

Memo

Date: Monday, February 05, 2024

Project: City of Grand Haven – Harbor Island

To: Derek Gajdos, City of Grand Haven

From: Lara Zawaideh, P.E., HDR Michigan, Inc.

Subject: Former J.B. Sims Generating Station
Determination of Statistically Significant Levels over Groundwater Protection Standards per §257.95(g) and Michigan Rule R 299.4441.

The U.S. Environmental Protection Agency's (EPA's) final Coal Combustion Residuals (CCR) Rule and Michigan Part 115 regulation establishes a comprehensive set of requirements for the management and disposal of CCR (or coal ash) in landfills and surface impoundments by electric utilities. The former J.B. Sims Generating Station (facility or Site) was a coal-fired power generation facility operated by Grand Haven Board of Light & Power (GHBLP) that ceased operations in February 2020. The Site is located at 1231 North 3rd Street, on Harbor Island, in Grand Haven, Michigan. The CCR generated at the former generating station were stored in two CCR units that are subject to the CCR Rule and Part 115 Solid Waste regulations: (1) the inactive Units 1/2 Impoundment and (2) the Unit 3A/B Impoundments. The inactive CCR Units 1/2 Impoundment was a depression in the ground where sluiced ash was disposed which ceased receiving CCR material in 2012. The former Unit 3A/B Impoundments were engineered, clay-lined, above-ground units which ceased receiving CCR material in July 2020. Excavation of CCR material from Unit 3A/B Impoundments was conducted in December 2020.

The objective of this memorandum is to document the updated groundwater protection standard (GPS) concentrations for each constituent of interest (COI) for the CCR facilities and evaluate if the concentration of detected Appendix IV constituents in groundwater from assessment monitoring were present at statistically significant levels (SSLs) over the updated Groundwater Protection Standards (GPS). In accordance with the CCR Rule, in 2017 the *Groundwater Monitoring System Certification* was developed for the 3A/B Impoundments, which consisted of one background well (MW-07), four (4) downgradient detection monitoring wells (MW-01R, MW-02, MW-03, and MW-04), and an additional assessment monitoring well (MW-09) (ERM, 2017). Groundwater monitoring conducted in 2017 by GHBLP identified statistically significant increases (SSI) of constituents in groundwater, and therefore the GHBLP implemented assessment monitoring (Golder, 2018a). Assessment monitoring identified statistically significant levels (SSLs) of constituents over groundwater protection standards (GPS) at the Site, and therefore GHBLP stated that they were initiating an assessment of corrective measures for the Site; however, this document was completed prior to the inclusion of Units 1/2 Impoundment and therefore represents only the status of the Unit 3A/B Impoundments (Golder, 2018b). On July 22, 2021, the *Updated Notice of Groundwater Protection Standard Exceedance* was issued to document SSLs over GPS for both Units 1/2 Impoundment and Unit 3A/B Impoundments.

In 2021, to better understand the groundwater flow around the entire Island and verify that the monitoring network in place at the time was adequate, 22 piezometers, six (6) staff gauges, and 3 stilling wells were installed. With this larger scale understanding of groundwater flow, the *Field Summary Report of Results from Approved Work Plan – Piezometer Installation and Additional Data Collection* suggested that MW-07 may be an inappropriate location for a background well due to the potential for groundwater to flow from the Units 1/2 Impoundment towards MW-07 (Golder, 2022). Therefore, a new groundwater monitoring network was selected for the CCR units, including new background wells. Background data collection for the revised monitoring well network began in November 2022, was completed in August 2023 and the new background threshold values for the CCR units were reported in Background Statistical Certification Report (HDR, 2024). The first detection/assessment monitoring event was completed in October 2023.

Determination of Background Values

As stipulated in CCR Rule 257.95(b), an initial assessment monitoring event was completed in October 2023 to sample all of the monitoring wells around the Units 1/2 Impoundment and Unit 3A/B Impoundments for Appendix IV constituents. **Table 1** lists the constituents in Appendices III and IV of CCR Rule Part 257.

Table 1. Federal Groundwater Monitoring Constituents – Assessment Monitoring Program	
Appendix III Constituents for Detection Monitoring	Appendix IV Constituents for Assessment Monitoring
Boron	Antimony
Calcium	Arsenic
Chloride	Barium
Fluoride	Beryllium
pH	Cadmium
Sulfate	Chromium
Total Dissolved Solids (TDS)	Cobalt
Additional Constituents	Fluoride
Total Suspended Solids (TSS)	Lead
	Lithium
	Mercury
	Molybdenum
	Selenium
	Thallium
	Radium-226/228

The assessment monitoring constituents are defined under Michigan Part 115 sections 324.11511a(3) and 11519b(2). The State rule sampling constituents are listed in **Table 2**. During the October 2023 initial detection/assessment monitoring sample event, samples were

analyzed for the constituents listed in **Table 2**. Table 2. State Assessment Monitoring Program Groundwater Monitoring Constituents

Table 2. State Assessment Monitoring Program Groundwater Constituents	
Constituents for Assessment Monitoring	
Antimony	Mercury
Arsenic	Molybdenum
Barium	Nickel
Beryllium	Radium-226
Boron	Radium-226/228
Cadmium	Radium-228
Calcium	Selenium
Chloride	Silver
Chromium	Sulfate
Cobalt	Thallium
Copper	Total Dissolved Solids (TDS)
Fluoride	Vanadium
Iron	Zinc
Lead	Additional Parameters
Lithium	Total Suspended Solids (TSS)

Background values were calculated for constituents listed for the Federal CCR Rule in **Table 1** and Michigan Part 115 Regulation in **Table 2**. Under the assessment monitoring program regulations for both the CCR Rule and Michigan Part 115, the upper tolerance limit (UTL) is used as the background value for each constituent. EPA’s Unified Guidance has recommended that the UTL be used as a fixed value similar to a groundwater protection standard where an MCL does not exist for a constituent at a location (USEPA, 2009). The UTLs for Appendix IV constituents are displayed in **Table 3**. The UTL was established based on the eight background sample events at the upgradient monitoring wells (MW-27, MW-33, and MW-34). The UTLs serve as the background values for development of the groundwater protection standards (GPS). The UTL values are not dependent on the number of downgradient wells being compared to the background or the number of parameters tested (like for the UPL); therefore the same UTL values are appropriate for both Units 1/2 and Unit 3A/B and the values are contained in **Table 3** (HDR, 2024).

Table 3. Upper Tolerance Limits with 95% Coverage and 95% Confidence						
Constituent	Unit	n	No. BDL	% BDL	Recommended distribution	State and Federal Program UTL
Appendix III						
Boron ¹	mg/L	24	0	0%	Nonparametric	4.0
Calcium ¹	mg/L	24	0	0%	Normal	250

Table 3. Upper Tolerance Limits with 95% Coverage and 95% Confidence

Constituent	Unit	n	No. BDL	% BDL	Recommended distribution	State and Federal Program UTL
Chloride ¹	mg/L	24	0	0%	Nonparametric	120
Fluoride ¹	mg/L	24	0	0%	Normal	0.45
pH (field) ¹	su	24	0	0%	Normal	7.4
Sulfate ¹	mg/L	24	4	17%	Nonparametric	100
Total Dissolved Solids ¹	mg/L	24	0	0%	Nonparametric	950
Appendix IV						
Antimony	mg/L	24	3	13%	Nonparametric	0.0012
Arsenic	mg/L	24	0	0%	Nonparametric	0.0040
Barium	mg/L	24	0	0%	Nonparametric	0.58
Beryllium	mg/L	24	23	96%	Nonparametric	0.0000059
Cadmium	mg/L	24	19	79%	Nonparametric	0.00015
Chromium	mg/L	24	1	4%	Normal	0.042
Cobalt	mg/L	24	1	4%	Normal	0.0021
Fluoride	mg/L	24	0	0%	Normal	0.45
Lead	mg/L	23	14	61%	Nonparametric	0.0016
Lithium	mg/L	24	0	4%	Nonparametric	0.10
Mercury	mg/L	24	24	100%	Nonparametric	0.00016*
Molybdenum	mg/L	24	10	42%	Gamma	0.0093
Radium-226/228	pCi/L	24	6	25%	Normal	2.6
Selenium	mg/L	24	6	25%	Nonparametric	0.00089
Thallium	mg/L	22	22	100%	Nonparametric	0.000075*
Additional Part 115						
Copper ¹	mg/L	24	4	17%	Nonparametric	0.020
Iron ¹	mg/L	24	0	0%	Nonparametric	83
Nickel ¹	mg/L	24	2	8%	Nonparametric	0.023
Silver ¹	mg/L	24	23	96%	Nonparametric	0.00011
Vanadium ¹	mg/L	24	18	75%	Nonparametric	0.0093
Zinc ¹	mg/L	24	6	25%	Lognormal	0.038

¹Constituent not included in Federal CCR Rule Assessment Monitoring program.

Determination of GPS

Results from the initial assessment monitoring sample event identified the detected Appendix IV constituents. All Appendix IV constituents were detected in at least one well. In accordance with CCR Rule 257.95(h), GPS were established for each detected Appendix IV COI. For each detected COI, **Table 4** lists the EPA established MCL from 40 CFR 141.62 and 141.66, the assessment monitoring background values for the Units 1/2 Impoundment and Unit 3A/B

Impoundments, and the GPS. The GPS for each COI is the higher of the two: MCL or background value. These concentrations are listed in the MCL column of **Table 4**.

Table 4. Background Values and Federal Program Groundwater Protection Standards for CCR Rule Compliance			
Parameter	Site-Specific Background Level	Federal Maximum Contaminant Level (mg/L)	Federal Program Groundwater Protection Standards (mg/L)
	Upper Tolerance Limit (UTL) (mg/L)		
Antimony	0.0012	0.0060	0.0060
Arsenic	0.0040	0.010	0.010
Barium	0.58	2.0	2.0
Beryllium	0.000059	0.0040	0.0040
Cadmium	0.00015	0.0050	0.0050
Chromium	0.042	0.10	0.10
Cobalt	0.0021	0.0060*	0.0060
Fluoride	0.45	4.0	4.0
Lead	0.0016	0.015*	0.015
Lithium	0.10	0.040*	0.10
Mercury	0.00016	0.0020	0.0020
Molybdenum	0.0093	0.10*	0.10
Radium-226/228	2.6	5.0	5.0
Selenium	0.00089	0.050	0.050
Thallium	0.000075	0.0020	0.0020

*EPA adopted health-based value for constituents with no MCL.

As required in Michigan Rule R 299.4441(9), the CCR owner must establish GPS for each constituent detected in the groundwater. The GPS for the State Part 115 compliance program shall be defined as the lowest of the following:

- U.S. EPA Maximum Contaminant Level (MCL) for constituents for which an MCL has been established;
- The applicable cleanup criteria for that constituent for groundwater as established pursuant to section 20120a of the act; or
- For constituents for which the background level (UTL) is higher than the MCL or applicable cleanup criteria for groundwater, the background concentration will be the GPS.

Table 5 provides the background level, the MCL, applicable cleanup criteria, and the GPS values for the Site.

Table 5. Background Values and State Groundwater Protection Standards for Michigan Part 115 Compliance

Parameter	Site-Specific Background Level	Federal Maximum Contaminant Level (mg/L)	State Non-Residential Drinking Water Cleanup Criteria for Groundwater (mg/L)*	State Groundwater Surface Water Interface (mg/L)*	State Program Groundwater Protection Standards (mg/L)
	Upper Tolerance Limit (UTL) (mg/L)				
Boron	4.0	NV	0.50	7.20	4.0
Calcium	250	NV	N/A	N/A	250
Chloride	120	NV	250	50	120
Fluoride	0.45	4.00	2.0	NV	2.0
Sulfate	100	NV	250	NV	250
Total Dissolved Solids	950	500	NV	NV	950
Antimony	0.0012	0.0060	0.0060	0.13	0.0060
Arsenic	0.0040	0.010	0.010	0.010	0.010
Barium	0.58	2.0	2.0	1.3 ¹	1.3 ¹
Beryllium	0.000059	0.0040	NV	0.036 ¹	0.0040
Cadmium	0.00015	0.0050	0.0050	0.0025 ¹	0.0025 ¹
Chromium	0.042	0.10	0.10	0.12 ¹	0.10
Cobalt	0.0021	0.0060 ²	0.10	0.10	0.0060
Fluoride	0.45	4.0	2.0	NV	2.0
Lead	0.0016	0.015 ²	0.0040	0.014 ¹	0.0016
Lithium	0.10	0.040 ²	0.35	0.44	0.10
Mercury	0.00016	0.0020	0.0020	0.0013	0.0013
Molybdenum	0.0093	0.10 ²	0.21	3.2	0.10
Radium 226/228	2.6	5.0	NV	NV	5.0
Selenium	0.00089	0.050	0.050	0.0050	0.0050
Thallium	0.000075	0.0020	0.0020	0.0037	0.0020
Copper	0.020	1.3	1.0	0.021 ¹	0.021 ¹
Iron	83	0.30	0.30	NV	83
Nickel	0.023	NV	0.10	0.12 ¹	0.10
Silver	0.00011	0.10	0.0098	0.00020	0.00020
Vanadium	0.00093	NV	0.0062	0.027	0.0062
Zinc	0.038	5.0	5.0	0.27 ¹	0.27 ¹

*Cleanup Criteria Requirements for Response Activity (Formerly the Part 201 Generic Cleanup Criteria and Screening Levels) found in R 299.44 Generic groundwater cleanup criteria.

NV=no value

¹Per Footnote G of Table 1 Cleanup Criteria Requirements for Response Activity (Formerly the Part 201 Generic Cleanup Criteria and Screening Levels) of the Groundwater Surface Water (GSI) criteria list, values noted are calculated based on the hardness (expressed as CaCO₃) of the receiving waters. Surface water sample from the Grand River (SG-01) had a hardness of 270 mg/L was used in the calculation of specific GSI values. The Grand River discharges into Lake Michigan, thus the GSI Criteria for Surface Water Protected for Drinking Water Use, is provided above.

²EPA adopted health-based value for constituents with no MCL.

Determination of SSLs

In October 2023, the initial assessment monitoring sample event was conducted for both CCR unit networks. Samples were analyzed for detected Appendix IV COIs. In accordance with CCR Rule 257.95(e), downgradient well concentrations were compared against background values, and some concentrations were found to be above background values. In accordance with CCR Rule 257.95(f), detected Appendix IV COI concentrations in downgradient wells were compared against GPS and some were found to exceed GPS. Therefore, following CCR Rule 257.95(g), downgradient well concentrations were statistically evaluated to determine “if one or more constituents in Appendix IV to this part are detected at statistically significant levels (SSLs) above the groundwater protection standard.”

To determine if an exceedance of a GPS was statistically significant, the 95% lower confidence limit (95LCL) was calculated for each of the downgradient wells for both CCR units for each of the detected Appendix IV COIs. The data set used to calculate the lower confidence limit (LCL) included all Appendix IV results from samples collected at these wells since the establishment of the groundwater monitoring system. Therefore, most wells had 9 sample events that were used to calculate the LCL, eight background sample events from November 2022 through August 2023, and the one assessment monitoring event in October 2023. The LCL results that exceeded Federal CCR Rule GPS for the Units 1/2 Impoundment are provided in **Table 6**. The LCL results that exceeded Federal CCR Rule GPS for the Unit 3A/B Impoundments are provided in **Table 7**.

Table 6. October 2023 LCLs for Constituents that Exceed Federal GPS for Units 1/2 Impoundment				
Monitoring Well	Appendix IV COI	Arsenic	Fluoride	Lithium
	Unit	mg/L	mg/L	mg/L
	Federal GPS	0.010	4.0	0.10
MW-06	95% LCL	--	--	0.18
MW-08	95% LCL	0.022	--	--
MW-10	95% LCL	--	4.7	0.81
MW-18	95% LCL	0.020	--	--
MW-30	95% LCL	--	--	0.11
MW-31	95% LCL	--	4.7	--
MW-32	95% LCL	--	--	0.11

Table 7. October 2023 LCLs for Constituents that Exceed Federal GPS for Unit 3A/B Impoundments			
Monitoring Well	Appendix IV COI	Fluoride	Lithium
	Unit	mg/L	mg/L
	Federal GPS	4.0	0.10
MW-01R	95% LCL	8.8	2.0
MW-02	95% LCL	8.7	1.2
MW-09	95% LCL	--	0.29
MW-10	95% LCL	4.7	0.81

In accordance with Michigan Rule R 299.4441, downgradient well concentrations were statistically evaluated to determine if one or more constituents are detected at SSLs above the GPS. To determine if an exceedance of a GPS value was statistically significant, the 95% lower confidence limit (95LCL) was calculated for each of the downgradient wells. The wells in which one or more COI exceeded State GPS at SSLs for the Unit 1/2 Impoundments are provided in **Table 8**. The wells in which one or more COI exceeded State GPS at SSLs for the Unit 3A/B Impoundments are provided in **Table 9**.

Table 8. October 2023 LCLs for Constituents that Exceed State GPS for Unit 1/2 Impoundments

Monitoring Well	Assessment Monitoring COI	Arsenic	Boron	Calcium	Chloride	Fluoride	Lead	Lithium	Sulfate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	State GPS	0.010	4.0	250	120	4.0	0.0016	0.10	250	950
MW-06	95% LCL	--	8.9	--	--	--	--	0.18	--	1200
MW-07	95% LCL	--	11	--	--	--	--	--	--	--
MW-08	95% LCL	0.022	4.9	--	--	--	--	--	--	--
MW-10	95% LCL	--	12	--	150	4.7	--	0.81	310	1700
MW-18	95% LCL	0.020	--	290	--	3.6	--	--	650	1300
MW-19	95% LCL	--	--	450	--	--	--	--	890	1800
MW-20	95% LCL	--	--	--	--	--	0.0018	--	--	--
MW-30	95% LCL	--	--	400	--	--	--	0.11	790	2100
MW-31	95% LCL	--	4.1	--	--	4.7	--	--	--	--
MW-32	95% LCL	--	--	--	--	--	--	0.11	--	--

Table 9. October 2023 LCLs for Constituents that Exceed State GPS for Units the 3A/B Impoundment

Monitoring Well	Assessment Monitoring COI	Arsenic	Boron	Calcium	Chloride	Fluoride	Lead	Lithium	Sulfate	TDS
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	State GPS	0.010	4.0	250	120	4.0	0.0016	0.10	250	950
MW-01R	95% LCL	--	89	--	--	8.8	--	2.0	--	2300
MW-02	95% LCL	--	88	--	130	8.7	0.0019	1.2	--	1700
MW-03	95% LCL	--	--	350	160	--	--	--	320	2200
MW-04	95% LCL	--	--	340	180	--	--	--	410	1800
MW-09	95% LCL	--	5.5	300	--	2.4	--	0.29	--	1100
MW-10	95% LCL	--	12	--	150	4.7	--	0.81	310	1700

References

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