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May 31, 2024

Delivered Electronically

Mr. Brian Rockensuess
Commissioner
Indiana Department of Environmental Management
100 N. Senate Avenue
Mail Code 50-01
Indianapolis, IN 46204-2251

**Re: Indiana-Kentucky Electric Corporation
June 2024 Semi-Annual Selection of Remedy for
Clifty Creek Station Landfill Runoff Collection Pond**

Dear Mr. Rockensuess:

As required by 40 CFR 257.106(h)(9), the Indiana-Kentucky Electric Corporation (IKEC) is providing notification to the Commissioner of the Indiana Department of Environmental Management that the ninth Semi-Annual Selection of Remedy has been completed in compliance with 40 CFR 257.97(a) for the Clifty Creek Station's Landfill Runoff Collection Pond (LRCP). The intent of the report is to provide a 6-month update on the progress of selecting a remedy for confirmed Appendix IV SSIs above the groundwater protection standard in the groundwater at the LRCP. The report has been placed on the facility's operating record in accordance with 40 CFR 257.105(h)(12), as well as, on the company's publicly accessible internet site in accordance with 40 CFR 257.107(h)(9), which can be viewed at <http://www.ovec.com/CCRCCompliance.php>.

If you have any questions, or require any additional information, please call me at (740) 289-7259.

Sincerely,

A handwritten signature in black ink that reads "Jeremy Galloway". The signature is written in a cursive style.

Jeremy Galloway
Environmental Specialist

JDG:zsh

Semi-Annual Report on the Progress of Remedy Selection

40 CFR 257.97(a)

Landfill Run-off Collection Pond

Clifty Creek Station
Madison, Indiana

June 2024

Prepared by: Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
Piketon, OH 45661



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1 INTRODUCTION

In accordance with 40 CFR § 257.97(a), the Indiana-Kentucky Electric Corporation (IKEC) has prepared this Semi-Annual report to document progress toward remedy selection, design and implementation of corrective actions associated with groundwater monitoring exceedances at the Clifty Creek Station's Landfill Runoff Collection Pond (LRCP). This report summarizes activities during the period of December 1, 2023 through June 1, 2024. Updates to the report will be published semi-annually, until such time a remedy has been selected. Upon selection, a final report will be prepared describing the selected remedy and how it meets the standards specified in the rule.

1.1 REGULATORY BACKGROUND

On December 19, 2014, the United States Environmental Protection Agency (U.S. EPA) issued their final Coal Combustion Residuals (CCR) regulation which regulates CCR as a non-hazardous waste under Subtitle D of Resource Conservation and Recovery Act (RCRA) and became effective six (6) months from the date of its publication (April 17, 2015) in the Federal Register, referred to as the "CCR Rule." The rule applies to new and existing landfills, and surface impoundments used to dispose of or otherwise manage CCR generated by electric utilities and independent power producers. The rule includes requirements for monitoring groundwater and assessing corrective measures if constituents listed in Appendix IV of the rule are detected in groundwater samples collected from downgradient monitoring wells at Statistically Significant Levels (SSL) greater than the established Groundwater Protection Standard (GWPS).

In May 2019, IKEC initiated an Assessment of Corrective Measures (ACM) at the Clifty Creek LRCP as a result of a confirmed SSL of Appendix IV constituent Molybdenum in monitoring well CF-15-08 during October 2018 Assessment Monitoring Activities, as required by 40 CFR § 257.97(a). In accordance with 40 CFR § 257.96(a), IKEC prepared an ACM report for the Clifty Creek LRCP. It was placed in the facility's operating record and uploaded to IKEC's CCR Rule Compliance internet site on September 19, 2019. A revised ACM report, which contains supplemental information, was placed on IKEC's CCR Rule Compliance internet site on November 30, 2020. The ACM Report provides an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c). Multiple strategies were evaluated to address groundwater exhibiting concentrations of Molybdenum above the GWPS, with two technically feasible options identified. Both options, which presently appear to be feasible require the removal of free water from the pond, followed by the execution of an engineered cap and closure of the LRCP facility, and are as follows:

- Monitored Natural Attenuation (MNA); and
- Conventional Vertical Well System (Groundwater Extraction and Treatment) (Ex-Situ).

Following the completion of the ACM Report, IKEC hosted a public meeting to present the options for remediation on November 7, 2019, in Madison, Indiana. IKEC then observed a 30-day public comment period, per 40 CFR § 257.97(a), prior to beginning the process of selecting a remedy. No comments were received during this time period.

Semi-annual reports are required pursuant to 40 CFR § 257.97(a) to document progress toward remedy selection and design. The CCR Rule provides flexibility for additional field investigation, which is still ongoing, data analysis and consideration prior to the selection of a remedy. IKEC will continue to review new data as it becomes available from active site evaluation and implement changes to the groundwater monitoring and corrective action program as necessary to maintain compliance with the rule.

IKEC recently completed significant construction activities associated with compliance obligations for the LRCP found in the CCR Rule, Part A, which was to cease receipt of CCR and non-CCR waste streams and initiate closure no later than October 17, 2023. As a result, IKEC worked with qualified professional engineers to design and construct an extensive lined stormwater conveyance corridor, which rerouted stormwater from hundreds of acres of watershed, most of which is not owned by IKEC, around the LRCP. The construction of this extensive stormwater conveyance corridor required significant alteration to the LRCP dam, which was performed under the applicable environmental permits. The dam modifications not only included lowering portions of the dam, but also the construction of a very large stormwater channel across the toe of the dam. Given the significant changes made to the area, IKEC believes that additional evaluation of the area is necessary to confirm that design considerations made to potential remedies remain viable.

1.2 REPORT CONTENTS

The ninth semi-annual progress report provides regulatory background, an overview of site characteristics and ACM findings, and summarizes activities supporting the selection and implementation of a remedy during the period of December 1, 2023, through June 1, 2024.

2 SITE BACKGROUND

The Clifty Creek Station, located in Madison, Indiana, is a 1.3-gigawatt coal-fired generating plant operated by IKEC, a subsidiary of the Ohio Valley Electric Corporation (OVEC). The Clifty Creek Station has six (6) 217.26-MW generating units and has been in operation since 1955. Ash products were sluiced to disposal ponds located in the plant site since it began operation. During the course of plant operations, CCRs have been managed and disposed of in various units at the station. The Type I Landfill and LRCP occupy an approximately 200-acre area situated within an eroded bedrock channel. To allow for more disposal capacity, an on-site fly ash pond was developed

into a Type III Landfill in 1988. All required permits for the Type III Landfill were obtained from the Indiana Department of Environmental Management (IDEM) and the Type III Landfill went operational in 1991. In March 1994, IDEM approved a pH variance for the disposal of low-sulfur coal ash in the fly ash Type III Landfill. Emplacement of low-sulfur coal ash in the Type III Landfill began in January 1995. In April 2007, IKEC submitted a permit application to IDEM to upgrade the former Type III landfill to a Type I landfill. In 2013, IDEM issued a renewed permit and approved IKEC's request to upgrade the landfill to a Type I landfill.

The Type I Landfill and the LRCP occupy an approximately 200-acre area situated within an eroded bedrock channel. The Type I Landfill consists of approximately 109 acres and has been approved by IDEM as a Type I Residual Waste Landfill. The remaining 91 acres consist of the LRCP located at the southwest end of the Type I Landfill.

2.1 UNIT SPECIFIC GEOLOGY AND HYDROGEOLOGY

Bedrock beneath the LRCP consists of impermeable limestone and shale of the Ordovician Dillsboro formation, which is overlain by approximately 20 feet of clayey gravel with sand. The clayey gravel with sand is overlain by a lean clay with sand, which is overlain by a fine to medium sand with gravel, silt and clay. The uppermost unit in the area is a surficial layer of silty clay. A limestone ridge known as the Devil's Backbone runs northeast to southwest along the length of the Type I Landfill & LRCP. The Devil's Backbone, as well as a similar steep geologic feature that runs approximately parallel to the Devil's Backbone, act as impermeable barriers that force groundwater passing beneath the Type I Landfill to flow either toward the northeast or toward the southwest. During periods when the water level in the Ohio River rises significantly and flooding occurs, groundwater flow in the uppermost aquifer will temporarily change direction of flow. The impact of this change in groundwater flow direction is still being evaluated in regard to the impact it may have on the ultimate selected remedy.

Based on historic aquifer testing conducted at the site, the upper lean clay deposits exhibit low permeability, do not yield adequate quantities of water to wells, and are considered to be an aquitard. The underlying fine-medium sand with silt is considered to be an unconfined or possibly semi-confined aquifer and is therefore designated as the uppermost aquifer at the LRCP.

2.2 POTENTIAL RECEPTOR REVIEW

IKEC completed an assessment of the proximity of public and private drinking water supplies to the LRCP in response to SSLs above the GWPS. It was determined that the withdrawal wells designated by the Indiana Department of Natural Resources (IDNR) as drinking water wells within a one-mile radius are not hydraulically connected to the groundwater at the LRCP facility or are located upgradient from the facility.

3 GROUNDWATER ASSESSMENT MONITORING PROGRAM

Groundwater assessment monitoring for the Clifty Creek LRCP is conducted in accordance with 40 CFR § 257.95.

3.1 GROUNDWATER MONITORING WELL NETWORK

In compliance with 40 CFR § 257.91, the CCR groundwater monitoring network for the LRCP consists of the following eight (8) wells:

- CF-15-04 (Background);
- CF-15-05 (Background);
- CF-15-06 (Background);
- CF-15-07 (Downgradient);
- CF-15-08 (Downgradient);
- CF-15-09 (Downgradient);
- WBSP-15-01 (Background); and
- WBSP-15-02 (Background).

Additionally, two (2) monitoring wells that were installed as part of the additional assessment activities for the LRCP were added to the CCR groundwater monitoring network for the LRCP as follows:

- CF-19-14 (Downgradient); and
- CF-19-15 (Downgradient).

3.2 TYPE I LANDFILL ALTERNATIVE SOURCE DEMONSTRATION

The Type I Landfill and LRCP share a common monitoring network. Due to this fact, upon verification of an exceedance above the GWPS, an Alternative Source Demonstration (ASD) was pursued. Based on a review of current and historic data, the Type I Landfill was not believed to be the source of Boron in groundwater in the area. An ASD was completed in general accordance with guidelines presented in the *Solid Waste Disposal Facility Criteria Technical Manual* (U.S. EPA 1993). It was concluded that the Type I Landfill was not the source of Boron detected in the area. This conclusion was supported by the following evidence:

- “Foundation soils” that extend from beneath the LRCP and the hydraulically placed fly ash southwest to the Ohio River provide a direct hydraulic connection between the historic hydraulically placed fly ash and the CCR groundwater monitoring wells CF-15-08 and CF-15-09.
- Historic data from the IDEM groundwater monitoring program indicate that Boron concentrations similar to those observed in CCR wells CF-15-08 and CF-15-09

were detected in IDEM wells CF-9406 and CF-9407 for 17 years prior to operation of the Type I Landfill, indicating that the Boron is associated with the historic hydraulically placed fly ash.

- Using the previously calculated groundwater flow velocity of 45 feet per year (ft/yr), it is estimated that it would take 120 years for groundwater flowing beneath the Type I Landfill to reach the CCR monitoring wells.

The ASD Report for the March 2018 Detection Monitoring Event was completed in June 2019, and was certified on July 3, 2019. By definition of the CCR Rule, the LRCP is unlined and the historic hydraulically placed fly ash extends beneath the LRCP to the embankment; therefore, an ACM was conducted at the LRCP.

3.3 GROUNDWATER CHARACTERIZATION

Groundwater assessment monitoring was first conducted at the Clifty Creek LRCP during October 2018 sampling. Molybdenum, an Appendix IV constituent, was detected and confirmed to exceed the GWPS of 100 µg/L at well CF-15-08. In response, IKEC was required to characterize the extent of the release, pursuant to 40 CFR § 257.95(g)(1), and installed additional groundwater monitoring wells at the property boundary (wells CF-19-14 and CF-19-15). It was determined that Molybdenum was not leaving the property at levels higher than the GWPS, and therefore the potential remediation zone was confined to the LRCP complex (AGES, 2019). Semi-annual sampling at the LRCP sentinel wells has continued, and has further demonstrated the assessment that Molybdenum at levels higher than the GWPS are confined to IKEC property. Continued sampling events have verified that Molybdenum levels higher than the GWPS are not leaving IKEC property, as originally determined.

4 ASSESSMENT OF CORRECTIVE MEASURES

In accordance with 40 CFR § 257.96(a), IKEC prepared an ACM report for the Clifty Creek LRCP and placed it in the facility's operating record, as well as uploaded it to IKEC's CCR Rule Compliance internet site on September 19, 2019. As noted above, a revised ACM report containing supplemental information was posted to IKEC's CCR Rule Compliance internet site on November 30, 2020. The ACM Report provided an assessment of the effectiveness of potential corrective measures in achieving the criteria provided in 40 CFR § 257.96(c).

4.1 PLANNED SOURCE CONTROL MEASURES

Per 40 CFR § 257.96(a), the objectives of the corrective measures evaluated in this ACM Report are "to prevent further releases, to remediate any releases, and to restore affected area to original conditions." As required in 40 CFR § 257.97(b), corrective measures, at minimum, must:

- (1) Be protective of human health and the environment;*
- (2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);*
- (2) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;*
- (5) Comply with standards for management of wastes as specified in § 257.98(d).*

During the ACM development process, several in-situ and ex-situ remedial technologies were evaluated to address Molybdenum in groundwater at the LRCP, and screened against evaluation criteria requirements in 40 CFR § 257.96(c). The two (2) technologies that appear to be most technically feasible, and therefore most likely for selection as a remedy are:

- Monitored Natural Attenuation; and
- Conventional Vertical Well System (Groundwater Extraction) (Ex-Situ).

As previously noted, both options require removal of free water, as well as pore water from the pond, followed by the construction of an engineered cap and closure of the LRCP facility. IKEC is committed to continued compliance with the requirements and timeframes of the CCR Rule, and will close the Clifty LRCP in accordance with 40 CFR § 257.102. IKEC is continuing to work with the site's Qualified Professional Engineer to refine the applicable designs and implement control mechanisms necessary to prepare for the safe closure of the LRCP, which has been initiated. IKEC has worked with IDEM to secure modification to its National Pollution Discharge Elimination System (NPDES) permit, which became effective December 1, 2022 to incorporate changes necessary to manage the changes to stormwater discharges from the LRCP facility.

Separately, IDEM has requested modification to the state program groundwater monitoring system associated with the monitoring of the landfill as part of the most recent landfill permit renewal. This groundwater monitoring system is located near the CCR groundwater monitoring system, and alteration of the groundwater monitoring well system could refine or influence what IKEC has observed thus far in the monitoring program, ultimately influencing the ultimate selection of remedy. IKEC has worked with IDEM to finalize locations and installation details of the requested groundwater monitoring wells; the installation of these additional wells was completed in August 2021. Further, IDEM has expressed an interest in reviewing and approving any corrective measures prior to their implementation. Should IDEM receive authority under the Water Infrastructure Improvements for the Nation Act from U.S. EPA to implement a state level CCR Permit Program, IKEC will prepare and submit a report detailing the

selected corrective measure for review and comment prior to implementing the chosen remedy. In the interim, IKEC is attempting to work cooperatively with IDEM in anticipation of their CCR permit program approval.

The initial activities described above are anticipated to assist in the reduction of the potential for releases and migration of CCR constituents. Groundwater assessment monitoring as required by 40 CFR § 257.96(b) will continue until a remedy is selected and implemented. The monitoring will be conducted to track changes in groundwater conditions as a result of these closures and operational changes. These data will also be considered in the selection and design of a remedy in accordance with 40 CFR § 257.97.

4.2 POTENTIAL REMEDIAL TECHNOLOGIES

As a source control measure, the Clifty Creek LRCP will be closed in accordance with CFR § 257.102 prior to implementation of further groundwater remediation efforts. In addition to source control measures, two primary strategies were identified to address groundwater exhibiting concentrations of Molybdenum above the GWPS, including:

- Monitored Natural Attenuation; and
- Conventional Vertical Well System (Groundwater Extraction) (Ex-Situ).

The ACM report titled “Clifty Creek LRCP- Assessment of Corrective Measures Report- Rev 1”, which is available on IKEC’s publicly accessible internet site, provides a more detailed description of these corrective measures. The effectiveness of each potential corrective measure was assessed in accordance with 40 CFR § 257.96 (c). Both options listed above are considered technically feasible, and appropriate for groundwater remediation efforts at the LRCP.

5 SELECTION OF REMEDY: CURRENT PROGRESS

As noted in the ACM Report, IKEC determined that the most effective method for source control is to leave the CCR material in place and install a CCR compliant cap system to prevent future infiltration of precipitation that would fall directly on the footprint of the LRCP.

The LRCP cap design is currently being redeveloped by the facility’s Qualified Professional Engineer. This cap will be installed once all necessary dewatering activities are completed at the LRCP closure will be initiated once all non-CCR flows are diverted away from the LRCP supporting the closure.

IKEC’s hydrogeologist conducted the semi-annual groundwater sampling and testing during this report period. In addition to sampling the monitoring wells in the CCR groundwater monitoring network, the sentinel wells installed to aid in ACM activities

were also sampled. A total of 10 wells (8 Network and 2 Sentinel) were sampled near the LRCP and the results will be summarized in the 2024 Groundwater Monitoring and Corrective Action Report. Results to date indicate that concentrations of Molybdenum at the sentinel wells are well below the unit's GWPS. In addition to the semi-annual monitoring, IKEC's hydrogeologist also collected monthly depth-to-groundwater readings at wells in the area of the LRCP.

As noted in the previous Progress of Remedy Selection Report, a design package was developed and submitted to the Indiana Department of Natural Resources, who regulates dams and dikes in the State of Indiana, on November 8, 2021, to request permission to alter the existing LRCP dam structure to support commencement of closure of the impoundment. That permit was received on January 14, 2023, with the associated work completed prior to October 17, 2023. The influence on groundwater caused by these significant alterations to the LRCP dam structure are not definitive at this time, but IKEC is continuing to collect groundwater data. At a minimum, any siting of treatment equipment that was being considered must be relocated as result, as are routes for power.

On July 1, 2021, IKEC submitted an application for a Minor Modification to the Clifty Creek Landfill Permit, Solid Waste ID No. 39-04, to the Indiana Department of Environmental Management to permit the installation of stormwater controls in the area of the Type I Landfill and LRCP, as well as the construction of two new lined leachate ponds and two lined sedimentation ponds. These controls redirect stormwater runoff from the considerable watershed the LRCP previously managed to support initiation closure of the inactive CCR unit. The final minor modification permit was received from IDEM on May 25, 2022. The work associated with this permit was completed in conjunction with the site's CCR Rule, Part A project, and was completed prior to October 17, 2023.

In 2022, IKEC opted to conduct a groundwater model (MODFLOW-NWT) to evaluate the installation of groundwater extraction wells to capture groundwater from areas where Molybdenum concentrations exceed the GWPS. Groundwater modeling analyses were performed by an engineering firm (under subcontract to IKEC's hydrogeologist) to estimate pumping rates and other design parameters for the proposed system. Based on successive model runs, a series of seven (7) extraction wells with a total pumping rate of approximately 46 gallons per minute would likely be effective for capturing groundwater where Molybdenum exceeds the GWPS.

In December 2022 and January 2023, IKEC contracted a consultant (with a licensed drilling subcontractor) to install seven (7) extraction wells at the LRCP at locations specified in the groundwater flow model. The well depths ranged from 28 to 43 feet below ground surface; the wells were constructed of 6-inch diameter, 10-foot long, 20-slot stainless-steel wire-wrapped screen with attached 6-inch diameter PVC riser. After completion, all of the wells were developed by surging and over pumping.

In July 2023, IKEC retained an engineering firm (under subcontract to IKEC's hydrogeologist) to prepare a preliminary design package for the groundwater extraction and treatment system for the LRCP. However, that design was rendered obsolete given the significant modifications to the LRCP dam and toe of the dam as described above. In November 2023, a site visit was held to review the site modifications and how they will impact the design.

During the reporting period, design work on the groundwater extraction and treatment system continued, including design changes based on the results of the site visit in 2023. The design work included preparing detailed drawings of pumps and discharge piping routes and selecting potential locations for an NPDES outfall for the system; IKEC also consulted with IDEM regarding potential requirements for an NPDES permit. Bench tests were conducted using groundwater from the extraction wells to evaluate various resins to be used for the treatment of Molybdenum. Finally, discussions with vendors were conducted to determine the optimal sizing of potential treatment vessels. However, design of the pump and treat system were paused with the issuance of the 2024 Effluent Limitation Guidelines Rule since the new rule places new requirements on facilities that produce what is considered "unmanaged combustion residual leachate". IKEC is evaluating how to comply with the requirements of this new rule, and do so in an efficient manner. Further, IKEC anticipates that additional state permitting or permit modification, which is presently unknown, will now be required in order to install a remedy. IKEC may determine that an alternative remedy to MNA or a traditional pump and treat system is most prudent given USEPA's ever-changing determination of best available treatment for various wastewater streams.

5.1 PLANNED WORK

IKEC's consultant or hydrogeologist will continue to sample and test all of the monitoring wells as part of the semi-annual requirement.

IKEC's hydrogeologist will continue to collect monthly depth-to-groundwater readings at wells in the area of the LRCP. This will help to better understand the dynamic nature of groundwater flow at the LRCP, which is a function of unique site geologic formations and recent significant site modifications associated with the CCR Rule, Part compliance, ensuring the remedy selected is appropriate.

IKEC's hydrogeologist will continue to develop the Time-Series evaluations to determine if the concentrations of Molybdenum are increasing, decreasing, or are asymptotic.

IKEC's hydrogeologist will continue to evaluate the effects of flood events on the site.

IKEC's hydrogeologist and engineering subcontractor will continue to work on the design package for groundwater extraction and treatment system for the LRCP

IKEC will continue to work with industry experts to determine how its selection of remedy may be impacted by the 2024 ELG Rule, as well as work with state regulatory agencies to determine what permitting or permit modifications must be secured.

IKEC and their CCR hydrogeologist will continue to evaluate the technology options identified in the ACM, and engage the site's Qualified Professional Engineer to ensure the alternatives meet the criteria set forth in 40 CFR 257.97.

IKEC will submit the next progress report by December 1, 2024.

A final report will be prepared after the remedy is selected. This report will describe the proposed solution and how it meets the standards specified in 40 CFR § 257.97(b) and 257.97(c). Recordkeeping requirements specified in 40 CFR § 257.105(h), notification requirements specified in 40 CFR § 257.106(h), and internet requirements specified in 40 CFR § 257.107(h) will be complied with as required by 40 CFR § 257.96(f).