Amanda Graphics, LLC
Engineering Consulting & CAD Support

2023 Annual Landfill Inspection Report

Cardinal Plant

2023 CCR Landfill Inspection Report

CARDINAL OPERATING COMPANY

Cardinal Operating Company
306 County Rd. 7E
Brilliant, Ohio 43913

January, 2024

Prepared for:

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1. Introduction

This report was prepared by Amanda Graphics, LLC, to fulfill requirements of 40 CFR 257.84 and to provide Cardinal Operating Company and Buckeye Power, Inc. with an evaluation of the FAR I Residual Waste Landfill, located at the Cardinal Power Plant. The Cardinal Power Plant is located at 306 County Road 7 East, Brilliant, OH, 43913, in Jefferson County. Generating Units 1, 2 and 3 are owned by Buckeye Power. The power plant is managed and operated by Cardinal Operating Company.

Amanda Graphics, LLC completed the annual inspection in accordance with the CCR Rule requirements and prepared the following Cardinal Plant CCR Landfill Annual Inspection report.

The 2023 annual inspection was completed by Amanda Graphics, LLC staff, J.T. Massey-Norton (Sn. Geologist), accompanied by Amanda Padamadan under the supervision of Francis S. Brezny (P.E.), Mr. Nicholas Kasper C.P.G. and Paul Jackson P.E. of Buckeye Power also participated in the inspection along with Mr. Zachary Miller of the Cardinal Operating Company who is directly responsible for the management of the CCR landfill. The site inspection was performed on October 11th, 2023. Weather conditions were good, ranging from cloudy to partly sunny as the day progressed with temperatures reaching into the mid 60°F.

This report contains inspection findings, observations, photographs, conclusions, and maintenance recommendations. An aerial survey was performed by Jack A. Hamilton & Assoc., Inc. on December 8th, 2023(Appendix A.) A field photographic log identifying typical conditions and any items that need correction or requiring additional monitoring is provided in Appendix B.

2. Facility Description

2.1 Permit History

The Cardinal Plant FAR I Residual Waste Landfill was constructed under Permit to Install (PTI) No. 06-07993, issued on May 11, 2007, by the Ohio Environmental Protection Agency (Ohio EPA). The landfill's initial purpose was to dispose of flue gas desulfurization (FGD) gypsum material produced as a byproduct of the power plant's flue gas scrubber system and solids from the wastewater treatment plant (WWTP). As operational changes have been made at the plant, the landfill also receives fly ash, bottom ash, and other minor residual solid wastes.

2.2 Landfill Components

The designed 129.45-acre landfill consists of two phases and six cells. Phase 1 consists of Cells 1 and 2 which overlie the bench area between FAR I and a bedrock highwall that is located around a portion of the

facility's perimeter on its north and west sides. Cells 1 and 2 are constructed over bedrock near the highwall interfacing with the mine spoil berm of FAR I. Phase 2 consists of Cells 3, 4, 5, and 6. Figure 1 depicts the 2023 survey for all cells active/inactive (Appendix A).

Cell 1 and Cell 3 (the northernmost cells of the landfill) are the only currently active cells at the facility; Cells 2, 4, 5, and 6 are inactive. Cell 1 is approximately 23 acres in size and is bound by two features - the highwall to the south and the mine spoil berm/bench to the north. The bench area of Cell 1 was constructed and certified in 2007 and 2008. A portion of the highwall area (approximately 60 ft. in height) was built and certified.

Cell 3 is approximately 21.25 acres in area and is bound by the termination berm and landfill haul road to the north and east, the interphase berm to the west, and the Cell 3/Cell 4 inter-cell berm on the south.

At the time of this inspection Cells 2, 4, 5, and 6 are still in pre-construction condition. Earthen materials are being stockpiled in these cells to be used in future construction.

2.2.1 Active Placement Areas

The active placement areas during this landfill inspection include Cell 1 and Cell 3. During the past year, there has been very little placement in Cells 1 and 3 due to sales of the gypsum byproduct material. Gypsum is continuing to be reclaimed from Cell 1 for beneficial utilization. In order to continue the reclamation of gypsum from Cell 1, Cell 3 has been the primary cell for receiving waste.

2.2.2 Closed Areas

Closed areas include a small portion of Cell 1 (approximately one acre) that was closed in 2009.

2.2.3 Inactive Areas

As mentioned in section 2.2, Cells 2, 4, 5, and 6 are in pre-construction condition. Earthen and granular drainage materials are being stockpiled in these cells to be used in future construction. The stockpiles are graded to promote positive drainage and stormwater is discharged to a permitted NPDES outfall.

2.2.4 Leachate Collection System

The leachate collection system (LCS) at FAR I Residual Waste Landfill was constructed in 2007. The LCS is constructed of granular drainage materials embedded with perforated collection pipes connected to risers extending through the CCR fill. The landfill's LCS is graded to drain to the east side of the landfill where the leachate is then routed into collection manholes which are connected by a transmission pipe, becoming progressively larger from 24" diameter in the north to 36" diameter at the south end. The transmission pipe discharges to a collection sump. On the date of the inspection, the leachate effluent was observed to be flowing freely into the concrete sump without obstruction and was visually clear. The effluent is then pumped to pretreatment settling tanks, prior to discharging to a permitted NPDES outfall.

2.2.5 Subsurface Drainage Collection System

A subsurface drainage layer (SDL) was incorporated in the landfill design to prevent uplift conditions to the landfill liner. The system consists of a 2-foot thick (minimum) layer of free-draining material (the SDL), a geotextile placed above the SDL as a separator, 6" diameter perforated HDPE subsurface drainage pipes, 6" diameter solid HDPE transmission pipes. The subsurface drainage pipes also discharge into the leachate collection sump, and is pretreated in the settling tanks, prior to discharging to a permitted NPDES outfall.

2.3 Constructed Capacity

The constructed storage capacities of Cell 1 and Cell 3 are 2.04 million cubic yards and 2.89 million cubic yards, respectively. The total permitted waste volume of the landfill is 18.95 million cubic yards. The total permitted area of the landfill is approximately 129.45 acres and the currently constructed area of the landfill is approximately 44.28 acres (Cell 1 and Cell 3).

3. Regulatory Requirements

The Annual inspection report is completed to meet CCR regulatory requirements specified in CCR Rule Section 257.84(b)(1). These requirements include at a minimum:

(i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., the results of inspections by a qualified person, and results of previous annual inspections); and

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.

In addition to the annual inspections, 7-day inspections per CCR Rule Section 257.84(a)(1) are completed by Cardinal Operating Company and are documented in the facility operating record per § 257.105(g)(5) .

Once the annual inspection has been completed, the CCR Rule Section 257.84(b)(2) requires the qualified professional engineer to prepare a report following each inspection that addresses the following:

(i) Any changes in geometry of the structure since the previous annual inspection.

(ii) The approximate volume of CCR contained in the unit at the time of the inspection.

(iii) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and

(iv) Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.

4. Review of Available Information 257.84(b)(1)(i)

Pursuant to CCR Rule Section 257.84(b)(1)(i), prior to completing the visual inspection, Amanda Graphics, LLC has reviewed available information regarding the status and condition of the landfill, which includes files available in the operating record, such as design and construction information, previous 7 day inspection reports, and previous annual inspections. This information was referenced prior to and during the inspection (if needed).

Cardinal Operating Company personnel complete an inspection of the landfill facility every 7-days. This includes a visual inspection of the landfill components including the active areas, final cover area, culverts, drainage berms/ditches, leachate collection system, leachate pond, leachate pumps, and haul roads. The inspections are completed to comply with the requirements of § 257.84 of the CCR Rule. Amanda Graphics, LLC was provided access to and has reviewed the 7-day inspection reports from January 1, to December 27, 2023. These reports have noted no significant deficiencies or maintenance items.

5. Inspection (257.84(b)(1)(ii))

5.1 Definitions of Visual Observations and Deficiencies

This summary of the visual observations uses terms to describe the general appearance or condition of an observed item, activity, or structure. These terms are defined as follows:

Good:	A condition or activity that is generally better than what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.
Fair/Satisfactory:	A condition or activity that generally meets what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.
Poor:	A condition or activity that is generally below what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.
Minor:	An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance conditional is below what is minimally expected, but does not currently pose a threat to structural stability.
Significant:	An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally expected, and could pose a threat to structural stability if not addressed.
Excessive:	An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally expected,

and which the ability of the observer to properly evaluate the structure or particular area being observed or which poses a threat to structural stability.

A “deficiency” is some evidence that a landfill has developed a problem that could impact the structural integrity of the landfill. There are four general categories of deficiencies. These four categories are described below:

1. **Uncontrolled Seepage:** Uncontrolled seepage is seepage that is not behaving as the design engineer has intended. An example of uncontrolled seepage is seepage that comes through or around the embankment and is not picked up and safely carried off by a drain. Seepage that is collected by a drain can still be uncontrolled if it is not safely collected and transported. Seepage that is not clear and is turbid would also be considered as uncontrolled. Seepage that is unable to be measured and/or observe it is considered uncontrolled seepage.

   Note: Wet or soft areas are not considered as uncontrolled seepage but can lead to this type of deficiency. These areas should be monitored more frequently.

2. **Displacement**: Displacement of berms, embankments, or waste masses is large scale movement of part of the structure. Common signs of displacement are cracks, scraps, bulges, depressions, sinkholes, and slides.

3. **Blockage of Control Features**: Blockage of Control Features is the restriction of flow at spillways, pipes or pipe outfalls, or drains.

4. **Erosion**: Erosion is the gradual movement of surface material by water, wind, or ice. Erosion is considered a deficiency when it is more than a minor routine maintenance item.

5.2 FAR I Residual Waste Landfill Inspection Findings

The overall site layout in plan view is shown in Appendix A. The site inspection began in the southwest corner of the landfill's Cell 1 area progressing along the highwall. The inspection then observed the condition of the active fill areas of both cells progressing to the closed and capped portions/perimeter berms of the landfill. As previously noted, Cells 4, 6, 5, and 2 have not been constructed but have been used to stockpile fill materials for future construction activities. Results of the visual inspection performed on October 11th, 2023, are summarized below. A photographic log of the facility site conditions at the time of the inspection is included in Appendix B.

The interim berm between Cell 3 and the landfill's undeveloped cells was observed to be in good condition with the slope terminating at a crest which forms a temporary ditch along the perimeter of the cell to convey contact storm water to the LCS. The interim slope is constructed with a temporary cover soil in which an established vegetation was observed to be in good condition. The slope appeared to be uniform and free of displacement or other signs of instability (Photo 1). The stockpiles within the future undeveloped landfill

cells shows an orderly excavation of these fill materials (Photo 2). The stockpiles are well graded to promote drainage.

Areas within the landfill where no activity was taking place were observed to be in excellent condition and were protected using a polymeric dust suppressant which had been sprayed on the surface. No fugitive dust was observed on the date of the inspection at any location. The temporary slopes within the active waste placement areas were also observed to be in good condition exhibiting uniform slopes, no erosion, slumping or other signs of instability or displacement.

The bedrock highwall located along the western perimeter of Cell 1 appeared to be stable with no significant rock overhangs, rockfall or other signs of instability (Photo 3). The bedrock highwall is composed of alternating sequences of thin to thick bedded limestone interbedded with shale and siltstone reaching a height of 60 ft. No ponded water or uncontrolled seepage flows were observed at the base of the highwall, suggesting that the seepage collection system is functioning as intended.

The active fill areas within Cells 1and 3 were observed to be well maintained and in excellent condition. Cell 1 did not exhibit any ponded water or erosion within the cell and appeared to be well graded to promote drainage to the LCS's risers (also referred to as chimney drains). The riser structures (exposed on account of the excavation activities) were surrounded and protected by a layer of CCR to prevent impact from heavy equipment (Photo 4). FGD gypsum is actively being excavated from Cell 1 for beneficial utilization (Photo 5). Dry fly ash is actively being landfilled in Cell 3.

A protective vegetative cover is well established in Cell 1 in the closed portion of the landfill showing a healthy grass stand, approximately 6 inches in height. The northern closed area was in excellent condition. No erosion or animal burrows were observed, and the slopes were uniform (i.e., no slumping or bulging) and appeared to be well drained. The area also showed the recent placement of intermediate clay cover up to the active fill area (Photo 6).

A monitoring well located at the toe of the slope in Cell 1 was observed to be in excellent condition. The concrete well pad was not cracked or undermined, protective bollards were adequately spaced, and the casing protector was locked (Photo 7).

All areas in Cell 3 with protective vegetative cover established such as the closed portion of the landfill and berms had a healthy grass stand but did exceed 6 inches in height. No erosion, animal burrows, slumping or other signs of slope instability were observed (Photo 8). A minor barren soil was observed due to mowing operations at the apex of the (Photo 9). The intermediate clay cover was also being placed in Cell 3 inclusive of the area where 6 monitoring wells are located (Photo 10).

The pedestal for settlement profiler No.1 and associated piping was observed to be in excellent condition (Photo 11). Settlement profiler No. 2 shows excellent conditions (Photo 12). The adjacent LCS manhole also shows excellent conditions (i.e., no cracking, concrete spalling, or exposed rebar on the outer surface.

Photo 13 shows the excellent condition of the manhole's interior. The landfill's leachate was observed to be flowing freely into the manhole.

Drainage along the toe of the slope has been significantly improved from last year's inspection. No standing water was observed or soft/wet areas on the surface (Photo 14). The intermediate clay cover was actively being placed (Photo 15). The perimeter ditch to collect contact water from exposed CCR slopes was well maintained (Photo 16). Minor rutting and bare soil were observed along the toe of Cell 3 (Photo 17).

The leachate collection sump structure was observed to be in good condition and with leachate flowing freely into the concrete sump on the date of the inspection (Photos 18 and 19).

The leachate effluent is then discharged to pretreatment settling tanks in which temperature and effluent levels are monitored with subsequent discharge through a NPDES permitted outfall (Photo 20).

5.2.1 Changes in Geometry since Last Inspection 257.84(b)(2)(i)

No significant changes in geometry have been observed at the FAR I Residual Waste Landfill facility since the 2022 inspection. The landfill was maintained during operations by placing dust suppressant on inactive slopes, mowing the vegetative cover, and other maintenance requirements, as necessary.

5.2.2 CCR Landfill Volume 257.84(b)(2)(ii)

The plant is currently pursuing beneficial utilization of gypsum and successfully excavates and reclaims the byproduct for beneficial use.

The total volume of waste material contained in the Cardinal Plant CCR Landfill is approximately 2.12 million cubic yards.

5.2.3 Changes That Affect Stability or Operation 257.84(b)(2)(iii)

No appearances of actual or potential structural weakness of the CCR unit were identified during the 2023 inspection. No existing conditions were identified that were or had the potential to disrupt the operation and safety of the FAR I Residual Waste landfill. No deficiencies or disrupting conditions that would require immediate measures to remedy were identified in the inspection.

5.2.4 CCR Landfill Changes 257.84(b)(2)(iv)

The current survey indicates that all areas of active placement within Cells 1 and 3 have surface elevation that lies below the permitted top of waste grade.

6. Conclusions

The landfill's earthen berms, and open, closed, and inactive areas appear to be in good to excellent condition. The active disposal area of the landfill was in good condition with no evidence of significant erosion or water ponding. The vegetative growth along the downstream slopes of the earthen berms were in excellent condition. The closed areas of the landfill appeared to be stable and well maintained. The discharge structures and pipes were in excellent condition.

7. Recommendations – General Maintenance and Monitoring Conditions

7.1 Overall

1. Continue to mow all vegetated berms on a regular basis to prevent the growth of excess woody plants and brush.
2. Continue to reseed minor barren soil areas as needed to prevent erosion of the cover cap.
3. Continue to complete regular maintenance of minor erosion rills and use the polymer as needed for erosion control and fugitive dust control.
4. Continue to complete weekly inspections and submit inspection reports to the operating record.

7.2 Open Areas

1. Continue to monitor the leachate collection system and spring drain collection system for unobstructed flow.
2. Continue to monitor the perimeter ditch along the toe of the active slope and regrade as necessary to maintain an unobstructed flow.

7.3 Closed Areas

1. Continue current maintenance practices including but not limited to continuing to maintain the vegetative cover height at 6 inches or less and continue the 7-day inspections of the area.
2. Protective bollards should be placed around the 6 monitoring wells located in Cell 3 to prevent mowing operations from damaging these wells.

8. Recommendations – Remedial Actions/Repairs

8.1 Open Areas

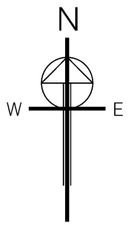
1. There were no deficiencies, signs of structural weakness, or signs of disruptive conditions observed at the time of the inspection that would require additional investigation or remedial action.

8.2 Closed Areas

1. There were no deficiencies, signs of structural weakness, or signs of disruptive conditions observed at the time of the inspection that would require additional investigation or remedial action.

Appendix A

Aerial Survey



HORIZONTAL DATUM: NAD27 OHIO SOUTH
VERTICAL DATUM: NGVD 29

LEGEND - EXISTING

- 509.5 — SPOT ELEVATION
- INTERMEDIATE CONTOUR
- 500 — INDEX CONTOUR
- DEPRESSION CONTOUR
- TREES AND TREE LINE
- STRUCTURE AND BUILDING
- FENCE
- ROADS
- EDGE OF WATER
- TOWER

UPDATED SURVEY PERFORMED BY
JACK A. HAMILTON & ASSOCIATES, INC.
ON DEC. 8, 2023.

Control Point Values provided by Buckeye Power
The topographic survey on this map has been translated to these coordinates

Point	Northing	Easting	Elevation	Description
5401	835028.310	2512948.540	1009.54	Mon 5401 fm Buckeye Power
5404	833975.600	2514249.350	1014.70	Mon 5404 fm Buckeye Power

Control Point Values from previous years survey (Do Not Use moving forward)
The topographic survey on this map has been translated from these coordinates

Point	Northing	Easting	Elevation	Description
5401	835028.411	2512944.899	1009.75	Mon 5401 fm previous year
5404	833975.910	2514246.030	1014.83	Mon 5404 fm previous year

AG Engineering & Surveying

CARDINAL
FAR 1 RWL FACILITY
ANNUAL AS-BUILT GRADES

FIGURE 1

PLOT DATE: DD-MMM-YYYY
PLOT TIME: HOUR:MINUTE
BY: USERPLOT
CROSS REFS:

Appendix B

Landfill Inspection Photographs

Photo 1
Typical view of intermediate slope between Cells 1& 3 and remaining undeveloped cells.

Photo 2
Typical view of remaining undeveloped cells and stockpiles.

Photo 3
Close up of the highwall seen in Photo No.1.

Photo 4
Typical view of leachate collection system riser pipe having a protective barrier surrounding the riser.

Photo 5
Typical view showing the reclamation of FGD gypsum for beneficial reutilization.

Photo 6
Typical view of the permanent cover cap showing a well-maintained vegetative cover and placement of intermediate cover.

Photo 7
Typical view of the landfill's monitoring well showing very good conditions (i.e. concrete pad, protective bollards, and locked casing protector).

Photo 8
View of Cell 3 exterior slope showing excellent condition, uniform slopes with a healthy vegetative grass cover.

Photo 9
View of a minor bare soil area due to mowing operations.

Photo 10
View of the landfill's monitoring wells and recent placement of intermediate cover.

Photo 11
Typical view of the settlement profiler No. 1 concrete pedestal and associated piping showing good conditions.

Photo 12
Typical view of the settlement profiler No. 2 concrete pedestal and associated piping showing good conditions.

Photo 13

Typical view showing excellent conditions of the manhole's interior for the leachate collection pipe. No spalling, cracking or noticeable deterioration of the concrete was observed. Leachate was flowing freely along the base of the manhole.

Photo 14

There is a significant improvement in drainage along the toe of Cell 3, no standing water was observed, and culverts were unobstructed.

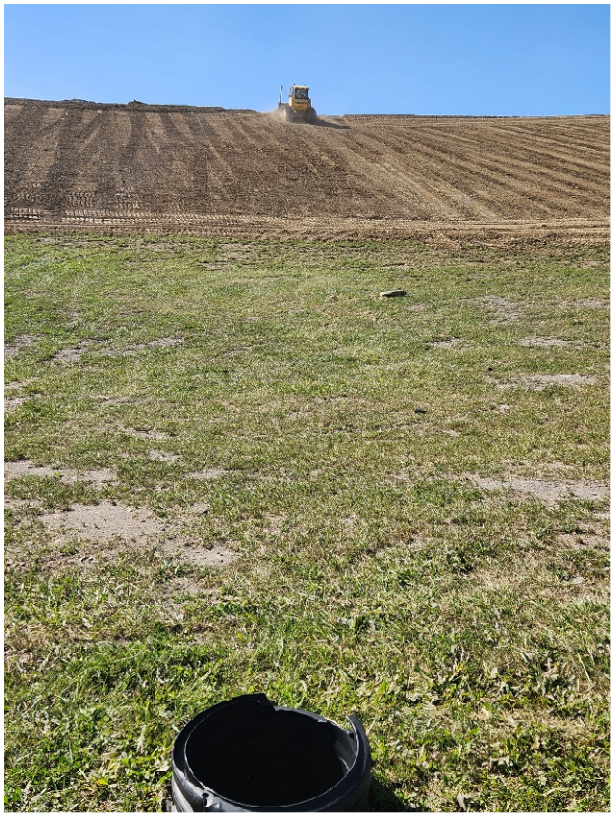


Photo 15
View of Cell 3 exterior slope showing excellent conditions with active placement of intermediate soil cover creating uniform slopes with the established permanent cover cap.

Photo 16
View of Cell 3 exterior slope showing excellent conditions with active placement of intermediate soil cover creating uniform slopes. Foreground shows perimeter ditch that will convey contact water to the landfill's LCS.

Photo 17
View of Cell 3 along the toe of the permanent slope showing minor rutting and bare soil.

Photo 18
Typical view of the LCS sump structure showing good conditions.

Photo 19
Typical view of the LCS sump structure showing interior conditions of the sump structure. Leachate from the LCS was flowing freely into the sump.

Photo 20

Typical view of the LCS tank showing good conditions.