Chlorobenzene Source Evaluation

TRAC Meeting

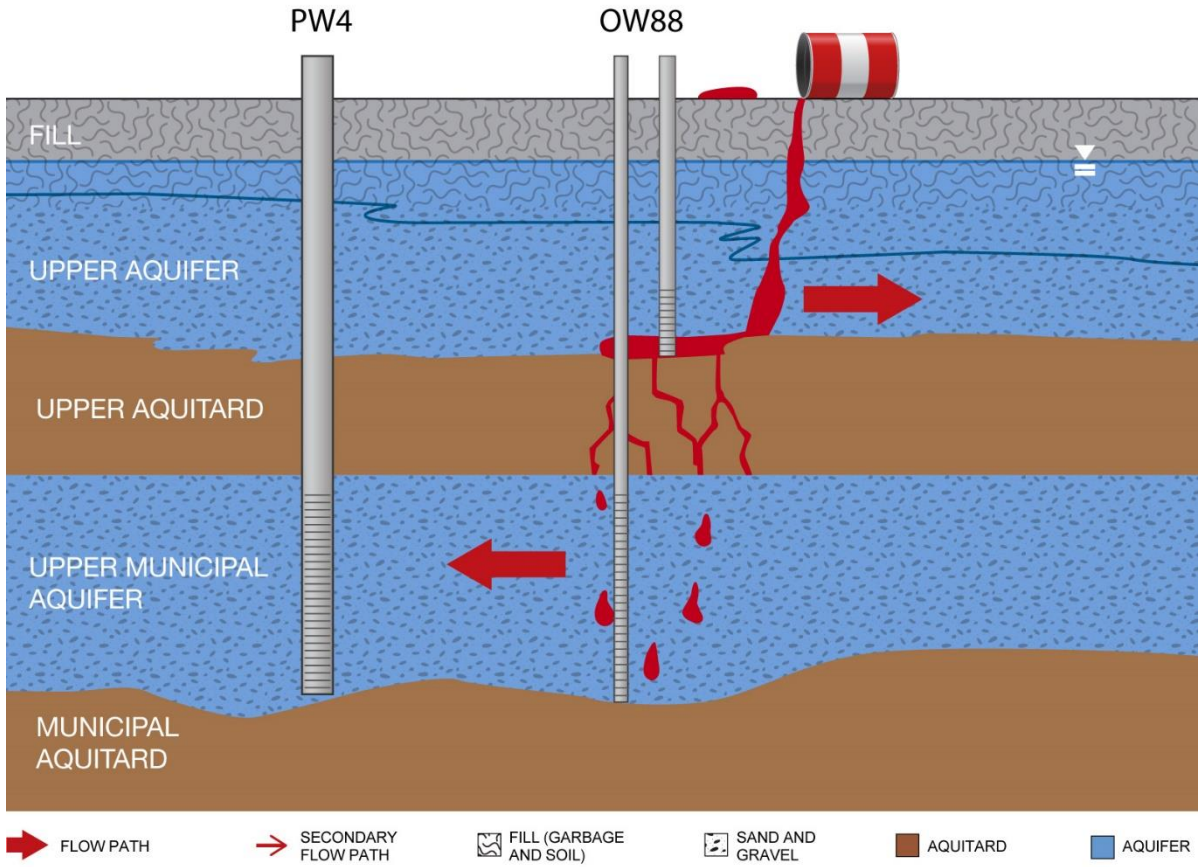
September 12, 2024

Chlorobenzene does not equal DNAPL

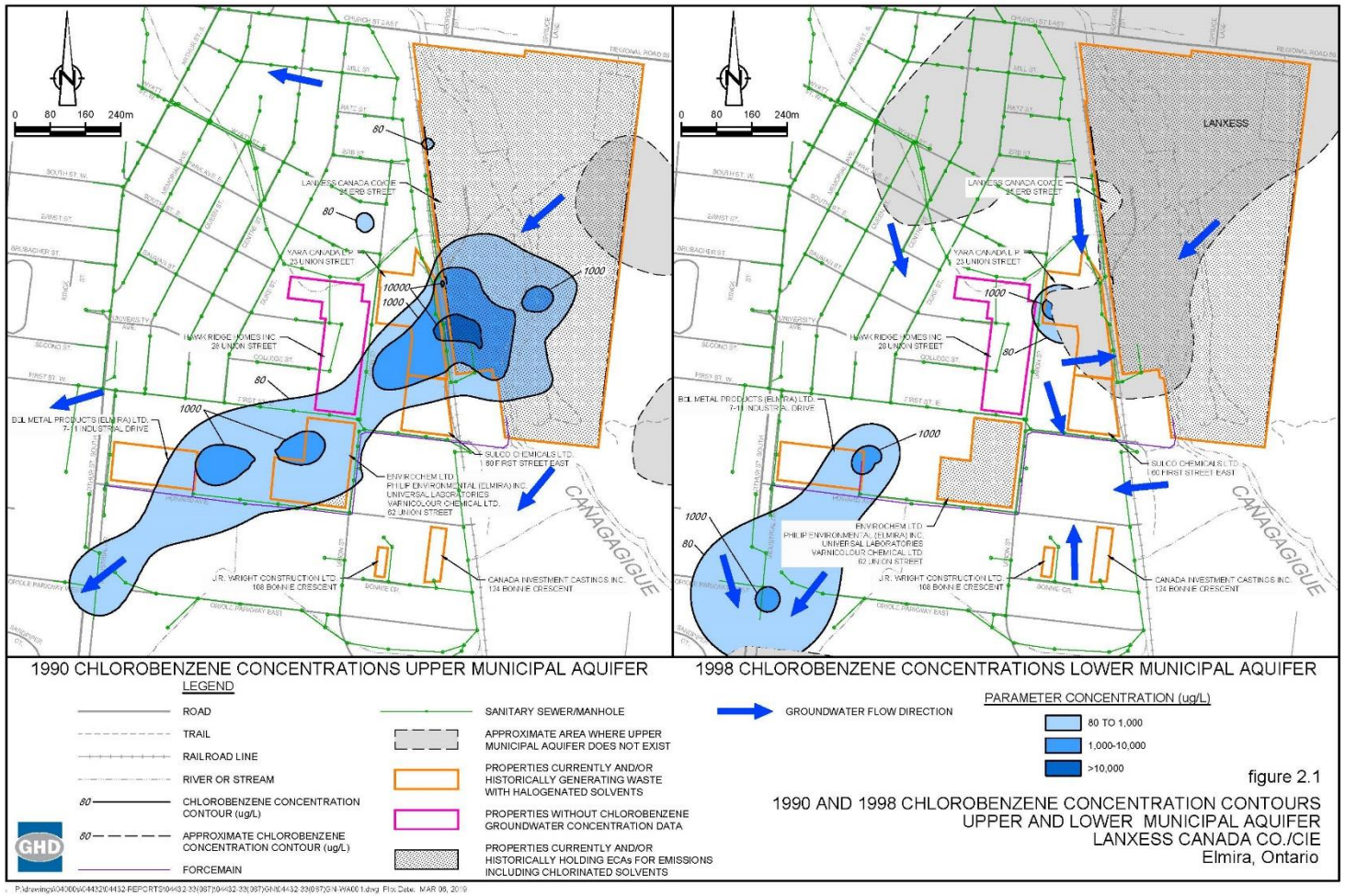
- Chlorobenzene aqueous solubility is 490,000 ug/L
- 1% of aqueous solubility = 4,900 ug/L

"experience has shown that DNAPL may be present up – gradient of a monitoring well displaying sampled groundwater concentrations in excess of 1 per cent of the effective solubility of the component of interest." Environment Agency, June 2003. Illustrated handbook of DNAPL transport and fate in the subsurface.

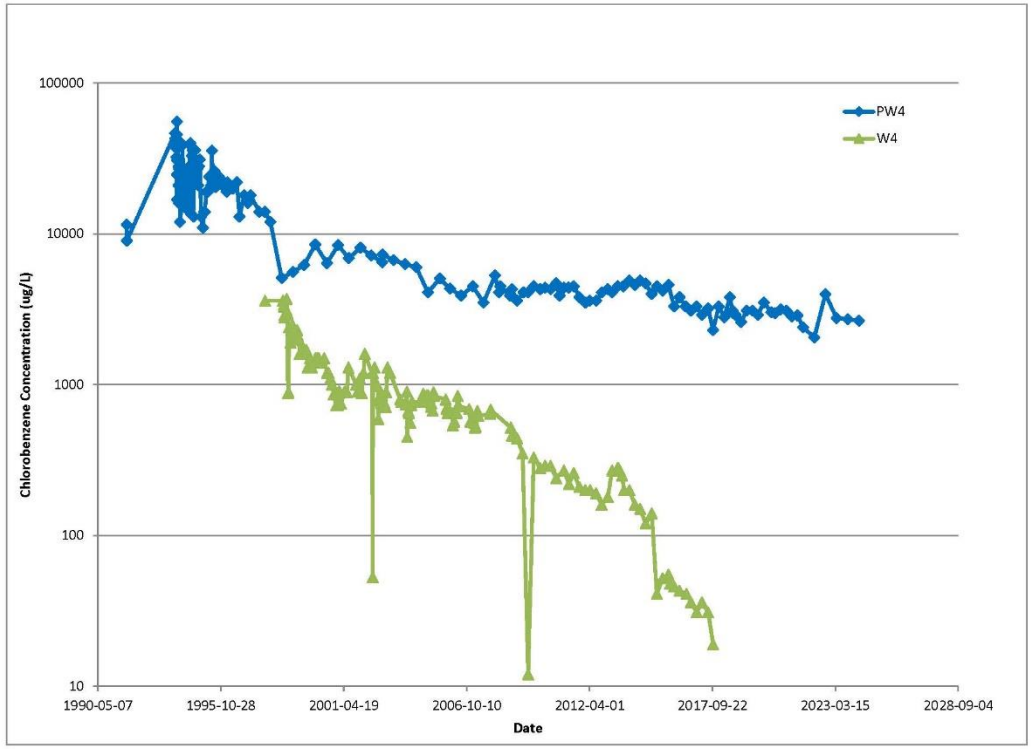
DNAPL at LANXESS



Historic Chlorobenzene Concentrations



Chlorobenzene Concentrations vs. Time



Chlorobenzene Source Evaluation

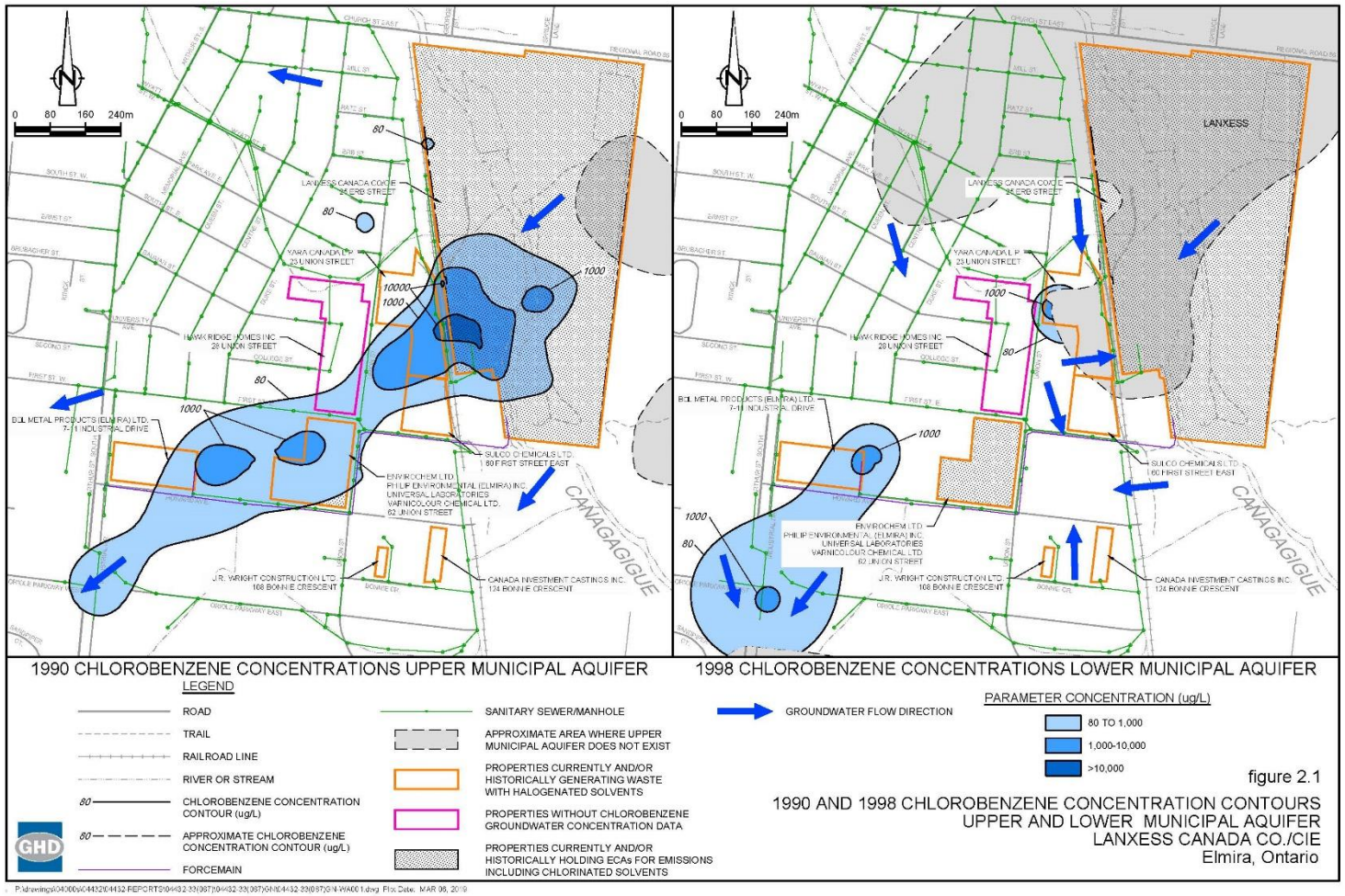
There were four main investigative activities:

- review of historic chlorobenzene users
- installing and sampling a new monitoring well nest
- collecting samples and analyzing them for volatile organic compounds (VOCs)
- collecting samples for isotope analysis

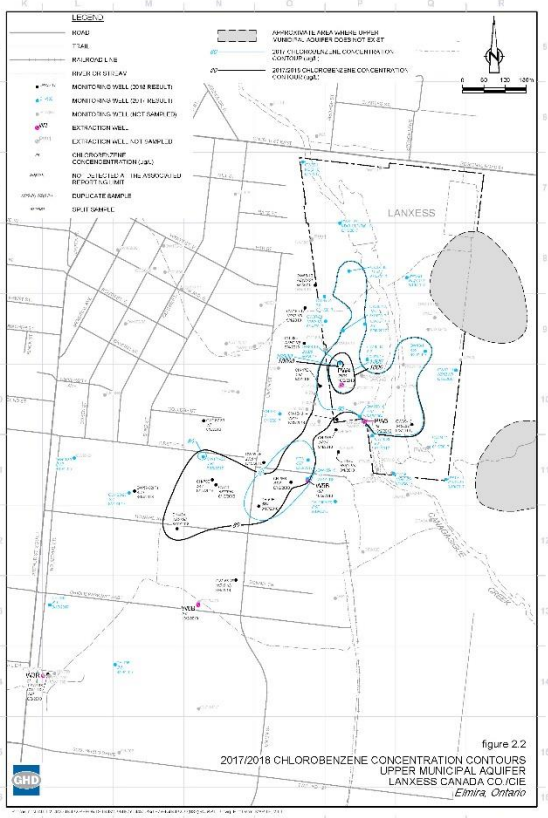
Review of Historic Chlorobenzene Users

- GHD reviewed the Environmental Risk Information Services (ERIS) database for facilities in Elmira that currently use or have used chlorinated solvents in the past.
- Several facilities that handled chlorinated solvents were identified, including the former Varnicolour facility at 84 Howard Ave.

Review of Historic Chlorobenzene Users



New Monitoring Well Nest



New Monitoring Well Nest

- Chlorobenzene was present in groundwater samples collected from new monitoring wells OW187-36 (13 µg/L) and OW187-39 (0.13 µg/L) but at concentrations less than the ODWQS (80 µg/L).
- These data address the gap in the monitoring well network and confirm the absence of additional chlorobenzene mass in the MA north of the existing plume limits.

VOCs Sample Analysis

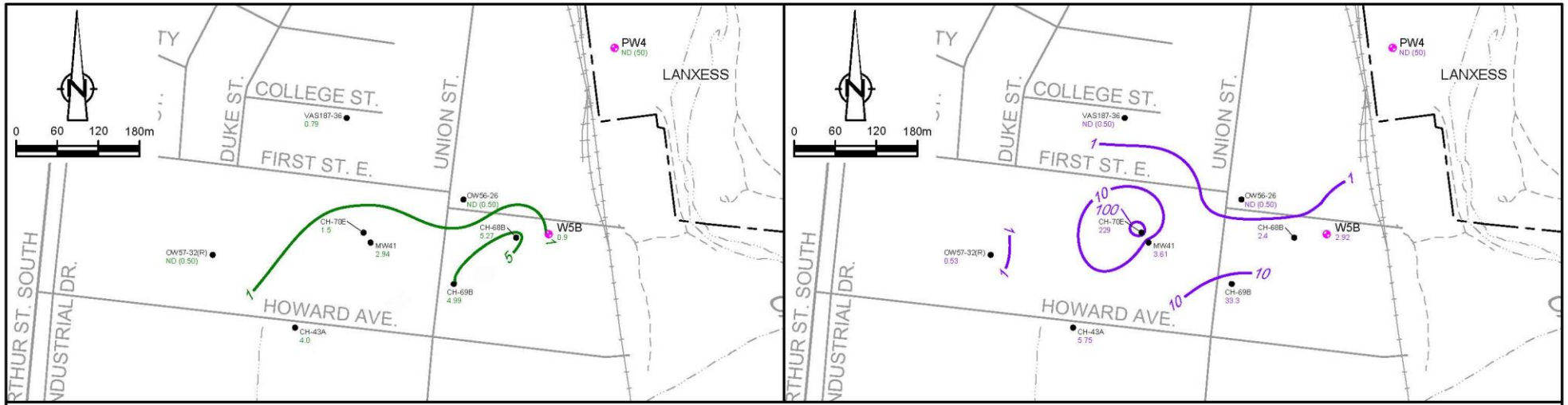
- Peritus ROC for 84 Howard
- In August 2018, Pertius collected groundwater samples from 19 UA, MU and ML monitoring wells plus W5A &W5B and provided the results to GHD
- MW45 is a UA monitoring well located at 84 Howard Ave.
- 1,1-Dichloroethane, cis-1,2-dichloroethene, trichloroethene trans-1,2-dichloroethene and trichloroethene were detected in the sample collected from MW45 completed at 84 Howard Ave.
- Chlorobenzene was not detected in the UA.

VOCs Sample Analysis

Table 2.3

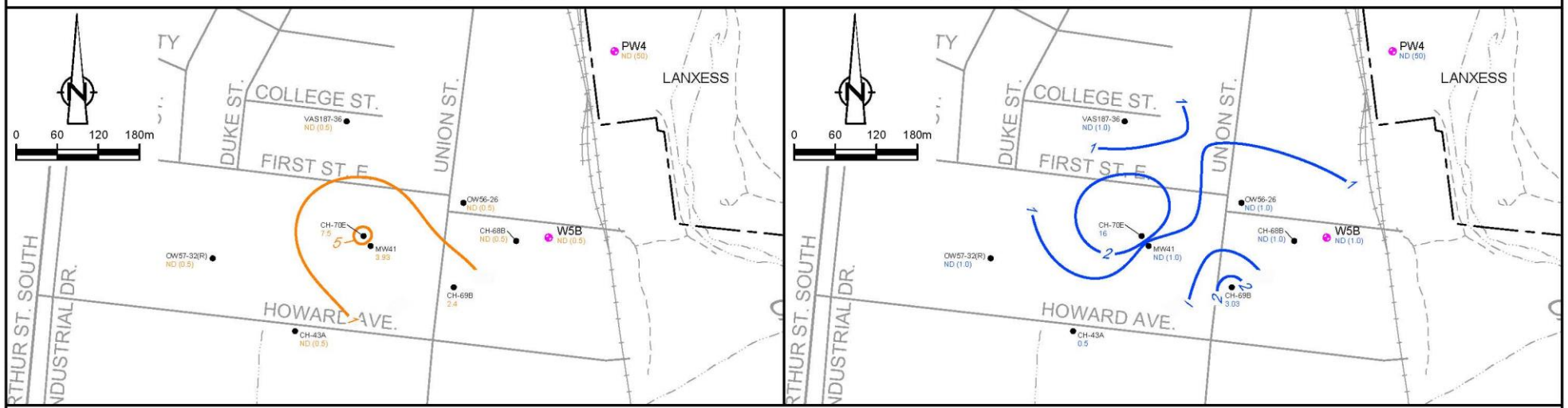
Selected Upper Aquifer VOC Results
Chlorobenzene Source Evaluation
LANXESS Canda Co./Cie
Elmira, Ontario

Sample Location:	Units	CH-43B	CH-43B (Duplicate)	CH-43C	CH-68C	CH-68D	CH-69C	CH-69D	MW45	OW56-16
1,1-Dichloroethane	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	1.87	13	ND(0.50)
1,1-Dichloroethene	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
1,2-Dichloroethane	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(1.0)	ND(0.50)
Benzene	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)
Chlorobenzene	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	1.42	0.67	ND(0.50)	0.72
cis-1,2-Dichloroethene	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	1.85	84	0.92
Tetrachloroethene	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	2.2	ND(0.50)
Trichloroethene	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	22	ND(0.50)
Vinyl chloride	µg/L	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	ND(0.50)	3.27	1.24	ND(1.0)	ND(0.50)



2018 BENZENE CONCENTRATIONS

2018 CIS-1,2-DICHLOROETHENE CONCENTRATIONS



2018 TRICHLOROETHENE CONCENTRATIONS

2018 VINYL CHLORIDE CONCENTRATIONS

LEGEND

- ROAD
- TRAIL
- RAILROAD LINE
- RIVER OR STREAM
- OW56-26 MONITORING WELL (2017 RESULT)
- W5B EXTRACTION WELL
- 1 2018 BENZENE CONCENTRATION CONTOUR (ug/L)
- 1 2018 CIS-1,2-DICHLOROETHENE CONCENTRATION CONTOUR (ug/L)
- 1 2018 TRICHLOROETHENE CONCENTRATION CONTOUR (ug/L)
- 1 2018 VINYL CHLORIDE CONCENTRATION CONTOUR (ug/L)
- 4.99 AVERAGE CONCENTRATION (µg/L)

figure 3.1

2018 BENZENE, CIS-1,2-DICHLOROETHENE, TRICHLOROETHENE AND VINYL CHLORIDE CONCENTRATION CONTOURS
UPPER MUNICIPAL AQUIFER
LANXESS CANADA CO./CIE
Elmira, Ontario

P:\drawings\04000s\04432\04432-REPORTS\04432-33(087)\04432-33(087)GN\04432-33(087)GN-WA002.dwg Plot Date: MAR 06, 2019

VOCs Sample Analysis

- Trichloroethene, cis-1,2-dichloroethene, and vinyl chloride are present in the MU samples
- These VOCs are not COCs at the LANXESS Site.
- 84 Howard Ave appears to be a source of VOCs in the MA, except for chlorobenzene

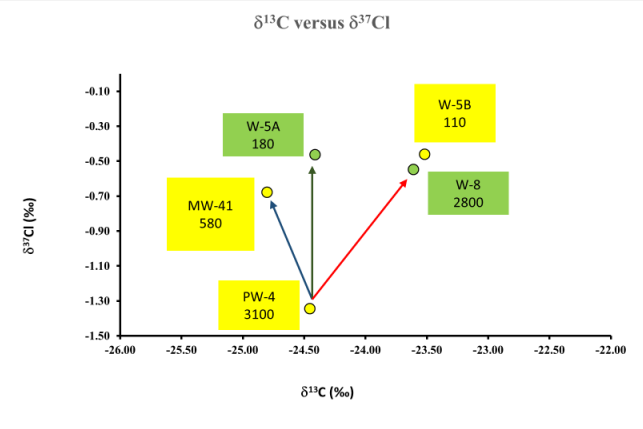
Isotope Sample Analysis

- Groundwater samples from 6 wells were collected for chlorine and carbon isotope analysis to determine if isotopes could be used to detect the presence of multiple sources of chlorobenzene.
- The imperfect relationship between the isotope data suggests that variations are not only caused by a simple transformation process, but that they might be influenced by other processes, including mixing between more than one source or the presence of more than one mechanism of transformation.
- "*This data set is very limited and it is not easy to establish a conclusion based on two or three data points*" Isotope Tracer Technologies Inc, February 2019

Thank You

Isotope Sample Analysis

$\delta^{13}C$ versus $\delta^{37}Cl$



- Generally, by assuming that the isotopic values of PW-4 to be the most representative to one of the original sources of MCB in the study area:
  - The other four points cannot be related to PW-4 unless the different points are either influenced by different conditions that cause them to change isotopically in a different directions or being influenced by mixing between different sources or both scenarios.
  - The presence of other chlorinated solvent or other organic compounds in some parts of the study area, suggest that the site contains more than one plume and possibly more than one source of contaminants.