ARCADIS U.S., Inc.
126 North Jefferson Street
Suite 400
Milwaukee
Wisconsin 53202
Tel 414 276 7742
Fax 414 276 7603
www.arcadis-us.com

ENVIRONMENT

Nick Bertolas
Waste Water Specialist – Bureau of Water Quality
Wisconsin Department of Natural Resources
South Central Region
3911 Fish Hatchery Rd
Fitchburg WI 53711

Subject:
Discharge Monitoring Report – Groundwater Extraction and Treatment System (GETS) Madison-Kipp Corporation (MKC) Site, 201 Waubesa Street, Madison, Wisconsin.

Date:
August 14, 2015

Contact:
Jennine Trask

Phone:
414.277.6203

Email:
Jennine.Trask@arcadis-us.com

Our ref:
WI001368.0026

Dear Mr. Bertolas:

On behalf of MKC, this letter summarizes the activities completed from July 1 through July 31, 2015 as part of the Groundwater Extraction and Treatment System at the MKC site located at 201 Waubesa Street in Madison, Wisconsin (site) under Wisconsin Pollution Discharge Elimination System (WPDES) Permit WI-0046566-6. Wisconsin Department of Natural Resources (WDNR) approved the sodium permanganate neutralization for WPDES discharge memo electronically on July 9, 2015. A revised discharge monitoring report DMR form was provided by the WDNR on August 5, 2015 and is included as Attachment A, for the GETS monitoring events completed during the reporting period. A summary of operation and activities completed through July 31, 2015 is presented below.

GETS Operation and Monitoring

The GETS system was started on July 14, 2015 after confirmation of sodium permanganate neutralization by addition of hydrogen peroxide. The system was started at approximately 8:40 am July 14, 2015 at the design flow rate of 45 gallons per minute. Initial compliance samples were collected the morning of July 15, 2015 within the first 24 hours of operation per the permit. The initial sample results were received Friday July 17, 2015 and indicated an elevated concentration for tetrachloroethe (PCE) and trichloroethene (TCE). A complete list of all GETS WDPES Compliance Sample Results is included in Table 1. Upon review of the data the system was shutdown pending further system review. On Tuesday July 21, 2015, a mechanical issue at the booster Blower B-202 was identified and repaired before restarting the system. Additional mechanical issues were identified and corrected at Discharge Flow Meter FT-211 and Transfer Pump P-103 on July 26 through July 29, 2015. Upon repair of Transfer Pump P-103 the system ran continuously through July

31, 2015. WPDES compliance samples were only taken during days when the system was operating to collect both influent and effluent samples.

Per the August 4, 2015 notification email, initial results indicate an exceedance of PCE above the established monthly WPDES discharge limit for the Madison-Kipp GETS. The initial WPDES compliance sample, collected on July 15, 2015, contained a concentration for PCE and TCE above the WPDES discharge limits. As such the monthly average is above the discharge limit for PCE; however, the TCE concentration is below the monthly average limit. After mechanical modifications, the compliance samples after the initial test have shown an improved treatment efficiency and are below the discharge criteria when operating at design conditions. We continue to optimize treatment. An additional sample collected after a pump motor replacement was slightly above the discharge criteria on July 29, 2015; however, after air flow modifications to the air stripper were made the next sample was below the discharge criteria for the daily grab samples and at the discharge limit for the monthly limit after that initial July 15, 2015 sample. Madison-Kipp recognizes the importance of effective treatment and is working to maintain the system operation as such. All other compliance samples are below the monthly average limit as shown on Table 1.

Sodium permanganate neutralization is documented in Attachment B. Concentrations observed continue to fall in the 3.8 milligram per liter range on the *Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines* colormetric chart dated August 2012, Attachment C. The hydrogen peroxide is dosed to the Mix Tank T-102 via a chemical feed pump. Hydrogen peroxide dosing is adjusted manually based on the neutralization observations and the level in the hydrogen peroxide storage drum. Process modifications are being designed to send notification if the neutralization process is interrupted. This design will be finalized for implementation in August.

If you have any questions or require any additional information, please contact us at 414.276.7742.

Sincerely,

ARCADIS U.S., Inc.

Rebecca A Robbennolt

Rebecca Robbennolt
Remediation Specialist

Christopher D. Kubacki, PE
Senior Engineer

Table 1 GETS WPDES Compliance Sample Results

Attachment A Discharge Monitoring Report Form
Attachment B Neutralization Log
Attachment C *Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines* colormetric chart dated August 2012

Copies:
Alina Satkoski – Madison Kipp
Mike Schmoller – WDNR (electronic)
George Parrino – Madison Department of Health (electronic)

Table 1
GETS WPDES Compliance Sample Results

Discharge Monitoring Report – Groundwater Extraction and Treatment System
Madison-Kipp Corporation Site
201 Waubesa Street
Madison, Wisconsin

		Location Sample Date	Influent 7/15/2015	Influent 7/24/2015	Influent 7/27/2015	Influent 7/29/2015	Influent 7/30/2015	Influent 7/31/2015	Influent Monthly Average	Influent Composite 7/15/2015
Parameter	**Permit Discharge Limits**	**Unit**								
Miscellaneous										
Oil & Grease	10	mg/L	1.7 JB	1.2 JB	NA	NA	2.9 JB	NA	1.9	NA
Chloride	395	mg/L	210	200	NA	NA	190	NA	200	NA
Total Suspended Solids	40	mg/L	<1.6	4.0 J	NA	NA	2.0 J	NA	3.0	2.0 J
Biological Oxygen Demand	20	mg/L	<2.0	<2.0	NA	NA	<2.0	NA	ND	NA
VOCs										
1,1,1-Trichloroethane	50	µg/L	<2.0	<1.0	<1.0	<1.0	<0.40	<2.0	ND	NA
1,1,2,2-Tetrachloroethane	50	µg/L	<2.3	<1.2	<1.2	<1.2	<0.47	<2.3	ND	NA
1,1,2-Trichloroethane	50	µg/L	<2.8	<1.4	<1.4	<1.4	<0.56	<2.8	ND	NA
1,1-Dichloroethene	50	µg/L	<3.1	<1.5	<1.5	<1.5	<0.61	<3.1	ND	NA
1,2-Dichloroethane	180	µg/L	<2.9	<1.4	<1.4	<1.4	<0.57	<2.9	ND	NA
Benzene	50	µg/L	<0.74	<0.37	<0.37	<0.37	<0.15	<0.74	ND	NA
Bromodichloromethane	120	µg/L	<1.7	<0.87	<0.87	<0.87	<0.35	<1.7	ND	NA
Bromoform	120	µg/L	<3.3	<1.7	<1.7	<1.7	<0.67	<3.3	ND	NA
Bromomethane	NE	µg/L	<3.1	<1.5	<1.5	<1.5	<0.61	<3.1	ND	NA
Carbon Tetrachloride	150	µg/L	<2.6	<1.3	<1.3	<1.3	<0.51	<2.6	ND	NA
cis-1,2-Dichloroethene	NE	µg/L	530	470	580	480	350	320	455	NA
Dichloromethane	NE	µg/L	<1.9	<0.93	<0.93	<0.93	<0.37	<1.9	ND	NA
Ethylbenzene	NE	µg/L	<1.3	<0.63	<0.63	<0.63	<0.25	<1.3	ND	NA
Tetrachloroethene	**50**	µg/L	**2,600**	**3,000**	**2,700**	**3,000**	**2,200**	**2,900**	**2,733**	NA
Toluene	NE	µg/L	<1.2	<0.58	<0.58	<0.58	<0.23	<1.2	ND	NA
Total Xylenes	NE	µg/L	<0.69	<0.34	<0.34	<0.34	<0.14	<0.69	ND	NA
trans-1,2-Dichloroethene	NE	µg/L	<2.5	<1.3	<1.3	<1.3	<0.50	<2.5	ND	NA
Trichloroethene	**50**	µg/L	**340**	**300**	**340**	**330**	**300**	**270**	**313**	NA
Vinyl chloride	10	µg/L	<2.9	<1.5	<1.5	<1.5	<0.58	<2.9	ND	NA
Total BTEX	750	µg/L	ND	ND	ND	ND	ND	ND	ND	NA
Total VOCs (includes BTEX)	NE	µg/L	3,470	3,770	3,620	3,810	2,850	3,490	3,502	NA

Notes on Page 2.

Table 1
GETS WPDES Compliance Sample Results

Discharge Monitoring Report – Groundwater Extraction and Treatment System
Madison-Kipp Corporation Site
201 Waubesa Street
Madison, Wisconsin

		Location Sample Date	Influent 7/15/2015	Influent 7/24/2015	Influent 7/27/2015	Influent 7/29/2015	Influent 7/30/2015	Influent 7/31/2015	Influent Monthly Average	Influent Composite 7/15/2015
Parameter	**Permit Discharge Limits**	**Unit**								
PAHs										
Benzo(a)anthracene	NE	µg/L	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA
Benzo(a)pyrene	0.1	µg/L	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA
Benzo(b)fluoranthene	NE	µg/L	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA
Benzo(g,h,i)perylene	NE	µg/L	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA
Benzo(k)fluoranthene	NE	µg/L	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA
Chrysene	NE	µg/L	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA
Dibenzo(a,h)anthracene	NE	µg/L	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA
Fluoranthene	NE	µg/L	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA
Indeno(1,2,3-cd)pyrene	NE	µg/L	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA
Naphthalene	70	µg/L	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA
Phenanthrene	NE	µg/L	<0.045	0.048 J	NA	NA	<0.046	NA	0.048	NA
Pyrene	NE	µg/L	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA
PAHs Group of 10	0.1	µg/L	ND	0.048	NA	NA	ND	NA	0.048	NA

Acronyms and Abbreviations:

µg/L = Micrograms per liter

PAHs Group of 10 = PAH group of 10 includes the sum of the following individual compounds: benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene

< = Less Than

B = Compound was found in the blank and sample.

J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

mg/L = Milligrams per liter

NA = Not Analyzed

ND = Not Detected

NE = Not Established

VOCs = Volatile Organic Compounds

PAHs = Polynuclear Aromatic Hydrocarbons

Table 1
GETS WPDES Compliance Sample Results

Discharge Monitoring Report – Groundwater Extraction and Treatment System
Madison-Kipp Corporation Site
201 Waubesa Street
Madison, Wisconsin

Parameter	Effluent 7/15/2015	Effluent 7/24/2015	Effluent 7/27/2015	Effluent 7/29/2015	Effluent 7/30/2015	Effluent 7/31/2015	Effluent Monthly Average	Effluent Composite 7/15/2015	Effluent Composite 7/24/2015	Effluent Composite 7/31/2015
Miscellaneous										
Oil & Grease	1.3 JB	2.0 JB	NA	NA	3.0 JB	NA	2.1	NA	NA	NA
Chloride	220	200	NA	NA	190	NA	203	NA	NA	NA
Total Suspended Solids	<1.6	3.5 J	NA	NA	<1.6	NA	3.5	<1.6	<1.6	<1.6
Biological Oxygen Demand	<2.0	<2.0	NA	NA	<2.0	NA	ND	NA	NA	NA
VOCs										
1,1,1-Trichloroethane	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	ND	NA	NA	NA
1,1,2,2-Tetrachloroethane	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	ND	NA	NA	NA
1,1,2-Trichloroethane	<0.28	<0.28	<0.28	<0.28	<0.28	<0.28	ND	NA	NA	NA
1,1-Dichloroethene	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	ND	NA	NA	NA
1,2-Dichloroethane	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	ND	NA	NA	NA
Benzene	<0.074	<0.074	<0.074	<0.074	<0.074	<0.074	ND	NA	NA	NA
Bromodichloromethane	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	ND	NA	NA	NA
Bromoform	<0.33	<0.33	<0.33	<0.33	<0.33	<0.33	ND	NA	NA	NA
Bromomethane	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	ND	NA	NA	NA
Carbon Tetrachloride	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	ND	NA	NA	NA
cis-1,2-Dichloroethene	150	53	53 F1	61	60	64	73.5	NA	NA	NA
Dichloromethane	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	ND	NA	NA	NA
Ethylbenzene	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	ND	NA	NA	NA
Tetrachloroethene	**270**	46	46	**54**	47	48	**85.2**	NA	NA	NA
Toluene	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	ND	NA	NA	NA
Total Xylenes	<0.069	<0.069	<0.069	<0.069	<0.069	<0.069	ND	NA	NA	NA
trans-1,2-Dichloroethene	0.41 J	<0.25	<0.25	<0.25	<0.25	<0.25	ND	NA	NA	NA
Trichloroethene	**52**	12	12	13	13	14	19.3	NA	NA	NA
Vinyl chloride	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	ND	NA	NA	NA
Total BTEX	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA
Total VOCs (includes BTEX)	472	111	111	128	120	126	178	NA	NA	NA

Notes on Page 4.

Table 1
GETS WPDES Compliance Sample Results

Discharge Monitoring Report – Groundwater Extraction and Treatment System
Madison-Kipp Corporation Site
201 Waubesa Street
Madison, Wisconsin

Parameter	Effluent 7/15/2015	Effluent 7/24/2015	Effluent 7/27/2015	Effluent 7/29/2015	Effluent 7/30/2015	Effluent 7/31/2015	Effluent Monthly Average	Effluent Composite 7/15/2015	Effluent Composite 7/24/2015	Effluent Composite 7/31/2015
PAHs										
Benzo(a)anthracene	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA	NA	NA
Benzo(a)pyrene	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA	NA	NA
Benzo(b)fluoranthene	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA	NA	NA
Benzo(g,h,i)perylene	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA	NA	NA
Benzo(k)fluoranthene	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA	NA	NA
Chrysene	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA	NA	NA
Dibenzo(a,h)anthracene	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA	NA	NA
Fluoranthene	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA	NA	NA
Indeno(1,2,3-cd)pyrene	<0.023	<0.023	NA	NA	<0.023	NA	ND	NA	NA	NA
Naphthalene	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA	NA	NA
Phenanthrene	<0.045	0.047 J	NA	NA	<0.046	NA	0.047	NA	NA	NA
Pyrene	<0.045	<0.046	NA	NA	<0.046	NA	ND	NA	NA	NA
PAHs Group of 10	ND	0.047	NA	NA	ND	NA	0.047	NA	NA	NA

Acronyms and Abbreviations:

µg/L = Micrograms per liter

PAHs Group of 10 = PAH group of 10 includes the sum of the following individual compounds: benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene

< = Less Than

B = Compound was found in the blank and sample.

J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

mg/L = Milligrams per liter

NA = Not Analyzed

ND = Not Detected

NE = Not Established

VOCs = Volatile Organic Compounds

PAHs = Polynuclear Aromatic Hydrocarbons

ARCADIS

Attachment A

Discharge Monitoring Report Form

DISCHARGE MONITORING REPORT FORM **Year:_** July 2015
Contaminated Groundwater from Remedial Action Operations - Surface Water Discharge
Permit No. WI-0046566-6 Rev. December16, 2013

Facility Name and Location
Madison Kipp Corporation
201 Waubesa St
Madison, WI 53704
Consultant Managing Project: Arcadis
FIN#:

Outfall # and Description		Flow (gal/day)	Oil & Grease (mg/L)	BOD_5 (mg/L)	Total BETX (µg/L)	PAHs group of 10 (µg/L)	Benzo(a) pyrene (µg/L)	Naphthalene (µg/L)	Potassium Permanganate (mg/L)	Benzene (µg/L)	TSS (mg/L)
001 Influent	Month:7/15/2015	64,800	X	X	X	X	X	X	X	X	X
001 Effluent	Month:7/15/2015	64,800	X	X	X	X	X	X	X	X	X
001 Influent	Month:7/24/2015	64,800	X	X	X	X	X	X	X	X	X
001 Effluent	Month:7/24/2015	64,800	X	X	X	X	X	X	X	X	X
001 Influent	Month:7/27/2015	64,800			X		X	X	X	X	
001 Effluent	Month:7/27/2015	64,800			X		X	X	X	X	
001 Influent	Month:7/29/2015	64,800			X		X	X	X	X	
001 Effluent	Month:7/29/2015	64,800			X		X	X	X	X	
001 Influent	Month:7/30/2015	64,800			X		X	X	X	X	
001 Effluent	Month:7/30/2015	64,800			X		X	X	X	X	
001 Influent	Month:7/31/2015	64,800	X	X	X	X	X	X	X	X	X
001 Effluent	Month:7/31/2015	64,800	X	X	X	X	X	X	X	X	X
See Footnotes					(1)	(2)			(3)		
Effluent Limits (refer to sec. 4 of the permit)		--	10 mg/l	20 mg/L	750 µg/L	0.1 µg/l	0.1 µg/l	70 µg/l		50 µg/l	40 mg/L
Sample Frequency: Pre-treatment		Daily	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Sample Frequency: Post-treatment		Daily	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Sample Type		Estimate	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Impaired or TMDL surface waters			Does this facility discharge a pollutant of concern to an impaired surface water or to a surface water with a TMDL allocation? ☐ No ☐ Yes								

	Facility Name and Location
	Madison Kipp Corporation 201 Waubesa St Madison, WI 53704 Consultant Managing Project: Arcadis FIN#:

Outfall # and Description		VOCs (µg/L)	Vinyl Chloride (µg/L)	trans-1,2-Dichloroethene (µg/L)	1,1-Dichloroethene (µg/L)	Tetrachloroethene (µg/L)	Chloride (mg/L)	cis-1,2-Dichloroethene (µg/L)	Trichloroethene (µg/L)	
001 Influent	Month:7/15/2015	X	X	X	X	X	X	X	X	
001 Effluent	Month:7/15/2015	X	X	X	X	X	X	X	X	
001 Influent	Month:7/24/2015	X	X	X	X	X	X	X	X	
001 Effluent	Month:7/24/2015	X	X	X	X	X	X	X	X	
001 Influent	Month:7/27/2015	X	X	X	X	X		X	X	
001 Effluent	Month:7/27/2015	X	X	X	X	X		X	X	
001 Influent	Month:7/29/2015	X	X	X	X	X		X	X	
001 Effluent	Month:7/29/2015	X	X	X	X	X		X	X	
001 Influent	Month:7/30/2015	X	X	X	X	X		X	X	
001 Effluent	Month:7/30/2015	X	X	X	X	X		X	X	
001 Influent	Month:7/31/2015	X	X	X	X	X	X	X	X	
001 Effluent	Month:7/31/2015	X	X	X	X	X	X	X	X	
See Footnotes										
Effluent Limits (refer to sec. 4 of the permit)			10 ug/L		50 µg/L	50 µg/L	395 mg/L		50 µg/L	
Sample Frequency: Pre-treatment		Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	
Sample Frequency: Post-treatment		Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	

FOOTNOTES:

(1) Total BETX is the sum of the benzene, ethylbenzene, toluene and xylene concentrations.

(2) PAH group of 10 (Polynuclear Aromatic Hydrocarbons) include the sum of the following individual compounds: benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene

(3)) Madison Kipp/Arcadis will conduct visual monitoring for this compound.

DIRECTIONS:

☞ For "Outfall # and Description" enter the number of the outfall you are reporting (001 or 002, etc.)

☞ Monitoring for a given parameter depends on if the discharge is to surface water or groundwater.

☞ The value entered must be the highest value of all samples analyzed for that day.

☞ Print additional DMRs as necessary for monthly reporting.

RETURN REPORT BY: **February 15, of the year following completion of monitoring**

RETURN TO: **ATTN: Nicholas Bertolas**
Department of Natural Resources 3911 Fish Hatchery Rd.
Fitchburg, WI 53711

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment, (40 CFR 122.5). I also certify that the values being submitted are the actual values found in the samples; no values have been modified or changed in any manner. Wherever I believe a value being reported is inaccurate, I have added an explanation indicating the reasons why the value is inaccurate.

Signature of Person Completing Form — Date

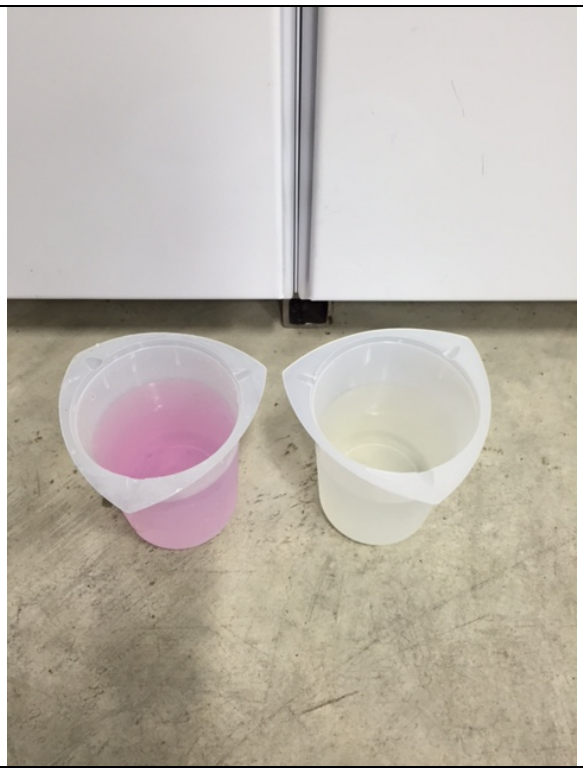
Alina Sarkesh — 8/13/15

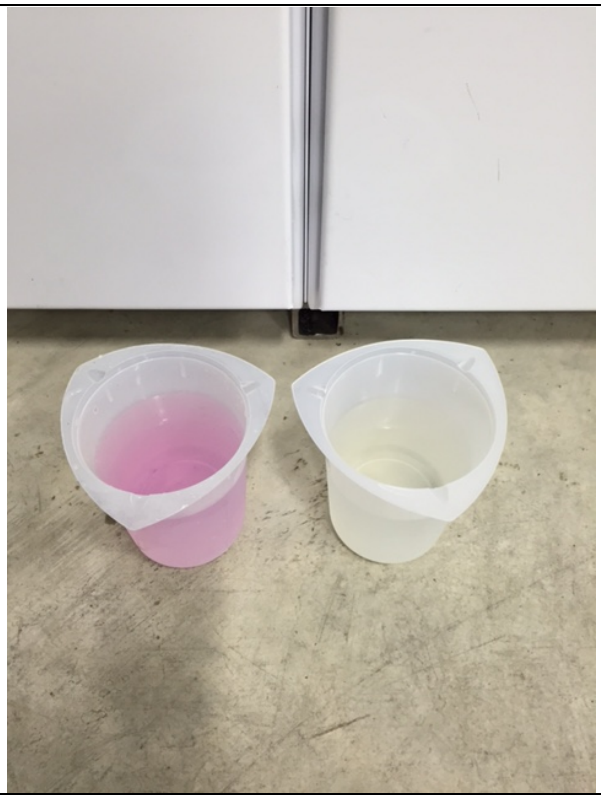
Signature of Principal Exec. or Authorized Agent — Date

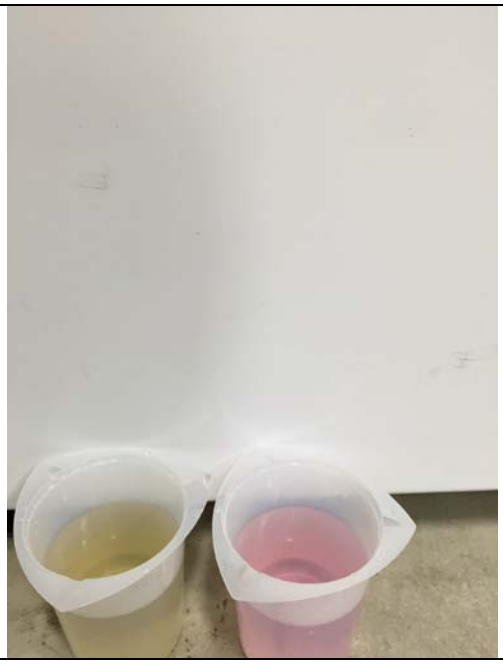
ARCADIS

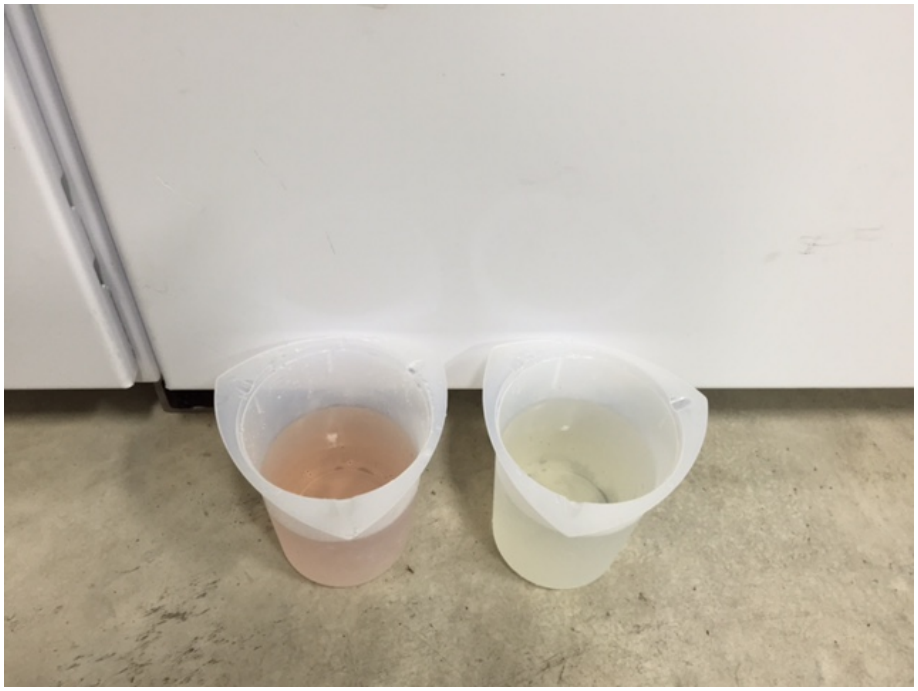
Attachment B

Neutralization Log

July 14, 2015	
Description: Influent – Left Effluent – Right	

July 15, 2015	
Description: Influent – Left Effluent – Right	

July 16, 2015	
Description: Influent – Right Effluent – Left	

July 17, 2015	
Description: Influent – Left Effluent – Right	

July 18, 2015	System off pending mechanical modifications.
July 19, 2015	System off pending mechanical modifications.
July 20, 2015	System off pending mechanical modifications.
July 21, 2015	Visual confirmation of neutralization made by ARCADIS personnel.
July 22, 2015	Visual confirmation of neutralization made by Madison-Kipp personnel.
July 23, 2015	System off pending plumbing modifications.

July 24th, 2015	
Description: Influent – Left Effluent – Right	

July 25th, 2015 **Description:** Influent – Right Effluent – Left	
July 26, 2015	System off pending mechanical modification.

July 27, 2015 **Description:** Influent – Left Effluent – Right	

ARCADIS
Infrastructure · Water · Environment · Buildings

Attachment B – Neutralization Log
Madison Kipp Corporation - Madison, WI

July 28, 2015	System off pending mechanical modification.
July 29, 2015 **Description:** Influent – Right Effluent – Left	
July 30, 2015	Visual confirmation of neutralization made by Madison-Kipp personnel.
July 31, 2015	Visual confirmation of neutralization made by Madison-Kipp personnel.

ARCADIS

Attachment C

Ground Water Sample Preservation at In-Situ Chemical Oxidation Sites – Recommended Guidelines colormetric chart dated August 2012

plan, or in general EPA documents such as the Resource Conservation and Recovery Act (RCRA) guidance document (U.S. EPA, 1992) or EPA SW-846 (U.S. EPA, 1982). Additional direction on ground water sampling techniques can be found in Yeskis and Zavala (2002).

2.1. Permanganate (MnO_4^-)

Data and information presented below are reported in terms of the permanganate anion (MnO_4^-; 118.9 grams per mole (g/mol)). Permanganate is purchased either as sodium permanganate ($NaMnO_4$; 141.9 g/mol) or potassium permanganate ($KMnO_4$; 158.0 g/mol) and as a result conversion to the permanganate anion concentration is needed to determine sample preservation needs as per the *Issue Paper*. Specifically, the ratios 118.9/141.9 (g-mole/g-mole) and 118.9/158.0 (g-mole/g-mole) are used to convert $NaMnO_4$ and $KMnO_4$, respectively to MnO_4^-.

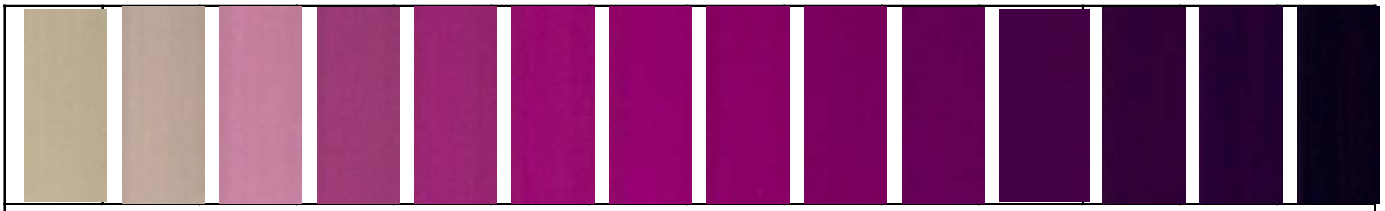
2.1.1. Analysis by Visual Observation

The characteristic pink or purple color of MnO_4^- in a 40 mL VOA vial can be used as a general guideline to estimate the concentration by using the MnO_4^- colorimetric scale (Table 1). This method should be used with caution because ground water turbidity and colloidal manganese dioxide solids (MnO_2(s)) can affect sample color and result in deviations from the tabulated color scale. Field filtration can help minimize these interferences, but may not fully remove all color if sub-micron colloidal and/or dissolved constituents are present.

2.1.2. Spectrophotometric Analysis

The permanganate concentration can be determined using commercially available field test kits (SenSafe™, 2011; CHEMetrics, 2011). Additionally, an accurate measurement of the permanganate concentrations can be determined using a field spectrophotometer (maximum absorbance wavelength (λ) = 525 nanometers (nm) (A_{525})) and a calibration curve involving a linear correlation between MnO_4^- concentration and A_{525} (Figure 2, Table 1). Filtered samples (0.2-0.45 micron) may be required to eliminate background colloidal or suspended solid materials that can absorb light at 525 nm and interfere with permanganate measurement. Volatilization of

Table 1. Permanganate concentration, spectrophotometric absorbance at 525 nm, and required amount of ascorbic acid required to neutralize the oxidant in a 40 mL vial. The color scale represents actual photos of MnO_4^- vials and is included for conceptual guidance. Actual colors vary based on background lighting, and color printers. Additionally, photographs of low concentrations (i.e., clear solutions) do not accurately capture transparency.



$[MnO_4^-]$ (mg/L) (millimolar in parentheses)													
0 (0)	0.75 (0.01)	3.8 (0.03)	7.5 (0.06)	11.3 (0.09)	18.8 (0.16)	30.1 (0.25)	37.6 (0.32)	56.4 (0.47)	75.3 (0.63)	113 (0.95)	151 (1.27)	188 (1.58)	376 (3.16)
Absorbance[1], wavelength (λ) = 525 nm													
0	0.011	0.059	0.134	0.197	0.329	0.516	0.627	NL	NL	NL	NL	NL	NL
Ascorbic Acid Stock Solution (M) [2]													
-	0.015	0.015	0.15	0.15	0.15	0.15	0.15	1.5	1.5	1.5	1.5	1.5	1.5
Volume of Ascorbic Acid solution (µL)													
0	30	150	30	46	76	121	152	23	30	46	61	76	152
Mass of Ascorbic Acid (mg)													
0	0.08	0.4	0.79	1.21	2.1	3.32	4.17	6.1	7.9	12.2	16.1	20.1	40.2

(1) $[MnO_4^-]$ (mg/L) = 58.8 × A_{525}; A_{525} is the absorbance at 525 nm; non-linear above 38 mg/L MnO_4^-.
(2) To minimize sample dilution, the ascorbic acid stock solution used was 0.015, 0.15, and 1.5 M.