REPORT

Dam Safety Assessment of CCW Impoundments

Wabash River Generating Station

United States Environmental Protection Agency
Washington, DC

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Prepared for:
US Environmental Protection Agency
Washington, DC

ROBERT R. BOWERS, P.E. – VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

TIM KRAUS, P.E. – VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

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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 BPA# EP10W000673, Order No. EP10W001240, 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 all environmental permits issued for the management units.
- Identify all 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 the Primary Ash Pond, Secondary Ash Pond, and the South Ash Pond at the Duke Energy, Indiana (DEI) Wabash River Generating Station in Terre Haute, Indiana. The above impoundments are owned and operated by DEI. In the course of this assessment, we obtained information through interviews with representatives of DEI.

2. PROJECT/FACILITY DESCRIPTION

2.1. GENERAL

The Wabash River Generating Station is located at 450 Bolton Road in West Terre Haute, Indiana. A Site Location Map is included as Figure 1. The generating station was commissioned in 1953 and includes a coal-fired electrical power generating facility with an approximate capacity of 668 megawatts (MW) gross generation capacity. Coal combustion waste that is produced during power generation is managed on-site with a CCW impoundment.

The facility utilizes four hydraulically connected impoundments known as the Primary Ash Pond (Pond A and Pond B), the Secondary Ash Pond, and the South Ash Pond for CCW management. The Primary Ash Pond is essentially one management unit that was expanded from Pond A to Pond B. Please note that only one checklist was completed for Primary Ash Pond A/Pond B, since these impoundments are hydraulically connected. The Secondary Pond is contiguous with the Primary Ash Pond, but the two impoundments are separated by an internal divider dike. The south pond is contiguous with the south dike of the Primary Ash Pond B and the Secondary Ash Pond.

2.2. MANAGEMENT UNIT DESCRIPTION

The four contiguous impoundments inspected during this safety assessment are identified on Figure 2 – Site Layout. None of the impoundments are regulated as a dam by the Indiana Department of Natural Resources (IDNR).

CCW that is managed in the impoundments consists of fly ash, bottom ash, and boiler slag. CCW generated at the Wabash River Generating Station is hydraulically sluiced to the Primary Ash Pond A.

2.2.1. Primary Ash Pond A

The Primary Ash Pond A (Pond A) is the northernmost pond and was commissioned in 1968. Hydraulically-sluiced CCW is discharged from sluice pipes at the northern end of Pond A. Pond A is currently full of CCW, which has been excavated and piled above the elevation of the perimeter dikes. Ditches excavated into the accumulated CCW in Pond A are used to channel water in the pond toward Pond B. The pond embankment has not been raised since its construction.

2.2.2. Primary Ash Pond B

The Primary Ash Pond B (Pond B) was commissioned in 1984 as an areal expansion of Pond A. Pond B is located south of and contiguous with Pond A, and west of and contiguous with the Secondary Ash Pond. An internal divider dike separates Pond B from the Secondary Ash Pond. Ditches extend from the CCW discharge point at the northern end of Pond A to Pond B where primary settling of CCW solids occurs. A decanting structure located at the northern end of the Pond B/Secondary Ash Pond divider dike conveys water from Pond B to the Secondary Ash Pond. Pond B is partially full of CCW. Accumulated CCW in Pond B is periodically dredged and transferred to the South Ash Pond for final disposal.

2.2.3. Secondary Ash Pond

The Secondary Ash Pond was constructed in 1984 at the time of Pond B expansion. The Secondary Ash Pond serves as a secondary CCW solids settling basin before final discharge of water to the Wabash River. Water from the Secondary Ash Pond is discharged to the Wabash River through a decanting weir located at the northeastern corner of the Secondary Ash Pond. The final discharge is permitted under NPDES # IN0002810.

2.2.4. South Ash Pond

The South Ash Pond was commissioned in 2005 and is currently utilized for final disposal of CCW at the Wabash River Generating Station. As shown in Figure 2, the South Ash Pond is contiguous with Pond B and the Secondary Ash Pond. CCW is placed in the South Ash Pond via periodic hydraulic dredging of CCW from Primary Ash Pond B. Four valved equalization pipes are utilized to transfer water between the Primary Ash Pond B and the South Ash Pond. The South Ash Pond is lined on the bottom and inboard slopes with a composite liner consisting of two feet of clay, meeting 1 x 10^{-6} cm/sec permeability, overlain by an HDPE liner.

2.3. HAZARD POTENTIAL CLASSIFICATION

Based on correspondence from Duke Energy in a response letter to US EPA regarding request for information dated March 25, 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 all of the CCW Impoundments at Wabash River Generating Station is **SIGNIFICANT** due to the potential for environmental impact to the Wabash River. A breach in the dikes surrounding the impoundments is not likely to cause loss of life or major economic losses, but CCW releases through a dike breach would likely flow into the Wabash River causing environmental damage and potential impacts to fish and wildlife downstream of the Generating Station.

2.4. IMPOUNDING STRUCTURE DETAILS

The CCW management units consist of four contiguous impoundments separated by internal divider dikes. The following sections summarize the structural components and basic operations of the Primary Ash Pond (Pond A & B), the Secondary Ash Pond, and the South Ash Pond. The locations of these features at the Wabash River Generating Station are shown on Figure 2. A smaller scale plan of the Primary and Secondary Ash Ponds and photo location identifiers is provided as Figure 3. The corresponding Photographic Log of selected photographs taken during the inspection is provided as Appendix B. Figure 4 details features and photograph locations of the South Ash Pond with corresponding Photographic Log provided as Appendix C.

2.4.1. Embankment Configuration

<u>Primary Ash Pond A</u>

The Primary Ash Pond A is a combined incised /diked earthen embankment impoundment with a total surface area of approximately 69 acres and a design storage capacity of approximately 1,350 acre-feet. Pond A is diked on the east and south sides and incised into the surrounding grades on the north and west sides. Maximum dike height is estimated at approximately 19 feet above the outboard toe along the east dike. The south dike of Pond A also forms the north dike of Pond B and the Secondary Ash Pond. The crest of the dikes serves as a 10-foot wide gravel-surfaced road and is situated at EL 483.5 feet above mean sea level (msl). The bottom of Pond A was designed at EL 462.5 feet msl. The inboard and outboard slopes of Pond A were constructed at 1.5 horizontal to 1 vertical (1.5H:1V) and 2H:1V, respectively. The dikes were constructed of natural clayey soils excavated from the interior of the ponds. Riprap armoring is present along the outboard slope of the east dike for erosion protection from high river levels.

Primary Ash Pond B

Primary Ash Pond B is an expansion of Pond A that was constructed in 1984. The crest of Pond B is at EL 483.5 feet msl and is an approximately 10-foot wide gravel-surfaced road. The normal operating water level is EL 480.3 feet msl which provides approximately 3 feet of freeboard on the dikes. The inboard and outboard slopes of Pond B were constructed at 3H:1V using clayey soils excavated from the pond interior. Pond B has a surface area of about 21 acres and original storage capacity of about 530 acre-ft. The east dike of Pond B serves as the divider dike between Pond B and the Secondary Ash Pond. The freeboard portion of the divider dike is armored with riprap. The south dike of Pond B is common with the contiguous South Ash Pond.

Secondary Ash Pond

The Secondary Ash Pond is a diked earthen embankment structure with a height of about 20 feet above its outboard toe. The west dike is common to Pond B and the south dike is common to the South Ash Pond. The crest is at EL 483.5 feet msl and the normal operating water level is EL 477.65 feet msl, which provides over 5 feet of freeboard on the dikes. The dikes were constructed of compacted clay from the pond interior excavation at inboard and outboard slopes of 3H:1V. The Secondary Ash Pond total surface area is approximately 7 acres with an original storage capacity of about 73 acre-feet. Riprap armoring is present along the eastern river side of the Secondary Ash Pond.

South Ash Pond

The South Ash Pond is a diked earthen embankment structure with a height of about 22 feet above its outboard toe. The north dike is common to Pond B and the Secondary Ash Pond. With the exception of the north dike which was constructed with Pond B, the South Ash Pond dikes were constructed of compacted ash fill with a 5 foot thick compacted clay shell on the exterior surfaces of the dike. The ash fill was keyed two feet into the natural soil foundation at 20 feet wide. The inboard and outboard slopes were constructed at 3H:1V. The South Ash Pond total surface area is approximately 70 acres with an original storage capacity of about 1450 acre-feet. The 18-foot wide crest of the dikes was established at EL 484.25 and serves as a gravel-surfaced access road. The normal operating water level is EL 480.6 feet msl, which provides over 3.5 feet of freeboard on the dikes. A lower gravel-surfaced access road is provided along the outboard toe of slope. Riprap armoring is present along the eastern and eastern half of the south dike outboard slopes. A divider dike separates the active South Ash Pond from the future expansion area to the south. The outboard slopes of the divider dike and the west dike are covered with crown vetch.

2.4.2. Type of Materials Impounded

Currently, influent into the Primary Ash Ponds A & B and the Secondary Ash Pond includes water with solids consisting of fly ash, bottom ash, boiler slag, and mill rejects. Other waste waters, including boiler blow down, coal pile runoff, stormwater runoff, and floor and laboratory drains, are discharged to these ponds. The South Ash Pond receives water and CCW solids consisting of fly ash, bottom ash, and boiler slag.

2.4.3. Outlet Works

The Primary Ash Ponds A and B are hydraulically linked via an excavated ditch that channels water from the sluice discharge on the north end of the Primary Ash Pond A to Pond B. Water from Pond B flows into a weir box (weir box #3) located at the northeastern corner of Pond B to outfall into the Secondary Ash Pond. Water in the Secondary Ash Pond is decanted into a weir box, flows through a 36-inch diameter, asbestos-bonded corrugated metal pipe that extends below the east dike and ultimately discharges into the Wabash River. The Secondary Ash Pond decanting structure consists of a pile supported metal channel that extends across the pond, decants the water and conveys it to a concrete weir box. Wood planks provided on the face of the piling serve as a baffle system to prevent solids and floating debris from entering the decanting weir.

Water in the South Ash Pond is decanted back into Pond B. The outlet works of the South Ash Pond consist of four side-by-side 24inch diameter HDPE pipes that are equipped with individual shutoff valves. These pipes are designed to equalize the water levels between Pond B and the South Ash Pond.

3. RECORDS REVIEW

A review of the available records related to design, construction, operation and inspection of the Wabash River Plant CCW impoundment was performed as part of this assessment. The documents provided by DEI are listed below:

Table 3.1 *Summary of Documents Reviewed*

Document	Dates	By	Description
Design Drawings of Primary Ash Pond A	1965	Sargent & Lundy Engineers	Design Drawing Nos. B-552 to B-563
Design Drawings of Primary Ash Pond B and Secondary Ash Pond	1983 – 1987	Sargent & Lundy Engineers	Design drawing Nos. C-50 – C-63, S-250 – 252
Slope Stability Analysis for Proposed Fly Ash Pond	2/28/2001	Burns & McDonnell Geotechnical Eng. Dept.	Design slope stability analyses of South Ash Pond Dikes
Addendum No. 1 to Slope Stability Analysis for Proposed Fly Ash Pond	7/10/2001	Burns & McDonnell Geotechnical Eng. Dept.	Addendum No. 1 to above document
Addendum No. 2 to Slope Stability Analysis for Proposed Fly Ash Pond	7/10/2001	Burns & McDonnell Geotechnical Eng. Dept.	Addendum No. 2 to above document
Design Drawings of South Ash Pond	2005	Burns & McDonnell	Design drawing Nos. C-315 – C-330, S-01
Letter of Response to CERCLA 104 (e) Request for Information	03/25/2009	Duke Energy Corp.	Response to EPA's request for information regarding CCW Impoundments at the Wabash Station
Ash Pond Slope Stability Analyses	11/12/2009	Sargent & Lundy	Static & seismic slope stability analyses of Pond A and Secondary Settling Pond exterior dikes
Pond Examination Report	12/25/2009	Sargent & Lundy	Examination of all ash ponds, review of stability analyses, and performance of new stability analyses

3.1. ENGINEERING DOCUMENTS

<u>Primary Ash Ponds A & B and Secondary Ash Pond</u>

Review of the documents and drawings revealed information on the design details for the Primary Ash Ponds A & B, and the Secondary Ash Pond which is summarized below:

- Pond A of the Primary Ash Pond was commissioned in 1968.
- Pond A dikes were constructed on a foundation of natural clayey soil. Where sandy material was encountered at the dike subgrade, a three-foot thick clay layer was to be added above the stripped subgrade, prior to dike construction.
- Due to the low permeability of the clayey native soils, the impoundments were designed without a liner.
- No documentation of slope stability analyses or other geotechnical data completed prior to design was available for Pond A, Pond B, or the Secondary Pond.
- The original outlet structure from Pond A known as Weir Box #1 was located at the southeastern corner of Pond A.

- Stormwater generated upgradient of the pond and collected by ditches is directed into an 84-inch diameter bituminous coated corrugated metal pipe (CMP), which passes underneath Pond A, extending below grade from the west side of Pond A to the outfall at the Wabash River. This pipe is embedded within the native soils below the pond bottom and base of the dikes.
- Pond B and the Secondary Pond were added contiguous with the south side of Pond A in 1984.
- Design drawing notes indicate that the footprint of the new pond was to be cleared, grubbed, and stripped prior to placement of dike fill.
- Drawing notes indicate that the new dikes for Pond B and the Secondary Ash Pond were to be constructed with silty clay soils, or lean clay (CL) per the Unified Soil Classification System, excavated from a borrow area within the Pond B interior.
- A concrete weir box (Weir Box #3) was constructed at the divider dike between Pond B and the Secondary Pond. Water is conveyed through a 36-inch CMP with anti-seep collars to the Secondary Pond.
- After construction of Pond B and the Secondary Pond, the western portion of the Pond A south dike was removed to allow water to flow from Pond A to Pond B.
- Weir Box #4 is the Secondary Pond outlet to the Wabash River. Water flows into the weir box and is conveyed to the Wabash River via a 36-inch CMP with anti-seep collars.
- No history of past slope failures, sloughing, cracking or other earth dike distress was indicated in the documents reviewed.
- No evidence or history of past releases due to perimeter dike failures or outlet structure failures was indicated in the documents reviewed.
- No evidence of construction of dike over existing ash foundation or coal slimes was indicated in the documents reviewed.

<u>South Ash Pond</u>

Review of the documents and drawings revealed information on the design details for the South Ash Pond which is summarized below:

- The South Ash Pond was commissioned in 2005.
- The north dike of the South Ash Pond is common with the south dikes of Pond B and the Secondary Pond.
- Based on the design geotechnical report, the upper soils at the South Ash Pond area are generally classified as Lean CLAY (CL) in accordance with the Unified Soil Classification procedure.
- The dikes were constructed using compacted ash fill as the dike core material with a 5 foot thick clay shell.
- Ash fill was to be compacted to 95 percent of standard Proctor density (ASTM D698). Clay shell was to be compacted to 95 percent of modified Proctor density (ASTM D1557)
- The inboard slopes and pond bottom are lined with an exposed HDPE synthetic liner.
- Four valved equalization pipes connect the South Ash Pond to Pond B and serve to transfer water from the south pond to Pond B and ultimately to the Secondary Ash Pond for final discharge to the Wabash River.
- No history of past slope failures, sloughing, cracking or other earth dike distress was indicated in the documents reviewed.
- No evidence or history of past releases due to perimeter dike failures or outlet structure failures was indicated in the documents reviewed.
- No evidence of construction of dike over existing ash foundation or coal slimes was indicated in the documents reviewed.

3.1.1. Stormwater Inflows

Given that the Wabash River 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 dikes; however, we understand that some unknown quantity of stormwater 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 based on 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 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 Wabash River Generating Station CCW impoundments is not expected to result in loss of life. Therefore, the impoundment appears to fall within the Low Hazard category by IDNR criteria. Per Section 2.3 of this report, the Wabash Generating Station CCW ponds are considered to have a Significant hazard potential per the definitions of this assessment.

As a potentially Low Hazard Dam in terms of the State of Indiana criteria, the facility should be designed to safely pass a flood in the range from the 100-year storm to 50 percent of the Probable Maximum Precipitation (PMP). Given the Significant hazard potential classification recommended in this assessment, the 50 percent PMP may be appropriate as it is the design storm event for a Significant hazard classification in Indiana. Since hydrologic and hydraulic analyses have not been provided for the Wabash River Generating Station CCW ponds, their capacity to safely pass the 100-year flood or the 50 percent PMP is unknown. Based on the freeboard available in Pond B, Secondary Pond, and the South Pond ranging from 3 to 5 feet, it appears that the hydraulically-linked CCW impoundments may be able to safely pass the 100-year flood; however the safe capacity (which avoids embankment overtopping) should be confirmed through a formal hydraulic and hydrologic analysis.

3.1.2. Stability Analyses

<u>Primary Ash Ponds A & B and Secondary Ash Pond</u>

As stated above, no design phase slope stability analyses were included in the records made available by DEI for Ponds A & B, and the Secondary Ash Pond. Recent slope stability analyses were included in Sargent & Lundy's Ash Pond Slope Stability Analyses Report and Pond Examination Report dated November 12, 2009 and December 11, 2009. The reports indicated the following minimum factors of safety were calculated for the outboard (east) dike sections analyzed for Pond A and the Secondary Pond:

Table 3.2 *Slope Stability Factors of Safety*

Load Case	Pond A	Secondary Pond	Required Minimum Factor of Safety*
Steady State Seepage	1.624	2.315	1.5
Seismic (0.05g)	1.426 (effective stress) 1.181 (total stess)	1.993 (effective stress) 1.970 (total stress)	1.1

*IDNR Dam Safety criteria

Based on our review of the slope stability analyses documented in the above referenced Sargent & Lundy report, the slope stability model geometry appears to be representative of existing conditions. Soil strength parameters used in the analysis were based on geotechnical data gathered during the design of the south ash pond. The phreatic surface through the dikes was conservatively estimated. The stability analysis methods appear to have been performed in general accordance with USACE Slope Stability Analysis Engineer Manual EM 1110-2-1902. Critical sections were selected along the eastern dikes of the Pond A and Secondary Ash Pond where the embankments are at maximum elevation. The computer software SLOPE/W was used to evaluate the factor of safety of the downstream slopes of the dikes. Load cases analyzed for the outboard slope include: steady-state seepage at normal operation pool, and steady-state seepage with seismic load at normal operation pool. Depending on the results of a hydrologic and hydraulic evaluation of the ponds relative to an appropriate design flood event, a stability analysis for the maximum surcharge pool (water level near the crest of the dikes) may be appropriate.

South Ash Pond

Slope stability analyses for the South Ash Pond dikes are documented in a report entitled, Slope *Stability Analysis for the Proposed Flyash Pond*, prepared by Burns & McDonnell, dated February 28, 2001. Addendum No. 1 and No. 2 to this report were also provided for review. This report documents the results of the design slope stability analyses for the South Ash Pond dikes. Loading conditions analyzed included end of construction, steady-state seepage, seismic, and rapid drawdown. The maximum surcharge pool loading case due to higher than normal water levels was apparently not analyzed. We note that even though the pond is lined, a conservative estimate of the phreatic surface was assumed in the steady-state seepage and rapid drawdown load cases. This demonstrates that the embankments will still meet the stability criteria in the unlikely event that the liner develops a leak in the future. The following table presents the calculated minimum factors of safety for the compacted ash core with clay shell dikes of the South Ash Pond:

Table 3.3 *Minimum Calculated Factors of Safety for South Ash Pond Dikes*

Load Case	Calculated Min. FOS	IDNR Minimum Required FOS
End of Construction	1.52	1.4
Steady State Seepage	1.54	1.5
Seismic (Ag = 0.05)	1.24	1.1
Rapid Drawdown	1.31	1.2

The report indicates that the minimum calculated factors of safety for the loading conditions above met or exceeded the values required by the Indiana Department of Natural Resources slope stability criteria for earth dams. IDNR guidelines for slope stability analysis require that the steady-state seepage condition be analyzed with the piezometric surface through the embankment due to a reservoir water level at the emergency spillway. This loading condition appears to be similar to the USACE maximum surcharge pool condition in which the thrust of the higher pool against the embankment and the higher phreatic/piezometric surface are taken into account in the analysis. The design slope stability analysis only considered the normal pool loading in the steady-state seepage analysis. Depending on the results of a hydrologic and hydraulic evaluation of the ponds relative to an appropriate design flood event, a stability analysis for the maximum surcharge pool may be appropriate. We note that the South Ash Pond is lined and therefore fluctuations in the phreatic surface through the dikes, if one is present at all, would not be expected with varying water levels unless there is a breach in the liner.

3.1.3. Instrumentation

No instrumentation is present at any of the CCW impoundments.

3.2. PREVIOUS INSPECTIONS

All of the CCW ponds were previously inspected by Sargent & Lundy Engineers on October 28, 2009. Based on their report entitled *Wabash River Pond Examination Report*, dated December 2009, all of the ponds were found to be in good operational condition with no immediate concerns or conditions considered to threaten the stability of the pond dikes. The report provided recommendations for future pond maintenance, which are summarized below:

- Repair rip in HDPE liner of the South Ash Pond
- Repair tears in the HDPE liner at vent caps and inspect all vent caps for tears in the liner
- Cut down trees on exterior dikes of Pond A and the Secondary Ash Pond and five feet beyond the toe of the dikes.
- Remove trees growing on the interior of Pond A, Pond B, and the Secondary Ash Pond
- Repair eroded area on west side of South Ash Pond where geotextile is exposed
- Place and compact gravel in depressions along the crest of Pond A
- Restore gravel road base and geotextile cover along lower south access road of future expansion area
- Install gravel (French) drains to alleviate ponding stormwater along toe of South Ash Pond dikes
- Inspect full length of 84-inch diameter CMP that runs beneath Pond A. Evaluate condition of bituminous liner and any deformities in the pipe shape.
- Monitor animal burrow(s)
- Monitor bare area on the southeast and east inboard slope of the future expansion area.

We understand that DEI personnel conduct quarterly inspections of the geomembrane (liner), pond dikes, rodent burrows, runoff control structures, and erosion control structures. These internal inspections are initiated by automated work order tickets. Corrective action tickets are written if needed to address problems observed. We did not review any previously completed dike inspection work orders.

3.3. OPERATOR INTERVIEWS

Numerous plant and corporate personnel took part in the inspection proceedings. The following is a list of participants for the inspection of the Ash Pond.

Table 3.4 *List of Participants*

Name	Affiliation	Title
Sherry Fisher	DEI	Environmental Coordinator
Owen Schwartz, L.P.G.	DEI	Environmental Specialist III
Mark Davis	DEI	
Tom Jeffers	DEI	
Peter Massa, P.E.	DEI	Senior Civil Engineer
James Meiers,CHMM	DEI	Principal Environmental Scientist
Ray Stasi	DEI	
Mike Shryock	DEI	
Adam Deller	DEI	
Ron Ehlers	DEI	
Dreher Whetstone, P.E.	O'Brien & Gere	Technical Associate
Tim Kraus, P.E.	O'Brien & Gere	Vice President

The DEI personnel provided a good working knowledge of the ash ponds, provided general plant operation background and available historical documentation.

4. VISUAL INSPECTION

The following sections summarize the inspection of the Wabash River Generating Station CCW Management Units (Primary Ash Ponds A & B, Secondary Ash Pond, and South Ash Pond), which occurred on May 11, 2010. Following the inspection, O'Brien & Gere completed an EPA inspection checklist for each impoundment that briefly summarizes the results of the inspection. The checklist was submitted electronically to EPA on May 19, 2010. A copy of the completed inspection checklists is included as Appendix A. Note that a single checklist was completed for Primary Ash Ponds A & B.

4.1. GENERAL

The weather on the date of the inspection was partly cloudy and approximately 75 degrees. Heavy rain showers had passed over the site the night before the inspection. The visual inspection consisted of a thorough site walk along the crest, outboard slope, and toe of the embankments, and along exposed portions of the inboard slopes. The team also inspected the inlet/outlet structures.

Photos of relevant features and conditions observed during the inspection were taken by O'Brien & Gere and are provided in Appendix B for the Primary Ash Ponds A & B and the Secondary Ash Pond. Photographs of the conditions and features observed during the inspection of the South Ash Pond are provided in Appendix C. Photo Location Plans corresponding to each Photo Log are presented as Figures 3 and 4.

4.2. SUMMARY OF FINDINGS

<u>Primary Ash Pond A</u>

The following observations were made during the inspection:

- Sluiced CCW by-product discharge enters the north end of Pond A. (Appendix B, Photo 1)
- Large trees and heavy vegetation are growing through riprap along the outboard slope of the east dike (Appendix B, Photo 3)
- The inboard slope was also generally overgrown with reedy grasses.
- Minor depressions and rutting of crest road was observed along east dike. (Appendix B, Photo 4)
- Ash is being stockpiled up to approximately 10 feet above the crest of the dikes.
- Some minor isolated erosion rills were observed along the outboard slope of the east dike.
- CCW has accumulated above the normal pool level over an estimated 90 percent of the pond area. Surface water in the pond is isolated to ditches excavated through the accumulated CCW (Figure 2).
- The outboard toe area was generally well drained.

<u>Secondary Pond</u>

The following observations were made during the visual inspection:

- The outboard slope of the east dike is covered with riprap, which appeared to be in good condition.
- Several large trees were observed at the outboard toe of the east dike.
- Some small trees and heavy weed growth was observed along the freeboard portion of the interior slopes.
- The outlet structure for the Secondary Pond is located in the northeastern corner of the pond. The structure appeared to be in good condition and operating normally. Discharge of water into the weir was clear.

Primary Ash Pond B

The following observations were made during the visual inspection:

- The south dike of Pond B is common with the South Ash Pond's north dike.
- Pond B was approximately 80 percent full of CCW at the time of inspection.
- The divider dike between Pond B and the Secondary Pond appeared to be in good condition. Some high vegetation and small brush was observed along the freeboard section of the divider dike.
- Riprap was observed along the freeboard section of the divider dike and the inboard side of the south dike.
- The outlet structure (Weir Box #3) that transfers water from Pond B to the Secondary Pond appeared to be in good condition and functioning normally.
- Dredging from Pond B to the South Ash Pond was in progress at the time of inspection (Appendix B, Photo 6)

South Ash Pond

The following observations were made during the visual inspection:

- An HDPE liner was observed on the interior slope of the pond. The liner appeared to be in good condition.
- The outboard slopes are covered with riprap along the east dike. The riprap appeared to be in good condition.
- Some ponding stormwater was observed beyond the toe of the east dike. This condition appears to be due to insufficient surface slope and rutting due to vehicle traffic. (Appendix C, Photo 1)
- The gravel on the surface of the crest and lower access roads was thin and exposed geotextile was observed in some locations.
- The outboard slope of the south dike was well-vegetated with crown vetch. (Appendix C, Photo 4) Some sapling trees have taken root near the toe of the slope and in the future expansion area.
- Four pipes with HDPE liner pipe boots were observed through the common dike between the South Pond and Pond B. The pipe boots appeared to be in good condition.
- Some minor erosion along the groin area between the access road ramp and the northwestern corner of the pond was observed. (Appendix B, Photo 8)

Based on conversations with plant personnel, no releases have occurred from the Wabash Generating Station CCW impoundments and no significant patchwork repairs or regrading have been performed to the dikes other than the modifications specifically designed for the various expansion projects.

5. CONCLUSIONS

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the impoundments are as follows:

Primary Ash Ponds A & B and Secondary Ash Pond

The Primary Ash Ponds A & B and Secondary Ash Pond are considered to be in **FAIR** condition**.** This condition rating is recommended primarily due to the need for hydrologic and hydraulic (H&H) analyses to demonstrate that the outlet can safely pass the 100-yr. precipitation, at a minimum. In addition, the maximum water level in the ponds generated by the H&H analysis will establish the pond level for the maximum surcharge pool load case for which slope stability should be evaluated if the resulting water levels are higher than those previously modeled.

Our interviews with plant engineering personnel responsible for the operation of the impoundment indicate that a regular operations procedure is in use at the Primary and Secondary Ash Ponds. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impounding embankments.

The station's engineering staff maintain all design documents and inspection reports in a well organized manner. The station's operations personnel make daily "drive-by" observations to monitor general conditions of the impoundments and complete quarterly documented inspections. Based on these findings, we are of the opinion that the operation and maintenance procedures being practiced at the Primary and Secondary Ponds are adequate, although we recommend additional maintenance actions be implemented to correct some of the conditions observed as presented in Section 6.

South Ash Pond

The South Ash Pond is considered to be in **SATISFACTORY** condition. Acceptable structural performance is expected under all loading conditions analyzed during the design of the impoundment. Our interviews with plant engineering personnel responsible for the operation of the impoundment indicate that a regular operations procedure is in use at the South Pond. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impounding embankments.

The station's engineering staff maintain all design documents and inspection reports in a well organized manner. The station's operations personnel make daily "drive-by" observations to monitor general conditions of the impoundments and complete quarterly documented inspections. Based on these findings, we are of the opinion that the operation and maintenance procedures being practiced at the South Pond are adequate, although we recommend additional maintenance actions be implemented to correct some of the conditions observed as presented in Section 6.

6. RECOMMENDATIONS

Based on the findings of our visual inspection and review of the available records for the Wabash River Generating Station CCW impoundments, O'Brien & Gere recommends the following actions be taken to address specific stability analysis issues cited above, and conduct maintenance.

6.1. URGENT ACTION ITEMS

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the impoundments in the near term.

6.2. LONG TERM IMPROVEMENT

Primary and Secondary Ash Ponds

The soil strength data and other basic data used in the stability analysis completed by Sargent & Lundy was not presented in their report; therefore, we cannot comment on the validity of the analysis. We recommend that an addendum to the report be prepared that presents the basis of the analysis. If the data used in the analysis cannot be substantiated with a reasonable degree of confidence, additional investigation of the east dike may be required to provide valid data for the slope stability analysis.

A hydrologic and hydraulic analysis should be performed to evaluate the potential for overtopping of the embankments during a 100-year to 50 percent PMP flood event and to identify a maximum surcharge pool elevation for slope stability analysis of that loading case.

Large trees growing in the outboard slope of the east dike and within five feet of the toe of the outboard slope of Primary Pond A should be removed along with other woody vegetation in accordance with standard dam safety practice. The primary reason behind the standard practice to remove trees from embankment dams is due to the potential for an uprooted tree to jeopardize the stability of the embankment and shorten seepage paths through the dike. Given that the Primary Pond A is nearly full of ash and does not retain a significant quantity of surface water (or liquid wastes) and no evidence of seepage was observed at the toe of this dike, the argument that the trees provide a measure of stability against rising and falling Wabash River levels may have merit, but only if it can be shown through investigation and analysis that the embankment will retain adequate stability should trees be uprooted, and if there is no future intent to remove the impounded ash and return Primary Ash Pond A to retaining large volumes of surface water or liquid wastes. If a decision is made to leave the trees in place, we recommend that underbrush and new tree growth be maintained to allow foot access for future visual inspections of the slope.

The trees growing along the outboard slope and within 5 feet of the toe of the Secondary Ash Pond dike should be removed. Additional maintenance recommendations are provided below:

- Remove trees/control heavy vegetation along freeboard of upstream slopes
- Place additional gravel road base in low areas on crest and regrade to maintain positive drainage
- Monitor outboard slopes for erosion and repair if conditions worsen

South Ash Pond

In general, the South Pond appeared to be in good condition. No major improvements to the South Pond are recommended at this time. Some minor maintenance recommendations are provided below:

- Place and compact additional gravel road base to provide minimum 6-inches of cover over non-woven geotextile along crest roads and secondary roads.
- Mow vegetated slopes at least twice annually to control vegetation
- Repair erosion along groin on outboard northwest corner of the South Pond

6.3. MONITORING AND FUTURE INSPECTION

The quarterly internal inspections should continue as planned; however, we recommend that the inspections be documented on a standard dam safety inspection checklist similar to the one provide by IDNR. Consideration should be given to inspections by licensed dam safety engineers on a regular basis to document the continued proper maintenance and operation of the CCW impoundments.

6.4. TIME FRAME FOR COMPLETION OF REPAIRS/IMPROVEMENTS

We recommend that the addendum or additional investigations needed to substantiate the stability analysis of the east dike of the Primary Pond A and Secondary Pond be completed within one year of this inspection. Other recommended maintenance items should be completed as soon as practical within one year of this inspection.

6.5. CERTIFICATION STATEMENT

I acknowledge that the Lower Ash Pond and Upper Ash Pond CCW management units referenced herein were personally inspected by me on May 11, 2010, and were found to be in the following condition:

Primary Ash Ponds A &B and Secondary Ash Pond

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

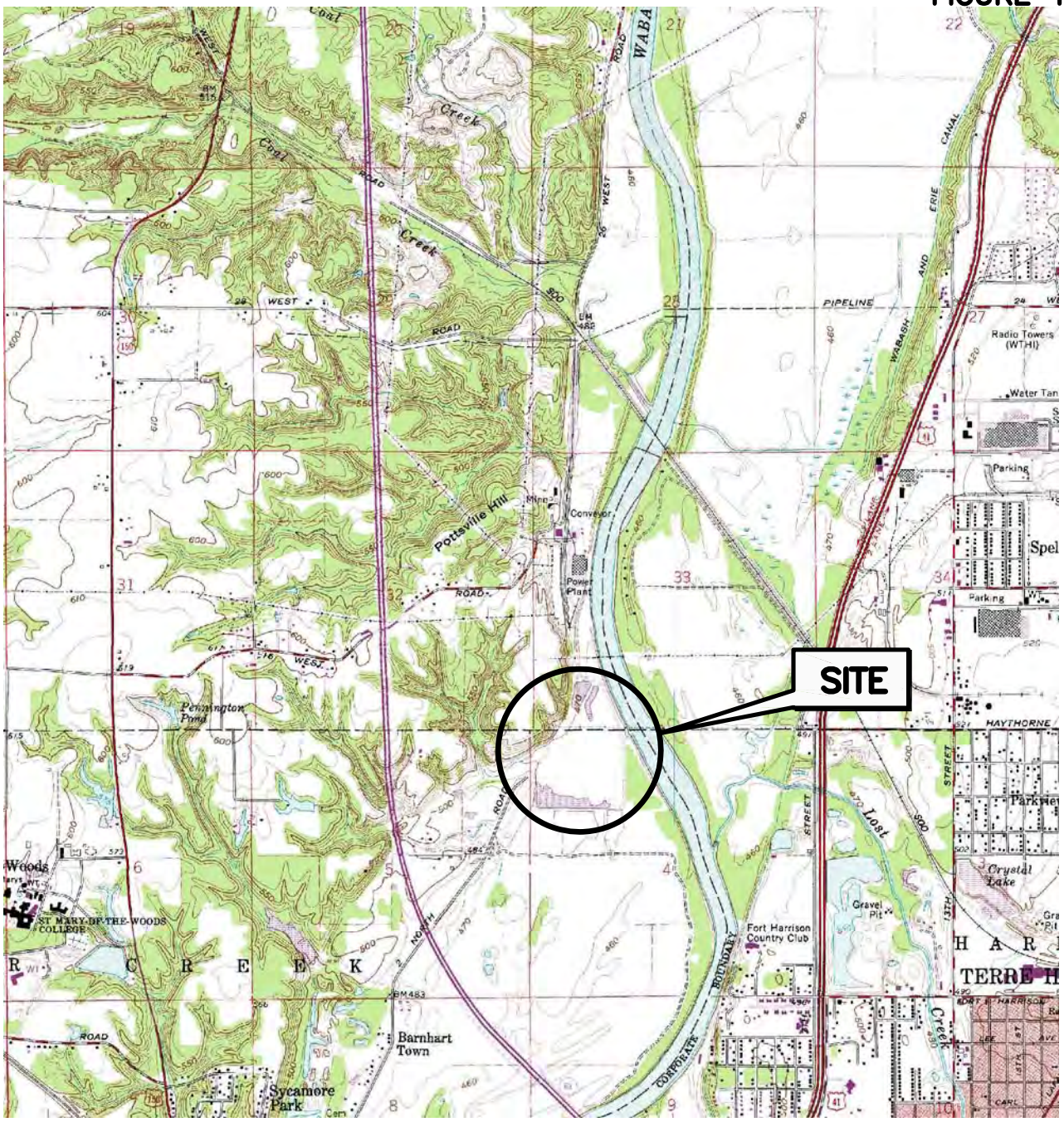
South Ash Pond

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

Signature: _____ Date: October 12, 2010

Tim Kraus, PE
Indiana PE # 19300099

FIGURE 1



ADAPTED FROM: NEW GOSHEN QUADRANGLE, INDIANA U.S.G.S. 7.5 MIN. QUAD 1963, PR 1986

QUADRANGLE LOCATION

US EPA
DAM SAFETY ASSESSMENT OF CCW IMPOUNDMENTS

WABASH RIVER GENERATING STATION
WEST TERRE HAUTE, INDIANA

SITE LOCATION MAP

1"=3000' 3000 0 3000

46122-WABASH-F01
OCTOBER 2010

O'BRIEN & GERE

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DATE: 10/11/2010 8:58:53 AM

NAME: KaufmaDR

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

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

SITE LAYOUT

DUKE ENERGY
WABASH RIVER GENERATION STATION
WEST TERRE HAUTE, INDIANA

0 300 600 1,200
Feet

N

FIGURE 2

OCTOBER 2010
13498/46122

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www.obg.com

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DATE: 10/11/2010 9:34:04 AM

NAME: KaufmaDR

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LEGEND

(1) Photograph Direction/Location

NOTES

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

PHOTO LOCATIONS
PRIMARY & SECONDARY ASH PONDS

DUKE ENERGY
WABASH RIVER GENERATION STATION
WEST TERRE HAUTE, INDIANA

0 150 300 600
Feet

N

FIGURE 3

OCTOBER 2010
13498/46122

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DATE: 10/11/2010 9:47:10 AM

NAME: KaufmaDR

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LEGEND

1 Photograph Direction/Location

NOTES

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

PHOTO LOCATIONS SOUTH ASH POND

DUKE ENERGY
WABASH RIVER GENERATION STATION
WEST TERRE HAUTE, INDIANA

0 250 500 1,000
Feet

N

FIGURE 4

OCTOBER 2010
13498/46122

O'BRIEN & GERE
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APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	DEI Wabash River Sta	Date:	5/11/10
Unit Name:	Secondary Ash Pond	Operator's Name:	Duke Energy, Indiana
Unit I.D.:		Hazard Potential Classification:	High (Significant) Low
Inspector's Name:	D. Whetstone, T. 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)?	477.6		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	477.5		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	483.5		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

12. Rubber baffles along weir inlet.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN 0002810 INSPECTOR D. Whetstone; T. Kraus
Date 5/11/10

Impoundment Name Secondary Ash Pond
Impoundment Company Duke Energy, Indiana
EPA Region 5
State Agency (Field Office) Address Indiana Dept of Environmental Management, EME
Indiana Govt. Center North, 100 N. Senate Ave.
Indianapolis, IN 46204
Name of Impoundment Secondary Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

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

IMPOUNDMENT FUNCTION: Secondary Settling of CCR; Primary Discharge

Nearest Downstream Town : Name Terre Haute, IN
Distance from the impoundment 0.5 - 1 miles
Impoundment
Location: Longitude 39 Degrees 30 Minutes 54 Seconds
Latitude 87 Degrees 25 Minutes 16 Seconds
State IN County Vigo

Does a state agency regulate this impoundment? YES _____ NO ✓

If So Which State Agency?_____

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.

__✓__ **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.

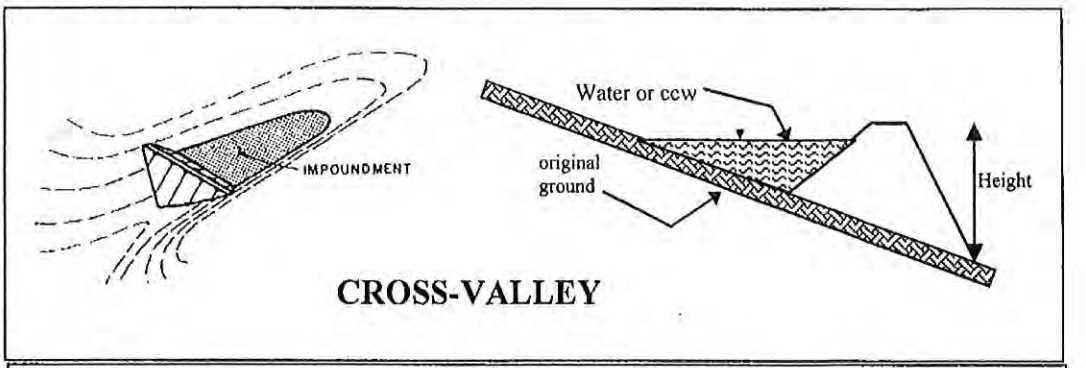
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

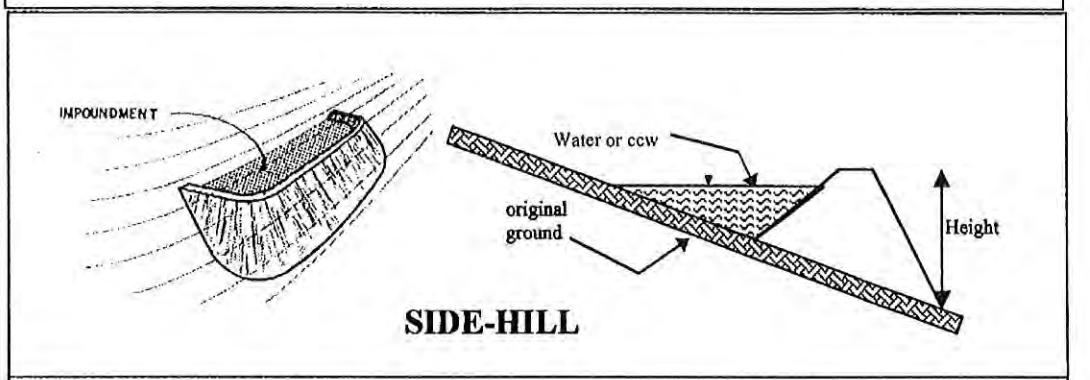
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

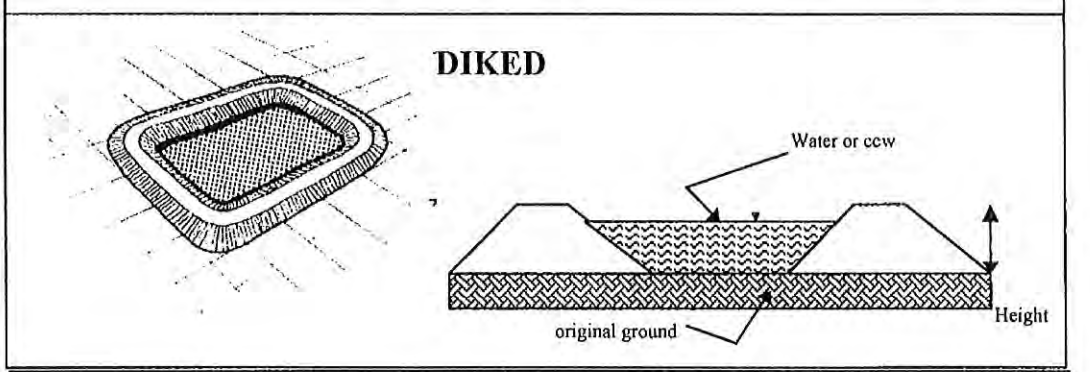
Environmental losses due to release of ash-laden water into the Wabash River.

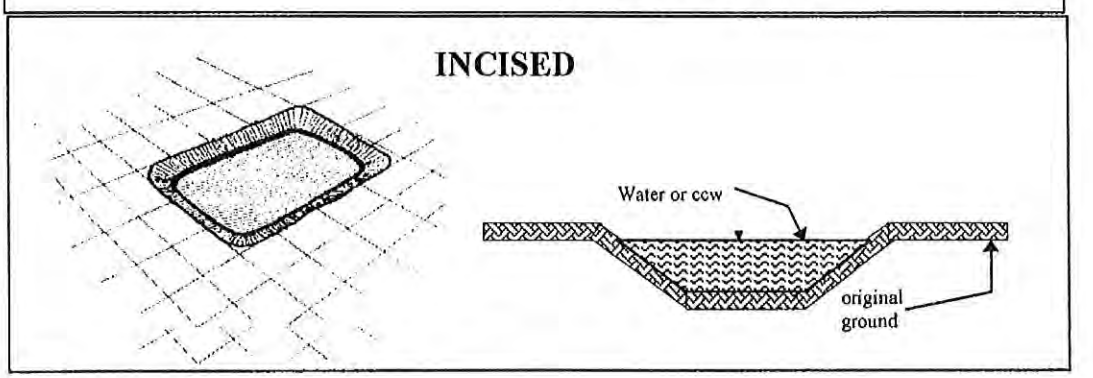
EPA Form XXXX-XXX, Jan 09

CONFIGURATION:







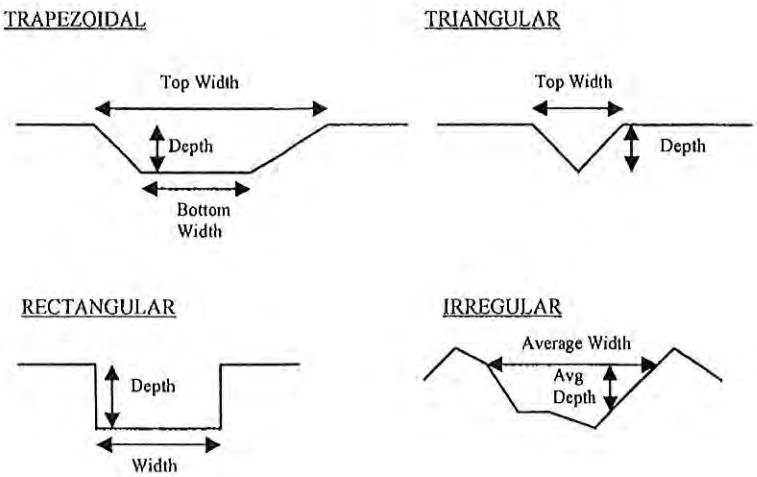


_____ Cross-Valley
_____ Side-Hill
__X__ Diked
_____ Incised (form completion optional) _____Combination Incised/Diked

Embankment Height ___20___ feet Embankment Material __Compacted Clay_____
Pool Area __7_____ acres Liner Clay (2 ft thick)
Current Freeboard 5-6_____ feet Liner Permeability 1 x 10^{-6} cm/sec

TYPE OF OUTLET (Mark all that apply)

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

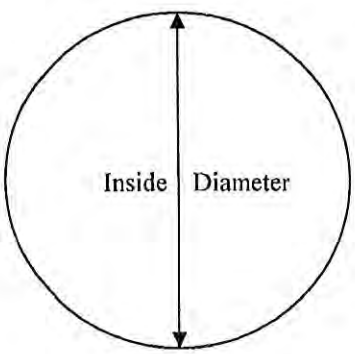


_____ depth
_____ bottom (or average) width
_____ top width

✓ **Outlet**

_____ inside diameter

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



Is water flowing through the outlet? YES ✓ NO _____

_____ **No Outlet**

✓ **Other Type of Outlet** (specify) Concrete Weir Box Decanting Structure to concrete pipe that discharges into the river.

The Impoundment was Designed By Sargent & Lundy (1983)

Has there ever been a failure at this site? YES _____ NO ✓_____
If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water able levels based on past seepages or breaches at this site? YES _____ NO ✓

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:	DEI Wabash River Sta	Date:	5/11/10
Unit Name:	Primary Ash / Pond Cell A Cell B	Operator's Name:	Duke Energy
Unit I.D.:		Hazard Potential Classification:	High (Significant) Low

Inspector's Name: D. Whetstone

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)?	477.5		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	477.5		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	483.5		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,stu topsoil in area where embankment fill will be placed)?	N/A		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

1. Informal daily drive-bys with quarterly work order tickets for formal inspection

~~9. 18 - 24"~~

~~23. Wabash River beyond toe of east dike.~~

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN 0002810 INSPECTOR D. Whetstone; T. Kraus
Date 5/11/10

Impoundment Name Pond A
Impoundment Company Duke Energy, Indiana
EPA Region 5
State Agency (Field Office) Address Indiana Dept of Environmental Management
Indiana Govt. Center North, 100 N. Senate Ave.
Indianapolis, IN 46204
Name of Impoundment Primary Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

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

IMPOUNDMENT FUNCTION: Storage of Fly Ash/Bottom Ash CCR

Nearest Downstream Town : Name Terre Haute, IN
Distance from the impoundment 0.5 - 1 miles
Impoundment Location:
Longitude 39 Degrees 31 Minutes 05 Seconds
Latitude 87 Degrees 25 Minutes 17 Seconds
State IN County Vigo

Does a state agency regulate this impoundment? YES _____ NO ✓

If So Which State Agency?_____

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.

✓ **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:

Significant hazard potential due to potential for environmental damage to the Wabash River

EPA Form XXXX-XXX, Jan 09

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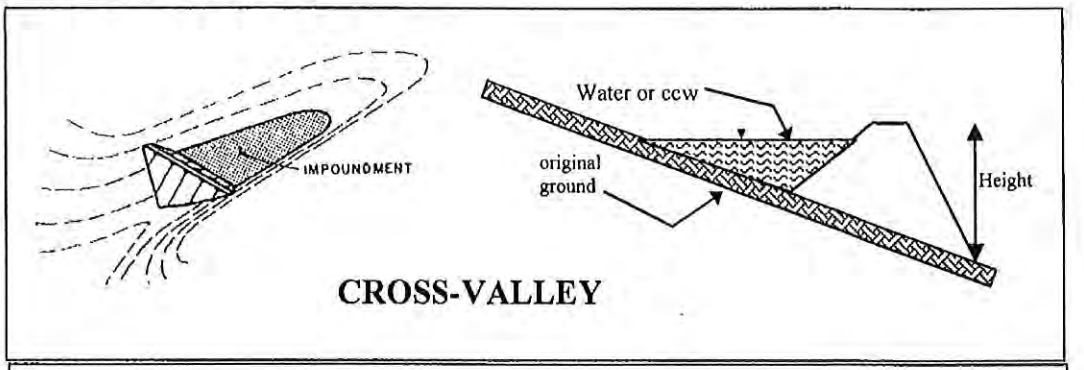
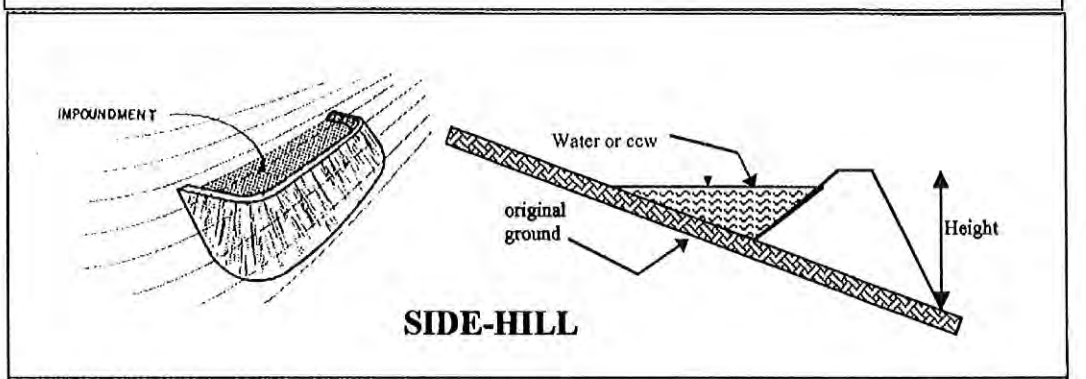
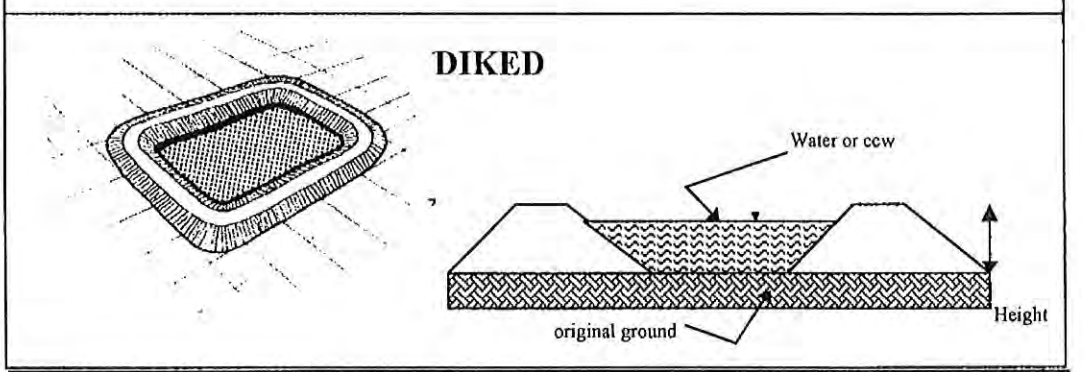
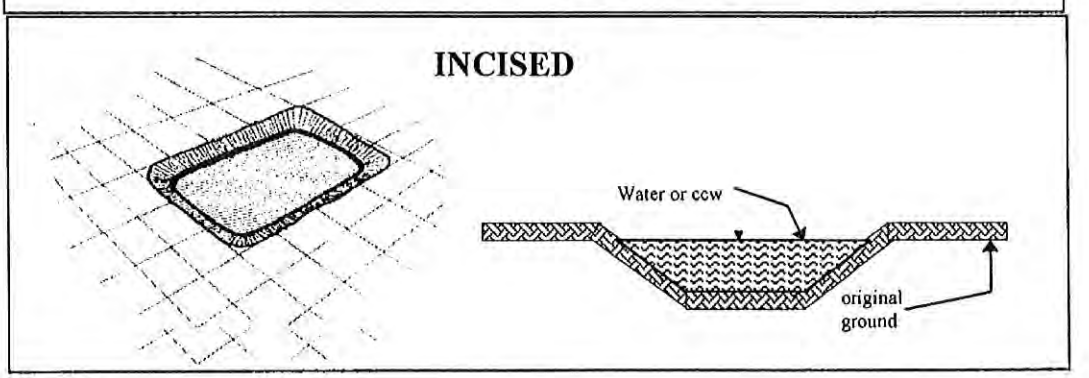








_____ Cross-Valley

_____ Side-Hill

_____ Diked

_____ Incised (form completion optional) ___✓___ Combination Incised/Diked

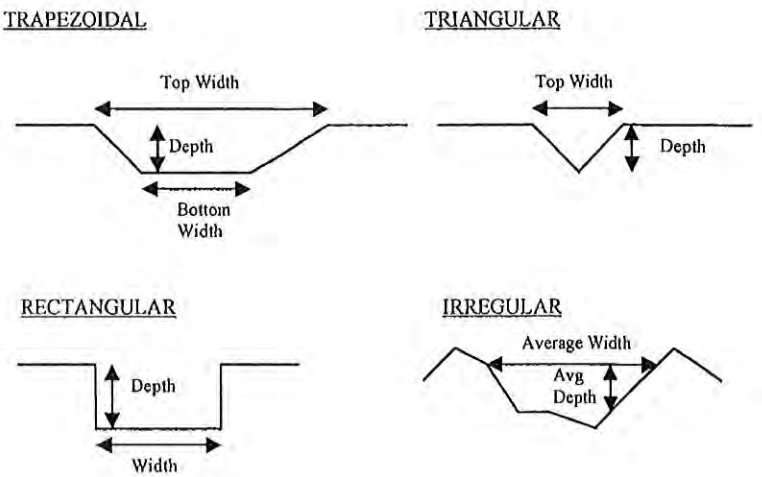
Embankment Height ___19___ feet Embankment Material ___Compacted Clay___

Pool Area ___21___ acres Liner ___Clay___

Current Freeboard ___5-6___ feet Liner Permeability ___1 x 10^{-6} cm/sec___

TYPE OF OUTLET (Mark all that apply)

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

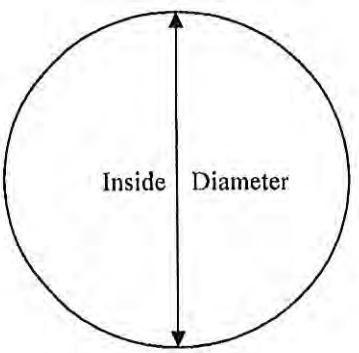


_____ depth
_____ bottom (or average) width
_____ top width

✓ **Outlet**

_____ inside diameter

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



Is water flowing through the outlet? YES ✓ NO _____

_____ **No Outlet**

✓ **Other Type of Outlet** (specify) Concrete Weir Box Decanting Structure

The Impoundment was Designed By Sargent & Lundy (1965)

Has there ever been a failure at this site? YES _____ NO ✓ _____
If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO ✓

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:	DEI Wabash River Sta	Date:	5/11/10
Unit Name:	South Ash Pond	Operator's Name:	Duke Energy, Indiana
Unit I.D.:		Hazard Potential Classification:	High (Significant) Low
Inspector's Name:	D. Whetstone, T. 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)?	480.6		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	478.7		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	484.3		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?		✓	Is water exiting outlet flowing clear?	N/A	
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

12. 4 HDPE equalization pipes between South Pond and Primary Ash Pond, Cell B.

20. No decanting outlet on this pond.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN 0002810 INSPECTOR D. Whetstone; T. Kraus
Date 5/11/10

Impoundment Name South Ash Pond
Impoundment Company Duke Energy, Indiana
EPA Region 5
State Agency (Field Office) Address Indiana Dept of Environmental Management
Indiana Govt. Center North, 100 N. Senate Ave.
Indianapolis, IN 46204
Name of Impoundment South Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

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

IMPOUNDMENT FUNCTION: Storage of CCR

Nearest Downstream Town : Name Terre Haute, IN
Distance from the impoundment 0.5 - 1 miles
Impoundment Location:
Longitude 39 Degrees 30 Minutes 36 Seconds
Latitude 87 Degrees 25 Minutes 30 Seconds
State IN County Vigo

Does a state agency regulate this impoundment? YES _____ NO ✓

If So Which State Agency?_____

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.

✓ **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.

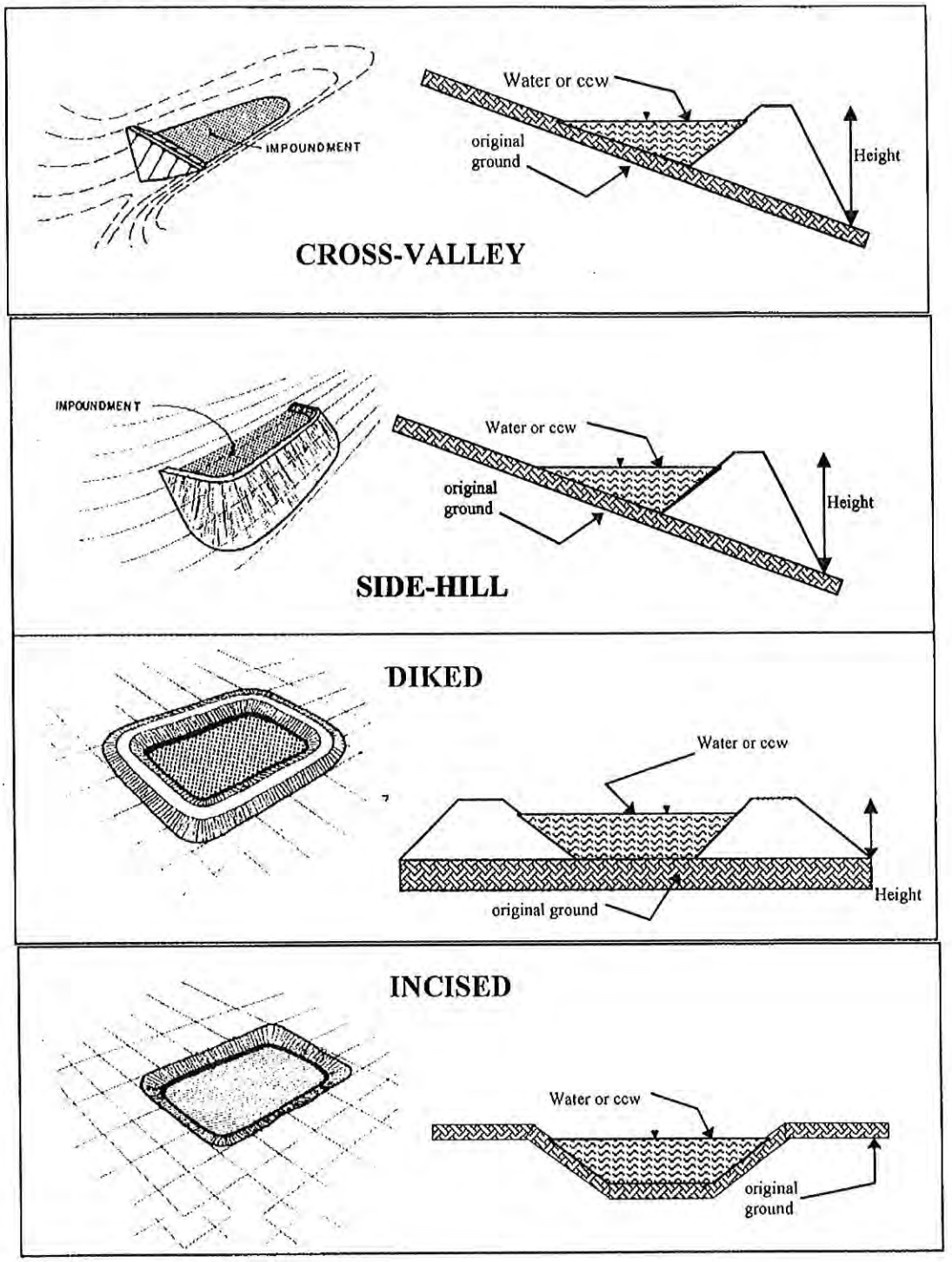
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Due to potential environmental losses from release into Wabash River.

EPA Form XXXX-XXX, Jan 09

CONFIGURATION:



_____ Cross-Valley

_____ Side-Hill

✓ Diked (3 sided with internal divider dike on north side)

_____ Incised (form completion optional) _____Combination Incised/Diked

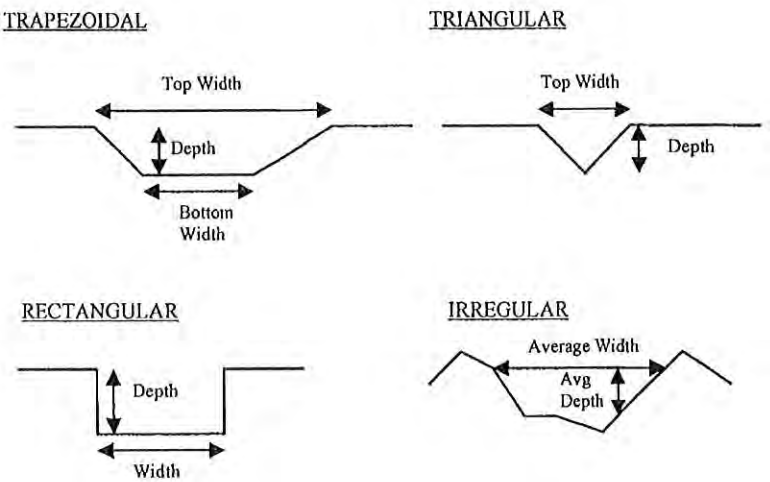
Embankment Height 27 feet Embankment Material Compacted Ash w/Clay Cover

Pool Area 70 acres Liner Composite HDPE w/Clay Underliner

Current Freeboard 3-4 feet Liner Permeability 1×10^{-6} cm/sec or less

TYPE OF OUTLET (Mark all that apply)

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

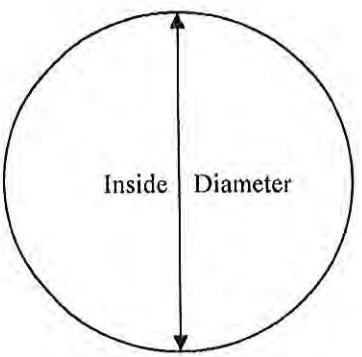


_____ depth
_____ bottom (or average) width
_____ top width

✓ **Outlet**

24" inside diameter

Material
_____ corrugated metal
_____ welded steel
_____ concrete
✓ plastic (hdpe, pvc, etc.)
(4 equalization pipes)
_____ other (specify)
_____



Is water flowing through the outlet? YES ✓ NO _____

_____ **No Outlet**

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

The Impoundment was Designed By Burns & McDonnell (2006)

Has there ever been a failure at this site? YES _____ NO ✓ _____
If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO ✓

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

If so Please Describe : _____

APPENDIX B

Photo Log: Primary Ash Ponds A & B, Secondary Ash Pond

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix B)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – Primary Ash Pond	Location:	Terre Haute, IN

Orientation: South

Description: CCW sluice discharge into Primary Ash Pond

Date: 6/14/2010

Photo Number: 1

Photographer: DDW

Orientation: North

Description: CCW sluice pipes with secondary concrete wall containment

Date: 6/14/2010

Photo Number: 2

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix B)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – Primary Ash Pond	Location:	Terre Haute, IN

Orientation: SE

Description: Large tree in downstream slope of east dike. Riprap covered slope.

Date: 6/14/2010

Photo Number: 3

Photographer: DDW

Orientation: North

Description: Crest of east dike.

Date: 6/14/2010

Photo Number: 4

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix B)

Client: US EPA	Project Number: 46122
Site Name: Wabash River Generating Station – Primary Ash Pond	Location: Terre Haute, IN

Orientation: South

Description: Heavy vegetation slope downstream slope of east dike.

Date: 6/14/2010

Photo Number: 5

Photographer: DDW

Orientation: East

Description: Decanting weir outfall.

Date: 6/14/2010

Photo Number: 6

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix B)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – Primary Ash Pond	Location:	Terre Haute, IN

Orientation: West

Description: Overview of decanting weir.

Date: 6/14/2010

Photo Number: 7

Photographer: DDW

APPENDIX C

Photo Log: South Ash Pond

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix C)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – South Ash Pond	Location:	Terre Haute, IN

Orientation: South

Description: Riprap armored downstream slope of east dike. Water at toe due to recent rainfall.

Date: 6/14/2010

Photo Number: 1

Photographer: DDW

Orientation: South

Description: Crest of east dike .

Date: 6/14/2010

Photo Number: 2

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix C)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – South Ash Pond	Location:	Terre Haute, IN

Orientation:

Description: Dredge discharge line to South Ash Pond. View of HDPE liner.

Date: 6/14/2010

Photo Number: 3

Photographer: DDW

Orientation: West

Description: South dike of South Ash Pond with crown vetch on downstream slope.

Date: 6/14/2010

Photo Number: 4

Photographer: DDW

O'BRIEN & GERE

PHOTOGRAPHIC LOG (Appendix C)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – South Ash Pond	Location:	Terre Haute, IN

Orientation: East

Description: Dredge discharge into South Ash Pond.

Date: 6/14/2010

Photo Number: 5

Photographer: DDW

Orientation: North

Description: Dredge in operation in Primary Ash Pond B.

Date: 6/14/2010

Photo Number: 6

Photographer: DDW

PHOTOGRAPHIC LOG (Appendix C)

Client:	US EPA	Project Number:	46122
Site Name:	Wabash River Generating Station – South Ash Pond	Location:	Terre Haute, IN

Orientation: North

Description: Equalization pipes between Primary Ash Pond B and South Ash Pond.

Date: 6/14/2010

Photo Number: 7

Photographer: DDW

Orientation: North

Description: Minor erosion along groin of dike.

Date: 6/14/2010

Photo Number: 8

Photographer: DDW