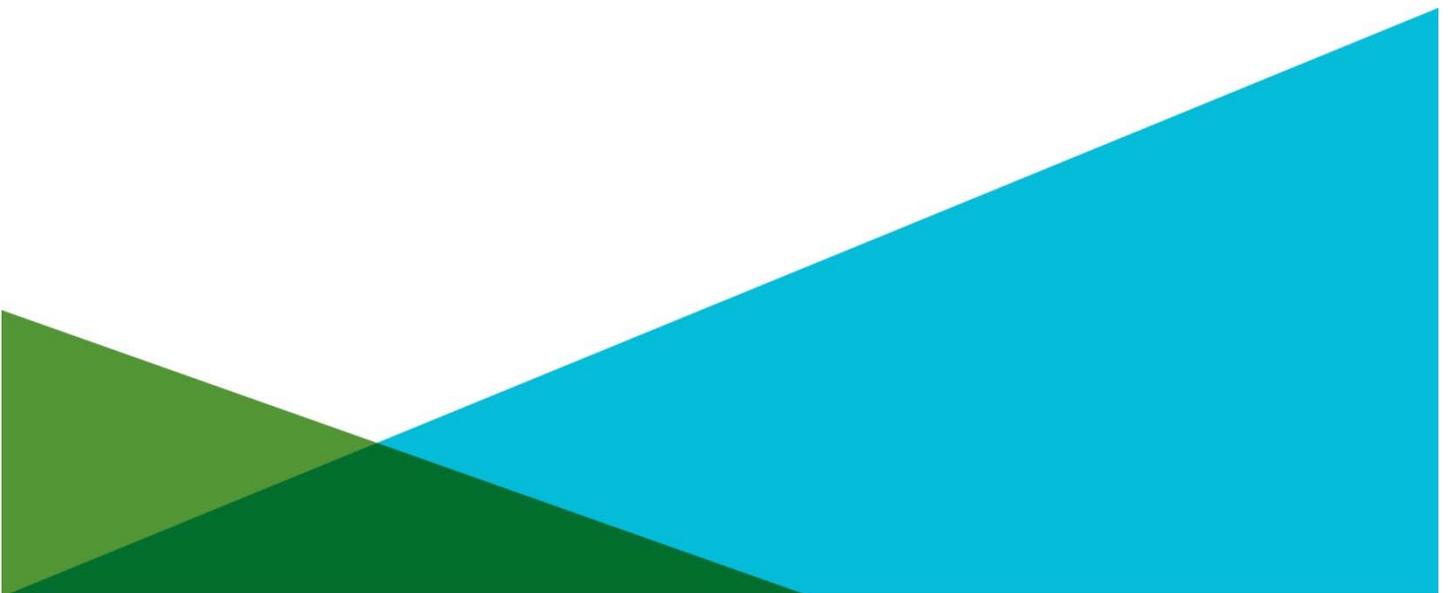


**REPORT ON**  
INITIAL PERIODIC STRUCTURAL STABILITY ASSESSMENT  
ASH POND  
KILLEN ELECTRIC GENERATING STATION  
MANCHESTER, OHIO

by Haley & Aldrich, Inc.  
Cleveland, Ohio

for Dayton Power & Light Company  
Aberdeen, Ohio

File No. 40373-447  
October 2016





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12 October 2016  
File No. 40373-447

Dayton Power & Light Company  
P.O. Box 468  
Aberdeen, Ohio 45101

Attention: Mr. Craig Spangler  
Leader, Commodities

Subject: Initial Periodic Structural Stability Assessment  
Ash Pond  
Killen Electric Generating Station  
Manchester, Ohio

Mr. Spangler:

Enclosed please find our report on the Initial Periodic Structural Stability Assessment for the Dayton Power & Light Company (DP&L) Ash Pond Coal Combustion Residuals (CCR) surface impoundment located at Killen Electric Generating Station in Manchester, Ohio.

This work was performed by Haley & Aldrich, Inc. (Haley & Aldrich) on behalf of DP&L in accordance with the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257, specifically §257.73(d).

The scope of our work consisted of the following: 1) obtain and review readily available reports, investigations, plans and data pertaining to the Ash Pond surface impoundment; 2) visit the site to observe the Ash Pond; 3) evaluate whether the design, construction, operation, and maintenance of the Ash Pond are consistent with recognized and generally accepted good engineering practices; and 4) prepare and submit this report presenting the results of our assessment including recommendations.

Dayton Power & Light Company

12 October 2016

Page 2

Thank you for inviting us to complete this assessment and please feel free to contact us if you wish to discuss the contents of the report.

Sincerely yours,  
HALEY & ALDRICH, INC.

A handwritten signature in black ink, appearing to read "S. Putrich", with a large, stylized flourish at the end.

Steven F. Putrich, P.E.

Vice President

Enclosures

# Table of Contents

	Page
<b>List of Figures</b>	<b>ii</b>
<b>1. General</b>	<b>1</b>
1.1 AUTHORITY	1
1.2 PURPOSE OF STRUCTURAL STABILITY ASSESSMENT	1
<b>2. Description and Operation of Ash Pond</b>	<b>2</b>
2.1 DESCRIPTION OF ASH POND	2
2.2 OPERATION, MAINTENANCE AND INSPECTION	3
<b>3. Structural Stability Assessment</b>	<b>4</b>
3.1 REVIEW OF EXISTING INFORMATION	4
3.2 SITE VISIT AND FIELD OBSERVATIONS	4
3.3 STRUCTURAL STABILITY ASSESSMENT	4
<b>4. Conclusions/Certification</b>	<b>8</b>
<b>Figures</b>	
<b>Appendix A – References</b>	

## List of Figures

Figure No.	Title
1	Project Locus
2	Site Plan

# 1. General

## 1.1 AUTHORITY

Haley & Aldrich, Inc. (Haley & Aldrich) has been contracted by Dayton Power & Light Company (DP&L) to perform the Initial Periodic Structural Stability Assessment for the DP&L Ash Pond Coal Combustion Residuals (CCR) surface impoundment located at Killen Electric Generating Station (KEGS) in Manchester, Ohio. This work was completed in accordance with the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257, specifically §257.73(d).

## 1.2 PURPOSE OF STRUCTURAL STABILITY ASSESSMENT

The purpose of this Initial Structural Stability Assessment was to document whether the design, construction, operation, and maintenance of the Ash Pond are consistent with recognized and generally accepted good engineering practices.

The scope of our work consisted of the following: 1) obtain and review readily available reports, investigations, plans and data pertaining to the Ash Pond surface impoundment; 2) visit the site to observe the Ash Pond; 3) evaluate whether the design, construction, operation, and maintenance of the Ash Pond are consistent with recognized and generally accepted good engineering practices; and 4) prepare and submit this report presenting the results of our evaluation, including recommendations.

## 2. Description and Operation of Ash Pond

### 2.1 DESCRIPTION OF ASH POND

The Ash Pond is located at DP&L's Killen Station in Manchester, Ohio. The Ash Pond is comprised of the Bottom Ash Pond and the Fly Ash Pond, but is considered to be a single impoundment by the Ohio Department of Natural Resources (ODNR). Therefore, for the purposes of this report, the overall impoundment is referred to as the "Ash Pond."

The Ash Pond was originally designed by Ebasco Services Incorporated, with construction completed in 1982. The function of the Ash Pond is to settle and store bottom ash and fly ash sluiced from the Killen Station generating unit, and to receive coal pile runoff and other waste waters from the plant.

The Ash Pond is bordered on the north by U.S. Route 52, on the south by the Ohio River, on the east by agricultural land, and on the west by the plant cooling tower, switchyard, and coal storage area.

The impoundment is surrounded on all sides by above-grade earthen embankments with low-permeability fill cores. The embankment height as measured from the crest to the exterior toe of slope ranges from 21 feet to 84 feet. Crest length of the Ash Pond is approximately 14,000 feet. Design crest elevation is El. 573 while actual elevations range from approximately El. 572 to El. 573. Interior and exterior slopes are designed at 2.5H:1V. At the design crest elevation, the Ash Pond is approximately 230 acres in area with storage of approximately 12,900 acre-ft.

After initial settling of bottom ash, flow from the bottom ash portion of the pond is conveyed to the fly ash portion through a concrete channel equipped with removable steel channel stop logs. In addition, a second outlet conveys flow from the bottom ash portion back to the plant for use as recycled make-up water for plant process. This water enters a 58-foot high concrete pump station intake tower and is conveyed back to the plant by gravity through a 36-inch diameter ductile iron pipe (DIP) which is installed inside of a 72-inch corrugated metal pipe (CMP) with open annulus. The 72-inch CMP is protected against corrosion by an asbestos bonded bituminous coating. The CMP is equipped with six 12-foot by 12-foot seepage collars where the pipe penetrates the Ash Pond embankment. A 36-inch stainless steel sluice gate is provided in the pump station tower to shut off flow from the impoundment to the plant as needed.

The fly ash portion of the Ash Pond has a single discharge point. A decant structure consisting of a 17-foot by 18-foot rectangular concrete overflow structure exists near the southwest corner of the impoundment. Water enters the overflow structure via dual weirs located on opposite sides of the structure. After entering the structure, water is conveyed through a 42-inch reinforced concrete pipe (RCP) to a 4-foot square vertical concrete standpipe. Water is conveyed from the standpipe by a 36-inch DIP which is installed through a 72-inch CMP with open annulus. The 72-inch CMP is equipped with four 12-foot by 12-foot seepage collars where the pipe penetrates the Ash Pond embankment. The 36-inch DIP outlets into a concrete energy dissipator structure and Parshall Flume. Flow from the flume enters a drainage ditch that discharges to the Ohio River.

## 2.2 OPERATION, MAINTENANCE AND INSPECTION

The Ash Pond is operated, maintained and inspected by DP&L personnel in accordance with DP&L's "Operation Maintenance and Inspection (OM&I) Manual" dated April 2014 (Reference 4).

DP&L has developed impoundment inspection forms and DP&L personnel are conducting 7-day inspections of the Ash Pond in accordance with EPA's Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257.83. In addition, the OM&I manual calls for annual visual inspections and semi-annual operational inspections to be performed by DP&L personnel, as well as inspections following heavy rain events. Five-year inspections are performed by Ohio Department of Natural Resources Dam Safety personnel.

Maintenance of the impoundment includes regular mowing of grass, seeding of thinly vegetated areas, control of woody growth, repair of erosion and riprap as needed, backfilling of animal burrows, and lubrication and inspection of pond drain mechanisms.

Operation includes regulating and monitoring wastewater discharge from the plant to the Ash Pond, regulating water levels in the pond, and monitoring discharges to the Ohio River.

### 3. Structural Stability Assessment

#### 3.1 REVIEW OF EXISTING INFORMATION

Ebasco Services Incorporated (Ebasco), the designer of the Ash Pond, conducted extensive subsurface explorations, laboratory testing and engineering analyses to support the design of the impoundment. The results of the field and laboratory program and engineering analyses were presented in their report entitled, "Final Engineering Report" dated August 1979 (Reference 6). The Ebasco report also included design drawings of the embankments and hydraulic structures, as well as earthwork specifications for construction of the impoundment.

For this assessment, Haley & Aldrich reviewed Ebasco's 1979 final engineering report and multiple other sources of information including: 1) report on the Initial Annual Inspection performed by DP&L in accordance with 40 CFR §257.83, dated December 21, 2015, 2) previous impoundment inspection reports by ODNR, GZA (on behalf of EPA), CEC, and DP&L, 3) OM& I manual, 4) Emergency Action Plan, 5) topographic plans and aerial photos, 6) settlement monitoring data for the Ash Pond embankments, 7) construction drawings, 8) geotechnical laboratory test results, 9) correspondence, and 10) a variety of other information in addition to verbal information provided by DP&L during our assessment.

#### 3.2 SITE VISIT AND FIELD OBSERVATIONS

On 16 March 2016, Haley & Aldrich visited Killen Station to observe conditions at the Ash Pond, and to meet with DP&L personnel to discuss operations and maintenance of the impoundment. Prior to the site visit, we reviewed previous inspection reports including the above-referenced Initial Annual Inspection Report by DP&L, and several previous inspection reports by ODNR, GZA, CEC, and DP&L.

#### 3.3 STRUCTURAL STABILITY ASSESSMENT

In accordance with 40 CFR §257.73(d), the owner or operator of a CCR surface impoundment must conduct initial and periodic structural stability assessments to determine whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

Haley & Aldrich reviewed the information provided to us and visited the site to observe the Ash Pond. Based on our review of available information and observations during our 16 March 2016 site visit, we have concluded the following in accordance with 40 CFR §257.73(d):

1. §257.73(d)(1)(i): *Stable foundations and abutments.*

Based on our review of available subsurface information, construction drawings, design reports, impoundment inspection reports, geotechnical test results, settlement monitoring data, and observations during our 16 March 2016 site visit, the Ash Pond impoundment was judged to have stable foundations. The Ash Pond embankments have not exhibited signs of excessive settlement, instability or other signs of inadequate foundation support.

2. §257.73(d)(1)(ii): Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.

Based on observations during our 16 March 2016 site visit, the interior slopes are well protected by riprap. The riprap was in generally good condition and was judged to provide adequate slope protection against surface erosion, wave action and adverse effects from sudden drawdown.

The downstream slopes are well vegetated with grass and judged to be in good condition. A number of areas were noted at the toe of the exterior slope where the soil was wet or where standing water existed. During our site visit, we observed no flowing water in the wet areas. These areas were noted in previous inspections and should be monitored during all future inspections.

3. §257.73(d)(1)(iii): Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

The Ash Pond construction specification written by Ebasco for Excavation, Backfill, Filling and Grading specifies systematic compaction of embankment fill using a vibratory steel drum roller imparting a minimum dynamic force of 72,000 lbs. The specifications required that "All backfill shall be compacted to a minimum of 95 percent of the maximum density obtained on the Modified Proctor Compaction Test (ASTM D1557 – Method C).....The in-place density shall be tested in accordance with any of the following: ASTM D2922, ASTM D1556 or ASTM D2167, to insure that the backfill has been properly compacted."

Based on our review of available information, the fill soils used to construct the Ash Pond embankments were mechanically compacted during construction.

4. §257.73(d)(1)(iv): Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection.

At the time of our 16 March 2016 site visit, the grass on the Ash Pond exterior slopes was typically less than 6 inches in height. The interior slopes are protected by riprap.

5. §257.73(d)(1)(v)(A): Spillway Erosion Protection – All spillways must be either: (1) Of non-erodible construction and designed to carry sustained flows; or (2) Earth- of grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

The Ash Pond includes three concrete spillway structures as described in 3.3.7 below. These structures were each judged to be in good condition with no evidence of degradation or erosion.

6. §257.73(d)(1)(v)(B): Spillway Capacity – The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a: (1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or (2) 1000-year flood for a significant hazard potential CCR surface impoundment; or (3) 100-year flood for a low hazard potential CCR surface impoundment.

The Killen Ash Pond is physically separated into two segments (Bottom Ash Pond and Fly Ash Pond) by an internal dike. The Bottom Ash spillway is located in the dike that divides the two portions of

the Ash Pond. The spillway from the Ash Pond consists of the concrete decant structure located in the southwest corner of the impoundment and ultimately directs the exiting water to the Ohio River. Because the impoundment is classified as High Hazard Potential, the spillway capacity was analyzed using the local 24-hour Probable Maximum Precipitation (Reference 11) via HydroCAD v10.0 stormwater modeling software. Both the Bottom Ash and Fly Ash Pond spillways were found to provide adequate capacity to convey the 24-hour PMP while maintaining greater than 1.0 ft of impoundment berm freeboard within each portion of the pond system.

7. *§257.73(d)(1)(vi): Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.*

The Ash Pond contains the following three hydraulic structures: 1) pump station inlet structure which conveys flow from the bottom ash area of the pond, through the embankment and back to the plant for make-up water, 2) the decant structure located in the fly ash portion of the pond which conveys flow through the embankment and to the discharge point to the Ohio River, and 3) the concrete channel that conveys flow from the bottom ash portion to the fly ash portion of the Ash Pond.

Based on observations during our 16 March 2016 site visit, as well as DP&L's Initial Annual Inspection performed in December 2015, and GZA's 2012 inspection for EPA, all three hydraulic structures are in good condition. The structures were free of obstructions and the concrete and mechanic equipment were judged to be in good condition. The 72-inch CMPs that penetrate the embankment are equipped with seepage collars and corrosion protection, and show no signs of leakage or other problems.

During construction, a temporary drain was installed which penetrated the Ash Pond embankment in accordance with the Ebasco drawings. The drain was filled with grout at the end construction in accordance with the Drawings. No seepage or soft ground has been observed in the vicinity of the de-commissioned drain.

8. *§257.73(d)(1)(vii): For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.*

The only water body in the vicinity of the Ash Pond is the Ohio River. The Ebasco construction drawings show the lowest level of the exterior toe of slope is at approximately El. 510, along the Ash Pond south embankment. Based on information obtained from the National Oceanic and Atmospheric Administration (NOAA), since construction of the Ash Pond was completed in 1982, the level of the Ohio River in the vicinity of Killen Station has exceeded El. 510 only one time. In 1997, the river reached El. 511, approximately 1 foot higher than the exterior toe of slope.

Historically, within the past 100 years, the water level in the Ohio River has exceeded El. 510 a total of seven times. Of these seven times, three exceeded El. 510 by less than 2 feet. On three other occasions, the river level exceeded El. 510 by 2.7 to 5.5 feet. The highest level ever recorded in the river was El. 526 in 1937.

Based on the above information, the possibility of inundation impacting the stability of the Ash Pond embankments is low and would potentially only reach the south embankment.

9. §257.73(d)(2): *Identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures.*

Based on observations of the Killen Ash Pond during our 16 March 2016 site visit, as well as our review of available subsurface information, impoundment inspection reports, construction records, design reports, geotechnical test results and other information, we did not identify any structural stability deficiencies in the Ash Pond.

#### 4. Conclusions/Certification

Based on our review of the information provided to us and observations during our 16 March 2016 site visit, it is our opinion that the design, construction, operation, and maintenance of the Ash Pond at Killen Station is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded in the Ash Pond.

#### Professional Engineer Certification

I certify that the Periodic Structural Stability Assessment for DP&L's Ash Pond at the Killen Electric Generating Station was conducted in accordance with the requirements of §257.73(d) of the USEPA's Final CCR Rule.

Signed:   
Consulting Engineer

Print Name: Steven F. Putrich  
Ohio License No.: 67329  
Title: Vice President  
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal and date:





LUCAS, ANDY Printed: 6/16/2016 10:59 AM Layout: PROJECT LOCUS G:\40373\_DP&LICAD-KS\GLOBAL\FIGURES\KILLEN POND STRUCTURAL STABILITY ASSESSMENT\40373 FIG-1-PROJECT LOCUS.DWG

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DAYTON POWER & LIGHT COMPANY  
KILLEN ELECTRIC GENERATING STATION  
MANCHESTER/WRIGHTSVILLE, OHIO

**KILLEN POND  
PROJECT LOCUS**

APPROXIMATE SCALE: 1" = 10 000'  
OCTOBER 2016

**FIGURE 1**

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Printed: 6/16/2016 11:03 AM Layout: SITE PLAN



**LEGEND**

--- APPROXIMATE KILLEN POND BOUNDARY

**NOTES**

1. AERIAL IMAGERY PROVIDED BY GOOGLE EARTH PRO. PHOTO TAKEN ON 8 OCTOBER 2013.



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DAYTON POWER & LIGHT COMPANY  
KILLEN ELECTRIC GENERATING STATION  
MANCHESTER/WRIGHTSVILLE, OHIO

**KILLEN POND  
SITE PLAN**

SCALE: AS SHOWN  
OCTOBER 2016

**FIGURE 2**

## **APPENDIX A**

### **References**

## References

1. Civil & Environmental Consultants, Inc., "Report on Coal Ash Impoundment Inspection," dated April 30, 2009
2. Dayton Power & Light Company, "Killen Station Ash Pond Annual Inspection," dated December 21, 2015.
3. Dayton Power & Light Company - Various weekly, monthly and annual impoundment inspection reports – Various dates
4. Dayton Power & Light Company, "Operation, Maintenance and Inspection Manual – Killen Station Ash Pond Dam," dated April 2014.
5. Dayton Power & Light Company, "Emergency Action Plan – Killen Station Ash Pond Dam," dated December 2012.
6. Ebasco Services Incorporated, "Final Engineering Report – Ash Disposal Pond, Dike and Foundation Studies," dated August 1979.
7. Ebasco Services Incorporated - Ash Pond Construction Drawings and Specifications, dated 1976-1979.
8. Ebasco Services Incorporated, "Ash Pond Dike Settlement Assessment," dated May 1994.
9. GZA GeoEnvironmental, Inc., "Final Report – Round 10 Dam Assessment, Killen Electric Generating Station, Bottom Ash Pond and Fly Ash Pond," dated August 16, 2012.
10. Ohio Department of Natural Resources, "Dam Safety Inspection Report," dated July 30, 2008.
11. Ohio Department of Natural Resources, "Probable Maximum Precipitation Application Guidelines," dated August 23, 2013.