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# **Coal Combustion Residual Landfill Closure Plan**

**Basin Electric Power Cooperative  
Antelope Valley Station**

**October 2016**

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## Purpose

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 Coal Combustion Residual (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.

## Introduction

Antelope Valley Station (AVS) is a lignite coal-fired power plant consisting of two units that generate about 900 megawatts (MW) combined. The power plant, owned and operated by Basin Electric Power Cooperative (Basin Electric), is located approximately eight miles northwest of Beulah, in Mercer County, North Dakota. CCRs from AVS are disposed at the Section 7 Landfill, regulated as special waste landfill 0160 by the North Dakota Department of Health (NDDoH).

The landfill was first permitted by the NDDoH for solid waste disposal in 1995. The first phase of liner construction was completed in 1996, with ash placement beginning the same year. The fourth and final phase of landfill liner construction was completed in 2015. Partial sequential closure has been conducted as areas of the landfill are filled to final grade, with closure efforts occurring in 2003, 2011, and 2014. To date, approximately 44.47 acres of the 102.66 acre CCR landfill footprint have been closed using an engineered cover system approved by the NDDoH. An additional 19.68 acres are anticipated to be closed during fall 2016.

## Closure Narrative

Once CCRs have reached final elevation in the landfill, a two-foot thick clay-rich barrier layer will be constructed over the waste to minimize infiltration potential. Clay-rich materials suitable for use as a low permeability barrier layer have been identified onsite during previous geotechnical investigations. The barrier layer would be moisture-conditioned and compacted to achieve permeabilities of  $1 \times 10^{-7}$  cm/sec or less. Construction Quality Assurance/Quality Control (QA/QC) methodologies consistent the NDDoH guidelines would be utilized so that the final

cover is constructed to meet the requirements set forth in the CCR Rule and NDDoH rules and guidance. After the clay barrier layer has been constructed, an additional three feet of cover materials (clay-rich subsoil to serve as a rooting zone) will be placed over filled areas. Finally, six to eight inches of suitable plant growth material (SPGM) will be placed above the rooting zone. Final cover slopes of approximately 15 percent are consistent with the NDDoH rules and guidance. The relatively gentle slopes promote run-off without being subject to excessive erosion.

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.

## Final Cover System Design and Performance

The cover system will be constructed, from bottom to top, of a barrier layer consisting of a minimum of 24 inches of compacted clay-rich soil with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/second or less overlain by a minimum of 36 inches of uncompacted material to serve as a rooting zone. The uppermost layer of the landfill cover system consists of a minimum of six inches of SPGM to serve as growth medium for shallow-rooted native vegetation. Total thickness of the cover system will be a minimum of 66 inches. 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 barrier layer (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  $1 \times 10^{-5}$  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 be overlain by an erosion layer capable of sustaining native plant growth with a minimum thickness of six inches. The landfill was constructed with a six-inch thick to two-foot thick compacted soil bottom liner with a permeability no greater than  $1 \times 10^{-7}$  cm/sec. The

permeability of the cover system barrier (infiltration) layer is no greater than  $1 \times 10^{-7}$  cm/sec, which is less than or equal to the low permeability bottom liner. Accordingly, the cover system meets the design criteria for permeability.

The final cover system is designed with an infiltration layer thickness of 24 inches which is greater than the minimum thickness requirement of 18 inches. The erosion layer, consisting of 36 inches of subsoil and six inches of SPGM, amounts to a total thickness of 42 inches, which is much greater than 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.

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 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 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. The relatively gentle slope (approximately 15 percent) and native vegetation on the cover system contributes to structural stability and helps to minimize 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 NDDoH rules and guidance and generally accepted good engineering practices, the cover system will be constructed in phases as areas are filled to grade (partial sequential closure).

## CCR Inventory and Maximum Closure Area Estimates

The maximum inventory of CCR ever on-site (design capacity) during the active life of the CCR unit is estimated to be 16,000,000 cubic yards. The largest area of the CCR unit ever requiring

final cover at any time during the CCR unit's life is estimated to be 58.19 acres, reflecting the current conditions at the site.

## Closure Schedule

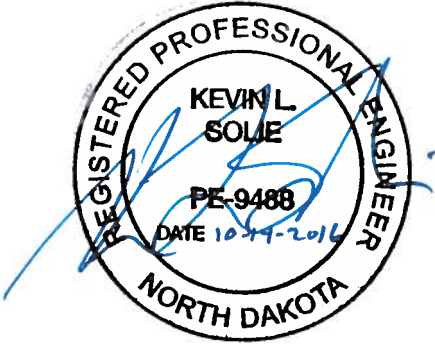
The CCR unit has an estimated remaining capacity of 5,887,617 cubic yards, which equates to 10.1 years of remaining capacity. The remaining life of the facility (filled to maximum capacity in late 2026) may vary depending on factors such as ash content of coal, diversion of CCRs for beneficial use, and 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 20 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.

## Recordkeeping and Reporting

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).

Certification Statement

I certify that the design of the final cover system meets the requirements of 40 CFR §257.102 as specified in the *Standards of Coal Combustion Residuals in Landfills and Impoundments*.



Kevin L. Solie, North Dakota PE-9488  
October 14, 2016