CCR Rule Report:

Closure and Post-Closure Plans

Duck Creek Power Station
CCR Landfill, Fulton County, Illinois

Submitted to Illinois Power Resources Generating, LLC
October 2016

HANSON
Engineering | Planning | Allied Services

Table of Contents

1. Introduction 1
2. Site Description 1
3. Closure Plan 1
3.1 Narrative Description of Closure 1
3.2 Description of the Final Cover System 1
3.3 Closure Performance Standard when Leaving the CCR in Place 2
3.3.1 Control of Post-Closure Infiltration and Releases 2
3.3.2 Preclusion of Future Impoundment of Water, Sediment, or Slurry 3
3.3.3 Provisions for Major Slope Stability 3
3.3.4 Minimization of the Need for Further Maintenance 3
3.3.5 Closure Completion in the Shortest Amount of Time 3
3.4 Final Cover System 3
3.4.1 Permeability of the Final Cover System 3
3.4.2 Infiltration of Liquids 4
3.4.3 Erosion of the Final Cover System 4
3.4.4 Disruption of the Integrity of the Final Cover System 4
3.5 Inventory and Area Estimates 4
3.6 Closure Schedule 4
4. Post-Closure Care Plan 5
4.1 Post-Closure Monitoring and Maintenance 6
4.1.1 Final Cover Maintenance 6
4.1.2 Groundwater Monitoring 6
4.2 Contact 7
4.3 Property Use during the Post-Closure Care Period 7
5. Amendments to Written Closure Plan or Post-Closure Plan 7
6. References 7
7. Certification Page 8

Copyright © 2016 by Hanson Professional Services Inc. All rights reserved. This document is intended solely for the individual or the entity to which it is addressed. The information contained in this document shall not be duplicated, stored electronically, or distributed, in whole or in part, by anyone other than the recipient without the express written permission of Hanson Professional Services Inc., 1525 S. Sixth St., Springfield, IL 62703, (217) 788-2450, www.hanson-inc.com. Unauthorized reproduction or transmission of any part of this document is a violation of federal law. Any concepts, designs and project approaches contained herein are considered proprietary. Any use of these concepts and approaches by others is considered a violation of copyright law.

Closure and Post-Closure Plans

1. Introduction

In accordance with 40 CFR 257.102(b) and 40 CFR 257.104(d), the owner or operator of an existing Coal Combustion Residuals (CCR) landfill must prepare initial written closure and post-closure plans no later than October 17, 2016. This document acts as those plans and describes the planned steps needed to close Duck Creek Power Station's CCR Landfill (CCR Landfill) as well as maintain and monitor it during the post-closure care period.

2. Site Description

The CCR Landfill is located southeast of Canton, Illinois, approximately 3 miles north of the Duck Creek Power Station generating facility in Fulton County, Illinois. More specifically, the CCR Landfill is located within Sections 7 and 18 of Banner Township, Township 6 North, Range 5 East of the Fourth Principal Meridian. The CCR Landfill consists of 106 acres, of which only the north 22 acres (Cells 1A and 1B) have been constructed and are active. The remaining 84 acres have not yet been developed as a CCR landfill. The CCR Landfill is permitted as a nonhazardous, special waste landfill with Illinois Environmental Protection Agency (IEPA), Bureau of Land, Division of Land Pollution Control. The facility is designed, constructed and operated in compliance with all applicable requirements of 35 Ill. Adm. Code 811, 812 and 815.

3. Closure Plan

3.1 Narrative Description of Closure

40 CFR 257.102(b)(1)(i) states that a written closure plan must include a narrative description of how the CCR unit will be closed in accordance with section 257.102.

Once areas of the CCR Landfill reach design capacity, they will be closed in place with a composite final cover system. Major closure activities include final grading of CCR to promote drainage, the placement of the composite final cover system, establishment of vegetative cover and surface water control features. The composite final cover system is designed to cover the entire CCR Landfill and will consist of the following layers (from bottom to top): a low-permeability layer (compacted soil layer and geomembrane) and a final protective layer (protective cover soil layer and a topsoil layer).

3.2 Description of the Final Cover System

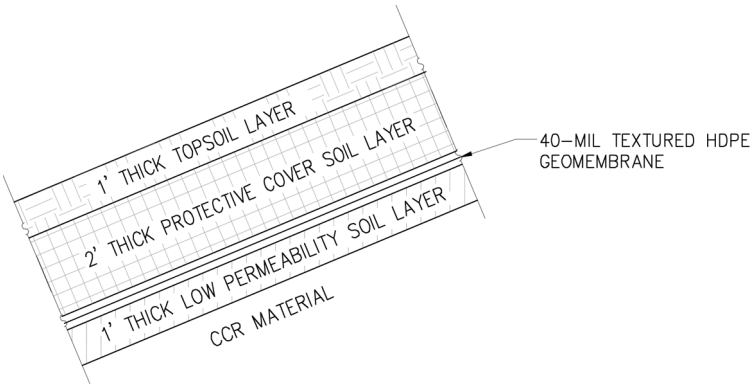
40 CFR 257.102(b)(1)(iii) states that if closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system and methods and procedures used to install the final cover must be included in the written closure plan.

The composite final cover system will consist (from bottom to top) of a low-permeability layer made of a 1-foot-thick, compacted soil layer (maximum hydraulic conductivity of 1.0×10^{-6} cm/sec) and a 40-mil-thick textured geomembrane; and a final protective layer made of a 2-foot-thick protective cover soil layer and a 1-foot-thick topsoil layer. Refer to Figure 3-1 for a depiction of the composite final cover system. The low-permeability soil layer will cover the entire CCR mass. The final protective layer will cover the entire low-permeability soil layer and geomembrane. Installation of the protective cover soil layer will occur concurrent with the installation of the low-permeability soil layer and geomembrane in

order to minimize desiccation, cracking, freezing or other damage to the low-permeability soil layer during installation. The composite final cover system for the CCR Landfill will be sloped to promote surface water run-off and prevent surface water infiltration into the CCR mass.

Construction specifications and a construction quality assurance plan detailing methods and procedures for installation of the composite final cover system are on file.

Figure 3-1 Composite Final Cover System



3.3 Closure Performance Standard when Leaving the CCR in Place

Per 40 CFR 257.102(b)(1)(iii), if closure will be accomplished by leaving CCR in place, the closure plan must discuss how the final cover system will achieve the performance standards specified in 40 CFR 257.102(d) as follows:

(1) The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:

- (i) control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate or contaminated run-off to the ground or surface waters or to the atmosphere;
- (ii) preclude the probability of future impoundment of water, sediment or slurry;
- (iii) include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;
- (iv) minimize the need for further maintenance of the CCR unit; and
- (v) be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

3.3.1 Control of Post-Closure Infiltration and Releases

To control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the CCR and releases of CCR, leachate or contaminated run-off to the ground or surface waters or to the atmosphere, the CCR Landfill will be covered with a composite final cover system that meets or exceeds the performance standards of 40 CFR 257.102(d)(3). These performance standards are discussed in greater detail in Section 3.4 below.

3.3.2 Preclusion of Future Impoundment of Water, Sediment, or Slurry

To preclude the probability of future impoundment of water, sediment or slurry, the sides of the CCR Landfill will be sloped. The slope of the composite final cover system will vary with location. The maximum slope of the composite final cover system for the CCR Landfill is approximately 25 percent. This maximum slope generally will occur around the perimeter of the CCR Landfill.

3.3.3 Provisions for Major Slope Stability

Slope stability analyses were performed for the final cover system for static and dynamic conditions using shear strength parameters of the critical interface. The final cover system provides for major slope stability to prevent the sloughing or movement of the final cover system during closure and throughout the post-closure care period.

3.3.4 Minimization of the Need for Further Maintenance

In order to minimize the need for further maintenance, vegetation will be promoted to minimize wind and water erosion of the composite final cover system.

3.3.5 Closure Completion in the Shortest Amount of Time

To address the requirement that the closure be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices, an estimated closure schedule was calculated using durations consistent with generally accepted construction averages. It is estimated that closure will be completed within six months.

3.4 Final Cover System

Per 40 CFR 257.102(d)(3)(i), the design of the final cover system must be included in the written closure plan. A final cover system must be installed that is designed to minimize infiltration and erosion and, at a minimum, meets the requirements of 40 CFR 257.102(d)(3)(i) below. Specifically, the final cover system must be designed and constructed to meet the following criteria:

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1 x 10^{-5} cm/sec, whichever is less.
(B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.
(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of 6 inches of earthen material that is capable of sustaining native plant growth.
(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

3.4.1 Permeability of the Final Cover System

A Hydrologic Evaluation of Landfill Performance (HELP) Model water balance analysis was performed on the CCR Landfill in the closed condition. The analysis estimates that the composite final cover

system will have a peak volumetric flow rate much less than the 1 x 10^{-5} cm/sec permeability requirement listed in 40 CFR 257.102(d)(3)(i)(A) and less than that of the bottom liner system.

3.4.2 Infiltration of Liquids

The composite final cover system incorporates a low-permeability layer that achieves an equivalent or greater reduction in infiltration than the minimum 18 inches of earthen material required by 40 CFR 257.102(d)(3)(i)(B). Additionally, the sides and top of the CCR Landfill will have positive slopes to preclude the future impoundment of liquids.

3.4.3 Erosion of the Final Cover System

The erosion of the composite final cover system will be minimized by the rapid establishment of vegetation on the 1-foot-thick topsoil layer. The soil will not be heavily compacted to allow for adequate root penetration. Soils used for topsoil layer will be capable of supporting the composite final cover vegetation either as they are, or fertilizer will be introduced as needed.

3.4.4 Disruption of the Integrity of the Final Cover System

Final grades across the top of the composite final cover system will be a minimum of 4 percent to accommodate differential settlement and subsidence.

3.5 Inventory and Area Estimates

In accordance with 40 CFR 257.102(b)(1)(iv) and (v):

The estimated maximum inventory of CCR ever on site over the active life of the CCR Landfill is 10,052,000 cubic yards.

An estimate of the largest area of the CCR Landfill ever requiring a composite final cover during the CCR Landfill's active life is 25 acres.

3.6 Closure Schedule

40 CFR 257.102(b)(1)(vi) requires that a schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CCR unit will be completed, be included in the closure plan. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including major milestones, such as coordinating with and obtaining necessary approvals and permits from other agencies … or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. Per 40 CFR 257.102(f)(1), the owner or operator must complete closure of an existing CCR landfill within six months of commencing closure activities unless, per 40 CFR 257.102(f)(2), the owner or operator can demonstrate that it was not feasible to complete closure of the CCR unit within the required timeframes because of factors beyond the facility's control.

At this time, based on CCR placement rates to date, it is projected that closure of the CCR Landfill will begin no earlier than 2069, will be completed six months following commencement of closure. Refer to Table 3-2 for a projected timeline of the activities necessary to close the CCR Landfill.

Table 3-2
Schedule for Closure
Duck Creek Power Station CCR Landfill

Tasks	Time in Months						
	0	1	2	3	4	5	6
1. Acquire Approvals/Permits and Cease Placement of CCR							
2. Closure Commencement							
3. Place and Compact Low Permeability Soil Layer							
4. Place Geomembrane							
5. Place Final Protective Cover Layer and Topsoil							
6. Surface Water Management Construction and Place Vegetation							
7. Construction Quality Assurance							
8. Plat of Survey							
9. Documentation of Closure							

4. Post-Closure Care Plan

40 CFR 257.104(d) requires that the post-closure plan include, at a minimum, the following:

(i) a description of the monitoring and maintenance activities required in paragraph (b) (outlined in Section 4.1 below) for the CCR unit, and the frequency at which these activities will be performed;
(ii) the name, address, telephone number, and email address of the person or office to contact about the facility during the post-closure care period; and
(iii) a description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart. Any other disturbance is allowed if the owner or operator of the CCR unit demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of CCR, will not increase the potential threat to human health or the environment. The demonstration must be certified by a qualified Professional Engineer, and notification shall be provided to the state director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible internet site.

It should be noted that 40 CFR 257.104(c) requires that post-closure care is conducted for 30 years. If at the end of the post-closure care period, the owner or operator of the CCR unit is operating under assessment monitoring in accordance with 40 CFR 257.95, the owner or operator must continue to conduct post-closure care until the owner or operator returns to detection monitoring in accordance with 40 CFR 257.95.

4.1 Post-Closure Monitoring and Maintenance

40 CFR 257.104(b) requires that following closure of the CCR unit, the owner or operator must conduct post-closure care for the CCR unit, which must consist of at least the following:

(1) maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion or other events and preventing run-on and run-off from eroding or otherwise damaging the final cover;
(2) 40 CFR 257.104(b)(2) is applicable to new landfills and any lateral expansion; therefore, not applicable because the lateral expansion will not be used; and
(3) maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of 40 CFR 257.90 through 257.98.

In accordance with 40 CFR 257.104(b) and 257.104(d)(i), the post-closure monitoring and maintenance program will include the following:

4.1.1 Final Cover Maintenance

Inspection of the CCR Landfill will be conducted on an annual basis for a minimum period of 30 years after closure. A written record of the inspection(s) will be made and retained. The inspector will visually assess the condition and need for repair of composite final cover system and vegetation, as well as surface water control features.

During the 30-year, post-closure care period, repairs and maintenance — including soil filling and reseeding — will be performed if ponding is observed, vegetative or vector problems arise, or if leachate seeps are present. Areas that have been identified as particularly susceptible to erosion will be recontoured and reseeded. All eroded and scoured drainage channels will be repaired, as warranted, and the lining material replaced if necessary. The vegetation will be mowed on a regular basis to maintain vegetation growth and facilitate inspection.

Residual settlement and erosion may require minor composite final cover system repairs. Areas where ponding occurs or erosion appears will be repaired, as appropriate, in order to maintain the integrity of the composite final cover system. Recently filled and covered areas are anticipated to require the most maintenance. Areas of settlement will be repaired with additional cover soils, as required. Off-site material will be secured to maintain the composite final cover system.

4.1.2 Groundwater Monitoring

Groundwater monitoring will be conducted in accordance with the requirements of 40 CFR 257.90 – 257.98. The site will operate a groundwater monitoring program as defined in 40 CFR 257.90 – 257.92, which requires sampling, analysis and reporting of the site groundwater monitoring results. Groundwater monitoring frequency will be at least semi-annual, except as provided in 40 CFR 257.94(d). These activities will be conducted for a minimum of 30 years after closure, as described in the Site Groundwater Monitoring Plan. This plan will be completed no later than October 2017.

4.2 Contact

In accordance with 40 CFR 257.104(d)(ii), during the post-closure care period, the office to contact about the CCR Landfill is:

Illinois Power Resources Generating, LLC
CCR Office
601 Travis Street, Suite 1400
Houston, TX 77002
800.633.4704
ccr@dynegy.com

4.3 Property Use during the Post-Closure Care Period

In accordance with 40 CFR 257.104(d)(iii), the use for the property during the 30-year, post-closure period is anticipated to be undeveloped. This use will not disturb the integrity of the composite final cover system, liner or any other component of the containment system, nor will it inhibit the functioning of the monitoring systems.

Following closure of the CCR Landfill, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 CFR 257.102(i). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements per 40 CFR 257.104(d)(1)(iii). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be placed in the facility's operating record. The notification will be placed on the owner's or operator's publicly accessible CCR website, in accordance with 40 CFR 257.107.

5. Amendments to Written Closure Plan or Post-Closure Plan

In accordance with 40 CFR 257.102(b)(3)(i) and 257.104(d)(3)(i), the owner or operator may amend the initial or any subsequent written closure plan or written post-closure plan, respectively, at any time. In accordance with 40 CFR 257.102(b)(3)(ii) and 257.104(d)(3)(ii), the owner or operator must amend the written closure plan or post-closure plan, respectively, whenever: (a) there is a change in the operation of the CCR unit that would substantially affect the written plan in effect; or (b) before or after closure activities have commenced or after post-closure activities have commenced, unanticipated events necessitate a revision of the written plan. Finally, under 257.102(b)(3)(iii) and 257.104(d)(3)(iii), the owner or operator must amend the closure plan or post-closure plan, respectively, at least 60 days prior to a planned change in the operation of the facility or CCR unit, or no later than 60 days after an unanticipated event requires the need to revise an existing written plan. If a written closure plan or post-closure plan is revised after closure or post-closure activities have commenced for a CCR unit, the owner or operator must amend the current plan no later than 30 days following the triggering event.

6. References

Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 40 CFR 257 (2015)

7. Certification Page

DUCK CREEK POWER STATION CCR LANDFILL
ILLINOIS POWER RESOURCES GENERATING, LLC
INITIAL CLOSURE AND POST-CLOSURE PLANS
LICENSED PROFESSIONAL ENGINEER CERTIFICATION

As a qualified professional engineer as defined by 40 CFR 257 Subpart D, I have personally examined and am familiar with the closure and post closure plans referenced below. Based on my inquiry of those individuals immediately responsible for obtaining the information contained therein, I believe that the information is true, accurate and complete. I certify that:

1. The **Duck Creek Power Station CCR Landfill** Closure Plan meets the requirements set forth in 40 CFR 257.102 as published on April 17, 2015;

2. The design of the final cover system for the **Duck Creek Power Station CCR Landfill** as included in the initial written closure plan meets the requirements of 40 CFR 257.102 as published on April 17, 2015; and

3. The **Duck Creek Power Station CCR Landfill** Post-Closure Plan meets the requirements set forth in 40 CFR 257.104 as published on April 17, 2015.

David B. Hoots, P.E.
Hanson Professional Services Inc.
1525 South Sixth Street
Springfield, IL 62703-2886
(217) 788-2450
Registration No. 062-055737

Seal:



Signature: _____

Date: 10/13/2016, LICENSE EXPIRES 11/30/2017