DRAFT REPORT

Dam Safety Assessment of CCW Impoundments

Luminant Generation Co., LLC/OAK GROVE STEAM ELECTRIC STATION

United States Environmental Protection Agency
Washington, DC

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O'BRIEN & GERE
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Prepared for:
US Environmental Protection Agency
Washington, DC

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TABLE OF CONTENTS

Figures

Appendices

1. INTRODUCTION

1.1. GENERAL

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of CCW impoundments or "management units". A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations.

The U.S. EPA has authorized O'Brien & Gere to provide site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of BPA# EP10W000673, Order EP-B12S-00065, dated July 18, 2012.

1.2. PROJECT PURPOSE AND SCOPE

The purpose of this work is to provide Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit (or shortly thereafter) to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles down gradient of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last 5 years.

- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the FGD-A and FGD-B Ponds at the Luminant Generation Co., LLC Oak Grove Steam Electric Station near Franklin, TX. This power generation facility is owned and operated by Luminant Generation Co., LLC (Luminant). In the course of this assessment, O'Brien & Gere obtained information from Luminant representatives.

2. PROJECT/FACILITY DESCRIPTION

The Oak Grove Steam Electric Station (SES) is located near Franklin, Robertson County, Texas (see Figure 1 for location plan). The generating facility has two operating units with a combined capacity of 1,600 MW. Construction of the Oak Grove facility began in 1979, the owner of the facility at that time was Texas Utilities (TXU) and the site was known as "Twin Oaks". Due to a significant drop in electricity demand, the plant was mothballed before construction could be completed. Construction re-commenced in 2007 and the facility became fully operational in 2010. The plant burns lignite mined at the Luminant-owned Kosse Mine located approximately 15 miles from the Oak Grove SES.

All flyash generated at the facility is handled in a dry manner. It is collected through electrostatic precipitators and pneumatically conveyed to bag houses, then silos before it is transported offsite. Bottom ash is also handled dry by drag chains to conveyor belts and ultimately transported off site via trucks. The CCW stored at the site is primarily wastewater from the facility's flue gas desulphurization (FGD) system wet scrubber blowdown, though the facility is permitted to also receive, metal cleaning waste, low volume wastewater, bottom ash contact water, and storm water runoff. Runoff from approximately 15 acres of the SES site can reportedly be pumped to the FGD-A Pond.

2.1 MANAGEMENT UNIT IDENTIFICATION

The location of the CCW impoundments inspected during this safety assessment is identified on Figures 1 and 2. The impoundments are identified as FGD-A Pond and FGD-B Pond. The embankments for both impoundments were constructed with on-site borrow materials. FGD-A Pond was partially constructed during the initial construction phase but was not completed at that time. It was completed before the 2010 opening of the Oak Grove Steam Electric Station. Construction of FGD-B Pond was completed in 2012.

FGD-A Pond has a surface area of approximately 9.4 acres, it is used as the primary unit, while FGD-B Pond (11.3 acres) is used when there is maintenance on FGD-A Pond, or if FGD-A is otherwise out of service. The ponds are covered by a Texas State Pollutant Discharge Elimination System (TPDES) permit (Permit No. WQ0001986000). There is, however, no passive discharge structure from the ponds and site personnel indicate that due to evaporation and water management, the ponds have never discharged any of their contents. If necessary, FGD-A Pond contents can overflow/decant to FGD-B Pond through a 12-inch pipe. FGD-B Pond contents must be pumped to FGD-A Pond. Water can be recycled from FGD-A Pond back to the SES through a pumping station located near the northeast corner of the Pond.

2.2. HAZARD POTENTIAL CLASSIFICATION

The State of Texas classifies dams or embankments in accordance with Title 30 of the Texas Administrative Code (TAC), Chapter 299, Dams and Reservoirs. The regulations are administrated by the Texas Commission on Environmental Quality (TCEQ), Texas Dam Safety Program. The TCEQ Dam Safety program regulations apply to "*design, review, and approval of construction plans and specifications; and construction, operation and maintenance, inspection, repair, removal, emergency management, site security, and enforcement of dams that:*

1. *have a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet, as described in paragraph (2) of this subsection;*
2. *have a height greater than 6 feet and a maximum storage capacity greater than or equal to 50 acre-feet;*
3. *are a high- or significant-hazard dam as defined in §299.14 of this title (relating to Hazard Classification Criteria), regardless of height or maximum storage capacity; or*
4. *are used as a pumped storage or terminal storage facility.*

Dam and embankment hazard classifications are established by 30 TAC §299.14 and provide standards regarding impoundment facility structure classification:

> *The executive director shall classify dams for hazard based on either potential loss of human life or property damage, in the event of failure or malfunction of the dam or appurtenant structures, within affected developments, that are existing at the time of the classification. The hazard classification may include use of a breach analysis that addresses the incremental impact of the potential breach over and above the impact of the flood that may have caused the breach, as defined in §299.15(a)(4)(A)(i) of this title (relating to Hydrologic and Hydraulic Criteria for Dams). The classification must be according to the following.*
>
> *(1) Low. A dam in the low-hazard potential category has:*
> *(A) no loss of human life expected (no permanent habitable structures in the breach inundation area downstream of the dam); and*
> *(B) minimal economic loss (located primarily in rural areas where failure may damage occasional farm buildings, limited agricultural improvements, and minor highways as defined in §299.2(38) of this title (relating to Definitions)).*
> *(2) Significant. A dam in the significant-hazard potential category has:*
> *(A) loss of human life possible (one to six lives or one or two habitable structures in the breach inundation area downstream of the dam); or*
> *(B) appreciable economic loss, located primarily in rural areas where failure may cause:*
> *(i) damage to isolated homes;*
> *(ii) damage to secondary highways as defined in §299.2(58);*
> *(iii) damage to minor railroads; or*
> *(iv) interruption of service or use of public utilities, including the design purpose of the utility.*
> *(3) High. A dam in the high-hazard potential category has:*
> *(A) loss of life expected (seven or more lives or three or more habitable structures in the breach inundation area downstream of the dam); or*
> *(B) excessive economic loss, located primarily in or near urban areas where failure would be expected to cause extensive damage to:*
> *(i) public facilities;*
> *(ii) agricultural, industrial, or commercial facilities;*
> *(iii) public utilities, including the design purpose of the utility;*
> *(iv) main highways as defined in §299.2(33); or*
> *(v) railroads used as a major transportation system.*

The TCEQ Dam Safety Program currently does not regulate the FGD Scrubber Ponds and therefore Hazard Potentials have not been previously designated. In the absence of a state-assigned classification, the FEMA guidelines, *Hazard Potential Classification System for Dams* (2004) have been applied in this assessment to recommend a hazard potential classification for the following impoundment. The definitions for the four hazard potentials (Less than Low, Low, Significant and High) to be used in this assessment are included in the EPA CCW checklist found in Appendix A.

Based on site evaluation, both units are considered **Low** Hazard Potential. This classification assumes that no probable loss of human life and low economic and/or environmental losses would occur in the event of a dam/embankment failure. The area that would potentially be inundated by a breach of any embankment of the FGD Scrubber Ponds is limited to property owned by Luminant. The potential exists for discharge to reach the Twin Oak Reservoir, which is also owned by Luminant. The Reservoir provides cooling water for the Oak Grove SES and is used for recreation. It is not a water supply reservoir. The Twin Oak Reservoir has a reported storage capacity of 30,319 acre-feet. The volume of water and CCWs impounded in the FGD-A and FGD-B Ponds is

approximately 240 acre-feet (78.5 million gallons). Thus the quantity of a release from an embankment breach would represent less than 1% of total available reservoir storage and the environmental damage would be limited to the adjacent area in the western reach of the reservoir.

2.3. IMPOUNDING STRUCTURE DETAILS

The following sections summarize the structural components and basic operations of the subject impoundments. The impoundments are located to the northwest of the Oak Grove SES, the impoundments abut each other. The location of the impoundments on the plant grounds is shown on Figures 1 and 2.

2.3.1. Embankment Configuration

FGD-A Pond

FGD-A Pond is approximately 9.4 acres in size. The impoundment is partially incised. The embankment's design crest elevation is EL. 449.5 and the designed bottom is at EL. 422.0. Embankment height varies, but is approximately 20 feet at the maximum section. The combined length of the impoundments embankments is approximately 2,400 feet. Construction of the impoundment began during the initial (1979) phase of construction of the Oak Grove SES and was completed prior to the SES being brought on-line in 2010. The designed slope of the inboard face is 2.5H:1V. A three-foot thick clay liner was installed on the embankment's inboard face. The clay liner and the embankment materials were excavated from on-site borrow areas. Portions of the inboard face are also coved by a high density polyethylene (HDPE) liner. A "dividing dike" extends approximately 300 feet westward from the eastern embankment approximately 200 feet south of the northern embankment. The dike provides separation from the inflow structure and pump station intake within the pond.

FGD-B Pond

FGD-B Pond is approximately 11.3 acres in size. The impoundment is partially incised. The embankment's design crest elevation is EL. 431.5 and the designed bottom varies from EL. 425.0 to EL. 416.0. Embankment height varies, but is approximately 10 feet at the maximum section. The designed inboard and outboard slopes are 3H:1V. The combined length of the impoundments embankments is approximately 3,000 feet. A two-foot thick clay liner is overlain by a 60-mil HDPE on the inboard slopes. The design also included one-foot of soil "protective cover" on top of the HDPE liner.

2.3.2. Type of Materials Impounded

FGD scrubber waste is the primary material that is impounded in the FGD-A and FGD-B Ponds. The Ponds, however, are permitted to receive FGD wet scrubber blowdown, metal cleaning waste, low volume wastewater, bottom ash contact water, and storm water runoff. Thus trace amounts of the other waste-products may be detected in the Ponds.

2.3.3. Outlet Works

FGD-A Pond is constructed with a 12-inch overflow/decant pipe that can discharge into FGD-B Pond. Flow through the pipe is controlled by a valve. The impoundment does not have a "passive" spillway system but water can be pumped from FGD-A Pond back to the Oak Grove SES through a pumping station located east of the impoundment. FGD-B Pond does not have a permanently installed outlet system. Portable pumps are used to pump wastewater from FGD-B into FGD-A when necessary.

3. RECORDS REVIEW

3.1. GENERAL

A review of the available records related to design, construction, operation and inspection of the FGD-A and FGD-B Ponds was performed as part of this assessment. The documents provided by Luminant are listed below:

Table 3.1 *Summary of Documents Reviewed*

Document	Dates	By	Description
FGD Scrubber Pond Cross Sections	Jun 24, 2008	Flour Enterprises, Inc.	Design sections for FGD-A Pond
Figure 2-1: FGD Scrubber Pond Liner Verification Sampling Plan	August 5, 2008	Flour Enterprises, Inc.	Soil sample locations for FGD-A Pond
Oak Grove SES. FGD Pond Soil Liner Evaluation Report. Robertson County, Texas.	November 17, 2008	Golder Associates, Inc.	Summary report of Golder's quality assurance services during subgrade prep and clay liner installation in FGD-A Pond
Oak Grove SES Groundwater. Water Level Data, 2-Yr. History	2009 - 2012	Luminant	Groundwater readings from 9 wells located near FGD-A and FGD-B Ponds
FGD-B Slope Stability Evaluation Report. Luminant Oak Grove SES	April 27, 2010	Golder Associates, Inc.	Summary report of slope stability analyses performed for the design of FGD-B Pond
FGD-A Slope Stability Evaluation Report. Luminant Oak Grove SES	March 2011	Golder Associates, Inc.	Summary report of slope stability analyses performed for FGD-A Pond
Luminant Oak Grove FGD-B Pond: Site Map with Monitoring Well Locations	March, 2011	Pastor, Behling & Wheeler, LLC.	Site plan showing FGD-A Pond, FGD-B Pond and monitoring well locations
Critical Impoundment Inspection Report for Oak Grove SES	March 4, 2011	Luminant	Summary report of annual inspection of the FGD-A Pond by Luminant
Oak Grove Steam Electric Station. FGD-B Pond Construction. Robertson County, Texas.	September, 2011	Golder Associates, Inc.	Design Drawings for FGD-B Pond
Liner Evaluation Report. Oak Grove SES. FGD-B Pond. Golder Robertson County, Texas.	January 2012	Golder Associates, Inc.	Summary report of Golder's Construction Quality Assurance (CQA) services during construction of the composite liner for the FGD-B Pond
Oak Grove Steam Electric Station. Robertson County, Texas. Critical Impoundment Inspection Report	April 25, 2012	HDR Engineering	Summary report of annual inspection of the FGD-A and FGD-B Ponds

3.2. DESIGN DOCUMENTS

3.2.1. General

Review of the available drawings and reports revealed the following:

- Construction of FGD-A Pond began during the initial construction phase of the Oak Grove SES but was not completed until 2008 during the second phase of plant construction.
- Golder Associates, Inc. provided third-party Construction Quality Assurance/Quality Control Plan (CQA/QCP) services during placement of the 3-foot thick clay liner on the inboard faces and floor of FGD-A Pond.

- The subgrade to the liner was inspected and its condition approved by Golder prior to placement of the clay liner.
- The liner was reported to have been placed in accordance with the project plans and specifications. The in-place hydraulic conductivity of the liner is reported to be no greater than $1.0x10^{-7}$ centimeters per second (cm/sec).
- Data pertaining to foundation preparation or condition for construction of the Pond's embankments was not provided in the Golder report.

- Construction of FGD-B Pond began in 2011 and was completed in 2012.
- Golder Associates, Inc. provided third-party Construction Quality Assurance (CQA) monitoring and testing services during construction of the embankments and the composite liner for the FGD-B Pond.
  - Golder approved the subgrade (foundation) preparation prior to the placement of structural fill or liner material.
  - The composite liner was reported to have been placed in accordance with the project plans, specifications and Quality Control Plan (QCP). The in-place hydraulic conductivity of the composite liner is reported to be no greater than $1.0x10^{-7}$ centimeters per second (cm/sec).
  - The structural fill that form the embankments was reported to have been placed at, or above, 95% Maximum Dry Density.
- No breach or overtopping event of either impoundment has been reported.
- Formal "Critical Impoundment Inspections" are performed annually by a professional engineer licensed in Texas. Informal inspections are performed on a daily basis by Oak Grove personnel. Routine maintenance of the embankments is performed on an as-needed basis.
- Readings of the 9 monitoring wells are taken on a semi-annual basis.
- Annual inspections of FGD-A Pond indicate the impoundment has been found to be in good condition with minor rutting of the crest and localized erosion of the soil cover over the clay liner on the inboard face observed.
- Construction of the FGD-B Pond was completed shortly before the 2012 annual inspection and the vegetative cover had not had time to properly take root due to droughty conditions.
- The groundwater readings have remained relatively steady throughout the monitoring history.

3.2.2. Stormwater Inflows

No hydrologic & hydraulic analyses were available for review. According to Luminant personnel, stormwater inflow to the FGD-A and FGD-B Ponds has been evaluated and the Ponds were designed for a minimum design storm of the 24-hour, 25-year event. Because the embankments are raised on all sides of both ponds, direct runoff to the ponds is limited rainfall on the impoundments. However, runoff from approximately 15 acres of the SES facility can be pumped to FGD-A Pond. Based on charts presented in the National Weather Service's Technical Paper 40 (NWS TP-40), the 24-hour 25-year rainfall is approximately eight (8) inches and the regularly available freeboard exceeds seven (7) feet in FGD-A Pond and five (5) feet in FGD-B Pond, therefore the Ponds should be capable of containing the design event plus site runoff without overtopping their respective embankments. The Ponds should also be able to contain the 24-hour 100-year event which is approximately ten (10) inches of rainfall. While no formal hydrologic and hydraulic analyses have been performed, informal calculations indicate that the maximum possible volume of runoff from the 100-year event that could be pumped to the FGD-A Pond is approximately 544,500 ft^3. The pond has approximately 2,460,000 ft^3 of available storage. Thus the FGD-A Pond appears to have the capacity to store 4.5 times the maximum possible 24-hour, 100-year inflow. The ponds do not have a spillway or overflow structure, therefore the ponds will retain the precipitation and any stormwater pumped in until the precipitation evaporates or is pumped from the ponds.

3.2.3. Stability Analyses

O'Brien & Gere reviewed the April 2010 "FGD-B Slope Stability Investigation" and the March 2011 "FGD-A Slope Stability Evaluation" reports by Golder Associates, Inc. (Golder) as part of the investigation of the CCW impoundments at the Oak Grove SES. These reports document the stability analyses for the FGD Ponds. Two cross-sections through each impoundment were analyzed using the slope stability software program SLIDE. The load cases analyzed include long term and short term steady-state seepage under "full pond" conditions. Rapid drawdown and short term "empty pond" under seismic loading were not analyzed. Load cases analyzed were performed on the inboard and outboard slopes.

Soil shear strength parameters used in the slope stability analyses were based on a combination of information obtained during field (sampling) programs and laboratory soil testing. The field programs included sampling from the interior and embankment of FGD-A Pond and from the proposed location of FGD-B Pond. As-built samples of FGD-B Pond were not collected.

Disturbed samples were collected using a standard split spoon sampler and Standard Penetration Tests (SPT) were conducted as part of the sampling program. The disturbed samples were tested for grain-size analysis, Atterberg Limits, and natural moisture content. In addition, undisturbed samples of clayey soils were collected using steel Shelby tubes. Unconsolidated-undrained (UU) and consolidated-undrained (CU) triaxial compression tests were performed on the undisturbed samples. The soil properties utilized for the slope stability analyses are presented in Table 3.1.

Table 3.2 *Soil Material Properties*

Location	Stratum	Description	γ_{moist} (pcf)	$\gamma_{saturated}$ (pcf)	Undrained Shear Strength		Drained Shear Strength	
					C (psf)	ϕ (°)	C (psf)	ϕ (°)
FGD-A Pond Northwest	I	Sandy Clay	127	132	3000	-	270	26
	II	Sandy Clay / Silty Clay / Sandy Silt	127	132	2000	-	0	26
	III	Sand	127	132	0	-	0	36
FGD-A Pond Northeast	I	Sandy Clay	127	132	3000	-	270	26
	II	Sandy Clay / Clay	127	132	2000	-	0	26
	III	Clayey Sand	127	132	0	-	0	32
FGD-B Pond	I	Clay / Silty Clay / Sandy Clay	123	128	3200	0	278	26
	II	Sandy Clay / Clay	120	125	2000	0	0	26
	III	Clayey Sand	120	125	0	42	0	42
		Structural Fill	123	128	3200	0	278	26

The above soil parameters are based on laboratory and field tests on representative samples of the various soil strata encountered in the test borings. The soil parameters listed in Table 3.2 appear to be appropriate based on the review of available data.

Table 3.3 below provides a summary of the minimum computed factors of safety for slope stability of the two ponds:

Table 3.3 *Summary of Minimum Computed Factors of Safety for Slope Stability*

Location	Case	Description	Factor of Safety
FGD-A Pond	1	Northwest (interior) sideslope; full pond; short-term (undrained) conditions	5.8
	2	Northwest (interior) sideslope; full pond; long-term (drained) conditions	2.0
	3	Northeast (exterior) sideslope; full pond; short-term (undrained) conditions	6.2
	3a	Northeast (exterior) sideslope; full pond; long-term (drained) conditions	1.9
	4	Northeast (interior) sideslope; full pond; short-term (undrained) conditions	5.9
	5	Northeast (interior) sideslope; full pond; long-term (drained) conditions	2.0
FGD-B Pond	1	West sideslope; short-term (undrained) conditions	9.9
	2	West sideslope; long-term (drained) conditions	3.7
	3	East sideslope; short-term (undrained) conditions	5.2
	4	East sideslope; long-term (drained) conditions	2.5
	5	East sideslope (considering FGD pond); short-term (undrained) conditions	4.6
	6	East sideslope (considering FGD pond); long-term (drained) conditions	2.5

The results of the slope stability analyses indicated that the computed factors of safety exceed the minimum standard set by Golder (Factor of Safety = 1.5) for all load cases. The report stated that rapid drawdown analysis of the interior slope was not an applicable load case given the operational controls of the impoundment pool level.

It does not appear that a seismic stability analysis was performed for the embankment slopes of either pond. At a minimum, a pseudostatic slope stability analysis should be performed for the critical slope section of the Ponds to demonstrate that the slopes have a minimum factor of safety of 1.0 for the 2,500-year return period earthquake. However, based on the review of the static load case factors of safety, and given the low seismic coefficient for the site location, it is likely that the minimum Factor of Safety criteria will be met. In addition, the seismic stability analysis should include a liquefaction potential screening. While the majority of the soils encountered within borings conducted for the Golder slope stability analyses indicate predominantly fine-grained soils that are not typically susceptible to liquefaction, some saturated sand deposits were encountered within the deeper native soils, which could potentially be susceptible to liquefaction.

3.3. PREVIOUS INSPECTIONS

Two previous inspection reports were provided by Luminant. The report dated March 4, 2011 was prepared by Luminant and the April 25, 2012 report was prepared by HDR Engineering, Inc. Similar issues related to the FGD-A Pond embankments were noted in the two reports. These include minor rutting on the crest and minor erosion gullies on the "upstream" (inboard) face of the embankment. The FGD-B Pond was not inspected in 2011 because it was not completed until after the 2012 inspection. Erosion gullies on the crest and inboard face of the embankment were noted in the 2012 inspection report. Additionally, it was noted that construction of the impoundment was not yet complete.

3.4. OPERATOR INTERVIEWS

Numerous plant personnel took part in the inspection proceedings along with a representative of the United States Environmental Protection Agency (USEPA). The following is a list of participants for the September 2012 assessment of the FGD - A and FGD - B Ponds:

Table 3.4 *Personnel Present at the Assessment of the Oak Grove SES CCW Impoundments*

Name	Affiliation
Jon King	Luminant
Marshall Shaw	Luminant
Julie Preyean	Luminant
Max Stephens	Luminant
Mark Kelly	Luminant
Jeff Jones	Luminant
Gary Spicer	Luminant
Bob Gentry	Luminant
Golam Mustafa	USEPA
Robert C. Ganley, PE	O'Brien & Gere
Johan Anestad, PE	O'Brien & Gere

Facility personnel provided a good working knowledge of the CCW impoundments, provided general plant operation background and provided requested historical documentation. These personnel also accompanied O'Brien & Gere and the USEPA representative throughout the visual assessment to answer questions and to provide additional information as needed in the field.

4. VISUAL ASSESSMENT

4.1. GENERAL

A visual assessment of the FGD-A and FGD-B Ponds was performed on September 19, 2012. The individuals listed in Table 3.4 were present during the assessment.

The weather on the date of the assessment was sunny and approximately 70 degrees. Field checklists were prepared by O'Brien & Gere to summarize the visual assessment and are included as Appendix A. Photographs were taken by both Luminant and O'Brien & Gere. Pertinent photos taken by O'Brien & Gere are included as Appendix B.

4.2. SUMMARY OF FINDINGS

Prior to the visual assessment, staff from Luminant provided an overview of the facility operation, including how fly ash and bottom ash are handled. Both materials are dry-handled and are not discharged into a CCW impoundment. Discharge to FGD-A Pond is primarily wastewater from the facility's flue gas desulphurization (FGD) system wet scrubber blowdown, though the Pond can receive runoff from approximately 15 acres of the SES facility as well as metal cleaning waste, low volume wastewater and bottom ash contact water. Discharge to FGD-B Pond is limited to overflow from the FGD-A Pond through a 12-inch HDPE cross-over pipe installed in the western embankment of FGD-A Pond. During the visual assessment of the FGD-A and FGD-B Ponds, the full length of the crests and outboard faces of the embankment were walked and representative features observed. The following observations were made during the assessment:

FGD-A Pond

- FGD wastewater enters the pond through pipes installed through the southern half of the Pond's eastern embankment.
- Minor erosion gullies in the clay liner cover material was observed in several locations on the eastern embankment and the "dividing dike".
- Minor erosion of the cover material was also observed along the water-line, primarily on the Pond's northern embankment.
- An HDPE liner is exposed at the southeast abutment of the "dividing dike" and the eastern embankment.
- An animal burrow was observed adjacent to one of the inflow pipes on the outboard face of the eastern embankment.
- Damage at the outboard toe and face of the Pond's western embankment was observed. Luminant personnel reported that the damage was caused by wild boars.
- No evidence of prior releases, failures or patchwork of the impoundment was observed.

FGD-B Pond

- Inflow to the pond is limited to overflow from the FGD-A Pond through a 12-inch HDPE pipe in the western embankment of FGD-A Pond. No water was observed entering the Pond during the assessment.
- Minor erosion gullies were observed on the outboard face of the northern embankment. Heavy vegetative growth was also observed on portions of this embankment.
- The Twin Oaks Reservoir (owned by Luminant) is located north of the impoundment. The reservoir does not directly abut the Pond's embankment; it abuts the natural ground upon which the FGD-B Pond embankment is constructed.

- Erosion of the HDPE's cover material was observed along the water-line throughout the impoundment. A small section of liner was exposed near the northwest corner of the impoundment.
- The vegetative cover planted when construction of the impoundment was completed earlier in 2012 has not grown significantly due to drought conditions after planting.
- A deep erosion gully was observed on the eastern embankment. The liner's cover material was fully eroded and the liner was exposed at this location.
- No evidence of prior releases, failures or patchwork of the impoundment was observed.

5. CONCLUSIONS

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual assessment, the overall condition of FGD-A Pond and FGD-B Pond is considered to be **POOR**. While the visual condition of this management unit is good and recent engineering studies on the structural stability of the impounding dikes indicate acceptable performance under normal long-term loading conditions, this rating must be given since a seismic stability analysis has not been completed to assess the stability during the maximum credible earthquake (MCE). The MCE to be applied in the seismic analysis is equivalent to the 2,500-year return period or 2% probability of exceedence in 50 years earthquake. Acceptable performance is expected; however, some deficiencies exist that require repair and/or additional studies or investigations.

Major deficiencies include the following:

- Seismic stability analyses and liquefaction potential screenings were not performed for either FGD Pond.

Minor deficiencies include the following:

- Erosion of cover material down to the HDPE in one location of the eastern embankment of FGD-B Pond.
- The animal burrow observed adjacent to one of the inflow pipes on the outboard face of FGD-A Pond.
- Damage to outboard face of the western embankment of the FGD-A Pond from wild boars.
- Erosion of cover material at multiple locations along the waterline in both the FGD-A and FGD-B Ponds.

6. RECOMMENDATIONS

Based on the findings of our visual assessment and review of the available historical documents for the FGD-A Pond and the FGD-B Pond, O'Brien & Gere is recommending further evaluation of embankment stability under seismic loading and repairs to the erosion of the liner cover material and the animal burrow noted in the assessment.

6.1. URGENT ACTION ITEMS

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the dam in the near term.

6.2. LONG TERM IMPROVEMENT/MAINTENANCE ITEMS

- Evaluate the seismic stability of the embankments and liquefaction potential of the embankments and underlying native soils given a 2,500 year earthquake.
- Repair eroded cover material.
- Fill the animal burrow.

6.3. MONITORING AND FUTURE INSPECTION

Daily visual inspections are reportedly performed and the results of annual detailed inspections have been recorded in inspection reports. Deficiencies noted during the annual inspections and in this CCW assessment report should be addressed in a timely manner to maintain dam integrity. Consideration should be given to development of an O&M Plan that would establish a firm schedule for operations, maintenance and inspection activities.

6.4. RECOMMENDED SCHEDULE FOR COMPLETION OF ACTION ITEMS

The facility should address any items noted during visual inspections in a timely manner, depending on the severity and location of the deficiency. The regular inspection schedule should be maintained.

6.5. CERTIFICATION STATEMENT

I acknowledge that the FGD-A Pond and FGD-B Pond management units referenced herein were personally assessed by me on September 19, 2012 and was found to be in **POOR** condition due to the lack of a seismic slope stability and liquefaction potential evaluation for critical embankment sections.

SATISFACTORY

FAIR

POOR

UNSATISFACTORY

Signature: _____ Date: _____

Robert C. Ganley, PE
TX PE License #

FIGURES

FIGURE 1

ADAPTED FROM: PETTEWAY & BALD PRAIRIE QUADRANGLES, TEXAS U.S.G.S. 7.5 MIN. QUAD; 2010

QUADRANGLE LOCATION

US EPA
DAM SAFETY ASSESSMENT OF CCW IMPOUNDMENTS

OAK GROVE STEAM ELECTRIC STATION
ROBERTSON COUNTY, TEXAS

SITE LOCATION MAP

1 0 1/2 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

46122-OAK GROVE-F01
MAY 2013

SCALE: 1:24000

O'BRIEN & GERE

I:\US-EPA.13498\46122.ASSESS-OF-DAM-S\DOCS\DWG\SHEETS\46122-OAK GROVE-F01.DWG, 05/24/2013 1:06PM

FIGURE 2

1 PHOTOGRAPH NUMBER AND ORIENTATION

US EPA
DAM SAFETY ASSESSMENT
OF CCW IMPOUNDMENTS
LUMINANT ENERGY
OAK GROVE
STEAM ELECTRIC STATION
ROBERTSON COUNTY, TEXAS

SITE AERIAL PHOTOGRAPH AND PHOTOGRAPH LOCATION MAP

FILE NO. 13498.46122.F02
MARCH 2013

O'BRIEN & GERE

I:\US-EPA.13498\46122.ASSESS-OF-DAM-S\DOCS\DWG\SHEETS\46122-OAK GROVE-F02.DWG, 05/24/2013 1:07PM

APPENDIX A

Visual Inspection Checklists

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Oak Grove Steam Electric Station	Date:	September 19, 2012
Unit Name:	FGD Scrubber Ponds	Operator's Name:	Luminant Power
Unit I.D.:	Pond A	Hazard Potential Classification:	High Significant Low ✓
Inspector's Name:	NJ Anestad, PE & RC Ganley, PE		

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?	Daily		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	438.0		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	442.0		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?			Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	449.5		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?			Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		✓	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)?	✓		From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?		✓	From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?			Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?			22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

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

4, 14, 15: N/A. Impoundment does not have a spillway.

6: No instrumentation installed.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WQ 0001986000 INSPECTOR NJ Anestad, PE
RC Ganley, PE
Date September 19, 2012

Impoundment Name FGD Scrubber Pond A
Impoundment Company Luminant Power
EPA Region 6
State Agency (Field Office) Addresss 1445 Ross Avenue
Dallas, Texas 75202-2733
Name of Impoundment FGD Scrubber Pond A
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

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

IMPOUNDMENT FUNCTION: Storage of FGD scrubber discharge

Nearest Downstream Town : Name n/a: facility sits adjacent to Twin Oak Reservoir
Distance from the impoundment Approx. 500'
Impoundment Location:
Longitude 96 Degrees 29 Minutes 24 Seconds
Latitude 31 Degrees 11 Minutes 17 Seconds
State _____ County _____

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

If So Which State Agency?_____

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.

__X__ **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.

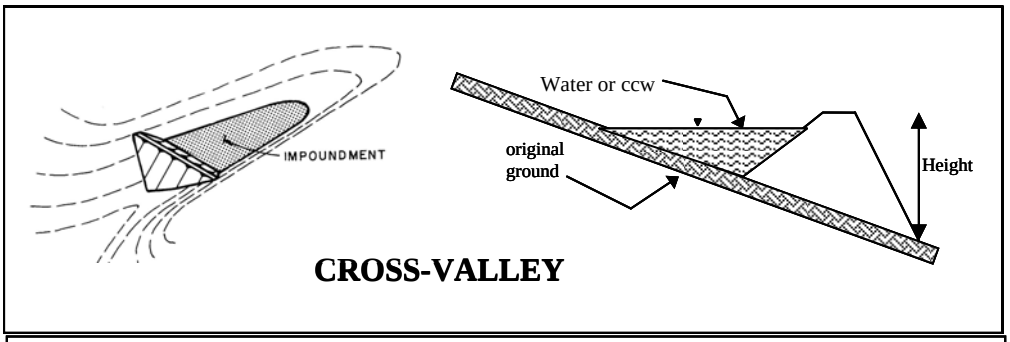
_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

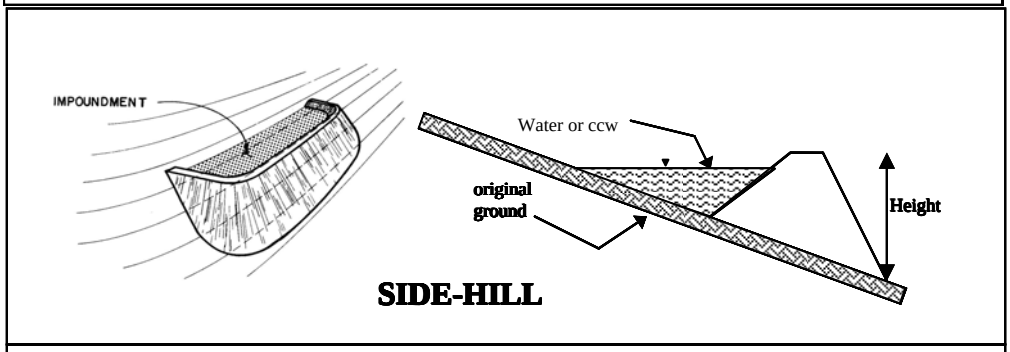
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

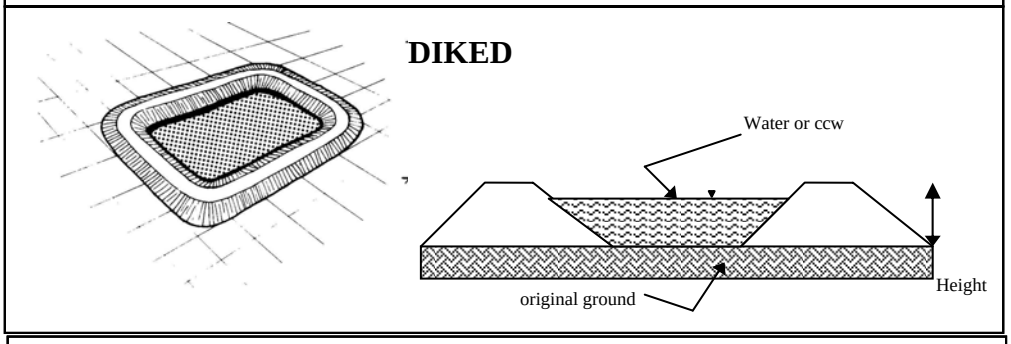
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

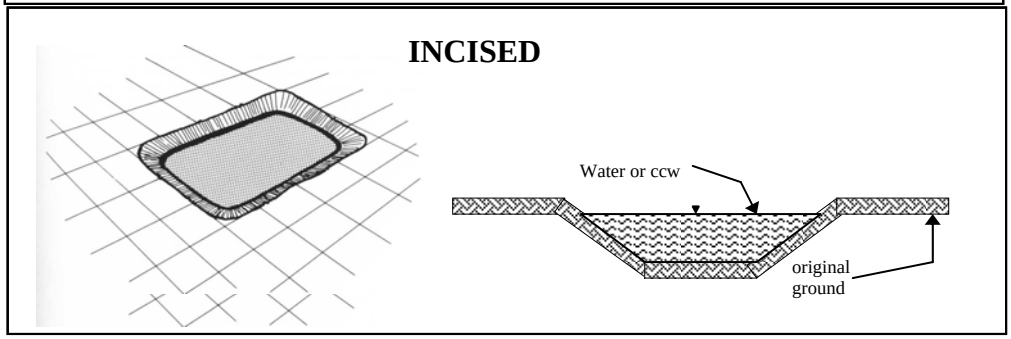
The area potentially inundated by a breach of any embankment of the CCW impoundment is limited to property owned by Luminant Power. The potential exists for some discharge to reach Twin Oak Reservoir which is also owned by Luminant Power. Environmental impacts with the waterbody are unknown due to unknown nature of stored materials constituents.

CONFIGURATION:









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

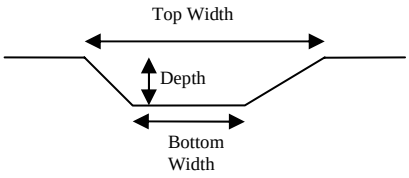
Embankment Height 30 feet
Pool Area 9.44 acres
Current Freeboard 11.5 feet

Embankment Material Silty clay
Liner Clay
Liner Permeability Unknown

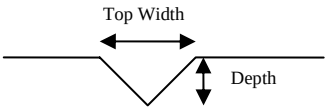
TYPE OF OUTLET (Mark all that apply)

_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

TRAPEZOIDAL

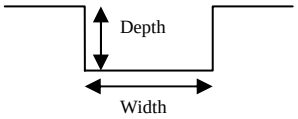


TRIANGULAR

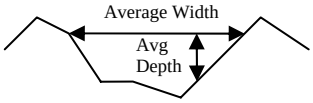


_____ depth
_____ bottom (or average) width
_____ top width

RECTANGULAR

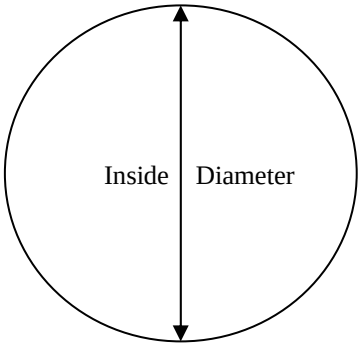


IRREGULAR



__X__ **Outlet**

__12"__ inside diameter



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

Is water flowing through the outlet? YES _____ NO __X__

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) Water may be pumped out of impundment

The Impoundment was Designed By Fluor Enterprises, Inc.

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

If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____

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 : _____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

No

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Oak Grove Steam Electric Station	Date:	September 19, 2012
Unit Name:	FGD Scrubber Ponds	Operator's Name:	Luminant Power
Unit I.D.:	Pond B	Hazard Potential Classification:	High Significant Low ✓
Inspector's Name:	NJ Anestad, PE & RC Ganley, PE		

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?	Daily		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	425.0		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?			20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?			Is water entering inlet, but not exiting outlet?		
5. Lowest dam crest elevation (operator records)?	431.5		Is water exiting outlet, but not entering inlet?		
6. If instrumentation is present, are readings recorded (operator records)?			Is water exiting outlet flowing clear?		
7. Is the embankment currently under construction?		✓	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)?	✓		From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?			From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?			Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?			22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?			23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

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

3, 4, 12, 14, 15, 16, 20: N/A. Impoundment does not have decant pipes or spillway. Water is pumped from impoundment to facility for reuse.

6: No instrumentation installed.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # WQ 0001986000 INSPECTOR NJ Anestad, PE
RC Ganley, PE
Date September 19, 2012

Impoundment Name FGD Scrubber Pond B
Impoundment Company Luminant Power
EPA Region 6
State Agency (Field Office) Addresss 1445 Ross Avenue
Dallas, Texas 75202-2733
Name of Impoundment FGD Scrubber Pond B
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

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

IMPOUNDMENT FUNCTION: Storage of FGD scrubber discharge

Nearest Downstream Town : Name n/a: facility sits adjacent to Twin Oak Reservoir
Distance from the impoundment Approx. 200'
Impoundment Location:
Longitude 96 Degrees 29 Minutes 24 Seconds
Latitude 31 Degrees 11 Minutes 17 Seconds
State _____ County _____

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

If So Which State Agency?_____

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.

__X__ **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.

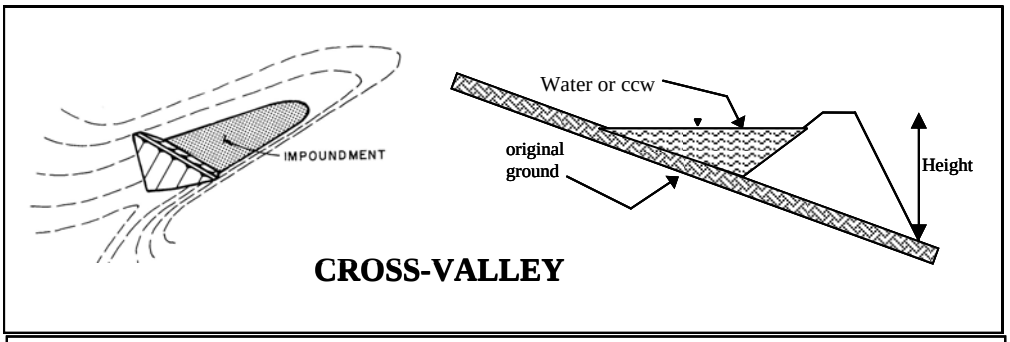
_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

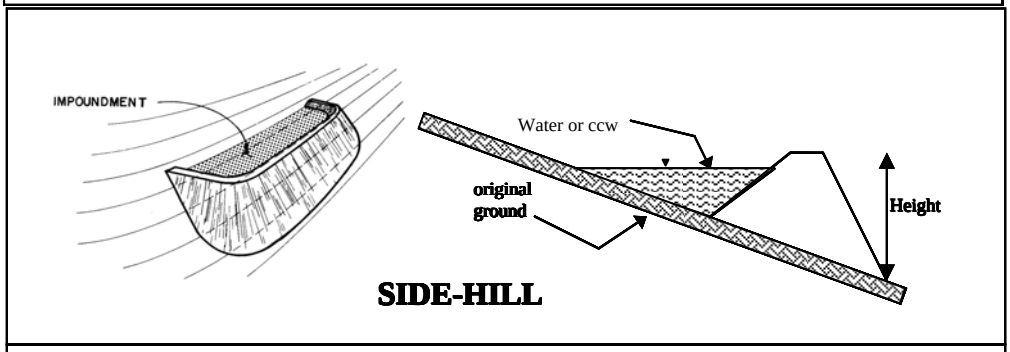
_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

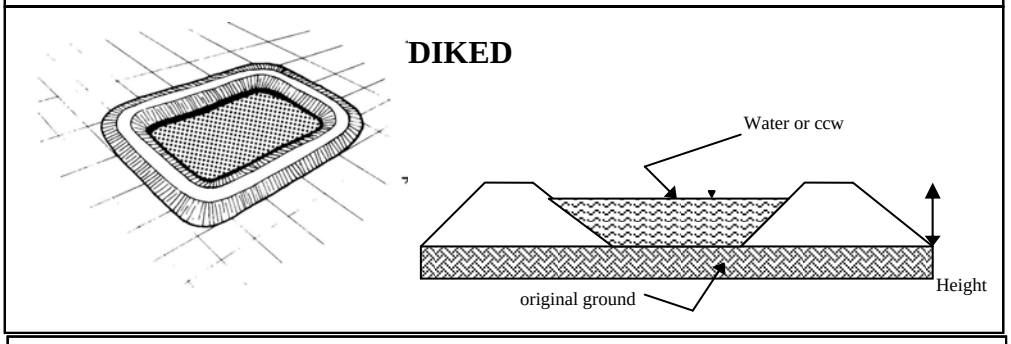
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

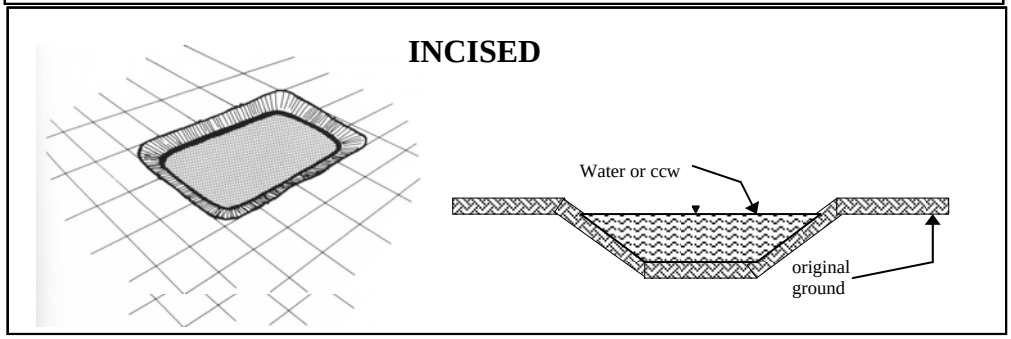
The area potentially inundated by a breach of any embankment of the CCW impoundment is limited to property owned by Luminant Power. The potential exists for some discharge to reach Twin Oak Reservoir which is also owned by Luminant Power. Environmental impacts with the waterbody are unknown due to unknown nature of stored materials constituents.

CONFIGURATION:









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

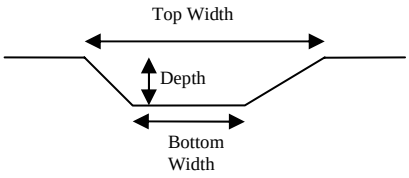
Embankment Height 6 feet
Pool Area 11.29 acres
Current Freeboard 6 feet

Embankment Material Silty/sandy clay
Liner 60-mil. HDPE + 2' Clay
Liner Permeability Unknown

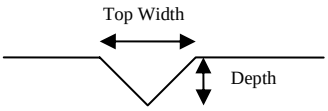
TYPE OF OUTLET (Mark all that apply)

_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

TRAPEZOIDAL

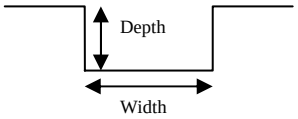


TRIANGULAR

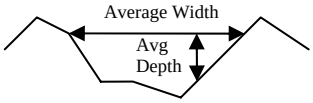


_____ depth
_____ bottom (or average) width
_____ top width

RECTANGULAR

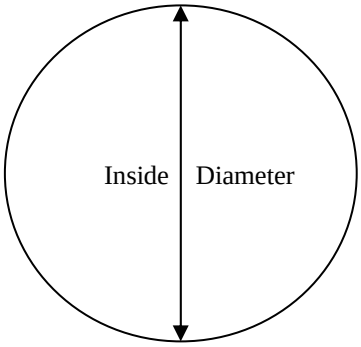


IRREGULAR



_____ **Outlet**

_____ inside diameter



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

Is water flowing through the outlet? YES _____ NO _____

__X__ **No Outlet** None: water is pumped from impoundments when needed

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

The Impoundment was Designed By Golder Associates

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

If So When? _____

If So Please Describe : _____

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

If So When? _____

IF So Please Describe: _____

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 : _____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

No

APPENDIX B

Photographs

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: W Description: FGD-A Pond. Interior of impoundment. Note Pond "Dividing Dike". Date: 9/19/12 Photo Number: 1 Photographer: NJA	
Orientation: W Description: FGD-A Pond "Dividing Dike" Date: 9/19/12 Photo Number: 2 Photographer: NJA	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: E Description: FGD-A Pond. Southeast abutment of the "Dividing Dike" and the Pond's Eastern embankment. Note exposed liner. Date: 9/19/12 Photo Number: 3 Photographer: RCG	
Orientation: S Description: CCW discharge into FGD-A Pond. Date: 9/19/12 Photo Number: 4 Photographer: NJA	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: W Description: FGD-A Pond. Erosion gully on inboard face of Eastern embankment. Photo is typical of several observed gullies. Date: 9/19/12 Photo Number: 5 Photographer: RCG	
Orientation: S Description: FGD-A Pond. Outboard face of Eastern embankment. Photo typical of majority of Eastern, Southern and Northern embankments. Date: 9/19/12 Photo Number: 6 Photographer: RCG	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: W Description: FGD-A Pond. Inflow piping. Date: 9/19/12 Photo Number: 7 Photographer: RCG	
Orientation: W Description: FGD-A Pond. Animal burrow adjacent to inflow piping. Date: 9/19/12 Photo Number: 8 Photographer: RCG	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: N Description: FGD-A Pond. Discharge end of inflow piping. Date: 9/19/12 Photo Number: 9 Photographer: RCG	
Orientation: W Description: FGD-A Pond. Outboard face of Southwest corner of embankment. Date: 9/19/12 Photo Number: 10 Photographer: NJA	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: W

Description: FGD-A Pond. Wild hog damage to outboard face of Western embankment. Several locations of hog damage observed.

Date: 9/19/12

Photo Number: 11

Photographer: RCG

Orientation: S

Description: FGD-A Pond. Overflow/ decant pipe to FGD Pond B.

Date: 9/19/12

Photo Number: 12

Photographer: RCG

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: E Description: FGD-A Pond. Interior of impoundment. Note Steam Electric Station in background. Date: 9/19/12 Photo Number: 13 Photographer: RCG	
Orientation: N Description: FGD-A Pond. Inboard faces of Western and Northern embankments. Note erosion of liner cover near water line Date: 9/19/12 Photo Number: 14 Photographer: RCG	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: N

Description: FGD-A Pond. Inboard face of Northern embankment. Note erosion of liner cover near water line

Date: 9/19/12

Photo Number: 15

Photographer: RCG

Orientation: E

Description: FGD-A Pond. Outboard face of Northern embankment.

Date: 9/19/12

Photo Number: 16

Photographer: NJA

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: W Description: FGD-A Pond. Crest of Northern embankment. Condition shown in photo is typical of entire crest. Date: 9/19/12 Photo Number: 17 Photographer: RCG	
Orientation: E Description: FGD-A Pond. Pond pump station. Used to pump water from the pond to the plant. Date: 9/19/12 Photo Number: 18 Photographer: RCG	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: S

Description: Western embankment of FGD-A Pond to the left and FGD-B Pond to the right of the photo.

Date: 9/19/12

Photo Number: 19

Photographer: NJA

Orientation: NW

Description: FGD-B Pond. Outboard face, northeast corner.

Date: 9/19/12

Photo Number: 20

Photographer: NJA

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: W Description: FGD-B Pond. Inboard face and crest of Northern embankment. Date: 9/19/12 Photo Number: 21 Photographer: RCG	
Orientation: W Description: FGD-B Pond. Outboard face of Northern embankment. Note reservoir adjacent to the impoundment. The reservoir does not abut any embankment. Date: 9/19/12 Photo Number: 22 Photographer: NJA	

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: NE

Description: FGD-B Pond. Inboard face of Northern embankment. Note exposed liner.

Date: 9/19/12

Photo Number: 23

Photographer: RCG

Orientation: S

Description: FGD-B Pond. Outboard face of Western embankment.

Date: 9/19/12

Photo Number: 24

Photographer: RCG

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: N

Description: FGD-B Pond. Inboard face of Western embankment.

Date: 9/19/12

Photo Number: 25

Photographer: RCG

Orientation: E

Description: FGD-B Pond. Inboard face of Southern embankment.

Date: 9/19/12

Photo Number: 26

Photographer: RCG

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: NW

Description: FGD-B Pond. Outboard face of Northern embankment.

Date: 9/19/12

Photo Number: 27

Photographer: RCG

Orientation: NE

Description: FGD-B Pond. Discharge end of overflow/ decant pipe from FGD-A Pond.

Date: 9/19/12

Photo Number: 28

Photographer: RCG

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: E

Description: Outboard face of the Western embankment of FGD-A. Note valve-box for control valve on overflow/ decant pipe.

Date: 9/19/12

Photo Number: 29

Photographer: NJA

Orientation: N

Description: FGD-B Pond. Inboard face of Eastern embankment.

Date: 9/19/12

Photo Number: 30

Photographer: RCG

O'BRIEN & GERE

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122.270.100
Site Name:	Oak Grove Steam Electric Station	Location:	Franklin. Robertson County, TX

Orientation: N Description: Outboard face of the Western embankment of FGD-A Pond as observed from crest of FGD-B Pond. Date: 9/19/12 Photo Number: 31 Photographer: NJA	
Orientation: W Description: FGD-B Pond. Deep erosion gully on the inboard face of the Eastern Embankment. Date: 9/19/12 Photo Number: 32 Photographer: RCG	

APPENDIX C

Pertinent Documentation

NOTE: Copies of the March 2011 "FGD-A Slope Stability Evaluation Report" and the April 2010 "FGD-B Slope Stability Investigation" Report currently marked "Confidential" will be included in the Final Dam Safety Assessment Report of the Oak Grove SES