



Your Touchstone Energy® Cooperative 

Green CCR Surface Impoundment

Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule CCR Impoundment 2016 Annual Inspection Report

January 10, 2017

Prepared By:



Project ID: 160122A

Big Rivers Electric Corporation
Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule
CCR Impoundment 2016 Annual Inspection Report

CCR Surface Impoundment Information

Name: Green CCR Surface Impoundment
Operator: Sebree Generating Station
Address: 9000 Highway 2096
Robards, Kentucky 42452

Qualified Professional Engineer

Name: David A. Lamb
Company: Associated Engineers, Inc.
Kentucky P.E. Number: 17822

Regulatory Applicability

Per 40 CFR §257.83(b), annual inspections by a qualified professional engineer must ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards.

Annual inspections of any CCR surface impoundment must include, at a minimum: (1) a review of all previously generated information regarding the status and condition of the CCR unit, including, but not limited to, all operating records and publicly accessible internet site entries, design and construction drawings and other documentation; (2) a thorough visual inspection to identify indications of distress, unusual or adverse behavior, or malfunction of the CCR unit and appurtenant structures; and (3) a thorough visual inspection of hydraulic structures underlying the base of the CCR unit and passing through the dike of the CCR unit for structural integrity and continued safe and reliable operation.

Additionally, following each annual inspection, the qualified professional engineer must prepare an inspection report which documents the following: (1) any changes in geometry of the impounding structure since the previous annual inspection; (2) the location and type of existing instrumentation and the maximum recorded readings of each instrument since the previous annual inspection; (3) the approximate maximum, minimum, and present depth and elevation of the impounded water and CCR since the previous annual inspection; (4) the storage capacity of the impounding structure at the time of inspection; (5) the approximate volume of the impounded water and CCR at the time of the inspection; (6) 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; and (7) any other change(s) which may have affected the stability or operation of the impounding structure since the previous annual inspection.

Inspection Description

This is the second annual inspection report for the Green CCR Surface Impoundment pursuant to the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule which became effective April 17, 2015. The inspection was conducted on November 7, 2016 by Tim Brown P.E. and Matthew Lile of Associated Engineers, Inc. of Madisonville, Kentucky. Weekly (7-day) inspections conducted by Big Rivers Electric Corporation are kept in the facility operating record.

The inspection consisted of a visual assessment of the surface impoundment, embankments and discharge; and began on the crest of the west embankment. The inspection noted that the embankment crest north of the access road entrance is mostly grass with some bare areas and the crest south of the entrance is comprised of good gravel cover. The inside slope of the embankment is covered with good rip-rap cover and a very flat ditch runs along the toe of the out slope where vegetation is sparse most likely because of ponding water.

Some of the piezometer surface pads that are located on the south embankment crest may need to be stabilized. Good rip-rap cover was present on the west end of the upstream side, ending about midway along the slope and continuing towards the east. Some erosion was present on the east abutment of the downstream side of the embankment and some surficial ground cracking was evident from dry conditions. The downstream embankment was overgrown with tall Johnson grass on the east side and with fescue grass more prevalent on the west side. Some longitudinal tracking from mowing equipment was visible and some areas were bare or covered with thick clippings in flat areas along the toe. Standing water and thick stands of phragmites were visible in the ditch adjacent to and south of the toe.

The south embankment contains the discharge structure (two corrugated steel discharge pipes, each 30 inches in diameter). The upstream end of the discharge structure has a concrete common headwall with a variable height steel debris deflector that needs to be removed. Thin vegetative cover was present on the southwest corner of the embankment and tall vegetation was present around the spillway pipe outlets. The pipe conveyances were inspected by remote camera on September 20, 2016 and found to be in acceptable operating condition.

Inspection Report Specifications

(i) CCR Surface Impoundment Geometry

The Green CCR Surface Impoundment is a combined incised/earthen embankment structure. The immediate watershed that drains to the CCR surface impoundment, and in which the CCR surface impoundment is considered to be located, is unnamed and 54.13 acres in size. Embankments form the west, south and east sides of the impoundment and the north side is

incised. The original terrain on which the impoundment was constructed consisted of small stream valleys draining eastward to the Green River. Most of the central portion of the south dike was constructed on a subdued ridge and the toe of the outboard slope intersected a lower drainage area. The Green River is located approximately 400 feet east of the structure. The west dike is generally less than five feet in height and the south dike reaches a maximum height of 19.5 feet. The east dike reaches a maximum height of approximately eight feet and is buttressed with a secondary parallel embankment that serves as a 40-foot wide roadway. Bottom ash has been placed above the normal pool along the inboard side, essentially creating reclaimed land.

There have been no significant changes to the geometry of the impounding structure since the previous (2015) annual inspection. Placement of additional CCR material in the impoundment is ongoing.

(ii) CCR Surface Impoundment Instrumentation

There are five piezometers and one water level indicator associated with the Green CCR Surface Impoundment.

(ii) a – Piezometers

*Maximum elevation above mean sea level (AMSL) measured at each piezometer since the 2015 annual inspection report:

| Piezometer ID | Northing | Easting | Top of Casing Elevation (AMSL) | Depth to Static Water Level | Static Water Elevation* (AMSL) |
|---------------|-----------|------------|--------------------------------|-----------------------------|--------------------------------|
| P-1A | 480202.55 | 1492104.21 | 396.17 | 11.38 feet | 384.79 |
| P-2A | 480186.48 | 1492464.48 | 395.98 | 12.32 feet | 383.66 |
| P-3A | 480175.11 | 1492692.75 | 395.91 | 13.90 feet | 382.01 |
| P-6 | 480122.51 | 1492462.58 | 379.33 | 0.91 foot | 378.42 |
| P-7 | 480137.28 | 1492099.00 | 380.26 | 1.01 foot | 379.25 |

(ii) b – Water Surface Level Indicator

The maximum water surface elevation since the 2015 annual inspection report is 394.36 feet above mean sea level as measured at a water level indicator located in the southwest corner of the impoundment.

(iii) CCR Surface Impoundment Contents Depths and Elevations

The Green CCR Surface Impoundment contents depths and elevations are provided below. They are based on: 1) available measured water surface elevations, 2) comparison of 2015 and 2016 flight derived topographic contours and bathymetric survey data, and 3) best available as-built design data for the impoundment prior to placement of CCR material (i.e.

the Burns and Roe, Inc. Engineering and Consultants June 30, 1978 design plans provided by Big Rivers Electric Corporation).

Elevations are provided as feet above mean sea level and depths are provided as height in feet above the impoundment's design bottom prior to placement of CCR material. All values are rounded off to the nearest tenth of foot.

Minimum depth of impounded water = Not available¹

Minimum elevation of impounded water = <392.7 (pool elevation was below staff gauge)

Minimum depth of CCR material = 18.2

Minimum elevation of CCR material = 378.2

Maximum depth of impounded water = Not available¹

Maximum elevation of impounded water = 394.4

Maximum depth of CCR material = 50.6

Maximum elevation of CCR material = 410.6

Present depth of impounded water = 14.0²

Present elevation of impounded water = 393.6²

Present depth of CCR material = 50.6³

Present elevation of CCR material = 410.6³

¹Depth not available due to absence of bathymetric survey data at times of minimum and maximum pool elevations

²At location of maximum impounded water depth

³At location of maximum CCR material depth

(iv) CCR Surface Impoundment Storage Capacity

The Green CCR Surface Impoundment storage capacity is approximately 160,445 cubic yards (if CCR can be placed to the elevation of the spillway). This volume is based on: 1) available measured water surface elevations, 2) 2016 flight derived topographic contours and bathymetric survey data, and 3) best available as-built design data for the impoundment prior to placement of CCR material (i.e. the Burns and Roe, Inc. Engineering and Consultants June 30, 1978 design plans provided by Big Rivers Electric Corporation).

(v) CCR Surface Impoundment Contents Volumes

The Green CCR Surface Impoundment contents volume of impounded water is approximately 160,445 cubic yards and volume of CCR material is approximately 856,680 cubic yards. These volumes are based on: 1) available measured water surface elevations, 2) 2016 flight derived topographic contours and bathymetric survey data, and 3) best available as-built

design data for the impoundment prior to placement of CCR material (i.e. the Burns and Roe, Inc. Engineering and Consultants June 30, 1978 design plans provided by Big Rivers Electric Corporation).

(vi) CCR Surface Impoundment Structural, Operational, and Safety Items

No deficiencies were observed during the annual inspection.

(vii) CCR Surface Impoundment Changes

There have been no significant changes to the Green CCR Surface Impoundment (or impounding structure) since the previous (2015) annual inspection that may have affected the stability or operation of the CCR surface impoundment.



Flight Date: October 23, 2016



BIG RIVERS ELECTRIC CORPORATION

Green CCR Surface Impoundment
2016 Annual Inspection Aerial Photo

| | |
|-----------------|--------------|
| Project Number: | 16-0122A |
| Date: | 12/12/2016 |
| Scale: | NOT TO SCALE |
| Drawn By: | A.E.I. |

2740 North Main St. • Madisonville, KY 42431
Phone: (270) 821-7732 • Fax: (270) 821-7789
www.associatedengineers.com

BREC Final Rule CCR Impoundment 2016 Annual Inspection Checklist

| Operator: Sebree Generating Station CCR Surface Impoundment: Green Date: November 7, 2016 | | | | | Weather: Clear Temperature (Degrees F): 65 (average) Inspector/Qualified Person: Tim Brown P.E. & Matthew Lile (AEI) | |
|---|---|-------------------------------------|-------------------------------------|--------------------------|--|--|
| ITEM | | STATUS | | | OBSERVATIONS | |
| | | YES | NO | N/A | | |
| 1 | TOP OF DAM | | | | | |
| | Visual settlement | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Misalignment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Cracking | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Access road deterioration (potholes, rutting, etc.) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Isolated potholes | |
| 2 | UPSTREAM SLOPE | | | | | |
| | Any erosion | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | Longitudinal cracks | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Transverse cracks | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Adequate vegetative cover | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Sporadic bare areas & invasive species monocultures where not rip-rapped | |
| | Are trees growing on the slope | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Adequate riprap/slope protection | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Sporadic areas without rip-rap | |
| | Visual depressions | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Visual settlement | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Any stone deterioration | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Debris or trash present | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| 3 | DOWNSTREAM SLOPE AND TOE | | | | | |
| | Any erosion | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | Longitudinal cracks | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Minimal surficial cracking from dry conditions | |
| | Transverse cracks | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Minimal surficial cracking from dry conditions | |
| | Adequate vegetative cover | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Isolated bare areas | |
| | Are trees growing on the slope | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Visual depressions or bulges | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Some longitudinal tracking/rutting from tractor & mower tires | |
| | Visual settlement | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Animal Burrows | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Are boils present at the toe or slopes | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Are drainage features obstructed or damaged | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Drainage ditch along toe has heavy vegetation | |
| | Are drainage features flowing | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |
| | Is seepage present | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | |

| ITEM | | STATUS | | | OBSERVATIONS |
|----------|--|-------------------------------------|-------------------------------------|-------------------------------------|--|
| | | YES | NO | N/A | |
| | Is seepage or discharge carrying sediment | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Soft or spongy zones present | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 4 | ABUTMENTS | | | | |
| | Any erosion | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | East abutment on downstream side of embankment |
| | Visual differential movement | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Any cracks | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Are drainage features flowing | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Is seepage present | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Is seepage or discharge carrying sediment | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 5 | PRINCIPAL SPILLWAY | | | | |
| | Any deterioration of the spillway structure | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Any deterioration of the spillway conduit | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Spillway clear from obstructions | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Debris deflector needs to be removed |
| | Is the spillway functioning and discharging correctly | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| | Trash racks or skimmer operational | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Any signs of leakage with the structure or conduit | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | Abnormally high or low pool elevation | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| 6 | EMERGENCY SPILLWAY | | | | |
| | Any deterioration of the spillway structure | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Spillway clear from obstructions | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Signs or erosion or slope sloughing | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Adequate vegetative cover | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Signs of or currently discharging water | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 7 | VALVES/GATES | | | | |
| | Are the valves/gates operational | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Are the valves/gates broken or bent | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Are the valves/gates corroded or rusted | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Have the valves/gates been maintained | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 8 | HYDRAULIC STRUCTURES UNDER/THROUGH DAM | | | | |
| | Hydraulic structures under/through embankment are in safe and reliable operating condition | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| | Abnormal flow | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | No discharge at time of inspection |
| | Abnormally colored discharge | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Debris or sediment in discharge | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| 9 | SEEPAGE | | | | |
| | Seepage from toe drain | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

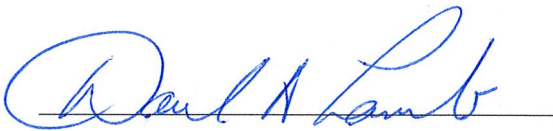
| ITEM | | STATUS | | | OBSERVATIONS |
|------|-----------------------------|--------------------------|-------------------------------------|-------------------------------------|--------------|
| | | YES | NO | N/A | |
| | Seepage from abutment drain | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Seepage from blanket drain | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |
| | Seepage from slope areas | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |

DEFICIENCIES AND MAINTENANCE ITEMS

No deficiencies were observed during the annual inspection.

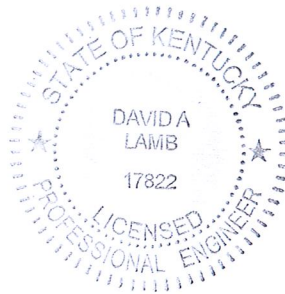
**Professional Engineer Certification [Per 40 CFR §257.83(b)]
Green CCR Surface Impoundment
Annual Inspections by a Qualified Professional Engineer**

I hereby certify that myself or an agent under my review has prepared this Annual Inspection Report (Report), and being familiar with the provisions of the final rule to regulate the disposal of coal combustion residuals (CCR) as solid waste under subtitle D of the Resource Conservation and Recovery Act (RCRA), attest that this Report has been prepared in accordance with good engineering practices and meets the intent of 40 CFR Part 257.83(b). To the best of my knowledge and belief, the information contained in this Report is true, complete, and accurate.



David A. Lamb, P.E.

State of Kentucky License No. 17822



Date: 1-11-2017