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Coal Combustion Waste Impoundment

Dam Assessment Report

Site 7
1982 Pond & 1964 Pond
Progress Energy Carolinas
Asheville, North Carolina

Project # 0-381

Assessment of Dam Safety
Coal Combustion Surface Impoundments
For the REAC Program

Prepared for:

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For
United States Environmental Protection Agency

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INTRODUCTION

The release of over 5 million cubic yards of coal ash from the Tennessee Valley Authority's Kingston, Tennessee, facility in December 2008 serves as an important reminder of the need for our continued diligence on disposal units where coal combustion wastes are managed. The coal ash from the facility flooded more than 300 acres of land, damaging homes and property. It is critical that we all work to the best of our abilities to prevent a similar catastrophic failure and resultant environmental damage. One of the first steps in this effort is to assess the stability of the impoundments and similar units that contain coal combustion residuals and by-products to determine if and where corrective measures may be needed and then to carry out those measures as expeditiously as possible.

This report for the Progress Energy Carolinas Asheville facility assesses the stability and functionality of the following management units. This evaluation is based on a site assessment conducted on Friday, May, 29th, 2009 by Dewberry & Davis, Inc.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is embarking on an initiative to investigate the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant or High Hazard Potential ranking. (For Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety)

In February 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion waste. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material 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. Utility companies provided information on the size, design, age and the amount of material placed in the units. The EPA used the information received from the utilities to determine preliminarily which management units had or potentially could have High Hazard Potential ranking.

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The purpose of this report is to evaluate the condition and potential of waste release from the selected High Hazard Potential management units. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner.

EPA sent two engineers, one of whom was a professional engineer (PE), for a one-day site visit. The two-person team met with the owner of the management unit to discuss the engineering characteristics of the unit as part of the site visit. During the site visit, the team collected additional information about the management unit to be used in determining the hazard potential classification of the management unit(s).

Factors considered in determining the hazard potential classification of the management units(s) included the age and size of the impoundment, the quantity of coal combustion residuals or by-products that were stored or disposed of in these impoundments, its past operating history, and its geographic location relative to down gradient population centers and/or sensitive environmental systems.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s). The team considered criteria in evaluating dams under the National Inventory of Dams, in making these determinations.

LIMITATIONS

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion waste management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from our one-day site visit and review of technical documentation provided by Progress Energy Carolinas.

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

1964 Dam – Embankment and spillway systems appear to be structurally sound. However, structural stability documentation was not provided so this conclusion was based on observation alone.

1984 Dam – Embankment and spillway systems appear to be structurally sound.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

1964 Dam – Adequate capacity and freeboard exists to safely pass the design storm; however, a detailed analysis should be included in the supporting technical documentation for this facility.

1982 Dam – Adequate capacity and freeboard exists to safely pass the design storm.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

Table 1.1.3 - Adequacy of Supporting Technical Documentation

	1964 Dam	1982 Dam
Hydrologic/Hydraulic Safety	Not Provided	Adequate
Structural Stability	Not Provided	Adequate

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

1964 Dam – Descriptions provided are appropriate.

1982 Dam – Descriptions provided are appropriate.

1.1.5 Conclusions Regarding the Field Observations

1964 Dam – Embankments visually appear to be well maintained, safe, and structurally sound. There are no apparent indications of unsafe conditions.

1982 Dam - Embankments visually appear to be well maintained, safe, and structurally sound. There are no apparent indications of unsafe conditions.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

1964 Dam – Maintenance and methods of operation are adequate.

1982 Dam – Maintenance and methods of operation are adequate.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

1964 Dam – Surveillance program is adequate; however no monitoring program is in place. The embankment no longer impounds a normal pool and is used to store dredged materials; therefore, a monitoring program for fluctuation of phreatic surface is not currently warranted. A monitoring program for internal seepage should be initiated and depending on the results of a detailed slope stability analysis, inclinometers or other instrumentation and monitoring programs for slope instability should be initiated.

1982 Dam – Surveillance and monitoring programs are adequate.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

1964 Dam – The facility is rated POOR for continued safe and reliable operation because critical studies or investigations are needed to identify potential dam safety deficiencies. A slope stability investigation, to identify potential structural deficiencies, is required to achieve a satisfactory rating. Based on visual observations and review of available data, no safety deficiencies are noted to prevent the facility for continued safe and reliable operation.

1982 Dam – Facility is SATISFACTORY for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

1964 Dam – Slope stability analysis should be performed to confirm that acceptable margins of safety exist.

1982 Dam – None appear warranted at this time.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

1964 Dam – None appear warranted at this time; however, a dam break analysis should be performed as part of an emergency action plan.

1982 Dam – None appear warranted at this time; however, a dam break analysis should be performed as part of an emergency action plan.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

Table 1.2.3: Recommendations for Supporting Technical Documentation

	1964 Dam	1982 Dam
Hydrologic/Hydraulic Safety	Perform inflow design flood analysis Perform dam break analysis	Perform dam break analysis
Structural Stability	Perform detailed slope stability analysis	None

1.2.4 Recommendations Regarding the Description of the Management Unit(s)

1964 Dam – None appear warranted at this time.

1982 Dam – None appear warranted at this time.

1.2.5 Recommendations Regarding the Field Observations

1964 Dam – None appear warranted at this time.

1982 Dam – None appear warranted at this time.

1.2.6 Recommendations Regarding the Maintenance and Methods of Operation

1964 Dam – It is recommended that

- The embankment should be cleared of any trees or deep rooted vegetation that is beginning to be established;
- A program be established to have the rip-rapped embankment slope cleared of vegetation at least once every year;
- Additional rip-rap placed in the ditch along the right groin to minimize erosion;
- Under drain outlets be protected with small-animal guards attached with a hinge allowing for unobstructed flow (a removable screen placed over the front of the weir box is an acceptable

alternative providing it is affixed with a mechanism providing for unobstructed flow should clogging occur).

1982 Dam - It is recommended that:

- Precaution be taken to not mow the embankment when wet or to take necessary measures to not create ruts perpendicular to the embankment slope;
- Grass, or similar shallow rooted herbaceous vegetative cover, needs to be established in bare areas where soil is visible;
- Small-animal burrows found on the downstream slope should be filled in with the appropriate material; and
- Under drain outlets be protected with small-animal guards attached with a hinge allowing for unobstructed flow (a removable screen placed over the front of the weir box is an acceptable alternative providing it is affixed with a mechanism providing for unobstructed flow should clogging occur).

1.2.7 Recommendations Regarding the Surveillance and Monitoring Program

1964 Dam – Continue current surveillance program and begin seepage monitoring at internal drain outlets. Implement additional monitoring recommendations as may be identified in a slope stability analysis.

1982 Dam – Continue current program.

1.2.8 Recommendations Regarding Continued Safe and Reliable Operation

1964 Dam – Perform a slope stability analysis and implement potential recommendations. Perform dam break analysis and develop an emergency action plan in the event of dam failure.

1982 Dam – Perform dam break analysis and develop an emergency action plan in the event of dam failure.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Karrie J. Shell – Environmental Protection Agency (EPA)
Janet Boyer – North Carolina Department of Natural Resources (NCDENR)
Laurie Moorehead – Progress Energy Carolinas (PEC)
Bill Forster - Progress Energy Carolinas (PEC)
Fred Holt - Progress Energy Carolinas (PEC)
John Toepfer - Progress Energy Carolinas (PEC)
Richard C.W. Horton - Progress Energy (PE)
Steve Blevins - MACTEC
Justin Story – Dewberry & Davis, Inc. (DDI)
Frederic Shmurak – Dewberry & Davis, Inc. (DDI)

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on May 29, 2009.

Frederic M. Shmurak, PE (NC # 027071)

Justin Story, Civil Engineer

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2.0 DESCRIPTION OF THE COAL COMBUSTION WASTE MANAGEMENT UNIT(S)

2.1 LOCATION

The Asheville Steam Electric Plant including the two ash pond dikes is located south of Skyland, North Carolina, and immediately east of Interstate Highway I-26 and the French Broad River in Buncombe County. The City of Asheville is approximately 7 miles downstream of the ash pond dams. See Appendix A – Doc 13.

2.2 SIZE AND HAZARD CLASSIFICATION

Based on data provided by Progress Energy Carolinas, Inc. (PEC), the 1964 ash pond dam was constructed with a maximum height of 60 feet with a crest width of 8 feet, side slopes of 2(H):1(V) and a length of 950 feet. In 1970-71 the dam was raised approximately 30 feet and was extended to provide additional ash storage. The classification for size, based on the height of the dam and storage capacity, is Intermediate in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria.

Based on data provided by MACTEC, the 1982 ash pond dam was constructed with a 95 maximum height, an approximately 1,500 feet in length and a crest elevation of 2165 feet MSL. The crest width is 15 feet and the side slopes are 2(H):1(V) upstream and 2.5(H):1(V) downstream. The classification for size, based on the height of the dam and storage capacity, is Intermediate in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria.

Table 2.2a USACE ER 1110-2-106
Size Classification

	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

These dams are established as a Hazard Classification of High. Per the Federal Guidelines for Dam Safety dated April 2004, a high hazard potential classification are those dams where failure or mis-operation results will probably cause loss of human life.

Table 2.2b FEMA Federal Guidelines for Dam Safety
Hazard Classification

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Table 2.2c: Summary of Dam Dimensions and Size		
	1964 Dam	**1982 Dam**
Dam Height	90' *	95'
Crest Width	12'	15'
Length	950'	1500'
Side Slopes (upstream)	1.5:1	2:1
Side Slopes (downstream)	1.5:1	2.5:1
Hazard Classification	High	High

*The original construction height of the 1964 Dam was 60' and in 1970-71 approximately 30' of height was added.

2.3 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

Per Progress Energy Carolinas, the 1964 ash pond contains fly ash, bottom ash, boiler slag, Flue Emission Control Residuals in the constructed wetlands and storm water. The 1964 ash pond was removed from service in 1982 and drained. The impoundment is currently used to store dredged material from the 1982 Ash Pond and does not maintain a normal pool. Storage capacity for the facility is approximately 1,380 acre-feet.

Per Progress Energy Carolinas, the 1982 ash pond primarily contains fly ash, bottom ash and boiler slag. Other materials that the pond contains are ash sluice water, categorical low volume wastewater, coal pile storm water runoff and other storm water. The drainage area for the 1982 pond is approximately 70 acres while the surface area of the pond is approximately 46 acres. The total storage capacity is approximately 1,400 acre-feet. The volume of the material currently stored is approximately 1,260 acre-feet based on an estimate from Progress Energy - Carolinas in March 2009.

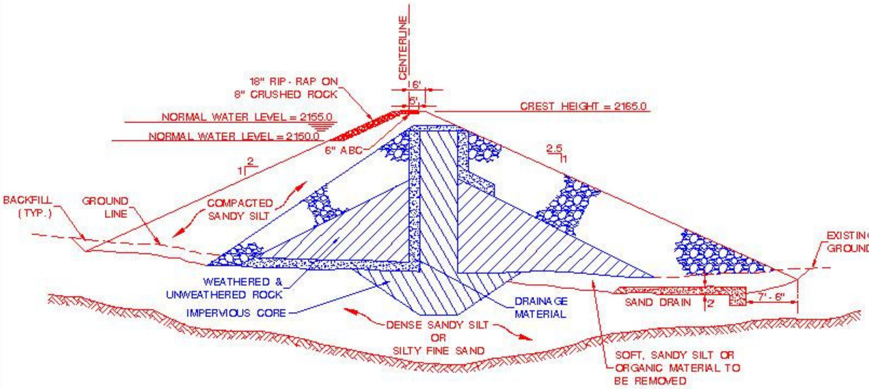
Table 2.3: Amount of Residuals and Maximum Capacity of Unit*		
	1964 Dam	**1982 Dam**
Surface Area (acre)	45	46
Current Storage Volume (acre-feet)	Not Reported	1,260
Total Storage Capacity (acre-feet)	1,380	1,400

*Data taken from PEC Questionnaire, See Appendix A-Doc 14.

2.4 PRINCIPAL PROJECT STRUCTURES

2.4.1 Earth Embankment Dam

1964 Dam – The dam embankment is a composite of compacted random earth fill and rock fill with a vertical impervious core and chimney drain system to control seepage. The following figure of the 1964 Dam Typical Design Section is representative of the configuration of the management unit.



ASHEVILLE DAM 1964

TYPICAL DESIGN SECTION

NOT TO SCALE

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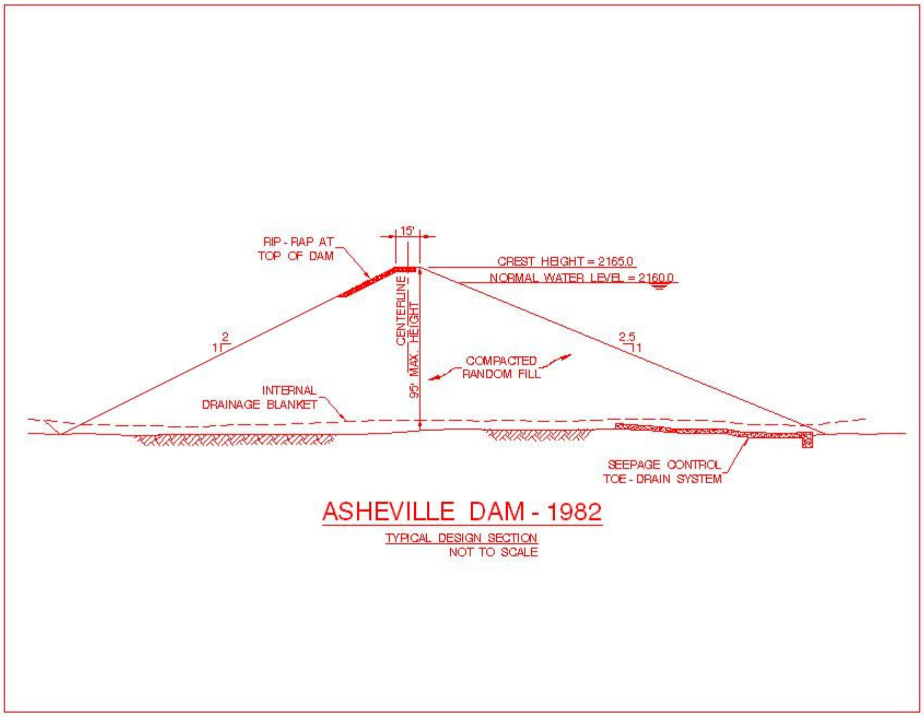
1982 Dam – The dam embankment consists of compacted random earth fill with an internal drainage blanket and toe-drain system to control seepage. The following figure of the 1982 Dam Typical Design Section is representative of the configuration of the management unit.



2.4.2 Outlet Structures

1964 Dam - The outlet works consist of a 30" diameter concrete pipe, with movable skimmer box, that passes through the embankment dam and is connected to an energy dissipater and discharges into a stilling pond. Water is discharged from the stilling pond through a rectangular concrete riser box and flows through a 60" diameter corrugated metal culvert beneath Interstate I-26 into the French Broad River.

1982 Dam – The outlet works consist of a 30" diameter concrete riser pipe, with a metal skimmer, that discharges to the 1964 Pond stilling basin via a concrete flume.

2.5 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

All critical infrastructures were located using aerial photography and might not accurately represent what exists down gradient of the site. See Appendix A – Doc 12.

Schools	Schools	Nursing Homes
Valley Springs Elementary 224 Long Shoals Rd Arden, NC 28704	University of Phoenix Asheville Learning Center 30 Town Square Blvd Asheville, NC 28803	Brookdale-Asheville Manor 308 Overlook Rd Asheville NC, 28803
Roberson High School 250 Overlook Rd Asheville, NC 28803	Avery's Creek Elementary School 15 Park South Rd Arden, NC 28704	Evergreen Living Home 90 Knob Hill Rd Asheville NC, 28806
		Transportation
William W. Estes Elementary 275 Overlook Rd Asheville, NC 28803	Bent Creek Baptist Church Pre-School 1554 Brevard Rd Asheville, NC 28806	Interstate 26 Blue Ridge Parkway

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNIT(S)

PEC provided the 5-Year Independent Consultant Inspection Report, by MACTEC, dated November 26, 2007 for the 1964 and 1982 Ash Pond facilities. The independent inspection is performed at 5-year intervals as required by the North Carolina Utilities Commission (NCUC) and not licensed by the Federal Energy Regulatory Commission. The report concluded that for both the 1964 and 1982 Ash Pond facilities "no deficiencies or indications of potential deficiencies were noted which would endanger the safety of the structures" and "no serious deficiencies were observed in maintenance or methods of operation, quality and adequacy of surveillance."

3.2 SUMMARY OF LOCAL, STATE AND FEDERAL ENVIRONMENTAL PERMITS

The facility is under regulation by the NCUC. No local, state or federal permits have been provided for these dams.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS (IF ANY)

No spills or releases from the Ash Pond facilities have been noted by PEC for this site.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

1964 Dam – The ash pond dam was completed and commissioned in 1964. The original designer was Ebasco Services, Inc.

The dam assessor did not meet with, or receive documentation from, the design engineer of record regarding foundation preparation for the 1964 Dam. No information has been provided to evaluate whether or not the 1964 impoundment was not constructed over wet ash, slag or unsuitable material.

1982 Dam – The ash pond dam was constructed during the summer and fall of 1981 and commissioned in 1982. The original designer was William L. Wells and the engineering staff of Carolina Power & Light.

The dam assessor did not meet with, or receive documentation from, the design engineer of record regarding foundation preparation for the 1982 Dam. Furthermore, no construction documentation was provided to determine if foundation preparation was in conformity with the design assumptions.

The 1982 impoundment embankment was not built over wet ash, slag or unsuitable material. Based on the Stability Model – Downstream Slope – 1982 Ash Pond Dam (Appendix A – Doc 17, Exhibit 12), the foundation soil is saprolite underlain by weathered rock.

4.1.2 Significant Changes/Modifications in Design since Original Construction

1964 Dam - The dam was raised approximately 30 feet in 1970-71 based on a design provided by Brown & Root Inc. In 1982, the unit was removed from service and drained. In 2000 the unit began receiving dredged ash from the 1982 pond. In 2006 a constructed wetland treatment system was constructed within the unit boundary to treat flue gas emission control wastewater and is currently in operation.

1982 Dam - The original design has not been modified.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

1964 Dam – No information was provided regarding repairs or rehabilitation.

No evidence of prior releases, failures, or patchwork was observed on the 1964 earthen embankment during the visual site assessment and no documents or statements were provided to the dam assessor that indicates prior releases, failures, or patchwork repairs have occurred.

1982 Dam - In 2006, Progress Energy Carolinas began dredging the 1982 ash pond to increase the ash storage capacity. Dredged sediments are stored within the 1964 Ash Pond.

No evidence of prior releases, failures, or patchwork was observed on the 1982 earthen embankment during the visual site assessment and no documents or statements were provided to the dam assessor that indicates prior releases, failures, or patchwork repairs have occurred.

4.2 SUMMARY OF OPERATIONAL HISTORY

4.2.1 Original Operational Procedures

The 1964 and 1982 dams were designed and operated for reservoir sedimentation and sediment storage; specifically, fly ash, bottom ash, boiler slag and flue emission control residuals. Plant process waste water slurrying coal combustion waste and stormwater runoff from the facility are discharged into the reservoir, inflow water is treated through gravity settling and deposition, and treated process water and stormwater runoff is discharged through an unregulated overflow outlet structure.

4.2.2 Significant Changes in Operational Procedures since Original Startup

1964 Dam - The dam was taken out of commission in 1982. In 2000, the unit began receiving dredged ash from the 1982 pond and in 2006 was converted to a wetlands treatment system.

1982 Dam – No operational procedures have changed.

4.2.3 Current Operational Procedures

1964 Dam – The 1964 dam is no longer operated as originally designed and is currently used to store dredged material.

1982 Dam – Original operational procedures are in effect.

4.2.4 Other Notable Events since Original Startup

1964 Dam – No additional information was provided.

1982 Dam – No additional information was provided.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry & Davis, Inc. personnel Fredric Shmurak, PE and Justin Story performed a site visit on Friday, May, 29th, 2009. The site visit began at 10:00 AM. Weather was a sunny, clear day, but damp from rain in the previous weeks. Due to the rainfall, the grass embankment had not been mowed. During the assessment, areas of thick vegetation were noted and pictures were taken. The overall visual assessment of both the 1964 dam and 1982 dam was that they are in satisfactory condition and no significant findings were noted. It should be noted that the 1964 facility is currently used to store dredged material from the 1982 Ash Pond and does not maintain a normal pool.

5.2 EARTH EMBANKMENT DAM

5.2.1 Crest

1964 Dam – The crest had no signs of any depressions, tension cracks or other indications of settlement or shear failure, and appeared to be in satisfactory condition.

1982 Dam - The crest had no signs of any depressions, tension cracks or other indications of settlement or shear failure, and appeared to be in satisfactory condition. The dredging that is taking place on site requires large tandem dump trucks to travel back and forth across the crest. There appeared to be minimal rutting from the vehicles in an isolated area of the crest, but overall the crest was in excellent condition.

5.2.2 Upstream Slope

1964 Dam –The upstream slope is vegetated with tall grasses and other wetland vegetation. Scarps, sloughs, depressions or other indications of slope instability or signs of erosion were not observed.

1982 Dam - The upstream slope contained large rip rap along the embankment and a variety of vegetation. Scarps, sloughs, depressions or other indications of slope instability or signs of erosion were not observed.

5.2.3 Downstream Slope and Toe

1964 Dam – The downstream slope is mostly rip-rapped with some vegetation established. Due to the 18-24" rip rap we were unable to walk the downstream slope. A stilling pond is located near the toe of the slope which receives discharge water from the 1964 and 1982 ash pond. The water is then discharged into the French Broad River directly downstream of the toe. Due to the large rip-rap along the slope, this embankment was assessed from the crest, right groin and left groin (as viewed from an observer facing downstream). Small trees and shrubs were growing through the rip rap. Scarps, sloughs, depressions or other indications of slope instability or signs of erosion were not observed.

1982 Dam - The downstream slope was grassed and no deep rooted vegetation was noted. There were areas of minor rill erosion, which likely resulted from the wheeled tractor that mowed the grass. The wet conditions did not allow Progress Energy to mow the area recently, so there were areas of thick vegetation along the left side of the embankment near the left downstream groin. A small animal burrow was found approximately 50 yards right of the piezometer in the mid section of the embankment. Scarps, sloughs, depressions or other indications of slope instability or signs of erosion were not observed.

5.2.4 Abutments and Groin Areas

1964 Dam –An unimproved access road has been constructed along the right side groin with a roadside ditch that is ponding water. Wetland vegetation was observed within the roadside ditch. A concrete flume, that conveys water from the 1982 dam outlet pipe to the stilling pond, is located along the left groin. Erosion or uncontrolled seepage was not observed along either groin.

1982 Dam - As previously noted, the recent rains had delayed cutting the grass and there were areas of thick vegetation along the left downstream groin. Along the right downstream groin, there were a few areas where grass needed to be established.

5.3 OUTLET STRUCTURES

5.3.1 Overflow Structure

1964 Dam – The primary outlet was not in use and could not be observed.

1982 Dam – The primary overflow was properly discharging flow from the pond and appeared to be in good condition.

5.3.2 Outlet Conduit

1964 Dam – The primary outlet was not in use and could not be observed.

1982 Dam – The visible portions of the riser and outlet conduit was functioning properly with no apparent deterioration.

5.3.3 Emergency Spillway (If Present)

1964 Dam - No emergency spillway is present.

1982 Dam - No emergency spillway is present.

5.3.4 Low Level Outlet

1964 Dam - No low level outlet is present.

1982 Dam - No low level outlet is present.

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6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Floods of Record

1964 Dam– No information was provided.

1982 Dam - Progress Energy Carolinas stated the highest pond elevation they have observed was approximately two feet above the designed pond elevation of 2160 feet. This rain event would have left approximately 3 feet of freeboard based on the provided top of dam elevation at 2165 feet. See Hydrologic Review dated November 7, 2005 under Appendix A – Doc 09.

6.1.2 Inflow Design Flood

According to FEMA Federal Guidelines for Dam Safety, current practice in the design of dams is to use the Inflow Design Flood (IDF) that is deemed appropriate for the hazard potential of the dam and reservoir, and to design spillways and outlet works that are capable of safely accommodating the floodflow without risking the loss of the dam or endangering areas downstream from the dam to flows greater than the inflow. The recommended IDF or spillway design flood for a high hazard intermediate sized structure (See section 2.2), in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria is the ½ PMF to PMF (See Table 6.1.2).

Table 6.1.2: USACE Hydrologic Evaluation Guidelines
Recommended Spillway Design floods

Hazard	Size	Spillway Design Flood
Low	Small	50 to 100-yr frequency
	Intermediate	100-yr to ½ PMF
	Large	½ PMF to PMF
Significant	Small	100-yr to ½ PMF
	Intermediate	½ PMF to PMF
	Large	PMF
High	Small	½ PMF to PMF
	Intermediate	PMF
	Large	PMF

The Probable Maximum Precipitation (PMP) is defined by American Meteorological Society as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. The National Weather Service (NWS) further states that in consideration of our limited knowledge of the complicated processes and interrelationships in storms, PMP values are identified as estimates. The NWS has published application procedures that can be used with PMP estimates to develop spatial and temporal characteristics of a Probable Maximum Storm (PMS).

A PMS thus developed can be used with a precipitation-runoff simulation model to calculate a probable maximum flood (PMF) hydrograph.

1964 Dam – The inflow design flood was not provided for this facility. The recommended spillway design flood for a high hazard intermediate sized structure, in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria, is the Probable Maximum Flood (PMF).

1984 Dam - The ash pond was designed for a ¾ PMP storm of 6 hour duration which is approximately a 26.3 inch rainfall. See Hydrologic Review dated November 7th, 2005– Appendix A – Doc 09. The recommended spillway design flood for a high hazard intermediate sized structure, in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria, is the Probable Maximum Flood.

6.1.3 Spillway Rating

1964 Dam - No spillway rating was provided.

1982 Dam - No spillway rating was provided.

6.1.4 Downstream Flood Analysis

1964 Dam - No downstream flood analysis has been provided.

1982 Dam - No downstream flood analysis has been provided.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

1964 Dam – An analysis of the facilities ability to safely store and pass the inflow design flood was not provided for this facility.

1982 Dam - Supporting technical documentation is sufficient.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

1964 Dam – Although an analysis of the facilities ability to safely store and pass the inflow design flood was not provided for this facility, adequate freeboard appears to exist in order to safely store and pass the PMP storm. The following basis was used to make this determination: The contributing watershed for the 1964 Dam is limited to the reservoir; the PMP rainfall depth (HMR-51 10mi^2 24-hour duration) for this location is approximately 39 -inches; existing freeboard is about 6-ft; therefore over 2 feet of freeboard exists during a PMF event. It should be noted that the 1964 facility is currently used to store dredged material from the 1982 Ash Pond and does not maintain a normal pool.

1982 Dam - Based on the Hydrologic Review dated November 7, 2005 (See Appendix A – Doc 09), a maximum rise for the water was 2.9 feet above the normal pond elevation of 2160 feet for the design storm. The freeboard elevation is approximately 2.1 feet when water is at the design storm. It was also stated that with a pond elevation of 2165 feet, there is sufficient freeboard for handling wave action during the short time of elevated water surface. Although this analysis indicated that the 1982 Ash Pond facility can to safely store and pass the ¾ PMP inflow design flood, adequate freeboard appears to exist in order to safely store and pass the PMP storm.

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7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

1964 Dam – No information provided

1982 Dam – Static and seismic loading were analyzed (see table 8.1.4)

7.1.2 Design Properties and Parameters of Materials

1964 Dam – No information provided

1982 – See Table 7.1.2

Table 7.1.2: Design Properties and Parameters of Materials					
		Consolidated-Undrained Strength-Parameters		Effective Stress Strength-Parameters	
Material	γ (psf)	C (psf)	ϕ	C' (psf)	ϕ'
Embankment	120	1000	23	370	30
Sand Drain	120	0	36	0	36
Foundation Soil (Saprolite)	130	650	30	400	32
Weathered Rock	135	10000	45	10000	45

Data taken from Stability Model – Downstream Slope – 1982 Ash Pond Dam provided by Progress Energy dated May 2007, see Appendix A – Doc 17 (Exhibit 12).

7.1.3 Uplift and/or Phreatic Surface Assumptions

1964 Dam – No information provided for Uplift or Phreatic Surface assumptions.

1982 Dam – No uplift calculations were provided. Based off the Stability Model – Downstream Slope – 1982 Ash Pond Dam drawing (See Appendix A – Doc 17 [Exhibit 12]), the assumed phreatic surface is consistent with the Piezometer readings. Assumptions on the phreatic surface were based on the Stability Model referenced above. In the 5 year report from Progress Energy Carolinas, it stated that the 2007 piezometer readings remained consistent with "the historic trend." The only changes in the readings were consistent with when the pond level was dropped to its current elevation of 2159 feet in August 2002. In October 2001 the pond elevation was at 2162 feet and in July 2002 the elevation was at 2163 feet. See

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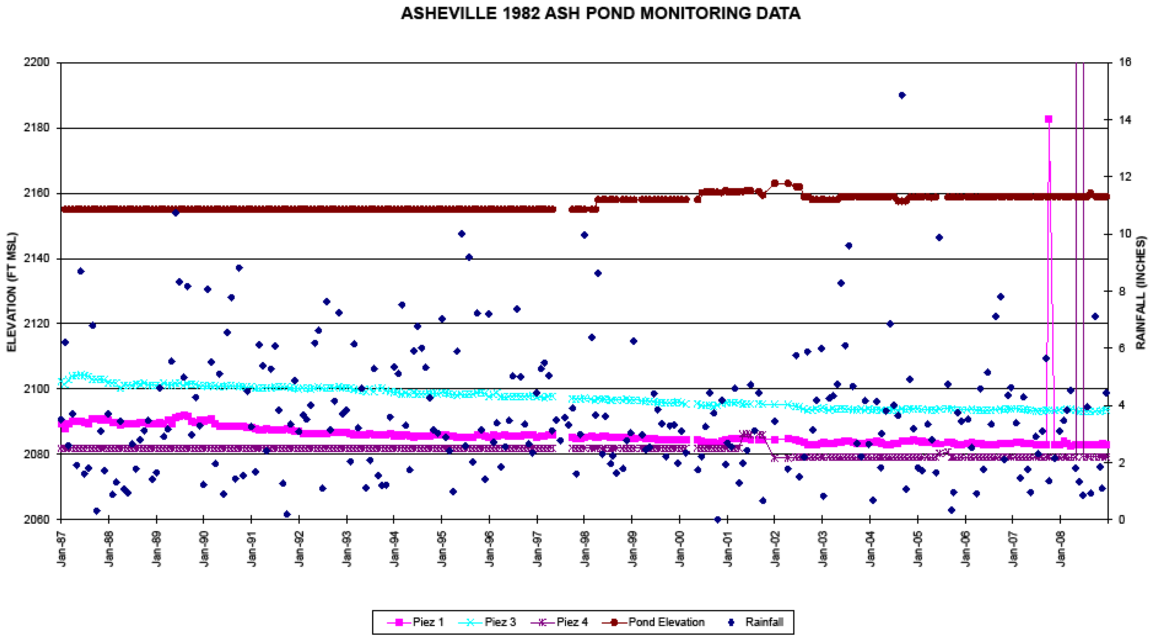
Appendix A – Doc 16: Page 10. The following chart represents piezometer readings recorded from January 1987 to May 2009 and indicate a steady and consistent trend.



7.1.4 Factors of Safety and Base Stresses

1964 Dam – No information was provided

1982 Dam – See Table 7.1.4

Table 7.1.4: Factors of Safety		
	Calculated Factor of Safety	
	(Reservoir @ Elevation 2160 ft - steady state seepage)	(Reservoir @ Elevation 2163 ft - steady state seepage)
Static Loading	1.68	1.63
Seismic Loading	1.07	1.03

7.1.5 Liquefaction Potential

1964 Dam – No liquefaction potential data was submitted. Foundation soil conditions do not appear susceptible to support liquefaction.

1982 Dam – No liquefaction potential data was submitted. Foundation soil conditions do not appear susceptible to support liquefaction..

7.1.6 Critical Geological Conditions and Seismicity

The 1964 and 1982 ash ponds and associated dam impoundments are located within Buncombe County, NC. Buncombe County is within the Blue Ridge Physiographic Province in North Carolina. The Blue Ridge Physiographic Province is generally characterized as a rugged, mountainous area with steep ridges, inter-mountain basins, and valleys.

The ash ponds and dam impoundments are further classified by their location within the Blue Ridge Geologic Belt, near the border of the Inner Piedmont Belt. The Blue Ridge Belt is a mountainous region consisting of rocks from over one billion to approximately one-half billion years old. The rocks are composed of igneous, sedimentary, and metamorphic rock that has been repeatedly squeezed, fractured, faulted, and twisted. The belt is well known for deposits of feldspar, mica and quartz (utilized in ceramic, paint, and electronic industries) and olivine (utilized for refactory and foundry molding sand).

The rock within the pond and dam impoundment areas is located within the Ashe Metamorphic Suite and Tallulah Falls Formation and is classified as Zatm, per the Geologic Map of North Carolina. The Zatm classification represents a Muscovite-Biotite Gneiss rock (locally sulfidic, interlayered and gradational with mica schist, minor amphibolites, and hornblende gneiss).

The Brevard Fault Zone is located approximately three to four miles Southeast of the ash ponds and dam impoundments.

1964 Dam - No critical geological conditions were provided. Based on USGS Seismic-Hazard Maps for the Conterminous United States, dated 2005, the facility is located in an area anticipated to experience a 0.1g acceleration with a 2-percent probability of exceedance in 50-years.

1982 Dam - No critical geological conditions were provided. Based on USGS Seismic-Hazard Maps for the Conterminous United States, dated 2005, the facility is located in an area anticipated to experience a 0.1g acceleration with a 2-percent probability of exceedance in 50-years.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

1964 Dam – Structural stability documentation was not provided.

1982 Dam – Structural stability documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

1964 Dam – Overall, the structural stability of the embankment visually appears to be in adequate condition; however, no slope stability analysis has been provided in order to determine if the embankment structural stability is in a satisfactory condition.

- The internal drains are flowing clear and at a consistent rate which is a good indication internal soil piping is not occurring;
- There were no indications of scarps, sloughs, depressions or bulging anywhere along the dam;
- Boils, sinks or uncontrolled seepage was not observed along the slopes, groins or toe; and
- The crest appeared free of depressions.

It should be noted that the 1964 facility is currently used to store dredged material from the 1982 Ash Pond and does not maintain a normal pool.

1982 Dam – Overall, the structural stability of the embankment appears to be satisfactory based on the following parameters:

- The internal drains are flowing clear and at a consistent rate which is a good indication internal soil piping is not occurring;
- There were no indications of scarps, sloughs, depressions or bulging anywhere along the dam;
- Boils, sinks or uncontrolled seepage was not observed along the slopes, groins or toe;
- The crest appeared free of depressions; and
- The computed factors of safety comply with accepted criteria.

Based on the previous assessments/inspections provided by MACTEC and Progress Energy Carolinas, our assessment is consistent with historical observations.

8.0 MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATIONAL PROCEDURES

1964 Dam – Operational procedures are adequate. The facility receives dredged ash from the 1982 pond and a wetland treatment system is employed for water quality. It should be noted that the 1964 facility does not maintain a normal pool.

1982 Dam – Operational procedures are adequate. The facility is operated for reservoir sedimentation and sediment storage; specifically, fly ash, bottom ash, boiler slag and flue emission control residuals. Coal combustion process waste water and stormwater runoff from the facility are discharged into the reservoir, inflow water is treated through gravity settling and deposition, and treated process water and stormwater runoff is discharged through an unregulated overflow outlet structure.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

1964 Dam – Maintenance procedures are adequate. Grassed areas are routinely mowed and deep rooted vegetation is removed from the rip-rap slopes. Spillways and outlets are maintained and debris is removed as needed. Deficiencies as noted in the surveillance & monitoring program are corrected and documented.

1982 Dam – Maintenance procedures are adequate. Grassed areas are routinely mowed and deep rooted vegetation is removed from the rip-rap slopes. Spillways and outlets are maintained and debris is removed as needed.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATION

8.3.1 Adequacy of Operational Procedures

1964 Dam – Operational procedures are adequate.

1982 Dam – Operational procedures are adequate.

8.3.2 Adequacy of Maintenance

1964 Dam – The maintenance program is adequate. It is recommended that

- The embankment should be cleared of any trees or deep rooted vegetation that is beginning to be established;
- A program be established to have the rip-rapped embankment slope cleared of vegetation at least once every year;
- Additional rip-rap placed in the ditch along the right groin to minimize erosion;
- Under drain outlets be protected with small-animal guards attached with a hinge allowing for unobstructed flow (a removable screen placed over the front of the weir box is an acceptable

alternative providing it is affixed with a mechanism providing for unobstructed flow should clogging occur).

1982 Dam - The maintenance program is adequate. It is recommended that:

- Precaution be taken to not mow the embankment when wet or to take necessary measures to not create ruts perpendicular to the embankment slope;
- Grass, or similar shallow rooted herbaceous vegetative cover, needs to be established in bare areas where soil is visible;
- Small-animal burrows found on the downstream slope should be filled in with the appropriate material; and
- Under drain outlets be protected with small-animal guards attached with a hinge allowing for unobstructed flow (a removable screen placed over the front of the weir box is an acceptable alternative providing it is affixed with a mechanism providing for unobstructed flow should clogging occur).

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9.0 SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Per Progress Energy Carolinas, the surveillance program is as follows:

Monthly Inspections:
1964 & 1982 Dam - "Monthly inspections are conducted by trained plant personnel, following strict procedures that include visual inspections and data gathering to detect any problems at an early stage of development." Chemical/wastewater parameters are not measured as part of the inspection. See Appendix A – Doc - 14 for copy of the February 26, 2009 inspection report.

Annual Inspections:
1964 & 1982 Dam - "Annual inspections are conducted by a third-party professional engineering contractor. The engineering firms that conduct the inspections have expertise in geotechnical and civil engineering." See Appendix A – Doc - 15 for copy of the February 17, 2009 inspection report.

1964 Dam - "Because the 1964 Ash Pond Dam currently retains only surface water associated with rainfall runoff (the wetlands treatment ponds are lined), only a cursory inspection of the exterior slope and adjacent natural ground of the former 1964 ash pond was performed." See Appendix A – Doc - 15 for copy of the February 17, 2009 inspection report.

Five-year Inspections:
1964 & 1982 Dam - "Comprehensive five-year inspections are conducted by a third-party professional engineer contractor as required by the North Carolina Utilities Commission. The engineering firms that conduct the inspection have expertise in geotechnical and civil engineering." See Appendix A – Doc 16 for copy of the November 26, 2007 inspection report.

9.2 INSTRUMENTATION MONITORING

9.2.1 Instrumentation Plan

The following data is based on inspection reports provided by Progress Energy:

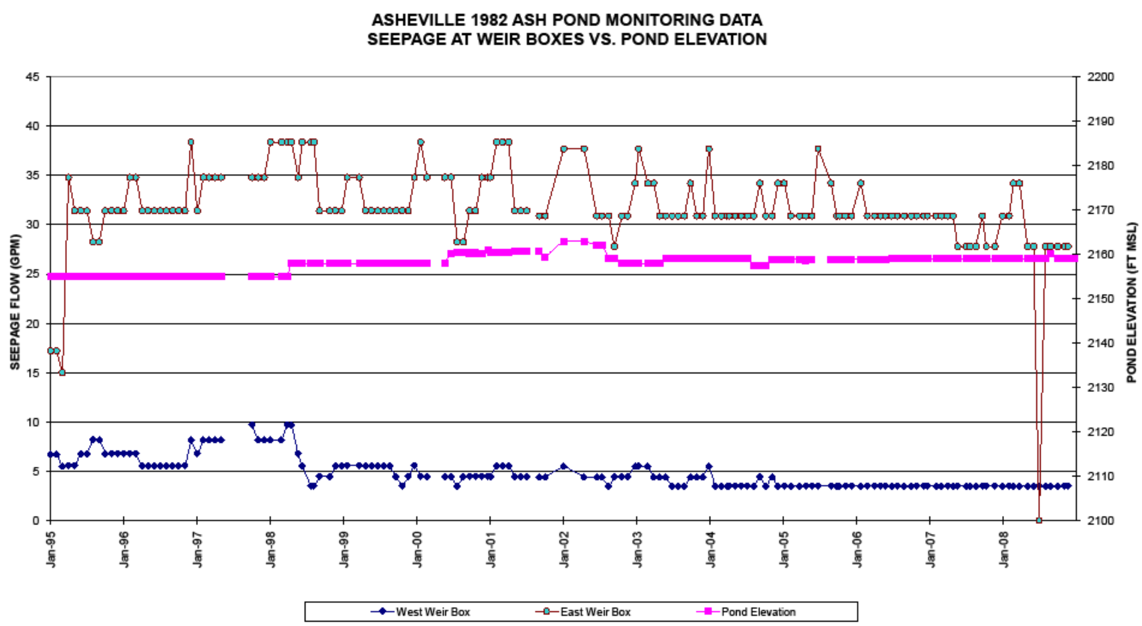
1964 Dam – No instrumentation is in place.

1982 Dam – A seepage collector box with a V-notch weir and measuring gauge is located at the toe of the slope at the outlets of the internal drains. Points of seepage flow are measured or estimated. Internal drain outlets are visually inspected for proper function. A ruler is then used to measure the height of the flow above the weir, at each internal drain outlet pipe, to the nearest 1/8 inch at weir location and correlated to flowrate. Four piezometers are located within the upper half of the downstream slope. For piezometer readings, a water level indicator probe is used, which is lowered within the monitoring well until water is reached, and the distance is recorded. Please refer to Appendix A, Doc 17 Asheville S.E.P. – Ash Pond Expansion, Dam Plan & Profile for locations of the seepage collector box and piezometers.

9.2.2 Instrumentation Monitoring Results

1964 Dam – No instrumentation is in place.

1982 Dam - Data is recorded on a standard inspection report for Progress Energy Carolinas. A copy is given to Richard Horton, with PEC's PGC – Field Engineering Department, and one additional copy is maintained in Progress Energy's files. Please refer to Appendix A, for sample reports. The following chart represents seepage readings recorded from January 1995 to May 2009, for the east and west outlets of the internal drainage system, and indicate a consistent trend.



9.2.3 Evaluation

1964 Dam - No internal seepage or slope stability records have been provided.

1982 Dam - The historical data indicates that the embankment dam is performing adequately.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

1964 Dam - Inspection program is adequate.

1982 Dam - Inspection program is adequate.

9.3.2 Adequacy of Instrumentation Monitoring Program

1964 Dam – Surveillance program is adequate; however no monitoring program is in place. The embankment no longer impounds a normal pool and is used to store dredged materials; therefore, a monitoring program for fluctuation of phreatic surface is not currently warranted. A monitoring program for internal seepage should be initiated and depending on the results of a detailed slope stability analysis, inclinometers or other instrumentation and monitoring programs for slope instability should be initiated.

1982 Dam – Surveillance and monitoring programs are adequate.

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10.0 RESPONSE TO SPECIFIC EPA QUESTIONS

The following questions and answers are provided in conformance with EPA's Technical Directive (TDF) 5 regarding the reassessment of Coal containment Waste Impoundment Assessment Reports as a result of the TVA failure mode analysis report for the Kingston embankment failure. One of the key findings was that the Kingston unit may have failed because the embankment was built upon coal ash slimes.

1. 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.

   The 1982 impoundment embankment was not built over wet ash, slag or unsuitable material. Based on the Stability Model – Downstream Slope – 1982 Ash Pond Dam (Appendix A – Doc 17, Exhibit 12), the foundation soil is saprolite underlain by weathered rock.

   No information has been provided to indicate that the 1964 impoundment was or was not constructed over wet ash, slag or unsuitable material.

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

   The dam assessor did not meet with nor receive documentation from the design engineer of record regarding foundation preparation for either the 1964 or 1982 embankment. As-constructed documentation was provided for the 1982 embankment; however, no construction documentation was provided for the 1964 embankment.

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

   No evidence, of prior releases, failures, or patchwork was observed on the 1964 or 1982 embankment during our visual site assessment and no documents or statements were provided to the dam assessor that indicates prior releases, failures, or patchwork repairs have occurred.