Groundwater Monitoring System Certification

Neal South CCR Monofill
Permit No. 97-SDP-13-98P
Salix, Iowa

MidAmerican Energy Company

GHD | 11228 Aurora Avenue Des Moines Iowa 50322-7905

11114654 | Report No 6 | October 17 2017

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1. Introduction

MidAmerican Energy Company (MidAmerican) has installed a groundwater monitoring system at the Neal South coal combustion residue (CCR) monofill (Neal South CCR Monofill) in accordance with 40 CFR Part 257. GHD has prepared this memorandum to certify the groundwater monitoring system meets the requirements specified in 40 CFR §257.91 Groundwater Monitoring Systems.

2. Groundwater Monitoring System

The groundwater monitoring system at the Neal South CCR Monofill consists of 14 monitoring wells. Groundwater elevation data are collected from the 14 wells and groundwater samples are collected from 9 of the 14 monitoring wells. The 9 sampled monitoring wells are screened at the water table (approximately 22 to 34 feet below ground surface [bgs]) and the remaining 5 monitoring wells are screened in a deeper portion (approximately 46 to 56 feet bgs) of the alluvial aquifer. Horizontal spacing between the downgradient shallow alluvial aquifer monitoring wells ranges from approximately 200 to 300 feet.

The uppermost aquifer in the vicinity is the Missouri River alluvial aquifer. The water table is located within either fine sand or overlying silts and clays that extend to the surface (Montgomery Watson, 1999). The deeper monitoring wells are screened in alluvial sand and gravel. Bedrock was not encountered during drilling at the Neal South CCR Monofill; however, bedrock was encountered at approximately 137 feet bgs during installation of a water well at the Neal North Energy Center (MWH, 2009), located approximately 2.5 miles northwest of the Neal South CCR Monofill. The uppermost bedrock in the area is the Cretaceous-age Dakota Formation.

Groundwater flow in the alluvial aquifer, based on nine monitoring events conducted between December 2015 and September 2017, is predominantly to the west-southwest, toward the Missouri River, with minor temporal variations with a slightly more westerly flow direction. Tabulated groundwater elevations for the nine recent sampling events are provided in Table 1.

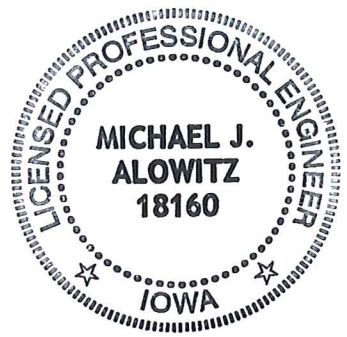
Groundwater at the Neal South CCR Monofill has been observed to consistently flow toward the west or west-southwest. Shallow monitoring wells MW-4 and MW-15 are located upgradient, and shallow monitoring wells MW-11, MW-12, MW-13, and MW-14 are consistently located downgradient of the Neal South CCR Monofill. Shallow monitoring wells MW-8 and MW-10 are located downgradient under some flow conditions and in a sidegradient location under other conditions. Shallow monitoring well MW-2 is located in a sidegradient position relative to groundwater flow.

All monitoring wells in the groundwater monitoring system consist of 2-inch nominal inner-diameter polyvinyl chloride (PVC) casing and screen. Monitoring well construction included placement of clean silica sand in the screened interval and an annular seal of bentonite to the near surface. Monitoring well surface completions consist of a lockable stick-up surface casing set in a concrete pad and placement of protective bollards in locations where traffic may be of concern. Review of

monitoring records and wells inspections indicate the monitoring wells have been operated and maintained adequately to meet the design specifications of the monitoring program.

3. Certification

I certify the Neal South CCR Monofill groundwater monitoring system has been designed and constructed to meet the requirements of 40 CFR Part 257, Section 91. The groundwater monitoring system includes the minimum number of monitoring wells specified in 40 CFR Part 257, Section 91, Paragraph (c)(1), as described in this report.



I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Michael J. Alowitz, P.E.	**Date** 10/17/17
License Number:	18160
My license renewal date is:	December 31, 2018
Pages or sheets covered by this seal:	Entire Document

4. References

Montgomery Watson, 1999. Hydrogeological Investigation, Groundwater Monitoring Plan and Baseline Groundwater Quality Report for the Neal South Ash Landfill. December 1999.

MWH, 2009. Hydrologic Monitoring System Plan, Neal South Coal Combustion Residue Monofill, Sioux City, Iowa. October 2009.

Table 1

Groundwater Elevation Data
MidAmerican Energy Company
Neal South CCR Monofill
Salix, Iowa

Well	Top of Casing (feet NAVD)	Total Depth (feet BTOC)	Groundwater Elevation (feet NAVD)								
			7-Dec-2015	29-Feb-2016	6-Jun-2016	19-Sep-2016	19-Dec-2016	20-Feb-2017	24-Apr-2017	5-Jul-2017	11-Sep-2017
MW-1 [a]	1,079.21	56.10	1,061.39	1,060.01	1,061.41	1,060.31	1,058.66	1,057.83	1,058.34	1,061.23	1,060.74
MW-2	1,078.96	30.30	1,061.38	1,060.03	1,061.64	1,060.29	1,058.67	1,057.80	1,058.51	1,061.23	1,060.68
MW-3 [a]	1,077.29	58.80	1,062.18	1,060.83	1,062.36	1,060.98	1,059.28	1,058.53	1,059.12	1,061.72	1,061.27
MW-4	1,077.52	26.70	1,062.30	1,061.01	1,062.49	1,061.09	1,059.39	1,058.65	1,059.24	1,061.83	1,061.38
MW-5 [a]	1,077.15	48.90	1,062.03	1,060.58	1,061.97	1,060.76	1,059.05	1,058.28	1,058.93	1,061.69	1,061.07
MW-7 [a]	1,078.45	50.40	1,061.36	1,059.93	1,061.38	1,060.23	1,058.52	1,057.74	1,058.54	1,061.34	1,060.65
MW-8	1,078.46	27.60	1,061.33	1,059.85	1,061.30	1,060.16	1,058.43	1,057.64	1,058.32	1,061.23	1,060.55
MW-9 [a]	1,076.20	56.20	1,061.25	1,059.87	1,061.37	1,060.25	1,058.53	1,057.76	1,058.72	1,061.64	1,060.84
MW-10	1,076.29	25.60	1,060.93	1,059.52	1,061.04	1,059.90	1,058.19	1,057.44	1,058.37	1,061.28	1,060.51
MW-11	1,081.23	37.10	1,060.96	1,059.58	1,061.18	1,059.96	1,058.26	1,057.49	1,058.34	1,061.08	1,060.48
MW-12	1,086.79	34.80	1,060.76	1,059.39	1,060.96	1,059.83	1,058.05	1,057.30	1,058.20	1,061.03	1,060.38
MW-13	1,085.38	35.10	1,060.65	1,059.23	1,060.80	1,059.67	1,057.89	1,057.16	1,058.10	1,060.98	1,060.27
MW-14	1,081.13	29.78	1,061.12	1,059.76	1,061.37	1,060.13	1,058.46	1,057.65	1,058.48	1,061.20	1,060.65
MW-15	1,076.86	25.19	1,062.52	1,061.02	1,062.48	1,061.13	1,059.43	1,058.63	1,059.22	1,061.92	1,061.38

Notes:
[a] Well is screened in deep portion of the alluvial aquifer.
BTOC - Below top of casing.
CCR - Coal combustion residual.
NAVD - North American Vertical Datum of 1988.

Source: U.S. Department of Agriculture (USDA)
Imagery Date: September 16, 2014

0 100 200ft

Coordinate System:
NAD83 STATE PLANE
IOWA NORTH

MIDAMERICAN ENERGY COMPANY
NEAL SOUTH CCR MONOFILL
SALIX, IOWA

11114654-CCR17
Sep 27, 2017

SITE MAP AND MONITORING NETWORK

FIGURE 1

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