

2019 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
CHOUTEAU, OKLAHOMA**

DECEMBER 2019

A&M PROJECT NO. 1986-037

PREPARED BY:



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

Consulting - Design - Construction - Remediation

CERTIFICATE OF AUTHORIZATION No.1326, EXP:6/30/2020

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GRAND RIVER ENERGY CENTER
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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 December 19, 2019. 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.

I certify to the best of my knowledge, information and belief the information contained in this report meets the requirements of OAC 252:517-13-5(b).

A & M ENGINEERING AND ENVIRONMENTAL SERVICES, INC.



Tolga M. Ertugrul, P.E.
Oklahoma Registration No. 30017

1-15-2020
Date

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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 miles east of the City of Chouteau in Mayes County, Oklahoma. Two (2) coal fired boilers were operated at GREC, which produce Coal Combustion Residuals (CCRs) consisting of fly ash and bottom ash. Currently, only one (1) coal fired boiler is in operation. Fly ash comprises greater than 80 percent (%) 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. EPA also approved new regulations issued by the State of Oklahoma addressing the disposal of CCRs from Electrical Utilities. These regulations are codified in the Oklahoma Administrative Code (OAC), Title 252, Chapter 517, and went into effect on September 15, 2016. The requirements of OAC 252:517 largely mirror the requirements of the Federal regulations.

As required by OAC 252:517-13-5(b), existing CCR landfills and any lateral expansion of a CCR landfill must be inspected on an annual 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) was retained by GRDA to perform the annual inspection of the existing landfill. This report complies with the requirements under OAC 252:517-13-5(b).

A & M performed a visual inspection on December 19, 2019 of the GRDA Landfill. Additionally, A & M reviewed the 2019 weekly landfill inspection reports, inspection reports from the Oklahoma Department of Environmental Quality (ODEQ), and 2019 ground water monitoring results along with existing operating records to prepare this annual report.

2.0 LANDFILL INFORMATION

The GRDA Landfill is currently permitted by the ODEQ 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 (ODEQ, 2015). The GRDA Landfill is situated south of the coal fired boiler units within the GREC complex. Following the 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. The following subsections provide information regarding the general history, design and construction, operational methods, and volume of CCRs placed in the landfill.

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.

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 five feet to 12 feet in thickness. The landfill was initially established by constructing a perimeter berm around a 70-acre portion of the permitted landfill.

GRDA is conducting a geotechnical evaluation of the existing berms and expects those results to be available in June 2020. Based on visual inspection of the samples, we believe that the perimeter berms were constructed using suitable fill material. Grading plans approved by the OSDH indicate that the exterior slopes of the perimeter berm were designed to range between three feet Horizontal to one foot Vertical (3:1 h:v) and 2.5:1 (h:v) while the interior slopes were designed to range between 2:1 and 2.5:1 (h:v) (Holway-United, 1979).

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 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.

The south and west slopes of the landfill were previously capped with an infiltration layer exceeding 18 inches in thickness and a topsoil layer exceeding six inches in thickness. The thickness and the permeability of the existing capping layers were analyzed in August 2019 by collecting samples using a Geoprobe[®]. The initial permeability results indicate that the existing capping layer complies with the final cover requirements in OAC 252:517-5-7(d)(3) and will be confirmed in the final report due in June 2020.

2.3 OPERATIONAL METHODS

General operational methods utilized at the GRDA Landfill include the transportation and placement of CCRs, general maintenance, and installation of soil cover as necessary.

CCR material to be disposed at the landfill is transferred from storage silos on to transport vehicles, utilizing dry loading methods. During loading, fly ash is moisture conditioned for 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 needed.

To minimize water infiltration and reduce erosion, GRDA has applied final or intermediate soil cover to the exterior landfill slopes and has established vegetation on the southern and western slopes. These efforts minimize water infiltration into the landfill and reduce erosion and transport of soils and/or CCR materials from the landfill. In addition, the side slopes of the landfill are monitored and maintained through regular mowing and inspection. To further minimize transport of CCR from the landfill, 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

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

From October 2018 through December 2019, GRDA placed 6,080 tons of bottom ash in the landfill. No fly ash was placed in the landfill during this period. Using an estimated specific gravity of 2.4 for bottom ash, GRDA placed approximately 3,006 cubic yards during this time period. As a result, it is estimated that approximately 3,006 cubic yards of storage capacity was utilized during this time period. Therefore, GRDA has placed approximately 4,325,797 cubic yards of CCRs within the landfill through December 31, 2019.

2.5 WEEKLY LANDFILL INSPECTIONS

GRDA personnel perform weekly inspections of the GRDA Landfill in accordance with 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 and integrity of the landfill. The inspection is designed to identify 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 discoloration that may indicate ash discharge from the landfill. Review of weekly landfill inspection forms do not indicate any safety or stability concerns.

2.6 QUARTERLY ODEQ LANDFILL INSPECTIONS

ODEQ personnel inspect the GRDA Landfill to determine compliance with the status and condition of the CCR unit. The inspections conducted in 2019 did not identify signs of distress or malfunction of the landfill.

3.0 LANDFILL INSPECTION

A visual field inspection of the GRDA Landfill was conducted by A & M President, Tolga M. Ertugrul, P.E, on December 19, 2019. Mr. Ertugrul is a licensed Professional Engineer in the State of Oklahoma. The landfill was inspected by driving around the perimeter berm and making observations every 400 to 500 feet or as necessary to document the condition of the berm and side slopes.

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. A landfill inspection form completed during the inspection is provided in **Appendix B**.

3.1 LANDFILL GEOMETRY

The permitted landfill boundary is illustrated in **Appendix A**. Approximately 47 acres are utilized and remain active to date. The southern half of this area is near the maximum design elevation according to the existing facility Closure Plan. The elevation of the crest along the southern edge of the landfill is approximately 680 feet in elevation (NAVD 1988 vertical datum). The lowest point along the toe of berm is approximately 606 feet in elevation. 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 berm. The topography of the active disposal area was slightly changed as a result of grading activities designed to prevent the accumulation of stormwater on top of the landfill. 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 berms and exterior slopes forming the perimeter road of the original landfill were generally observed to be well maintained and in good structural condition. Vegetation was generally well established on the exterior southern and western slopes and no signs of instability were observed.

Standing water was observed near the outer portion of the existing haul road on the east side of the landfill; near the northwest corner of the landfill; as well south of the outer toe of the southern berm. The source of the standing water is unclear and may be due to the rainfall totaling 0.3 of an inch from December 15th through the 19th prior to the inspection (Inola Mesonet; approximately 9.5 miles from GREC). Given the age of the landfill (approximately 40 years), it is anticipated that some water resulting from direct precipitation on the landfill may also be present within the landfill. However, considering the pozzolanic properties of fly ash, proper placement and compaction of the ash materials, adequate storm water drainage, and covering of the landfill, age hardening of the fill material would also be expected thereby resulting in a stable landform with reduced permeability, infiltration, and free-water generation.

A test boring to a depth of 70 feet from the top of the landfill was performed by Mohawk Drilling in 2019 to measure the blow counts by Standard Penetration Testing Method within the landfill. The blow count values show high strength characteristics throughout the fly ash deposited in the landfill. Furthermore, the sampling records for the effluent from the outfall permitted under the facility's OPDES permit, which is discharging effluent from the industrial surface impoundments surrounding the landfill, do not reflect any changes that would suggest contamination from landfill leachate. In addition, there were no observed appearances of actual or potential structural weakness or existing conditions that are disrupting the operation and safety of the landfill.

Local erosion was observed at the east side of the Landfill. Near the northeast corner of the landfill, there is an area with slopes that are steeper than 3:1 (h:v). A new eastern perimeter embankment has been proposed and will be constructed in pursuant to a Tier I Permit Modification. The northwest corner of the landfill was also observed to have areas that require 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 2018 annual landfill inspection report or the aerial photograph depicted in **Appendix A**. Primary fill activities remain at the top of the landfill and within the northern half of the active area. 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 OAC 252:517-13-5(b), A & M performed a visual inspection of the GRDA Landfill and a thorough review of information available within the landfill operating record on December 19, 2019. Available data indicates that the landfill was 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 ODEQ regulations and generally accepted good engineering standards.

A & M did not observe any maintenance issues apart from the presence of erosion on the northeast and northwest landfill slope faces. These areas will be improved during the upcoming eastern perimeter embankment construction activities. 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.

Due to the observed presence of standing water near the toe of the outer slopes of the south, northwest and northeast corner of the landfill, GRDA should continue to monitor these areas for

potential evidence for seepage. It is noted that GRDA is currently taking proactive measures to further evaluate these areas using non-intrusive geophysical techniques and by performing subsurface drilling and geotechnical testing (final report expected in June 2020).

There were no signs of structural weakness or disruptive conditions that were observed at the time of the inspection that would require immediate remediation. Further subsurface and non-intrusive testing methods are being conducted in and around the landfill to acquire engineering data for future design activities related to the eastern embankment as well as a closure plan design.

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 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 standards. Our findings suggest that the landfill was designed to protect 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 – SITE MAP



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

LEGEND	
	Approximate Landfill Permit Boundary
	Eastern Perimeter Dike
	East Haul Road

SITE MAP		
Grand River Dam Authority Chouteau, Oklahoma		
SCALE: 1" = 550'	DATE: 12/19/2019	FIGURE NO. FIGURE 1
APPROVED BY: TE	DRAWN BY: TF	PROJECT NO. 1986-037

APPENDIX B – LANDFILL INSPECTION FORM



LANDFILL INSPECTION FORM

Facility Name & Designation		Facility Location	
Grand River Energy Center CCR Landfill		Chouteau, Oklahoma	
Inspector Name		Inspection Date	Date of Last Inspection
Tolga M. Ertugrul, P.E.		12-19-2019	9/27/18

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

OVERALL STATUS OF CURRENT INSPECTION				
<input checked="" type="checkbox"/> Satisfactory	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor	<input type="checkbox"/> Unsatisfactory	<input type="checkbox"/> Not Rated

<input checked="" type="checkbox"/> YES	<input type="checkbox"/> N/A	PERIMETER BERMS			
Cover:	<input checked="" type="checkbox"/> Veg.	<input checked="" type="checkbox"/> Soil	<input type="checkbox"/> Gravel	<input type="checkbox"/> Other:	
Issues:	<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: (Debris, Vandalism, etc.)	
Comments/Action Required:					

<input checked="" type="checkbox"/> YES	<input type="checkbox"/> N/A	EXTERIOR SLOPES			
Cover:	<input checked="" type="checkbox"/> Veg.	<input type="checkbox"/> Soil	<input type="checkbox"/> Gravel	<input type="checkbox"/> Other:	
Slopes:	<input type="checkbox"/> 2:1	<input checked="" type="checkbox"/> 3:1	<input checked="" type="checkbox"/> 4:1	<input type="checkbox"/> 5:1	
Issues:	<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 checked="" 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: (Debris, Vandalism, etc.)	
Comments/Action Required: NE corner of landfill is as steep as 2.5:1 in areas. The upcoming construction project will address. NW corner of landfill needs dressing in spots.					


<input type="checkbox"/> YES	<input checked="" type="checkbox"/> N/A	LEACHATE SYSTEM			
Type:	<input 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:		
Issues:	<input 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:		
Comments/Action Required:					

<input checked="" type="checkbox"/> YES <input type="checkbox"/> N/A	STORM WATER CONTROL			
Issues:	<input type="checkbox"/> None	<input type="checkbox"/> Erosion	<input type="checkbox"/> Washouts	<input type="checkbox"/> Sediment
	<input type="checkbox"/> Culverts	<input type="checkbox"/> Ditches	<input type="checkbox"/> Riprap:	<input type="checkbox"/> Diversions
	<input checked="" type="checkbox"/> Other:			
Are Erosion or Sediment Controls Sufficient and Good Repair?			<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
Are Storm Water Run-On Measures Sufficient and in Good Repair?			<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
Are Storm Water Run-Off Measures Sufficient and in Good Repair?			<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
Comments/Action Required: Minor amounts of standing water along toe of outer slopes of the south, northwest and northeast corner of the landfill. The site has received rainfall recently.				

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

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

GENERAL SITE CONDITIONS	
Overall Site Conditions:	NO signs of structural weakness or disruptive conditions observed at the time of the inspection that require immediate remediation.
Security and Access Control:	The site is secure and access is controlled.
Other Comments:	

Inspector Signature and Date:
 12/19/2019