



**2018 Annual Groundwater Monitoring
Report**

DE Karn Power Plant
Lined Impoundment CCR Unit
Essexville, Michigan

January 2019



2018 Annual Groundwater Monitoring Report

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January 2019

*Prepared For
Consumers Energy Company*

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TRC | Consumers Energy Company

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) new lined impoundment at the DE Karn (DEK) Power Plant Site (the Site). Pursuant to the CCR Rule, no later than January 31 of the year following the calendar year a groundwater monitoring system has been established, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the Karn Lined Impoundment (KLI) CCR unit for the 2018 calendar year.

This 2018 Annual Report presents the monitoring results for the background data collection and detection monitoring (Appendix III and IV to Part 257 of the CCR Rule) completed in April through August 2018 for the KLI CCR unit. The initial detection monitoring event performed to comply with §257.94 was completed in November 2018 and the data will be evaluated to identify statistically significant increases (SSIs) of Appendix III constituents over background levels. The statistical comparison of downgradient data to background concentrations levels is underway and will be completed no later than March 13, 2019, within 90 days of completing the sampling and analysis for the initial detection monitoring event.

According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program **<or>** demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

If potential SSIs over background limits are noted during the November 2018 detection monitoring event, CEC plans to prepare an Alternative Source Demonstration (ASD) to evaluate whether a source other than the CCR unit caused the SSIs prior to initiating assessment monitoring.

Section 1

Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) new lined impoundment at the former DE Karn (DEK) Power Plant Site (the Site). Pursuant to the CCR Rule, no later than January 31 of the year following the calendar year a groundwater monitoring system has been established, and annually thereafter, the owner or operator of a new CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the Karn Lined Impoundment (KLI) CCR unit.

This 2018 Annual Report presents the monitoring results for the background data collection (Appendix III and IV to Part 257 of the CCR Rule) completed in April through August 2018 for the KLI CCR unit. The initial detection monitoring event performed to comply with §257.94 was completed in November 2018 and the data will be evaluated to identify statistically significant increases (SSIs) of Appendix III constituents over background levels. The statistical comparison of downgradient data to background concentrations levels is underway and will be completed no later than March 13, 2019, within 90 days of completing the sampling and analysis for the initial detection monitoring event. The monitoring was performed in accordance with the *Sample Analysis Plan (SAP)* (TRC, June 2018) and will be statistically evaluated per the *Groundwater Statistical Evaluation Plan (Stats Plan)* (TRC, June 2018).

1.2 Site Overview

The DE Karn (DEK) Power Plant site (the Site) is located north of the JC Weadock (JCW) Power Plant site (JCW Site), east of the Saginaw River, south and west of Saginaw Bay (Figure 1). A discharge channel runs along the majority of the southern perimeter of the site and separates the facility from the JCW Site to the south. The plant began generating electricity in 1959. Two power generating units (Units 1 & 2) are coal-fueled and two units (Units 3 & 4) are oil- and natural gas-fueled.

The locations of the Karn Lined Impoundment CCR Unit and the DEK Bottom Ash Pond Unit are shown on Figure 2. Previously, the DEK Bottom Ash Pond was used for wet ash

dewatering and was the primary settling/detention structure for the NPDES treatment system prior to discharge. CEC provided notification of initiation of closure on October 12, 2018 to implement the certified closure plan by removal of CCR under the self-implementing requirements and schedule of the CCR Rule. In preparation for removal of the Bottom Ash Pond, a new lined impoundment CCR unit (Karn Lined Impoundment CCR unit) has been constructed. The liner system for the new impoundment was designed as a double composite liner system, with the primary and secondary composite liners each consisting of 60-mil High Density Polyethylene (HDPE) geomembrane (GM) overlaying a 236-mil geosynthetic clay liner (GCL)¹. The wet ash dewatering was relocated to the new impoundment (KLI CCR unit), which began receipt of CCR in June 2018.

The DEK Bottom Ash Pond and KLI are located adjacent to the DEK Solid Waste Disposal Area. The Solid Waste Disposal Area received sluiced fly ash until the conversion to Dry Fly Ash handling was completed in December 2008. While the fly ash sluicing was in operation, the Solid Waste Disposal Area received slurried ash that traveled through a series of ponds to an eventual NPDES outfall on Saginaw Bay. The ponds were routinely dredged, and the ash was placed within the DEK Landfill. Consumers Energy received Solid Waste Construction Permit No. 0195 on December 12, 1986 for constructing a Type III Landfill based on the vertical expansion over the historically sluiced fly ash through dredge and stack operations and moisture conditioned dry fly ash.

Closure activities at the DEK Landfill commenced prior to the Effective Date of the CCR Rule (October 17, 2015); therefore, the landfill is subject only to permitting under state authorities. The DEK Landfill is being monitored in accordance with the Michigan Department of Environmental Quality (MDEQ)-approved HMP. The DEK Solid Waste Disposal Area is currently authorized under a permit (Groundwater Discharge Authorization GWE-0005) issued pursuant to Part 31² to discharge to the unusable aquifer directly underlying the solid waste that vents almost immediately to the Saginaw River and Saginaw Bay. Interim monitoring and compliance monitoring pursuant to Part 31 and Part 115³ detailed in the revised HMP was approved by the MDEQ on January 8, 2018.

¹ Golder Associates Inc. 2018. *Bottom Ash Lined Impoundment Liner System Design Certification Report, DE Karn Generating Facility, Essexville, Michigan*. April.

² Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994.

³ Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994.

1.3 Geology/Hydrogeology

The majority of the KLI area is comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1938, in addition to field descriptions of subsurface soil at the site, indicate that the site was largely developed by reclaiming low-lands through construction of perimeter dikes and subsequent ash filling.

The surficial fill consists of a mixture of varying percentages of ash, sand, and clay-rich fill ranging from 5 to 15 feet thick. Below the surficial fill, native alluvium and lacustrine soils are present at varying depths. Generally, there is a well graded sand unit present to depths of 10-30 feet below ground surface (ft bgs) overlying a clay till which is observed at depths ranging from 25 to 75 ft bgs. A sandstone unit, which is part of the Saginaw formation, was generally encountered at 80-90 ft bgs.

The site is bound by several surface water features (Figure 1): the Saginaw River to the west, Saginaw Bay (Lake Huron) to the north and east, and a discharge channel to the south. In general, shallow groundwater is encountered at a similar or slightly higher elevation relative to the surrounding surface water features. Groundwater flow in the upper aquifer is largely controlled by the surface water elevations of Saginaw River and Saginaw Bay. In the vicinity of the existing DEK Bottom Ash Pond and new KLI, the shallow groundwater flow is generally radial, flowing outward from the pond area toward the surrounding surface water bodies.

As Bottom Ash Pond closure activities commence, and dewatering begins, the local groundwater flow regime will be temporarily altered. Once the bottom ash removal activities are complete and groundwater elevations re-equilibrate, groundwater flow in the impoundment area will be driven by Saginaw Bay to the north and by the Saginaw River to the west in the absence of the hydraulic head from the former Bottom Ash Pond.

Section 2

Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with §257.91, CEC has developed a groundwater monitoring system for the new KLI CCR unit. Because of the site hydrogeology and presence of affected groundwater due to the history of CCR-related operations throughout the DE Karn Site, an intra-well statistical approach is recommended for detection monitoring. However, there is currently insufficient data from wells in the KLI monitoring well system to support intra-well statistical methods, and based on hydrogeologic conditions, the frequency of sampling to collect data to support the intra-well methods will take several years. Establishing background in a six-month time, per the CCR rule, does not allow for collection of sufficient statistically independent samples. Therefore, for an interim period, CEC will perform inter-well statistics using DEK-MW-15003 as the upgradient/background well until sufficient data are collected from the wells to support intra-well statistical procedures. The groundwater monitoring system for the KLI unit consists of:

Background:

DEK-MW-15003

Downgradient:

OW-12

DEK-MW-18001

OW-10

Supplemental Data Analysis⁴:

OW-11

The monitoring well locations are shown on Figure 2. Soil boring logs and well construction diagrams are included in the SAP.

2.2 Background Sampling

The initial background/baseline sampling period for new units is at least eight independent events collected over a six-month period for new CCR units per §257.94(b). This provides a minimal background data set to initiate statistical comparisons. Over time, the short baseline period may result in a high risk of false positive statistical results. However, more than eight independent groundwater samples were collected from DEK-MW-15003 as part of previous CCR unit sampling related to the existing bottom ash pond in 2016/2017; therefore, the

⁴ OW-11 will be sampled to be potentially utilized in a future intra-well statistical evaluation program.

background data for the KLI CCR unit has already been collected in accordance with the *DE Karn Monitoring Program Sample Analysis Plan (SAP)* (ARCADIS, May 2016).

The KLI CCR unit monitoring well network will be initially sampled for Appendix III and Appendix IV constituents on a quarterly basis for two years to evaluate the potential for an intra-well statistical program for detection monitoring. Once sufficient sample data are collected from the five (5) KLI groundwater monitoring system wells for intra-well analysis, CEC will evaluate these data and determine alternative strategies for statistical evaluation of groundwater data.

2.2.1 Data Summary

Background data collected from DEK-MW-15003 prior to the 2018 calendar year is discussed in the January 31, 2018 *Annual Groundwater Monitoring Report for the DE Karn Power Plant Bottom Ash Pond CCR Unit* (TRC, 2018). A preliminary Appendix IV only assessment monitoring event for the DEK Bottom Ash Pond (per §257.95(b)) was performed on April 12, 2018. DEK-MW-15003 was subsequently sampled on May 23, 2018, within 90 days of the preliminary assessment monitoring event (per §257.95(d)), for the constituents from Appendix III and IV of the CCR Rule.

The entire groundwater monitoring well network for the KLI Unit was sampled in August 2018, after the KLI Unit went in to service in June 2018. Static water elevation measurements were collected at the site and are summarized in Table 1 and groundwater elevation data are shown on Figure 3. Monitoring wells were purged with peristaltic pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) for Appendix III and IV constituents during the KLI background monitoring events, in accordance with the SAP. The analytical results from each event are summarized in Table 3.

2.2.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. The data quality reviews are summarized in Appendix A.

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the most recent background sampling events were similar to data collected during the initial rounds of sampling that commenced in October 2015. Groundwater elevations at the site are generally within the range of 580 to 588 feet above mean sea level (ft AMSL) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the August 2018 sampling event are provided on Table 1 and were used to construct a groundwater contour map (Figure 3).

The map indicates that current groundwater flow continues to radiate outward from the BAP area toward the surface water. The geometric mean hydraulic gradient throughout the KLI CCR unit area during this event is estimated at 0.0066 ft/ft. The gradient was calculated using the well pair DEK-MW-15004/DEK-MW-15005, as well as the well water elevation difference and distance between DEK-MW-15001 and the discharge channel (Figure 3). Using the mean hydraulic conductivity of 15 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity is approximately 0.33 ft/day or 120 ft/year for this event.

The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III constituents that could potentially migrate from the KLI CCR unit.

2.3 Detection Monitoring

The initial groundwater detection monitoring event for the KLI Unit was performed on November 6 and 7, 2018, by TRC personnel and samples were analyzed by Pace for Appendix III constituents in accordance with the SAP. The data evaluation is currently in progress.

Section 3

Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits will be established for the Appendix III constituents following the November 2018 sampling event using data collected from DEK-MW-15003. The Appendix III background limits will be used throughout the detection monitoring period to determine whether groundwater has been impacted from the KLI CCR unit by statistically comparing concentrations in the downgradient wells to the background limits for each Appendix III constituent.

3.2 Data Comparison to Background Limits

The concentrations of Appendix III constituents in the downgradient wells will be compared to the statistical background limits calculated from the background data collected from DEK-MW-15003. The data comparison will be completed within 90 days of the initial detection monitoring event sampling and analysis (March 13, 2019) in accordance with §257.93(h)(2). Consumers Energy will enter this information into the operating record as soon as it is available and include it in the 2019 Annual Groundwater Monitoring and Corrective Action Report.

Section 4

Conclusions and Recommendations

Within 90 days of the completing the sampling and analysis for the initial detection monitoring event, the concentrations of Appendix III constituents will be compared to the background levels (March 13, 2019). According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program ~~or~~ demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

The owner or operator must complete a written demonstration (i.e., Alternative Source Demonstration, ASD), of the above within 90 days of confirming the SSI. Based on the outcome of the ASD the following steps will be taken:

- If a successful ASD is completed, a certification from a qualified professional engineer is required, and the CCR unit may continue with detection monitoring.
- If a successful ASD is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under §257.95. The facility must also include the ASD in the annual groundwater monitoring and corrective action report required by §257.90(e), in addition to the certification by a qualified professional engineer.

During the 90-day period after triggering assessment monitoring, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for Appendix IV constituents pursuant to §257.95(b). Within 90 days of obtaining the results from the first assessment monitoring event, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for all Appendix III constituents and the Appendix IV constituents detected during the initial assessment monitoring event.

If potential SSIs over background limits noted during November 2018, CEC plans to prepare an ASD to evaluate whether a source other than the KLI CCR unit caused the SSIs prior to initiating assessment monitoring. Based on the results from the ASD, CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 5

References

- ARCADIS. May 18, 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program. DE Karn Monitoring Program Sample Analysis Plan, Essexville, Michigan. Prepared for Consumers Energy Company.
- Consumers Energy Company. December 19, 2017. Hydrogeological Monitoring Plan Rev. 3: DE Karn Solid Waste Disposal Area.
- TRC. January 2018. Annual Groundwater Monitoring Report for the DE Karn Power Plant Bottom Ash Pond CCR Unit, Essexville, Michigan. Prepared for Consumers Energy Company.
- TRC. June 2018. Groundwater Statistical Evaluation Plan – DE Karn Power Plant Lined Impoundment, Essexville, Michigan. Prepared for Consumers Energy Company.
- TRC. June 2018. Sample Analysis Plan – Electric Generation Facilities RCRA CCR Detection Monitoring Program. DE Karn Power Plant Lined Impoundment, Essexville, Michigan. Prepared for Consumers Energy Company.
- TRC. June 2018. Groundwater Monitoring System Summary Report – Consumers Energy, DE Karn Lined Impoundment (KLI). Prepared for Consumers Energy Company.
- USEPA. April 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 80 Federal Register 74 (April 17, 2015), pp. 21301-21501 (80 FR 21301).
- USEPA. July 2018. 40 CFR Part 257. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One); Final Rule. 83 Federal Register 146 (July 30, 2018), pp. 36435-36456 (83 FR 36435).

Tables

Table 1
 Summary of Groundwater Elevation Data
 Karn Lined Impoundment – RCRA CCR Monitoring Program
 Essexville, Michigan

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)	August 13, 2018		
				Depth to Water (ft BTOC)	Groundwater Elevation (ft)	
DEK Bottom Ash Pond & Karn Lined Impoundment						
DEK-MW-18001	593.47	Sand	579.2 to 574.2	7.78	585.69	
DEK-MW-15002	590.87	Sand	578.3 to 575.3	5.72	585.15	
DEK-MW-15003	602.80	Sand	578.8 to 574.8	14.54	588.26	
DEK-MW-15004	611.05	Sand	576.6 to 571.6	24.87	586.18	
DEK-MW-15005	589.72	Sand	572.3 to 567.3	8.68	581.04	
DEK-MW-15006	589.24	Sand	573.0 to 568.0	8.20	581.04	
OW-10	591.58	Silty Sand and Silty Clay	576.0 to 571.0	5.90	585.68	
OW-11	607.90	Silt/Fly Ash	587.5 to 582.5	19.71	588.19	
OW-12	603.07	Silty Sand	584.2 to 579.2	15.90	587.17	

Notes:

Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18).
 Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

Table 2
 Summary of Field Parameter Results – April through August 2018
 Karn Lined Impoundment – RCRA CCR Monitoring Program
 Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
DEK-MW-15003	4/12/2018	1.19	-126.6	7.8	678	13.63	1.31
	5/23/2018	0.33	-123.8	8.2	666	17.25	2.02
	8/16/2018	0.33	-126.2	7.9	650	17.47	1.57
Downgradient							
DEK-MW-18001 ⁽¹⁾	5/23/2018	0.31	-68.0	7.8	740	14.73	2.71
	8/17/2018	0.46	-38.3	7.5	628	15.33	5.49
OW-10	8/16/2018	0.25	-73.5	7.4	830	13.28	8.08
OW-12	8/16/2018	0.35	-9.7	7.5	570	17.76	0.82
Supplemental							
OW-11	8/16/2018	0.39	-40.7	8.4	982	14.82	6.38

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius

NTU - Nephelometric Turbidity Unit.

(1) - DEK-MW-18001 was installed on May 21, 2018.

Table 3
 Summary of Groundwater Sampling Results (Analytical) – April through August 2018
 Karn Lined Impoundment – RCRA CCR Monitoring Program
 Essexville, Michigan

		Sample Location:				DEK-MW-15003			DEK-MW-18001		OW-10	OW-11		OW-12	
		Sample Date:				4/12/2018	5/23/2018	8/16/2018	5/23/2018	8/17/2018	8/16/2018	8/16/2018	8/16/2018	8/16/2018	
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI [^]	background			downgradient		downgradient	supplemental		downgradient	
Appendix III															
Boron	ug/L	NC	500	500	7,200	--	1,010	913	1,600	1,080	1,340	Field Dup	2,470	2,370	748
Calcium	mg/L	NC	NC	NC	500	--	58.1	59.1	64.9	47.7	82.6	96.3	84.5	39.5	
Chloride	mg/L	250**	250	250	50	--	57.2	59.4	69.1	78.3	79.0	100	102	59.6	
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	1,200	1,100	< 1,000	
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.8	8.2	7.9	7.8	7.5	7.4	8.4	8.4	7.5	
Sulfate	mg/L	250**	250	250	500	--	39.1	38.0	30.6	< 2.0	10.3	194	177	91.8	
Total Dissolved Solids	mg/L	500**	500	500	500	--	354	374	434	356	464	650	608	372	
Appendix IV															
Antimony	ug/L	6	6	6	2.0	< 1.0	< 1.0	< 2.0	< 1.0	< 2.0	< 2.0	< 2.0	2.3	< 2.0	
Arsenic	ug/L	10	10	10	10	478	450	456	225	146	10.6	502	446	25.3	
Barium	ug/L	2,000	2,000	2,000	1,200	61.2	73.3	66.8	101	82.4	113	293	252	49.7	
Beryllium	ug/L	4	4	4	25	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Cadmium	ug/L	5	5	5	2.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0	
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	1,000	< 1,000	1,200	1,100	< 1,000	
Lead	ug/L	NC	4	4	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Lithium	ug/L	NC	170	350	440	39	33	35	23	28	35	52	48	27	
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	
Molybdenum	ug/L	NC	73	210	120	< 5.0	5.3	< 5.0	< 5.0	< 5.0	< 5.0	521	562	20.6	
Radium-226	pCi/L	NC	NC	NC	NC	0.686	< 0.842	1.20	0.906	< 0.938	< 1.01	< 0.925	< 0.741	< 1.08	
Radium-228	pCi/L	NC	NC	NC	NC	< 0.755	1.12	< 0.837	< 0.733	< 0.717	< 0.774	< 0.771	< 0.779	< 0.874	
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.33	1.63	< 1.76	1.63	< 1.66	< 1.78	< 1.70	< 1.52	< 1.95	
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 2.0	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	
Thallium	ug/L	2	2	2	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

[^] - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO₃/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}.

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Figures



LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)

- ### NOTES
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000 Feet

1" = 1,000'
1:12,000

PROJECT:	
CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:	
SITE PLAN	
DRAWN BY: S. MAJOR	PROJ NO.: 290805-001
CHECKED BY: D. LITZ	FIGURE 2
APPROVED BY: G. CROCKFORD	
DATE: JANUARY 2019	
1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.: 290805-001-018.mxd	



LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- SLURRY WALL (APPROXIMATE)
- (580.85)** GROUNDWATER ELEVATION (FEET, MSL)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)

- ### NOTES
1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
 2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
 3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
 4. MONITORING WELL DEK- MW-18001 WAS INSTALLED IN MAY 2018. SURVEY DATA NOT YET AVAILABLE.

0 1,000 2,000 Feet

1" = 1,000'
1:12,000

PROJECT:		CONSUMERS ENERGY COMPANY DE KARN AND JC WEADOCK POWER PLANTS ESSEXVILLE, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP AUGUST 2018	
DRAWN BY:	S. MAJOR	PROJ NO.:	290805-001
CHECKED BY:	D. LITZ	FIGURE 3	
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2019		
		1540 Eisenhower Place Ann Arbor, MI 48108-3284 Phone: 734.971.7080 www.trcsolutions.com	
FILE NO.:	290805-001-016.mxd		

Appendix A

Data Quality Review

Laboratory Data Quality Review

Groundwater Monitoring Event August 2018

CEC DE Karn Lined Impoundment

Groundwater samples were collected by TRC for the August 2018 sampling event. Samples were analyzed for anions, alkalinity, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4616507 and 4616508.

During the August 2018 sampling event, a groundwater sample was collected from each of the following wells:

- DEK-MW-15003
- DEK-MW-18001
- OW-10
- OW-11
- OW-12
- KLI-SCS

Each sample, with the exception of sample KLI-SCS, was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
Total Dissolved Solids (TDS)	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

Sample KLI-SCS was analyzed for all constituents listed above except radium.

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;

- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the method blank samples.
- One equipment blank (EB-1) and one field blank (FB-1) were collected.
 - TDS was detected in EB-01 at 102 mg/L and in FB-01 at 90 mg/L. The presence of TDS in the equipment and field blanks has no effect on the sample results.

- Radium-226 was detected in EB-01 at 0.425 ± 0.391 pCi/L. The positive result for radium-226 in one sample associated with this equipment blank was potentially impacted, as summarized in the attached table.
- The LCS recoveries for all analytes were within QC limits.
- MS/MSD analyses were performed on sample OW-12 for select metals. All recoveries and relative percent differences (RPDs) were within the QC limits.
- MS and/or MSD analyses were performed on sample DEK-MW-15003 for anions, mercury, alkalinity, radium, and metals.
 - The arsenic and boron concentrations in sample DEK-MW-15003 were >4x the spike concentration; therefore, the MS/MSD results for boron and arsenic were not evaluated. Data usability was not affected.
- The field duplicate pair samples were Dup-01 and OW-11; RPDs between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were performed on sample DEK-MW-15003 for chloride, sulfate, fluoride, TDS, and alkalinity; RPDs were within QC limits.

Attachment A

Summary of Data Non-Conformances for Lined Impoundment Analytical Data
CEC DE Karn Lined Impoundment – CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
DEK-MW-15003_20180816	8/16/2018	Radium-226	Detection in equipment blank (EB-01). Normalized absolute difference between blank and sample result <1.96. Result may be a false positive.