STRUCTURAL STABILITY ASSESSMENT
CFR 257.73(d)

Fly Ash Reservoir II

Cardinal Plant
Brilliant, Ohio

October, 2016

Prepared for: Cardinal Operating Company - Cardinal Plant

Brilliant, Ohio

Prepared by: Geotechnical Engineering Services

American Electric Power Service Corporation

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Columbus, OH 43215

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FLY ASH RESERVOIR II
CARDINAL PLANT

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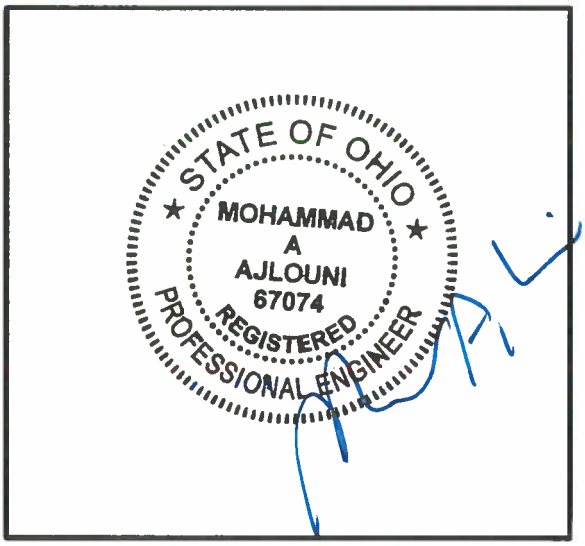
Manager – AEP Geotechnical Engineering



I certify to the best of my knowledge, information and belief that the information contained in this structural stability assessment meets the requirements of 40 CFR 257.73(d)

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1.0 OBJECTIVE 257.73(d)

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.73(d) and document whether the design, construction, operations, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices. This is the initial assessment as per the Rule.

2.0 NAME AND DESCRIPTION OF CCR SURFACE IMPOUNDMENT

The Cardinal Power Plant in Wells Township, Jefferson County, near the town of Brilliant in eastern Ohio. It is owned by Buckeye Power and AEP Generation Resources (GENCO) and is operated by Cardinal Operating Company. The facility operates two surface impoundments for storing CCR; the Bottom Ash Complex and Cardinal Fly Ash Reservoir II (FAR II) Dam. The focus of this report is the FAR II Dam.

The FAR II Dam is a valley filled dam with a unique structure whose current configuration is the result of the original earth fill dam and two separate raisings. The original earth fill dam (Stage 1) consisted of a 180 feet high arched earth embankment incorporating a zoned cross section. At 925 feet NGVD, the dam featured a 70-foot wide by 1,055-feet long crest. The maximum operating pool that could be achieved with the original configuration was El. 913. In 1997, the original dam was raised, referred to as Stage 2. Following this raising, the dam was 237 feet high with a 30-foot wide crest. In 2013, the dam was raised 13 feet using back-to-back MSE walls, bringing the dam into its current, Stage 3 configuration. The principal features of the typical section are the MSE wall themselves and a vinyl sheet pile wall extending from the existing clay core to the top of the PMF flood level for seepage cutoff purposes.

3.0 STABLE FOUNDATION AND ABUTMENTS 257.73(d)(1)(i)

[Was the facility designed for and constructed on stable foundations and abutments? Describe any foundation improvements required as part of construction.]

Since the overburden is saturated and appeared to be heterogeneous, with some material having a softer consistency than that of the sample tested, it was determined to be unsuitable as a foundation material, and was removed in the area beneath the dam and along the valley slopes up to approximately elevation 800 feet NGVD.

Based on the design drawings, a foundation key was constructed along the centerline of the dam. The key was excavated 6-8 feet into the rock beneath the dam and along the valley slopes up to approximately elevation 800 feet NGVD.

At the abutments location, a cut to rock was made at the proposed abutment. The orientation of the trimmed faces has been designed so that the upstream core of the dam intersects the abutments at right angles. This symmetrical configuration resulted in balanced seating of the clay core against the rock which reduces interface seepage and minimizes the potential for cracking of the core.

A grout curtain was provided in the abutments of the dam. The dam was arched in the upstream direction and camber was provided to compensate for settlement. Slope protection consisted of RCC

Facing for stage 2 in the upstream and grass and riprap on the downstream for stage 1 and 2 slopes with riprap in the groin of the dam. Stage 3 does not require slope protection.

Based on recent subsurface investigations, the density and description of the foundation materials are adequate for this CCR unit.

4.0 SLOPE PROTECTION 257.73(d)(1)(ii)

[Describe the slope protection measures on the upstream and downstream slopes.]

Slope protection consisted of RCC Facing for stage 2 in the upstream and grass on the downstream for stage 1 and 2 slopes with riprap in the groin of the dam. Stage 3 does not require slope protection. Any erosion that may occur is repaired within a timely period.

5.0 EMBANKMENT CONSTRUCTION 257.73 (d)(1)(iii)

[Describe the specifications for compaction and/or recent boring to give a relative comparison of density.]

The design drawings show that the embankment materials were to be compacted to 90% Modified proctor density. Recent borings through the embankment indicate that the material is stiff and representative of compacted earthen materials.

6.0 VEGETATION CONTROL 257.73 (d)(1)(iv)

[Describe the maintenance plan for vegetative cover.]

The vegetative areas are mowed to facilitate inspections and maintain the growth of the vegetative layer; and prevent the growth of woody vegetation.

7.0 SPILLWAY SYSTEM 257.73(d)(1)(v)

[Describe the spillway system and its capacity to pass the Inflow Design Flood as per its Hazard Classification.]

The spillway system consists of a primary weir box and pipe for normal operations and an open channel spillway to pass flood events. The CCR unit has a high Hazard rating and design flood is the PMF flood. The facility can safely pass this flood (PMF) without overtopping the dam crest.

7.1 SERVICE SPILLWAY

The existing service spillway is a vertical concrete shaft structure with side opening for effluent discharge connecting into a sloping concrete shaft structure with one side opening, four feet wide, connecting into a 54 inch diameter pre-stressed concrete cylinder pipe (PCCP), designed for 200 feet of internal hydraulic pressure and 200 feet of overburden pressure. During most operating conditions, discharge through the service spillway is controlled by the-weir flow over the side openings in the shaft. The bottom of the sloping concrete shaft and the entire 54-inch concrete pipe were constructed within bedrock as part of the 1997 raising. Stop logs are utilized to maintain settling action and control the operating pool level.

Results of the reservoir routings establish a maximum operating level of 974.0 feet, with the 50-year design flood reaching a level of 975.5 feet, 1.5 feet above the maximum operating pool.

7.2 EMERGENCY SPILLWAY

As of 2013 construction, the existing emergency was raised to El. 975.5 through the use of a mass concrete gravity section in conjunction with reinforced concrete training walls, in a manner similar to the existing configuration. The new walls direct the flow into the existing spillway outlet channel.

In accordance with State of Ohio dam safety requirements for Class 1 dams, the new emergency spillway was designed to pass the design probable maximum flood (PMF) without overtopping the dam. The new spillway features a 108 foot long by 15 foot wide concrete control section positioned at El. 975.5, or 1.5 feet above the maximum operating pool. The training walls are located above elevation 975.5 and will consequently not be exposed to a continuous pool reducing corrosion concerns.

Based on the flood routing, the calculated peak discharge from the dam is 5,409 cfs at a maximum pool elevation of 981.9 feet NGVD. The PMF routing was also checked with the service spillway blocked, which resulted in a maximum pool elevation of 982.8 and 0.2 feet of freeboard.

8.0 BURIED HYDRAULIC STRUCTURES 257.73 (d)(1)(vi)

[Describe the condition of the sections of any hydraulic structure that in buried beneath and/or in the embankment.]

The principal outlet pipe from FAR II Pond passes though the dam near the southwestern side of the impoundment. The portion of the outlet pipe that passes though the embankment is a 54 inch diameter pre-stressed concrete cylinder pipe (PCCP), designed for 200 feet of internal hydraulic pressure and 200 feet of overburden pressure. The entire 54-inch concrete pipe was constructed within bedrock as part of the 1997 raising. There are no performance issues with the outlet pipe that would indicate plugging or failure of the pipe. Given that this portion of pipe is reinforced concrete, structural integrity is not considered to be an issue. In general reinforced concrete pipe has a long service life under a range of conditions and is an appropriate design for this application.

Based on recent video inspection of the pipe, the concrete pipe is in excellent conditions with no signs of deformation or deterioration.

9.0 SUDDEN DRAWDOWN 257.73 (d)(1)(vii)

[If the downstream slope is susceptible to inundation, discuss the stability due to a sudden drawdown.]

The downstream slope of the Fly Ash Reservoir II is not expected to be inundated from any adjacent water bodies.