

Sustainable In-Situ Remediation Co-operative Alliance

Effects Driven Assessment and Management of Complex Operating Sites Results of Initial Field Investigation

Patrick Campbell, Steven Siciliano, Kris Bradshaw, Rachel Peters, Natacha Hogan, Markus Hecker, Mark Hanson

Presenting Members



Complex site

What makes up a complex site?

- Long and complex industrial history
- Limited knowledge of potential contaminants
- Apparent inconsistent spatial distribution of chemical constituents across site
- Constituents form highly complex mixtures affecting subsurface soil and groundwater
- Chemical mixtures consist of parent compounds are break-down products
- Traditional analytical chemistry methods not effective
- No regulatory guidelines or toxicology information
- Subsurface conditions are difficult to assess





Introduction







Managing a Complex Site

Typical Management Process

- 1. Identify areas of concern.
- 2. Identify contaminants of concern.
- 3. Assess concentrations of contaminants of concern.
- 4. Compare concentrations to Tier 1 guideline values.
- Detailed assessment of contaminants of concern that exceed Tier 1 values.
- 6. Development management plan.

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Areas of Concern

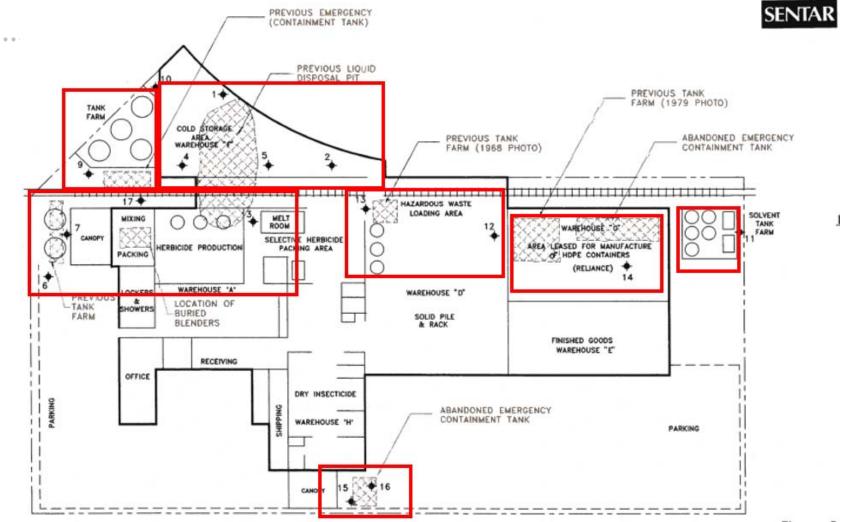


Figure D





Areas of Concern







Assessment work – 2010, 2012, 2013, 2015

2012 Assessment Photos

• Clay soil cores with NAPL. TH7 4.5-6.1 m







Assessment work – 2010, 2012, 2013, 2015

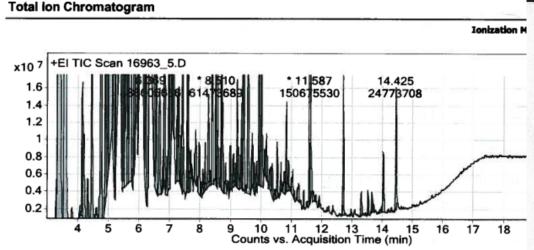
2013 Rail upgrade photos







Initial qualitative analysis



- 130 tentatively identified compounds
- 100 unidentified chemical formulations

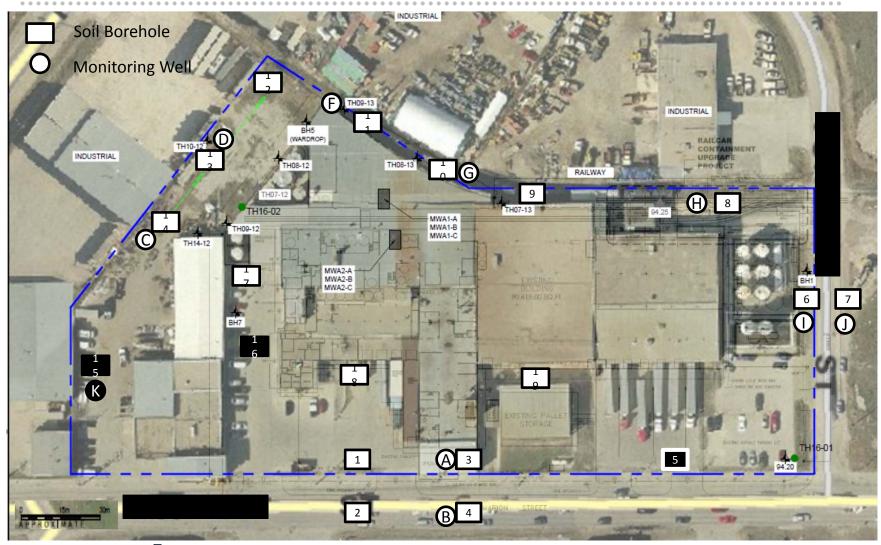
Qualitative Analysis Report						
a %	Tentative Identity					
4 40 202	The state of the s					

22 5.488 3362707 0.32% C11 compound	reak	KI	Area	Area %	Tentative Identity
24 5.635 59575586 5.74% C4 substituted benzene 25 5.68 890666893 8.58% C4 substituted benzene 26 5.815 47887088 0.46% C5 substituted benzene 27 5.853 20046275 0.19% unknown 28 5.886 428568748 1.13% C4 unsaturated substituted benzene 30 5.978 9752124 0.09% unknown 31 6.006 309359344 2.88% C4 substituted benzene + unknown 32 6.058 39008284 0.38% C5 substituted benzene + unknown 33 6.1 12376851 0.12% C5 substituted benzene 34 6.13 45663995 0.44% C5 substituted benzene 35 6.19 94052116 0.91% C5 substituted benzene 36 6.311 37175638 0.36% Chlorophenol 37 6.369 88660565 8.54% Naphthalene 38 6.42 17792069 1.71% C5 substituted benzene 40 6.658 35191516 0.94% C5 substituted benzene 40 6.658 35191516 0.34% C6 substituted benzene 41 6.795 36992964 0.36% C5 substituted benzene 42 6.806 19102503 0.18% (unknown 43 6.89 7243680 0.07% unknown 44 6.499 51924635 0.50% C2 substituted benzene 45 7.03 79913947 0.77% Chlorophenol 46 7.086 13522915 0.13% C2 substituted benzene 47 7.111 10455311 0.10% unknown 48 7.229 22386078 0.229 C5 substituted indane 49 7.267 17973709 0.17% unknown 50 7.347 9946700 0.09% unknown 51 7.372 9622880 0.03% C2 substituted benzene 52 7.405 35006080 0.34% C1 substituted henzene 53 7.427 5580955 0.05% C2 substituted penzene 54 7.568 17561702 0.17% Chlorophethylphenol 55 7.885 23988782 0.29% C3 substituted teaphthalene 56 7.626 7002218 0.09% unknown 57 7.666 8845630 0.09% unknown 58 7.831 2866090 0.34% C1 substituted naphthalene 58 7.831 2866090 0.03% C2 substituted tetrahydronaphthalene 59 7.835 9945126 0.09% (2 substituted tetrahydronaphthalene 60 7.95 12940854 0.12% C5 substituted tetrahydronaphthalene 60 8.531 3.143 9193271 0.09% Unknown 61 8.151 7.372 9.09512 0.09% unknown 62 substituted tetrahydronaphthalene 63 8.143 9193271 0.09% (2 substituted tetrahydronaphthalene 64 8.251 23477431 0.09% (2 substituted tetrahydronaphthalene 65 8.316 2509156 0.02% (2 substituted tetrahydronaphthalene 66 8.537 55142303 0.59% (2 substituted tetrahydronaphthalene 67 8.558 308608083 0.37% (2 substituted tetrahydronaphth	22	5.488	33627077	0.32%	C11 compound
25 5.68 890666893 8.58% C4 substituted benzene 26 5.815 47387068 0.46% C3 substituted benzene 27 5.883 20046275 0.19% unknown 28 5.886 428568748 4.13% C4 unsaturated substituted benzene 29 5.957 16565463 0.16% unknown 30 5.978 9752124 0.09% unknown 31 6.006 309359344 2.88% C4 substituted benzene 32 6.058 39008284 0.38% C5 substituted benzene 33 6.1 12376851 0.12% C5 substituted benzene 34 6.13 45663955 0.44% C5 substituted benzene 35 6.19 94052116 0.91% C5 substituted benzene 36 6.311 37175638 0.36% Chiorophenol 37 6.369 88660555 8.54% Naphthalene 38 6.42 177929069 1.71% C5 substituted benzene 40 6.658 3151516 0.34% C5 substituted benzene 41 6.793	23	5.547	238875253	2.30%	C4 substituted benzene
26 5.815 47387068 0.46% CS substituted benzene	24	5.635	595755586	5.74%	C4 substituted benzene
27 5.853 20046275 0.19% unknown 28 5.886 428568748 4.13% ("d unsaturated substituted benzene 29 5.957 16565463 0.16% unknown 30 5.978 9752124 0.09% unknown 31 6.006 309359384 2.88% ("d substituted benzene" + unknown 32 6.058 39008284 0.38% ("G substituted benzene" + unknown 33 6.1 12376851 0.12% ("G substituted benzene 34 6.13 45663695 0.44% ("G substituted benzene 35 6.19 94052116 0.91% ("G substituted benzene 36 6.311 3717638 0.36% ("Chrophenol") 37 6.369 886605656 8.54% Naphthalene 39 6.531 6.846452 0.61% ("G substituted benzene 40 6.658 35191516 0.34% ("G substituted benzene 41 6.795 36992964 0.36% ("G substituted benzene 42 6.806 19102503 0.18% ("G substituted benzene 44 6.949 51924635 0.07% (unknown 44 6.949 51924635 0.07% (unknown 45 7.03 79913947 0.77% ("Chiorophenol") 46 7.086 13522915 0.13% ("C substituted indane 47 7.111 10455311 0.10% (unknown 48 7.229 22386078 0.22% ("G substituted indane 49 7.267 1797709 0.17% ("Chiorophenol") 50 7.347 9646700 0.99% (unknown 51 7.372 9627898 0.09% ("G substituted indane) 51 7.372 9627898 0.09% ("G substituted naphthalene + unknown 52 7.666 8845630 0.99% ("C substituted naphthalene + unknown 53 7.626 7002218 0.07% (unknown 54 7.568 17561702 0.17% ("G substituted tetrahydronaphthalene + unknown 59 7.863 12940854 0.09% ("G substituted tetrahydronaphthalene + unknown 59 7.865 17561702 0.17% ("G substituted tetrahydronaphthalene + unknown 59 7.865 23988782 0.23% ("G substituted tetrahydronaphthalene + unknown 59 7.866 8845630 0.09% ("G substituted tetrahydronaphthalene + unknown 59 7.866 17561702 0.07% (unknown 59 7.866 8845630 0.09% ("G substituted tetrahydronaphthalene + unknown 59 7.866 17561702 0.07% (unknown 59 7.866 8845630 0.09% ("G substituted tetrahydronaphthalene 50 7.95 12940854 0.09% ("G substituted tetrahydronaphthalene + unknown 59 7.866 8845630 0.09% ("G substituted tetrahydronaphthalene 50 8.51 61473689 0.09% ("G substituted naphthalene 50 8.53 1.343 1932271 0.09% ("G substituted naphthalene 50 8.53 1.343 1932271 0.09% ("G substituted naphthalene 50	25	5.68	890666893	8.58%	C4 substituted benzene
28 5.886 428568748 4.13% C4 unsaturated substituted benzene 29 5.957 16565463 0.16% unknown 30 5.978 9752124 0.09% unknown 31 6.006 309359384 2.98% C4 substituted benzene + unknown 32 6.058 39008284 0.38% C5 substituted benzene 33 6.1 12376851 0.12% C5 substituted benzene 33 6.1 347663695 0.44% C5 substituted benzene 34 6.13 45663695 0.44% C5 substituted benzene 35 6.19 94052116 0.91% C5 substituted benzene 36 6.311 37175638 0.36% Chlorophenol 37 6.369 886605656 8.54% Naphthalene 38 6.42 177929069 1.71% C5 substituted benzene 39 6.535 62846452 0.61% C5 substituted benzene 40 6.658 35191516 0.34% C5 substituted benzene 41 6.795 3699264 0.36% C5 substituted benzene 42 6.806 19102503 0.18% unknown 43 6.89 7243680 0.07% unknown 44 6.949 51924635 0.50% C2 substituted indane 45 7.03 79913947 0.77% Chlorophenol 46 7.086 13522915 0.13% C2 substituted indane 47 7.111 10455311 0.10% unknown 48 7.229 22386078 0.22% C5 substituted benzene 49 7.267 17973709 0.17% Unknown 50 7.347 9646700 0.09% unknown 51 7.372 9627898 0.039% C1 substituted benzene 52 7.666 8845630 0.039% unknown 53 7.427 5580955 0.05% C1 substituted aphthalene 54 7.568 17561702 0.17% C1 substituted naphthalene 55 7.666 8845630 0.09% unknown 56 7.813 2866090 0.03% C2 substituted tetrahydronaphthalene 58 7.813 2866090 0.03% C2 substituted tetrahydronaphthalene 59 7.835 9545126 0.09% unknown 60 7.95 1294084 0.09% unknown 61 8.019 2813119 0.03% unknown 62 substituted tetrahydronaphthalene 63 8.143 9193271 0.09% unknown 64 2.545 23477431 0.09% unknown 65 8.55 1.2477431 0.09% unknown 66 8.575 5.5466 2.259156 0.09% (2 substituted tetrahydronaphthalene 67 8.51 1473689 0.09% (2 substituted tetrahydronaphthalene 68 8.538 38608083 0.37% C2 substituted naphthalene 69 8.565 7290602 0.07% unknown 60 7.95 12940854 0.09% unknown 60 7.95 12940854 0.09% unknown 60 7.95 12940854 0.09% unknown 61 8.019 2813119 0.03% unknown 62 substituted naphthalene 63 8.516 1473689 0.09% (2 substituted naphthalene 64 8.551 24477431 0.09% unknown 65 22 substituted naphthalene 66 8.538 3860808	26	5.815	47387068	0.46%	C5 substituted benzene
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30 5.978 9752124 0.09% unknown 31 6.006 309359384 2.88% C4 substituted benzene + unknown 32 6.058 39008284 0.38% C5 substituted benzene 33 6.1 12376851 0.12% C5 substituted benzene 34 6.13 45663695 0.44% C5 substituted benzene 35 6.19 94052116 0.91% C5 substituted benzene 36 6.311 3775638 0.36% C10orophenol 37 6.369 886605656 8.54% Naphthalene 38 6.42 177929069 1.71% C5 substituted benzene 40 6.658 35191516 0.34% C5 substituted benzene 40 6.658 35191516 0.34% C5 substituted benzene 41 6.795 36992964 0.36% C5 substituted benzene 42 6.806 19102503 0.18% unknown 43 6.89 7243680 0.07% unknown 44 6.949 51924635 0.50% C2 substituted benzene 45 7.03 79913947 0.77% C10ioropmethylphenol 46 7.086 13522915 0.13% C2 substituted indane 47 7.111 10455311 0.10% unknown 48 7.229 22386078 0.22% C5 substituted hane 49 7.267 17973709 0.17% unknown 50 7.347 9646700 0.99% unknown 51 7.372 9627888 0.09% unknown 52 7.405 35006080 0.35% C1 substituted haphthalene 53 7.427 5580955 0.05% C1 substituted haphthalene 54 7.568 17561702 0.17% C1 substituted naphthalene 55 7.666 8845630 0.09% (2 substituted tetrahydronaphthalene 59 7.813 2866090 0.03% C2 substituted tetrahydronaphthalene 60 7.95 12940854 0.09% unknown 61 8.019 2813119 0.03% unknown 62 8.072 7769057 0.09% (2 substituted tetrahydronaphthalene 64 8.251 23477431 0.23% C2 substituted tetrahydronaphthalene 65 8.114 1932271 0.09% Unknown 66 8.537 55142303 0.53% (2 substituted tetrahydronaphthalene 66 8.537 55142303 0.53% (2 substituted tetrahydronaphthalene 67 8.51 61473689 0.09% (2 substituted tetrahydronaphthalene 68 8.53 38608083 0.37% (2 substituted naphthalene 69 8.565 7290602 0.09% unknown 60 9.59% Unknown 60 9.59% Unknown 61 8.515 61473689 0.99% (2 substituted naphthalene 62 substituted naphthalene 63 8.538 38608083 0.37% (2 substituted naphthalene 64 8.251 23477431 0.23% (2 substituted naphthalene 65 8.516 61473689 0.99% unknown 66 8.538 38608083 0.37% (2 substituted naphthalene 67 8.51 61473689 0.99% unknown	28	5.886	428568748	4.13%	C4 unsaturated substituted benzene
31 6.006 309359384 2.98% C4 substituted benzene 4.000 30008284 0.38% C5 substituted benzene 33 6.1 12376851 0.12% C5 substituted benzene 34 6.13 45663695 0.44% C5 substituted benzene 35 6.19 94052116 0.91% C5 substituted benzene 36 6.311 37175638 0.36% C1 C1 C1 C1 C2 C3 C3 C3 C3 C4 C4 C4 C4	29	5.957	16565463	0.16%	unknown
32 6.058 39008284 0.38% CS substituted benzene 33 6.1 12376851 0.12% CS substituted benzene 34 6.13 45663695 0.44% CS substituted benzene 35 6.19 94052116 0.91% CS substituted benzene 36 6.311 37175638 0.36% Chlorophenol 37 6.369 886605656 8.54% Naphthalene 38 6.42 177929069 1.71% CS substituted benzene 39 6.535 62846452 0.61% CS substituted benzene 40 6.658 35191516 0.34% CS substituted benzene 41 6.795 3699264 0.36% CS substituted benzene 42 6.606 19102503 0.18% unknown 43 6.89 7243680 0.07% unknown 44 6.949 51924635 0.50% C2 substituted indane 45 7.03 79913947 0.77% Chloropmethylphenol 46 7.086 13522915 0.13% C2 substituted indane 47 7.1111 10455311 0.10% unknown 48 7.229 22386078 0.22% CS substituted benzene 50 7.347 9646700 0.09% unknown 51 7.372 9627898 0.09% unknown 51 7.372 9627898 0.09% unknown 51 7.372 9627898 0.09% unknown 55 7.566 17561702 0.17% Cl substituted haphthalene 57 7.666 8845630 0.09% (C substituted raphthalene + unknown 58 7.813 2866090 0.34% C1 substituted raphthalene + unknown 59 7.835 9545126 0.09% (C substituted tetrahydronaphthalene 60 7.95 12940854 0.09% (C substituted tetrahydronaphthalene 61 8.019 2813119 0.03% unknown 62 substituted tetrahydronaphthalene 63 7.813 2966090 0.39% (C substituted tetrahydronaphthalene + unknown 64 8.251 23477431 0.23% (C substituted tetrahydronaphthalene 64 8.251 23477431 0.23% (C substituted raphthalene 65 8.366 2599156 0.09% (C substituted raphthalene 66 8.377 55142303 0.53% (C substituted raphthalene 67 8.51 61473689 0.99% (C substituted raphthalene 68 8.538 38608083 0.37% (C substituted raphthalene 69 8.565 7290602 0.07% unknown 60 8.555 7290602 0.07% unknown 61 8.516 61473689 0.99% (C substituted raphthalene 69 8.565 7290602 0.07% unknown 60 9.59% (C substituted raphthalene 60 8.577 55142303 0.53% (C substituted raphthalene	30	5.978	9752124	0.09%	unknown
33 6.1 12376851 0.12% CS substituted benzene 34 6.13 45663995 0.44% CS substituted benzene 35 6.19 94052116 0.91% CS substituted benzene 36 6.311 37175638 0.36% Chlorophenol 37 6.369 886605656 8.54% Naphthalene 38 6.42 177929069 1.71% CS substituted benzene 39 6.535 62846452 0.61% CS substituted benzene 40 6.658 35191516 0.34% CS substituted benzene 41 6.795 36992964 0.36% CS substituted benzene 42 6.806 19102503 0.18% unknown 43 6.89 7243680 0.07% unknown 44 6.949 51924635 0.50% C2 substituted indane 45 7.03 79913947 0.77% Chloropmethylphenol 46 7.086 13522915 0.13% C2 substituted indane 47 7.111 10455311 0.10% unknown 48 7.229 22386078 0.22% CS substituted benzene 49 7.267 17973709 0.17% unknown 50 7.347 9646700 0.09% unknown 51 7.372 9627898 0.09% unknown 52 7.405 35006080 0.34% C1 substituted naphthalene 53 7.427 5580955 0.05% C1 substituted naphthalene 54 7.568 17561702 0.17% C1 substituted naphthalene 55 7.868 17561702 0.17% C1 substituted tetrahydronaphthalene 57 7.666 8845630 0.09% C2 substituted tetrahydronaphthalene 59 7.813 2866090 0.03% C2 substituted tetrahydronaphthalene 60 7.95 12940854 0.12% unknown 61 8.019 2813119 0.03% unknown 62 8.077 7769057 0.09% Unknown 63 8.143 9193271 0.09% C2 substituted tetrahydronaphthalene 64 8.251 23477431 0.23% C2 substituted tetrahydronaphthalene 65 8.316 2509156 0.09% C2 substituted naphthalene 66 8.377 55142303 0.53% C2 substituted tetrahydronaphthalene 67 8.51 61473689 0.09% C2 substituted tetrahydronaphthalene 68 8.338 38608083 0.37% C2 substituted naphthalene 69 8.555 729602 0.07% unknown 60 20 substituted tetrahydronaphthalene 60 7.95 12940854 0.09% C2 substituted naphthalene 60 8.577 55142303 0.53% C2 substituted naphthalene 60 8.537 55142303 0.53% C2 substituted naphthalene	31	6.006	309359384	2.98%	C4 substituted benzene + unknown
34 6.13 45663695 0.44% CS substituted benzene 35 6.19 94052115 0.91% CS substituted benzene 36 6.311 3715638 0.936% Chrorophenol 37 6.369 88660565 8.54% Naphthalene 38 6.42 177929069 1.71% CS substituted benzene 39 6.535 62846452 0.61% CS substituted benzene 40 6.658 35191516 0.34% CS substituted benzene 41 6.795 36992964 0.36% CS substituted benzene 42 6.806 19102503 0.18% unknown 43 6.89 7243680 0.07% unknown 44 6.949 51924635 0.50% C2 substituted indane 45 7.03 79913947 0.77% Chloropmethylphenol 46 7.086 13522915 0.13% C2 substituted indane 47 7.111 10455311 0.10% unknown 48 7.229 22386078 0.22% CS substituted benzene 49 7.267 17973709 0.17% unknown 50 7.347 9646700 0.99% unknown 51 7.372 9627898 0.09% unknown 52 7.405 35006080 0.34% C1 substituted naphthalene 53 7.427 5580955 0.05% C2 substituted naphthalene 54 7.568 17561702 0.17% C1 substituted naphthalene 55 7.666 8845630 0.09% (C2 substituted tetrahydronaphthalene 57 7.666 8845630 0.09% (C2 substituted tetrahydronaphthalene 58 7.813 2866090 0.03% (C2 substituted tetrahydronaphthalene 59 7.835 9545126 0.09% (C2 substituted tetrahydronaphthalene 60 7.95 12940854 0.12% unknown 61 8.019 2813119 0.03% unknown 62 substituted tetrahydronaphthalene 63 8.143 9133271 0.09% (C2 substituted tetrahydronaphthalene 64 8.251 23477431 0.23% (C2 substituted naphthalene 65 8.37 5142309 0.09% unknown 66 8.538 38608083 0.37% (C2 substituted naphthalene 67 8.51 61473689 0.09% (C2 substituted naphthalene 68 8.538 38608083 0.37% (C2 substituted naphthalene 69 8.565 7290602 0.07% unknown 60 0.09% (C2 substituted naphthalene	32	6.058	39008284	0.38%	C5 substituted benzene
35 6.19 94052116 0.91% CS substituted benzene	33	6.1	12376851	0.12%	C5 substituted benzene
36 6.311 37175638 0.36% Chlorophenol	34	6.13	45663695	0.44%	C5 substituted benzene
37 6.369	35	6.19	94052116	0.91%	C5 substituted benzene
37 6.369	36	6.311	37175638	0.36%	Chlorophenol
39 6.535 62846452 0.61% C5 substituted benzene	37	6.369	886605656		
39 6.535 62846452 0.61% CS substituted benzene	38	6.42	177929069	1.71%	C5 substituted benzene
40 6.658 35191516 0.34% CS substituted benzene 41 6.795 36992964 0.36% CS substituted benzene 42 6.806 19102503 0.18% unknown 43 6.89 7243680 0.07% unknown 44 6.949 51924635 0.50% C2 substituted indane 45 7.03 79913947 0.77% Chloropmethylphenol 46 7.086 13522915 0.13% C2 substituted indane 47 7.111 10455311 0.10% unknown 48 7.229 22386078 0.22% CS substituted benzene 49 7.267 17973709 0.17% unknown 50 7.347 9646700 0.09% unknown 51 7.347 9646700 0.09% unknown 52 7.405 35006080 0.34% CI substituted aphthalene 53 7.427 5580955 0.05% Unknown 55 7.568 17561702 0.17% CI substituted haphthalene + unknown 55 7.568 17561702 0.17% C2 substituted tetrahydronaphthalene 56 7.626 7002218 0.07% unknown 57 7.666 8845630 0.09% C2 substituted tetrahydronaphthalene 58 7.813 2866090 0.03% C2 substituted tetrahydronaphthalene + unknown 59 7.835 9545126 0.09% C2 substituted tetrahydronaphthalene 60 7.95 12940854 0.12% unknown 61 8.019 2813119 0.03% unknown 62 8.072 7769057 0.07% unknown 64 8.251 23477431 0.23% C2 substituted tetrahydronaphthalene 65 8.316 2509156 0.09% C2 substituted naphthalene 66 8.377 55142303 0.53% C2 substituted tetrahydronaphthalene 66 8.538 38608083 0.37% C2 substituted naphthalene 67 8.51 61473689 0.59% C2 substituted naphthalene 68 8.538 38608083 0.37% C2 substituted naphthalene 69 8.565 7290602 0.07% unknown 70 8.663 4933310 0.05% C3 substituted naphthalene					
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2017 Assessment work





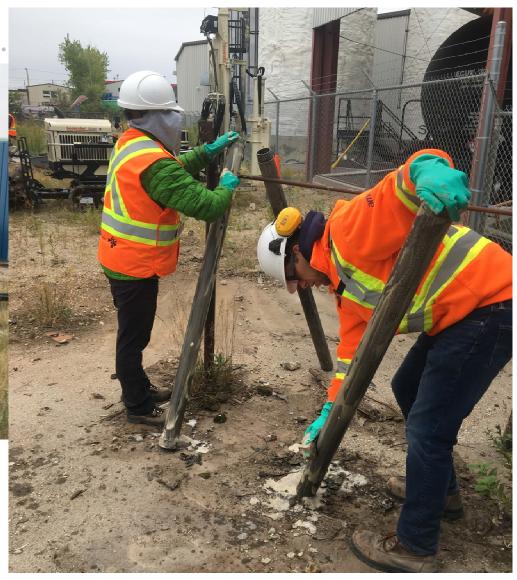
Assessment work - 2017





Assessment work - 2017







What chemicals were present from the assessment process?

- A wide range of parent compounds are present.
- Innumerable metabolites are present.

COPC	Media
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)*	GW
2,4,6-trichlorophenol	GW
2,4-D (2,4-dichlorophenoxyacetic acid)	S, GW
2,4-DB (4-(2,4-dichlorophenoxy)butyric acid)	S, GW
2,4-dichlorophenol	GW
2,4-DP (Dichlorprop)*	GW
2,6-dichlorophenol	GW
3,4-dichlorophenol	GW
Aldrin	GW
Bromacil	GW
Bromoxynil	S, GW
Chlordane	S
Chloroethane*	GW
Chloroform	S
Clopyralid*	S
DDD p,p	GW
DDE p,p	GW
DDT, o, p'	GW
DDT, p,p'	GW
Dicamba	GW
Dieldrin	GW
Dimethoate	GW
Endrin	GW
F1	S
F1-BTEX	S
F2	0

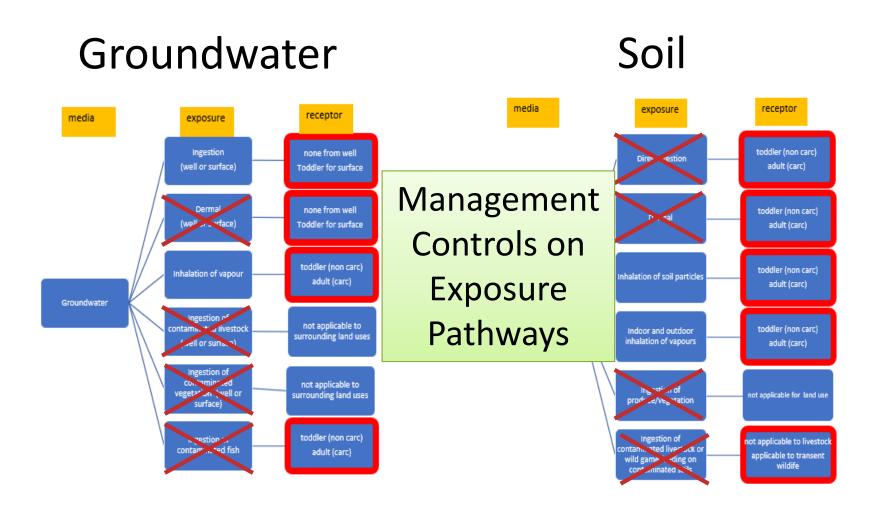
What exposure pathways are active?

MCPA	S, GW
MCPP (mecoprop)*	GW
Metribuzin	GW
Phenol	GW
Solv Esso 100*	S, GW
Solv Esso 150*	S
Treflan (Trifluralin)	S, GW
Trilate/Triallate	GW
Xylene	S, GW





Off Site and Future On Site Exposure Pathways







Complex Operating Site Assessment What is considered volatile?

- 1. Vapour intrusion was only considered for compounds with a Henry's law constant greater than 10⁻⁵ atm m³ mol⁻¹.
- Many contaminants of potential concern were not present in US EPA Johnson and Ettinger model. Surrogates were picked
 - i.e Solv Esso 100, we picked hexane.
- 3. Dust inhalation was assessed for the inhalation and ingestion pathway (many particles are captured in the upper respiratory tract and redirected to the digestive tract).





Contaminants of Potential Concern

Initial Screen

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COPC	Media
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)*	GW
2,4,6-trichlorophenol	GW
2,4-D (2,4-dichlorophenoxyacetic acid)	S, GW
2,4-DB (4-(2,4-dichlorophenoxy)butyric acid)	S, GW
2,4-dichlorophenol	GW
2,4-DP (Dichlorprop)*	GW
2,6-dichlorophenol	GW
3,4-dichlorophenol	GW
Aldrin	GW
Bromacil	GW
Bromoxynil	S, GW
Chlordane	S
Chloroethane*	GW
Chloroform	S
Clopyralid*	S
DDD p,p	GW
DDE p,p	GW
DDT, o, p'	GW
DDT, p,p'	GW
Dicamba	GW
Dieldrin	GW
Dimethoate	GW
Endrin	GW
F1	S
F1-BTEX	S
F2	S
F3*	GW
Heptachlor	GW
Indeno (1,2,3-cd)pyrene	GW
Lindane	S, GW
Malathion	GW
МСРА	s, gw
MCPP (mecoprop)*	GW
Metribuzin	GW
Phenol	GW
Solv Esso 100*	S, GW
Solv Esso 150*	S
Treflan (Trifluralin)	s, gw
Trilate/Triallate	GW
Xylene	S, GW

After Paper Screening

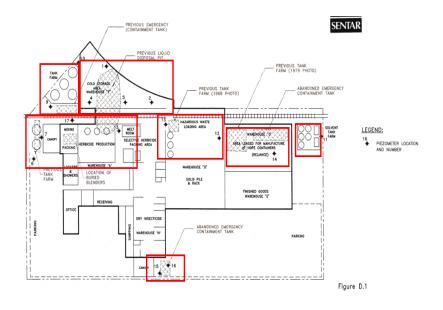
COPC	Media
2,4-D (2,4-dichlorophenoxyacetic acid)	S, GW
2,4-DB (4-(2,4-dichlorophenoxy)butyric	
acid)	S, GW
2,4-dichlorophenol	GW
Benzene	GW
Chloroform	S
Dicamba	GW
DDE p,p	GW
DDT, p,p'	GW
Dimethoate	GW
Dieldrin	GW
Endosulfan	GW
Heptachlor	GW
Napthalene	GW
MCPA	S, GW
Xylene	S, GW





Areas and Metabolites

Which areas pose the greatest concern?



Have we missed the big movers of risk?

- Chemical results do not correspond with impact assessment team's visual recording and were often fragmentary.
- It is simply not possible to screen for all possible metabolites at all locations.
- We need to use in vitro assays.

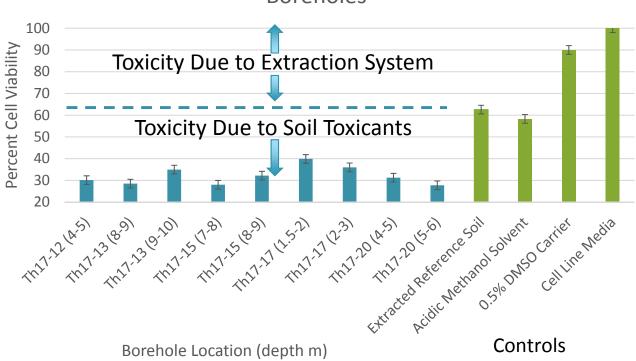




How should we focus our hazard assessment?

Out of 42 chemicals of concern, 28 were known hepato-toxicants (liver). Thus, as an initial screen, we used liver cell lines to screen over 20 boreholes.

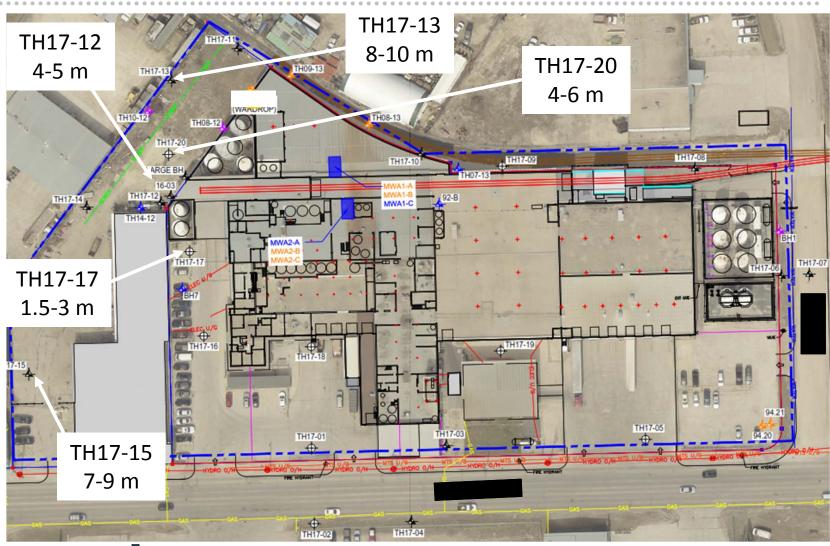
HepG2 72 Hours Exposure to 5 Most Toxic Boreholes







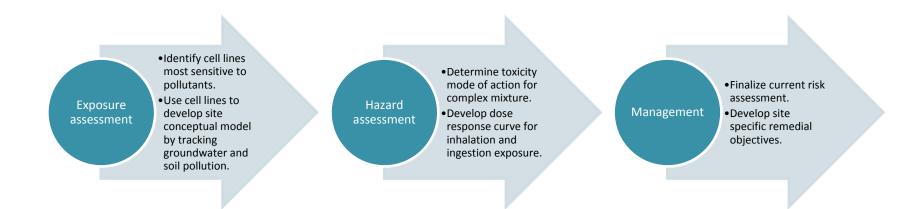
Where are these boreholes on the site?







Next steps (3 to 4 years)



- Results to date identified that the primary risk exposure pathways of concern are vapour inhalation and groundwater.
- Areas of concern are not as spatially dispersed as initially assumed, but may be more localized. However, groundwater models still need additional work after cell lines are developed.







Sustainable In-Situ Remediation Co-operative Alliance



Acknowledgements





