DRAFT REPORT

Dam Safety Assessment of CCW Impoundments

Gallagher Generating Station

United States Environmental Protection Agency
Washington, DC

October 6, 2010

O'BRIEN & GERE
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13498/46122

Dam Safety Assessment of CCW Impoundments

Gallagher Generating Station

Prepared for:
US Environmental Protection Agency
Washington, DC

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1. INTRODUCTION

1.1. GENERAL

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the U.S. Environmental Protection Agency (USEPA) has initiated a nationwide program of structural integrity and safety assessments of coal combustion waste impoundments or "management units". A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations. This project is being conducted in accordance with the terms of our Order EP-CALL-0002 to Contract BPA# EP10W000673, dated April 8, 2010.

1.2. PROJECT PURPOSE AND SCOPE

The purpose of this work is to provide Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles downstream of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify environmental permits issued for the management units.
- Identify leaks, spills, or releases of any kind from the management units within the last 5 years.
- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for Ash Pond A and the Secondary Pond at the Gallagher Generating Station located in New Albany, Indiana. The above impoundments are owned and operated by Duke Energy. In the course of this assessment, we obtained information directly from and through interviews with representatives of Duke Energy.

2. PROJECT/FACILITY DESCRIPTION

2.1. GENERAL

The Gallagher Generating Station is located at 30 Jackson Street in New Albany, Indiana. A Site Location Map is included as Figure 1. The generating station was commissioned in 1970 and includes a coal-fired electrical power generating facility with four units each with a capacity of 150 megawatts (MW) gross generation capacity. The Gallagher Generating Station is a "peaking" facility which is only in service during peak electrical demand. Coal combustion waste that is produced during power generation is managed on-site with a CCW impoundment.

The facility utilizes three hydraulically-connected impoundments known as the Primary Pond, Ash Pond A and the Secondary Ash Pond for CCW management. The Primary Pond discharges into Ash Pond A; however, CCW material is hydraulically sluiced directly into Ash Pond A and not to the Primary Pond, which only receives discharges from the station waste tank drain, oil/water separator, concrete field storm drains, pipe tunnel drain, roof drains, ion exchange system, coal yard sump and waste water treatment plant. Since the Primary Pond does not contain CCW material, a checklist was not submitted for this pond and it has not been assessed in this report. The Secondary Pond is contiguous with Ash Pond A, but the two impoundments are separated by an internal divider dike.

2.2. MANAGEMENT UNIT DESCRIPTION

The three contiguous impoundments inspected during this safety assessment are identified on Figure 2 – Facility Layout Plan. None of the impoundments are regulated as dams by the Indiana Department of Natural Resources (IDNR).

2.2.1. Ash Pond A

Pond A is the southernmost pond and was commissioned in 1970. Bottom ash is hydraulically sluiced directly into Ash Pond A. The principal spillway outlet structure, located at the southeast corner of Ash Pond A, conveys flow through the separation dike and into the Secondary Ash Pond. The outlet structure contains an adjustable decanting weir which allows for management of the water level in Ash Pond A. The discharge pipe from this outlet structure is a 30" diameter corrugated metal pipe. Ash Pond A also has an emergency spillway overflow structure with four 30" corrugated metal pipes through the separation dike. Both the principal and emergency spillways have weir boxes for floatables control.

2.2.2. Secondary Pond

The Secondary Pond is the easternmost pond and was constructed in 1970 at the same time as Ash Pond A. The Secondary Pond serves as a secondary CCW solids settling basin before final discharge of water to the Ohio River. Overflow from the Secondary Pond is discharged to the Ohio River through an adjustable decanting weir structure located at the northeastern corner of the impoundment. The discharge from this outlet structure is via twin 30" pipes that lead into the Station's discharge tunnel, where the water is either recirculated by the Station or eventually discharged through an NPDES outfall to the river. The final discharge is permitted under NPDES # IN0002798.

2.3. HAZARD POTENTIAL CLASSIFICATION

Based on correspondence from Duke Energy in a response letter to USEPA dated March 27, 2009, none of the impoundments identified above are currently regulated by the State of Indiana Department of Natural Resources. In addition, none of the facilities are listed on the National Inventory of Dams. As such, no hazard classifications have been assigned to the CCW impoundments by any state or federal dam safety agency.

The definitions for the four hazard potential classifications (Less than Low, Low, Significant and High) to be used in this assessment are included in the EPA CCW checklist found in Appendix A. Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for Ash Pond A is Significant due to the potential for flooding of Route 111 in the event of a failure of the western embankment and the potential for overtopping and failure of the eastern embankment of the Secondary Pond in the event of a failure of the separation dike.

Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for the Secondary Pond is Low due to the reportedly minimal amount of CCW material in the pond. A breach in the eastern embankment of the Secondary Pond is not likely to release a significant amount of CCW material into the Ohio River.

2.4. IMPOUNDING STRUCTURE DETAILS

The CCW management units consist of two impoundments, which are contiguous but separated by an internal divider dike. The following sections summarize the structural components and basic operations of Ash Pond A and the Secondary Pond. The locations of these features at the Gallagher Generating Station are shown on Figure 2. Selected photographs taken during the inspection are presented in Appendices B and C and the locations of the photographs are shown on Figures 3 and 4.

2.4.1. Embankment Configuration

Ash Pond A

Ash Pond A is impounded by a diked embankment that extends along the western, southern and eastern sides of the pond and has a surface area of approximately 37 Acres. The total length of the embankment is approximately 3650 feet and the maximum height is about 30 feet. According to the Sargent & Lundy drawings, the upstream and downstream slopes were originally constructed at 2H:1V, but the raised section of the embankment was designed with steeper slopes of about 1H:1V.

Secondary Pond

The Secondary Pond is impounded by the separation dike between Ash Pond A and the Secondary Pond along the western side and a diked embankment along the eastern side. The pond is incised on the northern and southern sides and has a surface area of approximately 5 Acres. The length of each embankment is about 950 feet and the maximum height of the separation dike is approximately 29 feet. The eastern embankment slopes a considerable distance down to the Ohio River, but the embankment height to the bottom of the pond is about 20 feet. As for Ash Pond A, the upstream and downstream slopes of the separation dike are shown as 2H:1V with a 4-foot high raised section with 1H:1V slopes (although it appears that the embankment was only raised about 2 feet). The inboard slope of the eastern embankment is shown as 2H:1V and this embankment does not appear to have been raised.

2.4.2. Type of Materials Impounded

Currently, influent into Ash Pond A includes water with solids consisting primarily of bottom ash. Other waste waters from the waste tank station drain, oil/water separator, concrete field storm drains, pipe tunnel drain, roof drains, ion exchange system, coal yard sump and waste water treatment plant are also discharged to these ponds via the Primary Pond. Landfill storm drain and leachate effluent pipes also discharge into the southern end of Ash Pond A. The Secondary Pond receives only overflow discharge from Ash Pond A.

2.4.3. Outlet Works

Water flows from Ash Pond A to the Secondary Pond through a decant weir outlet structure that serves as the principal spillway. The outlet structure contains a stoplog system which allows for adjustment of the weir elevation and management of the water level. The outlet pipe from this overflow structure is a 30" corrugated metal pipe through the separation dike that discharges into the Secondary Pond. Ash Pond A also has an auxiliary overflow structure with four 30" corrugated metal pipes that serves as an emergency spillway. Weir boxes have been placed on the inboard side of both spillway structures to prevent solids and floating debris from entering the discharge pipes.

Water in the Secondary Pond flows into the Ohio River through a decant weir outlet structure that is similar to the Ash Pond A principal spillway. The outlet structure contains a stoplog system which allows for management of the water level. The outlet pipes from the overflow structure are twin 30" corrugated metal pipes that lead back toward the Station for potential recirculation or for discharge to the Ohio River. A weir box has been placed on the inboard side of the outlet structure to prevent floating debris from entering the pipes.

3. RECORDS REVIEWED

3.1 RECORDS REVIEWED

A review of the available records related to design, construction, operation and inspection of the Gallagher Generating Station CCW impoundments was performed as part of this assessment. The documents provided by Duke Energy include:

Table 3.1: Summary of Documents Reviewed

Document	Dates	By	Description
Site Survey	March 2009	ATC	Pond Survey
Visual Site Inspection Report	April 2009	ATC	Report on Inspection of Primary Pond, Secondary Pond and Ash Pond A Embankments
Drawing No. S-950	October 1996	Sargent & Lundy	Ash Pond Addition Plan & Sections
Drawing No. S-951	October 1996	Sargent & Lundy	Ash Pond Addition Discharge Structures
Drawing No. S-952	December 1994	Sargent & Lundy	Ash Pond Addition Details

3.2. ENGINEERING DOCUMENTS

Review of the ATC report and the Sargent & Lundy drawings (which were also appended to the report) revealed some information regarding the design and construction history for Ash Pond A and the Secondary Pond as follows:

Ash Pond A

- Ash Pond A was constructed in the 1972/1973 time frame.
- According to the ATC report, the embankments were constructed with on-site cohesive materials and the base of the pond was likely founded in cohesive soils.
- The Sargent & Lundy drawings show a proposed 4-foot raising of the western, southern, and eastern embankments; however, the ATC field survey indicates that the embankments were only raised about 2 feet.
- The pond was originally constructed with a principal spillway only, the emergency spillway was added at a later date.

Secondary Pond

- The Secondary Pond was constructed at the same time as Ash Pond A.
- The original outlet system was modified in 1985.

3.2.1. Stormwater Inflows

Given that the Gallagher Generating Station CCW impoundments are diked above surrounding grades, contributory drainage to the ponds appears to be limited to that precipitation which falls directly on the water surface and crest of the embankments; however, we understand that some limited but unknown quantity of storm water generated on upgradient plant areas is routed to the ponds.

The scope of this CCW impoundment assessment includes an evaluation of the ability of the management unit to safely pass an appropriate design flood up to the Probable Maximum Flood (PMF). Generally, Spillway Design Floods (SDF) are assigned on the basis of the hazard classification of the structure. The dam safety statutes or regulations provided by the State in which an impoundment is located may be considered for guidance in selecting the appropriate SDF for a CCW management unit.

The Indiana Dam Safety Guidelines classify dam hazard on the basis of potential loss of life or property damage, or interruption of highways, railroads, or important utilities in the event of a failure of the impounding structure. Failure of any of the Gallagher Generating Station CCW impoundments is not expected to result in loss of life, but could cause interruption of traffic along Route 111. Therefore, the impoundment would appear to be a Low or Significant Hazard category by IDNR criteria, which would result in an SDF in the range of the 100-year flood to 50 percent of the Probable Maximum Flood (1/2 PMF). Since hydrologic and hydraulic analyses are not available for review for the Gallagher Generating Station CCW ponds, their capacity to safely pass the 100-year flood or the ½ PMF is unknown. Based on the freeboard available in Ash Pond A and the Secondary Pond on the date of the inspection and the limited drainage area, it appears that the hydraulically-linked CCW impoundments could safely pass the ½ PMF; however the safe capacity (which avoids embankment overtopping) should be confirmed through a formal hydrologic and hydraulic analysis.

3.2.2. Stability Analyses

Slope stability analyses were not included in the ATC report and design documentation to support the Sargent & Lundy drawings is not available. Slope stability analyses may have been completed by Sargent & Lundy during the original design of the impoundment embankments; however, Duke Energy was not able to retrieve any of this information prior to the issuance of this report.

3.2.3. Instrumentation

The only instrumentation for the Gallagher Generating Station impoundments is for measurement of the water level of the Secondary Pond.

3.3. PREVIOUS INSPECTIONS

The CCW impoundments were previously inspected by ATC in March 2009. Based on the April 2009 inspection report, the overall condition of the impoundment embankments was considered to be Fair; however, Ash Pond A was considered to be Conditionally Poor due to the relatively high water level in the pond and the potential for overtopping of the embankments during a major storm event.

3.4. OPERATOR INTERVIEWS

Numerous plant and corporate personnel took part in the impoundment inspections and the review of records. The following is a list of participants for the inspection of Ash Pond A and the Secondary Pond:

Table 3.2: List of Participants

Name	Affiliation	Title
Owen Schwartz	Duke Energy	Environmental Specialist III
Bryan Walsh	Duke Energy	Station Manager
William Chanley	Duke Energy	Senior Engineering Technologist
Andrew Leininger	Duke Energy	Manager Resources II
Adam Deller	Duke Energy	Engineer I
Jeff Kling	Duke Energy	Senior EHS Professional
Ron Ehlers	Duke Energy	Senior Engineer
Kristie Beaven	Duke Energy	Engineering Manager
Bill Taylor	Duke Energy	Environmental Specialist II

4. VISUAL INSPECTION

The following sections summarize the inspections of Ash Pond A and the Secondary Pond, which were conducted on August 13, 2010. Following the inspections, O'Brien & Gere completed EPA inspection checklists for each ash pond, which were submitted electronically to EPA on August 20, 2010. Copies of the completed inspection checklists are included as Appendix A.

4.1. GENERAL

The weather on the date of the inspections was clear with temperature between 80 and 90 degrees. The visual inspections consisted of thorough site walks along the crest and downstream portions of both ash ponds. O'Brien & Gere team members made observations and took photographs along the crest, downstream slope and toe, and along accessible portions of the upstream slopes. The team also inspected the outlet structures.

Photographs of relevant features and conditions observed during the inspections were obtained by O'Brien & Gere and are provided in Appendices B and C for Ash Pond A and the Secondary Ash Pond, respectively. Site Plans of these ponds are presented as Figures 3 and 4, which also provide photograph locations and directions.

4.2. SUMMARY OF FINDINGS

Ash Pond A

The following observations were made during the visual inspection of Ash Pond A:

- The outlet channel from the Primary Pond terminates at its discharge point at the northwestern corner of Ash Pond A (Appendix B – Photo 1). The northwestern portion of the pond has been filled with bottom ash. The crest of the western embankment appears to be substantially wider than shown on the design drawings, primarily because of the ash that has been placed along the embankment and vegetation that has become established on the ash material (Appendix B – Photo 2).

- The drainage channel along the outboard toe of the western embankment is partially filled with water (Appendix B – Photo 3), presumably due to poor drainage since there is minimal grade along most of the length of this channel. As a result, the outboard slope of the western embankment is saturated and reedy vegetation has become established in the channel. However, the grade increases toward the southwestern corner of the pond (where the channel terminates and a 42" CMP outlet is visible) and the channel and outboard toe of embankment are dry for a short stretch in this vicinity (Appendix B – Photo 4).

- The outboard slope of the southern embankment ties into an abandoned road embankment (Old River Road). For the purposes of this report, the tie-in point is considered to be the outboard toe of the embankment; however, it should be noted that the abandoned road embankment slopes down to a lower elevation beyond the Ash Pond A embankment (Appendix B – Photos 6 and 7).

- The crest elevation of the western and southern embankments appears to be fairly uniform, except toward the southeastern corner of the pond where the embankment was raised for cover over the landfill leachate pipes (Appendix B – Photos 8 and 9). Spot elevations shown on the plan view presented in the 2009 ATC report indicate that the crest elevation of these embankments is about El. 442 (+/- 0.3 ft), which contrasts with the Sargent & Lundy drawings which show the crest raised to El. 444.

- Weir boxes (rather than trash racks) have been installed to prevent floating debris from entering both the principal and emergency spillways (Appendix B – Photos 10 and 11). The principal spillway appears to be in good condition and functioning as designed, with flow occurring into the Secondary Pond on the date of the inspection. Stop logs are used to adjust the overflow elevation of the principal spillway, as necessary.

- On the date of the inspections, the water surface elevation was approximately 3.3 feet below the principal spillway operating platform (Appendix B – Photo 12), which is shown at El. 440 in the Sargent & Lundy drawings. This would correspond to a pool elevation of about El. 436.7, which would provide at least 5 feet of freeboard to the embankment crest elevation. The records indicate that the normal pool elevation is El. 438, which would provide less than 4 feet of freeboard at the embankment crest low points.

- The eastern embankment divides Ash Pond A from the Secondary Pond, but the Secondary Pond water elevation was significantly lower than the Ash Pond A water elevation such that most of the outboard slope was visible (Appendix B – Photo 13). This slope is lined with rock fill and appears to be in stable condition.

Secondary Pond

The following observations were made during the inspection of the Secondary Pond:

- As noted above, the dike that separates Ash Pond A and the Secondary Pond serves as the western embankment of the Secondary Pond (Appendix C – Photo 1). The Ash Pond A principal spillway outlet pipe is located through the separation dike and, on the date of the inspection, water was discharging into the Secondary Pond. The pool elevation of the Secondary Pond was considerably lower than the Ash Pond A elevation. According to the ATC report, the normal pool elevation of the Secondary Pond is El. 427.

- On the date of the inspection, water was entering the Secondary Pond principal spillway riser pipe from beneath the weir box and discharging through the twin 30-inch outlet pipes (Appendix C – Photos 2 and 3).

- The crest of the eastern embankment is significantly lower than the western embankment (separation dike) crest. According to the surveyed spot elevations presented in the ATC report, the low point of the eastern embankment crest is approximately El. 433.8 while the remainder of the embankment crest is between El. 435 and 436.

- The inboard slope of the eastern embankment appeared to be relatively steep just above the pool elevation, indicating that erosion from wave action may be occurring in this vicinity. However, brush that had been recently cleared from the inboard slope was hanging over the water's edge in many locations, which could be giving the appearance of erosion (Appendix C – Photos 4 and 5).

- Large-sized riprap and mature trees cover the outboard slope of the eastern embankment, which also serves as the bank for the Ohio River (Appendix C – Photo 6). The riprap was presumably placed along the river bank to protect against erosion. According to Duke Energy personnel, the river level overtopped the eastern embankment of the Secondary Pond on at least one occasion in recent history.

- The eastern and western embankments of the Secondary Pond tie into natural ground at the northern and southern ends of the impoundment (Appendix C – Photo 7). Erosion gullies from landfill runoff are evident in the southern slope (Appendix C – Photo 8); however, this section does not constitute an embankment and the erosion does not pose a dam safety concern.

5. CONCLUSIONS

Based on the EPA ratings defined in the BPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspections, the overall condition of the dams is considered to be as follows:

Ash Pond A

The Ash Pond A impoundment is considered to be in **FAIR** condition**.** Based on the visual inspection, the embankments and the principal and emergency spillways appear to be in satisfactory condition and functioning as designed. Therefore, acceptable performance is expected under all required loading conditions. However, limited engineering documentation is available to substantiate that the embankments meet current slope stability criteria and that the spillways are capable of passing the appropriate Spillway Design Flood (SDF). Since there is minimal runoff to the pond and the reported normal pool elevation would allow nearly 4 feet of freeboard to the low point of the embankment crest (compared to the ½ PMF rainfall of less than 2 feet), the spillway system should be more than adequate to safely pass the SDF. Nonetheless, in the absence of proper engineering analyses and operational procedure information, Ash Pond A cannot be classified in the SATISFACTORY condition category. Several minor maintenance items should also be performed as described in Section 6 below.

Secondary Pond

The Secondary Pond impoundment is also considered to be in **FAIR** condition**.** As for Ash Pond A, the embankments and spillway appear to be in satisfactory condition and functioning as designed, and acceptable performance is expected under all required loading conditions. However, SDF and slope stability analyses are not available to document that current dam safety standards are being met; therefore, the Secondary Pond can only considered to be in FAIR condition. Several minor deficiencies were also noted during the inspection that should be addressed under a long-term maintenance program as described in Section 6 below.

6. RECOMMENDATIONS

Based on the findings of our visual inspection and review of the available records for Ash Pond A and the Secondary Pond, O'Brien & Gere recommends that engineering studies be performed to demonstrate reliable performance and adherence to dam safety standards, and that some maintenance of the embankments be performed for both ponds. The recommended measures are outlined as follows:

6.1. IMMEDIATE ACTION ITEMS

Ash Pond A and Secondary Pond

As noted above, the available engineering documentation is limited to the 2009 ATC report, which includes three drawings from the original Sargent & Lundy design (apparently updated in 1994 and 1996). Subsequent to our inspection, Duke Energy personnel contacted Sargent & Lundy in an unsuccessful attempt to obtain more engineering information. Due to this lack of documentation, it is recommended that the following additional investigations and analyses be undertaken:

- A subsurface investigation should be performed to establish the geotechnical properties of the embankments and foundations for both ponds. Piezometers should be installed as part of this subsurface investigation to allow for measurement and monitoring of the phreatic surface (water level) through the embankments. The subsurface data should be combined with the recent survey information to establish the critical cross-sections for each embankment for use in the stability analyses.

- An updated hydrologic/hydraulic analysis should be performed to evaluate the adequacy of the existing spillway systems, using the maximum reservoir operating levels and the ½ PMF for Ash Pond A (as required for "Significant Hazard" dams in Indiana) and the 100-year flood for the Secondary Pond. A dam breach analysis should also be considered to evaluate if a failure of the eastern embankment of Ash Pond A (separation dike) would cause overtopping and potential failure of the eastern embankment of the Secondary Pond.

- Based on the embankment cross-sections described above, the measured phreatic water levels in the piezometers, and current normal and maximum operating pools, updated slope stability analyses should be performed for each of the embankment sections. These analyses should include all applicable loading conditions, including normal pool with earthquake.

6.2. LONG TERM IMPROVEMENTS

The minor deficiencies observed during the inspection do not require immediate attention, but should be corrected in the near future as part of a regular maintenance plan. The recommended maintenance items are presented below.

Ash Pond A

- The slope of the drainage channel along the outboard toe of the western embankment should be investigated to establish if regrading of the channel would allow the standing water to drain more freely to the outlet pipe. Once the channel is regraded (if feasible), the reedy vegetation should be removed from the channel.

- Based on the hydrologic/hydraulic analyses recommended above, a design crest elevation should be established for the embankments and low spots in the crest should be filled/raised to create a uniform crest elevation around Ash Pond A (except in the area of the landfill leachate/drain pipes).

- Piezometers installed during the subsurface investigations recommended above should be monitored annually to provide historical performance data for the impoundment.

- Consideration should be given to developing an Operations and Maintenance (O&M) Plan that would establish a regular inspection/maintenance program and operating procedures for use of the spillway stop logs, including setting a maximum operating level for the pond to prevent potential overtopping of the embankments during storm events.

Secondary Pond

- Based on the hydrologic/hydraulic analyses recommended above, an appropriate crest elevation should be established for the eastern embankment of the Secondary Pond. The embankment crest should then be regraded to a uniform elevation to eliminate the significant variation that currently exists in the crest elevation.

- Standard dam safety practice typically recommends the removal of trees from earth embankment sections, due to the potential for uprooting of the trees during storm events and the resulting damage to the embankment. However, since the outboard slope of the eastern embankment also serves as the Ohio River bank, the large trees growing on the slope may reduce the erosion potential from high river flows and, therefore, we recommend that these trees be left in place. However, it would be advisable to perform periodic inspections of this slope, particularly after major storm events, to identify any trees that may have been uprooted and damaged the embankment.

6.3. MONITORING AND FUTURE INSPECTION

As noted above, development of an O&M Plan would be beneficial for establishing schedules for inspection and maintenance of the impoundments and procedures for operation of the pond level controls. Regardless, we recommend that the quarterly informal inspections by Duke Energy personnel continue and that any piezometers installed during the recommended subsurface investigation program be monitored on either a quarterly or annual frequency.

6.4. TIME FRAME FOR COMPLETION OF REPAIRS/IMPROVEMENTS

It is O'Brien & Gere's recommendation that the hydrologic/hydraulic and stability analyses for Ash Pond A and the Secondary Pond be undertaken within the next 6 months. It is our understanding that Duke Energy has already initiated the process of retaining an engineering firm for this purpose. If the analyses indicate that remedial action is necessary, these improvements should be implemented within 12 months.

6.5. CERTIFICATION STATEMENT

I acknowledge that the Ash Pond A and Secondary Pond CCW management units referenced herein were personally inspected by me on August 13, 2010, and were found to be in the following condition:

Ash Pond A

~~SATISFACTORY~~
FAIR
~~POOR~~
~~UNSATISFACTORY~~

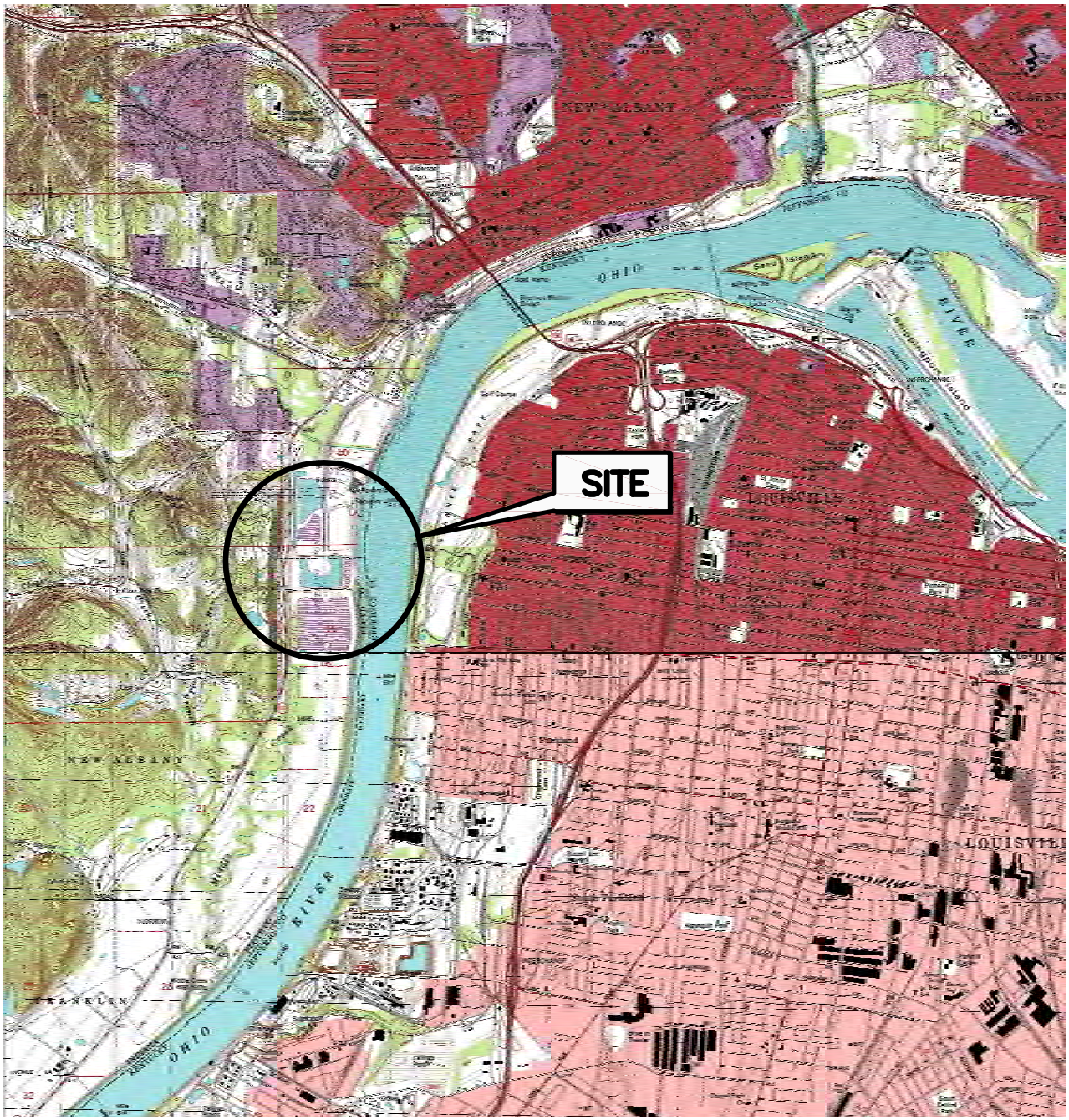
Secondary Pond

~~SATISFACTORY~~
FAIR
~~POOR~~
~~UNSATISFACTORY~~

Signature: _____ Date: _____

Timothy W. Kraus, PE
IN PE # _____

FIGURE 1



ADAPTED FROM: NEW ALBANY AND LOUISVILLE WEST QUADRANGLES, INDIANA U.S.G.S. 7.5 MIN. QUADS

QUADRANGLE LOCATION

US EPA
DAM SAFETY ASSESSMENT
OF CCW IMPOUNDMENTS

DUKE ENERGY – INDIANA
NEW ALBANY, INDIANA

SITE LOCATION MAP

1"=3000' 3000 0 3000

46122–GALLAGHER–F01
OCTOBER 2010

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DRAFT FIGURE 2

NOTES
Aerial imagery provided by National Agriculture Imagery Program (USDA), 2010.

DUKE ENERGY
GALLAGHER STATION
FLOYD COUNTY, INDIANA

FACILITY LAYOUT PLAN

0 250 500 1,000
Feet

OCTOBER 2010
13498/46122

O'BRIEN & GERE

PLOT DATE: never never KaufmaDR

This document was developed in color. Reproduction in B/W may not represent the data as intended.

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This document was developed in color. Reproduction in B/W may not represent the data as intended.

PLOT DATE: never never KaufmaDR

DRAFT FIGURE 3

N

LEGEND

B1 Photograph Direction/Location

NOTE
Aerial imagery provided by National Agriculture Imagery Program (USDA), 2010.

DUKE ENERGY
GALLAGHER STATION
FLOYD COUNTY, INDIANA

PHOTO LOCATIONS

0 150 300 600
Feet

OCTOBER 2010
13498/46122

O'BRIEN & GERE

APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Gallagher Generating Station	Date:	August 13, 2010
Unit Name:	Ash Pond A	Operator's Name:	Duke Energy
Unit I.D.:		Hazard Potential Classification:	High Significant ✓ Low
Inspector's Name:	Bowers/Kraus		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Quarterly		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	438.0		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	434.0		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?			Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	441.7		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?			Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?			From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
2	The normal pool elevation is reportedly El. 438, but stoplogs are used to adjust the operating level
6	No existing instrumentation
8	No construction records are available
11	The crest elevation is approximately 2 feet below the modified elevation shown in the 1996 as-built drawings, but it appears that the crest was constructed 2 feet lower rather than settlement
12	Weir boxes serve to prevent floating debris from entering the spillways rather than trash racks
23	Standing water was observed in a low-lying drainage ditch along the outboard toe of the west embankment

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0002798 INSPECTOR Bowers/Kraus
Date 13-August 2010

Impoundment Name Gallagher Generating Station – Ash Pond A
Impoundment Company Duke Energy
EPA Region 5
State Agency (Field Office) Addresss _____

Name of Impoundment Ash Pond A
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: CCW, Stormwater/Process Water Storage

Nearest Downstream Town : Name New Albany, IN
Distance from the impoundment < 1 Mile
Impoundment
Location: Longitude 85 Degrees 50 Minutes 24 Seconds
Latitude 38 Degrees 15 Minutes 25 Seconds
State IN County Floyd
Does a state agency regulate this impoundment? YES _____ NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

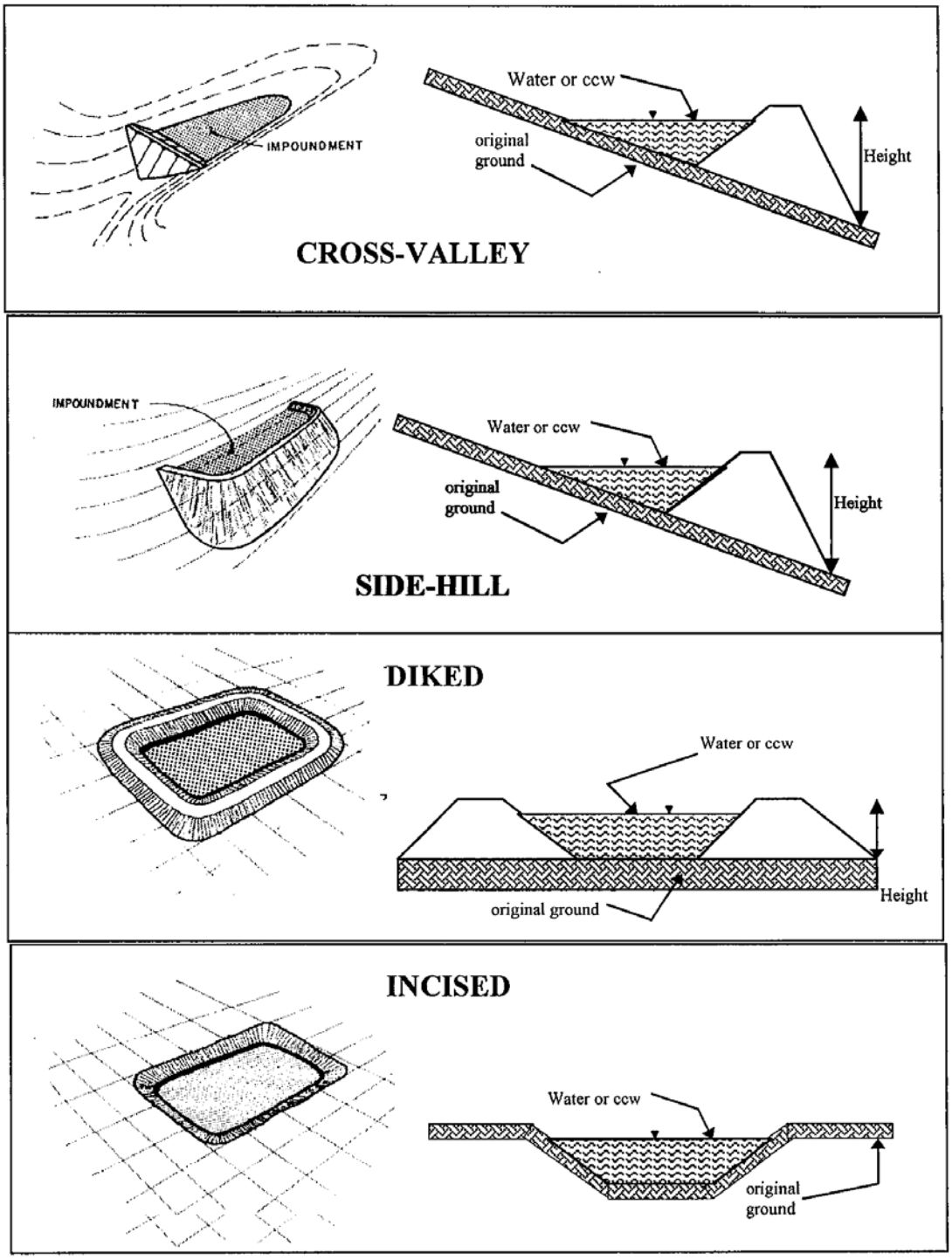
_X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

A failure of the west embankment would result in flooding of portions of Route 111 and failure of the east embankment would likely cause overtopping and possible failure of the east embankment of the Secondary Ash Pond with potential release of CCW material to the Ohio River.

CONFIGURATION:

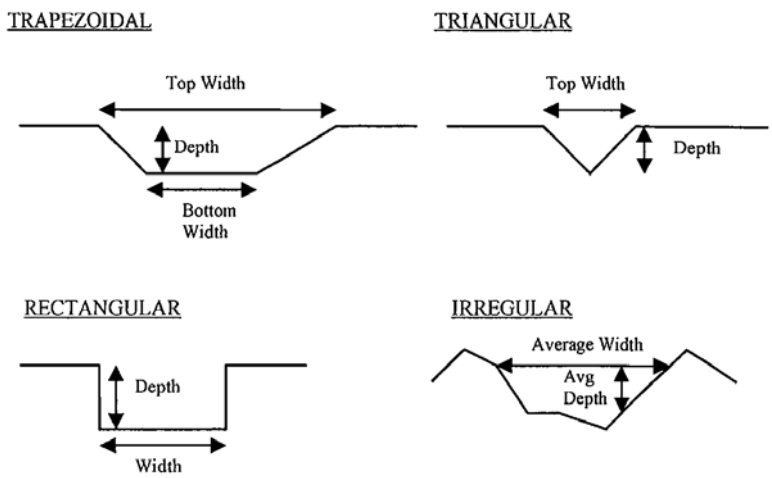


_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional) _X_ Combination Incised/Diked

Embankment Height_29 (max)_ feet Embankment Material_unknown_____
Pool Area __37 +/-_____ acres Liner _____None_____
Current Freeboard _____5 +/-__ feet Liner Permeability _____N/A_____

TYPE OF OUTLET (Mark all that apply)

_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

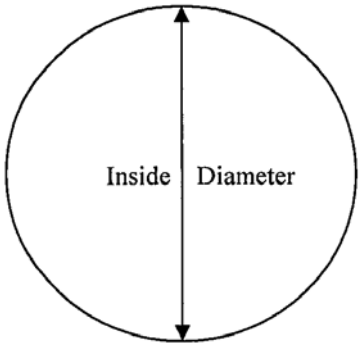


_____ depth
_____ bottom (or average) width
_____ top width

_____ **Outlet**

_30”_ inside diameter

Material
_X___ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify)
_____



Is water flowing through the outlet? YES ___X____ NO _____

_____ **No Outlet**

_____ **Other Type of Outlet** (specify)_Emergency Spillway: Four 30” diameter CMP’s_

The Impoundment was Designed By _Sargent & Lundy_____
_____

Has there ever been a failure at this site? YES _____ NO _____X_____

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES _____ NO ____X____

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lowerPhreatic water able levels based on past seepages or breaches at this site? YES _____NO _____X____

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Gallagher Generating Station	Date:	August 13, 2010
Unit Name:	Secondary Ash Pond	Operator's Name:	Duke Energy
Unit I.D.:		Hazard Potential Classification:	High Significant Low ✓
Inspector's Name:	Bowers/Kraus		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Quarterly		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	427.0		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	423.8		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?			Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	433.8		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?		✓	Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?			From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)	✓		At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
2	The normal pool elevation is reportedly 427.0; however, stop logs are used to adjust the operating level
4	Spillway is not open channel
6	The only instrumentation is a pond level telemeter
8	No construction records available
9	Large trees are growing on the outboard slope of the east embankment section, but this slope also serves as the Ohio River bank
11	The crest elevation of the east embankment varies considerably, but there is no evidence of settlement
12	A weir box serves the purpose of a trash rack
20	The spillway pipe outlet is remote from the pond and was not observed
23	The Ohio River is located along the outboard toe of the East Embankment

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0002798 INSPECTOR Bowers/Kraus
Date 13-August 2010

Impoundment Name Gallagher Generating Station – Secondary Ash Pond
Impoundment Company Duke Energy
EPA Region 5
State Agency (Field Office) Addresss _____

Name of Impoundment Secondary Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?		X

IMPOUNDMENT FUNCTION: Ash Pond A Overflow, Settling Pond

Nearest Downstream Town : Name New Albany, IN
Distance from the impoundment < 1 Mile
Impoundment
Location: Longitude 85 Degrees 50 Minutes 24 Seconds
Latitude 38 Degrees 15 Minutes 25 Seconds
State IN County Floyd
Does a state agency regulate this impoundment? YES _____ NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_X___ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

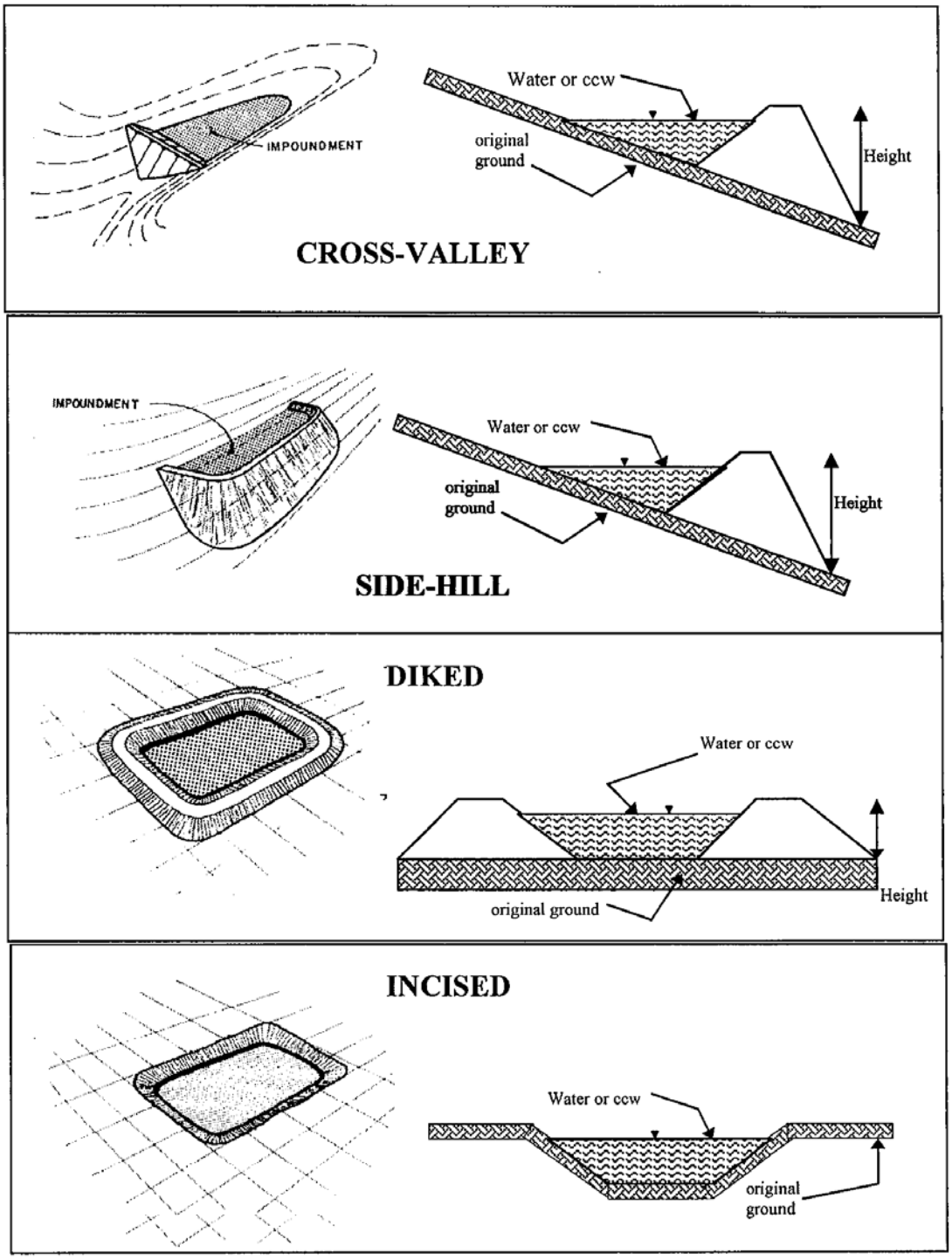
_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

According to Plant personnel, the only source of inflow to the Secondary Ash Pond (other than rainfall and localized runoff) is from Ash Pond A overflow, which contains minimal CCW material. Therefore, release of water to the Ohio River from a failure of the Secondary Ash Pond embankment should result in low environmental impact.

CONFIGURATION:

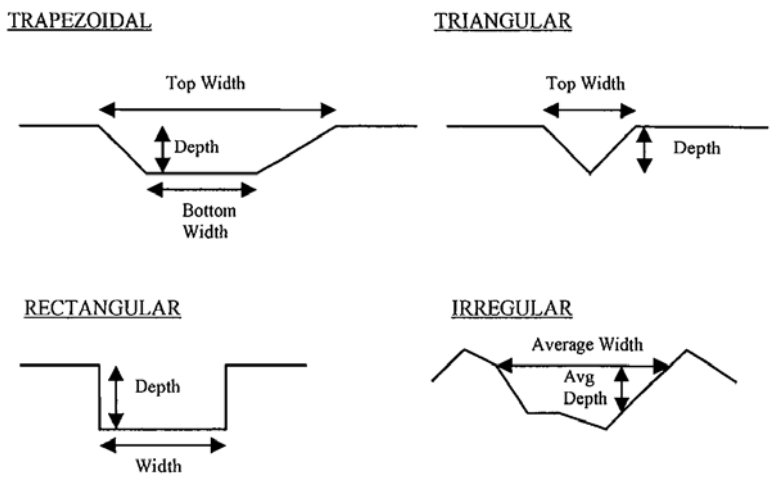


_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional) _X_ Combination Incised/Diked

Embankment Height__29 +/-___ feet Embankment Material_unknown_____
Pool Area __4.5 +/-_____ acres Liner _____None_____
Current Freeboard _____5 +/-__ feet Liner Permeability _____N/A_____

TYPE OF OUTLET (Mark all that apply)

_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

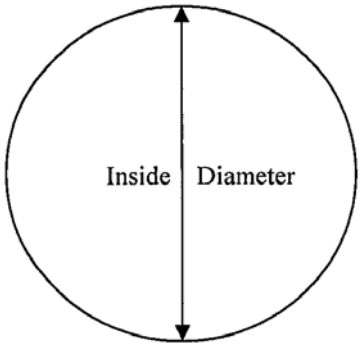


_____ depth
_____ bottom (or average) width
_____ top width

_____ **Outlet**

_30" (2)_ inside diameter

Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_X___ other (specify)
_____Unknown_____



Is water flowing through the outlet? YES ___X____ NO _____

_____ **No Outlet**

_____ **Other Type of Outlet** (specify)_____

The Impoundment was Designed By _Sargent & Lundy_____
_____

Has there ever been a failure at this site? YES _____ NO _____X_____

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES _____ NO ____X____

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lowerPhreatic water able levels based on past seepages or breaches at this site? YES _____NO _____X____

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

APPENDIX B

Photographs – Ash Pond A

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

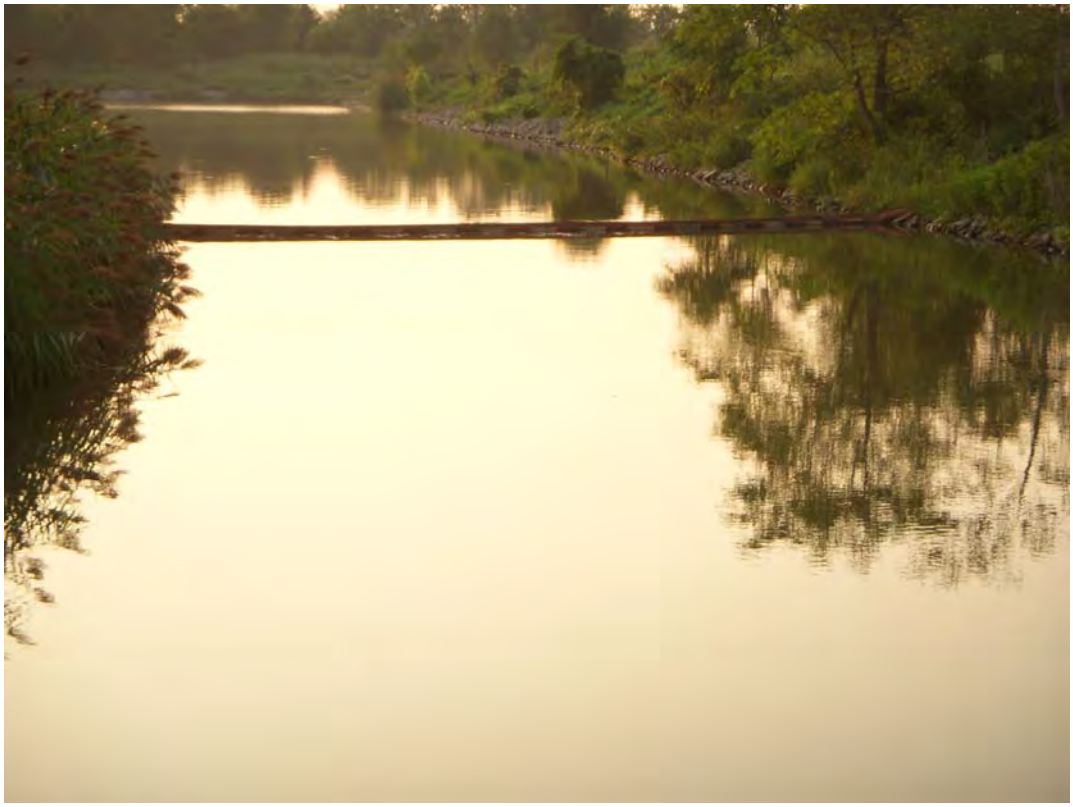
Orientation: Looking North

Description: Flow control weir on Primary Pond outlet channel (inlet to Ash Pond A)

Date: 8/13/10

Photo Number: 1

Photographer: Tim Kraus



Orientation: Looking South

Description: Inboard side of western embankment of Ash Pond A

Date: 8/13/10

Photo Number: 2

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking South

Description: Outboard slope of western embankment of Ash Pond A

Date: 8/13/10

Photo Number: 3

Photographer: Tim Kraus

Orientation:

Description: Outlet pipe for the drainage channel at the southwestern corner of Ash Pond A

Date: 8/13/10

Photo Number: 4

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking East

Description: Southern embankment of Ash Pond A

Date: 8/13/10

Photo Number: 5

Photographer: Tim Kraus

Orientation: Looking East

Description: Outboard slope of southern embankment of Ash Pond A

Date: 8/13/10

Photo Number: 6

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking West

Description: Outboard slope of southern embankment of Ash Pond A

Date: 8/13/10

Photo Number: 7

Photographer: Tim Kraus

Orientation: Looking West

Description: Landfill storm water and leachate effluent pipes into Ash Pond A

Date: 8/13/10

Photo Number: 8

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking East

Description: Raised section of southern embankment of Ash Pond A for landfill pipe cover

Date: 8/13/10

Photo Number: 9

Photographer: Tim Kraus

Orientation:

Description: Weir box for principal spillway inlet at southeastern corner of Ash Pond A

Date: 8/13/10

Photo Number: 10

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation:

Description: Weir box for emergency spillway outlet pipes from Ash Pond A to the Secondary Pond

Date: 8/13/10

Photo Number: 11

Photographer: Tim Kraus

Orientation: Looking West

Description: Access bridge and operating platform for Ash Pond A principal spillway

Date: 8/13/10

Photo Number: 12

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking NE

Description: Eastern slope of separation dike (eastern embankment of Ash Pond A)

Date: 8/13/10

Photo Number: 13

Photographer: Tim Kraus

APPENDIX C

Photographs – Secondary Pond

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA

Project Number: 46122

Site Name: Gallagher Station

Location: New Albany, IN (Floyd County)

Orientation: Looking South

Description: Eastern slope of separation dike (inboard slope of western embankment of Secondary Pond

Date: 8/13/10

Photo Number: 1

Photographer: Tim Kraus

Orientation: Looking East

Description: Principal spillway outlet structure for Secondary Pond

Date: 8/13/10

Photo Number: 2

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Photographer: Tim Kraus

Orientation:

Description: Principal spillway inlet for the Secondary Pond

Date: 8/13/10

Photo Number: 3

Photographer: Tim Kraus

Orientation: Looking South

Description: Inboard slope of the eastern embankment of the Secondary Pond

Date: 8/13/10

Photo Number: 4

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking South

Description: Cut vegetation along the inboard slope of the eastern embankment of the Secondary Pond

Date: 8/13/10

Photo Number: 5

Photographer: Tim Kraus

Orientation: Looking East

Description: Large riprap and overgrowth of trees on outboard slope of eastern embankment (Ohio River bank) of Secondary Pond

Date: 8/13/10

Photo Number: 6

Photographer: Tim Kraus

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Gallagher Station	Location: New Albany, IN (Floyd County)

Orientation: Looking West

Description: Tie-in of separation dike and eastern embankment to natural ground at south end of the Secondary pond

Date: 8/13/10

Photo Number: 7

Photographer: Tim Kraus

Orientation:

Description: Runoff erosion rills along the natural ground slope at the south end of the Secondary Pond

Date: 8/13/10

Photo Number: 8

Photographer: Tim Kraus