September
2023

COAL COMBUSTION RESIDUAL IMPOUNDMENT INSPECTION – WINYAH GENERATING STATION

Georgetown, South Carolina

santee cooper®

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**Please note that the terms "embankment", "berm", "dike", and "dam" are used interchangeably within this report, as are the terms "pond", "basin", and "impoundment".*

Executive Summary

This assessment of the stability and functionality of the Winyah Generating Station (WGS) coal combustion residual (CCR) management units is based on a review of available documents and an on-site assessment conducted by Santee Cooper engineering staff on September 14, 2023. The supporting technical information was found to be generally adequate. The assessment team had several recommendations based on field observations that may help WGS to continue to maintain the management units in safe condition.

In summary, the WGS CCR management units are in generally satisfactory condition for continued safe and reliable operation. No recognized existing or potential management unit safety deficiencies were identified within the parameters of design and operation.

Summary of Recommendations

Ash Pond A

1. Bare spots should be reseeded.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.

Ash Pond B

1. Bare spots should be reseeded.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.
3. Root growth, thick vegetation, and small trees in the upstream slope should be cut and removed.

South Ash Pond

1. Bare soil areas should be reseeded and continued to be monitored as part of routine maintenance.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.

Units 3 & 4 Slurry Pond

1. Pipes receiving stormwater from the temporarily capped West Pond should be cleaned.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.

This report presents the opinion of the assessment team as to the potential for catastrophic failure and reports on the condition of the CCR units at Winyah Generating Station. The assessment of dam safety reported herein is based on field observations and review of readily available information provided to the inspection team of the subject CCR management units. Qualified Santee Cooper engineering staff performed the field observations and review of pertinent information and made the assessment in conformance with the requirements of Section 257.83 of the Code of Federal Regulations and in accordance with reasonable and generally accepted engineering practices.

Coal Combustion Residual Impoundment Inspection – Winyah Generating Station

1.0 General Information and Introduction

1.1 Introduction and Summary Conclusions

This assessment of the stability and functionality of the Winyah Generating Station (WGS) coal combustion residual (CCR) management units is based on a review of available documents and an on-site assessment conducted by Santee Cooper engineering staff on September 14, 2023. The supporting technical information was found to be generally adequate. The assessment team had several recommendations based on field observations that may help WGS to continue to maintain the management units in safe condition.

In summary, the WGS CCR management units are generally satisfactory for continued safe and reliable operation. No recognized existing or potential management unit safety deficiencies were identified within the parameters of design and operation.

1.2 Purpose and Scope

The purpose of this report is to fulfill the requirements of Section 257.83(b) of the Code of Federal Regulations regarding the safety and inspection of CCR surface impoundments. Section 257.83(b) states that "If the existing or new CCR surface impoundment or any lateral expansion of the CCR surface impoundment is subject to the periodic structural stability assessment requirements under Section 257.73(d) or 257.74(d), the CCR unit must additionally be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards."

The inspection must, at a minimum, include:

i. A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., CCR unit

design and construction information required by Section 257.73(c)(1) and 257.74(c)(1), previous periodic structural stability assessments required under Section 257.73(d) and 257.74(d), the results of inspections by a qualified person, and results of previous annual inspections.

ii. A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit and appurtenant structures.

iii. A visual inspection of any hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit for structural integrity and continued safe and reliable operation.

The inspection report must also be written by a qualified professional engineer and must address the following (required information on the CCR impoundments at WGS included in bold below the Code of Federal Regulations excerpt):

i. Any changes in geometry of the impounding structure since the previous annual inspection
   - **No change noted in the geometry of the management units at WGS other than Ash Pond A. A class III landfill is under construction on Ash Pond A in concurrence with the CCR removal of this ash pond.**

ii. The location and type of existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection
   - **Staff gauges are located in the ponded water at Ash Pond B, Units 3 & 4 Slurry Pond and the South Ash Pond.**

iii. The approximate minimum, maximum, and present depth, and elevation of the impounded water and CCR since the previous annual inspection
   - **See Table 1.1 below for information on all WGS Ponds**

iv. The storage capacity of the impounding structure at the time of inspection
   - **See Table 1.1 below for information on all WGS Ponds**

v. The approximate volume of the impounding water and CCR at the time of inspection
   - **See Table 1.1 below for information on all WGS Ponds**

Table 1.1: Impoundment Capacity Information

	Ash Pond A[2]	Ash Pond B	South Ash Pond	Units 3 & 4 Slurry Pond
Surface Area (acre)[1]	88	63	61	100
Current CCR and Water Storage Volume (acre-feet)	0	429	705.5	893
Total Storage Capacity (acre-feet)[1]	1,641*	1,040	1,129	2,850
Crest Elevation (feet)	41.5	41.5	37.0	38.0
Current Water Elevation (feet)	-	Below Gage (Low)	Below Gage (Low)	Below Gage (<19.6)
Maximum Water Elevation in 2023 (feet)	-	Below Gage (Low)	Below Gage (Low)	Below Gage (<19.6)
Minimum Water Elevation in 2023 (feet)	-	Below Gage (Low)	Below Gage (Low)	Below Gage (<19.6)

1 From Santee Cooper response to EPA's RFI dated March 9, 2009.
Note: Some storage capacity values differ from the Dewberry and Davis Report due to additional studies performed in anticipation of pond closures.
**Design storage volume, currently minimal or zero capacity due to Class III Landfill Area 2 within the Ash Pond A footprint.*

vi. Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit and appurtenant structures

- **Some maintenance required on the ponds as discussed in Executive Summary and Sections 4.0 and 5.0; however, ponds are safe for continued operation**

vii. Any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection.

- **No other changes noted that impact the stability or operation of the impounding structures**

2.0 Description of Coal Combustion Residual Management Units

2.1 Location and General Description

The Winyah Generating Station (WGS) is located on Penny Royal Road, Georgetown, South Carolina, near Penny Royal Creek.

WGS has four (4) CCR management impoundments: Ash Pond A, Ash Pond B, South Ash Pond, and the Units 3 & 4 Slurry Pond. The impoundments are divided into separate units by internal dikes. The West Ash Pond, temporarily capped and partially closed in 2015, was not part of this inspection. Unit 2 Slurry Pond was closed and converted to a landfill in 2017. Table 2.1 below shows a summary of the size and general dimensions of the CCR management impoundments at WGS.

Table 2.1: Summary of Dam Dimensions and Size

	Ash Pond A	Ash Pond B	South Ash Pond	Units 3 & 4 Slurry Pond
Dam Height (ft)	24.5	31	22	30
Crest Width (ft)	12	12	15	15
Length (ft)	8854	6243	8663	5937
Design Side Slopes (upstream) H:V	2:1	2:1	3:1 & 4:1	2:1 & 3:1
Design Side Slopes (downstream) H:V	3:1	2:1	3:1 & 4:1	2:1 & 3:1

2.2 Amount and Type of CCRs Currently Stored in Units and Maximum Capacity

Ash Ponds A and B were constructed in 1975 and were used for fly ash, bottom ash, and boiler slag. In 1980, the South Pond was constructed and was used for fly ash, bottom ash, and boiler slag. Also that year, Units 3 & 4 Slurry Pond was constructed and was used

for flue gas emission control residual. In 2015, the operation level for Units 3 & 4 Slurry Pond was lowered for seismic mitigation. In late 2017, staff gauges identifying water surface elevation in the NAD 88 datum were installed in Ash Pond B, Units 3 & 4 Slurry Pond and South Ash Pond to monitor the water levels within these ponds. The amount of CCRs currently stored in the units and maximum capacities are summarized in Table 1.1. All CCR and/or non-CCR wastewater inflows to Ash Pond A, Ash Pond B, South Ash Pond, and Units 3 & 4 Slurry Pond ceased as of April 11, 2021, thus commencing closure.

2.3 Principal Project Structures

2.3.1 Earth Embankments

Ash Pond A and Ash Pond B are unlined and dewatered to facilitate ash excavation or Class III Landfill construction. The top of Ash Pond A dam elevation from the original design plans is 41.5 feet; the original design top of dam elevation for Ash Pond B was 34.5 feet. The perimeter embankment along Ash Pond B was raised in 1997 by approximately 6.8 feet to match the top of dam elevation of Ash Pond A. No internal drainage blankets or toe drains for seepage control were included in the original design of the perimeter dams or in the design of the dam raise for Ash Pond B. The length of the embankment raised was 5,200 feet. The raised embankment outside toe encroached slightly into the adjacent Cooling Pond. In these areas the design called for the foundation of the embankment toe to be constructed of riprap to above the water level and placement of a filter on top of the riprap before constructing the soil embankment on top of it. Efforts to remove CCR material from Pond A initiated in 2015 and was completed in 2021 and the construction of a class III landfill at Pond A started in early 2022. Pond A is not officially completed with CCR removal but there is currently no CCR removal work being performed at this time and landfilling activities are the main work being conducted at Pond A at this point.

The South Ash Pond basin is unlined and dewatered to facilitate ash excavavtion. A toe drain is used for seepage control and water is pumped back into the South Pond. Seepage water collected in the drain discharges through 4-inch diameter solid-wall PVC pipes extending from the internal drain to daylight at the toe; the design spacing of these seepage drainage pipes is 200 feet. The design drawings show that a 30-inch

diameter CMP through a southwest section of the perimeter dike was used for drainage from the basin area during construction. This CMP was plugged with concrete at the upstream and downstream toes of the dam and left in-place at completion of construction in 1980. In 2008, a 60' long slurry wall was installed at the CMP location to a depth of 45' to provide an impermeable barrier within the dike and mitigate seepage in this area. Several discontinuous toe drain systems have been installed within the dike, located in areas where the existing toe drain system was clogged, and minor seepage was found on the downstream slope. In preparation of future work to remove all CCR from the South Ash Pond, recent efforts to dewater the pond have been initiated. Currently, construction crews are setting up HDPE piping within the pond to route all water directly to the outlet structure. Removal of CCR material from the pond started in 2021 and is currently underway.

Units 3 & 4 Slurry Pond basin is unlined and dewatered to facilitate ash excavation. No internal drainage blankets or formal toe drains for seepage control were used. The pond shares a common dike on its south side with the West Ash Pond. During construction of the pond, a 30-inch diameter temporary corrugated metal pipe (CMP) was used for drainage. This CMP was plugged with concrete at the upstream and downstream toes of the dam and left in-place at completion of construction. In 2008, a 225' long slurry wall was installed at the CMP location to a depth of 45' to provide an impermeable barrier within the dike and mitigate seepage in this area. Currently, CCR from the pond is being stockpiled within the pond and taken to Holcim and Converse and shipped off-site for beneficial reuse.

2.3.2 Outlet Structures

Ash Pond A has two abandoned outlet structures located near the southwest corner of the basin. One of these outlet structures discharged treated water toward the west direction through the perimeter dike to an outfall into the Discharge Canal to the Cooling Pond; it has been filled with controlled low strength material (CLSM). This outlet structure was demolished and taken-out, but the outlet pipe was abandoned in-place. The other outlet structure discharged through the non-structural cross dike and into Ash Pond B. This outlet structure and outlet pipes were demolished and removed,

and the cross dike was rebuilt. Currently, as efforts to build the class III landfill at Ash Pond A are ongoing, dewatering pumps are being used to drain stormwater to either Ash Pond B and/or the Cooling Pond.

Ash Pond B's original outlet consisted of a rectangular reinforced concrete drawdown structure that discharged treated water into a reinforced concrete pipe (RCP) that extends through the bottom of the perimeter dike to the Discharge Canal then routed to the Cooling Pond. In 2012, a new drawdown structure was installed as a replacement, approximately 370' south of the original outfall. A 100' long 24" HDPE outfall pipe was also installed. Water level in the pond is controlled by the top elevation of the new drawdown structure, where water overflows into the structure. The excavated section of the new outfall pipe which penetrated the existing dike was encased in 134 cubic yards of CLSM. The original outlet was abandoned, and the RCP was filled entirely with CLSM once the new structure was installed. A video inspection using a high-resolution video camera was conducted on July 11th, 2022, to check the condition of the outlet pipe. The outlet pipe appeared to be in good condition.

The South Ash Pond outlet is located at the east end of the basin and consists of a rectangular reinforced concrete decant tower with bottom discharge into a 36-inch diameter lined RCP conduit that extends easterly through the bottom of the perimeter dike; the water ultimately outfalls into the Discharge Canal then routed to the Cooling Pond. Stop logs are used to manage the water level in the pond. A video inspection of the outlet pipe for South Ash Pond was also performed on July 11th, 2022, and the outlet pipe appeared to be in good condition.

Units 3 & 4 Slurry Pond had a temporary drainage pipe (30-inch CMP) that was used for drainage during construction that was plugged with a slurry wall in 2008. In 2014, a floating pump station, with an adjustable weir, was installed over the deepest part of the pond pool. The pump station is anchored to four points with ¼" stainless steel wire rope. The station uses two submersible pumps and approximately 2,500 LF of 14" SDR 17 HDPE pipe that run along the top of the interior slope and then down the downstream slope to discharge to Pump Station No. 1. Seismic stability is maintained at water elevations less than 26 feet. The pump station was installed to drawdown water levels and sustain storage volume between 16 and 26 feet to allow for operational

flexibility and additional storage capacity for rain events. Also, in 2015 two 36" HDPE pipes were installed through the divider dike between the West Ash Pond and the Units 3 & 4 Slurry Pond because of the West Ash Pond temporary cap to ensure the West Ash Pond does not retain any liquids on top of the temporary cap system.

3.0 Summary of Relevant Reports and Incidents

3.1 Summary of Reports on the Safety of CCR Units

Furnished reports of weekly inspections, conducted by WGS personnel for the period October 2022 through July 2023, indicated no major structural or operational problems. In addition, previous annual inspection reports were reviewed by the Civil Projects group. Several minor, potential maintenance items were noted in the report and were carefully observed during the field inspection.

4.0 Field Observations

4.1 Project Overview and Significant Findings

Santee Cooper qualified engineer Alfred D. Manalac, P.E., performed a site visit to WGS on September 14th, 2023. Weather conditions during the visit were sunny and dry with temperatures at approximately 78 degrees Fahrenheit. The overall condition of the CCR impoundment dikes was satisfactory with no significant findings noted.

4.2 Ash Pond A

4.2.1 Crest

The crest of the Ash Pond A perimeter dike was generally found to be in satisfactory condition. No major sags, depressions, or other signs of significant settlement were observed in the crest.

4.2.2 Upstream/Inside Slope

The inside slope of the Ash Pond A embankment dam at the west and northwest location is

no longer visible because of the landfilling activities and the remaining embankments were observed to be free of ash. The south embankment (cross dike between Ash Pond A and Ash Pond B) appears to be in fair condition, but some sections need to be reseeded.

4.2.3 Downstream/Outside Slope and Toe

The downstream slope and toe of Ash Pond A was found to be in generally satisfactory condition.

4.2.4 Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam.

4.2.5 Outlet Works

Ash Pond A no longer has outlet structures. As mentioned, the conduit through the perimeter dike was properly abandoned and filled with flowable fill. The other conduit through the internal divider dike into Ash Pond B was removed. Stormwater drainage is being handled using dewatering pumps.

4.2.6 Emergency Spillway

No emergency spillway was observed, although the design plans indicate that there was to be an emergency overflow on the perimeter dam on the west side of the basin. Santee Cooper has not found any evidence that the emergency spillway was constructed as part of the original construction.

4.3 Ash Pond B

4.3.1 Crest

The crest of the Ash Pond B perimeter dike was generally found to be in satisfactory condition. No major sags, depressions, or other signs of significant settlement were observed in the crest. No tension cracks were observed in the crest or along the edge of the crest.

4.3.2 Upstream/Inside Slope

The upstream/inside slope of the Ash Pond B perimeter dike was observed to be generally covered with ash. No obvious signs of slumps, slides, bulges, tension cracks, seepage, or animal burrows were observed on the inside slope. A few small trees growing near the crest were observed and are recommended to be removed.

4.3.3 Downstream/Outside Slope and Toe

The downstream/outside slope and toe of Ash Pond B was found to be in generally satisfactory condition. Some areas of bare soil and sparse grass cover were observed.

4.3.4 Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam.

4.3.5 Outlet Works

The 24" HDPE outfall pipe was observed at its inlet during the inspection and appeared to be in good condition. A detailed inspection with a mobile submersible camera was performed on July 11th, 2022, and the outfall pipe appeared to be in good condition.

4.3.6 Emergency Spillway

No emergency spillway was observed, although the design plans indicate that there was to be an emergency overflow on the original perimeter dam on the west side of the basin. Santee Cooper has not found any evidence that the emergency spillway was constructed as part of the original construction.

4.4 South Ash Pond

4.4.1 Crest

The crest was observed to be in overall good condition. No major sags, depressions, or other signs of significant settlement were observed in the crest. No tension cracks were

observed in the crest or along the edge of the crest.

4.4.2 Upstream/Inside Slope

The inside slope of the South Ash Pond embankment dam was observed to be filled with ash in most of the basin. At the east end of the pond, the section of the slope above the water level appeared to be in generally good condition. No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the ash and water levels. No significant erosion was noted.

4.4.3 Downstream/Outside Slope and Toe

Some areas with bare earth were observed that appeared to be caused by maintenance equipment.

4.4.4 Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam.

4.4.5 Outlet Works

The South Ash Pond outlet is located at the east end of the basin and consists of a rectangular reinforced concrete decant tower with bottom discharge into a 36-inch diameter lined RCP conduit that extends easterly through the bottom of the perimeter dike, the discharge ultimately outfalls into the Discharge Canal via a ditch. Water level in the pond is controlled by stop logs in the outlet. A video inspection of the outfall pipe was conducted on July 11th, 2022, and appeared to be in good condition.

4.4.6 Emergency Spillway

There is no emergency spillway.

4.5 Units 3 & 4 Slurry Pond

4.5.1 Crest

The surface of the crest was observed to be in good condition. No major depressions, sags, cracks, or other signs of settlement were observed. No tension cracks which might suggest soil shear failure were observed in the crest or along the edge of the crest.

4.5.2 Upstream/Inside Slope

No slumps, slides, or other signs of shear failure were observed in the visible parts of the slopes above the water level. No significant erosion was noted. A section of the pond is currently being used for stockpiling CCR.

4.5.3 Downstream/Outside Slope and Toe

Areas of minor erosion, bare earth and sparse vegetation were observed, with some of the areas caused by maintenance equipment.

4.5.4 Abutments and Groin Areas

Not applicable; there are no abutments or groins in the perimeter ring-dam.

4.5.5 Outlet Works

The floating pump station was observed from the dike; however, its condition could not be determined due to its distance from the dike.

4.5.6 Emergency Spillway

There is no longer a spillway associated with this pond.

4.6 Adequacy of Maintenance, Operating, and Surveillance Procedures

4.6.1 Adequacy of Maintenance Procedures

Overall, maintenance of the impounding embankments and outlet works of all ponds

appears to be adequate. No major maintenance issues were noted during the field inspection or in the weekly inspection reports completed by WGS personnel and reviewed by the inspection team. No changes to maintenance procedures are recommended at this time.

4.6.2 Adequacy of Operating Procedures

Based on field observations and discussions with WGS personnel, the operating procedures for the ponds appear to be adequate.

4.6.3 Adequacy of Surveillance Procedures

WGS personnel complete daily informal inspections and weekly formal inspections on the ash ponds in accordance with good engineering practice and Section 257.83 of the Code of Federal Regulations. These inspections are being properly documented and should continue as they are currently being conducted.

5.0 Conclusions and Recommendations

5.1 Conclusions

Conclusions are based on visual observations from a one-day site visit and review of the technical and historical documentation provided to the inspection team.

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

Santee Cooper engaged a third-party consultant (ARCADIS) to review the existing information for the impoundment dikes and submitted a report to the USEPA on 29 March 2012. The ARCADIS report recommended that a seismic stability and liquefaction evaluation be performed for the Units 3 & 4 Slurry Pond perimeter dikes. Santee Cooper retained Geosyntec Consultants to perform subsurface investigation and seismic and liquefaction evaluations of the perimeter dikes associated with Units 3 & 4 Slurry Pond and the West Ash Pond. The investigation and evaluation results were summarized in a Seismic Investigation Report prepared by Geosyntec in July 2013 and submitted to USEPA

and the South Carolina Department of Health and Environmental Control (DHEC) on July 26th, 2013.

Conclusions of this report suggest drawdown of the Units 3 &4 Slurry Pond and West Ash Pond as mitigation measures for increasing seismic stability. Since this report, the Units 3 & 4 Slurry Pond's operating level has been lowered and the West Ash Pond has been temporarily capped to prevent water infiltration. West Ash Pond has been partially open, and pumps are being used to ensure that water elevation continues to be as low as possible to maintain the above-mentioned mitigating measure.

5.1.2 Conclusions Regarding Field Observations

The inspector was provided access to all areas in the vicinity of the ash ponds as required, to conduct a thorough field inspection. The embankment dikes and outlet structures were observed to have no signs of significant settlement, shear failure, or other signs of instability.

5.2 Recommendations

The following recommendations refer to issues observed during the field inspection that are summarized in Section 4.0 of this report.

5.2.1 Ash Pond A

Maintenance and monitoring recommendations:

1. Bare spots should be reseeded.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.

5.2.2 Ash Pond B

Maintenance and monitoring recommendations:

1. Bare spots should be reseeded.
2. For Best Management Practice, grass on the slopes should be maintained and cut

to a height that would make wet areas and slides easily noticeable.
3. Root growth, thick vegetation, and small trees in the upstream slope should be cut and removed.

5.2.3 South Ash Pond

Maintenance and monitoring recommendations:

1. Bare soil areas should be reseeded and continued to be monitored as part of routine maintenance.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.

5.2.4 Units 3 & 4 Slurry Pond

Maintenance and monitoring recommendations:

1. Pipes receiving stormwater from the capped West Pond should be cleaned.
2. For Best Management Practice, grass on the slopes should be maintained and cut to a height that would make wet areas and slides easily noticeable.