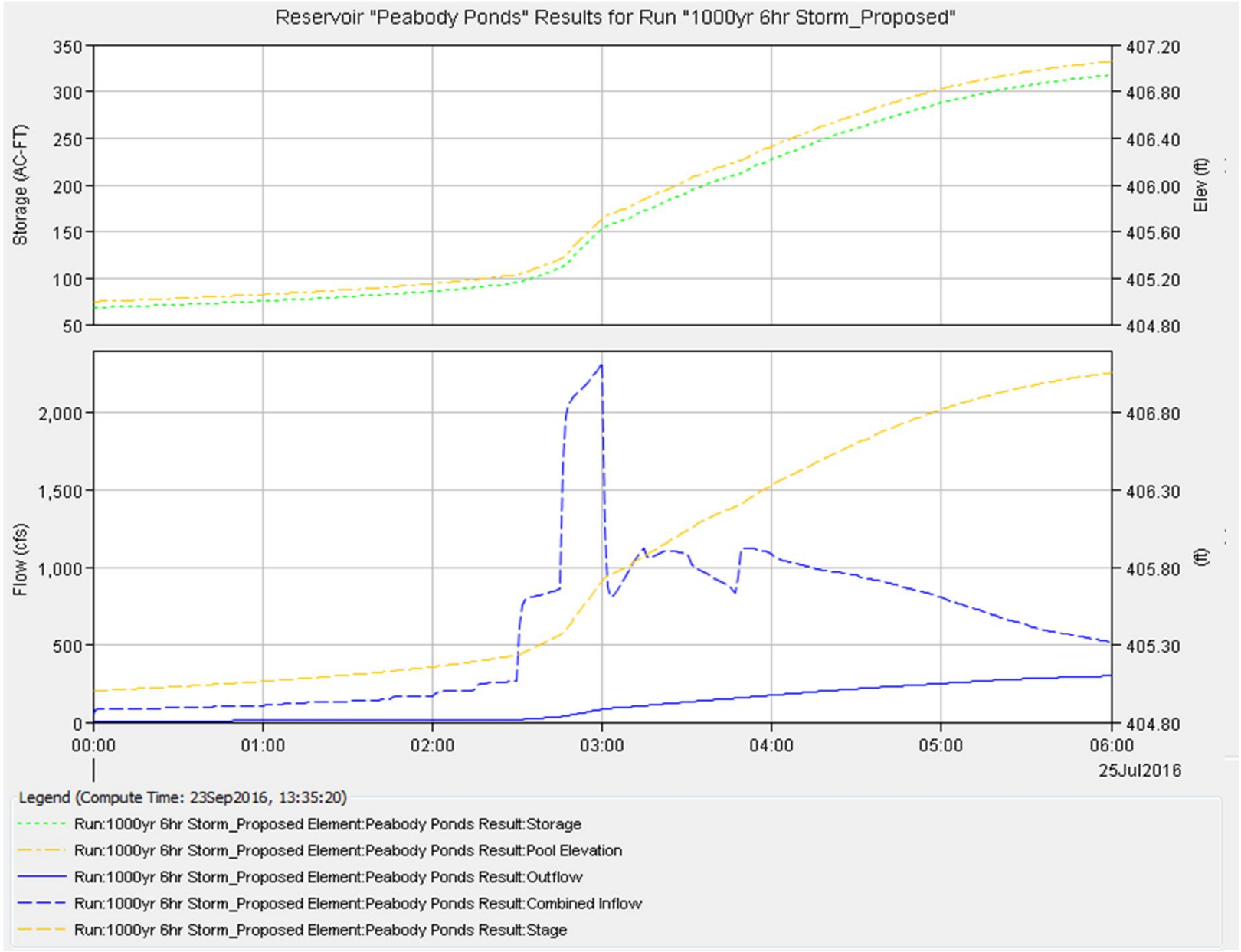
6.0 REFERENCES

The modeling results suggest the ponds would not overtop during a 1000-year, 6-hour design storm, and the freeboard for Peabody Ash Pond during this storm event is acceptable.

1. Environmental Protection Agency, "Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities", Federal Register, April 17, 2015.
2. AECOM, Peabody Ash Pond, History of Construction 257.73(c)(1) prepared for CCR Certification, 2016
3. Stantec Consulting Services Inc., Hazard Potential Classification Assessment, Peabody Ash Pond, 2016
4. National Oceanic and Atmospheric Administration, Atlas 14, Volume 2, Version 3; 2016
5. TVA, Paradise Fossil Plant Permit No. KY0004201 Wastewater Flow Schematic Rev 9-2011.
6. United States Army Corps of Engineers, Hydrologic Modeling System (HEC-HMS), Version 4.0, 2016.

APPENDIX A
HEC-HMS OUTPUT

Peabody Ash Pond
1000yr 6hr



Peabody Ash Pond
1000yr 6hr

Project: TVA PAF Peabody Simulation Run: 1000yr 6hr Storm_Proposed
Reservoir: Peabody Ponds

Start of Run:	25Jul2016, 00:00	Basin Model:	Peabody with Gypsum Stack
End of Run:	25Jul2016, 06:00	Meteorologic Model:	1000yr 6hr
Compute Time:	23Sep2016, 13:35:20	Control Specifications:	6hr

Volume Units: (•) IN ( ) AC-FT

Computed Results

Peak Inflow:	2319.9 (CFS)	Date/Time of Peak Inflow:	25Jul2016, 03:00
Peak Discharge:	297.4 (CFS)	Date/Time of Peak Discharge:	25Jul2016, 06:00
Inflow Volume:	3.63 (IN)	Peak Storage:	317.8 (AC-FT)
Discharge Volume:	0.65 (IN)	Peak Elevation:	407.1 (FT)