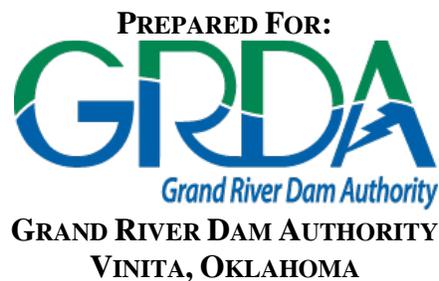


CLOSURE PLAN
FOR
GRAND RIVER DAM AUTHORITY LANDFILL
GRAND RIVER ENERGY CENTER
MAYES COUNTY, OKLAHOMA
SOLID WASTE PERMIT NO. 3549012



FEBRUARY 22, 2018

A & M PROJECT NO. 1986-018



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TABLE

TABLE 1 GRDA LANDFILL TENTATIVE CLOSURE SCHEDULE

FIGURES

FIGURE 1 GRDA LANDFILL CLOSURE CONTOURS



CERTIFICATION STATEMENT

I certify that this Closure Plan was prepared under my direction or supervision in accordance with good engineering practice and the requirements of Oklahoma Administrative Code (OAC) 252:517 for the GRDA Landfill located within the Grand River Energy Center complex in Mayes County, Oklahoma. Based on the information reviewed, this report is to the best of my knowledge and belief, true, accurate and complete.

A & M ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Jared T. Bates, P.E.

Oklahoma Registration No. 20681

Date



CLOSURE PLAN
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GRAND RIVER ENERGY CENTER
MAYES COUNTY, OKLAHOMA

1.0 INTRODUCTION

The Grand River Dam Authority (GRDA) owns and operates the Grand River Energy Center (GREC) electric generating station located 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.

The GRDA Landfill is 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 and has been in operation since 1982. The original landfill permit area consisted of approximately 116 acres, of which only 69.5 acres was available for use. A revised permit area was established in October 2017 which reduced the permit area to approximately 67 acres, of which 48 acres was available for use. 47 acres have been utilized for CCR disposal to date.

40 CFR 257.102(b) requires existing CCR landfills to prepare “*a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section.*”

Oklahoma adopted the new CCR rules into code OAC 252:517, adopted February 17, 2017, approved by the Governor June 13, 2017, effective September 15, 2017.



OAC 252:517-15-7(b)(1) states: *The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(A) through (F) of this Section.*

This Closure Plan has been prepared to satisfy the requirements of Oklahoma Administrative Code (OAC) 252:517.

2.0 CLOSURE PLAN [OAC 252:517-15-7]

Closure of the GRDA Landfill will be necessary once there is no further CCR production at GREC or once the final closure elevations for CCR materials are achieved. Closure of the landfill will be accomplished by closing the CCR waste materials in place. The proposed closure of the GRDA Landfill will be completed according to the following general steps:

- The top of the CCR waste material will be graded and compacted to establish a stable subgrade for the construction of the final cover system. Subgrade elevations shall not exceed the maximum allowable top of waste elevations as determined by the approved closure grading plan.
- A twenty four (24) inch thick compacted barrier layer consisting of clay soil shall be placed over the prepared subgrade.
- A minimum of twelve (12) inches of soil capable of sustaining native plant growth shall be placed over the compacted barrier layer.
- Native plant cover shall be installed through seeding, sprigging, or sodding of the site.
- Soil and vegetative cover of the southern and western exterior slopes that was installed earlier shall be inspected and restored, if necessary.

The following sections further describe the applicable closure requirements and procedures.



2.1 FINAL COVER SYSTEM [OAC 252:517-15-7(D)(3)]

The purpose of the final cover system is to control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste thereby minimizing the release of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.

Based on the existing DEQ approved landfill Closure Plan, a maximum of 48 acres will require final closure as shown in **Figure 1**. If closure is required prior to the utilization of the entire 48 acre area, this Plan will be revised and a revised closure design will be developed. It is anticipated that prior to the closure of GRDA Landfill, updated engineered construction drawings and specifications will be prepared for closure construction and submitted to DEQ for approval prior to commencing closure activities.

The final cover system will consist of a clay barrier layer, an erosion layer and vegetative cover. Prior to final cover system construction, the top of the CCR waste material will be graded and compacted to establish a firm subgrade for final cover construction.

The clay barrier layer will consist of at least twenty four (24) inches of earthen material constructed in six (6) inch compacted lifts over the prepared subgrade. The clay barrier layer shall have a hydraulic conductivity no greater than 1.0×10^{-5} cm/sec. It is estimated that 158,300 cubic yards of clay material will be required to construction the clay barrier layer.

The barrier layer soils shall meet the following standards:

1. **Plasticity Index (ASTM D4318):** Plasticity index shall be greater than or equal to 10%.
2. **Liquid Limit (ASTM D4318):** Liquid Limit shall be greater than or equal to 24%.
3. **Percent Fines (ASTM D422):** Percent fines passing the #200 mesh sieve shall be greater than or equal to 30%.
4. **Gravel Amount (ASTM D422):** The amount of gravel (dry-weight percentage retained on the No. 4 sieve) shall be less than or equal to 20%.
5. **Particle Size:** Particle size shall be less than one-inch in diameter.



6. **Water Content:** After the soil is compacted, the water content of the soil shall be equal to or greater than optimum moisture.
7. **Soil Density:** After the soil is compacted, the minimum density of the soil shall be greater than or equal to:
 - a. 95% of the standard proctor density (ASTM D698); or
 - b. 90 % of the modified proctor density (ASTM D1557).

Soil having characteristics within the above limits are workable, good for erosion control and suitable for attaining proper grading. This soil will help minimize liquid infiltration and leachate generation. The soil characteristics for the clay cover soils shall be tested at a minimum rate of one sample per 10,000 cubic yards for conformance.

The erosion layer will be installed above the barrier layer and will consist of at least twelve (12) inches of soil capable of sustaining native plant growth. It is estimated that approximately 79,150 cubic yards of vegetative soil will be required.

A permanent vegetative cover shall be established with plant species that are of equal or superior utility to native vegetation during each season of the year. Permanent vegetation must be effective, long-lasting and capable of self-regeneration and plant succession. Deep-rooted plants, trees, or other similar vegetation should not be allowed to thrive on the final cover.

The final cover gradient on top of the fill, as measured from the center of the fill area to the break in slope between the top and sides of the fill, shall not exceed four (4) percent (25:1) so as to prevent the erosion of cover. Final side slopes of the fill shall not exceed twenty-five (25) percent grade (4:1). Surface contours, including the final grading of completed disposal areas, shall prevent ponding of water and erosion of fill areas.

2.2 FINAL CERTIFICATION [OAC 252:517-15-7(F)(3)]

Upon completion of the final closure, a certification of final closure will be prepared by a qualified professional engineer verifying that the closure has been completed in accordance with the Closure Plan, engineering design and applicable regulations. The certification of final



closure will include as-built drawings for the final cover system with elevations and thickness of each layer as verified by a professional land surveyor during construction.

2.3 ESTIMATED MAXIMUM INVENTORY OF CCR [OAC 252:517-15-7(B)(1)(D)]

Based on historical records of CCR disposal at the landfill and the expected compaction density of these materials, GRDA estimates that approximately 4,317,456 cubic yards of CCRs have been placed within the landfill through December 31, 2016. Based on the information provided by GRDA, the estimated maximum total capacity of the permitted landfill is 5,131,024 cubic yards.

2.4 ESTIMATED MAXIMUM AREA OF COVER [OAC 252:517-15-7(B)(1)(E)]

The total permit area of the landfill consists approximately 67 acres, of which only 47 acres (3,047,320 square feet) have been developed.

2.5 SCHEDULE OF CLOSURE [OAC 252:517-15-7(B)(1)(F)] CERTIFICATION [OAC 252:517-15-7(B)(4)] REQUIRED NOTIFICATIONS [OAC 252:517-15-7(B)(5)]

Closure of the GRDA Landfill will begin no later than 30 days following the known final receipt of CCR or non-CCR waste. If remaining capacity is available, closure may be delayed for up to two years after the most recent receipt of waste if there is a reasonable likelihood that it will receive additional wastes in the future. Closure of the landfill can also be delayed if CCR will be removed from the landfill for beneficial use purposes.

Based on recent disposal rates, the existing 47 acre landfill is expected to reach capacity in 2045. Closure of the GRDA Landfill is anticipated to be completed within 6 months after commencing closure activities. No later than the date that GRDA initiates closure of the landfill, GRDA must prepare a notification of intent to close the landfill. The notification must include the certification by a qualified professional engineer for the design of the final cover system.

Upon completion of closure, GRDA must obtain a certification from a qualified professional engineer verifying that closure has been completed in accordance with the Closure Plan. Within



30 days of completion of closure of the landfill, GRDA must prepare a notification of the closure of the landfill.

Following closure of the landfill, GRDA must record a notation on the deed to the property stating that the land has been used for the disposal of CCR and that its use is restricted under the post-closure care requirements. Within 30 days of recording a notation on the deed to the property, GRDA must prepare a notification stating that the notation has been recorded. The notification is considered complete when it has been placed in the facility's operating records.

A tentative schedule of closure activities are provided in **Table 1** below based on the timeline of required activities discussed in this Closure Plan. As shown in Table 1, the closure of the GRDA Landfill is expected to be complete by December 31, 2045.

2.6 CLOSURE COST ESTIMATES [OAC 252:517-17-34]

GRDA will continue to provide DEQ with annual closure cost estimate updates and satisfy financial assurance obligations required by the facility permit.

3.0 PLAN AMENDMENTS AND REVISIONS [OAC 252:517-15-7(B)(3)]

In accordance with OAC 252:517-15-7(b)(3), GRDA may amend this written Closure Plan at any time provided the revised plan is placed in the facility's operating record as required by OAC 252:517-19-1(i)(4). GRDA is required to amend this written Closure Plan whenever there is a change in conditions that would substantially affect the written plan in effect or if unanticipated events before or after the commencement of closure activities necessitates a revision.

GRDA must amend this Plan at least 60 days prior to a planned change in the operation of the facility or no later than 60 days after an unanticipated event requires the need to revise the Plan. If a written closure plan is revised after closure activities have commenced for the landfill, GRDA must amend the written closure plan no later than 30 days following the triggering event.



4.0 RECORDKEEPING REQUIREMENTS [OAC 252:517-19-1(I)(4)]

In accordance with OAC 252:517-19-1(i)(4), GRDA must maintain this Closure Plan in the facility operating record.

5.0 OTHER NOTIFICATION REQUIREMENTS [OAC 252:517-19-2]

In accordance with OAC 252:517-19-2, the DEQ Land Protection Division must be notified when this document or any subsequent amendments or revisions to this document are placed in the operating record and on the publicly accessible internet site.

6.0 CCR WEBSITE REQUIREMENTS [OAC 252:517-19-3]

In accordance with OAC 252:517-19-3, GRDA must maintain this Closure Plan on the corporate “CCR Rule Compliance Data and Information” webpage.

7.0 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.

United States Environmental Protection Agency (USEPA), *40 CFR Part 257, Subpart D.* April 17, 2015.

State of Oklahoma, Oklahoma Department of Environmental Quality (ODEQ), *OAC 252:517 Disposal of Coal Combustion Residuals from Electric Utilities,* September 15, 2017

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



TABLE 1: GRDA LANDFILL TENTATIVE CLOSURE SCHEDULE

TASK Description	Anticipated Start Date	Anticipated Completion Date
<i>Landfill Operation</i>		
CCR Disposal	1982	12/31/2045
<i>Design / Bidding</i>		
Preparation Closure Design Drawings and Specifications	3/31/2045	9/30/2045
Obtain a Qualified Contractor to Perform Closure	9/30/2045	12/31/2045
<i>Construction</i>		
Place a <i>Notification of Intent to Close</i> the Landfill in the Operating Record	1/31/2046	1/31/2046
Send <i>Notification of Intent to Close</i> to DEQ and Post Notification to the Internet Website.	1/31/2046	1/31/2046
Perform Closure Construction Activities	1/31/2046	7/31/2046
<i>Post-Construction</i>		
Certification of final closure by Professional Engineer	8/1/2046	8/31/2046
Place a Notification of Final Closure Completion in the Operating Record	8/1/2046	8/31/2046
Send Notification of availability of Closure Completion documentation to DEQ and publish to the Internet Website	8/1/2046	8/31/2046
Record a Notation of the landfill closure on the Deed of the Property	8/1/2046	8/31/2046
Place a Notification of the Deed Notation in the Operating Record	8/1/2046	8/31/2046
Send Notification of availability of Deed Notation to DEQ and publish Deed Notation to the Internet Website	8/1/2046	8/31/2046
Post-Closure Care Period	9/1/2046	9/1/2076

