MEMORANDUM

October 14, 2016
CEC Project 144-189.6502

SUBJECT: CCR Closure Plan: Version 1
Carter Hollow Landfill
Dayton Power & Light Co.
J.M. Stuart Electric Generating Station
Sprigg Township, Adams County, Ohio

Dayton Power & Light Company (DP&L) operates the coal-fired J.M. Stuart Electric Generating Station (JMSS) located in Sprigg Township, Adams County, Ohio. Carter Hollow Landfill (CHLF) is an existing Class III residual waste landfill that is being constructed and will operate in compliance with the approved Permit to Install (PTI) No. RSWL019994 issued by the Ohio Environmental Protection Agency (Ohio EPA), which includes a Final Closure/Post-Closure Plan (Approved Closure Plan) in Appendix C9-C. CHLF is a Coal Combustion Residuals (CCR) Unit by definition of the United States Environmental Protection Agency (USEPA) CCR Rule which has been published in the Federal Register (FR) on April 17, 2015 and is an extension of the current Code of Federal Rules (CFR) Title 40, Part 257 (§257).

This CCR Closure Plan has been prepared for DP&L to demonstrate that the CHLF meets or exceeds the requirements for a written Closure Plan as defined in §257.102(b) *written closure plans*. Civil & Environmental Consultants, Inc. (CEC) has been contracted by DP&L to provide a qualified Professional Engineer to certify compliance with the written closure plan requirements within §257.

The CCR Closure Plan has been developed based upon information provided by DP&L and describes CHLF, closure design, a schedule for closure, and steps required to amend the CCR Closure Plan in the future if necessary. When CHLF will no longer receive CCR waste, the landfill will be closed leaving CCR's in-place and a final cover system will be installed. The applicable sections of the subject CCR Rule are provided below in italicized text followed by DP&L's description of compliance with the rule.

> *§257.102(b)(1): 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)(i) through (vi) of this section.*

Currently, DP&L plans to operate the CHLF facility through the year 2036. CHLF will begin closure activities in accordance with the Approved Closure Plan and within seven days after any of the following occurrences:

- DP&L declares that no more residual waste will be accepted for disposal at CHLF;
- If the solid waste license issued for CHLF has expired; or
- When the approved limits of waste placement have been reached.

Closure activities will include completion of the following sequential items in order to meet the requirements in §257.102:

1. Obtain written Professional Engineer (PE) certification that design of the cover system meets the requirements of the CCR Rule.
2. No later than the date closure is initiated, prepare a notification of intent to close CHLF and place the notification in the CHLF Operating Record. The notification of intent to close must include the PE certification from Item 1.
3. Commence closure no later than 30 days after known final receipt of CCR.
4. Complete installation of final cover system within 6 months of commencing closure activities, unless an extension is requested and supporting demonstration is prepared in accordance with §257.102(f)(2)(i).
5. Obtain PE certification verifying closure has been completed in accordance with this CCR Closure Plan.
6. Within 30 days of closure completion, prepare a notification of CHLF closure and place notification in the CHLF Operating Record. The notification of closure must include the PE certification from Item 5.
7. Following closure of CHLF, record a notation on the deed to the property or some other instrument normally examined during title search.
8. Within 30 days of recording a notation on the deed to the property, prepare a notification stating that the notation has been recorded and place the notification in the CHLF Operating Record.

§257.102(b)(1)(i): A narrative description of how the CCR unit will be closed in accordance with this section

DP&L plans to close CHLF by leaving CCR in-place with a final cover system designed and constructed to meet the Approved Closure Plan and §257.102. A demonstration that the final cover system specified in the Approved Closure Plan meets the requirements of §257.102(d)(3)(i)(A-D) is provided below:

CCR Rule	CCR Rule Requirement	Approved Closure Plan
§257.102(d)(3)(i)(A)	Permeability of final cover system equal to bottom liner system or no greater than $1x10^{-5}$ cm/sec, whichever is less.	Permeability of Recompacted Soil Barrier (RSB) equal to $1x10^{-7}$ cm/sec (which is equal to the bottom liner system).
§257.102(d)(3)(i)(B)	Infiltration layer equal to 18-inches thick.	RSB thickness is 24-inches.
§257.102(d)(3)(i)(C)	Erosion layer 6-inches thick and capable of sustaining native plant growth.	Vegetative Cover/Frost Protection Layer will be 24-inches thick, the top 6-inches will consist of soil able to support vegetation.
§257.102(d)(3)(i)(D)	Final cover system design must minimize settling and subsidence.	All calculated factors of safety meet the requirements of OAC 3745-30-07(C)(11)(c, d, and f), and thus, the planned final cover system and diversion berms will be stable.

The components comprising the final cover system for the CHLF, from top to bottom, are described below:

- **Erosion Layer (§257.102(d)(3)(i)(C))**

This layer will be comprised of the following:

Vegetative Cover: Erosion of the final cover system will be minimized by the placement of a minimum 6-inch thick layer that will consist of clean soil of sufficient thickness and fertility to support vegetation. The surface of the vegetative cover will be fertilized, seeded and mulched as necessary to provide a dense vegetative cover. The soil will not contain excessively large materials.

Frost Protection Layer: The minimum thickness of this layer was calculated to be 18-inches and combined with the vegetative cover provides a total thickness of 2 feet for frost protection of the RSB in conformance with OAC 3745-30-09(F)(3)(b). This layer

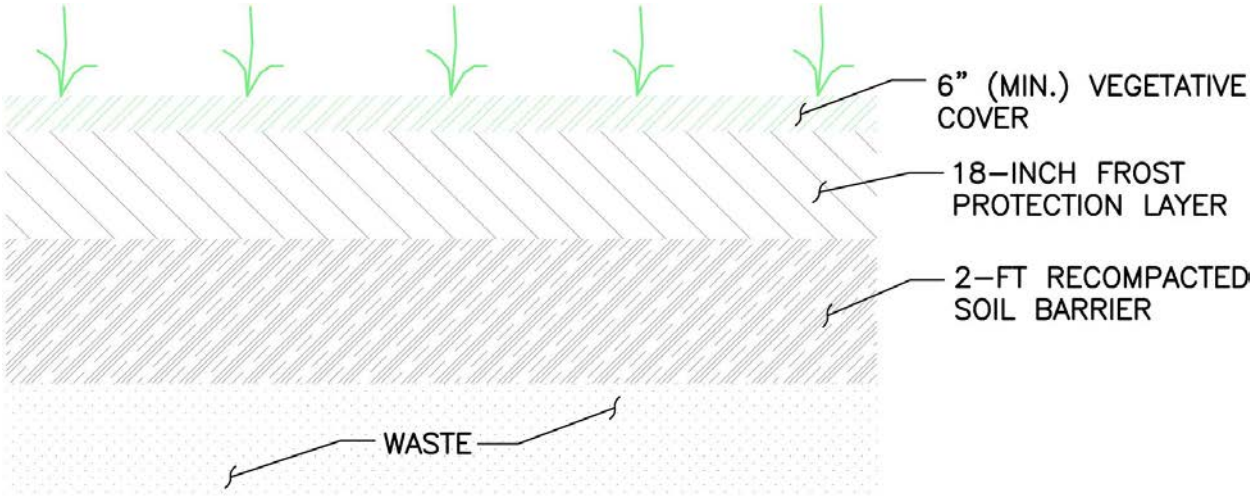
will consist of clean soil of sufficient thickness to protect the RSB from damage due to root penetration. The soil will not contain excessively large materials.

- **Infiltration Layer (§257.102(d)(3)(i)(B))**

This layer, defined as the Recompacted Soil Barrier (RSB) in the Approved Closure Plan, will be 2 feet thick and constructed in accordance with the specifications in OAC 3745-30-07 and modeled by the construction of a test pad in accordance with OAC 3745-30-07. The criteria for the RSB are as follows:

- Minimum installed thickness of 24 inches;
- Permeability shall be less than or equal to 1 x 10^{-7} cm/sec;
- One hundred percent of material with a maximum particle size of 2 inches;
- No more than 10 percent of material, by weight, having a particle size greater than 0.75 inches;
- At least 50 percent of the particles, by weight, passing through the No. 200 sieve; and
- At least 25 percent of the particles having a maximum dimension of 0.002 millimeters (mm).

A typical section of the final cover system from the Approved Closure Plan, which also meets the requirements of §257.102(d)(3)(i)(A-D), is presented below.



TYPICAL FINAL COVER SYSTEM

The top of the final cover will be graded to adequately drain stormwater runoff to a series of diversion berms, collection channels, culverts, perimeter channels and sedimentation ponds. These control structures will convey stormwater off-site to the main channel in Carter Hollow that flows downstream to the Ohio River.

Drawings 4E and 4F in the approved PTI present the top of waste and top of protective cover of the cover system, respectively. The side slopes of the cover system are graded at 25 percent (4H:1V) with surface water diversion berms installed at 25-foot intervals. The berms are designed to slope toward collection channels at 2 percent minimum slope.

Drawing 4F in the approved PTI presents the surface water management plan. The surface water management system is designed to convey surface water to the sedimentation ponds. This system consists of surface water diversion berms, collection channels, culverts, perimeter channels and sedimentation ponds.

Drawings 7A and 7B in the approved PTI present the cover system details, including but not limited to the key trench, penetrations, cap drainage structures and surface water drainage structures. Drawings 7A through 7G in the approved PTI present design details for the sedimentation pond discharge structures and surface water control structures.

The proposed final cover system will be constructed to satisfy the closure performance standards per the requirements of §257.102(d)(1) as described in the following pertinent sections (refer to pages 7 through 10 of this CCR Closure Plan).

> *§257.102(b)(1)(ii): If closure of the CCR unit will be accomplished through removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.*

This rule is not applicable to the CHLF because the landfill will be closed-in-place.

> *§257.102(b)(1)(iii): If closure of the CCR unit will be accomplished by leaving CCR in place,* ***a description of the final cover system****, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*

See the description provided in *§257.102(b)(1)(i)* above.

> *§257.102(b)(1)(iii): If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and* ***the methods and procedures to be used to install the final cover****. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*

Construction of the CHLF final cover system will follow the procedures and specifications in the Approved Closure Plan and the Construction Quality Assurance/Quality Control (CQA/QC) Plan in the Approved PTI, (Appendix C-9B).

The construction of drainage structures will occur sequentially with the installation of the final cover system. Areas of final waste placement will have the cover system constructed and will be graded towards surface water control structures. The actual sequence of construction will be implemented to allow discharge to be conveyed completely off the surface of the landfill. In general, structures at the lower slopes will be constructed prior to those located in upslope areas. For example, perimeter channels will be constructed initially to provide an outlet for runoff from surface water berms. Construction of the remaining drainage system components will occur as areas of the landfill attain final grade and receive final cover, until the entire system is constructed across the landfill.

General installation methods and procedures for construction of the final cover system are summarized below:

Subgrade Preparation

Prior to placement of the RSB (infiltration layer), the surface of the waste or intermediate cover (if present) shall be prepared and proof rolled. The surface shall be free of debris, rocks, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft areas. The surface shall be smoothed to provide a suitable working base for final cover system installation. Fill soil may be required to shape the subgrade and fill in low areas or repair erosion as necessary. Any soft areas should be under-cut and recompacted as necessary to provide a firm, unyielding foundation for placement and compaction of the RSB layer. The subgrade shall be maintained in a smooth, uniform, and drained condition prior to placement of the RSB.

The subgrade will be surveyed to establish as-built elevations of the RSB base surface prior to placement of the infiltration layer.

Recompacted Soil Barrier (Infiltration Layer)

A 24-inch thick RSB shall be constructed as part of the final cover system following the specifications in the approved CQA/QC Plan, Section II. The criteria for the RSB are as follows:

- Minimum installed thickness of 24 inches;
- Permeability shall be less than or equal to 1×10^{-7} cm/sec;
- One hundred percent of material with a maximum particle size of 2 inches;
- No more than 10 percent of material, by weight, having a particle size greater than 0.75 inches;
- At least 50 percent of the particles, by weight, passing through the No. 200 sieve; and
- Not less than 25 percent of the particles having a maximum dimension of not greater than 0.002 mm.

A test pad shall be constructed for each borrow source to establish construction details or verify or amend the construction details proposed in the approved PTI. In addition, a test pad shall be constructed whenever there is a significant change in soil material properties for the RSB. Test pads shall be constructed using the same material, equipment, and procedures to be used in the construction of the RSB.

RSB soils shall be compacted to achieve the specified compaction and permeability requirements. The 24-inch thick RSB shall be placed in 8-inch thick maximum loose lifts. Soil clods shall be broken down to 3 inches or half the lift thickness, whichever is less. Moisture conditioning may be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content throughout the soil mass. The RSB shall be compacted to a density of at least 95 percent of the Standard Proctor maximum dry density or 90 percent of the Modified Proctor maximum dry density at a moisture content at or above the optimum moisture content. For each lift, the density and moisture shall be tested at a frequency of five tests per acre. All test penetrations shall be filled with bentonite.

The surface of the RSB shall have no abrupt changes in grade that may result in damage to overlying components. Surveying shall be performed to document that finished dimensions are as specified.

Vegetative Cover/Frost Protection Layer (Erosion Layer)

The vegetative cover/frost protection layer shall have a minimum thickness of 24-inches. The upper top 6 inches shall consist of soil able to support vegetation and be reasonably free of large particles, frozen materials, foreign objects and organics. The physical characteristics of the materials shall be evaluated through visual observation both before and during placement. The vegetative cover /frost protection layer shall be placed in one or more uniform lifts so that thickness and slopes meet the design specifications in the approved CQA/QC Plan, Section II.

The vegetative cover/frost protection layer shall be placed and spread to the required thicknesses using a low ground pressure dozer or other suitable earth moving equipment. The vegetative cover/frost protection layer installation shall proceed upslope only. Precautions shall be taken to make sure that at least 3 feet of soil material is provided for trucks to run on when bringing vegetative cover /frost protection layer materials to the work area. The operators of all equipment used in transporting or spreading the soil material shall be advised to use gradual turns and stop/starts.

The final surface of the vegetative cover shall be scarified, seeded, mulched, and fertilized as required to establish a dense vegetative growth. Surveying shall be performed to document that finished cover system dimensions are as specified.

Temporary or permanent erosion control materials (mulches, fabrics, rock check dams, soil tackifier) may be used to minimize erosion and aid in establishment of vegetation. Hard armor such as cobbles or rip rap may be used in areas where establishment of vegetation may be difficult or impossible.

§257.102(b)(1)(iii): If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. ***The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.***

§257.102(d)(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:

§257.102(d)(1)(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;

The RSB layer of the CHLF final cover system will be constructed with soil that has a permeability equal to the landfill base liner and will be less than or equal to 1 x 10^{-7} cm/s, which will minimize infiltration of liquids into the waste and inhibit the generation of CCR leachate. The final cover system will minimize releases of CCR and CCR contaminated run-off by completely covering the in-place CCR material and preventing exposure to erosive conditions. The final cover system will minimize the potential for CCR fugitive dust by completely covering the in-place CCR preventing exposure to wind and vehicle traffic.

§257.102(d)(1)(ii): Preclude the probability of future impoundment of water, sediment, or slurry;

The final cover will be graded to promote positive drainage and prevent the impoundment of surface water, sediment, or slurry. The top of the final cover will be graded at a minimum 2% slope and will direct stormwater to a series of diversion berms, collection channels, culverts, perimeter channels and sedimentation ponds. The final grading and stormwater conveyance system will prevent the impoundment of storm/surface water on the cap.

§257.102(d)(1)(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;

The approved PTI includes a detailed slope stability analysis to ensure overall stability of the CHLF final cover grading plan and final cover system. Both static and seismic conditions were evaluated. Results of the analysis indicate an acceptable factor of safety against slope failure for both static and seismic conditions. The establishment of vegetation and stormwater controls designed for the CHLF will aid in prevention of erosion, saturation, sloughing and instability of the final cover.

§257.102(d)(1)(iv): Minimize the need for further maintenance of the CCR unit; and

The final cover system has been designed to minimized long-term maintenance. The combination of cap grading, stormwater conveyance structures and establishment of vegetation on the vegetative cover /frost protection layer will minimize the potential for erosion, settlement and sloughing of the final cover system and the need for future maintenance.

§257.102(d)(1)(v): Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

Closure will be completed in the shortest amount of time consistent with generally accepted good engineering practices and industry standard construction methods. However, the schedule for closure will require adjustments, as needed, to accommodate potential weather delays due to periodic and seasonal conditions and availability of construction materials. These elements have been accounted for in the closure schedule shown in the response for §257.102(b)(1)(vi) below.

> *§257.102(b)(1)(iv): An estimate of the maximum inventory ever on-site over the active life of the CCR unit.*

The maximum storage volume of CHLF is estimated to be approximately 15,110,000 cubic yards.

> *§257.102(b)(1)(v): An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.*

The CHLF construction plan includes five phases, with final cover being constructed sequentially as the final waste grades are achieved. The CCRs in CHLF will be placed over the RSB base liner system during Phase 1A through 3, with Phase 4 consisting of a vertical overfill above these phases. As waste placement expands from Phase 1A through Phase 3, the perimeter waste limit sideslopes will occur; thus, final cover will be constructed once the permitted waste grades have been achieved. Based on the planned phased construction and corresponding waste grades at CHLF, partial final cover construction will occur in Phases 1A, 1B, 2, 3, 4, and through final closure. The estimated plan areas that will receive final cover within these phases is 1.13 acres (Phase 1A), 3.63 acres (Phase 1B), 5.44 acres (Phase 2), 27.14 acres (Phase 3), and 45.81 acres (Phase 4). Under a scenario where CHLF is closed prior to reaching final grades, the largest area requiring final cover is planned to occur at the beginning of Phase 3 operations and is estimated to be a maximum area of 63.88 acres.

> *§257.102(b)(1)(vi): 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. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that*

the time required to complete closure will exceed the timeframes specified in paragraph (f)(1) of this section, the written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under paragraph (f)(2) of this section.

An estimated schedule for completing the activities necessary to satisfy the closure in place criteria of the CCR Rule is provided below. The schedule lists the sequential steps that need to be taken to close the CHLF.

DP&L – Carter Hollow Landfill
Closure Schedule

Step #	Task Item	Completion Timeframe (months)												
		Design and Permitting												
		1	2	3	4	5	6		1	2	3	4	5	6
1	Prepare Construction Plans													
2	PE Design Certification													
3	Notice of Intent to Close Landfill													
4	Cease placing CCR in landfill													
		Closure Construction and Notification												
		1	2	3	4	5	6		1	2	3	4	5	6
5	Commence Closure													
6	Final Cover Installation													
7	PE Closure Certification													
8	Notice of Landfill Closure													
9	Record Deed Notation													
10	Notice of Deed Recordation													

DP&L will plan to initiate some closure activities prior to commencing closure of CHLF. As indicated on the schedule, DP&L will need to take action on Steps 1-3 as early as 6 months prior to the anticipated final receipt of CCR at CHLF.

Per §257.102(e)(3) closure of the CHLF has commenced when DP&L has ceased placing CCR in the landfill and completes any of the following actions or activities: (i) Taken any steps necessary to implement the written closure plan; (ii) Submitted a completed application for any required state or agency permit or permit modification; or (iii) Taken any steps necessary to

comply with state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of the CCR Unit.

DP&L intends to operate the CHLF through 2036 with closure activities estimated to be completed in 2037.

> *§257.102(b)(3)(i): The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to paragraph (b) (1) of this section at any time.*

DP&L will assess the CCR Closure Plan and amend the plan whenever there is a change in operation of CHLF that would substantially affect the Closure Plan or when unanticipated events necessitate a revision of the plan either before or after closure activities have commenced.

The CCR Closure Plan will be amended at least 60 days prior to a planned change in the operation of CHLF or no later than 60 days after an unanticipated event requires the need to revise the Closure Plan. If the Closure Plan needs to be revised after closure activities have commenced, the plan will be revised no later than 30 days following the triggering event.

The amended CCR Closure Plan will be placed in the CHLF Operating Record as required by the CCR Rule.

A record of amendments to the plan will be tracked below. The latest version of the CCR Closure Plan will be noted on the front cover of the plan.

Version	Date	Description of Changes Made
1	October 14, 2016	Initial Issue

§257.102(b)(4): The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this section.

I certify that this CCR Closure Plan for DP&L's Carter Hollow Landfill at the J.M. Stuart Electric Generating Station meets the USEPA's Final CCR Rule requirements of §257.102(b).

Signed: _____
Consulting Engineer

Print Name: Anthony P. Amicon
Ohio License No.: E-58805
Title: Principal
Company: Civil & Environmental Consultants, Inc.

Professional Engineer's Seal: