Location Restrictions Demonstration - Gerald Gentleman Station Ash Disposal Facility

Nebraska Public Power District - Gerald Gentleman Station

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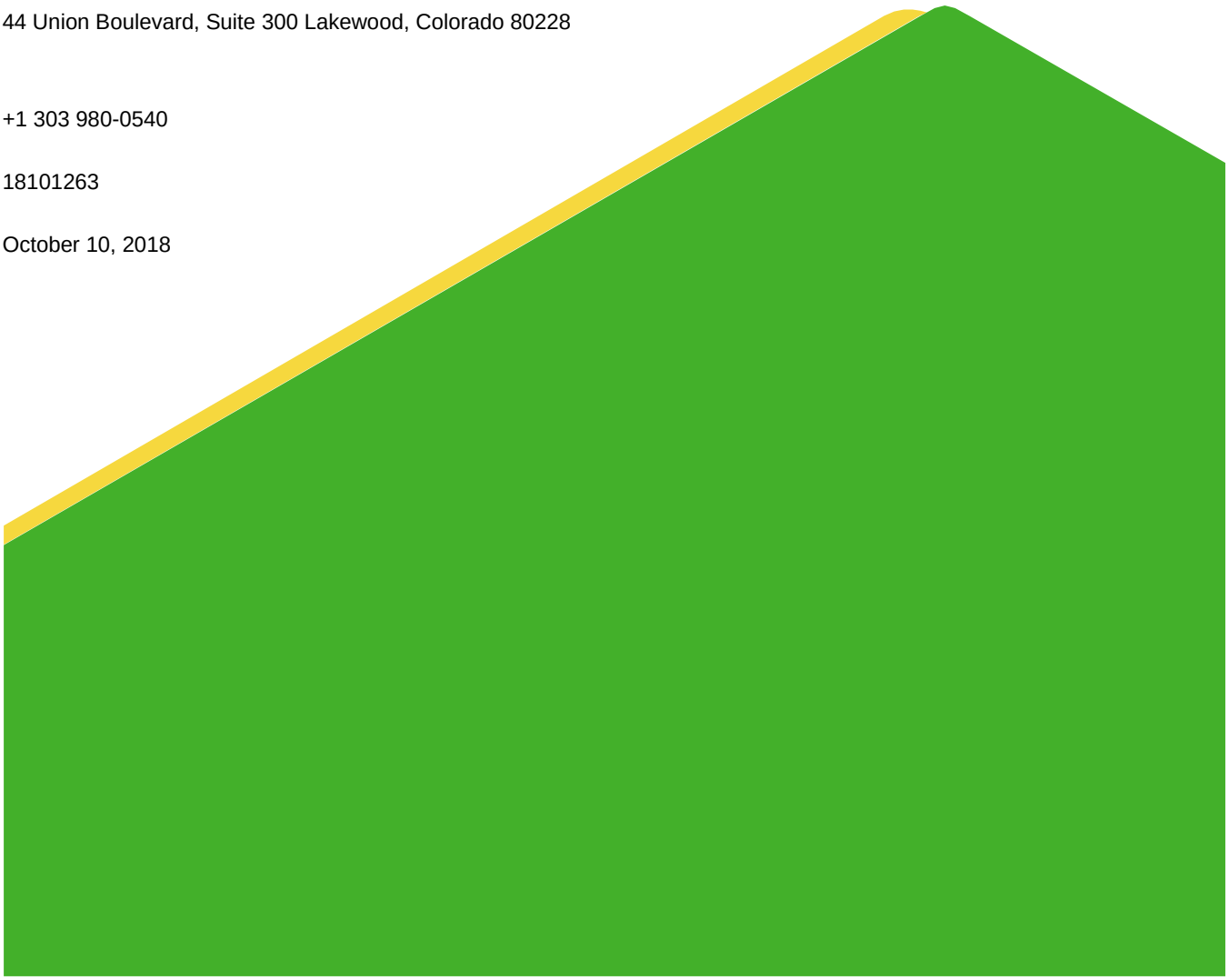
October 10, 2018



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1.0 INTRODUCTION

This report presents documentation and certification of the Location Restrictions Demonstration for the ash disposal facility at Nebraska Public Power District's (NPPD) Gerald Gentleman Station (GGS). The ash disposal facility at GGS is an active coal combustion residuals (CCR) landfill that receives bottom ash and fly ash. This report addresses the requirements of the United States Environmental Protection Agency's (EPA's) CCR rule (40 CFR 257.60 through 257.64, (EPA, 2015)). The location restrictions as defined in the CCR rule are summarized in the following sections.

1.1 Site Background

GGS is a coal-fired electric generation facility located in southwestern Nebraska in Sections 19, 20, and 30, Township 13N, Range 33W. The site is 5 miles south of the village of Sutherland and 20 miles west of the city of North Platte, in Lincoln County. The CCRs are managed in dry waste landfill facilities regulated and permitted by the Nebraska Department of Environmental Quality (NDEQ) Permit No. NE0203254.

The ash disposal facility at Gerald Gentleman Station is located southwest of the plant (Figure 1). The ash disposal facility consists of Ash Pit Nos. 1, 2, 3, and 4 and the bottom ash landfill. Ash Pit Nos.1 and 2 are closed, and Ash Pit Nos. 3 and 4 are active. The bottom ash landfill is no longer active and is in the process of being closed as of October 2018.

2.0 LOCATION RESTRICTIONS

The location restrictions are found within the following sections of the Code of Federal Regulations:

- 40 CFR 257.64 – Unstable Areas

Per the CCR rule definitions, the ash disposal facility is considered an existing landfill, and only the Unstable Areas location restriction applies. Many of the locational restrictions requirements of the CCR rule have been addressed in the facility's NDEQ permit, specifically in the Locational Criteria Documentation (Golder, 2004), Hydrogeologic Characterization Report (Golder, 2004a), and the Engineering and Design Plan (Golder, 2014). These documents, along with the rest of the NDEQ permit are part of the site operating record.

3.0 UNSTABLE AREAS

Per 40 CFR 257.64, new and existing CCR landfills, new and existing CCR surface impoundments, and all lateral expansions must not be located in unstable areas, unless a demonstration can be made that shows the structural components of the unit will not be disrupted. The rule defines an unstable area as a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the structural components responsible for preventing releases from a CCR unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains. Per the rule, structural components are any component used in the construction and operation of the unit that is necessary to ensure the integrity of the unit and to prevent a release, and can include liners, leachate collection systems, embankments, spillways, outlets, final covers, and inflow design flood control systems.

Per the rule, the following factors were considered in determining whether the facilities have been located within unstable areas:

- On-site or local soil conditions that may result in significant differential settlement;
- On-site or local geologic or geomorphologic features; and

- On-site or local human-made features or events (both surface and subsurface).

Potential indications of unstable areas are evaluated during the annual visual inspections required to satisfy 40 CFR Part 257.84. These inspections are specifically meant to assess hydraulic structures, upstream and downstream slopes, berm crests, and the toe of the facility to look for signs of structural weakness, differential settlement, or other conditions that could affect stability. No evidence of differential settlement or other indications of unstable areas has been observed at the facility during the annual inspections performed in 2015 (Golder, 2015), 2016 (Golder, 2016), and 2017 (Golder, 2017).

3.1 Soil Conditions

The ash disposal facility is founded on stiff, low plasticity sandy-silty clays with trace gravel underlain by loose to medium dense silts and sands that are very fine-grained, well-sorted, and well-rounded. The soils are well-drained and moderately permeable with similar material below.

The ash disposal facility at GGS is generally constructed over Eolian silts and sands, varying in thickness from 17 feet to 34 feet throughout the area (Golder, 2004a).

Currently, Ash Pit Nos. 1 and 2 are inactive. Ash Pit No. 1 was opened in 1979 and closed in 1982. Ash Pit No. 2 was opened in 1982 and closed in 1991. Ash Pit Nos. 3 and 4 are currently active. The bottom ash landfill is no longer active and is in the process of being closed as of October 2018.

Ash Pit No. 3 was originally constructed in May 1991 with a clay liner of approximately 2 feet in thickness. Operations began in July 1991 where ash was placed as a slurry until October 1995. A final cover was constructed in late Fall of 1995. Ash Pit No. 3 was re-opened in 2015 and a new composite liner system consisting of a geosynthetic clay liner and a 60 mil LLDPE geomembrane was installed over the historic ash disposal area.

Ash Pit No. 4 was constructed in 1995 with a composite liner consisting of a 60-mil high density polyethylene (HDPE) geomembrane over 6 inches of compacted subgrade. Fly ash was initially placed in Ash Pit No. 4 as a slurry when operations began; however, since 2001 fly ash has been placed via damp unloading.

Foundation soil conditions do not indicate that the facility is located in an unstable area susceptible to significant differential settlement. Additionally, the site facilities are routinely inspected for both state and federal regulatory requirements. The facility will continue to be inspected per the state and federal regulatory requirements, and signs of significant differential settlement will be documented and corrected as necessary.

3.2 Geologic and Geomorphologic Features

The local geology is described in section 3.1 of the Locational Criteria Report (Golder 2004), which is included in the site operating record. In general, GGS is situated above the Ogallala Formation. The upper surface of the Ogallala was shaped by erosion into a complex of hills and valleys, now almost completely buried beneath a mantle of unconsolidated sediments of Quaternary age. The unconsolidated Quaternary deposits consist of alluvium, loess, and eolian sand. The Ogallala Formation in the vicinity of the ash disposal facility consists of three general stratigraphic units: upper silty clay paleosol unit, middle clayey or sandy silt unit, and lower unit of either predominantly sand and gravel or an equivalent unit of predominantly silt and clay.

The potential for subsurface hazards at the site was evaluated as part of the Locational Criteria Report (Golder, 2004). Examination of a map of possible karst terrane in the vicinity of the GGS indicates that this region of Nebraska has a low likelihood of karst subsurface conditions.

3.3 Human-Made Features

3.3.1 Historic Ash Deposition (Ash Pit No. 3)

Ash Pit No. 3 was originally constructed in May 1991 with a clay liner of approximately 2 feet in thickness. It was in operation in July 1991 where ash was placed as a slurry until October 1995. A final cover was constructed in late Fall of 1995. In 2015 a portion of the cover soil was removed and a new composite liner system consisting of a geosynthetic clay liner and a 60 mil LLDPE geomembrane was installed over the historic ash disposal area. Observations of the Ash Pit No. 3 area indicate that minimal settling occurred in the historic ash prior to liner construction in 2015. Discussion of the potential for settlement is provided in Section 4.4.2 of the Engineering and Design Report (Golder 2014). In general, the risk for differential settlement in Ash Pit No. 3 is low due to the slow ash deposition rates on the site.

3.3.2 Other Human-Made Features

The ash disposal facility is neighbored to the east by a human-made evaporation pond. The evaporation pond is approximately 50 acres and has a re-compacted earthen liner. The perimeter embankment of the evaporation pond varies between 15 and 25 feet tall, and the typical water level in the pond varies between zero and 20 feet. Topography in the area directs surface water from north to south between the evaporation pond and the ash disposal facility, and to the east away from the ash disposal facility along the south side of the evaporation pond. Although failure of the evaporation pond embankment in the area near the ash disposal facility is unlikely, topography of the area is such that a failure does not pose a significant risk to the stability of the ash disposal facility.

3.4 Safety Factor Assessment

Slope stability analysis was performed as part of the NDEQ permit for the site. The site Engineering and Design Report (Golder, 2014), Section 4.4.1 provides a summary of the safety factor assessment. Results of the stability analysis are summarized below.

The slope stability was evaluated based on Spencer's Method for circular and non-circular slip surfaces. Analysis focused on non-circular movement along geomembrane interfaces and circular movement through the CCR material. The analysis was performed using pore pressures as determined by the modeled water table (piezometric surface).

The loading rate (strain rate) for the ash disposal facility is anticipated to be at or below typical rates for earthen fills, indicating that the loading of the facility is slow enough so as not to generate significant excess pore pressures in the construction and foundation materials. Therefore, deposition at the ash disposal facility will not be of significant concern to overall slope stability.

The ash disposal facility is not in a seismic impact zone and no seismic slope stability analysis will be performed.

The slope stability analysis indicated that factors of safety against circular and non-circular movement are relatively high with a minimum factor of safety of 2.5. For structures of this type, the minimum acceptable factor of safety is 1.5. Therefore, a minimum factor of safety of 2.5 is adequate for this structure based on the risks associated with movement, and the level of uncertainty in the material properties and construction (Golder, 2014).

4.0 CERTIFICATION

The undersigned attest to the completeness and accuracy of the above written Location Restrictions Demonstration and certify that the location of ash disposal facility at GGS is not in an unstable area and meets the requirements detailed in 40 CFR 257.64.

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REFERENCES

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FIGURE 1

Gerald Gentleman Station
CCR Facilities

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NEBRASKA PUBLIC POWER DISTRICT
GERALD GENTLEMAN STATION
ASH DISPOSAL FACILITY

FIGURE 1

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