Prepared for Illinois Power Generating Company

Date
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Project No. 1940100711-003

2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT GMF GYPSUM STACK POND COFFEEN POWER PLANT COFFEEN, ILLINOIS CCR UNIT 103



2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN POWER PLANT GMF GYPSUM STACK POND

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ACRONYMS AND ABBREVIATIONS

§	Section
40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	coal combustion residuals
CMA	Corrective Measures Assessment
СРР	Coffeen Power Plant
GMF	Gypsum Management Facility
GSP	Gypsum Stack Pond
GWPS	groundwater protection standard
NA	not applicable
NRT/OBG	Natural Resource Technology, an OBG Company
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SAP	Sampling and Analysis Plan
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TBD	to be determined
TDS	total dissolved solids

EXECUTIVE SUMMARY

This report has been prepared to provide the information required by Title 40 of the Code of Federal Regulations (40 C.F.R.) Section (§) 257.90(e) for the Gypsum Management Facility (GMF) Gypsum Stack Pond (GSP) located at Coffeen Power Plant (CPP) near Coffeen, Illinois.

Groundwater is being monitored at GMF GSP in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.94.

No changes were made to the monitoring system in 2021 (no wells were installed or decommissioned).

The following Statistically Significant Increases (SSIs) of 40 C.F.R. § 257 Appendix III parameter concentrations greater than background concentrations were determined:

- Calcium at well G209 and G215
- Chloride at well G215
- pH at wells G206, G212, and G215
- Sulfate at well G215
- Total dissolved solids (TDS) at well G215

Alternate Source Demonstrations (ASDs) were completed for the SSIs referenced above and GMF GSP remains in the Detection Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll Americas Engineering Solutions, Inc. (Ramboll) on behalf of Illinois Power Generating Company, to provide the information required by 40 C.F.R. § 257.90(e) for the GMF GSP located at the CPP near Coffeen, Illinois.

In accordance with 40 C.F.R. § 257.90(e), the owner or operator of a coal combustion residuals (CCR) unit must prepare an Annual Groundwater Monitoring and Corrective Action Report for the preceding calendar year that documents the status of the Groundwater Monitoring and Corrective Action Program for the CCR unit, summarizes key actions completed, describes any problems encountered, discusses actions to resolve the problems, and projects key activities for the upcoming year. At a minimum, the annual report must contain the following information, to the extent available:

- 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.
- 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.
- 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.
- 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 [SSI] relative to background levels).
- 5. Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.
- 6. A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. At a minimum, the summary must specify all of the following:
 - i. At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95.
 - ii. At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95.
 - iii. If it was determined that there was a SSI over background for one or more constituents listed in Appendix III of §257 pursuant to §257.94(e):
 - A. Identify those constituents listed in Appendix III of §257 and the names of the monitoring wells associated with the SSI(s).
 - B. Provide the date when the assessment monitoring program was initiated for the CCR unit.

- iv. If it was determined that there was a [Statistically Significant Level] SSL above the Groundwater Protection Standard [GWPS] for one or more constituents listed in Appendix IV of §257 pursuant to §257.95(g) include all of the following:
 - A. Identify those constituents listed in Appendix IV of §257 and the names of the monitoring wells associated with the SSL(s).
 - B. Provide the date when the corrective measures assessment [CMA] was initiated for the CCR unit.
 - C. Provide the date when the public meeting was held for CMA for the CCR unit.
 - D. Provide the date when the CMA was completed for the CCR unit.
- v. Whether a remedy was selected pursuant to §257.97 during the current annual reporting period, and if so, the date of remedy selection.
- vi. Whether remedial activities were initiated or are ongoing pursuant to § 257.98 during the current annual reporting period.

This report provides the required information for the GMF GSP for calendar year 2021.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the monitoring program status in calendar year 2021 and GMF GSP remains in the Detection Monitoring Program in accordance with 40 C.F.R. § 257.94.

3. KEY ACTIONS COMPLETED IN 2021

The Detection Monitoring Program is summarized in **Table A** on the following page. The groundwater monitoring system, including the CCR unit and all background and compliance monitoring wells, is presented in **Figure 1**. No changes were made to the monitoring system in 2021. In general, one groundwater sample was collected from each background and compliance well during each monitoring event.¹ All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP; Natural Resource Technology, an OBG Company [NRT/OBG], 2017a). All monitoring data obtained under 40 C.F.R. § 257.90 through 257.98 (as applicable) in 2021, and analytical results for the August 2020 sampling event, are presented in **Tables 1** and **2**. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSIs of Appendix III parameters relative to background concentrations.

Statistical background values are provided in **Table 3**. The background values reported in **Table 3** are slightly different from those reported previously because different software was utilized to calculate these values in 2021.

Potential alternate sources were evaluated as outlined in the 40 C.F.R. § 257.94(e)(2). ASDs were completed and certified by a qualified professional engineer. The dates the ASDs were completed are provided in **Table A**. The ASDs are included in **Appendix A**.

¹ Sampling was limited to G212 and G215 during the June 2021 sampling event, and G206, G209, G215, and G218 during the December 2021 sampling event, to confirm SSIs of select Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event, as allowed by the Statistical Analysis Plan.

Sampling Date	Analytical Data Receipt Date	Parameters Collected	SSI(s)	SSI(s) Determination Date	ASD Completion Date
August 11 - 13, 2020	October 15, 2020	Appendix III	Calcium (G209) pH (G206)	January 13, 2021	April 13, 2021
January 26 - 29, 2021	April 14, 2021	Appendix III	Calcium (G215) Chloride (G215) pH (G212) Sulfate (G215) TDS (G215)	July 13, 2021	October 11, 2021
June 29, 2021 ¹	August 3, 2021	Calcium at well G215; Chloride at well G215; pH at wells G212 and G215; Sulfate at well G215; TDS at well G215 ²	NA	NA	NA
August 18 - 20, 2021	September 27, 2021	Appendix III	Boron (G215) Calcium (G209, G215, and G218); Chloride (G215) Sulfate (G215) TDS (G215)	December 26, 2021	TBD
November 29, 2021 ³	December 9, 2021	Boron at well G215; Fluoride at wells G206, G215, and G218; pH at well G209; TDS at well G218 ²	NA	NA	NA

Table A. 2020-2021 Detection Monitoring Program Summary

Notes:

NA: not applicable

TBD: to be determined

¹ Sampling was limited to G212 and G215 during the June 2021 sampling event to confirm SSIs of select Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event, as allowed by the Statistical Analysis Plan.

² Groundwater sample analysis was limited to select Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event to confirm SSIs, as allowed by the Statistical Analysis Plan.

³ Sampling was limited to G206, G209, G215, and G218 during the June 2021 sampling event to confirm SSIs of select Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event, as allowed by the Statistical Analysis Plan.

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the Groundwater Monitoring Program during 2021. Groundwater samples were collected and analyzed in accordance with the SAP and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2022

The following key activities are planned for 2022:

- All or part of the monitoring well network that was proposed for compliance with Title 35 of the Illinois Administrative Code § 845 is under evaluation for incorporation into the current monitoring system.
- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2022.
- Complete evaluation of analytical data from the compliance wells, using background data to determine whether an SSI of Appendix III parameters detected at concentrations greater than background concentrations has occurred.
- If an SSI is identified, potential alternate sources (*i.e.*, a source other than the CCR unit caused the SSI or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated. If an alternate source is demonstrated to be the cause of the SSI, a written demonstration will be completed within 90 days of SSI determination and included in the 2022 Annual Groundwater Monitoring and Corrective Action Report.
- If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 C.F.R. § 257.94 through 257.98 as may apply in 2022 (*e.g.*, Assessment Monitoring) will be met, including associated recordkeeping/notifications required by 40 C.F.R. § 257.105 through 257.108.

6. **REFERENCES**

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a. *Sampling and Analysis Plan, Coffeen GMF Gypsum Stack Pond, Coffeen Power Station, Coffeen, Illinois, Project No. 2285, Revision 0.* October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b. *Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company.* October 17, 2017.

TABLES

TABLE 1

GROUNDWATER ELEVATIONS 2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN POWER PLANT

103 - GMF GYPSUM STACK POND

COFFEEN, IL

Well ID	Well Type	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date	Depth to Groundwater (ft BMP)	Groundwater Elevation (ft NAVD88)
				08/10/2020	7.78	618.16
				01/20/2021	6.31	619.63
				03/29/2021	2.67	623.27
				04/20/2021	4.08	621.86
				05/03/2021	3.25	622.69
6200	Background	20.07514	-80 30501	05/17/2021	3.84	622.10
9200	Background	39.07314	-85.55501	06/09/2021	5.10	620.84
				06/23/2021	6.56	619.38
				07/12/2021	5.42	620.52
				07/26/2021	6.20	619.74
				08/16/2021	6.06	619.88
				10/25/2021	3.60	622.34
				08/10/2020	12.90	619.92
				01/20/2021	11.32	621.50
				03/29/2021	Not Me	easured
				04/20/2021	10.75	622.07
				05/03/2021	10.22	622.60
	Compliance	39.06740	-89.39855	05/17/2021	10.51	622.31
G206				06/09/2021	11.11	621.71
				06/23/2021	12.28	620.54
				07/12/2021	10.43	622.39
				07/26/2021	10.82	622.00
				08/16/2021	10.74	622.08
				10/25/2021	9.88	622.94
				11/29/2021	11.02	621.80
		39.06792		08/10/2020	13.32	619.59
				01/20/2021	10.97	621.94
				03/29/2021	Not Me	easured
				04/20/2021	10.51	622.40
				05/03/2021	10.09	622.82
				05/17/2021	10.40	622.51
G209	Compliance		-89.39685	06/09/2021	10.88	622.03
				06/23/2021	12.02	620.89
				07/12/2021	10.83	622.08
				07/26/2021	10.50	622.41
				08/16/2021	10.35	622.56
				10/25/2021	10.03	622.88
				11/29/2021	10.62	622.29
				08/10/2020	13.75	619.14
				01/20/2021	12.81	620.08
				03/29/2021	Not Me	easured
G212	Compliance	39.06843	-89.39532	04/20/2021	11.29	621.60
				05/03/2021	10.77	622.12
				05/17/2021	11.15	621.74
				06/09/2021	11.70	621.19
				06/23/2021	12.93	619.96



TABLE 1 GROUNDWATER ELEVATIONS

2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN POWER PLANT

103 - GMF GYPSUM STACK POND

COFFEEN, IL

Well ID	Well Type	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date	Depth to Groundwater (ft BMP)	Groundwater Elevation (ft NAVD88)
				07/12/2021	12.34	620.55
C212	Compliance	20.06942		07/26/2021	11.76	621.13
0212	Compliance	39.06843	-89.39532	08/16/2021	11.48	621.41
				10/25/2021	10.73	622.16
				08/10/2020	15.95	617.11
				01/20/2021	15.87	617.19
				03/29/2021	Not Me	easured
				04/20/2021	14.23	618.83
				05/03/2021	13.86	619.20
				05/17/2021	13.96	619.10
G215	Compliance	39.06931	-89.39394	06/09/2021	14.41	618.65
				06/23/2021	15.61	617.45
				07/12/2021	14.82	618.24
				07/26/2021	14.27	618.79
				08/16/2021	14.15	618.91
				10/25/2021	13.92	619.14
				11/29/2021	16.86	616.20
			-89.39396	08/10/2020	15.69	617.42
				01/20/2021	15.58	617.53
		39.07088		03/29/2021	Not Me	easured
				04/20/2021	13.58	619.53
	Compliance			05/03/2021	13.21	619.90
				05/17/2021	13.39	619.72
G218				06/09/2021	13.79	619.32
				06/23/2021	15.24	617.87
				07/12/2021	14.51	618.60
G215 G218 R201				07/26/2021	14.00	619.11
				08/16/2021	13.78	619.33
				10/25/2021	13.83	619.28
				11/29/2021	14.26	618.85
				08/10/2020	7.45	618.89
				01/20/2021	5.82	620.52
				03/29/2021	2.82	623.52
				04/20/2021	4.18	622.16
				05/03/2021	3.43	622.91
D 201	Destaura	20.07514	00.00706	05/17/2021	3.66	622.68
K2U1	Баскground	39.07514	-89.39/86	06/09/2021	5.22	621.12
				06/23/2021	6.42	619.92
				07/12/2021	5.00	621.34
				07/26/2021	5.97	620.37
				08/16/2021	5.73	620.61
				10/25/2021	3.00	623.34

Notes:

BMP = below measuring point

ft = foot/feet

NAVD88 = North American Vertical Datum of 1988



TABLE 2 ANALYTICAL RESULTS - APPENDIX III PARAMETERS

2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN POWER PLANT 103 - GMF GYPSUM STACK POND

COFFEEN, IL

Well ID	Well Type	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (field) (SU)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)			
				08/11/2020	<0.01	85	63	0.427	7.2	110	530			
G200	Background	39.07514	-89.39501	01/29/2021	0.014	81	53	0.36	7.3	110	580			
	G200BackgroundG206ComplianceG209ComplianceG212Compliance			08/18/2021	0.016	87	44	0.383	7.2	100	540			
				08/13/2020	0.015	81	23	0.391	7.4	130	500			
C206	Compliance	20.06740	90 209EE	01/27/2021	<0.01	65	22	0.426	7.1	130	480			
G200	Compliance	39.00740	-99.39633	08/20/2021	<0.01	83	21	0.643	7.2	130	560			
				11/29/2021				0.456	7.2					
				08/13/2020	0.018	150	65	0.474	7.2	270	800			
6200	Compliance	20.06702	90,20095	01/27/2021	<0.01	120	77	0.401	7.1	250	810			
G209	Compliance	39.06792	-99.39085	08/20/2021	0.02	150	59	0.493	6.8	240	840			
				11/29/2021					7.0					
		39.06843					08/13/2020	<0.01	54	42	0.323	7.3	53	430
6212	Compliance		-89.39532	01/26/2021	0.032	56	41	<0.25	6.8	55	400			
G212 Compliance	Compliance			06/29/2021					7.4					
			08/19/2021	<0.01	54	41	0.322	7.2	51	420				
		39.06931			08/13/2020	0.051	110	70	0.366	7.2	210	710		
						01/26/2021	0.36	180	120	<0.25	6.8	490	1100	
G215	Compliance		-89.39394	06/29/2021		180	110		7.1	470	950			
				08/19/2021	0.49	180	110	0.597	7.0	440	1300			
				11/29/2021	0.62			0.338	6.9					
				08/13/2020	<0.01	120	84	0.34	7.1	220	720			
6218	Compliance	20.07099	80.20206	01/26/2021	0.017	120	81	0.276	7.0	210	710			
GZIØ	Compliance	39.07088	-07.2720	08/19/2021	<0.01	150	88	0.63	7.1	260	1000			
				11/29/2021				0.371	7.0		880			



TABLE 2 ANALYTICAL RESULTS - APPENDIX III PARAMETERS

2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN POWER PLANT 103 - GMF GYPSUM STACK POND COFFEEN, IL

Well ID	Well Type	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date	Boron, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Fluoride, total (mg/L)	pH (field) (SU)	Sulfate, total (mg/L)	Total Dissolved Solids (mg/L)
R201 Background		39.07514	7514 -89.39786	08/11/2020	<0.01	120	87	0.364	6.9	240	790
	Background			01/29/2021	0.01	94	46	<0.25	7.0	160	710
				08/18/2021	0.012	110	88	0.472	7.0	180	740

Notes:

mg/L = milligrams per liter

SU = Standard Units

concentration is less than the concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since they are not utilized in statistics to determine Statistically Significant Increases (SSIs) over background

-- = not analyzed



TABLE 3

STATISTICAL BACKGROUND VALUES 2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN POWER PLANT 103 - GMF GYPSUM STACK POND

COF	FEEN	I, IL

Parameter	Statistical Background Value (LPL/UPL)
40 C.F.R. Part	257 Appendix III
Boron (mg/L)	0.390
Calcium (mg/L)	150
Chloride (mg/L)	96.0
Fluoride (mg/L)	0.502
pH (field) (SU)	6.9/7.3
Sulfate (mg/L)	300
Total Dissolved Solids (mg/L)	949

Notes: 40 C.F.R. = Title 40 of the Code of Federal Regulations LPL = Lower Prediction Limit (applicable for pH only) mg/L = milligrams per liter SU = Standard Units UPL = Upper Prediction Limit



FIGURES



BACKGROUND WELL COMPLIANCE WELL PART 257 REGULATED UNIT (SUBJECT UNIT)

- SITE FEATURE
- CAPPED AREA (IEPA APPROVED CLOSURE)

PROPERTY BOUNDARY

MONITORING WELL LOCATION MAP

FIGURE 1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.



2021 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT GMF GYPSUM STACK POND COFFEEN POWER PLANT COFFEEN, ILLINOIS



APPENDICES

APPENDIX A ALTERNATE SOURCE DEMONSTRATIONS

Intended for Illinois Power Generating Company

Date April 13, 2021

Project No. 1940100711-003

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION

COFFEEN GMF GYPSUM STACK POND COFFEEN POWER PLANT COFFEEN, ILLINOIS CCR UNIT 103



CERTIFICATIONS

I, Brian G. Hennings, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Brian G. Hennings Professional Geologist 196-001482 Illinois Ramboll Americas Engineering Solutions, Inc. Date: April 13, 2021



I, Anne Frances Ackerman, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Anne Frances Ackerman Qualified Professional Engineer 062-060586 Illinois Ramboll Americas Engineering Solutions, Inc. Date: April 13, 2021



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TABLES (IN TEXT)

Table ASummary Statistics for Boron and Sulfate in Downgradient Wells with SSIs (from
November 2015 to August 2020)

FIGURES (IN TEXT)

Figure A Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with the GMF Gypsum Stack Pond and Samples of Surface Water from the GMF Gypsum Stack Pond

FIGURES (ATTACHED)

- Figure 1 Groundwater Elevation Contour Map August 10, 2020
- Figure 2 Sample Location Map

ACRONYMS AND ABBREVIATIONS

ny

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by Ramboll Americas Engineering Solutions, Inc. to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Coffeen Gypsum Management Facility (GMF) Gypsum Stack Pond (GSP), located near Coffeen, Illinois.

The most recent Detection Monitoring sampling event (Detection Monitoring Round 7 [D7]) was completed on August 11 and 13, 2020 and analytical data were received on October 15, 2020. Analytical data from D7 were evaluated in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017a) to determine any SSIs of Appendix III parameters over background concentrations. That evaluation identified the following SSI at downgradient monitoring wells as follows:

- pH at well G206
- Calcium at well G209

Pursuant to 40 C.F.R. § 257.94(e)(2), the following lines of evidence (LOEs) demonstrate that sources other than the Coffeen GMF GSP were the cause of the SSIs listed above. This ASD was completed by April 13, 2021, within 90 days of determination of the SSI (January 13, 2021), as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site Location and Description

The Coffeen Power Station (Site) is located in Montgomery County, in central Illinois, approximately 2 miles south of the city of Coffeen. The area is bordered by Coffeen Lake to the west, east, and south, and by agricultural land to the north. Several underground coal mines were historically operated both beneath and in the vicinity of the Site.

2.2 Geology and Hydrogeology

The Site geologic and hydrogeologic setting summarized below is from the Coffeen Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

Pleistocene deposits of unlithified glacial diamictons, lacustrine/alluvial deposits, and windblown loess overlie Pennsylvanian-age bedrock throughout central Illinois. The most extensive glacial deposits are those from the Illinoian Stage which cover much of the state and are present at the Site. Windblown (aeolian) deposits, the Peoria and Roxana Silts, cover the glacial deposits over a majority of the state. These units are fine-grained deposits blown from river valleys by prevailing winds.

Till members of the Glasford Formation include the Smithboro Member, the Mulberry Grove Member, the Vandalia Member, and the Hagarstown Member (oldest to youngest). The Smithboro Member is described as a gray, compact, silty till. The Smithboro is bounded below by the Yarmouth Soil. The Mulberry Grove Member is intermittent at the Site and is described as a calcareous gray silt and fine sand containing some fossil mollusks. The Vandalia Member is a sandy till with thin lenticular bodies of silt, sand, and gravel. It is calcareous, except where weathered, generally gray, and moderately compact. The Hagarstown Member is bounded at the top by the Sangamon Soil. The member consists of gravelly till, poorly sorted gravel, well sorted gravel, and sand.

The Quaternary deposits in the Coffeen area consist mainly of diamictons and intercalated outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits and bedrock which occur at the Site include the following units (beginning at the ground surface):

- Upper Confining Unit Low permeability clays and silts, including the Roxana Silt and Peoria Silt (Loess Unit) and the upper clayey till portion of the Hagarstown Member.
- Uppermost Aquifer Thin (generally less than 3 feet [ft]), moderate to high permeability sand, silty sand, and sandy silt/clay units which include the Hagarstown Member (also referred to as the Hagarstown Beds) and the upper Vandalia Till Member (where weathered).
- Lower Confining Unit Thick (generally greater than 15 ft), very low permeability sandy, silt till, or clay till that includes the unweathered Vandalia Member, Mulberry Grove Member (discontinuous), and Smithboro Member.
- Bedrock Pennsylvanian-age Bond Formation characterized by limestone and calcareous clays and shales.

Coffeen Lake was built by damming the McDavid Branch of the East Fork of Shoal Creek in 1963 for use as an artificial cooling lake for the Coffeen Power Station. The CCR units at the Site are located

between the two lobes of the lake (identified as "Coffeen Lake" and "Unnamed Tributary" on Figure 1), which results in a north/south trending groundwater divide observed beneath the CCR units. Groundwater flow is to the southeast or southwest, downgradient of the divide, converging on the tributary valleys leading to Coffeen Lake on the east and west sides of the property.

Groundwater elevations were obtained from measurements in monitoring wells on August 10, 2020 prior to a combined sampling event for the five CCR units located at Coffeen Power Station. Groundwater elevations (referenced to North American Vertical Datum of 1988 [NAVD88]) in the GSP area ranged from about 625 ft to 616 ft (Figure 1). The groundwater elevations and flow directions for the Coffeen Power Station during the D7 sampling event are shown in Figure 1, and generally follow the flow patterns established by the groundwater divide beneath the CCR units. The groundwater flow beneath the GMF GSP was to the southeast, toward the unnamed tributary.

2.3 Groundwater and GMF Gypsum Stack Pond Monitoring

Figure 1 shows all monitoring wells present at the Site, including those in the groundwater monitoring systems established in accordance with 40 C.F.R. § 257.91 at Ash Pond No. 1, Ash Pond No. 2, the GMF Recycle Pond, the Landfill and the GMF GSP and wells not used for federal CCR monitoring. The GMF GSP is a 77-acre facility that has been in operation since 2010. The monitoring system for the GMF GSP includes background wells R201 and G200, located north of the GSP, and downgradient monitoring wells are G206, G209, G212, G215, and G218 (Figure 2). The GMF GSP surface water was sampled at two locations in the northwest and northeast corners of the pond (GPb and GPc, respectively) during the D7 sampling event.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than the GSP (the CCR unit) caused the SSIs. LOEs supporting this ASD include the following:

- 1. GMF GSP Composite Liner Design.
- 2. The ionic composition of GMF GSP water is different from the ionic composition of groundwater.
- 3. LOE#3: Downgradient concentrations of Boron and Sulfate do not exceed background limits.

These LOEs are described and supported in greater detail below.

3.1 LOE #1: GMF GSP Composite Liner Design

Construction of the GMF GSP was in accordance with Water Pollution Control Permit 2008EA4661 granted by the Illinois Environmental Protection Agency (IEPA). The GMF GSP composite liner system includes the following components:

- 60-millimeter high-density polyethylene geomembrane liner.
- Three-foot-thick layer of recompacted, low-permeability soil having a maximum hydraulic conductivity of 1 x 10⁻⁷ centimeters per second.

The IEPA-approved Coffeen GMF GSP composite liner system exceeds the design criteria for a composite liner for new CCR landfills established by 40 C.F.R. § 257.70(b).

The composite liner design criteria were established to help prevent contaminants in CCR from leaking from the CCR unit and impacting groundwater. Therefore, the presence of the composite liner system suggests that the GMF GSP is not the source of the SSIs.

3.2 LOE #2: The Ionic Composition of GMF GSP Water is Different from the Ionic Composition of Groundwater

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content on the two lower triangular portions of the diagram, providing the information which, when combined on the central, diamond-shaped portion of the diagram, identifies compositional categories or groupings (hydrochemical facies). Figure A is a Piper diagram that displays the ionic composition of groundwater samples from the GMF GSP monitoring wells and GSP surface water samples (GPb and GPc) collected during the D7 sampling event.

The Piper diagram indicates that the background and downgradient groundwater (enclosed within the black ellipse) are in the calcium-bicarbonate facies, and that the surface water from the GMF GSP are in the sodium-chloride (GPb) or calcium-sulfate (GPc) facies. The differences in ionic composition between the groundwater and GMF GSP surface water indicate that the GMF GSP is not the source of the SSIs.



Figure A. Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with the GMF Gypsum Stack Pond and Samples of Surface Water from the GMF Gypsum Stack Pond.

3.3 LOE #3: Downgradient Concentrations of Boron and Sulfate Do Not Exceed Background Limits

Boron and sulfate are indicators of CCR impacts to groundwater due to their leachability from CCR and mobility in groundwater. If the groundwater downgradient of the GMF GSP had been impacted by CCR from the unit, boron and sulfate concentrations would be expected to be elevated above background Upper Prediction Limits (UPLs). The UPL is an upper bound on background concentrations calculated for comparing downgradient measurements to background. Downgradient monitoring wells with SSIs had concentrations of boron and sulfate that were below their respective UPLs (0.39 milligrams per liter [mg/L] for boron and 351 mg/L for sulfate; Table A).

	Boron (UPL=0.39 mg/L)		Suli (UPL=35	fate 51 mg/L)
Location	Minimum	Maximum	Minimum	Maximum
G206	0.01	0.11	95	150
G209	0.01	0.019	95	280

Table A. Summary Statistics for Boron and Sulfate in Downgradient Wells with SSIs (fromNovember 2015 to August 2020).

In downgradient monitoring wells with SSIs, concentrations of boron and sulfate below their UPLs indicate that these wells have not been affected by CCR. Therefore, the GMF GSP is not the source of the SSIs.

4. CONCLUSIONS

Based on these three LOEs, it has been demonstrated that the Coffeen GMF Gypsum Stack Pond is not the source of the pH SSI in G206 or the calcium SSI in G209.

- 1. GMF GSP Composite Liner Design.
- 2. The ionic composition of GMF GSP water is different from the ionic composition of groundwater.
- 3. Downgradient concentrations of Boron and Sulfate do not exceed background limits.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSI observed during the D7 monitoring event were not due to the GMF Gypsum Stack Pond. Therefore, an assessment monitoring program is not required and the GMF Gypsum Stack Pond will remain in detection monitoring.

5. REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017a. *Statistical Analysis Plan. Coffeen Power Station, Newton Power Station*. Illinois Power Generating Company.

Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017b. *Hydrogeologic Monitoring Plan. Coffeen Ash Pond No. 1 – CCR Unit ID 101, Coffeen Ash Pond No. 2 – CCR Unit ID 102, Coffeen GMF Gypsum Stack Pond – CCR Unit ID 103, Coffeen GMF Recycle Pond – CCR Unit ID 104, Coffeen Landfill – CCR Unit ID 105.* Coffeen Power Station, Coffeen, Illinois. Illinois Power Generating Company.

FIGURES



- CCR RULE MONITORING WELL LOCATION
- ♣ NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)

- - INFERRED GROUNDWATER ELEVATION CONTOUR

600

L Feet

0

300

1



SURFACE WATER FEATURE

NOTE:

* = NOT USED FOR CONTOURING

GROUNDWATER ELEVATION CONTOUR MAP AUGUST 10, 2020

FIGURE 1

RAMBOLL US CORPORATION A RAMBOLL COMPANY



CCR RULE GROUNDWATER MONITORING

COFFEEN POWER STATION COFFEEN, ILLINOIS



SAMPLE LOCATION MAP

FIGURE 2

RAMBOLL US CORPORATION A RAMBOLL COMPANY



CCR UNIT BOUNDARY, SUBJECT SITE CCR UNIT BOUNDARY

SURFACE WATER FEATURE

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

COFFEEN GMF GYPSUM STACK POND COFFEEN POWER STATION COFFEEN, ILLINOIS

350 700 J Feet

BACKGROUND MONITORING WELL

DOWNGRADIENT MONITORING WELL POND WATER SAMPLE LOCATION

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Intended for Illinois Power Generating Company

Date **October 11, 2021**

Project No. 1940100711-003

40 C.F.R. § 257.94(E)(2): ALTERNATE SOURCE DEMONSTRATION COFFEEN POWER PLANT GMF GYPSUM STACK POND CCR UNIT 103



CERTIFICATIONS

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole^(M). Pagano Professional Geologist 196-000750 Illinois Ramboll Americas Engineering Solutions, Inc. Date: October 11, 2021



I, Anne Frances Ackerman, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Anne Frances Ackerman Qualified Professional Engineer 062-060586 Illinois Ramboll Americas Engineering Solutions, Inc. Date: October 11, 2021



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FIGURES (ATTACHED)

Figure 1	Uppermost Aquifer Groundwater Elevation Contours Map – January 20, 2021
Figure 2	Sample Location Map

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CCR Rule	40 C.F.R. § 257 Subpart D
СРР	Coffeen Power Plant
D8	Detection Monitoring Round 8
GMF	Gypsum Management Facility
GSP	Gypsum Stack Pond
IEPA	Illinois Environmental Protection Agency
LOE	line of evidence
NAVD88	North American Vertical Datum of 1988
NRT/OBG	Natural Resource Technology, an OBG Company
SSI	Statistically Significant Increase
TDS	total dissolved solids
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. § 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by Ramboll Americas Engineering Solutions, Inc. to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Coffeen Power Plant (CPP) Gypsum Management Facility (GMF) Gypsum Stack Pond (GSP), located near Coffeen, Illinois.

The most recent Detection Monitoring sampling event (Detection Monitoring Round 8 [D8]) was completed on January 27, 2021 and analytical data were received on April 14, 2021. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. § 257 Subpart D (CCR Rule) Appendix III parameters over background concentrations was completed by July 13, 2021, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at compliance monitoring wells:

- Calcium at well G215
- Chloride at well G215
- pH at wells G212 and G215
- Sulfate at well G215
- Total dissolved solids (TDS) at well G215

In accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017a), well G215 was resampled on June 29, 2021 and analyzed for calcium, chloride, pH, sulfate, and TDS to confirm the SSIs. Following evaluation of analytical data from the resample event, the following SSIs remained:

- Calcium at well G215
- Chloride at well G215
- pH at well G212
- Sulfate at well G215
- TDS at well G215

Pursuant to 40 C.F.R. § 257.94(e)(2), the following lines of evidence (LOEs) demonstrate that sources other than the GMF GSP were the cause of the SSIs listed above. This ASD was completed by October 11, 2021, within 90 days of determination of the SSI (July 13, 2021), as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site Location and Description

The Coffeen Power Plant (CCP) is located in Montgomery County, in central Illinois, approximately 2 miles south of the city of Coffeen. The area is bordered by Coffeen Lake to the west, east, and south, and by agricultural land to the north. Several underground coal mines were historically operated both beneath and in the vicinity of the Site.

2.2 Geology and Hydrogeology

The CPP geologic and hydrogeologic setting summarized below is from the Coffeen Hydrogeologic Monitoring Plan (NRT/OBG, 2017b).

Pleistocene deposits of unlithified glacial diamictons, lacustrine/alluvial deposits, and windblown loess overlie Pennsylvanian-age bedrock throughout central Illinois. The most extensive glacial deposits are those from the Illinoian Stage which cover much of the state and are present at the CPP. Windblown (aeolian) deposits, the Peoria and Roxana Silts, cover the glacial deposits over a majority of the state. These units are fine-grained deposits blown from river valleys by prevailing winds.

Till members of the Glasford Formation include (oldest to youngest): the Smithboro Member, the Mulberry Grove Member, the Vandalia Member, and the Hagarstown Member. The Smithboro Member is described as a gray, compact, silty till. The Smithboro is bounded below by the Yarmouth Soil. The Mulberry Grove Member is intermittent at the CPP.

and is described as a calcareous gray silt and fine sand containing some fossil mollusks. The Vandalia Member is a sandy till with thin lenticular bodies of silt, sand, and gravel. It is calcareous, except where weathered, generally gray, and moderately compact. The Hagarstown Member is bounded at the top by the Sangamon Soil. The member consists of gravelly till, poorly sorted gravel, well sorted gravel, and sand.

The Quaternary deposits in the Coffeen area consist mainly of diamictons and intercalated outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits and bedrock which occur at the CPP include the following units (beginning at the ground surface):

- Upper Confining Unit Low permeability clays and silts, including the Roxana Silt and Peoria Silt (Loess Unit) and the upper clayey till portion of the Hagarstown Member.
- Uppermost Aquifer Thin (generally less than 3 feet), moderate to high permeability sand, silty sand, and sandy silt/clay units which include the Hagarstown Member (also referred to as the Hagarstown Beds) and the upper Vandalia Till Member (where weathered).
- Lower Confining Unit Thick (generally greater than 15 feet), very low permeability sandy, silt till, or clay till that includes the unweathered Vandalia Member, Mulberry Grove Member (discontinuous), and Smithboro Member.
- Bedrock Pennsylvanian-age Bond Formation characterized by limestone and calcareous clays and shales.

Coffeen Lake was built by damming the McDavid Branch of the East Fork of Shoal Creek in 1963 for use as an artificial cooling lake for the Coffeen Power Plant. The CCR units at CPP are located between the two lobes of the lake (identified as "Coffeen Lake" and "Unnamed Tributary" on Figure 1), which results in a north/south trending groundwater divide observed beneath the CCR units. Groundwater flow is to the southeast or southwest, downgradient of the divide, converging on the tributary valleys leading to Coffeen Lake on the east and west sides of the property.

Groundwater elevations were obtained from measurements in monitoring wells on January 20, 2021 prior to a combined sampling event for the five CCR units located at Coffeen Power Plant. Groundwater elevations (referenced to North American Vertical Datum of 1988 [NAVD88]) in the GMF GSP area ranged from about 617 to 622 feet (Figure 1). The groundwater elevations and flow directions for the Coffeen Power Plant during the D8 sampling event are shown in Figure 1, and generally follow the flow patterns established by the groundwater divide beneath the CCR units. The groundwater flow beneath the GMF GSP was to the southeast, toward the unnamed tributary.

2.3 Groundwater and GMF GSP Monitoring

Figure 1 shows all monitoring wells present at the CPP, including those in the groundwater monitoring systems established in accordance with 40 C.F.R. § 257.91 at Ash Pond No. 1, Ash Pond No. 2, the GMF Recycle Pond, the Landfill, and the GMF GSP, and wells not used for federal CCR monitoring. The GMF GSP is a 77-acre facility that has been in operation since 2010. The monitoring system for the GMF GSP includes background wells R201 and G200, located north of the GMF GSP, and downgradient monitoring wells are G206, G209, G212, G215, and G218 (Figure 2).

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than the GMF GSP (the CCR unit) caused the SSIs. LOEs supporting this ASD include the following:

- 1. GMF GSP Composite Liner Design.
- 2. Downgradient concentrations of boron do not exceed background limits.

These LOEs are described and supported in greater detail below.

3.1 LOE #1: GMF GSP Composite Liner Design

Construction of the GMF GSP was in accordance with Water Pollution Control Permit 2008EA4661 granted by the Illinois Environmental Protection Agency (IEPA). The GMF GSP composite liner system includes the following components:

- 60-millimeter high-density polyethylene geomembrane liner.
- Three-foot-thick layer of recompacted, low-permeability soil having a maximum hydraulic conductivity of 1 x 10^{-7} centimeters per second.

The IEPA-approved GMF GSP composite liner system exceeds the design criteria for a composite liner for new CCR landfills established by 40 C.F.R. § 257.70(b).

The composite liner design criteria were established to help prevent contaminants in CCR from leaking from the CCR unit and impacting groundwater. Therefore, the presence of the composite liner system suggests that the GMF GSP is not the source of the SSIs.

3.2 LOE #2: Downgradient Concentrations of Boron Do Not Exceed Background Limits

Boron is an indicator of CCR impacts to groundwater due to its leachability from CCR and mobility in groundwater. If the groundwater downgradient of the GMF GSP had been impacted by CCR from the unit, boron concentrations would be expected to be elevated above background Upper Prediction Limits (UPLs). The UPL is an upper bound on background concentrations calculated for comparing downgradient measurements to background. Downgradient monitoring wells with SSIs had concentrations of boron that were below the UPLs (0.39 milligrams per liter).

In downgradient monitoring wells with SSIs (G212 and G215), concentrations of boron are below the UPLs, indicating that these wells have not been affected by CCR. Therefore, the GMF GSP is not the source of the SSIs.

4. CONCLUSIONS

Based on these two LOEs, it has been demonstrated that the GMF GSP is not the source of the pH SSI in G212 or the calcium, chloride, sulfate, and TDS SSIs in G215.

- 1. GMF GSP Composite Liner Design.
- 2. Downgradient concentrations of boron do not exceed background limits.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.94(e)(2) that the SSI observed during the D8 monitoring event were not due to the GMF GSP. Therefore, an assessment monitoring program is not required and the GMF GSP will remain in detection monitoring.

5. **REFERENCES**

Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017a. *Statistical Analysis Plan. Coffeen Power Station, Newton Power Station*. Illinois Power Generating Company.

Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017b. *Hydrogeologic Monitoring Plan. Coffeen Ash Pond No. 1 – CCR Unit ID 101, Coffeen Ash Pond No. 2 – CCR Unit ID 102, Coffeen GMF Gypsum Stack Pond – CCR Unit ID 103, Coffeen GMF Recycle Pond – CCR Unit ID 104, Coffeen Landfill – CCR Unit ID 105.* Coffeen Power Station, Coffeen, Illinois. Illinois Power Generating Company.

United States Environmental Protection Agency, 2020. Disposal of Coal Combustion Residuals from Electric Utilities, 40 C.F.R. § 257 Subpart D, published April 17, 2015, updated 2020. Accessed from URL <u>https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D#page-top</u>

FIGURES



BACKGROUND WELL GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88) COMPLIANCE WELL GROUNDWATER FLOW DIRECTION CCR RULE MONITORING WELL PART 257 REGULATED UNIT NON-CCR RULE MONITORING WELL (SUBJECT UNIT) SITE FEATURE e 1 PROPERTY BOUNDARY NOTE: ELEVATIONS IN PARENTHESIS WERE NOT USED 0 300 600 FOR CONTOURING. _ Feet

GROUNDWATER ELEVATION CONTOUR MAP JANUARY 20, 2021

> RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.



FIGURE 1

ALTERNATE SOURCE DEMONSTRATION GMF GYPSUM STACK POND (UNIT ID: 103) COFFEEN POWER PLANT COFFEEN, ILLINOIS



FIGURE 2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.



SAMPLE LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION GMF GYPSUM STACK POND (UNIT ID: 103) COFFEEN POWER PLANT COFFEEN, ILLINOIS

BACKGROUND WELL

COMPLIANCE WELL

PART 257 REGULATED UNIT (SUBJECT UNIT)

SITE FEATURE

LIMITS OF FINAL COVER

PROPERTY BOUNDARY

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