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Vectren Corporation
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Evansville, Indiana 47702-0209

July 26, 2011
Submitted via Fed-Ex

Mr. Stephen Hoffman
Office of Resource Conservation and Recovery (5304P)
US Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, D.C. 20460

RE: Coal Ash Impoundment Assessment final report prepared by Kleinfelder

Dear Mr. Hoffman:

SIGECO (dba Vectren) would like to thank you for the opportunity to respond to the report for the Coal Ash Impoundment Site Assessment for our F. B. Culley Generating Station prepared by Kleinfelder.

In response to the recommendations in the final report, we offer the following status updates:

1. Stability, seepage, and seismic analysis – Enclosed please find a copy of the Stability Analysis report prepared by our outside consultant, ATC Associates, which indicates that both embankments are stable and will withstand moderate seismic activity. The report also indicates that there is no indication of seepage from either embankment in the 50+ years they have been in existence.

2. Evaluation of large trees on downstream slope – As indicated in the Kleinfelder report and the report from ATC Associates, we do not feel that the removal of the large trees would be beneficial to the integrity of the dam. We will, however, continue to evaluate the necessity and impact of their removal as part of the vegetation control discussed in the next section.

3. Control vegetation on upstream and downstream slopes – We have had the area reviewed by an outside vegetation control specialist and have determined that we will need additional time to evaluate the options. Due to the presence of the existing trees and brush, it is not possible to complete mechanical mowing at this time. We may need to consult with or submit a permit to the Corp of Engineers depending on the control option selected. We should be able to determine the best means for vegetation management and receive any applicable permits by December 31, 2011. Some method of control will likely begin in the fourth quarter 2011 although depending on the weather and river levels, it may be late first quarter 2012 until the control plan is fully implemented.

4. Repair erosion and oversteepening of upstream slope in both ponds – The plant has begun review the surface erosion and is evaluating the best method for repairing the oversteepening of the upstream slopes. This should be completed by September 30, 2011.

5. Update the EAP – We have consulted with our internal Safety Department to determine if there are any additional guidelines from OSHA to address embankment breaches and could find none. We have updated our EAP to include additional notifications to the river loading / unloading areas and the adjacent power plant operated by Warrick Generating Company. Since the ash pond embankments are also the river bank there are no houses or other structures in the path of a failure.

6. Perform hydrologic and hydraulic study – We are in the process of having these studies conducted by ATC Associates. A topographic flyover and initial site evaluation were conducted in late spring 2011 to support this process and a final site visit will occur the week of July 25th. The final report will be completed by September 30, 2011.

7. Perform an emergency spillway study – The evaluation of a potential location for an emergency spillway will be discussed in the above mentioned hydrologic and hydraulic study which will be completed by September 30, 2011. It is anticipated it will take an additional 3-6 months to install the spillway if a suitable location can be identified.

8. Priority 2 recommendations – A Preventative Maintenance work assignment has been added to test the West and East pond pumps on an annual basis. The Advantis computer based O and M system has a separate work log function for ash pond related work which allows for computer access to quarterly inspection forms and work orders, pump test work orders, and any other future ash pond specific maintenance projects such as vegetation control.

Thank-you again for the opportunity to comment on the final assessment. Please contact me at 812-491-4666 or lmessinger@vectren.com if you have any further questions.

Sincerely,

Lisa C. Messinger

Lisa C. Messinger, CHMM
Manager, Utility Environmental Compliance

Cc: J. Minnette, plant copy
D. Bryenton
File

EMBANKMENT STABILITY ANALYSES

EAST AND WEST ASH PONDS
F.B. CULLEY GENERATING STATION
YANKEETOWN, INDIANA

ATC PROJECT NO. 86.33159.0070

JUNE 24, 2011

PREPARED FOR:

VECTREN UTILITY HOLDINGS, INC.
ENVIRONMENTAL AFFAIRS
P.O. BOX 209
EVANSVILLE, INDIANA 47702-0209

ATTENTION: MS. LISA MESSINGER

ATC ASSOCIATES INC.
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June 24, 2011

Vectren Utility Holdings, Inc.
Environmental Affairs
P.O. Box 209
Evansville, Indiana 47702-0209

Attention: Ms. Lisa Messinger

Re: **Embankment Stability Analyses**
East and West Ash Ponds
F.B. Culley Generating Station
Yankeetown, Indiana
ATC Project No. 86.33159.0070

Dear Ms. Messinger:

Submitted herewith is the report of the results of our stability analyses on the East and West Ash Pond embankments at the F.B. Culley Station. This study was authorized in accordance with ATC Proposal No. 086-2011-0104 dated January 28, 2011.

This report contains a description of the ash ponds, the results of slope stability analyses and a summary of our findings relative to the stability of the ash pond embankments. We wish to remind you that we will store the samples for 90 days after which time they will be discarded unless you request otherwise.

We appreciate the opportunity to be of service to you on this project and hope that the information contained in the report conforms to your needs. If you have any questions regarding this report, please do not hesitate to contact either of the undersigned.

Sincerely,

ATC Associates Inc.

DAVID L. WARDER REGISTERED No. 14474 STATE OF INDIANA PROFESSIONAL ENGINEER

Shawn M. Marcum, P.E.
Senior Project Engineer

David L. Warder, P.E., Ph.D.
Principal Engineer

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Principal Engineer

Copies: (3) Vectren Utility Holdings Attn: Ms. Lisa Messinger

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EMBANKMENT STABILITY ANALYSES

EAST AND WEST ASH PONDS
F.B. CULLEY GENERATING STATION
YANKEETOWN, INDIANA

ATC PROJECT NO. 86.33159.0070

1.0 INTRODUCTION

Vectren's F.B. Culley Generating Station is located on the north bank of the Ohio River about 1.5 miles southwest of Yankeetown, Warrick County, Indiana (see Vicinity Map, Figure A1, in Appendix A). The East Ash Pond and West Ash Pond are located just upstream and downstream, respectively, of the main power plant.

The purpose of this investigation was to determine the nature and condition of the materials within the embankments on the south sides of the ponds and the foundation soils below the embankments. The scope also included an evaluation of the stability condition of the embankments.

2.0 DESCRIPTION OF EMBANKMENT

The East Ash Pond covers approximately ten acres on the east side of the F.B. Culley Station (see Photo No. 1). This ash pond was reportedly created in the early 1970s by constructing an embankment adjacent to the Ohio River and Little Pigeon Creek on the south side. The embankment ties into higher ground along the east and west sides of the pond. Plans indicate that both embankments were designed with 3 (horizontal) to 1 (vertical) outside slopes and 2.5 (horizontal) to 1 (vertical) inside slopes. Design plans indicate that riprap was to be placed on the downstream slope. However, a heavy tree and brush cover on the outside slope precluded careful examination of the slope to determine the current condition of the riprap (see Photo No. 2 and 4). Concrete rubble was visible on parts of the outside slope (see Photo No. 4). The crest, which is approximately 10 ft wide, is covered with crushed stone (see Photo No. 2). The inside slope appeared to be relatively steep with limited vegetative cover and coal ash exposed in some areas (see Photo No. 3).

The approximately 32-acre West Ash Pond is located west of the coal storage pile (see Photo No. 5). Although no design plans are apparently available, it is believed that this pond was constructed in the 1950s by placing fill along the south side (i.e., adjacent to the Ohio River) and tying into high ground at either end. The normal pool in the west pond is maintained at about El 392 by a pumping system that circulates water from the impoundment back into the generating station. The crest of the south embankment is covered with crushed stone that is in generally good condition (see Photo No. 6). The inside slope was sparsely vegetated with brush and weeds and was relatively steep, apparently the result of past dredging operations (see Photo No. 7). Ash with numerous erosion gullies was exposed on the inside slope in some areas. The outside slope of the south embankment was mostly covered with riprap, with brush and trees growing through the riprap (see Photo No. 8).

Although the scope of this investigation did not include a careful inspection of all slopes, observations from the embankment crest did not reveal any clear signs of instability. There appeared to be no significant slides, sloughs or settlement nor were there any clear indications of seepage on or just below the outside slopes.

3.0 SITE GEOLOGY

The F.B. Culley Station is located on a terrace that is approximately 45 ft above the Ohio River normal pool elevation. Based upon site reconnaissance observations, it appears that fill has been placed to reach the plant floor elevation of about 394.

The site is located on the west flank of the Cincinnati-Kankakee Arch, in the Boonville Hills physiographic subdivision of the Southern Hills and Lowlands Region of Indiana. Bedrock at this site is mapped as the Pennsylvanian Carbondale group, which consists mostly of shale and sandstone with thin beds of limestone, clay and coal. The nearest mapped fault is about 12 miles east of the site in Spencer County, Indiana. Ground shaking from earthquakes would likely result from fault movements within either the New Madrid Seismic Zone, which is located in southeastern Missouri, or the Wabash Valley Fault System in southwestern Indiana.

The unconsolidated materials that overlay bedrock are rather complex. Units mapped as alluvium and outwash (primarily sand and gravel) are present near the Ohio River, with loess (wind-blown) and lacustrine (lake-bed) deposits mapped away from the river. The bluffs on the north and east portions of the Culley site are mapped as loess and the materials in the western portion, which is a low, flat plain, are mapped as lacustrine deposits from flooding of the Ohio River during the late Pleistocene, when the Ohio River served as a major glacial meltwater sluiceway. Silt and clay, reaching thicknesses exceeding 100 feet to the west of the area investigated, were deposited in water that ponded in the tributaries to the Ohio River, while sand and gravel were deposited in the main channel.

4.0 GENERAL SUBSURFACE CONDITIONS

In order to determine the general characteristics of the embankment materials and foundation soils, four test borings (two in each embankment) were drilled to a depth of 60.0 ft at the approximate locations shown on the Boring Pan (Figure A2 in Appendix A). Boring Nos. B-1 and B-2 were drilled from the crest of the East Ash Pond south embankment, Boring Nos. B-3 and B-4 from the crest of the West Ash Pond south embankment. Split-spoon samples were obtained at 2.5 ft intervals by Standard Penetration test procedure (ASTM D-1586). Representative portions of the split-spoon samples were sealed in glass jars and returned to our laboratory for inspection and testing. The results of test borings that were previously performed within the study area were also utilized.

Logs of the borings along with a description of drilling procedures are included in Appendix E. A sheet defining the terms and symbols used on the logs and explaining the Standard

Penetration test procedures is also included in Appendix E. Generalized subsurface cross-sections are illustrated on Figures B1 through B4 in Appendix B. To aid in classifying the soils and to determine general soil characteristics, grain size analyses and natural moisture content, Atterberg limits and various soil strength tests were performed on selected samples. The test results are presented in Appendix D. Conditions varied significantly between the two embankments as described below.

After penetrating approximately 8 in. of crushed stone at the surface, Boring Nos. B-1 and B-2, which were drilled on the crest of the East Pond south embankment (see Figure No. A2 in Appendix A), encountered sandy silty clay underlain by silty clay embankment fill to depths varying from 28.0 to 30.5 ft. The fill material, which varied in color from brown to gray, appeared to be a mostly soft to medium stiff with moisture contents typically varying between the upper teens and upper twenties. Pocket penetrometer unconfined compressive strength estimates were mostly greater than 1 ton/sq. ft, although there were pockets of softer material in each boring. Liquid limits of three fill samples tested varied from 28 to 39 with plastic limits varying from 19 to 20. The natural soils underlying the fill in both borings consisted of gray and/or brown, soft to medium stiff, silty clay (CL) to the boring termination depth of 60.0 ft. Moisture contents of the natural silty clay soil were mostly in the upper twenties to mid-thirties although moisture contents of between 40 and 50 percent were noted in most samples taken from below a depth of 40 ft in Boring No. B-2. Liquid limits on five natural silty clay samples tested varied from 41 to 48 percent with plastic limits varying between 19 and 24 percent. Natural dry densities of two samples taken below a depth of 40 ft in Boring No. B-2 were 82.8 and 88.1 lbs/cu. ft.

Boring Nos. B-3 and B-4, which were drilled from the crest of the south embankment of the West Ash Pond, penetrated approximately 10 in. of crushed stone underlain by fill that consisted of silty clay and sand with bottom ash, respectively, to a depth of about 3.0 ft. Below these materials, both borings encountered predominately sand fill that contained varying amounts of silt and gravel to depths of 20.5 and 18.0 ft, respectively. The sand fill appeared to be mostly medium dense, with some looser zones noted. A layer of apparently natural gray, stiff, sandy silty clay (CL) was noted below the fill between depths of 20.5 and 23.0 ft in Boring No. B-3. Boring No. B-4 encountered loose to medium dense sand and gravel (SP) from the bottom of the fill to a depth of about 33.0 ft. Below the materials described above, both borings encountered generally very loose to medium dense sandy silt (ML) to silty sand (SM) to the boring termination depth of 60.0 ft.

Ground water observations were made during the drilling operations by noting the depth of water on the drilling tools. Because all borings were backfilled at completion with cement/bentonite slurry, it was not possible to measure ground water at the completion of drilling. Ground water was noted during drilling in Boring Nos. B-3 and B-4 at depths of about 13 to 12 ft, respectively, which corresponds to an average ground water elevation of about 381 to 382. No free ground water was encountered during drilling in Boring Nos. B-1 and B-2. It should be noted, however, that short term ground water level observations made in test borings are not necessarily a reliable indication of the actual ground water level and that fluctuations in the ground water level should be expected due to variations in rainfall, Ohio River flow and other factors. One inch diameter PVC pipe piezometers were installed near Boring Nos. B-2 and B-3 to a depth of 20 ft to monitor future ground water trends.

5.0 DISCUSSION OF STABILITY ANALYSES

Circular arc stability analyses were performed on the outside slope of the ash pond embankments using the modified Bishop method and the computer program PCSTABL6H at two cross sections, one for each embankment. The sections that were analyzed are illustrated on Figures B1 and B3 in Appendix B. The results of pertinent analyses are presented in Appendix C. Effective strength parameters, ϕ' and c', of 27 degrees and 300 lbs./sq. ft, respectively, were used for the silty clay embankment materials within the East Ash Pond south embankment. Effective strength parameters of 31 degrees and 250 lbs./sq. ft were used for ϕ' and c' for the natural silty clay soils below this embankment. An effective friction angle of 32 degrees was used for both the sandy soils within the West Ash Pond as well as for the natural silty sand/sandy silt foundation soils. These estimated parameters were established using the results of tests performed for this study as well as published correlations between soil classification and soil strength.

Stability analyses were conducted for steady state seepage conditions on the existing outside slopes with the East Ash Pond water level at El 388 and the West Ash Pond water level at El 392. Stability analyses were also performed on the slopes analyzed with a 0.13g horizontal earthquake loading. A surcharge load on the embankment crests of 250 lbs/sq. ft was applied in the analyses. In addition, the rapid drawdown case was analyzed for both embankments for the case of an Ohio River flood returning to normal pool. The results of all analyses are presented in Appendix C and are summarized in the following table:

Section/Condition Analyzed	Computed Minimum Factor of Safety
East Ash Pond, Section A-A', Steady State Seepage	1.8
East Ash Pond, Section A-A', Steady State Seepage with Earthquake Loading	1.2
East Ash Pond, Section A-A', Rapid Drawdown	1.7
West Ash Pond, Section C-C', Steady State Seepage	1.7
West Ash Pond, Section C-C', Steady State Seepage with Earthquake Loading	1.1
West Ash Pond, Section C-C', Rapid Drawdown	1.3

Generally accepted minimum factors of safety for the downstream slope of dam embankments are 1.5 for steady state seepage, 1.1 for earthquake loading and 1.2 for rapid drawdown. All of the computed factors of safety in the table above exceed these generally accepted standards.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the results of the test borings – those performed for this as well as previous investigations, laboratory tests, stability analyses performed on representative sections and observations made during a site visit:

- Based on the results of Boring No. B-1 and B-2, the silty clay soils within south embankment of the East Ash Pond appear to be relatively uniform and of the type normally considered to be suitable for the construction of impounding structures. The natural soils below the embankment are low permeability silty clay soils that provide an adequate foundation and limit underseepage below the embankment.

- The results of Boring Nos. 3 and 4 indicate that the south embankment of the West Ash Pond was constructed with predominantly sand, which has the required strength characteristics, but not ideal permeability for an impoundment structure. The natural soils below the embankment are mostly silty sand or sandy silt. Even though both the embankment and foundation soils appear to relatively pervious, there are no clear indications that there is excessive seepage either through or beneath the embankment. This suggests that there may be a relatively impervious "blanket" on the inside slope and pond bottom (perhaps due to years of sediment deposition). In any case, the overall seepage characteristics of the system appear to be adequate to prevent excessive seepage.

- The results of stability analyses indicate that there is an adequate factor of safety relative to slope instability for both embankments that were analyzed.

- Because the stability safety factors are adequate, the embankments have performed satisfactorily for many years and there are no signs of instability or excessive seepage through or under the embankments, there appear to be no significant geotechnical engineering deficiencies at this time.

- It is recommended that the inside slopes of both embankments be modified by reducing the slope angle to no steeper than 2.5 (horizontal) to 1 (vertical), repairing any remaining erosion gullies and protecting the slopes from future erosion with either a grass cover or by placing riprap.

- In order to allow for periodic safety inspections that could detect early signs of a potential failure (such as excess seepage, depressions, sloughing or sliding), it is generally considered undesirable to have trees and brush growing on the slope of an earth dam. Rather, a good grass cover that is regularly mowed is preferred. The trees and brush on the outside slopes of both ash pond embankments prevents careful inspection of the slopes. An additional problem with large trees on embankment slopes is that uprooting (for example from high winds) can cause a depression on the slope that can lead to embankment failure. In this case, however, it appears that both embankments are wide enough that an uprooted tree would not infringe upon the minimum design embankment prism. Thus, it is unlikely that an uprooted tree would cause sufficient loss of ground to immediately jeopardize embankment stability.

  While removal of all trees and brush would improve the overall condition of the embankments, their presence does not appear to present an immediate threat to stability. Prior to removing the brush and trees, consideration must be given to any limitations by federal or state regulatory agencies that may apply. If the trees and brush are not removed, particular care should be taken to investigate and repair the effects of any fallen trees.

- It is important that the embankments be well-maintained and that thorough inspections be performed periodically. The crest and slopes of the embankments as well as the area immediately downstream of the embankments should be thoroughly inspected by a representative of the owner at least twice each year. These inspections should note any seepage as well as any sloughing, sliding or excessive erosion on any exposed surface. If any of these items are noted, appropriate action should be taken. This may include drawing down the pond level or performing an engineering investigation to determine the cause for the change in condition.

7.0 LIMITATIONS OF STUDY

The findings of this report are based on the results of test borings and readily observable geotechnical aspects of the embankments. While no significant defects were noted, the results of this evaluation should not be considered as a warranty or guarantee of the future safety or integrity of the embankments.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either express or implied. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the information presented in this report.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, ground water or surface water within or beyond the site studied.