LG&E – TRIMBLE COUNTY STATION

BOTTOM ASH POND ASSESSMENT

DRAFT REPORT COMMENTS

EPA Comments

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From: Kohler.James@epamail.epa.gov [mailto:Kohler.James@epamail.epa.gov]
Sent: Monday, July 13, 2009 8:06 AM
To: Killeen, Deborah A; Miller, Dennis A
Cc: Hoffman.Stephen@epamail.epa.gov
Subject: Comments on OBG's Draft Assessment Report for: Trimble County Station

Dear Dennis and Deborah:

Here are EPA's comments on OBG's Draft Assessment Report for: Trimble County Station:

1) Page 8, Section 3.2.4, complete third sentence on piezometer reading

Please let me know if you have any questions.

Sincerely,

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Jim Kohler, P.E.
Environmental Engineer
LT, U.S. Public Health Service
U.S. Environmental Protection Agency
Office of Resource Conservation and Recovery
Phone: 703-347-8953
Fax: 703-308-8433

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>>> "Killeen, Deborah A" <deborah.a.killeen@lmco.com> 8/3/2009 11:07 AM >>>
Robert,

Below please find additional EPA comments on the Trimble County draft final report.

Additionally, I think the first overarching question is pertinent to all assessments and should be addressed more explicitly in all of the final reports. The TVA root cause analysis revealed that failure was primarily caused by liquefaction at the interface of foundation layers that caused lateral motion and ultimate failure. Because we now know this, we should emphasize the foundation conditions and liquefaction potential more clearly in the final reports. I believe this has been addressed to some degree in the all the reports we have reviewed, however it should be more explicit given this new understanding from the root cause analysis.

>>>

Overarching questions:
(1) What is known about the nature/properties of the substrate on which the BAP is founded?
(2) Need to briefly discuss the method of the vertical extension of the three embankments ('upstream'?), and at least mention possible implications for the BAP's stability once the EFAB is revived andconverted into an FGD repository, as stated by the facility's personnel.

Specific comments/suggestions:

Sec. 2.1, 3rd P: it would be helpful to have some basic information on the plant's scrubbing process (wet or dry?), annual coal use, and annual CCW generation.

Sec 2.3: add description (using data from the 1/2009 inspection forms) to describe in further details that the height of the embankments vary (e.g., the eastern embankment's height decreases significantly southwards), and that the width of the W, S, and E embankments is ~30',but that of the N embankment is ~100. Modify accordingly dike height entry on page 3 of the Visual Inspection Checklist in Appendix A.

Sec. 3.2, 2nd bullet: Any information on the hydraulic conductivity of the liner's material or of the actually placed liner?

Sect. 3.2, bullets 2 and 3: Split second bullet into two bullets: one dealing with the lining, and the other - combined with the 3rd bullet, with the berms' elevation issue.

Sect. 3.2, next to last bullet: what material will be used for the raised embankments, and are there any plans for lining them?

Sec. 3.3, 1st P: statement about KDEP's inspection periodicity is inconsistent with statement in 4th P of Sec. 4.1 (I belief the latter is correct)

Sec. 3.3, bullets. State specifically "not completed" next to each of the incomplete tasks.

Sec. 4.2, 1st P: indicate that the moderate and normal priority recommendations of the 1/2009 report were not implemented.

Sec. 4.2, 2nd P: Add a sentence to reference ongoing activities in the NW quarter of the pond to remove ash and FGD material.

Sec. 4.2: Add a couple of sentences to indicate that the air-photo presented in Figure 2, although dated "July 2009", seems to represent an earlier reality, as the shrubbery on the outboard of the northern BAP embankment was no longer there during our June 1 inspection.

Sec. 5, 1st P: insert language to the effect that not all the recommendations of the 1/2009 inspection were addressed.

Figure 4: show at least one of the A-A and E-E sections, considering the
unusual dimensions (both height and width) of the north embankment that serves both the BAP and the EFAP.

Deborah A Killeen
Quality Assurance Officer
Lockheed Martin/REAC

Global EPA Comments

From: Hoffman.Stephen@epamail.epa.gov [mailto:Hoffman.Stephen@epamail.epa.gov]
Sent: Thursday, July 23, 2009 11:09 AM
To: Miller, Dennis A; Killeen, Deborah A
Cc: Ur.Nancy@epamail.epa.gov; Kane.Gloria@epamail.epa.gov; Zownir.Andy@epamail.epa.gov
Subject: TDF 5

The TVA failure mode analysis report for the Kingston embankment failure was made public several weeks ago. One of the key findings was that the unit may have failed because the embankment was built upon coal ash slimes. I am directing LM to contact all of its subs and have them reassess each of the draft reports it has already completed and have them answer the following questions for each facility and unit studied:

* Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

* Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

* From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

Stephen Hoffman
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State Comments

None

LG&E Comments

Comments were provided using MS-Word *Track Changes* as follows:

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Figures

Appendices

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 Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of coal combustion waste ~~(CCW)~~ 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. The administration of this program is being supported by Lockheed Martin, who has authorized O'Brien & Gere to provide actual site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of our Purchase Order No. 7100051854, dated May 29, 2009.

1.2. Project Purpose and Scope

As stated in the Request for Proposal, 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 downgradient 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 Bottom Ash Pond (BAP) Management Unit at the Trimble County Generating Station in Bedford, Kentucky. Th~~is~~e Louisville Gas & Electric (LG&E) ~~power generation~~BAP impoundment facility is owned and ~~owned~~ operated by ~~and operated by E.ON U.S~~LG&E. In the course of this assessment, we obtained information from representatives of LG&E and its parent company, E.ON U.S.

2. Project/facility description

2.1. Identification of Management Unit

The Louisville Gas & Electric (LG&E) power generation facility in Trimble County was placed in operation in 1990 and ~~operate~~include[s] a coal fired electrical power generating facility with an approximate capacity of 547 megawatts (MW) gross generation capacity. The main generating power comes from the coal fired facility and is supplemented during peak times with six~~everal small~~ simple cycle natural gas operated units for peak loads. Phase II of this facility will be a second coal fired generating unit, with a capacity of approximately 810 MW gross capacity, and is currently under construction and scheduled to be completed by mid-2010.

The facility is located at approximately elevation (EL) 475 feet above mean sea level along the alluvial floodplain of the Ohio River. The approximate 100 year floodplain elevation is 458 feet to 459 feet in the area. The small community of Wises Landing, KY is located approximately a mile south of the facility and is inhabited by about 30 residential homes. The small community of Bethlehem, IN is located approximately five miles south of the facility and is inhabited by about 40 residential homes.

The coal is supplied to the facility via barges from the Ohio River, and is then conveyed by belt to the coal pile and the boiler. All coal combustion waste (CCW) is managed as wet disposal. The facility has four~~three~~ impoundment areas; 1) a small storm water retention pond at the southern end of the site, which collects site runoff; 2) the Bottom Ash Pond (BAP) at the northern end of the site, which receives all the facility's CCW; ~~and~~ 3) an Emergency Fly Ash Pond located immediately north of the Bottom Ash Pond and 4) a small retention pond adjacent to the limestone grinding facility which collects limestone process and coal pile run-off water and pumps it to the BAP. According to LG&E personnel, the Emergency Fly Ash Pond has never been used or received any CCW. The Emergency Fly Ash Pond will be converted to a Gypsum Storage Pond (GSP) to be placed in service in 2010.

Both the BAP and Emergency Fly Ash Pond (future GSP) are separated from the Ohio River by a meandering stream and wooded area, which has been designated a nature reserve.

2.2. Hazard Potential Classification

The Commonwealth of Kentucky classifies dams or embankments in accordance with the Kentucky Revised Statutes (KRS) and Kentucky ~~Adminstrative~~Administrative Regulations (KAR). The regulations are administrated by the Kentucky Department for Environmental Protection (KDEP), Division of Water, Dam Safety and Floodplain Compliance Section of the Water Infrastructure Branch. The KRS defines a dam as any structure that is 25 feet in height, measured from the downstream toe to the crest of the dam, or has a minimum impounding capacity of 50 acre-feet or more at the top of the structure (KRS Chapter 151.100).

Dam and embankment hazard classifications are established by the 401 KAR 4:030 and provide standards regarding impoundment facility structure classification from the Division of Water Engineering Memorandum No. 5 (incorporated by reference in 401 KAR 4:030).

"In determining structure classification, a number of factors must be considered. Consideration must be given to the damage that might occur to existing and future developments downstream resulting from a sudden breach of the earth embankment and the structures themselves. The effect of failure on public confidence is an important factor. State and local regulations and the responsibility of the involved public agencies must be recognized. The stability of the spillway materials, the physical characteristics of the site and valley downstream, and the relationship of the site to industrial and residential areas all have a bearing on the amount of potential damage in the event of a failure."

A moderate or significant hazard classification may be applied for structures located such that failure may cause significant damage to property and project operation, but loss of human life is not envisioned. Such structures will generally be located in predominantly rural agricultural areas where failures may damage isolated homes, main highways or major railroads, or cause interruption of use or service of relatively important public utilities.

KDEP has rated the hazard potential of this BAP structure as "moderate hazard" (significant) due to the importance of the structure to the operation of this facility in which a failure of the structure cwould render the facility as inoperable. A failure of the structure cwould ~~most likely~~ cause significant environmental damage if ~~with the release of~~ the CCW was released into the Ohio River thereby damaging the surrounding area and wildlife habitat, potential damage to wildlife and "fish kills", and threatening the drinking water supplies of the downstream communities. With the proximity of the operation buildings and workers immediately downstream and the small communities of Wises Landing, KY and Bethlehem, IN, a failure cwould result in damage to isolated homes, main highways or major railroads, or cause interruption of use or service of relatively important public utilities.

2.3. Bottom Ash Pond Physical Configuration

The BAP is a zero discharge, combined incised/diked structure with a surface pool area of approximately 82 acres. The embankment dike is partially incised with the pond bottom at approximately EL 430. Considering an average ground surface at EL 475, the BAP bottom is approximately 45 feet below natural ground elevation. The eastern crest is the highest at EL 528, while the north, south, and west dike crests are at about EL 500. The north dike is common to the BAP and the Emergency Fly Ash Pond (future GSP) to the north. According to design and survey plans, the crest of the north dike is approximately 75 feet above the bottom of the emergency fly ash pond. The crest of the western dike is about 40 feet above the downstream toe elevation.

The inboard and outboard embankment slopes of all dikes are relatively steep, at two horizontal to one vertical slope (2H:1V). All dikes are constructed of native silt, sand and gravel with a 3 foot thick clay liner placed along the upstream slope. The clay material was mined from within the incised portion of the dike as well as from an adjacent borrow area to the north.

During the construction of the facility, the north, south, and west dikes were not completed to the design crest elevation of 528 feet, due to lack of available fill material, and as-built crest elevations met engineering requirements. However, the east dike was completed to the design crest elevation due to its parallel alignment with Corn Creek Road (KY 1838), which required relocation during the construction of the impoundment and necessitated construction of the dike to the final elevation. With the construction of the Phase II project (the second coal fired generating unit) at the facility, the dikes along the north, west and south sides are being expanded vertically to EL 528, which raises the western embankment height to about 68 feet. While the inspection team was on site, the contractor was in the process of mobilizing for the embankment vertical extension project.

Several groundwater monitoring wells were observed and originally placed around the BAP because the original intent was to have a landfill at the premises for the CCW in lieu of the "wet management unit". While the KDEP requires groundwater monitoring for landfills, they do not require monitoring wells for surface water impoundments. Several piezometers were observed along the east dike but were only installed for the analysis and design of the vertical extension project and are now mostly abandoned.

The BAP is an incised/dike impoundment that does not have any contributing drainage area. The structure does not have a spillway system. The BAP water levels are controlled by three vertical turbine pumps on a floating dock. These pumps recirculate the water back to the facilities' various processes of use. Level is added to the BAP via

two vertical Service Water Pumps which draw water from the Ohio River (there is no means of return from the BAP to the Ohio River).No other outlet works exist for this structure.

3. Records review

3.1. General

A review of the available records related to design, construction, operation and inspection of the Bottom Ash Pond was performed as part of this assessment. The documents provided by E.ON U.S. are listed below:

Document	Author	Date
Geotechnical Investigation Reports (3)	ATEC Associates	1976/1977
Design Drawings (Plans and Sections)	Fluor-Pioneer	1981 to 1986
Geotechnical Engineering Study Completion Report	ATEC Associates	1984
State Inspection Reports and Related Correspondence	KDEP-Dam Safety	1992 to 2009
Original Topography and Plant Layout Plans (4 drawings)	Fluor-Pioneer (originals) LG&E (revisions)	2000 to 2008
Report of Geotechnical Exploration – Bottom Ash Pond Dike Improvement	MACTEC	2008
Visual Dam Assessment Report	ATC Associates, Inc.	2009
Response to EPA Request for Information	E.ON U.S.	2009

3.2. Design Documents

Review of the 1976/1977 geotechnical investigation reports, early 1980's impoundment design drawings, and the 1984 Geotechnical Engineering Study (BAP and EFAP Pond Completion Report) revealed several things, as follows:

- The geotechnical engineering recommendations for pond siting, design slope inclinations, embankment drainage provisions, and pond liner thicknesses were generally followed in the impoundment design.

- The 1984 Geotechnical Engineering Study (BAP and EFAP Pond Completion Report) revealed that the north, south, and west embankments were completed at about EL 500 due to lack of on-site material. In addition, this report indicated that the pond bottom had not been lined with clay due to lack of clay material available on-site, but the inside slopes had been lined with the exception of the northwest portion of the north embankment. The report recommended that the clay liner be completed to cover these areas, but no documentation was available to verify that this was done. The liner was recommended to minimize seepage and reduce the potential for groundwater contamination by leachate from the pond.

- The 1984 Geotechnical Engineering Study (BAP and EFAP Pond Completion Report) also revealed that the north, south, and west embankments were completed to EL 500, while the east embankment was completed to EL 528. This variance in embankment crest elevations was due to the lack of on-site fill to bring all embankments up to the design crest EL 528.

Review of the 2008 Report of Geotechnical Exploration (MACTEC) revealed the following:

- This geotechnical exploration report was conducted to support the proposed vertical embankment extension design for the BAP. This project is reportedly currently underway and will bring the north, south, and west embankment crests up to EL 528 consistent with the east embankment crest.

- The embankments will be raised to the proposed grades using a combination of compacted fill at 2.5H:1V slopes and Mechanically Stabilized Earth (MSE) walls.

- The report stated that subsurface conditions revealed by the borings indicated that the embankments were well constructed and consistent with design drawings.

3.2.1. Spillway Design Flood

The Bottom Ash Pond is diked above surrounding grades on all sides and does not receive storm water drainage other than precipitation that falls directly into the impoundment or incidental runoff directed into the pond from the embankment crest. In addition, the BAP was designed as a "zero-discharge" impoundment with all inflow and outflow controlled by pumps. The normal pool is maintained at EL 495 giving sufficient freeboard to collect direct precipitation from a Probable Maximum Precipitation (PMP) event, during a period of pump failure.

3.2.2. Stability Analyses

The 1976/1977 ATEC geotechnical reports presented the results of extensive embankment slope stability modeling for short-term (end-of-construction), long-term static and dynamic (seismic), and rapid drawdown loading conditions. Conservative soil strength parameters used in the analyses were derived from laboratory tests of the foundation and proposed embankment soils. The results of these analyses indicated safety factors that meet current criteria for slope stability embankment dams.

The 2008 MACTEC geotechnical report presented results of embankment slope stability modeling of the proposed vertical embankment expansion design. These recent analyses were based on the existing slope geometry, soil strength parameters derived from laboratory testing, or in-situ testing of existing embankment soils, and the final embankment geometries/configurations proposed for the vertical expansion project. The analyses conducted included multiple sections representing all embankments analyzed for long-term, seismic, and rapid drawdown loading conditions. All results indicated safety factors that meet current criteria for slope stability embankment dams.

3.2.3. Summary of Design Modifications

The only design modification noted in the available records since the original construction of the BAP is the closure of the 48-inch Corrugated Metal Pipe (CMP) equalization pipe between the Bottom Ash Pond and the Emergency Fly Ash Pond. Based on review of the design drawings and discussions with plant engineering personnel, this pipe was sealed with grout shortly after construction of the two impoundments. The Emergency Fly Ash Pond was never used to store CCW by-products.

The current embankment vertical extension project will be the first major modification of the BAP.

3.2.4. Instrumentation

As part of the geotechnical study performed by MACTEC in 2008, four piezometers were installed to observe water levels within the BAP embankments. These piezometers indicated that seepage through the embankment was minimal with two of the four piezometers yielding no groundwater. The piezometer installed on the crest of the east dike indicated a water level at approximately EL 474 feet, which appears similar in elevation to the blanket drain at the native soil/embankment fill interface as shown in Section C-C of Figure 4. A piezometer installed on the south dike indicated a steady water level at approximately EL 481, which MACTEC attributed to a granular toe drain that was installed at this elevation during original construction. The seepage observed at the toe of south embankment is believed to be associated with discharge from this toe drain.

The piezometers were installed and monitored during the design development of the embankment vertical extension project. Based on our discussions with plant engineering personnel, the existing temporary piezometers are not currently being monitored as they fulfilled thier use for the design of the BAP vertical extension.

3.3. Previous Inspections/Analyses

KDEP Dam Safety personnel have been performing regular dam safety inspections of the BAP since 1992000, and inspected again in 2005; however, the 2007 inspection was not performed due to state inspection personnel shortages. The most recent state inspection was performed concurrently with our site visit on June 1, 2009. Based on our review of the state inspection reports, the only issues or action items addressed in the reports included recommendations for clearing of small trees and woody vegetation growing on the embankments and mowing of the embankments, all of which have been completed.

In January of 2009, LG&E contracted ATC Associates, Inc. to perform an independent dam safety inspection of the BAP. The conclusion of this inspection indicated the BAP and associated dikes to be in “Satisfactory” condition overall with no urgent problems noted. This inspection report did recommend completion of several maintenance and monitoring items, which generally included the following:

- Mowing of slopes (completed)
- Removal of trees on northern dike downstream slope (completed)
- Repair of shallow scarps or sloughs
- Repair erosion gullies (numerous locations)
- Grade crest toward pond to reduce erosion problems
- Evaluate and repair upstream slope erosion
- Monitor seepage at south toe
- Monitor former scarps on east downstream slope

3.4. Operator Interviews

LG&E engineering personnel accompanied the other members of the inspection team and provided answers to questions regarding the BAP structure and the CCW disposal process. Mr. Bob Waterman indicated that he was present during the original construction of the BAP and has been an employee at Trimble County Station since commissioning of the BAP in 1990. Mr. Waterman is serving as Project Manager of the vertical extension project currently underway. None of the plant personnel were aware of any former failures, releases, or other structural integrity problems occurring at the BAP.

4. Visual inspection

4.1. General

On June 1, 2009, the following individuals were present to visually inspect the Bottom Ash Pond at the LG&E Trimble County Station in Bedford, Kentucky:

Thomas Crutcher – LG&E
David Millay – LG&E
Robert Waterman – LG&E
Roger Medina – LG&E
Marilyn Thomas – KDEP
Ray Prater – KDEP
Alexander Livnat – US EPA
Bryan Lovan – O'Brien & Gere
Dreher Whetstone – O'Brien & Gere

The weather on the date of inspection was clear and approximately 89 degrees. A field checklist was prepared by O'Brien & Gere to summarize the visual inspection and is included as Appendix A. Photographs were taken by both KDEP and O'Brien & Gere. Pertinent photos taken by O'Brien & Gere are included as Appendix B.

KDEP's Dam Safety and Floodplain Compliance Section/Water Resources Branch/Division of Water inspections of the unit have taken place in 1989, and from 1990, bi-annually until 2000. Due to reductions in staff, the last inspection prior to our visit took place only in September, 2005. Marilyn Thomas with the KDEP Dam Safety and Floodplain Compliance Section conducted an inspection concurrently and the report would be made available upon request.

4.2. Summary of Findings

LG&E had contracted with ATC Associates to conduct a site inspection of the BAP on January 20, 2009. A copy of this inspection is presented in Appendix C. Results of this inspection were reviewed by O'Brien & Gere, the high priority items recommended for completion in the ATC report had been addressed by LG&E prior to this visual inspection.

During the visual site inspection of the BAP, the perimeter of the impoundment was walked by two groups. One group walked the downstream slope, while the other group walked the crest and upstream slope. Representative features were observed by both groups. The BAP does not have a spillway or outlet works and the water level is maintained in the pond by the recirculating pumps in conjunction with service water pumps which draw water from the Ohio River. The current water level is approximately five to seven feet below normal (EL 495) in preparation for construction of the vertical extension project.

Wave action erosion was observed on the unarmored upstream slopes of both the south and east embankment and was more noticeable with the lower pool elevation. This erosion and some minor gully erosion occurring near the influent/effluent piping were the only deficiencies found on the upstream slope.

The downstream slope had recently been mowed, which allowed for better observation of the slope. Several shallow sloughs were noticed along the downstream slopes, but it was evident that they were old occurrences due to the vegetative growth around the sloughs. No new sloughs or depressions were found during this inspection.

Several erosion gullies were observed on the downstream slopes of the west and north embankments. This erosion appears to be occurring due to concentrated storm water discharge due to rutting of the crest by equipment and irregular grading of the crest toward the downstream slope.

The deficiencies described above are considered minor issues that do not currently impact the structural integrity of the impoundment; however, these issues will require monitoring and repair in the future to avoid worsening

conditions and prior to the construction of the vertical extension project. Counter to the situation during the last KDEP inspection, grasses were mowed shortly before our visit. It was observed that the equipment used to conduct the mowing was causing some rutting, which may be contributing to the minor sloughs, especially if the embankment was wet from recent rainfall. No seepage was observed, with the exception of the noted seepage along the toe of the south dike that has been in existence since the late 1980s. This was noted in the field checklist. As discussed previously, this seepage is believed to be associated with discharge from a granular toe drain that was installed during the original construction.

5. Conclusions

Based on the findings of the visual inspection and the records review conducted for this study, the Bottom Ash Pond at Trimble County Station located in Bedford, Kentucky appears to be in satisfactory condition and is well maintained. As described in the previous section, several minor maintenance items were observed, which do not currently impact the structural integrity of the BAP management unit, but should be addressed in the near future to avoid worsening conditions. These items include areas of erosion and shallow slope sloughing on both the upstream and downstream slopes. One small seepage location was noted on the toe of the south embankment.

Our interviews with plant engineering personnel responsible for the operation of the management unit indicate that a regular operations plan is in use at the Trimble County facility. The system of CCW and process water management in the BAP appears to be consistent with the original design intent. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impoundment structures.

In recent years, maintenance of the BAP has consisted of regular mowing and prevention of woody vegetation growth on the embankments. The plant engineering staff maintains all design documents and inspection reports in a well organized manner. The plant participates in and cooperates with regular state inspections. The Plant~~BAP~~ operations personnel make daily "drive-by" observations to monitor general conditions of the management unit. Based on these findings, we are of the opinion that the operations and maintenance procedures being practiced at the BAP management unit are adequate, although we recommend additional maintenance ~~procedures~~ actions be implemented to correct some of the conditions observed.

6. Recommendations

Based on the findings of our visual inspection and review of the available historical documents for the Bottom Ash Pond Management Unit, O'Brien & Gere recommends that additional maintenance of the embankment be performed to correct the erosion, slope sloughing, and poor drainage conditions observed during the inspection. These recommendations are grouped into the following categories, based on the urgency and nature of the issue to be addressed.

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 dam in the near term. However, it is recommended that all of the maintenance items be undertaken during construction of the embankment extension project, given the need to correct these issues prior to placing additional fill on the embankments.

6.2. Long Term Improvement/Maintenance Items

All of the deficient conditions observed during the inspection are considered to be maintenance items that do not require immediate attention; however, we recommend that these issues be corrected prior to raising the embankments during the vertical extension project. This recommendation is made considering that it is the most logical time to complete the minor repairs during the course of a major earthwork project. Furthermore, access to the areas requiring repair will be difficult after the embankments are raised, and neglected erosion or slope sloughing conditions may eventually impact the stability of the newly modified embankments with increased loading. As such, the repairs should be treated as preparation measures for the new embankment extension. The needed repairs are listed below:

1. Upstream slope – repair eroded and sloughed areas near the top of the east and south embankments. Repairs should be completed in accordance with an engineered design. Consider armoring of upper portion of interior eastern and southern slopes to protect against wave action erosion.

2. Embankment Crest -- regrade crest to divert runoff into pond, fill low areas to establish a uniform crest elevation and to avoid concentrated channeling of runoff. Grade crest to promote sheet flow. Stabilize areas of crest where vehicle or equipment will travel or in material laydown areas to avoid rutting of soft surface soils and creation of poorly drained areas.

3. Downstream slopes – fill erosion gullies on the downstream slopes of the north, east, and west embankments. Repair sloughs, and re-grade irregular areas of slopes to avoid concentrated runoff channels or saturation of portions of slope. Repairs should be performed in accordance with an engineered design. Avoid mowing during wet conditions to reduce rutting by heavy tractor, which may be causing some minor slope sloughing. Place turf reinforcement erosion control matting over repaired areas to reduce the potential for future erosion gullies.

6.3. Monitoring and Future Inspection

O'Brien & Gere recommends continued participation in state bi-annual inspections. ~~We would also recommend~~Consideration should also be given to independent inspections, such as the one conducted by ATC Associates, Inc., by licensed dam safety engineers on at least a bi-annual basis. Consideration should be given to development of an O&M Plan that would establish a firm schedule for operations, maintenance, and inspection activities.

Although the minor seepage/wetness at the downstream toe of the south embankment is believed to be the result of controlled discharge from an engineered toe drain, this seepage area should be monitored for increased seepage volume, transport of fine-grained soils, or other changed conditions that may indicate a potential problem.

Installation of a small gravel blanket drain in the area with an outlet channel or pipe would help to alleviate the poor drainage conditions in the area and provide a means to measure seepage flow rate at a convenient discharge point.

Consideration should also be given to installing permanent piezometers at critical sections within each embankment. These piezometers can serve to monitor the phreatic surface and pore water pressure during and after the embankment extension project, and help to evaluate the performance of the clay liner under the higher hydraulic loading that will be applied with the raised normal pool elevation after completion of the embankment extension. Considering that the level of the phreatic surface, or pore water pressure, within the downstream embankment soils can have a significant effect on slope stability, the piezometers would help to ensure engineers that pore water pressures remain below the levels assumed in the design slope stability analyses. The engineer of record for the embankment extension project should be consulted regarding the location, depths, and types of piezometer instrumentation to be installed and the frequency of monitoring.

6.4 Certification Statement

I acknowledge that the Bottom Ash Pond management unit referenced herein was personally inspected by me on June 1, 2009 and was found to be in the following condition:

SATISFACTORY
FAIR
POOR
UNSATISFACTORY

Signature: _____
Bryan K. Lovan, PE