29 September 2016
File No. 41938-006

Westar Energy, Inc.
818 South Kansas Avenue
Topeka, Kansas 66612

Attention: Mr. Jared Morrison

Subject: Initial Periodic Structural Stability Assessment
         Bottom Ash Area 1 Impoundment
         Jeffrey Energy Center
         St. Marys, Kansas

Dear Mr. Morrison:

Enclosed please find our Initial Periodic Coal Combustion Residuals (CCR) Surface Impoundment Structural Stability Assessment Report for the Westar Energy, Inc. (Westar) Bottom Ash Area 1 Impoundment located at the Jeffrey Energy Center (JEC) in St. Marys, Kansas.

We completed an inspection on behalf of Westar on 8 October 2015 and have completed this assessment as a follow up activity. This work was performed by Haley & Aldrich on behalf of Westar in accordance with the US Environmental Protection Agency's (EPA’s) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 (Final CCR Rule), in particular §257.73(d).

The assessment consisted of the following: 1) obtain and review readily available reports, investigations, plans and data pertaining to the Bottom Ash Area 1 impoundment and appurtenant structures; 2) perform a visual inspection of the impoundment; 3) evaluate whether the design, construction, operation, and maintenance of the surface impoundment are consistent with generally accepted good engineering practices; and 4) prepare and submit this report presenting the results of our evaluation of the impoundment, including recommendations and remedial actions.
Thank you for inviting us to complete this assessment and please feel free to contact us if you wish to discuss the contents of the report.

Sincerely yours,
HALEY & ALDRICH, INC.

Steven F. Putrich, P.E.
Project Principal

Enclosures
REPORT ON
INITIAL PERIODIC STRUCTURAL STABILITY ASSESSMENT
BOTTOM ASH AREA 1 IMPOUNDMENT
JEFFREY ENERGY CENTER
ST. MARYS, KANSAS

by Haley & Aldrich, Inc.
Cleveland, Ohio

for Westar Energy, Inc.
St. Marys, Kansas

File No. 41938-006
September 2016
Executive Summary

This report summarizes the results of the Initial Periodic Structural Stability Assessment conducted by Haley & Aldrich, Inc. (Haley & Aldrich) for the Bottom Ash Area 1 coal combustion residuals (CCR) surface impoundment at the Jeffrey Energy Center in St. Marys, Kansas. This work was completed in accordance with the US Environmental Protection Agency’s (EPA’s) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 (Final CCR Rule), specifically §257.73(d).

The Bottom Ash Area 1 Impoundment was constructed in the 1980s for the purpose of storing CCR consisting primarily of bottom ash and boiler slag. Westar continues to operate the impoundment in that manner including operations to remove CCRs from the impoundment for beneficial use.

On the south and east sides of the impoundment, the topography slopes upward from the edge of the impoundment, thus there are no berms on these sides of the impoundment. Berms exist along the west and north sides of the impoundment. The west berm is approximately 800 ft in length and has a maximum height of approximately 42 ft. The berm extends across a natural valley, tying into existing grades at its south end and transitioning into the north berm at its other end. The north berm is defined by the drainage channel from the JEC that exists at the north downstream toe of slope. The north berm is approximately 750 ft in length and ranges in height from about 20 ft where it abuts the west berm, decreasing in height until tying into existing grades at its east end.

During our previous inspection of the Bottom Ash Area 1 Impoundment, no signs of instability (i.e., slides, sloughs, scarps) or unusual movements were observed in the upstream slopes. The crest surface is hard and in good condition, exhibiting no rutting, soft spots, depressions, settlement, surface cracking, or signs of horizontal movement or misalignment. On the downstream slopes, no signs of slides, scarps, unusual movements, or sinkholes were observed. However, seeps and erosion noted on the west berm downstream slope need further investigation to confirm stability and determine appropriate remedial actions.

Impoundment Inspection Assessment and Recommendations

Based on conditions observed during our visual inspection of the impoundment, discussions with site personnel and a review of available documents, the following deficiencies were noted:

1. Seeps on the downstream slope of the west berm.

2. Large areas without vegetation or other slope protection on the downstream slope of the west and north berms.

3. Tall vegetation up to several feet high on portions of the west and north downstream slopes.

4. Erosion rills on the downstream slope of the west berm.

5. Deep eroded channel along the west berm downstream toe of slope. The channel has cut into the toe at the south end of the berm.
6. Drainage channel along the north berm downstream toe of slope. Where flow enters the drainage channel from a culvert below the impoundment access road, a pool has formed at the discharge point which has enlarged over time, resulting in a steel railing falling into the pool area and the development near vertical slopes around portions of the pool.

7. Possible denting and hole in vertical riser intake pipe. It is our understanding that Westar has recently repaired this riser pipe.

Haley & Aldrich recommends the following actions:

1. Seeps – Evaluate the cause(s) of the seeps. Take appropriate measures to reduce seeps based on findings. Monitor and document the condition of the seeps while the cause(s) are evaluated and longer term measures are developed.

2. Unvegetated areas on downstream slopes – Provide some form of slope protection on unvegetated areas of the slope to achieve performance standards.

3. Tall vegetation – Cut vegetation and maintain at the required maximum height per the regulations. Maintain in a manner to reduce and control woody vegetation.

4. Erosion rills – Fill erosion rills on downstream slope.

5. Deep eroded channel along west berm downstream toe of slope – Re-locate the eroded drainage channel away from the toe of slope and armor with riprap or other appropriate erosion protection. Backfill the existing eroded channel.

6. Drainage channel along the north berm downstream toe of slope/eroded pool area – Where the culvert below the impoundment access road discharges, regrade/flatten the sides of the pool. Armor pool with suitable erosion protection. Re-install the metal railing along the access road at the top of the pool.

7. It is our understanding that Westar has repaired the damaged vertical riser pipe previously identified.

Structural Stability Assessment

In accordance with 40 CFR §257.73(d), the owner or operator of a CCR surface impoundment must conduct initial and periodic structural stability assessments to determine whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

Haley & Aldrich reviewed the information provided to us and inspected the Bottom Ash Area 1 impoundment as described above. Based on our review of the information and observations during our inspection, we have concluded the following in accordance with 40 CFR §257.73(d):
1. \$257.73(d)(1)(i) – Stable Foundations and Abutments:

As part of their 2009 engineering evaluation, Black & Veatch drilled five test borings in the west berm of the Bottom Ash Area 1 Impoundment. The test borings, designated B-1, B-1A, B-2, B-3, and B-3A, ranged in depth from 20 to 61 ft below the top of the berm. The borings encountered very dense bottom ash fill which ranged in thickness from approximately 21 to 29 ft at the boring locations. Underlying the bottom ash fill was shale residual soil, and shale and limestone bedrock. Based on our review of the boring logs and observations during our inspection, it is our opinion that the shale and limestone provide stable foundations and abutments for the surface impoundment. The safety factor assessment required by the CCR Rule related to modeling stability was not completed as part of this assessment and will be completed by Westar under separate cover.

2. \$257.73(d)(1)(ii) – Adequate Slope Protection:

Erosion protection on the downstream slopes of the west and north berms consists of vegetation comprised of a variety of tall grasses, scrub brush and bushes. Large areas exist on these slopes where the ground is devoid of vegetation or other erosion protection. As a result, erosion rills, typically about 4 to 8 in. deep, exist on large portions of the west and north downstream slopes. The lack of vegetation or other slope protection on portions of the downstream slope do not appear to present a berm stability problem, but will remain an ongoing maintenance issue if not addressed.

As discussed above, seeps were observed on the west berm downstream slope during our inspection. Although no running water was observed exiting the seeps, and we observed no evidence of movement of coal ash particles from within the berm (i.e., internal erosion), the seeps could potentially impact berm stability if not evaluated and appropriate actions taken to reduce, eliminate, add/or control the seepage, and monitor future seepage within these areas.

3. \$257.73(d)(1)(iii) – Dikes Mechanically Compacted:

Although records on the construction of the Bottom Ash Area 1 Impoundment are not available, the borings performed by Black & Veatch indicate the bottom ash fill at the boring locations typically has SPT N-values greater than 50, indicating very dense material. Based on these N-values, it is likely the berm fill was mechanically compacted during construction.

4. \$257.73(d)(1)(iv) – Height of Vegetation:

At the time of our impoundment inspection, portions of the west and north downstream slopes were vegetated by tall grasses, scrub brush and bushes that were up to several feet high.

5. \$257.73(d)(1)(v)(A) – Spillway Cover:

Bottom Ash Area 1 Impoundment does not have an emergency spillway. Water exits the impoundment through a 24-in. diameter CMP vertical riser intake pipe. Therefore, a discussion of spillway cover is not applicable. Details of the riser pipe are discussed below.
6. §257.73(d)(1)(v)(B) – Spillway Capacity:

The spillway capacity for the impoundment will be modeled and calculated in accordance with §257.82 Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments. Westar will complete that capacity requirement under separate cover, consistent with the CCR Rule Preamble reference to the same.

7. §257.73(d)(1)(vi) – Hydraulic Structures Underlying or Passing Through Embankment:

Only limited portions of the intake and outlet structures were visible during our inspection. As noted, the top of the 24-in. diameter CMP vertical riser intake pipe may be damaged but it was difficult to determine this since the top of the pipe is submerged. Regarding the 36-in. steel outlet pipe, the pipe is buried below the berm and only the downstream end of the pipe is visible. The visible portion of the pipe appeared sound and during our inspection, we observed no signs that would indicate seepage or internal erosion along the length of the pipe where it penetrates the west berm.

8. §257.73(d)(1)(vii) – Inundation of Downstream Slopes:

There is no possibility of the downstream slopes being inundated, therefore this condition is not applicable.

9. §257.73(d)(2) – Deficiencies and Recommendations:

See Section 3 of this report for a discussion of deficiencies and recommendations.
PREFACE

The assessment of the general condition of the surface impoundment is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this report. In reviewing this report, it should be realized that the described condition of the impoundment is based on observations of field conditions at the time of inspection, along with other data available to the inspection team. It is important to note that the condition of an impoundment depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the impoundment will continue to represent its condition at some point in the future.

CERTIFICATION

I certify that this Initial Periodic Structural Stability Assessment for Westar’s Bottom Ash Area 1 impoundment at the Jeffrey Energy Center was conducted in accordance with the requirements of §257.73(d) of the USEPA’s CCR Rule.

Signed: [Signature]
Consulting Engineer

Print Name: Steven F. Putrich
Kansas License No.: 24363
Title: Project Principal
Company: Haley & Aldrich, Inc.

Professional Engineer’s Seal:
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1. Description of Project

1.1 GENERAL

1.1.1 Authority

Haley & Aldrich, Inc. (Haley & Aldrich) has been contracted by Westar Energy, Inc. (Westar, Owner) to perform the Initial Periodic Structural Stability Assessment for the Bottom Ash Area 1 CCR Impoundment located at the Jeffrey Energy Center (JEC) near St. Marys, Kansas. This work was completed in accordance with the US Environmental Protection Agency’s (EPA’s) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257, specifically §257.73(d).

This report summarizes the results of our Initial Periodic Structural Stability Assessment for the Bottom Ash Area 1 impoundment, including our previous visual inspection of the impoundment. Results of our previous inspection were also included in the Initial Annual CCR Surface Impoundment Professional Engineer Inspection Report dated 15 January 2016.

1.1.2 Purpose of Work

The purpose of this assessment was to document whether the design, construction, operation, and maintenance of the Bottom Ash Area 1 impoundment is consistent with recognized and generally accepted good engineering practices. The visual inspection is intended to identify signs of distress or malfunction of the surface impoundment, should they exist. This report summarizes those findings and notes conditions observed that are disrupting or have the potential to disrupt the operation and safety of the surface impoundment.

The investigation is divided into four parts: 1) obtain and review readily available reports, investigations, plans and data pertaining to the Bottom Ash Area 1 impoundment and appurtenant structures; 2) perform a visual inspection of the impoundment; 3) evaluate whether the design, construction, operation, and maintenance of the surface impoundment are consistent with generally accepted good engineering practices; and 4) prepare and submit this report presenting the results of our evaluation of the impoundment, including recommendations and remedial actions.

1.1.3 Definitions

To provide the reader a better understanding of the report, definitions of commonly used terms associated with dams are provided in Appendix C. Many of these terms may be included in this report. The terms are presented under common categories associated with dams and surface impoundments which include: 1) orientation; 2) dam components; 3) hazard potential classification; and 4) miscellaneous.
1.2 DESCRIPTION OF PROJECT

1.2.1 Location

The Bottom Ash Area 1 Impoundment is located at the JEC in St. Marys, Kansas. The site is located approximately 7 mi. northwest of the commercial and residential center of town. The Bottom Ash Area 1 Impoundment is adjacent to the power plant, which is located at North latitude 39° 17.2’ and West longitude 96° 7.7’, as shown on Figure 1, Project Locus. The surface impoundment is accessed from the plant site along a gravel access road. Access to the plant and surface impoundment is restricted by full-time security and barriers/fences at the plant.

1.2.2 Owner/Operator

The Bottom Ash Area 1 Impoundment is owned and maintained by Westar Energy.

<table>
<thead>
<tr>
<th>Name</th>
<th>Impoundment Owner</th>
<th>Impoundment Caretaker</th>
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<tr>
<td>Name</td>
<td>Westar Energy</td>
<td>Westar Energy</td>
</tr>
<tr>
<td>Mailing Address</td>
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<td>Jeffrey Energy Center</td>
</tr>
<tr>
<td>Town</td>
<td>Topeka, Kansas 66612</td>
<td>St. Marys, KS 66536</td>
</tr>
<tr>
<td>Site Contact</td>
<td>Jared Morrison</td>
<td>Doug Mericle</td>
</tr>
<tr>
<td>Daytime Phone</td>
<td>(785) 575-8273</td>
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1.2.3 Purpose of the Impoundment

The JEC was originally commissioned in 1978 and currently consists of three separate coal-fired units. As part of plant operations, the Bottom Ash Area 1 Impoundment was constructed in the 1980s for the purpose of storing CCR consisting primarily of bottom ash and boiler slag. Westar continues to operate the impoundment in that manner including operations to remove CCRs from the impoundment for beneficial use.

1.2.4 Description of the Impoundment and Appurtenances

This surface impoundment is within the Kansas Department of Health and the Environment (KDHE) issued solid waste permit No. 359. The surface impoundment is understood to be constructed on native soils and bedrock consisting of shale residual soil, and shale and limestone bedrock. The embankment is up to approximately 42 ft in height and according to records, was constructed using a mixture of fly ash and bottom ash. We understand the impoundment was a non-engineered structure and minimal information related to the original design and construction was available.

On the south and east sides of the impoundment, the topography slopes upward from the edge of the impoundment, thus there are no berms on these sides of the impoundment. Berms exist along the west and north sides of the impoundment. For the purposes of this report, these berms are hereinafter referred to as the “west berm” and the “north berm.” The limits of the west and north berms are shown on Figure 2.
The west berm is approximately 800 ft in length and has a maximum height of approximately 42 ft. The berm extends across a natural valley, tying into existing grades at its south end and transitioning into the north berm at its north end.

The north berm is defined by the drainage channel from the JEC that exists at the north downstream toe of slope. The north berm is approximately 750 ft in length and ranges in height from about 20 ft where it abuts the west berm, decreasing in height until tying into existing grades at its east end.

Bottom ash and boiler slag from the plant are mixed with water and the slurry is sluiced from the plant to the Bottom Ash Area 1 Impoundment. The slurry discharges into the impoundment via a spillway located at the northeastern end of the impoundment. Coarser material settles out shortly after discharging, building up above water level in the northeast corner where it is excavated and hauled off for reuse.

The downstream slope of the west and north berms generally ranges from approximately 1.75 horizontal to 1 vertical (1.75H:1V) to 3H:1V. The downstream slope of the west berm is unvegetated in some areas and vegetated in other areas by tall grasses, scrub brush or bushes. The downstream slope of the north berm is generally unvegetated on the upper 4 ft, and vegetated with tall grasses and bushes along the lower portion of the slope. Saplings exist along the bank of the drainage channel.

The exposed upstream slopes of the west and north berms generally range from 1H:1V to nearly vertical. The slopes consist of bottom ash which is generally unvegetated but includes some areas vegetated by tall grass and brush. Within the past few months, a drainage channel was excavated inside the impoundment along the toe of the north and west upstream slopes. The purpose of the channel, which is approximately 20 ft in width, is to aid in drainage of the impoundment.

Currently, water flows through the impoundment area generally within the channels recently excavated along the north and west upstream toe of slope. Water is drained from the impoundment area via a 24-in. diameter CMP vertical riser pipe. The normal pool elevation is maintained by the fixed level of the riser pipe opening. Flow from the riser pipe is directed to a horizontal outlet pipe that penetrates the west berm and discharges at the downstream toe of the berm. The end of the outlet pipe is visible and appears to consist of a 36-in. diameter steel pipe. Water from the outlet pipe flows via an open channel to the Bottom Ash Pond which then discharges to the Tower Hill Lake.

Documentation on a recent vertical expansion of the impoundment in 2012 is limited, consisting of a written scope or work and sketch of proposed modifications to the vertical riser pipe/crest of impoundment berm. Approximately 1,500 LF of the 40-ft wide berm was raised by 4 ft (from El. 1239 to typically 1243) using a mixture of fly ash and bottom ash placed and compacted in 8-in. lifts. The 24-in. diameter vertical riser pipe was raised vertically during this construction.

Based on observations during our previous inspection and site visit and our review of available site plans, the Bottom Ash Area 1 Impoundment receives water from the following sources: 1) discharge of water/bottom ash slurry from the JEC plant, 2) discharge from the emergency Flue Gas Desulfurization dewatering bags, 3) limited runoff entering the impoundment during rain events and snow melt, and 4) direct precipitation falling into the impoundment. Bottom ash and boiler slag from the plant are mixed with plant process water and sluiced from the plant to the Bottom Ash Area 1 Impoundment. The sluice water discharges into the impoundment via a spillway located at the northeastern end of the impoundment.
1.2.5 **Operations and Maintenance**

The impoundment is operated and maintained by JEC personnel or Westar’s approved contractors. Operation of the impoundment includes removal/recovery of settled ash from the ponds for reuse.

Maintenance of the impoundment includes regular cutting of vegetation from the downstream slope and removal of woody vegetation as needed from the upstream slope.

When we previously met with site personnel, there was no written operation and maintenance plan for the Bottom Ash Area 1 Impoundment other than general statements in the overall plant O&M plan. Our understanding is that Westar has developed an updated plan for the state regulatory agency.

1.2.6 **Hazard Potential Rating**

Hazard Potential Classification is being completed outside the scope of this report in accordance with the applicable regulations. Results will be provided under separate cover.

1.3 **PERTINENT ENGINEERING DATA**

1.3.1 **Drainage Area**

As part of the Structural Stability Assessment, Haley & Aldrich delineated the contributory drainage area. Based on existing topography, contributory drainage area to the Bottom Ash Area 1 Impoundment was determined to be approximately 34 acres. The drainage area consists of the area immediately east of the impoundment up to the existing access road and railroad tracks. Drainage east of the road and tracks is collected in other stormwater ponds and discharged around this impoundment to other downstream ponds. The drainage area ground surface elevations range from approximately El. 1239 to El. 1299. The drainage area is shown in Figure 4.

1.3.2 **Reservoir**

The Bottom Ash Area 1 Impoundment has a surface area of approximately 6 acres based on the area contained within the El. 1239.5 (normal pool) contour line.

As shown on Figure 4, at the time of the inspection, the impounded CCR volume is estimated to be approximately 355 acre-ft and the volume of impounded water estimated to be 17 acre-ft. The remaining storage capacity of the Bottom Ash Area 1 Impoundment is estimated to be approximately 35 acre-ft.

The Bottom Ash Area 1 Impoundment and Landfill has an approximate design total capacity of 1,593,200 cubic yards (987.5 ac-ft) (as discussed above, the impoundment has approximately 355 ac-ft of impounded CCR volume) with an approximate footprint of 52.5 acres per the 2009 Final Permit Update Documents prepared by Burns & McDonnell (Reference 2). The 2009 report indicates the estimated fill rate of the impoundment to be 30,200 cubic yards of CCR per year. These capacities represent projections with original consisting of vertical berm expansions to increase available wetspace and disposal capacity.
1.3.3 Discharges at the Impoundment Site

Water from the discharge pipe flows via an unlined open channel to the Bottom Ash Pond which then discharges to the Tower Hill Lake.

1.3.4 Elevations and Impoundment Parameters

Relevant elevations and impoundment parameters are as follows:

A. Crest Elevation of West and North Berms  
   El. 1241.6 minimum, El. 1243 typical
B. Normal Pool Elevation  
   El. 1239.5
C. Intake Type  
   Vertical Riser Pipe (24-in. dia.)
D. Intake Elevation  
   El. 1239.25
E. Upstream Water at Time of Inspection  
   Approx. El. 1239.5
F. Low Point along Toe of Berms  
   Approx. El. 1200
G. Outlet Type  
   Steel Pipe (36-in. dia.)
H. Outlet Pipe Invert Elevation  
   El. 1205.56

1.3.5 Design and Construction Records

The Bottom Ash Area 1 Impoundment berms were constructed in the 1980s to create a sedimentation and storage basin for bottom ash/CCRs. We understand the impoundment was a non-engineered structure and has little documented design and construction information. Available documentation on the 2012 vertical expansion included a written scope or work and sketch of proposed modifications to the vertical riser pipe/crest of impoundment berm.

1.3.6 Operating Records

Operation of the Bottom Ash Area 1 Impoundment is per JEC’s State-approved operations plan. Written operational records are not historically maintained for the surface impoundment.

1.3.7 Previous Inspection Reports

In December 2009, Black & Veatch published a report entitled, “Bottom Ash Settling Berm Inspection and Engineering Evaluation Report” (Reference 1). The report summarized the results of a visual inspection of the berms, geotechnical test borings and laboratory testing, and slope stability analyses. Westar has also completed its Annual PE Inspection in January 2016, quarterly internal CQA and stormwater reports, and weekly internal inspections.
2. Inspection

2.1 VISUAL INSPECTION

On 8 October 2015, Haley & Aldrich conducted a visual inspection of the Bottom Ash Area 1 Impoundment west and north berms. The inspection was performed by Mark D. Brownstein, P.E. and Andy Lucas, EIT of Haley & Aldrich. In attendance for at least a portion of the inspection were the following Westar personnel: Jared Morrison, Brandon Griffin, and Kelley Kelsey. In addition, Sam Sunderraj of Kansas Department of Health and Environment was present during the initial portion of the inspection.

The following paragraphs describe the conditions observed on the west and north berms during the inspection. Photographs taken during the inspection are included in Appendix A. A copy of the Inspection Checklist is included Appendix B.

2.1.1 General Findings

2.1.1.1 West and North Upstream Slopes

At the time of the inspection, approximately 3 to 5 ft of the upstream slope was exposed above the water level in the impoundment. As discussed above, in recent months a drainage channel was excavated along the upstream edge of the west and north berms to aid in drainage of the impoundment. Although not visible below the water, it appears the sides of the drainage channel generally range from 1H:1V to nearly vertical.

The exposed upstream slopes of the west and north berms consist of bottom ash which is generally unvegetated but includes areas vegetated by tall grass and brush.

No signs of instability (i.e., slides, sloughs, scarps) or unusual movements were observed. In addition, no significant erosion, animal burrows, or signs of distress were observed.

The west and north berm upstream slopes are shown in Photos 1 and 2, respectively.

2.1.1.2 West and North Berm Crest

The crest of the west and north berms consists of a bottom ash surfaced access road that is approximately 40 ft in width. The elevation of the crest is typically at El. 1243 but is as low as El. 1241.6, and as high as El. 1245 at the far south and east ends of the berms. The crest surface is hard and in good condition, exhibiting no rutting, soft spots, depressions, settlement, surface cracking, or signs of horizontal movement or misalignment. The surface of the crest is unvegetated and shows no signs of erosion or animal burrows.

The west and north berm crests are shown in Photos 3 and 4, respectively.
2.1.1.3 **West and North Downstream Slopes**

**West Berm Downstream Slope**

Overall views of the west berm downstream slope are shown in Photos 5 and 6. Specific observations regarding the west downstream slope are discussed below:

- **Seeps** - The west berm downstream slope exhibited seeps at several locations along the south and central portions of the berm. The top of the seeps was generally about 30 ft down the slope from the downstream edge of crest, or approximately 10 ft vertically below the crest elevation. The seeps varied in size. The largest seep was approximately 20 ft wide at the top of the seep and 5 to 10 ft wide at the bottom of the seep. The smaller seeps were generally 3 to 10 ft in width. At the larger seeps, the ground had softened and it was possible to penetrate the surface of the berm approximately 3 in. with the heel of a boot. No running was observed exiting the seeps, however, the surface of the soil was wet at some locations and indentations made on the surface of the seep would slowly fill with water over time. No evidence of movement of coal ash particles from within the berm was observed (i.e., internal erosion), however, at some locations erosion rills were observed on the slope below the seep. It is possible the erosion rills were caused by erosion of the ground surface from water exiting the seep at some time in the past. Examples of the seeps are shown in Photos 7 through 11.

- **Eroded Channel at Toe of Slope** – A deep eroded channel exists along the downstream toe of slope at the south end of the west berm (see Photos 12 through 15). The erosion is caused by surface water runoff from upland areas to the south of the impoundment. At the south end of the berm, the channel has cut into the downstream toe of the berm. At its deepest point, the eroded channel is approximately 8 ft deep. The depth of the eroded channel decreases to about 3 to 4 ft moving north and the channel alignment moves away from the toe of slope. A 24-in. concrete pipe discharges into the channel a few hundred feet north of the beginning of the ditch. We understand the pipe carries flow from the lime settling pond about once per month for a period of about 8 hrs. Concrete debris exists in the ditch where the 24-in. pipe discharges.

- **Vegetation** – Large areas exist on the west downstream slope where the ground is devoid of vegetation (Photos 16 and 17). Other areas are vegetated with a variety of tall grasses, scrub brush and bushes that are generally 2 to 3 ft in height (Photos 18 and 19). Vegetation on the slope did not appear to be regularly cut.

- **Erosion** – Erosion rills exist in large portions of the west downstream slope. The erosion rills generally ranged in depth from about 4 to 10 in. (Photos 20 and 21).

- **Grading** – Surface grades at the south end of the west slope are irregular and include a benched area near the bottom of the slope (Photo 22).

During inspection of the west downstream slope, no signs of slides, scarps, unusual movements, sinkholes, or animal burrows were observed.
North Berm Downstream Slope

- **Drainage Channel at Toe of Slope** – A drainage channel exists along the toe of the north downstream slope (Photo 23). We understand this drainage channel functions as a bypass, periodically receiving water that the plant has pumped from its on-site make-up water ponds to the water storage tanks located at the plant. At times when a generating unit is shut down and water continues to be pumped, flow is diverted to this channel once the water tank is full.

- Water enters the drainage channel to the northeast of the impoundment and flows through a culvert below the impoundment access road. There is no erosion protection or energy dissipater at the discharge point of the culvert. As a result, a pool has formed at the discharge point which has enlarged over time, resulting in a steel railing falling into the pool area and the development of near vertical sides around portions of the pool (Photos 24 through 26). Repairs of the railing and surrounding slopes should be evaluated and acted on to maintain proper safety.

- **Vegetation** – The north berm downstream slope is typically unvegetated on the upper portion (likely due to the 2012 raising of the berm). The middle portion of the slope is vegetated with tall grasses while the toe of slope is heavily vegetated with grass, bushes and saplings adjacent to the drainage channel (Photo 27). Vegetation on the slope did not appear to be regularly cut. We understand the saplings along the bank of the drainage channel were left in place in response to prior Army Corps of Engineers requirements.

During inspection of the north downstream slope, no signs of slides, scarps, unusual movements, sinkholes, or animal burrows were observed.

**2.1.1.4 Intake and Outlet Works**

Water is drained from the impoundment via a 24-in. diameter CMP vertical riser pipe. The vertical riser pipe was submerged at the time of the inspection, therefore, only the upper few inches of the pipe were visible. During our inspection, it appeared the top of the pipe may be dented and Westar personnel indicated the riser pipe may have a hole in its side near the top of the pipe. However, at the time of the inspection, the riser pipe appeared to be functioning as intended with the water level being slightly above the top of the pipe (Photos 28 and 29). We would note that Westar has fixed this deficiency as of the time of this report.

Flow from the vertical riser pipe is directed to a horizontal outlet pipe that penetrates the west berm and discharges at the downstream toe of the berm. The end of the outlet pipe is visible and appears to consist of a 36-in. diameter steel pipe (Photo 30). At the time of the inspection, there we no obvious signs of seepage around the outlet pipe, sinkholes, or other signs of instability in the vicinity of the pipe. Although no erosion protection or energy dissipater exists at the outlet, the pool into which the outlet pipe discharges appear to be stable.

**2.1.1.5 Downstream Area**

The downstream areas beyond the west and north toe of slope are generally overgrown with heavy vegetation and the ground surface was not readily observable at the time of the inspection. However,
based on the limited visibility, no obvious signs of seeps, springs, soft spots, foundation seepage, or instability were observed (Photo 31).

2.2  CARETAKER INTERVIEW

On the day of the inspection, Haley & Aldrich met with Westar Energy personnel familiar with the operations, maintenance and construction of the Bottom Ash Area 1 Impoundment. Information provided by Westar personnel has been incorporated into this report.

2.3  OPERATION AND MAINTENANCE PROCEDURES

The impoundment is operated and maintained by JEC personnel and their approved contractors. Operation of the impoundment includes removal/recovery of settled ash from the ponds for reuse.

Maintenance of the impoundment includes regular cutting of vegetation from the downstream slope and removal of woody vegetation as needed from the upstream slope.

JEC personnel historically have performed and documented quarterly inspections of the impoundment, and are currently performing and documenting 7-day and 30-day inspections in accordance with 40 CFR §257.83(a).

2.4  EMERGENCY ACTION PLAN

A written Emergency Action Plan (EAP) does not exist for the impoundment, and since it is classified as a Low Hazard Potential impoundment, no EAP is required under 40 CFR Part 257.

The power plant is manned 24 hours a day. Select plant personnel are familiar with the operation of the impoundment and its construction, and can respond to a potential emergency situation should it arise. An overall plant communication plan is in place for the JEC facility.
3. **Impoundment Inspection Assessment and Recommendations**

3.1 **ASSESSMENT**

The following deficiencies were observed at the Bottom Ash Area 1 Impoundment:

1. Seeps on the downstream slope of the west berm.
2. Large areas without vegetation or other slope protection on the downstream slope of the west and north berms.
3. Tall vegetation up to several feet high on portions of the west and north downstream slopes.
4. Erosion rills on the downstream slope of the west berm.
5. Deep eroded channel along the west berm downstream toe of slope. The channel has cut into the toe at the south end of the berm.
6. Drainage channel along the north berm downstream toe of slope. Where flow enters the drainage channel from a culvert below the impoundment access road, a pool has formed at the discharge point which has enlarged over time, resulting in a steel railing falling into the pool area and the development near vertical slope around portions of the pool.
7. Possible denting and hole in vertical riser intake pipe.

3.2 **RECOMMENDATIONS**

Haley & Aldrich recommends the following remedial measures:

1. Seeps – Evaluate the cause(s) of the seeps. Take appropriate measures to reduce seeps based on findings. Monitor and document the condition of the seeps while the cause(s) are evaluated and longer term measures are developed.
2. Unvegetated areas on downstream slopes – Provide some form of slope protection on unvegetated areas of the slope to achieve performance standards.
3. Tall vegetation – Cut vegetation and maintain at the required maximum height per the regulations. Maintain in a manner to reduce and control woody vegetation.
4. Erosion rills – Fill erosion rills on downstream slope.
5. Deep eroded channel along west berm downstream toe of slope – Re-locate the eroded drainage channel away from the toe of slope and armor with riprap or other appropriate erosion protection. Backfill the existing eroded channel.
6. Drainage channel along the north berm downstream toe of slope/eroded pool area – Where the culvert below the impoundment access road discharges, regrade/flatten the sides of the pool.
Armor pool with suitable erosion protection. Re-install the metal railing along the access road at the top of the pool.

7. Damage to vertical riser pipe – Repair damage to vertical riser pipe. It is our understanding that Westar has repaired the damaged vertical riser pipe previously identified.
4. **Structural Stability Assessment**

In accordance with 40 CFR §257.73(d), the owner or operator of a CCR surface impoundment must conduct initial and periodic structural stability assessments to determine whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

Haley & Aldrich reviewed the information provided to us and inspected the Bottom Ash Area 1 impoundment as described above. Based on our review of the information and observations during our inspection, we have concluded the following in accordance with 40 CFR §257.73(d):

1. **§257.73(d)(1)(i) – Stable Foundations and Abutments:**

   As part of their 2009 engineering evaluation, Black & Veatch drilled five test borings in the west berm of the Bottom Ash Area 1 Impoundment. The test borings, designated B-1, B-1A, B-2, B-3, and B-3A, ranged in depth from 20 to 61 ft below the top of the berm. The borings encountered very dense bottom ash fill which ranged in thickness from approximately 21 to 29 ft at the boring locations. Underlying the bottom ash fill was shale residual soil, and shale and limestone bedrock. Based on our review of the boring logs and observations during our inspection, it is our opinion that the shale and limestone provide stable foundations and abutments for the surface impoundment.

2. **§257.73(d)(1)(ii) – Adequate Slope Protection:**

   Erosion protection on the downstream slopes of the west and north berms consists of vegetation comprised of a variety of tall grasses, scrub brush and bushes. Large areas exist on these slopes where the ground is devoid of vegetation or other erosion protection. As a result, erosion rills, typically about 4 to 8 in. deep, exist on large portions of the west and north downstream slopes. The lack of vegetation or other slope protection on portions of the downstream slope do not appear to present a berm stability problem, but will remain an ongoing maintenance issue if not addressed.

   As discussed above, seeps were observed on the west berm downstream slope during our inspection. Although no running water was observed exiting the seeps, and we observed no evidence of movement of coal ash particles from within the berm (i.e., internal erosion), the seeps could potentially impact berm stability if not evaluated and appropriate actions taken to reduce, eliminate, add/or control the seepage, and monitor future seepage within these areas.

3. **§257.73(d)(1)(iii) – Dikes Mechanically Compacted:**

   Although records on the construction of the Bottom Ash Area 1 Impoundment are not available, the borings performed by Black & Veatch indicate the bottom ash fill at the boring locations typically has SPT N-values greater than 50, indicating very dense material. Based on these N-values, it is likely the berm fill was mechanically compacted during construction.

4. **§257.73(d)(1)(iv) – Height of Vegetation:**

   At the time of our impoundment inspection, portions of the west and north downstream slopes were vegetated by tall grasses, scrub brush and bushes that were up to several feet high.
5. §257.73(d)(1)(v)(A) – Spillway Cover:

Bottom Ash Area 1 Impoundment does not have a spillway. Water exits the impoundment through a 24-in. diameter CMP vertical riser intake pipe. Therefore, a discussion of spillway cover is not applicable. Details of the riser pipe are discussed below.

6. §257.73(d)(1)(v)(B) – Spillway Capacity:

The spillway capacity for the impoundment will be modeled and calculated in accordance with §257.82 Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments. Westar will complete that capacity requirement under separate cover, consistent with the CCR Rule Preamble reference to the same.

7. §257.73(d)(1)(vi) – Hydraulic Structures Underlying or Passing Through Embankment:

Only limited portions of the intake and outlet structures were visible during our inspection. As noted, the top of the 24-in. diameter CMP vertical riser intake pipe may be damaged but it was difficult to determine this since the top of the pipe is submerged. Regarding the 36-in. steel outlet pipe, the pipe is buried below the berm and only the downstream end of the pipe is visible. The visible portion of the pipe appeared sound and during our inspection, we observed no signs that would indicate seepage or internal erosion along the length of the pipe where it penetrates the west berm.

8. §257.73(d)(1)(vii) – Inundation of Downstream Slopes:

There is no possibility of the downstream slopes being inundated, therefore this condition is not applicable.

9. §257.73(d)(2) – Deficiencies and Recommendations:

See Section 3 of this report for a discussion of deficiencies and recommendations.

Black & Veatch’s 2009 engineering evaluation (Reference 1) included a slope stability analysis of the impoundment berms based on their 2009 test borings and associated laboratory testing. The results, which are presented in Reference 1, indicate factors of safety exceeding US Army Corps of Engineers acceptance criteria.

Westar will be performing a Safety Factor Assessment in accordance EPA’s Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257(e). Results of the Safety Factor Assessment will be provided under separate cover.
5. References


INITIAL PERIODIC STRUCTURAL STABILITY ASSESSMENT
BOTTOM ASH AREA 1 IMPOUNDMENT
JEFFREY ENERGY CENTER
ST. MARYS, KS
SITE PLAN
SCALE AS SHOWN
SEPTEMBER 2016

NOTES
1. AERIAL IMAGERY PROVIDED BY GOOGLE EARTH PRO. PHOTO TAKEN 12 AUGUST 2014.
2. APPROXIMATE LIMITS OF IMPOUNDMENT BASED ON 1242 CONTOUR FROM 1994 USGS TOPO. VISUAL LIMITS OF ASH ACCORDING TO 2015 GOOGLE EARTH PRO AERIAL IMAGERY, AND APPROXIMATE TOE OF DAM DETERMINED BY 2014 PEC SURVEY.
INITIAL PERIODIC STRUCTURAL STABILITY ASSESSMENT
BOTTOM ASH AREA 1 IMPOUNDMENT
JEFFREY ENERGY CENTER
ST. MARYS, KS

PHOTO LOCATION PLAN
SCALE AS SHOWN
SEPTEMBER 2016

FIGURE 3

NOTES
1. AERIAL IMAGERY PROVIDED BY GOOGLE EARTH PRO. PHOTO TAKEN 12 AUGUST 2014.

LEGEND
- APPROXIMATE LIMITS OF BOTTOM ASH AREA 1 IMPOUNDMENT
- PHOTO LOCATION/DIRECTION

SCALE IN FEET
EXISTING TOPOGRAPHY, PROVIDED BY WESTAR, IS A COMBINATION OF A BATHYMETRIC SURVEY, CONDUCTED IN 2014, AND AN AERIAL TOPOGRAPHIC SURVEY, CONDUCTED BY PROFESSIONAL ENGINEERING CONSULTANTS, FLOWN 2014.

APPROXIMATE TOPOGRAPHY PRIOR TO TIME OF DAM CONSTRUCTION WAS USED FOR THE IMPOUNDED CCR VOLUME CALCULATION. THE TOPOGRAPHY WAS PROVIDED BY USGS 1964.

REMAINING STORAGE CAPACITY: 35 AC-FT
VOLUME BETWEEN THE MOST RECENT TOPOGRAPHY (SEE NOTE 1) AND ELEVATION 1241.6' (MINIMUM CREST ELEVATION OF DAM).

IMPOUNDED WATER VOLUME: 17 AC-FT
VOLUME BETWEEN THE MOST RECENT TOPOGRAPHY (SEE NOTE 1) AND THE WATER SURFACE ELEVATION AT THE TIME OF INSPECTION (1239.5').

IMPOUNDED CCR VOLUME: 355 AC-FT
VOLUME BETWEEN THE APPROXIMATE TOPOGRAPHY PRIOR TO DAM CONSTRUCTION (SEE NOTE 2) AND THE MOST RECENT TOPOGRAPHY (SEE NOTE 1).
APPENDIX A

Photographs
Bottom Ash Area 1 Impoundment
St. Marys, Kansas  

Photo No. 1
Upstream Slope – West Berm

Photo No. 2
Upstream Slope – North Berm
Photo No. 5
Downstream Slope – West Berm

Photo No. 6
Downstream Slope – West Berm
Photo No. 7
Seep – West Berm

Photograph No. 8
Seep – West Berm
Photo No. 9
Seep – West Berm – Note Footprints

Photo No. 10
Seep – West Berm
Photo No. 11
Seep – West Berm

Photo No. 12
Eroded Channel – West Berm Downstream Toe of Slope at South End
(Channel has cut into toe of slope)
Photo No. 13
Eroded Channel – West Berm Downstream Toe of Slope

Photo No. 14
Concrete Debris in Eroded Channel
West Berm Downstream Toe of Slope

24-in. Concrete Discharge Pipe from Lime Settling Pond
Photo No. 15
Eroded Channel – West Berm Downstream Toe of Slope

Photo No. 16
Unvegetated Area - West Berm Downstream Slope
Photo No. 17
Unvegetated Area - West Berm Downstream Slope

Photo No. 18
Tall Vegetation - West Berm Downstream Slope
Photo No. 21
Erosion Rills - West Berm Downstream Slope

Photo No. 22
Irregular Grading – West Berm Downstream Slope
Bottom Ash Area 1 Impoundment
St. Marys, Kansas

A-12

Date of Inspection: 8 October 2015
Bottom Ash Area 1 Impoundment
St. Marys, Kansas
A-13

Date of Inspection: 8 October 2015

Photo No. 25
Discharge Pool
Drainage Channel – North Berm Downstream Toe of Slope

Photo No. 26
Railing at Discharge Pool
Drainage Channel – North Berm Downstream Toe of Slope
Bottom Ash Area 1 Impoundment
St. Marys, Kansas

Unvegetated and Vegetated Areas
North Berm Downstream Slope

Vertical Riser Intake Pipe

Date of Inspection: 8 October 2015
Photo No. 29
Vertical Riser Intake Pipe

Photo No. 30
Discharge at Outlet Pipe
West Berm Toe of Slope
Photo No. 31
Area Downstream of West Berm
APPENDIX B

Inspection Checklist
<table>
<thead>
<tr>
<th><strong>NAME OF DAM:</strong></th>
<th>Bottom Ash Area 1 Impoundment</th>
<th><strong>STATE ID #:</strong></th>
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<td>No</td>
<td><strong>NID ID #:</strong></td>
<td>N/A</td>
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<td><strong>STATE SIZE CLASSIFICATION:</strong></td>
<td>N/A</td>
<td><strong>STATE HAZARD CLASSIFICATION:</strong></td>
<td>TBD</td>
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<tr>
<td><strong>CITY/TOWN:</strong></td>
<td>St. Marys</td>
<td><strong>COUNTY/STATE:</strong></td>
<td>Pottawatomie/Kansas</td>
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<tr>
<td><strong>DAM LOCATION:</strong></td>
<td>25903 Jeffrey Rd. St. Marys, Kansas</td>
<td><strong>ALTERNATE DAM NAME:</strong></td>
<td>N/A</td>
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<tr>
<td><strong>USGS QUAD.:</strong></td>
<td>Emmett, KS and Laclede, KS</td>
<td><strong>LAT.:</strong></td>
<td>39°17.2' N</td>
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<tr>
<td><strong>LONG.:</strong></td>
<td>96°7.7' W</td>
<td></td>
<td></td>
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<tr>
<td><strong>DRAINAGE BASIN:</strong></td>
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<td><strong>RIVER:</strong></td>
<td></td>
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<td><strong>IMPOUNDMENT NAME(S):</strong></td>
<td>Bottom Ash Area 1 Impoundment</td>
<td><strong>GENERAL DAM INFORMATION</strong></td>
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<tr>
<td><strong>TYPE OF DAM:</strong></td>
<td>Earthen Incised and Bermed</td>
<td><strong>OVERALL LENGTH (FT):</strong></td>
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<td><strong>PURPOSE OF DAM:</strong></td>
<td>Sedimentation and Storage Basin</td>
<td><strong>NORMAL POOL STORAGE (ACRE-FT):</strong></td>
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<td><strong>YEAR BUILT:</strong></td>
<td>1980's</td>
<td><strong>MAXIMUM POOL STORAGE (ACRE-FT):</strong></td>
<td>988</td>
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<tr>
<td><strong>STRUCTURAL HEIGHT (FT):</strong></td>
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<td><strong>EL. NORMAL POOL (FT):</strong></td>
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<tr>
<td><strong>HYDRAULIC HEIGHT (FT):</strong></td>
<td>39.5</td>
<td><strong>EL. MAXIMUM POOL (FT):</strong></td>
<td>1241.6 (minimum crest elevation)</td>
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<td><strong>RESERVOIR SURFACE AREA (ACRES):</strong></td>
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<td><strong>PUBLIC ROAD ON CREST:</strong></td>
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<td><strong>DRAWDOWN VOL. (AC-FT):</strong></td>
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<td>TITLE/POSITION</td>
<td>REPRESENTING</td>
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<tr>
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<td>----------------------</td>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td>Mark Brownstein</td>
<td>Senior Engineer</td>
<td>Haley &amp; Aldrich, Inc</td>
<td></td>
</tr>
<tr>
<td>Andy Lucas</td>
<td>Staff Engineer</td>
<td>Haley &amp; Aldrich, Inc</td>
<td></td>
</tr>
<tr>
<td>Brandon Griffin</td>
<td></td>
<td>Westar Energy</td>
<td></td>
</tr>
<tr>
<td>Jared Morrison (part-time)</td>
<td></td>
<td>Westar Energy</td>
<td></td>
</tr>
<tr>
<td>Kelley Kelsey (part-time)</td>
<td></td>
<td>Westar Energy</td>
<td></td>
</tr>
<tr>
<td>Sam Sunderraj (part-time)</td>
<td></td>
<td>KDHE</td>
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**INSPECTION SUMMARY**

**DATE OF INSPECTION:** October 8, 2015  
**DATE OF PREVIOUS INSPECTION:** November 13, 2009

**TEMPERATURE/WEATHER:** Sunny, 81

**ARMY CORPS PHASE I:** No 

**PREVIOUS ALT. PHASE I:** No

**CONSULTANT:** Haley & Aldrich, Inc

**BENCHMARK/DATUM:** N/A

**OVERALL PHYSICAL CONDITION OF DAM:**  

**DATE OF LAST REHABILITATION:** N/A

**SPILLWAY CAPACITY:**  

**EL. POOL DURING INSPE.:** 1239.5  
**EL. TAILWATER DURING INSPE.:** 1205.6
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<th>Name of Dam:</th>
<th>Bottom Ash Area 1 Impoundment Dam</th>
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<td>October 8, 2015</td>
<td>NID ID #:</td>
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<tr>
<th>Owner:</th>
<th>Westar Energy - Jeffrey Energy Center</th>
<th>Caretaker:</th>
<th>Westar Energy - Jeffrey Energy Center</th>
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<tr>
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<td>Mr. Jared Morrison</td>
<td>Name/Title:</td>
<td>Mr. Jared Morrison</td>
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<tr>
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<td>25903 Jeffrey Rd.</td>
<td>Street:</td>
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<tr>
<td>Town, State, Zip:</td>
<td>St. Marys, Kansas 66536</td>
<td>Town, State, Zip:</td>
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<tr>
<td>Phone:</td>
<td>785-575-8273</td>
<td>Phone:</td>
<td>785-575-8273</td>
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<tr>
<td>Emergency Ph. #:</td>
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<tr>
<td>Email:</td>
<td><a href="mailto:Jared.Morrison@westarenergy.com">Jared.Morrison@westarenergy.com</a></td>
<td>Email:</td>
<td><a href="mailto:Jared.Morrison@westarenergy.com">Jared.Morrison@westarenergy.com</a></td>
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<tr>
<td>Owner Type:</td>
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<p>| Primary Spillway Type: | 24&quot; dia. steel riser pipe |
| Spillway Length (FT): | N/A |
| Spillway Capacity (CFS): | N/A |
| Auxiliary Spillway Type: | N/A |
| Aux. Spillway Capacity (CFS): | N/A |
| Number of Outlets: | One |
| Outlet(s) Capacity (CFS): | Unknown |
| Type of Outlets: | 36&quot; dia. steel pipe |
| Total Discharge Capacity (CFS): | Unknown |
| Drainage Area (SQ MI): | N/A |
| Spillway Design Flood (Period/CFS): | Unknown |
| Has Dam Been Breached or Overtopped? (Yes/No): | No |
| If Yes, Provide Date(s): | |
| Fish Ladder (List Type if Present): | No |
| Does Crest Support Public Road? (Yes/No): | No |
| If Yes, Road Name: | |
| Public Bridge Within 50' Of Dam? (Yes/No): | No |
| If Yes, Road/Bridge Name: | |
| MHD Bridge No. (If Applicable): | |</p>
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<tr>
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<th>ACTION</th>
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<td>U/S SLOPE</td>
<td>1. SLIDE, SLOUGH, SCARP</td>
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<td>X</td>
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<td>2. SLOPE PROTECTION TYPE AND COND.</td>
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<td>3. SINKHOLE/ANIMAL BURROWS</td>
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<td>5. EROSION</td>
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<td>6. UNUSUAL MOVEMENT</td>
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<td>7. VEGETATION (PRESENCE/CONDITION)</td>
<td>Some areas vegetated by grasses and brush up to 2 ft tall, other areas unvegetated</td>
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</tbody>
</table>

ADDITIONAL COMMENTS:

None
None
None
None
None
None
None
**NAME OF DAM:** Bottom Ash Area 1 Impoundment  
**STATE ID #:** N/A  
**INSPECTION DATE:** October 8, 2015  
**NID ID #:** N/A

## EMBANKMENT (CREST)

<table>
<thead>
<tr>
<th>AREA INSPECTED</th>
<th>CONDITION</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREST</td>
<td>1. SURFACE TYPE</td>
<td>Bottom Ash</td>
</tr>
<tr>
<td></td>
<td>2. SURFACE CRACKING</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>3. SINKHOLES, ANIMAL BURROWS</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>4. VERTICAL ALIGNMENT (DEPRESSIONS)</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>5. HORIZONTAL ALIGNMENT</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>6. RUTS AND/OR PUDDLES</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>7. VEGETATION (PRESENCE/CONDITION)</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>8. ABUTMENT CONTACT</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**ADDITIONAL COMMENTS:** Surface is hard and in good condition
**NAME OF DAM:** Bottom Ash Area 1 Impoundment  
**STATE ID #:** N/A  
**INSPECTION DATE:** October 8, 2015  
**NID ID #:** N/A

---

### EMBANKMENT (D/S SLOPE)

<table>
<thead>
<tr>
<th>AREA INSPECTED</th>
<th>CONDITION</th>
<th>OBSERVATIONS</th>
<th>NO ACTION</th>
<th>MONITOR</th>
<th>REPAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WET AREAS (NO FLOW)</td>
<td>Wet areas at several seeps areas along west berm, ground soft at some seeps</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. SEEPAGE</td>
<td>Several seeps present along west berm downstream slope - south and central areas</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. SLIDE, SLOUGH, SCARP</td>
<td>None</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. EMB.-ABUTMENT CONTACT</td>
<td>N/A</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. SINKHOLE/ANIMAL BURROWS</td>
<td>None</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. EROSION</td>
<td>Erosion rills in unvegetated areas and adjacent to some seeps on west berm.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. UNUSUAL MOVEMENT</td>
<td>Deep eroded channel at south end of west berm due to runoff from the south.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. VEGETATION (PRESENCE/CONDITION)</td>
<td>Some areas are unvegetated, others covered by grasses and bushes up to 3 ft tall</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### ADDITIONAL COMMENTS:

__________________________

__________________________

__________________________
<table>
<thead>
<tr>
<th>AREA INSPECTED</th>
<th>CONDITION</th>
<th>OBSERVATIONS</th>
<th>ACTION</th>
<th>MONITOR</th>
<th>REPAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPILLWAY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPILLWAY TYPE</td>
<td>24&quot; dia. Steel riser pipe</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEIR TYPE</td>
<td>24&quot; dia. Steel riser pipe</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPILLWAY CONDITION</td>
<td>Fair, Denting observed on riser pipe</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRAINING WALLS</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPILLWAY CONTROLS AND CONDITION</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNUSUAL MOVEMENT</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPROACH AREA</td>
<td>Fair</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISCHARGE AREA</td>
<td>Fair</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEBRIS</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER LEVEL AT TIME OF INSPECTION</td>
<td>1239.5</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ADDITIONAL COMMENTS: 

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
**Bottom Ash Area 1 Impoundment**  
**N/A**  
**October 8, 2015**  
**N/A**

### OUTLET WORKS

<table>
<thead>
<tr>
<th>AREA INSPECTED</th>
<th>CONDITION</th>
<th>OBSERVATIONS</th>
<th>ACTION</th>
<th>MONITOR</th>
<th>REPAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTLET WORKS</td>
<td>TYPE</td>
<td>Outlet - 36-in. diameter steel pipe. Discharges D/S of west berm toe of slope.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INTAKE STRUCTURE</td>
<td>24-in. dia. Vertical Riser Pipe. Top of pipe dented and may have hole in it.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TRASHRACK</td>
<td>N/A</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRIMARY CLOSURE</td>
<td>N/A</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SECONDARY CLOSURE</td>
<td>N/A</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CONDUIT</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OUTLET STRUCTURE/HEADWALL</td>
<td>Outlet pipe discharges into pool and unlined drainage channel. Appears stable.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EROSION ALONG TOE OF DAM</td>
<td>Only erosion along toe is from stormwater runoff at south end of west berm.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SEEPAGE/LEAKAGE</td>
<td>No seepage around outlet pipe.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DEBRIS/BLOCKAGE</td>
<td>None</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UNUSUAL MOVEMENT</td>
<td>None</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DOWNSTREAM AREA</td>
<td>Heavily vegetated, difficult to see ground. Appears stable.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MISCELLANEOUS</td>
<td>None</td>
<td></td>
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</tr>
</tbody>
</table>

### ADDITIONAL COMMENTS:

- 
- 
- 
- 
-
<table>
<thead>
<tr>
<th>AREA INSPECTED</th>
<th>CONDITION</th>
<th>OBSERVATIONS</th>
<th>NO ACTION</th>
<th>MONITOR</th>
<th>REPAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/S AREA</td>
<td>1. ABUTMENT LEAKAGE</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. FOUNDATION SEEPAGE</td>
<td>None observed</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. SLIDE, SLOUGH, SCARP</td>
<td>None</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. WEIRS</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. DRAINAGE SYSTEM</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. INSTRUMENTATION</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. VEGETATION</td>
<td>Heavily vegetated downstream of berms. Ground surface generally not visible.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. ACCESSIBILITY</td>
<td>Difficult in some areas due to heavy vegetation.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. DOWNSTREAM HAZARD DESCRIPTION</td>
<td>Downstream hazard is low. No occupied structures, only Bottom Ash Pond and Lake.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. DATE OF LAST EAP UPDATE</td>
<td></td>
<td></td>
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</tbody>
</table>

ADDITIONAL COMMENTS:
<table>
<thead>
<tr>
<th>AREA INSPECTED</th>
<th>CONDITION</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PIEZOMETERS</td>
<td>Piezometers observed along dam crest and downstream</td>
<td>X</td>
</tr>
<tr>
<td>2. OBSERVATION WELLS</td>
<td>None present</td>
<td>X</td>
</tr>
<tr>
<td>3. STAFF GAGE AND RECORDER</td>
<td>None present</td>
<td>X</td>
</tr>
<tr>
<td>4. WEIRS</td>
<td>None present</td>
<td>X</td>
</tr>
<tr>
<td>5. INCLINOMETERS</td>
<td>None present</td>
<td>X</td>
</tr>
<tr>
<td>6. SURVEY MONUMENTS</td>
<td>None present</td>
<td>X</td>
</tr>
<tr>
<td>7. DRAINS</td>
<td>None present</td>
<td>X</td>
</tr>
<tr>
<td>8. FREQUENCY OF READINGS</td>
<td>No measurements are taken</td>
<td>X</td>
</tr>
<tr>
<td>9. LOCATION OF READINGS</td>
<td>N/A</td>
<td>X</td>
</tr>
</tbody>
</table>

ADDITIONAL COMMENTS:

---

NAME OF DAM: Bottom Ash Area 1 Impoundment
STATE ID #: N/A
INSPECTION DATE: October 8, 2015
NID ID #: N/A
Underlying Hydraulic Structures/Pipes

<table>
<thead>
<tr>
<th>Area Inspected</th>
<th>Condition</th>
<th>Observations</th>
<th>Action</th>
<th>Monitor</th>
<th>Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying Hydraulic Structures/Pipes</td>
<td>Type</td>
<td>36&quot; dia. Steel pipe</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inlet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conduit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outlet Structure/Headwall</td>
<td>Fair. Denting observed on riser pipe</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Erosion Along Structure</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seepage/Leakage</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Debris/Blockage</td>
<td>None present</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unusual Movement</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Downstream Area</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments:

Note: Use additional sheets for additional outlets.
APPENDIX C

Definitions
COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to Kansas State Rule 10 CSR 22 Dam and Reservoir Safety or other reference published by the Department of Natural Resources, the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, the Department of the Interior Bureau of Reclamation, or the Federal Emergency Management Agency.

Orientation

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Dam Components

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate there from including but not be limited to spillways; reservoirs and their rims; low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

Size Classification

Large – structure with a height greater than 40 feet or a storage capacity greater than 1,000 acre-feet.

Intermediate – structure with a height between 15 and 40 feet or a storage capacity of 50 to 1,000 acre-feet.

Small – structure with a height between 6 and 15 feet and a storage capacity of 15 to 50 acre-feet.
Non-Jurisdictional – structure less than 6 feet in height and having a storage capacity of less than 15 acre-feet.

Hazard Classification
(In the event the impoundment should fail, the following would occur):

Less Than Low Hazard Potential - Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

Low Hazard Potential - Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

Significant Hazard Potential - Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

High Hazard Potential - Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

General

EAP – Emergency Action Plan - Shall mean a predetermined plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam break.


Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet. On million U.S. gallons = 3.068 acre feet

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

Condition Rating

Unsafe - Major structural, operational, and maintenance deficiencies exist under normal operating conditions.
**Poor** - Significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions.

**Fair** - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.

**Satisfactory** - Minor operational and maintenance deficiencies. Infrequent hydrologic events would probably result in deficiencies.

**Good** - No existing or potential deficiencies recognized. Safe performance is expected under all loading including SDF.
REPORT ON
INITIAL PERIODIC STRUCTURAL STABILITY ASSESSMENT
BOTTOM ASH AREA 1 IMPOUNDMENT
JEFFREY ENERGY CENTER
ST. MARYS, KANSAS

by Haley & Aldrich, Inc.
Cleveland, Ohio

for Westar Energy, Inc.
St. Marys, Kansas

File No. 41938-006
September 2016