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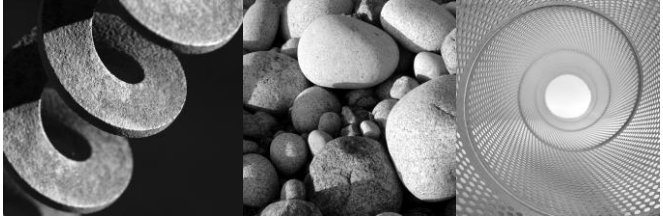

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Specific Site Assessment for Coal Combustion Waste Impoundments at Empire District Electric Company, Riverton Generating Station

Riverton, Kansas

Submitted to:
U.S. Environmental Protection Agency
Office of Resource Conservation and Recovery
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Washington, DC 20460

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Project 092883

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Acronyms and Abbreviations

ac-ft	acre-feet
CCW	coal combustion waste
DNR	Department of Natural Resources Division of Water
EDE	Empire District Electric Company
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
ft	feet
GEI	GEI Consultants, Inc.
H	horizontal
IDF	inflow design flood
MW	megawatt
pcf	per cubic foot
PMF	probable maximum flood
PMP	probable maximum precipitation
psf	per square foot
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USCS	Unified Soil Classification System
USGS	U.S. Geological Survey
V	vertical

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1.0 Introduction

1.1 Purpose

This report presents the results of a specific site assessment of the dam safety of the coal combustion waste (CCW) impoundment at the Riverton Generating Station in Riverton, Kansas. The Riverton Generating Station is operated and owned by Empire District Electric Company (EDE), Kansas. The impoundment is the unlined Ash Disposal Pond. The specific site assessment was performed on September 23, 2010.

The specific site assessment was performed with reference to Federal Emergency Management Agency (FEMA) guidelines for dam safety, which includes other federal agency guidelines and regulations (such as U.S. Army Corps of Engineers [USACE] and U.S. Bureau of Reclamation [USBR]) for specific issues, and defaults to state requirements were not specifically addressed by federal guidance or if the state requirements were more stringent.

1.2 Scope of Work

The scope of work between GEI Consultants, Inc. (GEI) and the U.S. Environmental Protection Agency (EPA) for the specific site assessment is summarized in the following tasks:

1. Acquire and review existing reports and drawings relating to the safety of the project provided by the EPA and Empire District Electric Company.
2. Conduct detailed physical inspections of the project facilities. Document observed conditions on Field Assessment Check Lists provided by EPA for each management unit being assessed.
3. Review and evaluate stability analyses of the project's coal combustion waste impoundment structures.
4. Review the appropriateness of the inflow design flood (IDF), and adequacy of ability to store or safely pass the inflow design flood, provision for any spillways, including considering the hazard potential in light of conditions observed during the inspections or to the downstream channel.
5. Review existing dam safety performance monitoring programs and recommend additional monitoring, if required.
6. Review existing geologic assessments for the projects.
7. Submit draft and final reports.

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1.3 Authorization

GEI performed the coal combustion waste impoundment assessment as a contractor to the EPA. This work was authorized by EPA under Contract No. EP09W001698, Order No. EP-CALL-0003 between EPA and GEI, dated August 26, 2010.

1.4 Project Personnel

The scope of work for this task order was completed by the following personnel from GEI:

Steven R. Townsley, P.E.	Senior Project Engineer/Task Leader
Stephen G. Brown, P.E.	Project Manager
Ken Hardesty, P.E.	Project Engineer
Nick Miller	Project Hydraulic Engineer

The Program Manager for the EPA was Stephen Hoffman.

1.5 Limitation of Liability

This report summarizes the assessment of dam safety of the Ash Disposal Pond coal combustion waste impoundment at the Riverton Generating Station, Riverton, Kansas. The purpose of each assessment is to evaluate the structural integrity of the impoundments and provide summaries and recommendations based on the available information and on engineering judgment. GEI used a professional standard of practice to review, analyze, and apply pertinent data. No warrantees, express or implied, are provided by GEI. Reuse of this report for any other purpose, in part or in whole, is at the sole risk of the user. The measurement read like this 6g throughout.

1.6 Project Datum

The project datum was not identified on the documents reviewed by the assessment team.

1.7 Prior Inspections

Anderson Engineering, Inc. performed a Preliminary Visual Slope Stability Assessment of the embankments in April 2009; however neither state nor federal regulatory officials have inspected the embankments within the last five years. Riverton Station employees perform visual inspections, however not on an established schedule.

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2.0 Description of Project Facilities

2.1 General

The Riverton Station is a coal-fired, natural gas and fuel oil power plant consisting of six units that generate about 286 megawatts (MW) combined. The power plant is located just southeast of the town of Riverton in Cherokee County, Kansas (see Figure 1). The generating units are owned and operated by EDE. The first unit went online in 1905. The CCW impoundment is located south and southwest of the power plant. The CCW impoundment contains two cells; the original West Cell constructed in 1951, and the expansion East Cell constructed in 1985.

2.2 Impoundment Dams and Reservoirs

The embankment dams of the CCW impoundment have not been previously assigned a hazard potential by a state or federal agency. Based on the geometry of the impoundment and the facilities downstream, recommended hazard potential classifications for the impoundment have been developed in Section 4.0 of this report. The basic dimensions and geometry of the CCW impoundment is summarized in Table 2-1.

In 1951, the West Cell was constructed as a single 8-acre ash pond, with a perimeter dike to contain the ash pond. There is no design or construction information available documenting the original West Cell construction. In 1985, the East Cell was constructed as a single 16-acre ash pond, with a perimeter dike bounded on the east by the cooling water discharge channel and the Spring River beyond, and bounded on the south by the Spring River flood plain. A portion of the western perimeter dike is a divider dike between the East and West Cells. There is no design or construction information available documenting the East Cell construction. The perimeter dikes have crest widths of approximately 20 feet wide and downstream side slopes ranging from 2H:1V to 1.5H:1V. Slopes are covered with dense grassy vegetation, with areas of heavy deciduous tree growth on lower portions of the slopes and at the toe. Tree diameters range from 2 inch up to 12 inch. The perimeter dikes range from 15 to 20 feet tall. The east perimeter dike of the East Cell forms the right bank, looking downstream, of the cooling water discharge channel. Riprap protection is in place at the perimeter dike in the cooling channel.

Drainage ditches collect surface water from the plant and adjacent land and divert water around the CCW impoundment. A ditch located along the north edge of the CCW impoundment collects surface runoff and discharged decant water from the East Pond and discharges into the cooling water channel along Spring River. A second drainage ditch located below the west perimeter dike collects surface runoff from west of the CCW impoundment and discharges into the Spring River south west of the CCW impoundment.

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Small drainage ditches are also located along the inside of the perimeter dikes for both cells of the CCW impoundment and collect surface runoff from the ash piles within the CCW impoundment. This water is discharged back into the impoundment at the East Cell.

Based on geotechnical borings drilled into the perimeter dikes performed by Anderson Engineering in 2010, the dikes appear to be constructed of loose fill material consisting of silty clays with traces of random fill materials such as brick and topsoil. The silty clay found in the perimeter dikes generally falls into the Unified Soil Classification System (USCS) soil group CL, which is considered a medium plastic material. The foundation materials below the perimeter dikes appear to be a very soft alluvial layer of sandy and clayey silts.

Table 2-1: Summary Information for Impoundment Dam Parameters

Parameter	Value	
Dam	West Cell	East Cell
Estimated Maximum Height (ft)	20	20
Estimated Perimeter Length (ft)	2,300	4,000
Crest Width (ft)	20	20
Crest Elevation (ft)	830.0	830.0
Design Side Slopes Upstream/Downstream (H:V)	NA/1.5-2:1	NA/1.5-2:1
Estimated Freeboard (ft) at time of site visit	4	4
Storage Capacity[1] (ac-ft)	NA	36
Surface Area[1] (acres)	28	3

[1] Surface area and capacity reported as 28 acres and 1.6 million cubic yards for entire impoundment on CERCLA 104(e) Request for Information Response (2009) prepared by EDE at the request of the EPA, dated May 12, 2009. Above reported surface areas and capacities are estimates for each cell.

2.3 Spillways

A spillway exists between the West and East Cells of the CCW impoundment. The spillway is a trapezoidal notch approximately 18 feet wide at the top, 6 feet wide at the base and approximately 5 feet deep. The spillway operates as an overflow between the cells, allowing sluiced water to flow from the West Cell to the East Cell. A steel plate bridge with a steel grated center section spans the spillway. This bridge can be removed to allow access to the spillway during dredging or vegetation cleaning.

2.4 Intakes and Outlet Works

Bottom and fly ash is sluiced from the plant to the West Cell and East Cell, respectively, through two 8-inch diameter above ground PVC outlet pipes, one for each cell. The PVC outlet pipes can be moved, as necessary, and therefore do not have a permanent flow measurement structure or invert elevation. The alignment of the PVC pipe delivering bottom ash to the West Cell is shown on Figure 2. The pipe discharges into the West Cell at the north end of the cell.

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The outlet for the impoundment is a 24-inch diameter riveted steel pipe buried approximately 3 feet below the perimeter dike crest in the northwest corner of the East Cell. Decant water flows out of the East Cell through the pipe into an unlined drainage channel along the north side of the East Cell. Water flows east and discharges into the cooling water channel near the northeast corner of the East Cell. The trashrack for the outlet pipe was not installed and was placed beside the pipe at the time of the inspection.

2.5 Vicinity Map

Riverton Station is located in Riverton, Cherokee County, Kansas as shown on Figure 1. The CCW impoundment is located south and southwest of the station, as shown on Figure 2.

2.6 Plan and Sectional Drawings

A survey drawing of the CCW impoundment was prepared by Tri-State Engineering in 2008. Construction record drawings from the original construction were not prepared.

2.7 Standard Operational Procedures

The Riverton Station is a coal-fired, natural gas and fuel oil power plant consisting of six units that generate about 286 megawatts (MW) combined. The burning of coal produces several gases and fly ash which are vented from the boiler, and bottom ash, which is made of coarse fragments, falls to the bottom of the boiler, and is removed along with boiler slag. Coal combustion waste from the power station is wet sluiced into the West Cell.

The West Cell is used for primary settling of bottom ash delivered from the plant through an 8-inch diameter PVC sluice pipe. Channels are excavated through the ash ponds, allowing the ash to settle out. As the excavated channels fill with ash, new channels are excavated and the sluiced ash is diverted to these newly excavated channels. The sluiced ash flows into the East Cell through the spillway notch located in the dividing dike between the cells as described above. The East Cell is used for secondary settling of the ash. The East Cell provides further clarifying of solids before the effluent is discharged to the drainage ditch to the north of the cell. Flow through the East Cell is generally north east to a large area of ponded water in the north portion of the East Cell. Flows are not measured into or out of the CCW impoundment, however they are estimated daily during site inspections by EDE operators.

Ash is generally excavated from the central areas of both the West Cell and East Cell and stockpiled along the edges of the cells, creating large berms around the cell edges, which contains the water within the central portions of the cells. The largest of the ash berms appeared to be 30 to 35 feet above the perimeter dike crest and have steep slopes approaching 1.5H:1V to 1H:1V.

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3.0 Summary of Construction History and Operation

The West Cell of the CCW impoundment was the original cell, constructed in 1951. In 1985, the East Cell was constructed to add capacity for ash storage. Existing documentation of the original design and construction of the CCW facility could not be located at the time of the inspection. Survey drawings and boring logs developed in the 2008 and 2009 for the CCW facility were reviewed, though design reports and construction records were not available. The borings extended between 15 to 20 feet beneath the base of the dike. Weathered bedrock was encountered in some holes, while others were terminated at dense alluvial gravels, soft sands or moist coal seams.

Based on visual observations during the site visit and review of available construction records, the embankments were not constructed over wet ash, slag or other unsuitable materials. Evidence of prior releases, failures or patchwork construction were not observed or evident based on review of available design documents or disclosed by plant personnel during the site visit.

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4.0 Hazard Potential Classification

4.1 Overview

According to the Federal Guidelines for Dam Safety the hazard potential classification for the CCW impoundments is based on the possible adverse incremental consequences that result from release of stored contents due to failure of the dam or misoperation of the dam or appurtenances. Impoundments are classified as Low, Significant, or High hazard, depending on the potential for loss of human life and/or economic and environmental damages.

4.2 Ash Pond Impoundment

The Ash Pond perimeter dike with a surface area of about 28 acres and a height of about 20 feet would be considered a "small" sized dam in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria.

In the event of a breach of the southern and east perimeter dikes, the CCW outflow could potentially reach the Spring River and/or the cooling channel, which is parallel to the Spring River and ultimately discharges to the river. Based on observed current operations, the East Cell contains a large volume of ponded water where further clarifying takes place before water is decanted out of the impoundment and is bordered to the east by large dry ash stockpiles. The ash at or below the water level in the East Cell is potentially saturated, however, no monitoring wells or boring data exists through the ash to verify this. Due to the small quantity of ash stored in the East Cell, flood outflow that would reach the river would likely cause a slight rise in river water levels and have only local environmental impacts.

A breach of the northern perimeter dike would likely result in CCW outflow that could potentially flood portions of the Riverton Station plant facilities to the north. CCW could collect in the north drainage ditch and block flows from draining into the cooling channel, resulting in minor flooding of plant facilities. Due to the small quantity of ash stored in the East Cell, flood waters would likely be widespread with shallow depths and gradually rising waters. The associated flood depths and flow velocities would be relatively small and are not considered to pose a significant hazard to vehicles or plant personnel.

Ash stored in the West Cell is stockpiled into two large piles along the east and west portions of the cell to a height of approximately 30 to 35 feet. These stockpiles create an inner ash basin which appears to be about 5 feet higher than the perimeter dikes based on observations and survey drawings from 2008. This ash could potentially be saturated during storm events and induce higher than anticipated hydrostatic loads on the perimeter dikes, most notably the west perimeter dike of the West Cell. Large wide drainage facilities exist to the west of the perimeter dike and appear to be capable of limiting flood flows to the drainage channel and preventing flows from reaching roads and residences to the west of the CCW impoundment.

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Drainage facilities would discharge the flood flows into the Spring River southwest of the CCW impoundment and would likely have only local environmental impacts along the river channel.

Consistent with the Federal Guidelines for Dam Safety and the Department of Natural Resources Division of Water (DNR), Kansas Dam Safety Laws and Regulations, we recommend the CCW impoundment perimeter dam be classified as a “Significant” hazard structure.

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5.0 Hydrology and Hydraulics

5.1 Floods of Record

Floods of record have not been evaluated and documented for the CCW impoundment at the Riverton Power Station.

5.2 Inflow Design Floods

Currently, there is no hazard classification for the CCW impoundment at the Riverton Power Station. Based on observations during the field inspection, we recommend the Riverton Power Station Ash Pond be rated as a "Significant" hazard dam (see Section 4.0). Based on the recommended "Significant" or "Hazard Class B" hazard classification, the Kansas Dam Safety Laws and Regulations (2007) specifies "Hazard Class B" Class 2 dams be capable of passing the 25 percent probable maximum precipitation (PMP) with 2 feet of freeboard. The USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 recommends a small "Significant" hazard dam be capable of passing the 100-year to 50 percent probable maximum flood (PMF) without overtopping the dam. Considering the "Significant" hazard rating, the scale of the economic and environmental damages that could potentially occur upon failure, and the recommended range of inflow design storms, it is reasonable to select 25 percent of the PMP as the inflow design storm for the Riverton Power Station Ash Pond. Considering the small drainage area and negligible time of concentration, the 6-hour PMP event should be used to analyze the inflow design floods for the Riverton Power Station Ash Pond. Accordingly, the 6-hour 25 percent PMP precipitation at the Riverton Power Station is about 7.1 inches based on Hydrometeorological Report Number 51 6-hour PMP data.

5.2.1 Riverton Power Station Ash Pond

The Riverton Power Station Ash Pond contributing drainage area is limited to the impoundment area (approximately 24.7 acres) because of the dikes. The topography within the Riverton Power Station Ash Pond Ash is irregular and continually changing. Currently, there is a network of excavated drainage channels within the ash pond that route water through the impoundment to the primary water storage area, which was estimated to have a surface area of approximately 5.5 acres.

Under the configuration, decant water in the Riverton Power Station Ash Pond is routed to a drainage channel through a 24-inch riveted steel decant pipeline located along the northern dike. The drainage channel discharges directly to the Spring River. Currently, the Riverton Power Station Ash Pond and water level is maintained at an elevation of approximately 826.0, providing about 4.0 feet of freeboard and an estimated storage capacity of

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approximately 22 acre-feet. Based on the 6-hour 25 percent PMP, the Riverton Power Station Ash Pond would receive approximately 14.6 acre-feet of storm water runoff assuming no losses. It is difficult to estimate the resulting pond elevation and freeboard due to the irregular topography and continually changing geometry of the Riverton Power Station Ash Pond. However, the storm volume is relatively small compared to the estimated available storage capacity of the pond and would likely result in a water surface elevation slightly above the decant weir elevation in the Riverton Power Station Ash Pond. Based on this result, the Riverton Power Station Ash Pond is expected to meet the regulatory requirements for storing and passing of the 6-hour 25 percent PMP inflow design flood with two feet of freeboard.

5.2.2 Determination of the PMF

Not applicable.

5.2.3 Freeboard Adequacy

Based on a very simplified evaluation using conservative assumptions, the freeboard appears to be adequate at the Riverton Power Station CCW Impoundment.

5.2.4 Dam Break Analysis

Dam break analyses have not been performed for the CCW impoundment at the Riverton Power Station.

5.3 Spillway Rating Curves

Spillway rating curves were not provided for the Riverton Power Station CCW Impoundment.

5.4 Evaluation

Based on the current facility operations and inflow design floods documents, the CCW impoundment at the Riverton Power Station appear to have adequate capacity to store and pass the regulatory design floods with 2 feet of freeboard based on the recommended hazard classifications for the dam.

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6.0 Geologic and Seismic Considerations

6.1 Site Geology

Based on the Anderson Engineering Geotechnical Investigation Report – Ash Ponds Landfill, Riverton Plant, Riverton, Kansas (2010):

> *The immediate area is underlain by possibly the bottom of the Warner Sandstone member over the Riverton coal bed (generally less than 1 foot) over about 10 feet of shale and underclay, and/or the top of the Warsaw Limestone rock of the Mississippi Age. The limestone generally consists of semi-granular limestone with dolomite, with relatively large amounts of distinctive gray, mottled, opaque chert.*
>
> *The upper surface of limestone bedrock is generally irregular due to the effects of differential weathering and solutioning activity, therefore, the depth to bedrock in any given area can vary dramatically. The overburden is residual soil having formed by the weathering of the rock through chemical action of infiltration through the rock formation. Less resistant rock formed the present soil matrix; more resistant rock is still present as weathered and intact gravel and cobble.*

The geology of the site has the potential for Karst features such as sink holes and other large open voids in the rock. No record exists of any seepage issues or ground collapses due to a Karst formation at the Riverton site.

6.2 Site Seismic Risk

We are not aware of any seismic analyses that have been performed on the perimeter dikes at the Riverton CCW impoundment. According to the 2008 U.S. Geological Survey (USGS) Seismic Hazard Map of Kansas, the site has a regional probabilistic peak ground acceleration of approximately 0.06g with a 2 percent Probability of Exceedance within 50 years (recurrence interval of approximately 2,500 years).

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7.0 Instrumentation

7.1 Location and Type

Five ground water monitoring wells are installed around the CCW impoundment perimeter. Monitoring wells MW-1 to MW-4 were installed in 1996 and MW-5 was installed in 2005. These wells are monitored annually by the Kansas Department of Health and Environment for water quality impacts to the groundwater from the CCW impoundment. There is no other instrumentation installed at the CCW Impoundment.

7.2 Readings

7.2.1 Flow Rates

Flow rates are not recorded at the CCW impoundment.

7.2.2 Staff Gauges

There are no staff gages at the CCW impoundment.

7.3 Evaluation

There are no instruments installed at the Riverton CCW impoundment. It would be beneficial to install staff gages and flow measurement devices to measure and record water levels in the ash ponds and discharges into and out of the ash ponds, along with surveyed benchmarks, embankment settlement monuments and piezometers to measure and record any movement of the perimeter dikes and to tie measurements to a known vertical datum.

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8.0 Field Assessment

8.1 General

A site visit to assess the condition of the CCW impoundment at the Riverton Station was performed on September 23, 2010, by Steven R. Townsley, P.E., and Ken L. Hardesty, P.E. of GEI. Duane Zerr, Kavan Stull and Cory Larson of EDE assisted in the assessment.

The weather during the site visit (September 23, 2010) was sunny, with temperatures around 70 degrees Fahrenheit. The ground was dry to slightly moist at the time of the site visit.

At the time of inspection, GEI completed an EPA inspection checklist, which is provided in Appendix A, and photographs, which are provided in Appendix B. The field assessment of the CCW impoundment included a site walk to observe the dam crest, upstream slope, downstream slope, and intake structures.

8.2 Embankment Dam

8.2.1 Dam Crest

The dam crest of the CCW impoundment appeared to be in good condition. No signs of cracking, settlement, movement, erosion or deterioration were observed during the assessment. The dam crest surface is generally composed of road base material that traverses the length of the dam for vehicle access.

8.2.2 Upstream Slope

The upstream slopes of the perimeter dikes are covered by the stored CCW in the impoundment and could not be inspected. A grass lined perimeter drainage ditch approximately 8-10 feet across and 3-4 feet deep exists along the inside slope of the perimeter dike crest. This ditch collects surface runoff from the interior of the ash ponds and discharges back into the East Cell.

8.2.3 Downstream Slope

The downstream slopes of the CCW impoundment have well-established stands of grass, which provides some erosion protection. No scarps, sloughs, depressions or other indications of slope instability or signs of erosion were observed during the inspection of the CCW impoundment, however the heavy vegetation limited much of the visual inspections of the downstream slopes. Based on an Anderson Engineering Preliminary Visual Slope Stability Assessment dated April 13, 2009, minor sloughing and shallow slope failures were observed at locations along the downstream toe of the perimeter dike. A deep failure was also

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identified in the report, located at the toe of the east perimeter dike in the cooling water discharge channel.

Riprap erosion protection is present along the toe of the slope in the cooling water discharge channel and appears to be functioning adequately. No riprap protection is present at the downstream toe of the north perimeter dike, which is in the drainage ditch that runs along the north edge of the impoundment.

Tree growth was observed at the toe of the downstream slope around the entire perimeter dike. Dense growths of trees are located along the east perimeter dike in the cooling water channel, where some trees are also growing out of the downstream slope, and along the west and north perimeter dikes. Several trees (up to 1-foot-diameter) were observed in these dense growths of trees. The south perimeter dike contains sparse tree growth and is contained within the Spring River flood plain.

8.3 Seepage and Stability

No evidence of ongoing seepage was observed at the CCW impoundment. No evidence of slumps, sloughs, or settlement associated with slope instability was observed; however, the heavy vegetation limited much of the visual inspections of the downstream slopes. Based on an Anderson Engineering Preliminary Visual Slope Stability Assessment dated April 13, 2009, minor seepage was observed in 6 locations at the toe of the perimeter dike. These locations could not be verified during this site assessment.

8.4 Appurtenant Structures

8.4.1 Outlet Structures

The riveted steel outlet pipe in the northwest corner of the East Cell appeared to be in good condition and showed no signs of corrosion or deterioration. The pipe was observed to be working properly and was discharging decant water to the north drainage ditch. The pipe has been in service for approximately 25 years.

8.4.2 Pump Structures

No pump structures are present at the CCW impoundment.

8.4.3 Emergency Spillway

No emergency spillways are present at the CCW impoundment.

8.4.4 Water Surface Elevations and Reservoir Discharge

No water surface elevations were provided for the site assessment and no gages exist to accurately measure water levels. EDE indicated the ponds were kept at constant water

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surface elevations for the prior several years. Based on the observed location of the outlet pipe in the East Cell, the water levels in the East Pond appear to be approximately 3 feet below the dam crest, or approximately elevation 827 feet.

Discharge is not measured and is estimated daily by EDE employees. Based on observations of the outflow at the outlet pipe in the East Cell, the discharge appears to be approximately 100 gpm, or 0.22 cfs.

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9.0 Structural Stability

9.1 Visual Observations

The assessment team saw no visible signs of instability associated with the perimeter or dividing dikes of the CCW impoundment during the September 23, 2010 site assessment.

9.2 Field Investigations

No subsurface investigation reports were provided for the original design and construction of the West Cell, constructed in 1951, or the East Cell, constructed in 1985. Anderson Engineering, Inc. performed a geotechnical exploration of the CCW impoundment and performed slope stability analysis as part of the exploration program. The geotechnical exploration included twelve borings that were drilled in and around the ash landfill and penetrated through the ash within the CCW impoundment or the perimeter dikes to the underlying natural ground. Nine of the borings appear to have been drilled through the perimeter dike crest or at the toe of the perimeter dike. The remaining three borings were drilled through ash material within the CCW impoundment. Limited laboratory tests were performed including natural moisture content, grain size analysis, -200 sieve analysis, unit weight, unconfined compression and angle of repose tests. The boring logs, location plan and testing results are included in the Anderson Engineering Geotechnical Exploration Report, Slope Stability Analysis, Ash Ponds Landfill, Riverton Plant, Riverton, Kansas for EDE (July 26, 2010).

9.3 Methods of Analysis

Anderson Engineering performed a slope stability analysis on two sections representative of the future planned configuration of the CCW impoundment as part of their Geotechnical Exploration Report and Slope Stability Analysis (2010). Both sections represented in the report are in an east-west direction, one through the widest portion of the impoundment through the West Cell, and the other through the East Cell. Both sections appear to include the largest stockpiles of ash within the impoundment. The phreatic surfaces assumed for the analysis were based on water levels found during the geotechnical exploration and/or future anticipated water levels, which result in a phreatic surface within the embankment dike exiting at the downstream toe of the dike. A seismic analysis was not performed as part of the slope stability analysis.

The perimeter dike sections have a height of 20 feet, a crest width of 18 feet, and downstream slopes of 1.75H:1V for the constructed dike. The ash stockpiles were modeled to a full build-out height of 30 feet above the dike crest for the East Cell and 60 feet above the dike crest for the West Cell. A slope of 4H:1V was used for the planned ash stockpiles.

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The stability analyses were performed using the computer program PCSTABL developed by GEOCOMP Corp., Concord, MA. The sections were modeled using the Modified Bishop Method, which is applicable to circular shaped failure surfaces. Based on the Anderson report, the scope of the stability analysis was to determine critical factors of safety for overall global stability for the perimeter dikes and not for the ash stockpiles.

9.4 Discussion of Stability Analysis and Results

The material properties used in the Anderson Engineering 2010 stability evaluations for the CCW impoundment slope stability sections indicate cohesion for the perimeter dike embankment material of 500 pounds per square foot (psf) and a friction angle of 0 degrees. The native alluvial soil beneath the embankment was assigned a cohesion of 250 psf and a friction angle of 0 degrees. The load from the ash fill contained in the pond was considered to have a cohesion of 0 psf, a friction angle of 26-30 degrees, and a unit weight of 100-105 pounds per cubic foot (pcf). These parameters are considered consistent with undrained parameters, however the loading condition used for the stability analysis was steady seepage, which is consistent with drained conditions. The undrained material parameters used are considered to be not applicable for the slope stability analysis performed. The factors of safety calculated in the report may not represent the appropriate current or future conditions of the CCW impoundment and have been disregarded for this evaluation.

The stability analysis did not consider the stability of the ash piles that are currently stacked approximately 30 feet above the perimeter dike, however the stability models show slope failures through the future ash stockpile. The current configuration of the ash stockpiles is much lower than the final planned ash stockpile, however they include much steeper slopes of nearly 1H:1V and could potentially induce higher loads on the perimeter dikes. Excluding the ash as part of the slope stability analysis eliminates a potential failure mode for the ash and perimeter dike that should be included in a slope stability analysis performed in the CCW impoundment.

Both stability cross-sections considered ash that appears greater in height than the existing ash stockpiles currently found in the CCW impoundment. The sections also considered the water level within the ash to be coincident with the perimeter dike crest elevation, however current operations within the West Cell of the CCW impoundment have the potential to result in higher water levels within the ash, resulting in higher hydrostatic loads on the perimeter dikes of the CCW impoundment. Borings from the Anderson report indicate the potential for ash materials and other foreign materials to be located either within the perimeter dike fill or directly below the perimeter dike fill material, which could result in potential localized instabilities within the perimeter dikes. Based on localized slope failures observed by Anderson in 2009 and the potential for weaker material lenses within the perimeter dikes, a more thorough stability analysis of the perimeter dike should be investigated.

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9.5 Seismic Stability and Liquefaction Potential

A seismic analysis was not performed as part of the slope stability analysis. The Anderson report indicates that the peak ground accelerations at the site based on the USGS seismic hazard map for Kansas is approximately 0.06g at 2-percent probability exceedance in 50 years. Selection of the design earthquake should also consider the function and level of hazard posed by the facility. A longer return period and higher peak ground acceleration may be appropriate for this facility and should be considered in the stability analysis. Due to the significance of the Riverton Station as a CCW impoundment, a 0.10g threshold should not necessarily be used as an initial regulating threshold. As a result of inadequacies in the slope stability analysis and a lack of engineering data from the original perimeter dike construction, a seismic evaluation of the CCW impoundment and the perimeter dikes would be warranted.

The liquefaction potential at the CCW impoundments has not been previously evaluated based on review of the available documents. Conditions necessary for liquefaction include saturated, loose, granular soils and an earthquake of sufficient magnitude and duration to cause significant strength loss in the soil. The ash is hydraulically deposited and includes zones of loose, saturated ash and possibly thin layers of weak, fine ash, which can be susceptible to rapid loss of strength when subjected to increased load such as associated with raising the height of the ash pile. Based on the boring profiles included in the 2010 Anderson Engineering report, the natural granular foundation soils range mostly from a 2 to 4 foot thick alluvial sandy and clayey silt in a soft to medium firm to very loose condition. Below the alluvial soils exists more firm residual soils and bedrock. It is possible that soft and very loose saturated layers of sandy and clayey silts could be susceptible to strength loss as the result of earthquake shaking.

9.6 Summary of Results

The existing stability analysis is not considered applicable based on the assigned material properties for the loading case evaluated. The influence of the large trees growing on the perimeter dike was not considered in the development of the cross sections analyzed. The stability analysis also does not address the potential for larger earthquake loads. We recommend that revised slope stability analysis be performed that include pseudo-static seismic analysis and an evaluation of the static and dynamic liquefaction potential of the ash perimeter dike embankment and foundation soils with a higher phreatic surface within the ash representative of potential future conditions. The revised slope stability analysis should be presented relative to the appropriate FERC requirements.

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10.0 Maintenance and Methods of Operation

10.1 Procedures

EDE does not have a formal Operation and Maintenance Manual in which standard operating procedures exist for the CCW impoundment. The power plant is manned 24 hours a day, seven days a week. Daily visual inspections are performed for the entire CCW impoundment by operations staff. An inspection by Anderson Engineering was performed in March 2009. Dam safety-related inspections have not been previously made by state or federal agencies.

10.2 Maintenance of Impoundments

Maintenance of the CCW impoundment is performed by EDE staff under the guidance of EDE managers and engineers. Visual inspections of the CCW impoundment was performed in March 2009 by Anderson Engineering. However, dam safety-related inspections have not been previously made by state or federal agencies.

10.3 Surveillance

The CCW impoundment is patrolled approximately once daily by EDE operations personnel. Plant personnel are available at the power plant and on 24-hour call for emergencies that may arise.

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11.0 Conclusions

11.1 Assessment of Dams

11.1.1 Field Assessment

Issues of potential concern for the CCW impoundment are identified from our field assessment as follows:

- The perimeter dike downstream slopes have trees up to 1 foot in diameter in close proximity to the downstream toe in multiple locations around the perimeter of the CCW impoundment. A thick growth of trees was observed on the East Cell east perimeter dike downstream slope.
- The placement of large ash stockpiles in the West Cell of the CCW impoundment has created a potential location for ash to become saturated, potentially creating large hydrostatic loads on the perimeter dikes.
- The trashrack for the outlet in the northwest corner of the East Pond was not properly installed to protect the outlet pipe from clogging from larger debris.

11.1.2 Adequacy of Structural Stability

The slope stability analyses performed on the dikes in 2010 are considered inadequate due to a lack of seismic and liquefaction analysis, use of potentially un-conservative material parameters, analysis methods and hydrostatic loading conditions.

11.1.3 Adequacy of Hydrologic/Hydraulic Safety

The CCW impoundment at the Riverton Station currently appears to have adequate freeboard and storage capacity to safely store the 6-hour 25 percent PMP inflow design flood.

11.1.4 Adequacy of Instrumentation and Monitoring of Instrumentation

Instrumentation and monitoring programs are considered inadequate for the current facility operations. Daily water levels are not being measured and recorded, and there is no staff gage for reference in any of the ponds. No piezometers or settlement monuments are installed at any of the ash pond or settling basin dams. Several groundwater quality observation wells and a monitoring program are in place; however, the location of these wells may not provide useful information for dam safety purposes.

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11.1.5 Adequacy of Maintenance and Surveillance

The CCW impoundment at the Riverton Station has a fair maintenance and surveillance program. The facilities are generally adequately maintained and routine surveillance is performed by EDE staff. No regularly scheduled inspections are currently performed.

11.1.6 Adequacy of Project Operations

Operating personnel are knowledgeable and are well trained in the operation of the project. The current operations of the facilities are satisfactory.

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12.0 Recommendations

12.1 Corrective Measures and Analyses for the Structures

1. A thick growth of trees, many up to 1-foot in diameter, was observed on the East Cell east perimeter dike downstream slope and at the toe in the cooling water channel. The trees should be removed to prevent root systems from creating seepage paths through the embankment slopes. Removal of root balls of large trees can cause additional damage to a dike and is not recommended without proper engineering planning and consideration.

2. Trees were observed near the downstream toe of the perimeter dike along most of the perimeter of the CCW impoundment. A minimum of about 25 feet of clear space should be provided between the downstream toe and the tree line. Removal of root balls of large trees can cause additional damage to a dike and is not recommended without proper engineering planning and consideration.

3. A trashrack for the outlet in the northwest corner of the East Cell should be installed to prevent large debris from obstructing flows through the outlet pipe. The grating shown in Photo 14 is reported by Empire to be "used only as a platform to safely collect samples" and is not intended for use as a trashrack.

4. A slope stability analysis should be performed based on material properties consistent with the loading condition and that includes revised static slope stability analysis, pseudo-static seismic analysis and an evaluation of the liquefaction potential of the perimeter dike embankment and foundation soils. The analysis should address stability concerns within the existing ash stockpiles and within or beneath the perimeter dikes. The revised slope stability analysis should be presented relative to the appropriate FERC requirements.

12.2 Corrective Measures Required for Instrumentation and Monitoring Procedures

1. Daily water levels are not measured and there are no staff gages for reference in any of the ponds or basins. No piezometers or settlement monuments are installed at the ash pond or settling basin dams. We recommend an instrumentation and monitoring program be developed and implemented that would include, at a minimum, piezometers and settlement monuments installed along the dikes of any impoundment or cell that will continue to receive wet coal combustion waste or any dikes currently experiencing seepage. Seepage should be measured and monitored at the observed seepage locations. Flow measurement devices (weirs, flumes, etc.) should be installed at the discharge

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locations into the West Cell and out of the East Cell into the north drainage ditch to allow for measurement and recording of discharge volumes. A staff gage should also be installed in the East Cell to monitor water levels and should be set to the vertical datum used.

12.3 Corrective Measures Required for Maintenance and Surveillance Procedures

1. Currently, the CCW impoundment is visually inspected daily by EDE staff. We recommend EDE develop and document formal annual inspections of the ash ponds and settling basins by EDE staff trained in dam safety evaluations, and include an inspection at a minimum of every 5 years by a third-party professional engineer with experience in dam safety evaluations.

12.4 Corrective Measures Required for the Methods of Operation of the Project Works

None.

12.5 Summary

The following factors were the main considerations in determining the final rating of the CCW impoundment at the Riverton Power Plant.

- The perimeter dike of the CCW impoundment is a significant-hazard structure based on federal and state classifications.
- The CCW impoundment was generally observed to be in fair condition in the field assessment.
- There is thick vegetation, including large trees up to 1-foot diameter, at the toe of the perimeter dike around the majority of the CCW impoundment.
- An especially large and dense growth of trees is present in the downstream slope and at the toe of the perimeter dike on the east portion of the East Cell perimeter dike.
- The slope stability analyses performed on the dikes in 2010 are considered inadequate due to a lack of seismic and liquefaction analysis, use of potentially un-conservative material parameters, analysis methods and hydrostatic loading conditions.
- There is currently no instrumentation in place for the CCW impoundment. There is no method of accurately recording water levels, flow volumes or monitoring of perimeter dike performance (i.e. movement, settling, etc.).
- Maintenance, surveillance and operational procedures are considered fair.

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12.6 Acknowledgement of Assessment

I acknowledge that the management unit(s) referenced herein were personally inspected by me and found to be in the following condition **(select one only):**

Management Unit	Rating
Ash Pond – West Cell	Poor
Ash Pond – East Cell	Poor

SATISFACTORY: No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FAIR: Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

POOR: A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

UNSATISFACTORY: Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

I acknowledge that the management unit referenced herein:

Has been assessed on September 23, 2010

Signature:

COLORADO REGISTERED
STEVEN R. TOWNSLEY
27730
6-10-2011
PROFESSIONAL ENGINEER

List of Participants:

Steven Townsley, P.E.	Senior Project Engineer/Task Leader, GEI
Stephen Brown, P.E.	Project Manager, GEI
Ken Hardesty, P.E.	Project Engineer, GEI
Nick Miller, P.E.	Project Water Resources Engineer, GEI
Duane Zerr	Plant Manager, Empire District Electric
Cory Larson	Operations Manager, Empire District Electric
Kavan Stull	Environmental/Safety Services, Empire District Electric

13.0 References

Empire District Electric Company (2009). "CERCLA 104(e) Request for Information Response," prepared for U.S. Environmental Protection Agency, May 12.

Kansas Division of Water Resources (2007). Kansas Dam Safety Laws and Regulations, May.

Anderson Engineering, Inc. (2010). "Geotechnical Exploration Report, Slope Stability Analysis, Ash Ponds Landfill, Riverton Plant" prepared for EDE, Riverton, Kansas, July 26, 2010.

Anderson Engineering, Inc. (2009). Preliminary Visual Slope Stability Assessment dated April 13, 2009.

Midwest Environmental Consultants (2010). "2010 Annual Groundwater Sampling Report" prepared for EDE, Riverton Kansas, September 2010.

Tri State Engineering (2008). Survey drawing of the Riverton plant ash ponds, August 29, 2008.

U.S. Army Corps of Engineers (1979). "Recommended Guidelines for Safety Inspections of Dams. (ER 1110-2-106)." September 26.

Federal Energy Regulatory Commission (FERC) (rev, 2006). "Engineering Guidelines for the Evaluation of Hydropower Projects, Embankment Dams (Chapter IV)", September 2006.

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Figures

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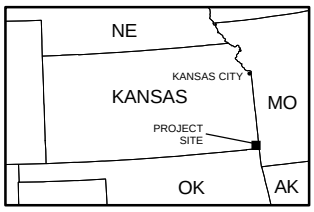

5 2.5 0 5
Miles

Assessment of Dam Safety of Coal Combustion Waste Impoundments at Empire District Electric, Riverton Station	GEI Consultants	SITE VICINITY MAP
Environmental Protection Agency Washington, D.C.	Project 092883	June 2011 Figure 1

P:\092883 EPA SSA Inspections\Riverton\Site Vicinity Map.mxd 10/10

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Base map is USDA Naip imagery,
Kansas, Cherokee County, 2006

300 150 0 300 600
Feet

Assessment of Dam Safety of Coal Combustion Waste Impoundments at Empire District Electric, Riverton Station	GEI Consultants	SITE MAP
Environmental Protection Agency Washington, D.C.	Project 092883	June 2011 Figure 2

P:\092883 EPA SSA Inspections\Riverton\Site Map.mxd 10/10

Appendix A

Inspection Checklists

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Site Name: **Riverton Power Station, Riverton, KS** Date: **September 23, 2010**

Unit Name: **Industrial Landfill–East and West Cells** Operator's Name: **Empire District Electric Co**

Unit ID: Hazard Potential Classification: High **Significant** Low

Inspector's Name: **Steve Townsley/Ken Hardesty**

Check the appropriate box below, Provide comments when appropriate. If not applicable or not available, record "N/A", Any unusual conditions or construction practices that should be noted in the comments section, For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	None		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	826 ft (approximately)		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	825 ft (approximately)		20. Decant Pipes		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	830 ft (approximately)		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	N/A		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	N/A	N/A	From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below.)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?		X
13. Depressions or sink holes in tailings surface or whirlpool in the pool area		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
9. Trees and heavy vegetation growing on embankments.	**9. Max. diameter tree trunks approximately 12"**
12. Decant and trashrack are clear.	**12. Trashrack not in place. Laying on ground near decant inlet.**
23. Water against the downstream toe of the east embankment.	**23. Cooling water return channel flows along toe of east embankment.**

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Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # TBD INSPECTOR Steve Townsley/Ken Hardesty

Date September 23, 2010

Impoundment Name Industrial Landfill–East and West Ponds

Impoundment Company Empire District Electric Company

EPA Region 7

State Agency (Field Office) Address 901 N. 5th St

Kansas City, KS 66101

Name of Impoundment Industrial Landfill–East and West Cells
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Fly ash and bottom ash

Nearest Downstream Town: Name Lowell
Distance from the impoundment 1.5 miles
Impoundment
Location:

Longitude	94	Degrees	42	Minutes	4.8	Seconds
Latitude	37	Degrees	2	Minutes	59.3	Seconds
State	KS	County	Cherokee			

Does a state agency regulate this impoundment? YES X NO _____

If So Which Sate Agency? Kansas Dept of Health and Environment, Bureau of Waste Mgmt (Permit #0784)

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HAZARD POTENTIAL (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.

__X__ **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.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Industrial landfill is being managed similar to a solid waste landfill, however is still being used for wet storage. The embankments surrounding the Impoundment have the potential to release coal combustion ash into the Spring River causing environmental damage and losses.

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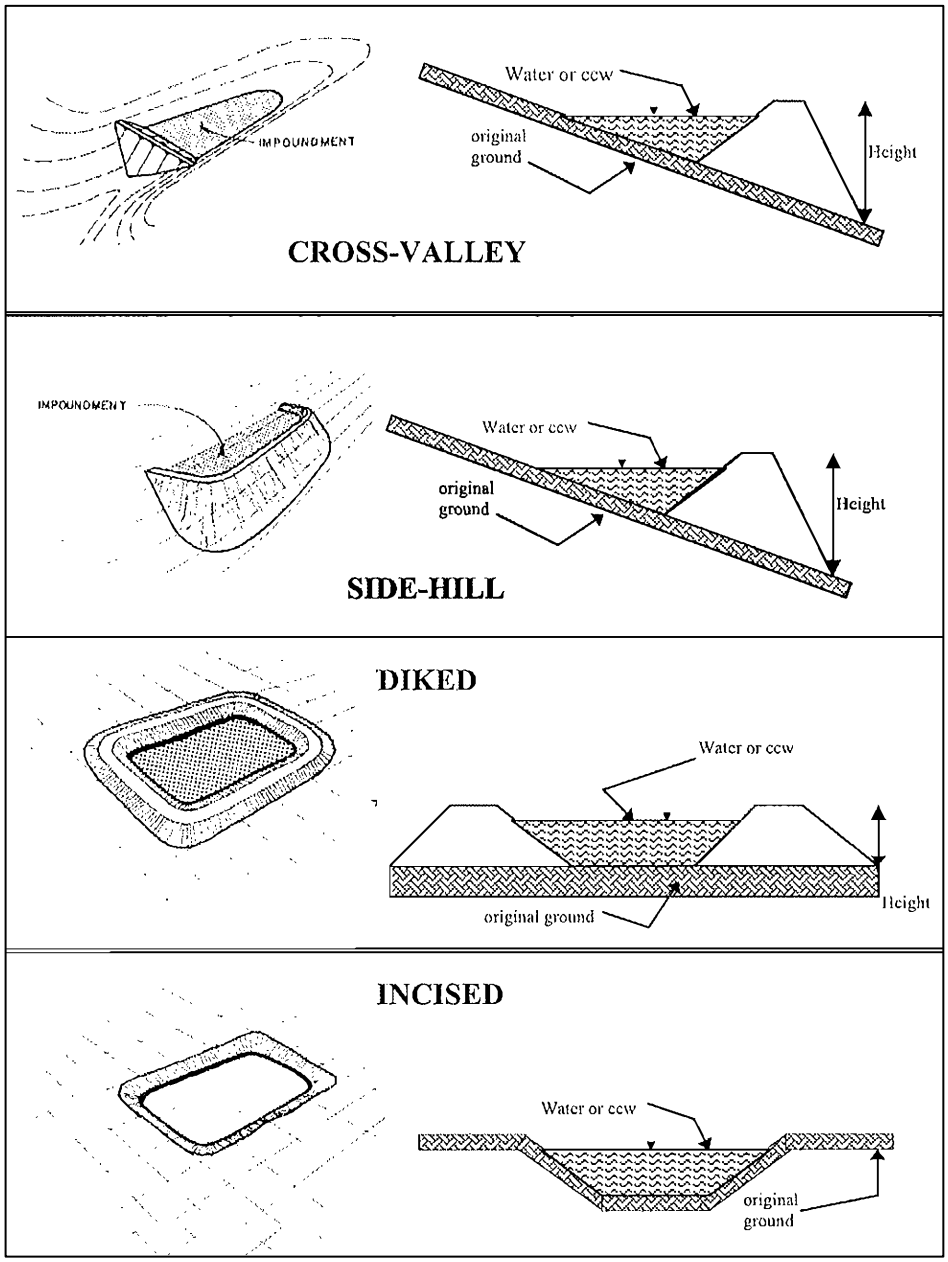
CONFIGURATION:



_____ Cross-Valley
_____ Side-Hill
__X__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height __19__ feet Embankment Material _____Earth_____
Pool Area____5_____ acres Liner_____N/A_____
Current Freeboard ___4___ feet Liner Permeability_____N/A_____

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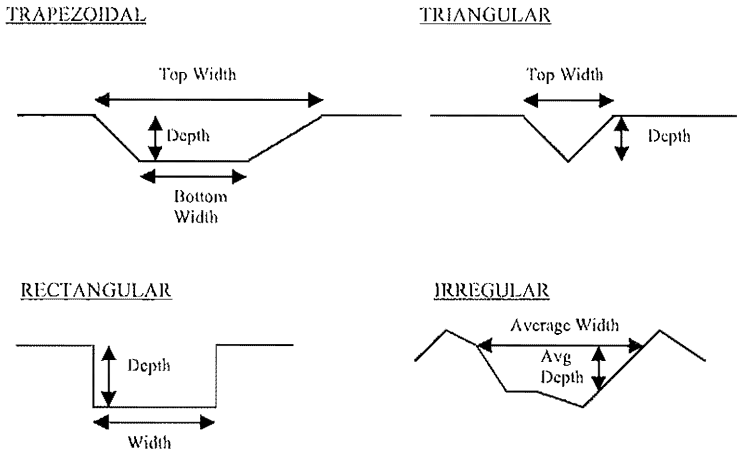
TYPE OF OUTLET (Mark all that apply)

N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Triangular

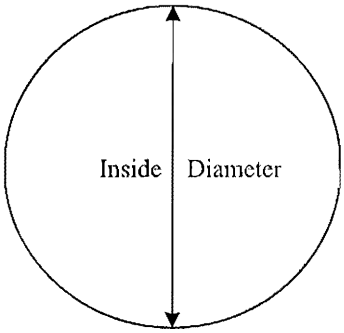
_____ Depth
_____ Bottom (or average) width
_____ Top width



X **Outlet**

24 in inside diameter

Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
X other (specify Riveted steel



Is water flowing through the outlet? YES X NO_____

_____ **No Outlet**

_____ **Other Type of Outlet (Specify)** _____

The Impoundment was Designed By N/A _____

_____

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Has there ever been a failure at this site? YES _____ NO __X__

If So When?_____

If So Please Describe:

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Has there ever been significant seepages at this site? YES _____ NO __X__

If So When? _____

If So Please Describe: _____

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Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO __X__

If So which method (e.g., piezometers, gw pumping, …)? _____

If So Please Describe:

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Appendix B

Inspection Photographs

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Photo 1: Riprap at downstream toe of the perimeter dike in the cooling water discharge channel.

Photo 2: Heavy vegetation and large trees in downstream slope of east perimeter dike, East Cell.

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Photo 3: Heavy vegetation in downstream slope of east perimeter dike, East Cell.

Photo 4: View of inside slope of ash piles in East Cell.

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Photo 5: East Cell, looking northwest toward the location of the outlet pipe.

Photo 6: Inlet for perimeter dike drain connection to East Cell pond (dike drain ditch in foreground).

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Photo 7: Trees at toe of south perimeter dike, shown at right.

Photo 8: West perimeter dike showing interior drainage ditch and ash piles in East Cell.

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Photo 9: View of West Cell looking northwest from bridge over spillway between the East and West Cells.

Photo 10: Bridge spanning spillway between the East and West Cells.

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Photo 11: View of ash in the West Cell, looking north along the dike between the East and West Cells.

Photo 12: Excavation in West Cell showing how sluiced ash is conveyed through cell, looking south.

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Photo 13: Intake to West Cell.

Photo 14: Riveted steel outlet pipe located in northwest corner of the East Cell (note grating used to collect samples).

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Photo 15: Outlet pipe in East Cell and PVC intake pipes located along north perimeter dike.

Photo 16: Discharge from outlet pipe.

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Appendix C

Reply to Request for Information Under Section 104(e)

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SERVICES YOU COUNT ON

Bradley P. Beecher
Vice President and Chief Operating Officer - Electric

May 12, 2009

Mr. Richard Kinch
US Environmental Protection Agency (5306P)
1200 Pennsylvania Ave., NW
Washington, DC 20460

RE: Request for Information under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act U.S.C. 9604 (e)

Mr. Kinch:

The Empire District Electric Company acknowledges receipt of the US Environmental Protection Agency Request for Information, received at the Riverton Power Station on May 5, 2009. Provided as an enclosure, is the requested response to your questionnaire.

If we can be of further assistance in providing additional information about our facilities, please contact George Thullesen, Director of Safety and Environmental Services, at 417-625-5123.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: Brad Beecher

Name: Brad Beecher

Title: Vice President & COO - Electric

sjb
Enclosures

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Enclosure

Response to Information Request: EPA letter received May 5, 2009

Riverton Power Station

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

The Riverton Power Station Industrial Landfill unit does not have an established rating relative to the National Inventory of Dams criteria. The Landfill is regulated by the Kansas Department of Health and Environment (KDHE), Bureau of Waste Management

2. What year was each management unit commissioned and expanded?

The Riverton Power Station Industrial Landfill as currently operated and managed was constructed in two separate phases. The West Pond was established in 1951 and the East Pond was completed in 1985. KDHE granted a Permit (#0784) for the combined unit to operate as an industrial solid waste disposal area on June 2, 2000.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).

The landfill unit contains both (1) fly ash and (2) bottom ash. A special monofill condition of the Permit limits the disposal area to only fly ash and bottom ash from the Riverton Power Station.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring or the safety of the waste management unit(s) under the supervision of a Professional Engineer?

The landfill unit was not designed or constructed under the supervision of a Professional Engineer. The inspection, monitoring and safety of the landfill area are performed by plant staff

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5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

On March 31, 2009 The Empire District Electric Company contracted with the Anderson Engineering, Inc. to conduct a preliminary visual slope inspection of the landfill unit. Anderson Engineering, Inc. is a Civil Engineering and Land Surveying Company licensed to provide services to state and federal agencies, utilities, and general industry in 26 states. Credentials include the design work and construction supervision of several storage ponds.

The Empire District Electric Company has reviewed the inspection report and plans to address the recommendations from the consulting engineering services company.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state of federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

The landfill unit was last inspected by the KDHE, Southeast District Office, Waste Management Program on May 9, 2008. No violations were identified. A copy of the report is attached. The Empire District Electric Company is not aware of any planned State or Federal inspections or other evaluations. The current inspection schedule used by the KDHE is not announced.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and if so describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

Except for the inspection cited in question # 6, to the best of The Empire District Electric Company's knowledge no assessment, evaluations or inspections have been conducted by State or Federal regulatory officials within the last year at the Riverton Power Station Industrial Landfill.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

The total surface area of the landfill is 28 acres. An aerial survey of the landfill conducted on March 6, 2009 estimates the total storage capacity to be approximately 1.6 million cubic yards. Total volume of fly ash and bottom ash stored in approximately 1.3 million cubic yards. The Maximum height is 19 feet.

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9. Please provide a brief history of known spills or un-permitted releases from the unit within the last ten years, whether or not these were reported to State or Federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

No un-permitted release or spills have occurred within the past ten years. The landfill has a water overflow point that is allowed to discharge. Effluent limitations and monitoring requirements are specified in the facilities National Pollutant Discharge Elimination System (NPDES) operating permit.

10. Please identify all current legal owners(s) and operator(s) at the facility.

The legal owner and operator of the Riverton Power Station Industrial Landfill is The Empire District Electric Company.

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