Big Rivers
ELECTRIC CORPORATION

Sebree Generating Station
Reid/HMP&L CCR Surface Impoundment

Demonstration for Extension to Closure Deadline

Revision 0

April 17, 2024

Issue Purpose: Use

Project No.: 14055-010

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1.0 INTRODUCTION

Federal CCR Rule Reference: 40 C.F.R. § 257.102(f)(2)(i)

1.1 PURPOSE

Pursuant to 40 C.F.R. § 257.102(f)(2)(i), Big Rivers Electric Corporation (BREC) is extending the closure deadline for the Reid/Henderson Municipal Power & Light (Reid/HMP&L) CCR Surface Impoundment by 5.5 months to October 1, 2024. On behalf of BREC, Sargent & Lundy (S&L) has prepared this document ("Demonstration") to demonstrate the need for this time extension for closing the Reid/HMP&L CCR Surface Impoundment. In accordance with 40 C.F.R. § 257.102(f)(2)(i) and 401 KAR 46:110 Section 9, this Demonstration (1) substantiates the need for additional time beyond April 17, 2024, and (2) justifies BREC's six-month extension for closing the Reid/HMP&L CCR Surface Impoundment.

1.2 BACKGROUND

The Reid/HMP&L CCR Surface Impoundment is a coal combustion residual surface impoundment (CCRSI) that is regulated by the U.S. Environmental Protection Agency's (EPA) regulations for CCRSIs codified in 40 CFR Part 257 Subpart D ("Federal CCR Rule") and by Title 401, Chapter 46 of the Kentucky Administrative Regulations (KAR), which incorporates the Federal CCR Rule by reference. The impoundment is located in Webster County, Kentucky, at the Sebree Generating Station, where three coal-fired power plants were historically co-located: the Robert D. Green Station, the Robert A. Reid Station ("Reid"), and HMP&L Station Two. The Reid/HMP&L CCRSI was constructed around the same time as HMP&L Station Two, which consisted of two units that began commercial operations in 1973 and 1974. The impoundment received sluiced CCR from both HMP&L Station Two and the Reid Station until the impoundment was retired in 2019. On April 17, 2019, BREC initiated closure of the Reid/HMP&L CCRSI and placed a notification of intent to close the pond in the Station's operating record in accordance with 40 CFR 257.102(g) and 401 KAR 46:110 Section 9. Therefore, pursuant to 40 CFR 257.102(f)(1)(ii), BREC must complete closure of the Reid/HMP&L CCRSI by April 17, 2024, unless BREC extends the closure deadline under 40 CFR 257.102(f)(2)(i).

In accordance with the Federal CCR Rule and 401 KAR 46:110 Section 8, BREC monitors groundwater at the Reid/HMP&L CCRSI site with a monitoring well network. This network initially consisted of four monitoring wells to monitor the impoundment's performance relative to potential impacts to groundwater: upgradient well MW-7 and downgradient wells MW-8, MW-9, and MW-10. In late 2018, lithium concentrations at MW-10 were determined to be at statistically significant levels (SSLs) above the groundwater protection standard (GWPS) established for lithium in accordance with 40 CFR 257.95(h). In response to this exceedance, BREC initiated an Assessment of Corrective Measures (ACM) in January 2019 to identify applicable remedial technologies to address the reported lithium impacts in groundwater pursuant to 40 CFR 257.96 (AECOM, 2019a).

2.0 DEMONSTRATION FOR CLOSURE DEADLINE EXTENSION

Federal CCR Rule Reference: 40 C.F.R. § 257.102(f)(2)(i)

BREC is extending the closure deadline for the Reid/HMP&L CCRSI at the Sebree Generating Station under 40 CFR 257.102(f)(2)(i) due to the cumulative time required to (1) select a remedy for the lithium impacts to groundwater observed at well MW-10 and to (2) dewater the CCR stored in the impoundment. In the 2019 ACM, BREC identified the closure of the Reid/HMP&L CCRSI as the primary means of controlling the source of lithium impacts observed at monitoring well MW-10 (AECOM, 2019a). Therefore, BREC could not start closure construction until a remedy for the lithium concentrations observed at well MW-10 was selected in accordance with 40 CFR 257.97(a). As discussed in Section 2.1, BREC needed to evaluate supplemental remedial technologies, collect additional data, and develop a contaminant fate and transport model before selecting a final remedy for groundwater at the impoundment. As discussed in Section 2.2, the contractor closing the Reid/HMP&L CCRSI initially forecasted having the impoundment closed by the April 17, 2024, deadline, but the predominately silty nature of the ash stored in the impoundment has required additional processing and dewatering time that has made it infeasible to meet this deadline. As noted in 40 CFR 257.102(f)(2)(i)(B), the "time required to dewater a surface impoundment due to…the characteristics of the CCR in the unit" is a factor that may substantiate the need for additional time to close a CCR unit beyond the maximum timeframe stipulated in 40 CFR 257.102(f)(1), *i.e.*, five years.

2.1 TIME REQUIRED TO SELECT GROUNDWATER REMEDY

In accordance with 40 CFR 257.97(a), BREC selected a remedy for the lithium impacts observed in the groundwater at MW-10 as soon as feasible. Within a year of initiating the ACM, a characterization monitoring well was installed at the Station's property line to define the extent of lithium migration downgradient of the Reid/HMP&L CCRSI, and a closing the impoundment in-place in accordance with 40 CFR 257.102(d) was initially selected as the primary means of controlling the source of the lithium contamination observed at well MW-10. BREC then implemented a systematic approach to select a groundwater remedy and develop a design for closing the Reid/HMP&L CCRSI. BREC first evaluated additional data needs and then performed the necessary field investigations and laboratory tests to obtain the required data. After obtaining enough data and developing conceptual closure designs for the impoundment, BREC developed a contaminant fate and transport model to evaluate the performance of the different closure alternatives and to determine whether supplemental remedial technologies were needed (*e.g.*, hydraulic containment, physical containment, *ex-situ* treatment). Using the results of the contaminant fate and transport model, BREC then completed an evaluation of potential corrective measures and selected the groundwater remedy that was forecasted to perform the best amongst the evaluated alternatives. Finally, BREC finalized the corresponding closure design and specifications and procured a contractor to execute the final closure plan for the Reid/HMP&L CCRSI.

After identifying lithium in well MW-10 at SSLs above the GWPS, BREC performed an ACM between January and June 2019 to identify potential groundwater remedies (AECOM, 2019a). Pursuant to 40 CFR 257.96(c), the ACM included an analysis of whether the identified potential corrective measures could meet the standards for a groundwater remedy specified under 40 CFR 257.97, including the five threshold criteria specified under 40 CFR 257.97(b). One of these threshold criteria, which are the minimum standards (*i.e.*, thresholds) that must be met in order for a potential corrective measure to be considered an acceptable remedy, is "control[ling] the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV [40 CFR Part 257] into the environment." 40 CFR 257.97(b)(3). Because the Reid/HMP&L CCRSI was indicated to be the source of the elevated lithium concentrations noted at well MW-10, the ACM identified closure of the impoundment as the primary means of meeting the source control criterion specified by the Federal CCR Rule for selecting a groundwater remedy. Therefore, closure construction at the Reid/HMP&L CCRSI could not commence until a remedy for the lithium concentrations observed at well MW-10 was selected in accordance with 40 CFR 257.97(a).

Approximately one month after initiating the ACM, BREC installed a new characterization well, MW-110, downgradient of the Reid/HMP&L CCRSI, near the Station's western property line in accordance with 40 CFR 257.95(g)(1)(iii). Pursuant to 40 CFR 257.95(g)(1), the purpose of this well was to "assist in the characterization of the existence, quality, quantity, areal extent of groundwater degradation, and the rate and direction of migration of CCR contaminants in the groundwater" (AECOM, 2019b, p. 7). BREC sampled well MW-110 in March and April 2019, and the corresponding analytical results found all Appendix III or Appendix IV constituents to be at concentrations below their respective GWPSs. Notably, these initial analytical test results indicated lithium contamination had not migrated off-site. (AECOM, 2019b.)

By December 2019, BREC anticipated closing the Reid/HMP&L CCRSI in-place in accordance with 40 CFR 257.102(d) as the primary means of mitigating the source of lithium impacts observed in the groundwater at well MW-10. In 2020 and 2021, BREC continued evaluating potential remedies centered around closure in-place of the impoundment, assessing whether supplemental remedial technologies would be needed to meet the performance standards for corrective action under the Federal CCR Rule. Two remedial technologies that were considered to pair with closing the impoundment were hydraulic containment (groundwater extraction wells with *ex-situ* treatment) and physical containment (funnel-and-gate slurry walls with an extraction well and *ex-situ* treatment) (AECOM, 2019c). While evaluating these potential remedial technologies, BREC developed a plan to collect the data necessary to complete the evaluation and select a remedy for the lithium impacts noted in the groundwater at well MW-10, including the engineering design for closing the Reid/HMP&L CCRSI. BREC started executing the plan in 2022, the major elements of which were:

- Conducting a subsurface investigation within the impoundment to obtain geotechnical data for the impounded ash and natural subsoils under the impoundment. (Geotechnical data for the impoundment's dikes was previously collected in 2016).
- Performing a survey of the Reid/HMP&L to obtain the topographic data needed to develop a final grading plan and a stormwater run-off control system for the closed impoundment.
- Installing additional monitoring wells downgradient and cross-gradient of the impoundment to confirm the southwestern and south-southeastern extents of lithium impacts to the groundwater. (MW-110 defined the western extents.)
- Developing a contaminant fate and transport model to determine the effectiveness of the impoundment closure design and to determine whether supplemental remedial technologies should be incorporated into the remedy (e.g., hydraulic containment, physical containment, *ex-situ* treatment).
- Developing cost estimates to support project planning and budgeting.

In February 2022, BREC conducted a subsurface exploratory program within the Reid/HMP&L CCRSI to obtain information on the physical and engineering properties of the CCR stored in the impoundment and the natural subsoils under the impoundment. The following month, BREC initiated a topographic and bathymetric survey to obtain the topographic data needed to develop and evaluate different options for closing the impoundment in-place. In the spring and summer of 2022, BREC developed several different closure designs for the impoundment using the geotechnical and topographic data at the site. At this time, BREC re-introduced closure-by-removal under 40 CFR 257.102(c) as a potential remedy for the lithium impacts noted at the Reid/HMP&L CCRSI. Although this closure methodology was eliminated from consideration in 2019, BREC's further study of the impoundment site warranted re-introducing closure-by-removal as a potential remedy.

In March 2022, BREC installed two new characterization wells, MW-111 and MW-112, to define the nature and extent of potential lithium migration southwest and south-southeast of the impoundment. Similar to the analytical test results at well MW-110, analytical testing of groundwater samples collected at wells MW-111 and MW-112 in March, June, and December 2022 did not report Appendix III or Appendix IV constituents at concentrations above GWPSs. Therefore, BREC was able to conclude that the lithium GWPS exceedance at the Reid/HMP&L CCRSI was limited in downgradient extent to the general vicinity of well MW-10.

After developing conceptual closure designs for the Reid/HMP&L CCRSI, and after conducting two sampling events at MW-111 and MW-112 (and at the impoundment's other CCR and characterization wells), BREC developed a contaminant fate and transport model to evaluate the effectiveness of each closure method in mitigating the lithium contamination observed at the site. Completed in October 2022, this contaminant fate and transport model was used to develop time-versus-decay curves for lithium at well MW-10 for four closure

scenarios: complete closure by-removal and three variations of closure in-place. These time-versus-decay curves were created by running the model incrementally for 100 years, as generally required in such environmental evaluations, and evaluating the forecasted lithium concentrations at well MW-10 at different timesteps. Based on an evaluation of these time-versus-decay curves for lithium at well MW-10, closure by-removal was found to achieve the GWPS in the shortest timeframe. For more information on the contaminant fate and transport model, refer to Appendix C in the "Final Report on Selection of Groundwater Remedy" for the Reid/HMP&L CCRSI (Sargent & Lundy and KPRG, 2023).

After developing and evaluating the contaminant fate and transport model for the impoundment, BREC started the final evaluation of alternative corrective measures for the lithium impacts observed in the groundwater at well MW-10. As detailed in the "Final Report on Selection of Groundwater Remedy" (Sargent & Lundy and KPRG, 2023), BREC performed this evaluation in accordance with the guidance promulgated by EPA's "Fact Sheet #3: Final Remedy Selection for Results-Based RCRA Corrective Action" (EPA, 2000) to determine the most appropriate remedy and, by extension, closure design for the Reid/HMP&L CCRSI. Based on the Federal CCR Rule's threshold and balancing criteria for selecting a remedy, BREC's evaluation concluded that closure by-removal would be the best performing remedy of the corrective measures alternatives considered to address the lithium impacts to groundwater observed at the Reid/HMP&L CCRSI.

In the spring of 2023, BREC started finalizing the engineering design for closing the Reid/HMP&L CCRSI by removing the CCR stored therein pursuant to 40 CFR 257.102(c). This effort included finalizing the design for the closed condition of the impoundment site and the corresponding technical specifications for the contractor tasked with closing the impoundment. In May 2023, BREC started engaging potential contractors to perform the closure work. Before making a final decision on the groundwater remedy to be implemented, and in accordance with 40 CFR 257.96(e), BREC held a public meeting on May 24, 2023, in Henderson, Kentucky, to discuss the ACM and evaluation of potential groundwater remedies. No members of the public attended the meeting, and no comments were received. In July 2023, after evaluating proposals submitted by contractors to perform the closure work, BREC finalized the engineering design and specifications for closing the Reid/HMP&L CCRSI and formally selected closure by-removal with institutional controls and continued groundwater monitoring to remedy the lithium impacts observed in the groundwater at MW-10.

Shortly after finalizing the groundwater remedy and, by extension, the closure design for the Reid/HMP&L CCRSI, BREC awarded the closure contract to a contractor. In accordance with the contractor's proposal, the contractor planned to be fully mobilized to the site by August 2023 and start removing ash in September 2023. With this start date, the contractor initially forecasted having all ash removed in the Reid/HMP&L by the April 17, 2024, deadline established by 40 CFR 257.102(f)(1). However, the predominantly silty nature of

the ash encountered in the Reid/HMP&L CCRSI by the contractor requires additional processing and dewatering time that has made it infeasible to meet this deadline.

2.2 TIME REQUIRED TO DEWATER CCR STORED IN THE IMPOUNDMENT

Prior to dewatering the ash stored in the Reid/HMP&L CCRSI, the contractor first had to install a temporary water treatment system to treat the interstitial water to ensure all water discharged from the site would meet the water quality requirements stipulated in the Station's Kentucky Pollutant Discharge Elimination System permit. Upon mobilizing to the site in August 2023, the contractor began installing the temporary water treatment system while also preparing the site for the forthcoming ash excavation and dewatering work. Site preparation work included clearing and grubbing vegetation within the impoundment, decanting free surface water in the southern end of the impoundment, and installing silt fences for temporary erosion and sediment control. By mid-September 2023, the temporary water treatment facility was online, and the site was ready for ash excavation and dewatering work to begin.

To dewater the ash in the Reid/HMP&L CCRSI, the contractor excavated a rim ditch around the perimeter of the pool storage area and several lateral ditches ("finger ditches") within the pool storage area that could drain into the rim ditch. The contractor excavated a sump near the outlet structure in the pond's southern corner to collect water from the rim ditch prior to discharge. Meanwhile, on the opposite end of the pond, the contractor developed a one-acre area to process / condition excavated ash to remove free liquids from the material prior to transferring the ash to the Station's landfill. To promote removal of free liquids, the contractor planned to use this area to windrow ash, stockpile ash, and blend drier ash with wetter ash. Using this excavation and dewatering plan, the contractor planned to haul ash to the Station's landfill at a rate of 5,885 cubic yards per day to ensure the Reid/HMP&L CCRSI was closed by April 17, 2024.

About one month into removing ash from the impoundment, the contractor noted that the ash materials encountered in the pond were more silty than coarse-grained. Siltier ash retains moisture better and, therefore, does not drain as freely as coarse-grained ash. Therefore, siltier ash particles require more processing time to add air and/or heat to dry the material than free-draining, coarse-grained ash particles. In the context of the material encountered in the Reid/HMP&L CCRSI, this means that the contractor had to use multiple excavators to move excavated ash between windrows multiple times in the one-acre ash processing area. On average, it has taken the contractor an additional four to five days to remove free liquids from the siltier ash material than the time required to dewater the coarse-grained ash material. This additional processing time has adversely impacted the contractor's production rate. For example, the contractor was only able to haul about 64% of the targeted volume of ash to the Station's landfill in October 2023 despite working six days per week. This loss in production was directly attributable to the additional time required to dewater the siltier ash material excavated from the Reid/HMP&L CCRSI.

By mid-November 2023, the initial one-acre ash processing area had reached capacity, so the contractor developed a second ash processing area to maintain production. Given the amount of siltier ash encountered within the impoundment and the impact the additional dewatering time was having on production, the contractor excavated several test pits to assess the distribution of silty to coarse-grained ash remaining in the impoundment and to adjust their excavation and dewatering plan as needed. By the end of November 2023, the contractor estimated the ash remaining in the impoundment was 70% to 80% silt-sized, with the balance consisting of free-draining, coarse-grained particles. Meanwhile, the contractor was only able to haul about 70% of the targeted volume of ash to the Station's landfill in November 2023 despite working six days per week.

Given the extent of siltier ash remaining in the impoundment, and the additional processing time required to dewater that ash, the contractor began implementing additional measures in December 2023 to maintain production. These measures included expanding the ash processing area to five acres, adding a new sump to redirect water away from the expanded processing area, and modifying the haul road to the landfill to divert truck traffic away from ash dewatering in the expanded processing area. Although implementation of this modified dewatering and excavation plan hindered production in December 2023 (in addition production was lost due to inclement weather), these measures ensured adequate space was provided to process the siltier ash material. During this time, the contractor also took samples of the ash material at 17 locations in the impoundment to determine grain size and *in situ* moisture content. Most of these samples had at least 70% of the ash particles pass the No. 200 sieve, confirming the abundance of silt-sized ash in the impoundment.

To date, the contractor has removed 512,000 cubic yards of ash from the Reid/HMP&L CCRSI, which is about 62% of the 822,000 cubic yards of total CCR estimated to be in the impoundment when the closure work began (Sargent & Lundy, 2023). In addition, the upper six inches of native subsoils below the CCR stored in the impoundment, equivalent to about 18,000 cubic yards of soil, will be removed to verify all CCR constituents have been removed in accordance with 40 CFR 257.102(c) and 401 KAR 46:110 Section 9. Therefore, the contractor still has approximately 328,000 cubic yards of CCR and native subsoils to remove from the impoundment.

Since ash removal started in mid-September 2023, the contractor has removed ash from the impoundment at an average rate of 66,000 cubic yards per month. The lowest four-week production rate recorded to date was approximately 40,000 cubic yards, which was caused by several days of heavy rains. If the contractor continues removing ash at an average rate of 66,000 cubic yards per month, except for one month where production is limited to 40,000 cubic yards to account for future weather impacts, then the contractor will require an additional 5.5 months to remove the remaining ash and six inches of native subsoils in the Reid/HMP&L CCRSI. Although the contractor has implemented necessary measures to maintain production,

the siltier ash material prevalent in the impoundment limits the rate at which ash can be transferred to the Station's landfill.

3.0 NEW CLOSURE DEADLINE FOR REID/HMP&L CCRSI

Federal CCR Rule References: 40 C.F.R. §§ 257.102(f)(2)(i) and 257.102(f)(2)(ii)(A)

Given the demonstration in Section 2.0 that an extension to the closure deadline for the Reid/HMP&L CCRSI is necessary due to the cumulative time required to (1) select a remedy for the lithium impacts to groundwater observed at MW-10 and to (2) dewater the CCR stored in the impoundment, BREC may, in accordance with 40 CFR 257.102(f)(2)(i), extend the closure deadline for the Reid/HMP&L CCRSI. Per 40 CFR 257.102(f)(2)(ii)(A), BREC may extend the closure deadline by up to two years. Based on the rate at which the contractor has been able to remove the predominately silt-sized ash material from the pond since ash removal began in mid-September 2023, BREC is extending the deadline for closing the Reid/HMP&L CCRSI by 5.5 months to October 1, 2024.

4.0 OWNER CERTIFICATION

Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(v)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

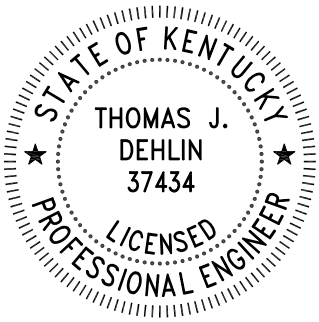
Heather Todd	**Date**
Plant Manager	

5.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I certify that this Demonstration was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the Commonwealth of Kentucky.

Certified By: Thomas J. Dehlin Date: April 17, 2024

Seal:



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6.0 REFERENCES

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AECOM. (2019b, November 18). “Groundwater Characterization Report, CCR Monitoring Program: Reid/HMP&L Surface Impoundment, Sebree Station, Webster County, Kentucky.”

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EPA. (2000, March). “Fact Sheet #3: Final Remedy Selection for Results-Based RCRA Corrective Action.” *RCRA Corrective Action Workshop On Results-Based Project Management: Fact Sheet Series*.

Sargent & Lundy. (2023, July 24). “Reid/HMP&L CCR Surface Impoundment Closure Plan.” Rev. 2.

Sargent & Lundy and KPRG. (2023, July 25). “Final Report on Selection of Groundwater Remedy.” Rev. 0.