

REPORT ON
2024 ANNUAL GROUNDWATER MONITORING REPORT FOR
BOTTOM ASH POND (BAP)
CARDINAL POWER PLANT FACILITY
BRILLIANT, OHIO

by
Haley & Aldrich, Inc.
Cleveland, Ohio

for
Cardinal Operating Company
Brilliant, Ohio

File No. 210218
January 2025

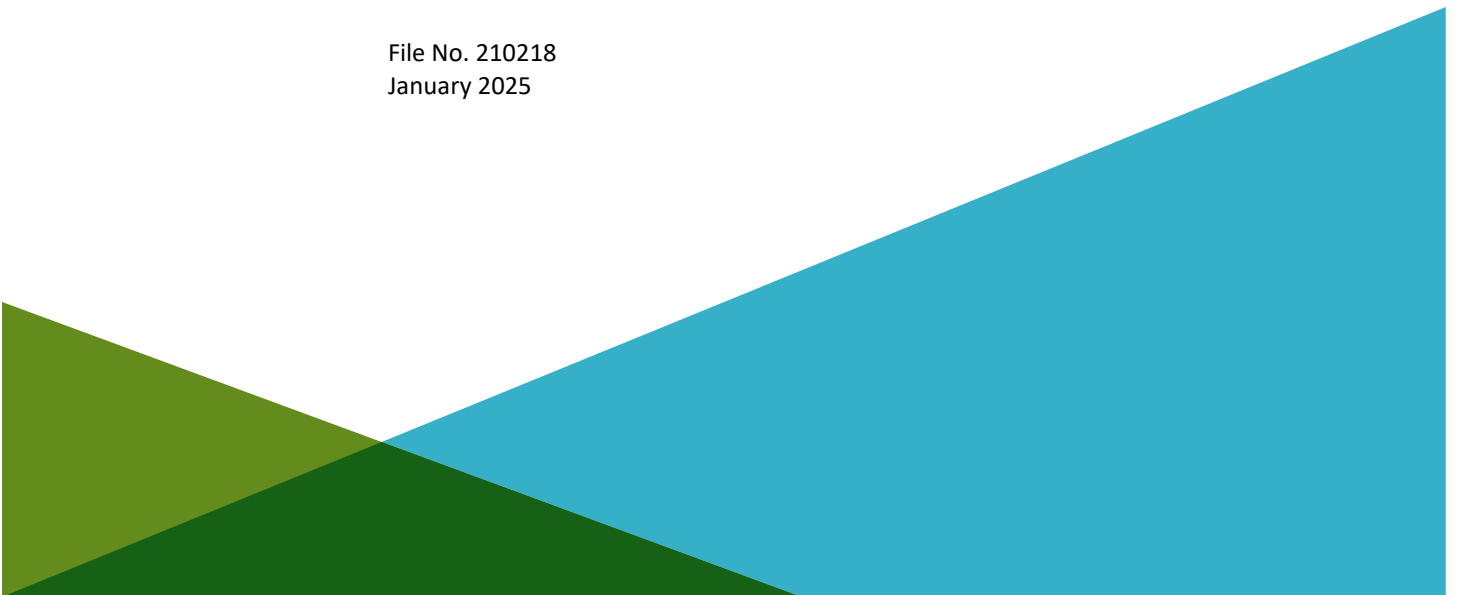


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1. Annual Groundwater Monitoring Report Summary

Haley & Aldrich, Inc. has prepared this 2024 Annual Groundwater Monitoring Report (Report) for the Bottom Ash Pond (BAP), an existing coal combustion residual (CCR) unit at the Cardinal Power Plant Facility in Brilliant, Ohio. This Report was prepared to comply with the United States Environmental Protection Agency (EPA) Hazardous and Solid Waste Management System; Disposal of CCR from Electric Utilities, Title 40 Code of Federal Regulations (CFR) Part 257, Subpart D dated 17 April 2015 (Rule), specifically subsection § 257.90(e)(1) through (6).

This Report summarizes groundwater monitoring activities conducted pursuant to the CCR Rule from 1 January 2024 through 31 December 2024.

In accordance with § 257.90(e)(6), an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit is provided below:

- At the start of the current annual reporting period (1 January 2024), the BAP was operating under the assessment monitoring program, which was initiated in May 2018.
- At the end of the current annual reporting period (31 December 2024), the BAP completed groundwater sampling under the assessment monitoring program.
- Statistically significant increases (SSIs) above background levels were identified during the October 2023 sampling event for the following Appendix III constituents:
 - boron: MW-BAP-1, MW-BAP-2, and MW-BAP-3
 - chloride: MW-BAP-1, MW-BAP-2, and MW-BAP-3
 - fluoride: MW-BAP-1 and MW-BAP-2
 - pH: MW-BAP-1
- SSIs above background levels were identified during the April 2024 sampling event for the following Appendix III constituents:
 - boron: MW-BAP-1, MW-BAP-2 and MW-BAP-3
 - chloride: MW-BAP-1 and MW-BAP-2
 - fluoride: MW-BAP-1, MW-BAP-2 and MW-BAP-3
 - pH: MW-BAP-1 and MW-BAP-2
- SSI above background levels were identified during the June 2024 sampling event for the following Appendix III constituents:
 - boron: MW-BAP-1, MW-BAP-2, MW-BAP-3
 - chloride: MW-BAP-1, MW-BAP-2, MW-BAP-3
 - fluoride: MW-BAP-1, MW-BAP-2
 - pH: MW-BAP-1
- There were no statistically significant levels of Appendix IV constituents for the October 2023, April 2024, or June 2024 assessment monitoring sampling events.
- Closure by removal was completed at the BAP (certified 7 October 2024). Groundwater concentrations remain below the groundwater protection standards (GWPSs) and no further monitoring is required as detailed by 40 CFR § 257.102(c)(1).

2. 40 CFR § 257.90 Applicability

To report on the activities conducted during the prior calendar year and document progress complying with the CCR Rule, the specific requirements listed in § 257.90(e)(1) through (5) are provided in the next section in bold/italic type followed by a short narrative stating how that specific requirement was met.

2.1 40 CFR § 257.90(a) AND (c)

All CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under §§ 257.90 through 257.98.

Once a groundwater monitoring system and groundwater monitoring program has been established at the CCR unit as required by this subpart, the owner or operator must conduct groundwater monitoring and, if necessary, corrective action through the active life and post-closure care period of the CCR unit.

The BAP is a CCR surface impoundment and is subject to the groundwater monitoring and corrective action requirements set forth by the EPA in 40 CFR §§ 257.90 through 257.98. This document satisfies the requirement under § 257.90(e) which requires the CCR Unit Owner/Operator to prepare an Annual Groundwater Monitoring and Corrective Action Report.

2.2 40 CFR § 257.90(e) SUMMARY

Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1).

This Report documents the activities completed in 2024 for the BAP as required by the subject regulations. Groundwater sampling and analysis were conducted per the requirements of § 257.93, and the status of the groundwater monitoring program, set forth in § 257.95, is provided in this Report.

2.2.1 Status of the Groundwater Monitoring Program

SSIs of Appendix III constituents were identified at the BAP from the October 2023 sampling event and the April 2024 and June 2024 semiannual monitoring events.

The BAP was closed by removal and was certified closed on 7 October 2024 in accordance with the requirements of 40 CFR § 257.102 (Appendix A). After all ash was removed, groundwater concentrations remained below the GWPSs, therefore, no further groundwater monitoring is required per 40 CFR § 257.102(c)(1).

2.2.2 Key Actions Completed

- Two semiannual groundwater monitoring events were conducted in April 2024 and June 2024.
- The June 2024 sampling event was conducted after confirmation that all ash was removed from the BAP.
- Potentiometric monitoring was conducted during the semiannual sampling events, as detailed in Section 2.3.5.
- Semiannual statistical evaluations were completed in 2024 for each of the sampling events (October 2023, April 2024 and June 2024).
- Upon receiving results that groundwater remained below the GWPSs, the BAP was certified closed on 7 October 2024 (Appendix A).
- On 2 and 3 December 2024, three wells were decommissioned in accordance with the Ohio Department of Natural Resources (ODNR) standards based on Rule 3745-07 of the State of Ohio Administrative Code (OAC). Water well sealing reports are included as Appendix B.

2.2.3 Problems Encountered

No problems were encountered in 2024.

2.2.4 Actions to Resolve Problems

No associated actions were required.

2.2.5 Project Key Activities for Upcoming Year

Key activities to be completed in 2025 include the following:

- Prepare the 2024 annual report; place it in the record as required by § 257.105(h)(1), notify the state [§ 257.106(d)]; and post to website [§ 257.107(d)].

2.3 40 CFR § 257.90(e) – INFORMATION

At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

2.3.1 40 CFR § 257.90(e)(1)

A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

As required by § 257.90(e)(1), a map showing the location of the BAP and associated upgradient and downgradient monitoring wells is presented as Figure 1.

2.3.2 40 CFR § 257.90(e)(2)

Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

During 2024, monitoring wells MW-BAP-1, MW-BAP-2, and MW-BAP-4 were decommissioned after certification of closure. On 2 and 3 December 2024, these three monitoring wells were decommissioned in association with the closure of the BAP. Work was done in accordance with the ODNR standards based on Rule 3745-07 of the OAC. Water well sealing reports are included as Appendix B.

2.3.3 40 CFR § 257.90(e)(3)

In addition to all the monitoring data obtained under § 257.90 through § 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

In accordance with § 257.95(b) and § 257.95(d)(1), two independent samples from each background and downgradient monitoring well were collected and analyzed. A summary table including the sample names, dates of sample collection, reason for sample collection (detection or assessment), and monitoring data obtained for the groundwater monitoring program for the BAP is presented in Table 1. A summary of the analytical results is presented in Table 2. In addition, in accordance with § 257.95(d)(3), Table 3 includes the GWPSs established under § 257.95(d)(2).

2.3.4 40 CFR § 257.90(e)(4)

A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

In accordance with § 257.95 of the CCR Rule, assessment monitoring at the BAP was initiated in May 2018 after SSIs over groundwater background levels were detected for boron, chloride, and fluoride. The BAP completed assessment monitoring throughout 2024 and no further groundwater monitoring is required after completion of closure.

2.3.5 40 CFR § 257.90(e)(5)

Other information required to be included in the annual report as specified in § 257.90 through § 257.98.

Other information specified in § 257.90 through § 257.98 is discussed in preceding sections.

As specified in § 257.93(c), groundwater flow rates and directions are provided as Figures 2 and 3, and Tables 4 and 5 for each sampling event.

TABLES

TABLE 1
SUMMARY OF 2024 SAMPLES COLLECTED
 BOTTOM ASH POND
 CARDINAL POWER PLANT FACILITY
 BRILLIANT, OHIO

| Location Name | Type of Well | Sample Date | Constituents Analyzed | Purpose | Sample Type |
|---------------|--------------|-------------|-----------------------|-------------------------------|-------------|
| MW-BAP-1 | Downgradient | 04/17/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-1 | Downgradient | 06/25/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-1 | Downgradient | 06/25/2024 | Appendix III and IV | Assessment Monitoring Program | Duplicate |
| MW-BAP-2 | Downgradient | 04/17/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-2 | Downgradient | 04/17/2024 | Appendix III and IV | Assessment Monitoring Program | Duplicate |
| MW-BAP-2 | Downgradient | 06/24/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-3 | Downgradient | 04/17/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-3 | Downgradient | 06/24/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-4 | Upgradient | 04/16/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-4 | Upgradient | 06/24/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-5 | Upgradient | 04/17/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |
| MW-BAP-5 | Upgradient | 06/24/2024 | Appendix III and IV | Assessment Monitoring Program | Primary |

TABLE 2
SUMMARY OF 2024 BAP ANALYTICAL RESULTS
 BOTTOM ASH POND
 CARDINAL POWER PLANT FACILITY
 BRILLIANT, OHIO

| Location Name | MW-BAP-1 | MW-BAP-1 | MW-BAP-1 | MW-BAP-2 | MW-BAP-2 | MW-BAP-2 | MW-BAP-2 | MW-BAP-3 | MW-BAP-3 | MW-BAP-4 | MW-BAP-4 | MW-BAP-5 | MW-BAP-5 |
|---|----------------------|----------------------|-----------------------|--------------------|-----------------------|---------------------|--------------------|---------------------|----------------------|--------------------|---------------------|---------------------|----------|
| Sample Name | MW-BAP-1-04172024 | MW-BAP-1-06252024 | MW-BAP-1-DUP-06252024 | MW-BAP-2-04172024 | MW-BAP-2-DUP-04172024 | MW-BAP-2-06252024 | MW-BAP-3-04172024 | MW-BAP-3-06242024 | MW-BAP-4-04162024 | MW-BAP-4-06242024 | MW-BAP-5-04172024 | MW-BAP-5-06242024 | |
| Sample Date | 04/17/2024 | 06/25/2024 | 06/25/2024 | 04/17/2024 | 04/17/2024 | 06/24/2024 | 04/17/2024 | 06/24/2024 | 04/16/2024 | 06/24/2024 | 04/17/2024 | 06/24/2024 | |
| Sample Type | Primary | Primary | Duplicate | Primary | Duplicate | Primary | Primary | Primary | Primary | Primary | Primary | Primary | |
| Well Type | Downgradient | Downgradient | Downgradient | Downgradient | Downgradient | Downgradient | Downgradient | Downgradient | Upgradient | Upgradient | Upgradient | Upgradient | |
| APPENDIX III CONSTITUENTS (mg/L) | | | | | | | | | | | | | |
| Boron, Total | 2.14 | 1.95 | 2.01 | 1.67 | 1.69 | 1.81 | 0.375 | 2.12 | 0.0777 | 0.0278 | 0.0937 | 0.102 | |
| Calcium, Total | 136 | 147 | 143 | 79.5 | 78.2 | 83 | 81.7 | 82.5 | 175 | 189 | 169 | 177 | |
| Chloride (mg/L) | 57.3 | 57.4 | 57.8 | 55.2 | 55.2 | 55.2 | 13.3 | 63.5 | 28.7 | 25.4 | 13.2 | 13.1 | |
| Fluoride (mg/L) | 0.34 | 0.37 | 0.37 | 0.51 | 0.51 | 0.52 | 0.17 | 0.096 | 0.098 | 0.12 | 0.062 | 0.069 | |
| Sulfate (mg/L) | 355 | 390 | 393 | 174 | 174 | 174 | 48.4 | 194 | 515 | 536 | 321 | 339 | |
| Total Dissolved Solids (TDS) (mg/L) | 751 | 740 | 738 | 435 | 441 | 434 | 323 | 421 | 1070 | 1010 | 778 | 773 | |
| pH, Field (pH units) | 7.37 | 7.09 | - | 7.29 | - | 6.45 | 6.85 | 6.83 | 6.73 | 6.51 | 7.11 | 6.93 | |
| APPENDIX IV CONSTITUENTS (mg/L) | | | | | | | | | | | | | |
| Antimony, Total | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | |
| Arsenic, Total | < 0.0005 | 0.00068 | 0.00054 | 0.0131 | 0.0128 | 0.015 | 0.0101 | < 0.0005 | 0.0437 | 0.0503 | 0.0087 | 0.0087 | |
| Barium, Total | 0.0429 | 0.0521 | 0.0519 | 0.139 | 0.139 | 0.147 | 0.385 | 0.0445 | 0.0348 | 0.0421 | 0.0862 | 0.0817 | |
| Beryllium, Total | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | |
| Cadmium, Total | 0.00021 | 0.00012 | 0.00013 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0001 | |
| Chromium, Total | < 0.001 | 0.0016 | 0.0014 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 | 0.0018 | 0.0016 | |
| Cobalt, Total | 0.00052 | 0.00079 | 0.00078 | 0.0011 | 0.0011 | 0.0013 | < 0.0005 | < 0.0005 | 0.0155 | 0.0171 | 0.00079 | 0.00082 | |
| Fluoride (mg/L) | 0.34 | 0.37 | 0.37 | 0.51 | 0.51 | 0.52 | 0.17 | 0.096 | 0.098 | 0.12 | 0.062 | 0.069 | |
| Lead, Total | < 0.0005 | 0.00062 | 0.00061 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | 0.0011 | 0.0009 | 0.00082 | |
| Lithium, Total | 0.0117 | 0.0233 | 0.0196 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | |
| Mercury, Total | 0.00000169 | 0.00000372 | 0.00000336 | 0.0000006 | < 0.0000005 | < 0.0000005 | < 0.0000005 | < 0.0000005 | 0.00000123 | 0.00000246 | 0.00000147 | 0.00000122 | |
| Molybdenum, Total | 0.0219 | 0.025 | 0.0245 | 0.0378 | 0.038 | 0.0322 | 0.0025 | 0.0013 | 0.0012 | 0.0013 | 0.00059 | 0.00051 | |
| Selenium, Total | < 0.0005 | 0.00058 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | 0.00067 | < 0.0005 | < 0.0005 | |
| Thallium, Total | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | < 0.0005 | |
| Radium-226 & 228 | 0.698 ± 0.936 | 0.367 ± 0.805 | 0.557 ± 0.828 | 0.995 ± 1.2 | 0.431 ± 1.09 | 0.998 ± 1.02 | 1.45 ± 1.02 | 0.517 ± 1.09 | 0.831 ± 0.637 | 0.93 ± 1.05 | 1.34 ± 0.888 | 0.945 ± 1.16 | |

< = Not detected at reporting limit
Bold = detected
 - = Not Analyzed

TABLE 3
GROUNDWATER PROTECTION STANDARDS
 BOTTOM ASH POND
 CARDINAL POWER PLANT FACILITY
 BRILLIANT, OHIO

| | Concentration Units | MCL | CCR Rules § 257.95(h)(2) | Background Limit | BAP GWPS |
|---------------------------------|------------------------|-------|-----------------------------|---------------------|-------------|
| APPENDIX IV CONSTITUENTS | | | | | |
| Antimony | mg/L | 0.006 | - | 0.0005 | 0.006 |
| Arsenic | mg/L | 0.01 | - | 0.0653 | 0.0653 |
| Barium | mg/L | 2 | - | 0.1131 | 2 |
| Beryllium | mg/L | 0.004 | - | 0.000227 | 0.004 |
| Cadmium | mg/L | 0.005 | - | 0.00018 | 0.005 |
| Chromium | mg/L | 0.1 | - | 0.0057 | 0.1 |
| Cobalt | mg/L | - | 0.006 | 0.0228 | 0.0228 |
| Fluoride | mg/L | 4 | - | 0.1643 | 4 |
| Lead | mg/L | - | 0.015 | 0.0086 | 0.015 |
| Lithium | mg/L | - | 0.04 | 0.0202 | 0.04 |
| Mercury | mg/L | 0.002 | - | 0.000007 | 0.002 |
| Molybdenum | mg/L | - | 0.1 | 0.00215 | 0.1 |
| Radium, Combined | pCi/L | 5 | - | 1.629 | 5 |
| Selenium | mg/L | 0.05 | - | 0.001 | 0.05 |
| Thallium | mg/L | 0.002 | - | 0.0005 | 0.002 |

MCL = Maximum Contaminant Level

GWPS is the higher value of either the background limit or the MCL. If an MCL is not available, values from the CCR Rules are used.

Background values are based upon statistical upper threshold limit (UTL) calculations.

UTLs are intended for comparison to confidence bands, not individual observations.

TABLE 4
GROUNDWATER FLOW CALCULATIONS - FIRST SEMIANNUAL EVENT
 BOTTOM ASH POND
 CARDINAL POWER PLANT FACILITY
 BRILLIANT, OHIO

| Program | Groundwater Zone | Well | Hydraulic Location ¹ | Depth to Water (ft) | Potentiometric Elevation (ft) ² | Gradient ³ (ft/ft) | Hydraulic Conductivity ⁴ (cm/sec) | | | Effective Porosity | Groundwater Velocity (ft/day) | | | Well Diameter ⁵ | Residence Time in well ⁶ (days) | | |
|---------|------------------|----------|---------------------------------|---------------------|--|-------------------------------|--|----------------|------|--------------------|-------------------------------|----------------|------|----------------------------|--|----------------|-------|
| | | | | | | | Low | Representative | High | | Low | Representative | High | | Low | Representative | High |
| BAP | BAP | MW-BAP-1 | Downgradient | 26.7 | 645.86 | 0.0001 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0001 | 0.06 | 0.11 | 8 | 5.99 | 11.98 | 5988 |
| BAP | BAP | MW-BAP-2 | Downgradient | 27.49 | 645.98 | 0.0002 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0002 | 0.09 | 0.18 | 8 | 3.71 | 7.41 | 3705 |
| BAP | BAP | MW-BAP-3 | Downgradient | 27.17 | 645.88 | 0.0000 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0000 | 0.01 | 0.03 | 8 | 23.32 | 46.64 | 23318 |
| BAP | BAP | MW-BAP-4 | Upgradient | 17.82 | 646.02 | 0.0002 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0002 | 0.09 | 0.19 | 8 | 3.56 | 7.11 | 3557 |
| BAP | BAP | MW-BAP-5 | Upgradient | 26.21 | 645.93 | 0.0003 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0002 | 0.10 | 0.20 | 8 | 3.36 | 6.72 | 3358 |

Notes and Abbreviations:

Measurements and calculations represent conditions on 9 April 2024.

¹ Groundwater Monitoring Network Evaluation; Cardinal Site – Bottom Ash Pond, Brilliant, Ohio prepared by Geosyntec Consultants in July 2016.

² Based on the National Geodetic Vertical Datum of 1929 (NGVD29) and top of casing elevations surveyed in October 2021.

³ Hydraulic gradient was calculated from a potentiometric surface using Arcmap software tools.

⁴ Low and high conductivity values are from the 2016 Groundwater Monitoring Network Evaluation, with a representative value chosen within this range that is consistent with previous velocity calculations.

⁵ Well diameter represents the diameter of the borehole (sandpack).

⁶ Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

TABLE 5
GROUNDWATER FLOW CALCULATIONS - SECOND SEMIANNUAL EVENT
 BOTTOM ASH POND
 CARDINAL POWER PLANT FACILITY
 BRILLIANT, OHIO

| Program | Groundwater Zone | Well | Hydraulic Location ¹ | Depth to Water (ft) | Potentiometric Elevation (ft) ² | Gradient ³ (ft/ft) | Hydraulic Conductivity ⁴ (cm/sec) | | | Effective Porosity | Groundwater Velocity (ft/day) | | | Well Diameter ⁵ | Residence Time in well ⁶ (days) | | |
|---------|------------------|----------|---------------------------------|---------------------|--|-------------------------------|--|----------------|------|--------------------|-------------------------------|----------------|------|----------------------------|--|----------------|------|
| | | | | | | | Low | Representative | High | | Low | Representative | High | | Low | Representative | High |
| BAP | BAP | MW-BAP-1 | Downgradient | 29.41 | 643.15 | 0.0027 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0021 | 1.04 | 2.09 | 8 | 0.32 | 0.64 | 319 |
| BAP | BAP | MW-BAP-2 | Downgradient | 29.31 | 644.16 | 0.0026 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0020 | 1.01 | 2.03 | 8 | 0.33 | 0.66 | 329 |
| BAP | BAP | MW-BAP-3 | Downgradient | 28.12 | 644.93 | 0.0013 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0010 | 0.52 | 1.04 | 8 | 0.64 | 1.28 | 642 |
| BAP | BAP | MW-BAP-4 | Upgradient | 18.62 | 645.22 | 0.0026 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0021 | 1.03 | 2.06 | 8 | 0.32 | 0.65 | 323 |
| BAP | BAP | MW-BAP-5 | Upgradient | 27.02 | 645.12 | 0.0019 | 0.0001 | 0.05 | 0.1 | 0.36 | 0.0015 | 0.74 | 1.49 | 8 | 0.45 | 0.90 | 449 |

Notes and Abbreviations:

Measurements and calculations represent conditions on 24 June 2024

¹ Groundwater Monitoring Network Evaluation; Cardinal Site – Bottom Ash Pond, Brilliant, Ohio prepared by Geosyntec Consultants in July 2016.

² Based on the National Geodetic Vertical Datum of 1929 (NGVD29) and top of casing elevations surveyed in October 2021.

³ Hydraulic gradient was calculated from a potentiometric surface using Arcmap software tools.

⁴ Low and high conductivity values are from the 2016 Groundwater Monitoring Network Evaluation, with a representative value chosen within this range that is consistent with previous velocity calculations.






⁵ Well diameter represents the diameter of the borehole (sandpack).

⁶ Residence time is an estimation of how long it would take groundwater to travel a distance equivalent to the well diameter at the calculated velocity.

FIGURES

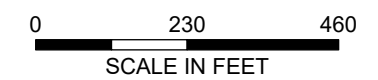
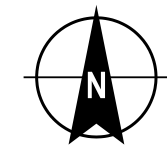


Legend

-  BAP MONITORING WELL
-  RBAP MONITORING WELL
-  RAILROAD
-  HISTORIC BOTTOM ASH POND (BAP)
-  RETROFITTED BOTTOM ASH POND (RBAP)

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE
2. DEFINITIONS
FT=FOOT
NGVD29=NATIONAL GEODETIC VERTICAL DATUM 1929
3. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL)
4. AERIAL IMAGERY SOURCE NEARMAP 14 MAY 2023



HALEY ALDRICH CARDINAL POWER PLANT FACILITY
BRILIANT OHIO
BOTTOM ASH POND

CCR UNIT
AND MONITORING WELLS







JANUARY 2025

FIGURE 1

C:\GIS\PROJECTS\2024\8\GIS\20240812\18_CARDINAL_PLANT_COLUMBUS_OH.aprx - USER: mtoner - LAST SAVED: 8/12/2024 5:28 PM

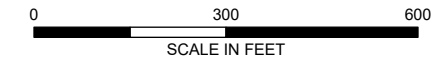


LEGEND

-  BAP MONITORING WELL WITH GROUNDWATER ELEVATION IN FEET
-  RBAP MONITORING WELL WITH GROUNDWATER ELEVATION IN FEET
-  GROUNDWATER ELEVATION CONTOUR, 0.05-FT INTERVAL (NGVD29)
-  RAILROAD
-  HISTORIC BOTTOM ASH POND (BAP)
-  RETROFITTED BOTTOM ASH POND (RBAP)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. DEFINITIONS:
FT = FOOT
NGVD29 = NATIONAL GEODETIC VERTICAL DATUM 1929
3. GROUNDWATER ELEVATIONS MEASURED 9 APRIL 2024.
4. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL).
5. AERIAL IMAGERY SOURCE: NEARMAP, 14 MAY 2023



HALEY ALDRICH CARDINAL POWER PLANT FACILITY
BRILLIANT, OHIO
BOTTOM ASH POND

**POTENTIOMETRIC SURFACE
UPPERMOST AQUIFER
9 APRIL 2024**







AUGUST 2024

FIGURE 2

C:\GIS\PROJECTS\2024\8\GIS\2024\06\18\CARDINAL_PLANT_COLUMBUS_OH.aprx - USER: mtoner - LAST SAVED: 9/9/2024 10:40 AM

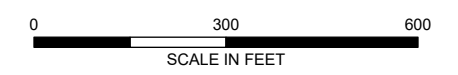


LEGEND

-  BAP MONITORING WELL WITH GROUNDWATER ELEVATION IN FEET
-  RBAP MONITORING WELL WITH GROUNDWATER ELEVATION IN FEET
-  GROUNDWATER ELEVATION CONTOUR, 0.5-FT INTERVAL (NGVD29)
-  RAILROAD
-  HISTORIC BOTTOM ASH POND (BAP)
-  RETROFITTED BOTTOM ASH POND (RBAP)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. DEFINITIONS:
FT = FOOT
NGVD29 = NATIONAL GEODETIC VERTICAL DATUM 1929
3. GROUNDWATER ELEVATIONS MEASURED 24 JUNE 2024.
4. ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (FT MSL).
5. AERIAL IMAGERY SOURCE: NEARMAP, 14 MAY 2023



HALEY ALDRICH CARDINAL POWER PLANT FACILITY
BRILLIANT, OHIO
BOTTOM ASH POND

**POTENTIOMETRIC SURFACE
UPPERMOST AQUIFER
24 JUNE 2024**

SEPTEMBER 2024

FIGURE 3

APPENDIX A

BAP - North Pond Complex Certification of Closure



Cardinal Power Plant Bottom Ash Pond Complex – North Pond

Certification of Closure

Revision 0

October 7, 2024

Issue Purpose: Client Comment

Project No.: 13770-005

In accordance with 40 CFR 257.102(f)(3), I certify that the Cardinal Power Plant North Pond of the Bottom Ash Pond Complex has been closed in accordance with:

- The closure plan which was prepared in accordance with 40 CFR 257.102(b) (“Cardinal Power Plant Bottom Ash Pond Complex, Amendment of Existing Closure Plan”, Revision 0, October 19, 2020), and
- The requirements of 40 CFR 257.102.

Certified By: David E. Nielson, P.E.

Date: October 7, 2024

Seal:



Digitally signed by David E.
Nielson, P.E.
Date: 2024.10.07 14:20:03 -05'00'

APPENDIX B
BAP Well Abandonment Reports

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
2045 Morse Road, Bldg B
Columbus, OH 43229-6693
Phone: (614) 265-6576

LOCATION

County JEFFERSON Township WELLS Section No. Lot No.

Owner BUCKEYE POWER CARDINAL OPERATING SYSTEM

Address of Well Location 306 COUNTY ROAD 7E

City BRILLIANT Zip Code 439131079

Well Location Description NEAR BOTTOM ASH POND (120 Characters)

Location of Well: Latitude/Longitude Latitude 40.237778 Longitude -80.658889

Previous Well Use MONITOR

Elevation of Well 657.38 +/- ft. Datum Plane: NAD27 NAD83

Source of Coordinates: [X] GPS [] Survey [] Other

Source of Elevation: [] GPS [] Survey [X] Other DIGITAL MAP

WELL IDENTIFICATION ODNR Well Log Number Project Well ID MW-BAP-1

MEASURED CONSTRUCTION DETAILS

Date of measurements 12/2/2024 [] No TD/Pump Stuck

Depth of Well 52 ft. Static Water Level 28.7 ft.

Borehole Depth ft. Borehole Diameter in.

Casing Diameter 2 in. Casing Length 54.5 ft. Casing Type PVC

Borehole Depth ft. Borehole Diameter in.

Casing Diameter in. Casing Length ft. Casing Type

Well Condition GOOD CONDITION

SEALING PROCEDURE

Table with 4 columns: Placement, Sealing Material, Volume/Weight Used, Placement Method. Row 1: From 0 ft. To 52 ft. CEMENT/BENTONITE MIX, 92.4/35 LBS CEMENT/BENTONITE MIX, PUMPED WITH TREMIE PIPE.

Condition of Casing GOOD CONDITION Was Casing Removed? [] Yes or [X] No (check one)

If casing Not Removed, was it Perforated? [X] Yes or [] No (check one) Perforations: From 41.6 ft. To 51.4 ft.

Date Sealing Performed 12/3/2024

Comments/Reason for Sealing decommissioned

CONTRACTOR

Name S & ME ODH Registration #

Address 6190 ENTERPRISE CT

City/State/Zip DUBLIN OH 43016

Signed CHRIS HALL Filed electronically on 12/12/2024

I hereby certify the information given is accurate and correct to the best of my knowledge.

Last revised on 12/26/2024

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
2045 Morse Road, Bldg B
Columbus, OH 43229-6693
Phone: (614) 265-6576

LOCATION

County JEFFERSON Township WELLS Section No. Lot No.

Owner BUCKEYE POWER CARDINAL OPERATING SYSTEM

Address of Well Location 306 COUNTY RD 7E

City BRILLIANT Zip Code 439131079

Well Location Description (120 Characters) NEAR BOTTOM ASH POND

Location of Well: Latitude/Longitude Latitude 40.236389 Longitude -80.659722

Previous Well Use MONITOR

Elevation of Well 659.32 +/- ft. Datum Plane: NAD27 NAD83

Source of Coordinates: [X] GPS [] Survey [] Other

Source of Elevation: [] GPS [] Survey [X] Other DIGITAL MAP

WELL IDENTIFICATION ODNR Well Log Number Project Well ID MW-BAP-2

MEASURED CONSTRUCTION DETAILS

Date of measurements 12/3/2024 [] No TD/Pump Stuck
Depth of Well 44.5 ft. Static Water Level 29.1 ft.

Borehole Depth ft. Borehole Diameter in.
Casing Diameter 2 in. Casing Length 47.8 ft. Casing Type PVC

Borehole Depth ft. Borehole Diameter in.
Casing Diameter in. Casing Length ft. Casing Type

Well Condition GOOD CONDITION

SEALING PROCEDURE

Table with 4 columns: Placement, Sealing Material, Volume/Weight Used, Placement Method. Row 1: From 0 ft. To 44.5 ft. CEMENT/BENTONITE MIX, 92.4/35 LBS CEMENT/BENTONITE MIX, PUMPED WITH TREMIE PIPE.

Condition of Casing GOOD CONDITION Was Casing Removed? [] Yes or [X] No (check one)

If casing Not Removed, was it Perforated? [X] Yes or [] No (check one) Perforations: From 34.1 ft. To 43.9 ft.

Date Sealing Performed 12/3/2024

Comments/Reason for Sealing decommissioned

CONTRACTOR

Name S & ME ODH Registration #

Address 6190 ENTERPRISE CT

City/State/Zip DUBLIN OH 43016

Signed CHRIS HALL Filed electronically on 12/12/2024

I hereby certify the information given is accurate and correct to the best of my knowledge.

Last revised on 12/26/2024

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey
2045 Morse Road, Bldg B
Columbus, OH 43229-6693
Phone: (614) 265-6576

LOCATION

County JEFFERSON Township WELLS Section No. _____ Lot No. _____

Owner BUCKEYE POWER CARDINAL OPERATING SYSTEM

Address of Well Location 306 COUNTY RD 7E

City BRILLIANT Zip Code 439131079

Well Location Description NEAR BOTTOM ASH POND
(120 Characters)

Location of Well: Latitude/Longitude Latitude 40.239444 Longitude -80.66

Previous Well Use MONITOR

Elevation of Well 657.18 +/- _____ ft. Datum Plane: NAD27 NAD83

Source of Coordinates: GPS Survey Other _____

Source of Elevation: GPS Survey Other DIGITAL MAP

WELL IDENTIFICATION ODNR Well Log Number _____ Project Well ID MW-BAP-4

MEASURED CONSTRUCTION DETAILS

Date of measurements 12/3/2024 No TD/Pump Stuck

Depth of Well 39.3 ft. Static Water Level 19.4 ft.

Borehole Depth _____ ft. Borehole Diameter _____ in.

Casing Diameter 2 in. Casing Length 41.8 ft. Casing Type PVC

Borehole Depth _____ ft. Borehole Diameter _____ in.

Casing Diameter _____ in. Casing Length _____ ft. Casing Type _____

Well Condition GOOD CONDITION

SEALING PROCEDURE

| Placement: | Sealing Material | Volume/Weight Used Units Required | Placement Method |
|--------------------------------------|-----------------------------|--------------------------------------|--------------------------------|
| From <u>0</u> ft. To <u>39.3</u> ft. | <u>CEMENT/BENTONITE MIX</u> | <u>92.4/35 LBS CEMENT/BENTONITE</u> | <u>PUMPED WITH TREMIE PIPE</u> |
| From _____ ft. To _____ ft. | _____ | _____ | _____ |
| From _____ ft. To _____ ft. | _____ | _____ | _____ |
| From _____ ft. To _____ ft. | _____ | _____ | _____ |

Condition of Casing GOOD CONDITION Was Casing Removed? Yes or No
(check one)

If casing **Not Removed**, was it Perforated? Yes or No Perforations: From 28.9 ft. To 38.7 ft.
(check one)

Date Sealing Performed 12/3/2024

Comments/Reason for Sealing decommissioned

CONTRACTOR

Name S & ME ODH Registration # _____

Address 6190 ENTERPRISE CT

City/State/Zip DUBLIN OH 43016

Signed CHRIS HALL Filed electronically on 12/12/2024

I hereby certify the information given is accurate and correct to the best of my knowledge.

Last revised on 12/26/2024