



Coal Combustion Residuals Landfill

Closure Plan – Revision 1

Laramie River Station

Prepared for
Basin Electric Power Cooperative

December 2023

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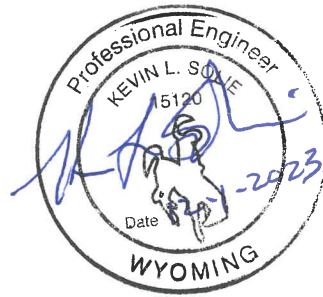
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Certification

I hereby certify that I have, or my agent has examined the facility and, being familiar with the provisions of 40 CFR 257 Subpart D, attest that this Coal Combustion Residuals landfill closure plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR § 257.102. I certify that the plan and final cover system design is adequate for this facility and that procedures for recordkeeping and reporting have been established.



A handwritten signature in blue ink, appearing to read "Kevin L. Solie".

Kevin L. Solie
Barr Engineering Co.
WY Registration Number PE-15120

Dated this 1st day of December 2023

1 Introduction

Laramie River Station (LRS) is owned by Missouri Basin Power Project (MBPP) and operated by Basin Electric Power Cooperative (Basin Electric). LRS consists of three 570 megawatt (MW) units located approximately five miles northeast of Wheatland in Platte County, Wyoming. Coal Combustion Residuals (CCRs) from LRS are disposed at an onsite landfill. The LRS landfill is authorized by a Solid Waste Chapter 3 (Industrial Waste) permit issued by the Wyoming Department of Environmental Quality (WYDEQ). The WYDEQ permit designation is Solid and Hazardous Waste Division (SHWD) File #20.066. CCR management is also subject to Federal Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments per 40 CFR 257 Subpart D. WYDEQ recently approved a minor modification for Basin Electric's final cover system that includes a low permeability geosynthetic clay liner (GCL) in addition to cover soil. The newly approved cover system would be as or more environmentally protective than the previously approved cover configuration; the change in cover system design also requires the revision of the written closure plan for the landfill.

The landfill was placed into operation in April 1980 and has been in continuous service since its initial construction. The landfill has been constructed in several phases, including cells 1 through 9, encompassing approximately 172.31 acres. Cell 10, encompassing an additional 15.5 acres, is yet to be constructed. Partial sequential closure of the landfill has been conducted as areas of the landfill are filled to final grade. To date, approximately 77.15 acres of the 187.81-acre CCR landfill footprint have been closed in accordance with WYDEQ regulations and the WYDEQ-issued permit. This closure plan applies only to the remaining 110.66-acre landfill footprint that will be capped during future closure phases (beginning in 2023).

The purpose of this document is to demonstrate compliance with 40 CFR § 257.102 (Criteria for conducting the closure or retrofit of CCR units) which requires the owner or operator of a CCR unit 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 unit consistent with recognized and generally accepted good engineering practices.

2 Closure Narrative

Once CCRs have reached final elevation in the landfill, the area to be closed will be graded and rolled to provide a smooth surface for the installation of the cover system. Materials suitable for use as a low permeability infiltration layer are not locally available; as such, a GCL will be utilized to minimize infiltration potential. Prior to deployment of the GCL, the subgrade surface will be inspected to ensure no deleterious materials are present that could affect the integrity of the GCL. Construction Quality Assurance/Quality Control (QA/QC) methodologies consistent with the industry guidelines will be utilized so that the final cover is constructed to meet the requirements set forth in the CCR Rule. The GCL infiltration layer will be covered with 18 inches of subsoil material to serve as a deep rooting zone overlain by six inches of topsoil. The cover system is 24" thick and has significant field capacity to store and hold water for later use by vegetation. In essence, the soil cover system acts as a sponge to store water for subsequent use by vegetation thus reducing the potential for infiltration. Closed areas will be seeded with a climatically adapted seed mix of shallow-rooted native vegetation. Final cover slopes of about one percent are present at the crest of the filled area while 10 to 20 percent slopes are present on the landfill flanks to help promote run-off. A terrace will be constructed about halfway up the slope to prevent excessive erosion. The closed landfill will not be used for cultivated crops, heavy grazing or any other use which might disturb the protective vegetative and soil cover.

3 Final Cover System Design

In addition to the basic description of the final cover system, the CCR Rule requires the closure plan to address both performance and design standards for closure of the CCR unit. CCR Rule design standards require a low permeability infiltration layer with a permeability less than or equal to the bottom liner system or natural subsoils present, or a permeability of no greater than 1×10^{-5} cm/sec, whichever is less. The design standards also require that the infiltration layer have a minimum thickness of 18 inches and the infiltration layer must be overlain by an erosion layer capable of sustaining native plant growth with a minimum thickness of six inches. The CCR Rule also allows an owner or operation to select an alternate cover system, provided it includes an infiltration later that achieves an equivalent reduction in infiltration as the prescriptive infiltration layer and includes an erosion layer that provides equivalent protection from wind or water erosion as the prescriptive erosion layer. Alternative covers may include a GCL or other materials approved by the owner.

GCLs are factory manufactured hydraulic barriers, typically consisting of sodium bentonite clay or other very low permeability material, sandwiched between geotextiles and/or geomembranes. GCLs are held together by needling and/or stitching and are typically 7 to 10 mm thick when hydrated. Sodium bentonite exhibits a high affinity for water; when hydrated, sodium bentonite swells up to 15 times its original volume, which provides the ability to seal around penetrations, self-heal punctures, and self-seam at overlaps. A fully hydrated GCL typically has a permeability of approximately 5×10^{-9} cm/sec or lower, more than 20 times lower than a typical compacted clay liner permeability. In terms of steady flux of water, a GCL is approximately equivalent to two feet of compacted clay liner (CCL) at 1×10^{-7} cm/sec permeability.

The cover system will be constructed, from bottom to top, of a GCL barrier (infiltration) layer equivalent to 18 inches of compacted, clay-rich soil with a hydraulic conductivity of 1×10^{-7} cm/second or less. The GCL will be overlain by a minimum of 18 inches of uncompacted subsoil material to serve as a rooting zone. The uppermost layer (erosion layer) consists of six inches of suitable plant growth material (SPGM). Total thickness of the cover system will be a minimum of 24 inches.

Soils present at the site are of colluvial (sand, gravel, etc.) or loessal (silty or clayey fine sand, silt, etc.) origin, with permeabilities ranging from approximately 1×10^{-5} to 1×10^{-3} cm/sec. The landfill base was constructed using these in-situ soils. The permeability of the cover system barrier (infiltration) layer is no greater than 5×10^{-9} cm/sec, which is less than or equal to the permeability of the natural subsoils underlying the CCRs. Accordingly, the cover system meets the design criteria for permeability.

The final cover system is designed with a subsoil/infiltration layer thickness of 18 inches which meets the minimum requirement of 18 inches. The erosion layer has a minimum thickness of six inches, which meets the minimum required thickness of six inches. As such, the cover system meets the minimum thickness design criteria for both the infiltration layer and for the erosion layer.

4 Final Cover System Performance

Final cover performance standards include ensuring the CCR unit closure system controls, minimizes, or eliminates, to the maximum extent feasible, post-closure infiltration of liquids into the waste; precludes the probability of impoundment of water, sediment, or slurry; addresses slope stability; minimizes the need for further maintenance; and that closure be completed in a time consistent with recognized and generally accepted good engineering practices.

The various components of the cover system design work synergistically to meet CCR Rule performance standards. Infiltration is minimized by using a combination of slope to promote run-off, shallow-rooted native vegetation to enhance evapotranspiration, and a low permeability GCL barrier layer to further limit infiltration. The closed landfill will be sloped to promote run-off thus limiting the probability of impounding liquids, slurry, or sediment. Landfill side slopes limited to approximately 20 percent contributes to structural stability and shallow-rooted native vegetation on the cover system minimizes the need for future maintenance. The pozzolanic properties of the CCRs also promote structural stability and reduce the likelihood of settling and subsidence. Consistent with generally accepted good engineering practices, the cover system will be constructed in phases as areas are filled and brought up to grade (partial sequential closure).

5 Closure Procedures and Methods

5.1 Final Cover Construction

Partial sequential closure will be completed when discrete areas (typically 10 to 20 acres) are filled to final grade and when it is reasonable to mobilize construction equipment and crews to implement closure. Areas to be closed during each final cover construction event will be determined in conjunction with preparation of construction plans and specifications. As discrete areas filled to final grade, final cover will be placed as soon as practical, factoring in the timing constraints imposed by late fall, winter and early spring weather conditions. Construction of the final cover system will proceed as follows:

1. Grade and smooth ash fill subgrade surface as needed;
2. Place, grade and smooth surface buffer soil layer (if buffer layer is needed);
3. Install GCL;
4. Place 18-inch thick plant rooting zone;
5. Place 6-inch thick SPGM topsoil layer;
6. Install temporary stormwater run-off controls; and
7. Seed, fertilize and mulch.

Once the final cover SPGM layer has been placed and the seedbed has been prepared, seeding will generally be performed along the contour using a grass seed drill. Climatically adapted, shallow-rooted native vegetation seed would typically be drilled to a depth of one inch or less. In some situations, a broadcast seeder would be used, followed by light harrowing and/or a mulched cover. Depending on the planting season, a nurse crop of rye or oats may also be utilized. The closed landfill will not be used for cultivated crops, heavy grazing or any other use which might disturb the protective vegetative and soil cover.

Closure activities will be carried out by a qualified earthwork contractor and GCL installer. Construction plans and specifications will be prepared for each phase of closure to direct the contractor's work. The construction of the various components of the final cover will be tested and documented in accordance with the testing requirements presented in the facility's Construction Quality Assurance Plan. A closure construction documentation report will be prepared and submitted to the WYDEQ after completion of an incremental closure event. The report will be signed by a professional engineer, registered in the state of Wyoming, stating that to the best of their knowledge and according to their records, cover construction has been completed in accordance with the approved plans, specifications, and permit requirements except for any deviations that have been noted in the report.

5.2 Final Closure

A notification of closure will be prepared within 30 days after completion of the last final cover construction event. The notification will include the certification by a qualified professional engineer verifying that closure has been completed in accordance with the closure plan as required by 40 CFR § 257.102(f)(3). The notification will be complete when it has been placed in the facility's operating record as required by 40 CFR § 257.105(i)(8).

A notation will be recorded on the deed to the property following complete closure of the landfill to notify any potential purchaser that: (i) The land has been used as a CCR unit; and (ii) Its use is restricted under the post-closure care requirements (40 CFR § 257.104(d)(1)(iii)). A notification stating that the notation has been recorded will be prepared within 30 days after filing the deed with the appropriate local official. The notification will be complete when it has been placed in the facility's operating record as required by 40 CFR § 257.105(i)(9).

6 CCR Inventory and Maximum Closure Area Estimates

The maximum inventory of CCR ever onsite (design capacity) during the active life of the CCR unit is estimated to be 18,499,190 cubic yards. The largest area of the CCR unit requiring final cover at any time during the CCR unit's life is estimated to be 110.66 acres.

7 Estimated Closure Schedule

As of November 2022, the CCR unit has an estimated remaining capacity of approximately 9,444,190 cubic yards, which equates to approximately 45 years of remaining capacity. The remaining life of the facility (filled to maximum capacity in 2068) may vary depending on factors such as ash content of coal, diversion of CCRs for beneficial use, and electrical generation rates, among others. Since sequential partial closure is periodically completed on the CCR unit, it is anticipated that the final area requiring final cover would be 40 acres or less. This relatively small area would easily be closed in one construction season. In any case, final closure would not take longer than 180 days.

8 Recordkeeping & Reporting

Basin Electric will maintain a copy of the most recent version of the closure plan in the facility's operating record in accordance with 40 CFR § 257.105, Recordkeeping Requirements, and the plan will be made publicly available on the Basin Electric CCR web site in compliance with 40 CFR § 257.107, Publicly Accessible Internet Site Requirements. Notification will be sent to the WYDEQ State Director in compliance with 40 CFR § 257.106 (Notification Requirements). A copy of this document will be placed into the facility's operating record in accordance with 40 CFR §257.105 (Recordkeeping Requirements) and will be posted to Basin Electric Power Cooperative's CCR Web site in accordance with 40 CFR §257.107 (Publicly accessible internet site requirements). Notification will be sent to the relevant State Director in accordance with 40 CFR §257.106 (Notification Requirements).