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August 4, 2010

Mr. Hank Kuehling, P.G.
Wisconsin Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg, WI 53711-5397

Subject: Reedsburg Cleaners, 349 E. Main Street, Reedsburg, WI, BRRTS# 02-57-001682
AECOM Project No. 60139948.0

Dear Mr. Kuehling:

As a follow-up to the WDNR e-mail dated July 15, 2010, this letter documents the recent completion of additional buffer and whey electron donor injection at the Reedsburg Cleaners site in Reedsburg, Wisconsin. Initial injection of whey and sodium bicarbonate buffer at this site occurred on December 1 and 2, 2009, as documented in the AECOM report dated December 11, 2009. The following provides a summary of the recently-completed buffer and electron donor injection tasks.

Injection of Additional Buffering Material

The production of hydrogen ion during reductive dechlorination, as well as production of volatile fatty acids from electron donor fermentation, tends to decrease the pH of the groundwater system. Based on information contained in AFCEE (2004) and ITRC (2008), pH values between 5 and 9 and total alkalinity values greater than 100 milligrams per liter (mg/L) are favorable for enhanced anaerobic bioremediation. Values of pH that are less than 5 indicate that a buffering agent may be required to sustain high rates of anaerobic dechlorination. At many sites, the natural buffering capacity of the aquifer matrix is adequate to prevent the development of acidic groundwater pH. The results of previous groundwater monitoring events reveal that the sandstone bedrock matrix at the Reedsburg Cleaners site may not have adequate natural buffering capacity, such that the injection of whey documented herein included the injection of additional aquifer buffer material.

Pursuant to the WDNR e-mail dated July 15, 2010, injection of additional aquifer buffer material through the on-site injection wells occurred on July 19, 2010. Specifically, injection of "Neutral Zone®" was completed, which is designed to duplicate the buffering capacity of a naturally calcareous soil. The product is a stable suspension of small-micron to sub-micron particles of calcium carbonate containing more than 500,000 mg/kg of total alkalinity (as CaCO3 equivalents) and proprietary additives that produce a negative surface charge. The calcium carbonate is food grade and the additives are approved as secondary direct additives in food for human consumption. The desired mobility of Neutral Zone® is based on the small micron to sub-micron particle size and additives that maintain a negative zeta potential. Colloidal buffer systems with a low solubility (10 to 20 mg/L for $CaCO_3$) can be transported significant distances in the subsurface, yet can also have substantial retention in the soil or aquifer after injection. The insoluble calcium carbonate dissolves primarily by contact with the acidity of the environment and the maximum pH is

limited by the generation of bicarbonate to a value of 8.34, whereas highly soluble buffers can create adversely high pH near injection points (>13.0 for potassium hydroxide, for example).

A total of 1,200 lbs of Neutral Zone® was injected through six existing on-site injection wells as an approximate 1.6 percent (16,000 mg/kg) solution of CaCO3 equivalents, such that a total of 4,500 gallons of Neutral Zone® and potable tap water solution was injected. Each of the six injection wells received the following Neutral Zone® buffer solution volumes:

- IW-1 – 568 gallons;
- IW-2 – 892 gallons;
- IW-3 – 630 gallons;
- IW-4 – 860 gallons;
- IW-5 – 850 gallons; and,
- IW-6 – 700 gallons.

Injection of Whey Electron Donor

The injection of additional buffer was followed by injection of whey electron donor on July 20 and 21, 2010. AECOM previously identified a supplier of whey in close proximity to the Reedsburg Cleaners site (Muscoda Protein Products of Muscoda, Wisconsin), that provided whey for the purpose of this groundwater remediation. The whey was delivered in bulk (6,000-gallon capacity tanker trucks), and injected through a portable manifold system into the six injection wells.

A log of the whey injection activities is provided as Attachment A, which identifies the 2-inch diameter injection wells as IW-1 through IW-6. As indicated in Attachment A, an estimated total of 12,040 gallons of whey was injected through the wells as follows:

- IW-1 – 660 gallons;
- IW-2 – 2,800 gallons;
- IW-3 – 1,650 gallons;
- IW-4 – 2,860 gallons;
- IW-5 – 2,580 gallons; and,
- IW-6 – 1,490 gallons.

The existing groundwater monitoring well network at the site will continue to be used for monitoring the effectiveness of the whey electron donor injection program. Ongoing groundwater monitoring data will be evaluated to document the progress of remediation and modify the electron donor injection program as appropriate.

Pursuant to the AECOM correspondence dated July 2, 2010, a groundwater monitoring event is scheduled to be conducted on August 9, 2010. As part of this monitoring event, the field parameters dissolved oxygen, ORP, and pH will be measured in all six injection wells (IW1 through IW6), and the following six monitoring wells: MW-2, MW-3R, MW-4, MW-5, MW-6, and MW-7. One groundwater sample will also be collected from monitoring well MW-7 for analysis of quantitative polymerase chain reaction (Q-PCR).

The results of the groundwater monitoring event to be conducted on August 9, 2010 will be used to evaluate groundwater conditions that are necessary to support bioaugmentation with commercially-available *Dehalococcoides* microbes. The Q-PCR testing will be used to evaluate and quantify existing dechlorinating bacteria for reduction of tetrachloroethene to non-toxic ethene. The results

of this upcoming groundwater monitoring event will be reported to the WDNR upon receipt. If you have any questions concerning the information contained herein, please feel free to contact us.

Yours sincerely,

Mark M. Mejac

Mark M. Mejac, PG, CGWP
Senior Hydrogeologist

Jeanne M. Tarvin

Jeanne M. Tarvin, PG, CPG
Senior Principal/EH&S Practice Leader

Enclosure

cc: Mr. Wayne Butz

References Cited

Air Force Center for Environmental Excellence (AFCEE). 2004. "Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents". Environmental Security Technology Certification Program, Arlington, Virginia.

ITRC (Interstate Technology & Regulatory Council). 2008. "In Situ Bioremediation of Chlorinated Ethene: DNAPL Source Zones," Washington, D.C.: Interstate Technology & Regulatory Council, Bioremediation of DNAPLs Team.

IW 1

INJECTION LOG
REEDSBURG CLEANERS
349 EAST MAIN STREET
REEDSBURG, WI
PROJECT REFERENCE #4646

Point ID	Date	Start Time	Flow Rate (GPM)	Pressure Rate (PSI)	Completion Time	Gallons Injected	
IW 1	7/19	9:35	4	15+		0	Running slow
		10:03				36	
		10:35				73	
		11:05				120	
		11:43				161	
		11:45				172	off blowout
		12:05				253	on
		12:35				298	
		1:05				332	
		1:35				385	
		2:05				415	
		2:35				482	
		3:05				550	
		3:15				568	off blowout
	7/20	8:30	0.5 +or-			0	
		9:00				15	
		9:30				30	
		10:00				45	
		10:30				60	
		11:00				75	
		11:30				90	
		12:00				105	
		12:30				120	
		1:00	off			120	off
		1:30	on			135	
		2:00	0.5 +or-			145	
		2:30				160	
		3:00				185	
		3:30				200	
		4:00				230	
		4:30				270	
		5:00				300	
		5:30				330	stop
		6:00					5685
	7/21	7:15	0.5 +or-			0	
		7:45				20	
		8:15				50	
		8:45				80	
		9:15				100	
		9:45				115	
		10:15				130	
		10:45				145	
		11:15				160	
		11:45				180	
		12:15				195	
		12:45				205	
		1:15				220	
		1:45	slow			225	
		2:15				235	
		2:45				245	
		3:15				255	
		3:45				270	
		4:15				300	
		5:00				390	off

B

IW 2

INJECTION LOG
REEDSBURG CLEANERS
349 EAST MAIN STREET
REEDSBURG, WI
PROJECT REFERENCE #4646

Point ID	Date	Start Time	Flow Rate (GPM)	Pressure Rate (PSI)	Completion Time	Gallons Injected	
IW 2	7/19	9:35 AM	4	15 +		0	
		10:05				37	
		10:35				72	
		11:05				113	
		11:35				207	
		12:05				298	
		12:35				409	
		1:05				501	
		1:35				613	
		2:05				719	
		2:35				802	
		3:05				892	off
	7/20	8:30	3 + or -			0	
		9:00				87	
		9:30				174	
		10:00				261	
		10:30				348	
		11:00				435	
		11:30				522	
		12:00				609	
		12:30				696	
		1:00				783	
		1:30	2 + or -			870	
		2:00				960	
		2:30				1030	
		3:00				1100	
		3:30				1160	
		4:00				1225	
		4:30				1300	
		5:00				1350	
		5:30				1400	
		6:00					stop
	7/21	7:15	3 +			0	
		7:45				96	
		8:15				190	
		8:45				285	
		9:15				350	
		9:45				400	
		10:15				490	
		10:45				570	
		11:15				650	
		11:45				750	
		12:15				840	
		12:45				920	
		1:15				1010	
		1:45				1110	
		2:15				1200	
		2:45				1290	
		3:15				1350	off
		3:45					
		4:15					

6

slow leak

F:\Excel\4500\Blank Injection Log

fix

IW 3

INJECTION LOG
REEDSBURG CLEANERS
349 EAST MAIN STREET
REEDSBURG, WI
PROJECT REFERENCE #4646

Point ID	Date	Start Time	Flow Rate (GPM)	Pressure Rate (PSI)	Completion Time	Gallons Injected	
IW 3	7/19	9:35	4	15 +		0	
		10:05				35	
		10:35				75	
		11:05				140	
		11:31				210	Running slow
		11:45				260	off
		12:05				292	on
		12:35				325	
		1:05				372	
		1:33				421	
		2:05				489	
		2:35				538	Blow out
		3:05				590	
		3:15				615	
						630	
	7/20	8:30	1+			0	
		9:00				35	
		9:30				70	
		10:00				105	
		10:30				140	
		11:00				175	
		11:30				210	
		12:00				245	
		12:30				280	
		1:00				315	
		1:30	1+			355	
		2:00	1+			395	
		2:10				435	
		3:00				475	
		3:30				525	
		4:00				595	
		4:30				670	
		5:00				765	
		5:30				810	
		6:00				860	stop
	7/21	7:15	2+			0	
		7:45				50	
		8:15				110	
		8:45				150	
		9:15				180	
		9:45				220	
		10:15				260	
		10:45				300	
		11:15				340	
		11:45				400	
		12:15				450	
		12:45				500	
		1:15				540	
		1:45				590	
		2:15	slow			610	
		2:45				630	
		3:15				660	
		3:45				690	
		4:15				720	off
		~~4:55~~ 4:55				790	

Blow out at sample B

IW4

INJECTION LOG
REEDSBURG CLEANERS
349 EAST MAIN STREET
REEDSBURG, WI
PROJECT REFERENCE #4646

Point ID	Date	Start Time	Flow Rate (GPM)	Pressure Rate (PSI)	Completion Time	Gallons Injected	
IW 4	7/19	9:35	3+	15+		0	
		10:05				50	
		10:35				94	
		11:05				136	
		11:35				212	
		12:05				307	
		12:35				421	
		1:05				519	
		1:35				610	
		2:05				713	
		2:35				809	
		3:05				860	off
	7/20	8:30	3+			0	
		9:00				70	
		9:30				140	
		10:00				210	
		10:30				280	
		11:00				350	
		11:30				420	
		12:00				490	
		12:30				560	
		1:00	3+			640	
		1:30	3+			705	
		2:00	3+			920	
		2:30				1030	
		3:00				1160	1164
		3:30				1220	
		4:00				1310	
		4:30				1410	
		5:00				1500	
		5:30				1590	
		6:00				1620	stop
	7/21	7:15	3+			0	
		7:45				115	
		8:15				230	
		8:45				330	
		9:15				380	
		9:45				450	
		10:15				540	
		10:45				640	
		11:15				730	
		11:45				800	
		12:15				890	
		12:45				980	
		1:15				1080	
		1:45				1180	
		2:15				1240	off
		2:45					
		3:15					
		3:45					
		4:15					
		4:45					

good
slow leak

F:\Excel\4500\Blank Injection Log

2100

IW 5

INJECTION LOG
REEDSBURG CLEANERS
349 EAST MAIN STREET
REEDSBURG, WI
PROJECT REFERENCE #4646

Point ID	Date	Start Time	Flow Rate (GPM)	Pressure Rate (PSI)	Completion Time	Gallons Injected	
IW 5	7/19	9:35	4	15+		0	
		10:05				39	
		10:35				70	
		11:05				112	
		11:35				204	
		12:05pm				301	
		12:35				389	
		1:05				475	
		1:35				587	
		2:05				698	
		2:35				773	
		3:05				850	off
	7/20	8:30	1			0	
		9:00	1			30	
		9:30	1			60	
		10:00	1			90	
		10:30	1			120	
		11:00	1			150	
		11:30	#3			210	
		12:00	2			270	
		12:30	2			330	?
		1:00	2 ter -			400	
		1:30				470	
		2:00				530	
		2:30				600	
		3:00				650	
		3:30				700	
		4:00				750	
		4:30				800	
		5:00				850	
		5:30				900	
		6:00				1115	
						1210	stop
	7/21	7:15	3+			0	
		7:45				100	
		8:15				200	
		8:45				298	
		9:15				340	
		9:45				440	
		10:15				530	
		10:45				630	
		11:15				710	
		11:45				810	
		12:15				900	
		12:45				1000	
		1:15				1090	
		1:45				1180	
		2:15				1270	
		3:15				1370	off
		3:45					
		4:15					
		4:45					

better throughout Good now

IW 6

INJECTION LOG
REEDSBURG CLEANERS
349 EAST MAIN STREET
REEDSBURG, WI
PROJECT REFERENCE #4646

Point ID	Date	Start Time	Flow Rate (GPM)	Pressure Rate (PSI)	Completion Time	Gallons Injected	
IW 6	7/19	9:35	4	15±		0	Running slow
		10:05				47	
		10:35				92	
		11:05				142	
		11:35				217	
		12:00				280	off
		12:05pm				330	on
		12:35				392	
		1:05				429	
		1:35				480	Blow
		2:05				510	
		2:35				590	
		3:05				633	
						700	off
	7/20	5:30	0.5 +or-			0	
		9:00				15	
		9:30				30	
		10:00				45	
		10:30				60	
		11:00				75	
		11:30				90	
		12:00				105	
		12:30				120	
		1:00				135	
		1:30				150	
		2:00				165	
		2:30				180	
		3:00				195	
		3:30				220	
		4:00				260	
		4:30				330	
		5:00				400	
		5:30				490	
		6:00				570	stop
	7/21	7:15	1±			0	
		7:45				50	
		8:15				100	
		8:45				180	
		9:15				230	
		9:45				320	
		10:15				390	
		10:45				440	
		11:15				500	
		11:45				540	
		12:15				600	
		12:45				620	
		1:15				650	
		1:45				730	
		2:15	slow			770	
		2:45				800	
		3:15				830	
		3:45				860	
		4:15				890	
		5:00				920	off

sidewalk

B