

# **2018 ANNUAL LANDFILL INSPECTION REPORT**

**FOR**

**GRAND RIVER DAM AUTHORITY LANDFILL**

**GRAND RIVER ENERGY CENTER**

**MAYES COUNTY, OKLAHOMA**

**SOLID WASTE PERMIT NO. 3549012**

**PREPARED FOR:**

**GRAND RIVER DAM AUTHORITY  
VINITA, OKLAHOMA**

**DECEMBER 21, 2018**

**A&M PROJECT NO. 1986-035**

**PREPARED BY:**



**A & M Engineering and  
Environmental Services, Inc.**

Consulting - Design - Construction - Remediation

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GRAND RIVER DAM AUTHORITY LANDFILL  
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MAYES COUNTY, OKLAHOMA**

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**CERTIFICATION STATEMENT**

I certify that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly observe, gather and evaluate the information submitted. The information submitted in this document is relevant to the annual inspection of the Grand River Dam Authority Coal Ash Landfill, located within the Grand River Energy Center complex in Mayes County, Oklahoma, that was performed on September 27, 2018. Based on the facility records reviewed and the on-site inspection performed, this report is to the best of my knowledge and belief, true, accurate and complete.

**A & M ENGINEERING AND ENVIRONMENTAL SERVICES, INC.**



12-21-2018

\_\_\_\_\_  
Tolga M. Ertugrul, P.E.

\_\_\_\_\_  
Date

Oklahoma Registration No. 33321

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**GRAND RIVER DAM AUTHORITY LANDFILL**  
**GRAND RIVER ENERGY CENTER**  
**MAYES COUNTY, OKLAHOMA**

**1.0 INTRODUCTION**

The Grand River Dam Authority (GRDA) owns and operates an electric generating station, referred to as the Grand River Energy Center (GREC), approximately three (3) miles east of the City of Chouteau in Mayes County, Oklahoma. Two (2) coal fired boilers are operated at GREC which produce Coal Combustion Residuals (CCRs) consisting of fly ash and bottom ash. Fly ash comprises greater than 80% of CCRs generated at the facility and is largely sold for beneficial use purposes. Excess fly ash and bottom ash is disposed at a permitted coal ash landfill, herein referred to as the GRDA Landfill, located within the GREC complex.

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published a final rule for the Disposal of CCRs from Electric Utilities. This new rule regulates the disposal of CCRs under Title 40 of the Code of Federal Regulations (CFR), Parts 257 and 261. The rule applies both to new and existing CCR landfills and surface impoundments at coal burning electric utility sites. The State of Oklahoma also approved new regulations for the disposal of CCRs from Electrical Utilities under Oklahoma Administrative Code (OAC), Title 252, Chapter 517 which went into effect on September 15, 2016. The requirements of OAC 252:517 largely mirror the requirements of the Federal regulations.

As required by 40 CFR Part 257.84(b) and OAC 252:517-13-5(b), existing CCR landfills and any lateral expansion of a CCR landfill must be inspected on a periodic basis by a qualified Professional Engineer to ensure that the design, construction, operation and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards (USEPA, 2015). A & M Engineering and Environmental Services, Inc. (A & M Engineering) was retained by GRDA to perform the annual inspection of the existing landfill and provide this report for compliance with 40 CFR Part 257.84 and OAC 252:517-13-5(b).

A & M Engineering performed a visual inspection of the GRDA Landfill and a review of information available within the landfill operating record on September 27, 2018. This report has been prepared to document the inspection performed and relevant information identified.

## **2.0 LANDFILL INFORMATION**

The GRDA Landfill is currently permitted by the Oklahoma Department of Environmental Quality (DEQ) as a Non-Hazardous Industrial Waste Landfill that is allowed to accept fly ash, bottom ash and spent powdered activated carbon used to control flue gas emissions, generated at the GREC (DEQ, 2015). The GRDA Landfill is situated south of the coal fired boiler units within the GREC complex. Following a recent Tier I Permit Modification, the total landfill permit area consists of approximately 48 acres, of which only 47 acres have been utilized to date and remain active. A Site Map is shown in **Figure 1** in **Appendix A**. The following subsections provide information regarding the general history of the landfill, design and construction of the landfill, operational methods employed, volume of CCRs placed in the landfill and other pertinent information identified during review of the landfill operating record.

### **2.1 GENERAL HISTORY**

On January 13, 1981, the Oklahoma State Department of Health (OSDH) issued GRDA a permit to construct, operate and maintain a coal ash landfill at the GREC (OSDH, 1981). The purpose of the landfill was to provide a proper means of disposal for ash materials that would be generated as a by-product of coal combustion from the electric generating station that was under construction at the time. The initial permit stipulated that only fly ash and bottom boiler ash resulting from the burning of coal at the GREC could be disposed at the site and that the landfill would be constructed and operated in strict accordance with the engineering plans and specifications approved by the OSDH. Since initial permitting and construction, GRDA has operated and maintained the landfill in accordance with the developing Federal and State rules and regulations applicable to the site.

## **2.2 DESIGN AND CONSTRUCTION HISTORY**

The CCR landfill is lined with a low permeability clayey gravel to gravelly lean clay stratum of varying thickness ranging from 5 feet to 12 feet in thickness. The landfill was initially established by constructing a perimeter dike around a 70-acre portion of the permitted landfill.

Based on documentation reviewed, it appears that the perimeter dikes were constructed of suitable clay materials from the site. Approved grading plans for the site indicate that the exterior slopes of the perimeter dike were designed to range between 3 feet Horizontal to 1 foot Vertical (3:1) and 2.5:1 while the interior slopes were designed to range between 2:1 and 2.5:1 (Holway-United, 1979).

A & M Engineering is not aware of nor has it reviewed any previously performed slope stability analysis of the landfill. However, provided the pozzolanic properties of fly ash, proper placement of ash materials, adequate storm water drainage and covering of the landfill is expected to promote age hardening of the fill material thereby resulting in a stable landform with reduced permeability and leachate generation. In addition, A & M Engineering prepared an unstable areas analysis earlier this year per the requirements of 40 CFR §257.64 and OAC 252:517-5-5 and concluded that no on-site or local geologic or geomorphologic features or human-made conditions exist at the CCR landfill site that would be considered as an unstable condition.

The landfill was designed so that all surface water drainage is routed around the landfill area and into a series of permitted Class III industrial wastewater treatment impoundments regulated under an Oklahoma Pollutant Discharge Elimination System (OPDES) permit. The industrial wastewater system consists of eleven (11) process water and storm water retention/treatment basins around the western and southern perimeter of the landfill. These surface impoundments provide a total holding capacity of 1,371,521,000 gallons as stated in the facility OPDES permit and receive process water; cooling tower water; and storm water run-off from the landfill, coal pile, and the operational areas of the plant.

### **2.3 OPERATIONAL METHODS**

General operational activities employed at the GRDA Landfill include the transportation and placement of CCRs in the landfill; general maintenance of the landfill; and installation of soil cover as necessary.

CCR material to be disposed at the landfill is transferred from storage silos to transport vehicles utilizing dry loading methods. During loading, fly ash is moisture conditioned for the purposes of fugitive dust control and compaction in the landfill (GRDA, 2015). Bottom ash has a granular/gravel texture and is also dampened with water for fugitive dust control purposes prior to loading (GRDA, 2015). Once loaded, the transport vehicles then convey CCRs to the landfill for final disposal. At the landfill, water trucks are used to minimize fugitive dust as necessary. Application of daily soil cover is not generally necessary for the conditions at this landfill.

As design top-of-waste elevations are achieved, GRDA has applied either final or intermediate soil cover to the exterior landfill slopes and has established vegetation in order to minimize water infiltration into the landfill and reduce erosion and transport of soils and/or CCR materials from the landfill. Side slopes are regularly mowed, monitored and maintained. Precipitation run-off from the exterior slopes is collected within the wastewater impoundments around the landfill. Precipitation run-off from the active landfill area is collected within the permitted landfill area and evaporated or drained into the industrial wastewater treatment system.

### **2.4 VOLUME OF CCR**

It is reported that CCRs generated at the GREC have been placed in the landfill since 1982. Based on historical records of CCR disposal at the landfill and the expected compaction density of these materials, GRDA estimated that approximately 4,322,790 cubic yards of CCRs have been placed within the landfill through September 30, 2018.

From January 2018 through September 2018, GRDA placed 4,275.25 Tons of flyash and 1,402.50 Tons of bottom ash. Using estimated specific gravities of 2.5 for flyash and 2.4 for bottom ash, the placed volume of waste is 2,722 cubic yards as a result, it is estimated that approximately 2,722 cubic yards of airspace capacity was utilized during this time period.

GRDA has placed approximately 4,322,790 cubic yards of CCRs within the landfill through September 30, 2018.

## **2.5 WEEKLY LANDFILL INSPECTIONS**

GRDA personnel perform weekly inspections of the GRDA Landfill in accordance with 40 CFR 257.84 and OAC 252:517-13-5(b). The primary purpose of the weekly inspections is to examine the landfill for any appearances of actual or potential structural weaknesses that have the potential to affect the safety of the landfill. Items to inspect for include: surface cracks, both transverse and longitudinal; slides, sinkholes or depressions; missing vegetative cover; vegetation larger than two (2) inches in diameter; accumulated liquid; and surface discoloring indicating ash discharge from the landfill. Review of weekly landfill inspection forms do not indicate any safety or stability concerns.

## **2.6 QUARTERLY DEQ LANDFILL INSPECTIONS**

DEQ personnel inspect the GRDA Landfill on a quarterly basis for permit compliance and regulatory requirements. DEQ inspections performed in 2018 did not indicate any compliance issues or problem areas that have not been identified in this Report.

## **3.0 LANDFILL INSPECTION**

A visual field inspection of the GRDA Landfill was conducted by A & M Engineering President, Tolga M. Ertugrul, P.E, on September 27, 2018. Mr. Ertugrul is a licensed Professional Engineer in the State of Oklahoma.

GRDA personnel accompanied Mr. Ertugrul during an initial walk through of the landfill facility. Mr. Ertugrul performed a visual inspection of the landfill perimeter dikes, side slopes and top. Mr. Ertugrul inspected the landfill by driving around the perimeter dike and making observations regarding the condition of the dike and exterior side slopes. Mr. Ertugrul stopped as conditions warranted or at every 400 to 500 feet to inspect the perimeter dike and exterior side slopes by foot. The crest of the landfill slope was similarly inspected. The visual inspection focused on identifying any actual or potential structural weakness of the landfill by the identification of indicators such as surface cracks, slides, slumping, sinkholes, depressions,



missing vegetative cover, excessive animal burrows, or leachate seepage. Photographic documentation was collected and filed in the landfill operating record for the purposes of comparison during the next annual inspection. A landfill inspection form completed during the inspection is provided in **Appendix B**.

### **3.1 LANDFILL GEOMETRY**

The permitted landfill limits are shown in **Figure 1**. Approximately 47 acres of this area have been utilized and remain active to date. The southern half of this area is near the maximum design elevation according to the facility Closure Plan. The elevation of the crest along the southern edge of the landfill is reported to be approximately 680 feet referenced to the NAVD 1988 vertical datum. The lowest point along the toe of dike is reported to be at approximately 606 feet. An intermediate or final cover has been installed on the southern and western exterior slopes of the landfill. These slopes are well vegetated and maintained. Precipitation run-off from the exterior slopes is collected within the wastewater impoundments around the landfill. The eastern and northern slopes of the active landfill are within the limits of the landfill perimeter dike. Precipitation run-off from the active landfill area is collected and evaporated or drained into the permitted industrial wastewater treatment system.

### **3.2 INSPECTION OBSERVATIONS**

The perimeter dikes and exterior slopes were generally observed to be well maintained and in good structural condition. Vegetation was generally well established on exterior slopes and no signs of instability were observed.

There were no observed appearances of actual or potential structural weakness or existing conditions that are disrupting or have a potential to disrupt the operation and safety of the landfill.

Near the northeast corner of the landfill, there is an area with slopes that are steeper than the 2.5:1 design. A new eastern perimeter embankment will be constructed in 2019 in association with the Tier I Permit Modification at which time this area will be improved and vegetated. The northwest corner of the landfill was also observed to have areas that needed minor dressing and

re-vegetation. These areas will also be addressed during the upcoming eastern perimeter embankment construction activities.

### **3.3 OBSERVED CHANGES IN GEOMETRY**

Based on the visual inspection of the landfill, the geometry does not appear to have changed significantly compared to the conditions documented in the 2017 annual landfill inspection report or the aerial photograph depicted in **Figure 1**. Primary fill activities remain at the top of the landfill and within the northern half of the active area. Intermediate or final cover was observed on the western and southern exterior slopes of the landfill with established and maintained vegetation.

### **4.0 SUMMARY OF FINDINGS**

As required by 40 CFR 257.84(b) and OAC 252:517-13-5(b), A & M Engineering performed a visual inspection of the GRDA Landfill and a review of information available within the landfill operating record on September 27, 2018. The landfill appears to have been constructed in accordance with the engineering plans approved by the OSDH in the early 1980's. On-going operations and maintenance of the GRDA Landfill appear to be conducted in a manner consistent with current DEQ regulations and generally accepted good engineering standards. A & M Engineering did not observe any maintenance issues. The landfill was generally observed to be well maintained and in good structural condition. No observations were found that would indicate an imminent danger or instability of the landfill.

### **5.0 LIMITATIONS**

The conclusions and recommendations presented in this report are based upon a review of relevant and available documents provided by GRDA as well as a visual inspection of the landfill that was performed by driving and walking around the majority of the landfill site. The purpose of this inspection was to ensure that the design, construction, operation and maintenance of the landfill is consistent with recognized and generally accepted good engineering standard with specific regards to the safety or adequacy of the facility against catastrophic failure during normal operation or during unusual events. The conclusions and recommendations presented in

this report were based on generally accepted engineering principles and practices at the time services were provided. No warranties, expressed or implied, are intended to be made.

## **6.0 REFERENCES**

Holway-United, *Grand River Dam Authority 490-MW Coal-Fired Generating Station Ash Disposal Site Permit Application, Chouteau, Oklahoma.* August 22, 1979.

Oklahoma State Department of Health (OSDH), *Permit for a Coal Ash Disposal Site.* January 13, 1981.

Oklahoma Department of Environmental Quality (DEQ), *Permit Modification to add an additional Solid Waste Stream, Grand River Dam Authority, Mayes County, Permit 3549012.* February 20, 2015.

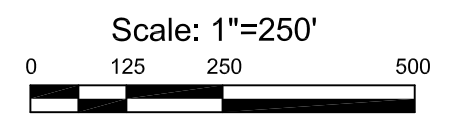
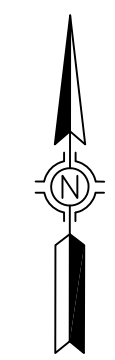
State of Oklahoma, *Oklahoma Administrative Code, Title 252, Chapter 517, Disposal of CCR from Electric Utilities.* September 15, 2016.

United States Environmental Protection Agency (USEPA), *40 CFR Part 257, Subpart D, Disposal of CCR from Electric Utilities.* April 17, 2015.

Grand River Dam Authority (GRDA), *Coal Combustion Residual Fugitive Dust Control Plan for Grand River Energy Center.* October 2015

## **APPENDIX A**

### **FIGURES**



Permit Boundary

GENERAL NOTES

1. AERIAL PHOTOGRAPHY FROM BING MAPS 2018.

REVISIONS

NO.	DESCRIPTION	BY	CHECKED	DATE	NO.	DESCRIPTION	BY	CHECKED	DATE



**A & M Engineering and Environmental Services, Inc.**  
 Consulting - Design - Construction - Remediation

**SITE MAP**  
**GRAND RIVER DAM AUTHORITY LANDFILL**  
**CHOUTEAU, OKLAHOMA**

DRAWN: TF	CHECKED BY: TE	MATERIALS BY:	ENGINEER: TE	APPROVED BY:	SCALE: 1" = 250'	PROJECT NUMBER: 1986-035	DRAWING NUMBER: 1 OF 1	REV.:
DATE: 12-21-18	DATE: 12-21-18	DATE:	DATE: 12-21-18	DATE:				

PATH: Z:\14 - Engineering & Environmental\Active\1986 - GRDA\013 - Annual Landfill Inspection\04 - 2018\Figures  
 FILE: E:\Site Maps\04 Inspection.dwg  
 DATE: Dec 21, 2018 - 7:48PM

**APPENDIX B**

**LANDFILL INSPECTION FORM**



## LANDFILL INSPECTION FORM

<b>Facility Name</b>	<b>Facility Location</b>
Grand River Energy Center Landfill	Mages County, OK
<b>Inspector Name</b>	<b>Inspection Date</b>
Tolga Ertugral, P.E.	9/27/18

LOCAL WEATHER CONDITIONS					
<b>Weather:</b>	<input type="checkbox"/> Brite Sun	<input checked="" type="checkbox"/> Clear	<input type="checkbox"/> Overcast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow
<b>Temp:</b>	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input checked="" type="checkbox"/> 70-85	<input type="checkbox"/> >85
<b>Wind:</b>	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Mod.	<input type="checkbox"/> High		
<b>Notes:</b>					

PERIMETER BERMS				
<b>Cover:</b>	<input checked="" type="checkbox"/> Veg.	<input type="checkbox"/> Soil	<input type="checkbox"/> Gravel	<input type="checkbox"/> Other:
<b>Issues:</b>	<input type="checkbox"/> None	<input type="checkbox"/> Animal Burrows	<input type="checkbox"/> Veg. >2" dia.	<input type="checkbox"/> Bare Spots
	<input type="checkbox"/> Poor Veg. Cover	<input type="checkbox"/> Erosion	<input type="checkbox"/> Seepage	<input type="checkbox"/> Drainage
	<input type="checkbox"/> Settlement	<input type="checkbox"/> Cracks	<input type="checkbox"/> Mass Movement	<input type="checkbox"/> Other:
<b>Comments/Action Required:</b>				

EXTERIOR SLOPES				
<b>Cover:</b>	<input checked="" type="checkbox"/> Veg.	<input type="checkbox"/> Soil	<input type="checkbox"/> Gravel	<input type="checkbox"/> Other:
<b>Slopes:</b>	<input type="checkbox"/> 2:1	<input checked="" type="checkbox"/> 3:1	<input checked="" type="checkbox"/> 4:1	<input type="checkbox"/> 5:1
<b>Issues:</b>	<input type="checkbox"/> None	<input type="checkbox"/> Animal Burrows	<input type="checkbox"/> Veg. >2" dia.	<input type="checkbox"/> Bare Spots
	<input type="checkbox"/> Poor Veg. Cover	<input type="checkbox"/> Erosion	<input type="checkbox"/> Seepage	<input type="checkbox"/> Drainage
	<input type="checkbox"/> Settlement	<input type="checkbox"/> Cracks	<input type="checkbox"/> Mass Movement	<input type="checkbox"/> Other:
<b>Comments/Action Required:</b>	Slopes on NW corner need dressing up and re-seeding in spots. NE corner of Landfill has slopes steeper than 2.5:1, needs veg.			

LEACHATE SYSTEM				
<b>Type:</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Sump/Pump	<input type="checkbox"/> Sump/Gravity	<input type="checkbox"/> Sump/Pump
	<input type="checkbox"/> Impoundment	<input type="checkbox"/> Tank	<input type="checkbox"/> Other:	
<b>Issues:</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Leaks	<input type="checkbox"/> Pumps	<input type="checkbox"/> Piping
	<input type="checkbox"/> Impoundment	<input type="checkbox"/> Tank	<input type="checkbox"/> Other:	
<b>Comments/Action Required:</b>				

<b>STORM WATER CONTROL</b>			
<b>Issues:</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Erosion	<input type="checkbox"/> Washouts
	<input type="checkbox"/> Culverts	<input type="checkbox"/> Ditches	<input type="checkbox"/> Riprap:
	<input type="checkbox"/> Other:	<input type="checkbox"/> Sediment	<input type="checkbox"/> Diversions
<b>Are Erosion or Sediment Controls Sufficient and Good Repair?</b>		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
<b>Are Storm Water Run-On Measures Sufficient and in Good Repair?</b>		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
<b>Are Storm Water Run-Off Measures Sufficient and in Good Repair?</b>		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
<b>Comments/Action Required:</b> <i>Minor repair is needed where described in Exterior Slopes Section, these issues will be repaired when new perimeter berm is constructed in 2019.</i>			

<b>MONITORING WELLS</b>			
<b>Are all wells in satisfactory condition?</b>	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
<b>Are all wells easily accessible?</b>	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
<b>Are all wells properly locked and secured?</b>	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
<b>Comments/Action Required:</b>			

<b>GAS WELLS AND VENTS</b>			
<b>Are all wells and vents in satisfactory condition?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
<b>Are all wells and vents easily accessible?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
<b>Are all wells and vents properly locked and secured?</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
<b>Comments/Action Required:</b>			

<b>GENERAL SITE CONDITIONS</b>	
<b>Overall Site Conditions:</b>	<i>Site is well maintained, No signs of instability</i>
<b>Security and Access Control:</b>	<i>Security fence and guardhouse; well maintained</i>
<b>Other Comments:</b>	

<b>Inspector Signature and Date:</b>
 <span style="font-size: 2em; vertical-align: middle; margin-left: 20px;">9/27/18</span>