TVA Colbert Fossil Facility
Ash Disposal Pond 4

Improving Operations
While Preparing for Closure

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Presentation Outline

• Colbert Fossil Facility
• Pond 4 - Existing Conditions & History
• Pond 4 - Evaluation
• Pond 4 - Improvements
  – High Hazard Removal: Design & Construction
  – Spillway Replacement: Design & Construction
  – Seepage Remediation: Design & Construction
• Partial Closure Phases 1 & 2
Colbert Fossil Facility

- Located in Tuscumbia, Alabama
- Five coal-fired generating units
- Yearly generation = 7.8 billion kW-hours
- Winter net dependable generating capacity = 1,198 MW
- Consumes 8,900 tons of coal/day
Pond 4 – Existing Conditions

- 52 acres
- Used for:
  - Disposal of coal combustion bottom ash
  - Treatment of several wastewater streams
- Operational Features
  - Inlets/outlets, sluicing and stacking

- Sluiced Bottom Ash
- Coal Yard Runoff
- Wastewater Streams

Pond 4

Cane Creek
Pond 4 – Existing Conditions

- Enclosed by approximately 6,700 feet of perimeter dikes
- Dike side slopes =2.5H:1V to 3H:1V.
- Bounded by:
  - Cane Creek on east side
  - Railroad tracks and US Route 72 on south side
Pond 4 – Existing Conditions

- **Initial conditions (2009):**
  - Average crest = El. 462.9
  - Pool elevation = El. 456.6
  - Free water volume = 89 million gallons

- **Historical information:**
  - 1972 – constructed with 20 feet high dikes (El. 440)
  - Originally used for fly ash disposal
  - 1984 - dikes raised by approximately 20 feet
Pond 4 - Evaluation

- Project Drivers:
  - Plant-wide assessment of effective CCP management improvements
  - Federal classification of impoundments yielded a High Hazard rating
  - TVA-driven policies to remove high hazard facilities and improve spillway conditions
- Evaluations included site visits, conceptual engineering, planning and assessing effective solutions
- Planning ahead and looking at the Project Drivers as a “collection” was key
Pond 4 - Evaluation

• Evaluation of Pond 4 conditions and operations performed to address needs related to:
  – Remediation of instabilities
  – Improvement of operations through upgrades
  – Preparation for eventual closure of the pond
Pond 4 - Evaluation

• Key Improvement Objectives:
  1. Remove High Hazard rating.
  2. Four “morning glory” spillway riser structures require redesign for operational concerns (age, construction, stability).
  3. Resolve seepage observed in the earthen perimeter dikes.

• All engineering and construction needed to occur without interruption of pond operations.
Pond 4 – Evaluation Summary

ISSUE #1: High Hazard Condition in the Event of Dike Breach

As Determined Status: Based on Conditions Prior to November 2009

LEGEND
1.1 “As Found” Factor of Safety (FS)

ISSUE #2: Tall, Unsupported Spillway Structures

ISSUE #3: Seepage Along Mid-Slope to Toe of East Dike

ISSUE: Low to Marginal Slope Stability FS on East Dike

ISSUE #1: High Hazard Condition in the Event of Dike Breach
High Hazard Classification

- TVA classified Pond 4 as a High Hazard structure
- Evaluation performed in general accordance with FEMA’s Hazard Potential of Dams (FEMA, 2004)
- High Hazard classification based on consequences (not probability) of failure in terms of probable loss of human life.
  - US Route 72 and railroad to the south
  - Existing structures to east and west side of Colbert Steam Plant Road
High Hazard Alternative Study

- Alternatives evaluated for High Hazard removal:
  - Armor/ protect downstream features
  - Lower crest level of dike
  - Partial closure to redirect possible dike breach
  - Close the pond entirely
  - Purchase impacted property
  - Change grades/ topography
  - Raise features downstream of inundation
High Hazard Alternative Study

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• A joint decision was made to lower the crest of a portion of the dike
High Hazard Removal Design

- Dam break inundation analyses performed to determine final dike elevation for high hazard removal
  - Overtopping analyses
- Dam failure will not reach the railroad or highway if a portion of the dike crest is lowered to EL 458 (~5 ft)
- Dike lowering:
  - Length ~900 ft
  - Location chosen based on inundation analysis and future construction projects
High Hazard Removal Construction

- Start Date = 8/23/10
- End Date = 9/03/10
Spillway Replacement

- Facility assessment found Pond 4 spillway structure at higher risk for failure than other spillways in TVA system.
- Potential hazard due to age and possible instabilities.
Spillway Replacement

- Pond 4 initially discharged through four “morning glory” structures at north end of stilling basin
- The morning glory spillways consist of four 48-inch risers on concrete base with 36-inch outlet pipe passing through the dike leading to discharge channel.
Typical Spillway Section

- Concrete riser
- Concrete base
- Outlet pipe
- Trapezoidal Discharge channel
Spillway Replacement Design

- TVA selected a design for the new spillway consistent with other successful projects.
  - New system will consist of spillway structure and siphons.
Spillway Replacement Design

• Spillway structure
  – Four stop-log weirs & four 30-inch HDPE conduits draining to channel north of the pond
  – Design allows adjustments in water level with plastic stop logs

• Siphons
  – Keep Stilling Pond lowered under normal plant flows during construction
Spillway Replacement Design

- **Challenge:** Construct new spillway system while maintaining normal plant operation
  - The water in the Stilling Pond **must** be lowered while maintaining the required free water volume
- **Solution:** Design and construction of a rock buttress with sheet piling
Spillway Replacement Design

- Rock Buttress and Sheet Pile wall separate Stilling Pond from Main Pond.
- Allows temporary lowering of water in Stilling Pond for construction.
- Remainder of pond is at normal pool elevation
  - Free water volume maintained
Spillway Replacement Design

- Rock Buttress and Sheet Pile Wall:
  - Slope stability and hydraulic analyses performed to determine design configuration
Spillway Replacement Design

- Rock buttress & sheet pile wall design configuration:
  - Buttress slopes:
    - 2.5H:1V - Main Pond side
    - A broken (separated by a 20 ft wide bench) 1.5H:1.5V Stilling Pond side
  - Sheet pile wall driven down the center of buttress to provide hydraulic separation.
  - Lowered center opening section through the crest of the buttress to allow inflows to Stilling Pond
Spillway Replacement Construction

Placement of Buttress Rock

Driving Sheet Piling

Grading of Rock Buttress

Completed Rock Buttress and Sheet Pile Wall

Center Opening
Spillway Replacement Construction

- Excavation of Dike for New Spillway Inlet
- Morning Glory Structures
- Lowered Pond Water Level
- Existing Walkway
- Pre-Construction Spillway Structures
Spillway Replacement Construction

- New Headwall
- New Walkway
- Siphon Pipes
- Construction of New Headwall

Original Channel – Pre-Construction
Spillway Replacement Construction

- Start Date = 7/06/10
- End Date = 1/20/11
Seepage Concerns

- Perimeter dikes- history of seepage along the east and southeast
- Seepage noted near El. 445
  - Possible contact of the original dike and new fill
  - May indicate permeable hydraulic connection from interior of pond
Seepage Remediation Design

- Seepage remediation system consists of the following:
  - Stone Buttress
  - Seepage Collection Drain
  - Lateral Piping
  - Conveyance Line
Seepage Remediation Design

- Access Road/Stone Buttress - working surface for construction of the conveyance line
- Seepage Collection Drain - intercept the seepage near the interface of the upper and lower dikes (~ El. 445 and 440)
- Lateral Pipes – convey flow to seepage conveyance line
- Conveyance Pipe - convey flows to new headwall structure and to existing treatment wetlands to the south of Pond 4
Seepage Remediation Design
Seepage Remediation Design

**ACTION:** Remediate Seepage and Low FS with Collection Pipes and Buttress Construction

[Diagram showing the remediation design with action and construction details]
Seepage Remediation Construction

• Stone Buttress:
  – East and south sides of dike
  – Construction start = 12/14/10
  – Construction Complete = 02/21/11

• Construction of remaining portions of seepage remediation to restart May 2011 (due to weather delays)
Pond 4 – Improvements Summary

- High Hazard removed
- New spillway and siphons installed
- Seepage remediation in progress
- Successful pond operation maintained throughout construction
- Construction progressed as scheduled
Partial Closure – Phases 1 & 2

• Pond 4 Closure
  — Closure of Pond 4 is part of TVA’s Programmatic goals for the Colbert Plant.
  — Closure will be accomplished in a “Phased” approach, wherein portions of the pond will be closed to allow for continued sluicing and wastewater treatment options.

• Regulatory framework:
  — No specific ADEM regulations for pond closure
  — Coordination with ADEM for other applicable permits
  — TVA Programmatic Document
Partial Closure – Phase 1

- Partial Closure Phase 1 includes:
  - New channel in divider dike to redirect inflows.
  - Separator dike to “close off” the south of Pond 4.
  - Filling the southern portion with the existing material from the bottom ash stack.
  - Stilling Pond to remain in use for other plant flows.
Partial Closure – Phase 2

• Phase 2 to begin after completion of Phase 1
• Bottom ash will be stacked on the southern portion of the pond
• Final grades and storm water management configuration to be determined based on generation rates and plant operation.
Partial Closure – Phase 2

• Partial Closure Phase 2 (FY18–FY19) and Final Closure (FY19-FY20)

• As the bottom ash production at the plant is converted from a wet operation to dry, the remaining portion of the south end of Pond 4 will be closed.

• TVA to evaluate continued use of Stilling Pond
Questions