From: Carl Stay <Carl.Stay@erm.com>
Sent: Thursday, April 11, 2019 4:50 PM
To: Beggs, Tauren R - DNR
Cc: Podlaski, Rick; Elisa R. Rombach Esq.; David De Courcy Bower
Subject: Revised cPAH tables
Attachments: NR722_cPAHs_Evaluator_LSB-4(REVISED).pdf; Table 2_LNAPL AREA SOIL ANALYTICAL RESULTS (REVISED).pdf; Table 3_CPAH EVALUATION SUMMARY TABLE (REVISED).pdf; NR722_cPAHs_Evaluator_LSB-2(REVISED).pdf

Tauren,

Thank you for the call this afternoon. Per your request, I have attached revised tables associated with the PAH analysis for the LSB borings at the Thermo Fisher site in Two Rivers, WI. You pointed out that the analyte Dibenzofuran was incorrect, and we have revised that constituent. The correct analyte should be Dibenzo(a,h)anthracene, and the concentrations shown in the tables are correct for Dibenzo(a,h)anthracene. This changes slightly the cPAH risk values but does not change the outcome. Also, Tables 2 and 3 of the February 2019 Investigation report had Dibenzofuran erroneously reported, so I have resubmitted those tables as well. We apologize for the confusion.

If you have any questions, please contact me or David.

Carl B. Stay, P.E., P.G.
Senior Engineer

ERM
700 W. Virginia St. Suite 601, Milwaukee, WI 53204
T +1 414-977-4709 | **M** +1 262-957-6967
E Carl.Stay@erm.com | **W** www.erm.com

Table 2: LNAPL Area Soil Analytical Results

BRRTS #02-36-578316
SITE NAME: Former Hamilton Industries
SITE ADDRESS: Two Rivers, Wisconsin

Parameter	Non-Industrial Direct Contact		Industrial Direct Contact		Soil-to-GW RCL	Soil Sample Results (mg/kg)						
	RCL	Basis	RCL	Basis		LSB-1 (2-4') Sand 8/28/2017	LSB-1 (10-12') Clay 8/28/2017	LSB-2 (2-4') Sand 8/28/2017	LSB-2 (12-14') Sand 8/28/2017	LSB-3 (2-4') Sand 8/28/2017	LSB-3 (10-12') Clay 8.28/2017	LSB-4 (2-4') Sand 8/28/2017
Petroleum Volatile Organics (PVOCs)												
1,2,4-Trimethylbenzene	219	Csat	219	Csat	1.38	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
1,3,5-Trimethylbenzene	182	Csat	182	Csat	1.38	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
Benzene	2	ca	7	ca	0.01	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
Ethylbenzene	8	ca	35	ca	1.57	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
Methyl-tert-butyl ether	64	ca	282	ca	0.03	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
Toluene	818	Csat	818	Csat	1.11	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
m&p-Xylene	388	Csat	388	Csat	3.96 (combined)	<0.050.0	<0.050.0	<0.050.0	<0.050.0	<0.050.0	<0.050.0	<0.050.0
o-Xylene	434	Csat	434	Csat	3.96 (combined)	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0	<0.025.0
Diesel Range Organics (DRO)	NS	NS	NS	NS	NS	<1.3	<1.5	26.5	<1.4	<1.2	<1.4	5.5
Polynuclear Aromatic Hydrocarbons (PAHs)												
1-Methylnaphthalene	17.6	ca	72.7	ca	NS	<0.0042	<0.0048	0.0099 J	<0.0047	<0.0042	<0.0047	0.0094 J
2-Methylnaphthalene	239	nc	3,010	nc	NS	<0.0053	<0.0059	0.0118 J	<0.0058	<0.0052	<0.0058	0.0132 J
Acenaphthene	3,590	nc	45,200	nc	NS	<0.0041	<0.0046	0.0083 J	<0.0045	<0.0040	<0.0045	0.0092 J
Acenaphthylene	NS	NS	NS	NS	NS	<0.0035	<0.0039	0.06	<0.0038	<0.0034	<0.0038	0.0398
Anthracene	17,900	nc	100,000	ceiling	197	<0.0060	<0.0067	0.0617	<0.0067	<0.0059	<0.0066	0.0575
Benzo(a)anthracene	1.14	ca	20.8	ca	NS	0.0094 J	<0.0037	0.202	<0.0037	<0.0033	<0.0037	0.163
Benzo(a)pyrene	0.12	ca	2.11	ca	0.47	0.0088	<0.0030	*0.226*	<0.0029	<0.0026	<0.0029	*0.179*
Benzo(b)fluoranthene	1.15	ca	21.1	ca	0.48	0.0073 J	<0.0033	0.232	<0.0033	<0.0029	<0.0033	0.184
Benzo(g,h,i)perylene	NS	NS	NS	0	NS	0.0051 J	<0.0024	0.151	<0.0024	<0.0021	<0.0024	0.113
Benzo(k)fluoranthene	11.5	ca	211	ca	NS	0.0082 J	<0.0030	0.208	<0.0029	<0.0026	<0.0029	0.156
Chrysene	115	ca	2,110	ca	0.14	0.0097 J	<0.0040	0.263	<0.0039	<0.0035	<0.0039	0.206
Dibenz(a,h)anthracene	0.12	ca	2.11	ca	NS	<0.0024	<0.0026	0.0521	<0.0026	<0.0023	<0.0026	0.0365
Fluoranthene	2,390	nc	30,100	nc	88.9	0.0163 J	<0.0062	0.497	<0.0061	<0.0054	<0.0060	0.412
Fluorene	2,390	nc	30,100	nc	14.8	<0.0044	<0.0049	0.0141 J	<0.0048	<0.0043	<0.0048	0.0113 J
Indeno(1,2,3-cd)pyrene	1.15	ca	21.1	ca	NS	0.0048 J	<0.0026	0.145	<0.0026	<0.0023	<0.0025	0.112
Naphthalene	5.52	ca	24.1	ca	0.66	<0.0089	<0.0099	0.0146 J	<0.0098	<0.0087	<0.0097	0.0222 J
Phenanthrene	NS	NS	NS	NS	NS	<0.0123	<0.0138	0.262	<0.0136	<0.0121	<0.0135	0.249
Pyrene	1,790	nc	22,600	nc	55	0.0132 J	<0.0053	0.417	<0.0053	<0.0047	<0.0052	0.35

Notes:

All units are milligrams per kilogram (mg/kg).

underline values exceed a soil to groundwater RCL

Italic values exceed an industrial direct contact RCL

Bold values exceed a non-industrial direct contact RCL

Csat = Saturation concentration

nc = non-carcinogen

ca = carcinogen

NS = No established standard

Table 3: CPAH Evaluation Summary Table

BRRTS #02-36-578316
SITE NAME: Former Hamilton Industries
SITE ADDRESS: Two Rivers, Wisconsin

Parameter	LSB-2 (2-4') Sand 8/28/2017	LSB-4 (2-4') Sand 8/28/2017	Non-Industrial Direct Contact RCL*	Soil-to-GW RCL
Petroleum Volatile Organics (PVOCs)				
1,2,4-Trimethylbenzene	<0.025.0	<0.025.0	219	1.38
1,3,5-Trimethylbenzene	<0.025.0	<0.025.0	182	1.38
Benzene	<0.025.0	<0.025.0	2	0.01
Ethylbenzene	<0.025.0	<0.025.0	8	1.57
Methyl-tert-butyl ether	<0.025.0	<0.025.0	64	0.03
Toluene	<0.025.0	<0.025.0	818	1.11
m&p-Xylene	<0.050.0	<0.050.0	388	3.96
o-Xylene	<0.025.0	<0.025.0	434	3.96
Diesel Range Organics (DRO)	26.5	5.5	NS	NS
Polynuclear Aromatic Hydrocarbons (PAHs)				
1-Methylnaphthalene	0.0099 J	0.0094 J	17.6	NS
2-Methylnaphthalene	0.0118 J	0.0132 J	239	NS
Acenaphthene	0.0083 J	0.0092 J	3,590	NS
Acenaphthylene	0.06	0.0398	NS	NS
Anthracene	0.0617	0.0575	17,900	197
Benzo(a)anthracene	0.202	0.163	cPAH	NS
Benzo(a)pyrene	0.226	0.179	cPAH	0.47
Benzo(b)fluoranthene	0.232	0.184	cPAH	0.48
Benzo(g,h,i)perylene	0.151	0.113	NS	NS
Benzo(k)fluoranthene	0.208	0.156	cPAH	NS
Chrysene	0.263	0.206	cPAH	0.14
Dibenz(a,h)anthracene	0.0521	0.0365	0.12	NS
Fluoranthene	0.497	0.412	2,390	88.9
Fluorene	0.0141 J	0.0113 J	2,390	14.8
Indeno(1,2,3-cd)pyrene	0.145	0.112	cPAH	NS
Naphthalene	0.0146 J	0.0222 J	5.52	0.66
Phenanthrene	0.262	0.249	NS	NS
Pyrene	0.417	0.35	1,790	55
Results of Modified RCL Spreadsheet				
Cumulative cPAHs Cancer (DC)	2.90E-06	2.30E-06		
Number of Individual Exceedances (DC)*	0	0		
Cumulative hazard index	0.0133	0.0106		
Cumulative cancer risk	2.90E-06	2.30E-06		

Notes:
All units are milligrams per kilogram (mg/kg).
Underlined values exceed a soil-to-groundwater pathway RCL
Bold values exceed an industrial direct contact RCL
NS = No established standard
* Direct Contact RCLs for six cPAHs are not consisdered on the modified spreadsheet.
Only the cumulative cPAH cancer risk is calculated for these compounds.

NR 722 Direct-Contact ***Exceedance*** - ***Hazard*** - ***Risk*** Calculation Summary from Soil Data (Exclusive Cumulative-only Assessment of cPAHs)

Note: This Summary is OLD. Update with 'Get Summary' in Row 924 of the applicable *_DC_RCLs tab.

BRRTS # :	# of Soil-Concentration Entries:	18	(Cumulative) cPAH Cancer Risk	Number of Individual Exceedance	(Cumulative) Hazard Index	(Cumulative) Cancer Risk
Type BRRTS No. Here (If Known)	#02-36-578316		2.9E-06	0	0.0133	2.9E-06
Bore LSB-2 (3')	Bottom-Line:		Yes, levels are below direct-contact concern.			

Date of Entry: 4/11/2019.
Date of Worksheet Used: 03/14/2017.

List below only has contaminants with data.

Contaminant	CAS Number	NC RCL (mg/kg)	C RCL (mg/kg)	Not-To-Exceed D-C RCL (mg/kg)	Basis	BTV (mg/kg)	INPUTTED Site Data (mg/kg)	cPAH Cancer Risk from Data	Flag E = Individual Exceedance!	Hazard Quotient (HQ) from Data	Cancer Risk (CR) from Data
Naphthalene	91-20-3	178.	5.52	5.52	ca		0.0146			0.0001	2.6E-09
Benzo[a]pyrene	50-32-8	17.8	0.115	0.115	ca		0.226	1.97E-06	cPAH	0.0127	2.0E-06
Acenaphthene	83-32-9	3,590.	-	3,590.	nc		0.0083			0.	
Acenaphthylene	208-96-8	-	-				0.06				
Anthracene	120-12-7	17,900.	-	17,900.	nc		0.0617			0.	
Benz[a]anthracene	56-55-3	-	1.14	1.14	ca		0.202	1.77E-07	cPAH		1.8E-07
Benzo[b]fluoranthene	205-99-2	-	1.15	1.15	ca		0.232	2.02E-07	cPAH		2.0E-07
Benzo[g,h,i]perylene	191-24-2	-	-				0.151				
Benzo[k]fluoranthene	207-08-9	-	11.5	11.5	ca		0.208	1.81E-08	cPAH		1.8E-08
Chrysene	218-01-9	-	115.	115.	ca		0.263	2.29E-09	cPAH		2.3E-09
Dibenz[a,h]anthracene	53-70-3	-	0.115	0.115	ca		0.0521	4.53E-07	cPAH		4.5E-07
Fluoranthene	206-44-0	2,390.	-	2,390.	nc		0.497			0.0002	
Fluorene	86-73-7	2,390.	-	2,390.	nc		0.0141			0.	
Indeno[1,2,3-cd]pyrene	193-39-5	-	1.15	1.15	ca		0.145	1.26E-07	cPAH		1.3E-07
Methylnaphthalene, 1-	90-12-0	4,180.	17.6	17.6	ca		0.0099			0.	5.6E-10
Methylnaphthalene, 2-	91-57-6	239.	-	239.	nc		0.0118			0.	
Phenanthrene	85-01-8	-	-				0.262				
Pyrene	129-00-0	1,790.	-	1,790.	nc		0.417			0.0002	

NR 722 Direct-Contact ***Exceedance*** - ***Hazard*** - ***Risk*** Calculation Summary from Soil Data (Exclusive Cumulative-only Assessment of cPAHs)

Note: This Summary is OLD. Update with 'Get Summary' in Row 924 of the applicable *_DC_RCLs tab.

BRRTS # :	# of Soil-Concentration Entries:	18	(Cumulative) cPAH Cancer Risk	Number of Individual Exceedance	(Cumulative) Hazard Index	(Cumulative) Cancer Risk
Type BRRTS No. Here (If Known)	#02-36-578316		2.3E-06	0	0.0106	2.3E-06
Bore LSB-4 (2-4')	Bottom-Line:		Yes, levels are below direct-contact concern.			

Date of Entry: 4/11/2019.
Date of Worksheet Used: 03/14/2017.

List below only has contaminants with data.

Contaminant	CAS Number	NC RCL (mg/kg)	C RCL (mg/kg)	Not-To-Exceed D-C RCL (mg/kg)	Basis	BTV (mg/kg)	INPUTTED Site Data (mg/kg)	cPAH Cancer Risk from Data	Flag E = Individual Exceedance!	Hazard Quotient (HQ) from Data	Cancer Risk (CR) from Data
Naphthalene	91-20-3	178.	5.52	5.52	ca		0.0222			0.0001	4.0E-09
Benzo[a]pyrene	50-32-8	17.8	0.115	0.115	ca		0.179	1.56E-06	cPAH	0.0101	1.6E-06
Acenaphthene	83-32-9	3,590.	-	3,590.	nc		0.0092			0.	
Acenaphthylene	208-96-8	-	-				0.0398				
Anthracene	120-12-7	17,900.	-	17,900.	nc		0.0575			0.	
Benz[a]anthracene	56-55-3	-	1.14	1.14	ca		0.163	1.43E-07	cPAH		1.4E-07
Benzo[b]fluoranthene	205-99-2	-	1.15	1.15	ca		0.184	1.60E-07	cPAH		1.6E-07
Benzo[g,h,i]perylene	191-24-2	-	-				0.113				
Benzo[k]fluoranthene	207-08-9	-	11.5	11.5	ca		0.156	1.36E-08	cPAH		1.4E-08
Chrysene	218-01-9	-	115.	115.	ca		0.206	1.79E-09	cPAH		1.8E-09
Dibenz[a,h]anthracene	53-70-3	-	0.115	0.115	ca		0.0365	3.17E-07	cPAH		3.2E-07
Fluoranthene	206-44-0	2,390.	-	2,390.	nc		0.412			0.0002	
Fluorene	86-73-7	2,390.	-	2,390.	nc		0.0113			0.	
Indeno[1,2,3-cd]pyrene	193-39-5	-	1.15	1.15	ca		0.112	9.74E-08	cPAH		9.7E-08
Methylnaphthalene, 1-	90-12-0	4,180.	17.6	17.6	ca		0.0094			0.	5.3E-10
Methylnaphthalene, 2-	91-57-6	239.	-	239.	nc		0.0132			0.0001	
Phenanthrene	85-01-8	-	-				0.249				
Pyrene	129-00-0	1,790.	-	1,790.	nc		0.38			0.0002	