# Low Level MIP Technology
## from Geoprobe Systems®

Geoprobe®-DI
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# LL MIP Method

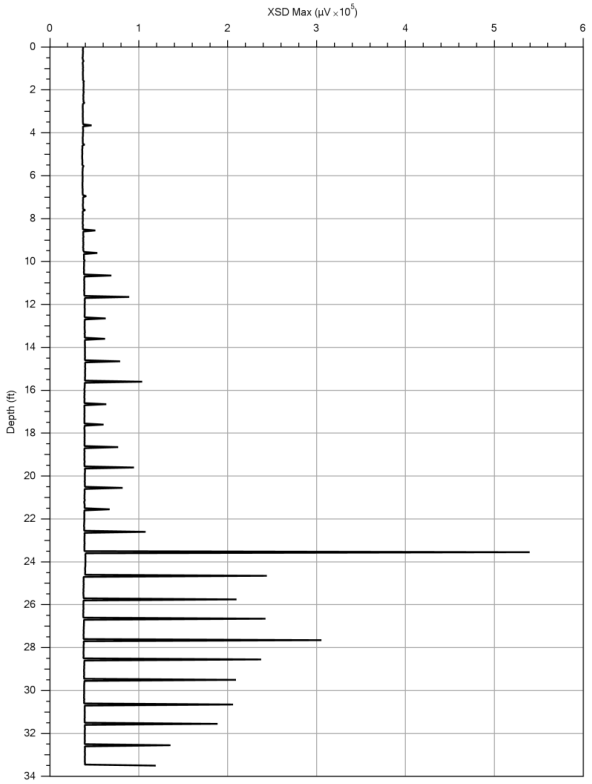
The Low Level (LL) MIP method significantly improves MIP detector sensitivity and signal to noise ratios.

Users will have greater confidence with their results when LL MIP is used where standard MIP detector signals have reached their practical limits.

LL MIP expands the utility of MIP by mapping certain VOC plumes an order of magnitude lower than the standard MIP method.

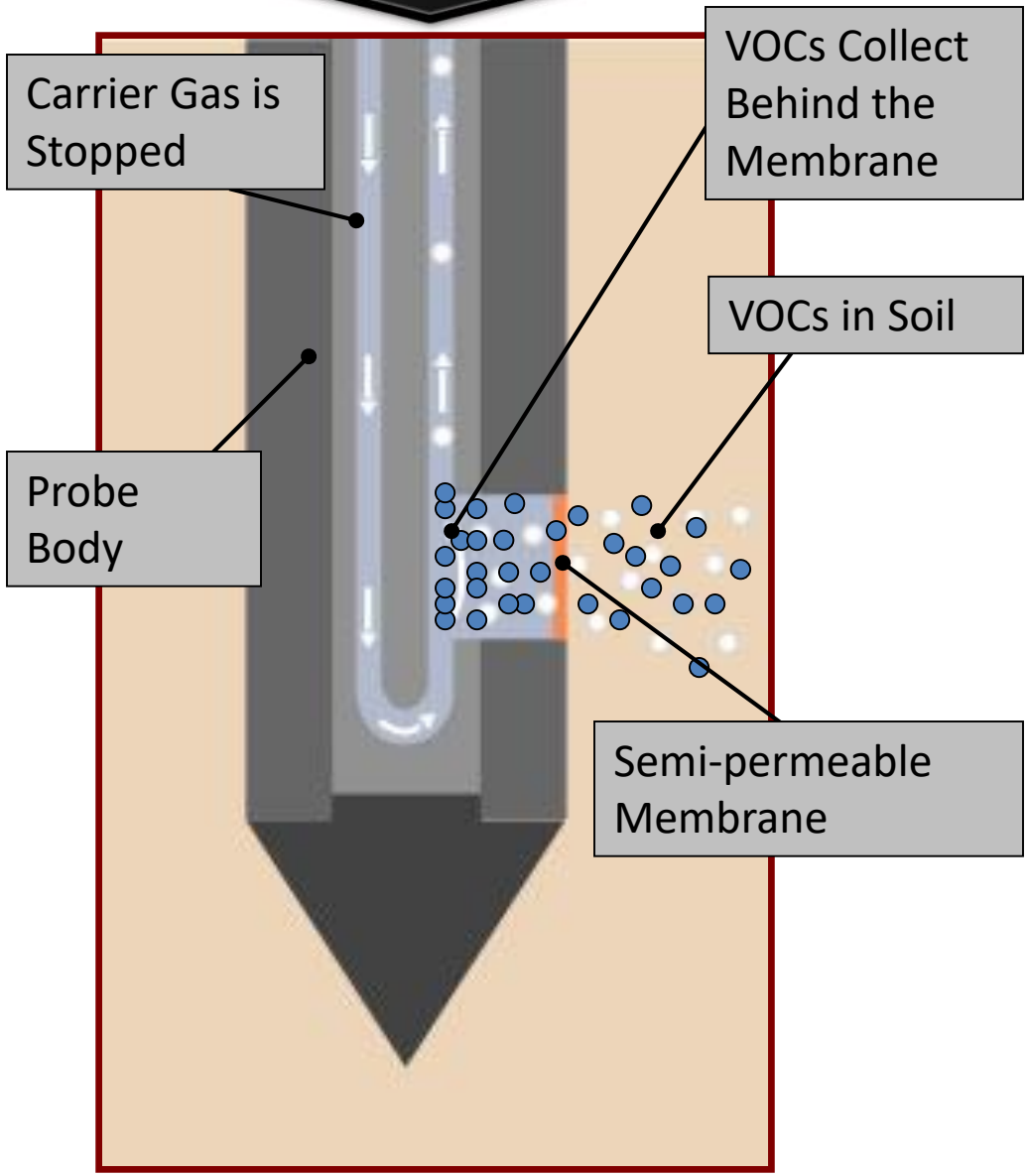
Standard MIP is still required in areas of ample and robust signal.

# LL MIP Technology




- Enhances detector sensitivity ~10x.
- Adaptable to existing FI based MIP systems.
- Operate with any MIP probe or trunkline.
- Method is fully automated in software.
- Simple to switch between methods.

# LL MIP Operation

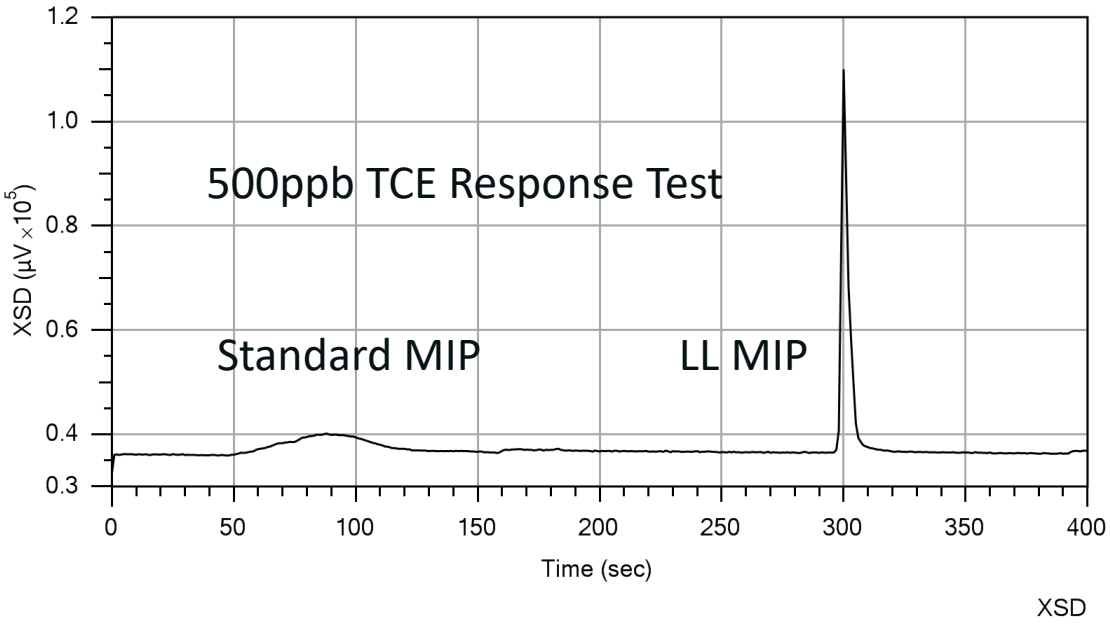



TL carrier flow is stopped.

Under a concentration gradient VOCs move across the membrane via diffusion.

In the LL method, VOCs will accumulate behind the membrane until the TL carrier gas flow is resumed. Then the contaminant mass (peak) is transported to the detectors.

# LL MIP Method




Comparison of 500ppb TCE standard response tests performed by standard MIP and LL MIP methods.

# LL MIP Equipment

Operate LL technology with an FI based MIP system with any standard gas phase detectors.

# LL MIP Equipment


- MIP
- MiHpt
- MIP-CPT
- MIP-HTL

Operate LL MIP technology with any MIP trunkline or MIP tooling package you plan to utilize

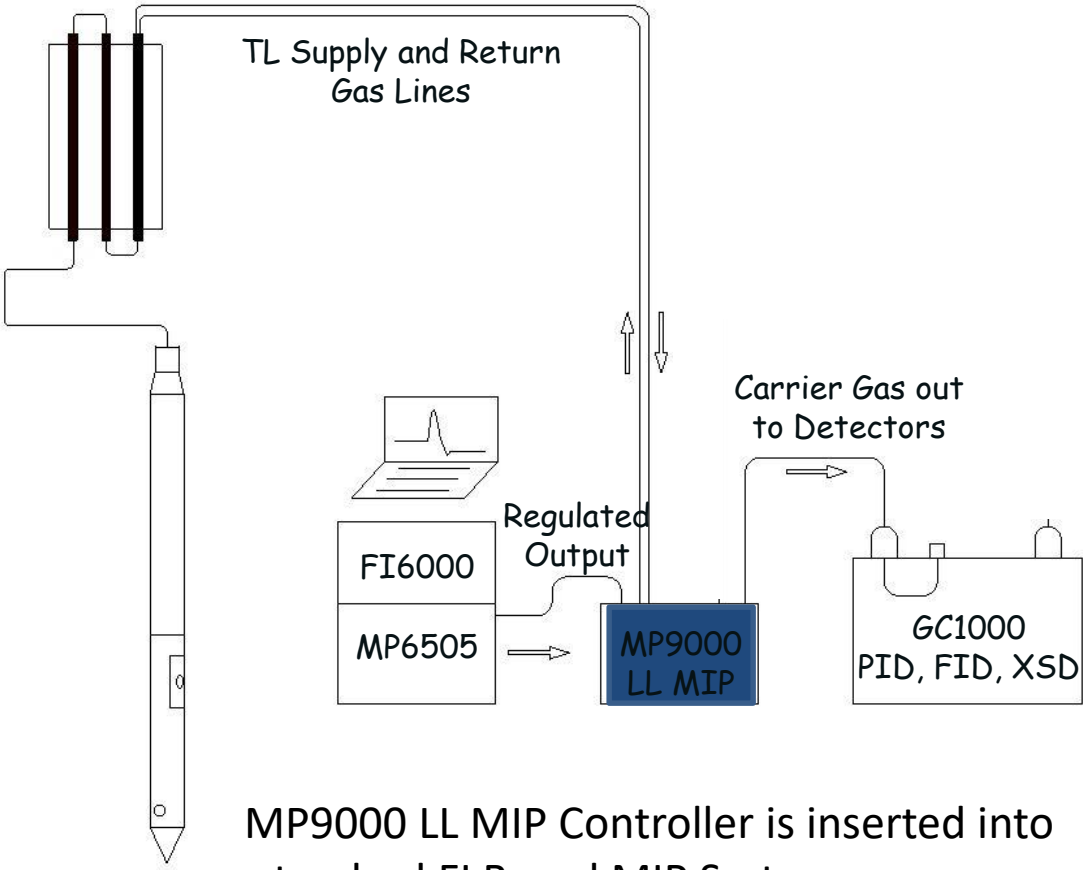
# LL MIP Equipment


LL MIP Controller - MP9000

Only additional piece of equipment needed to operate the LL MIP method.

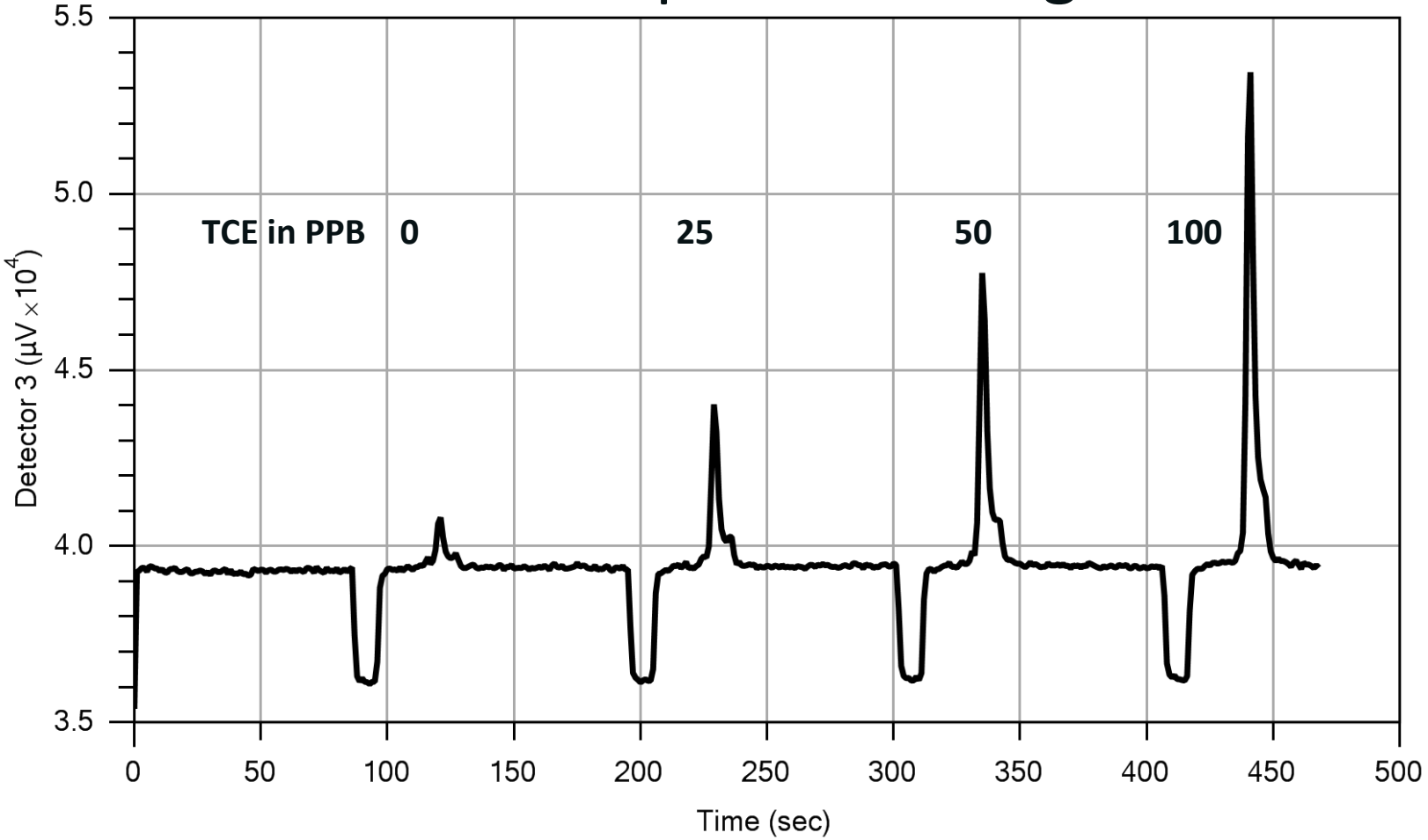
Add this controller to your existing FI based MIP system.

# LL MIP System Setup



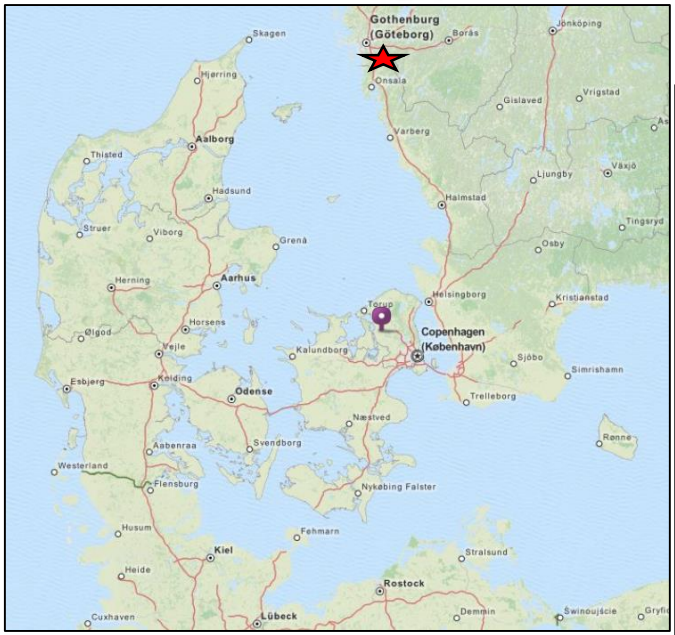

MP9000 LL MIP Controller is inserted into standard FI Based MIP System.

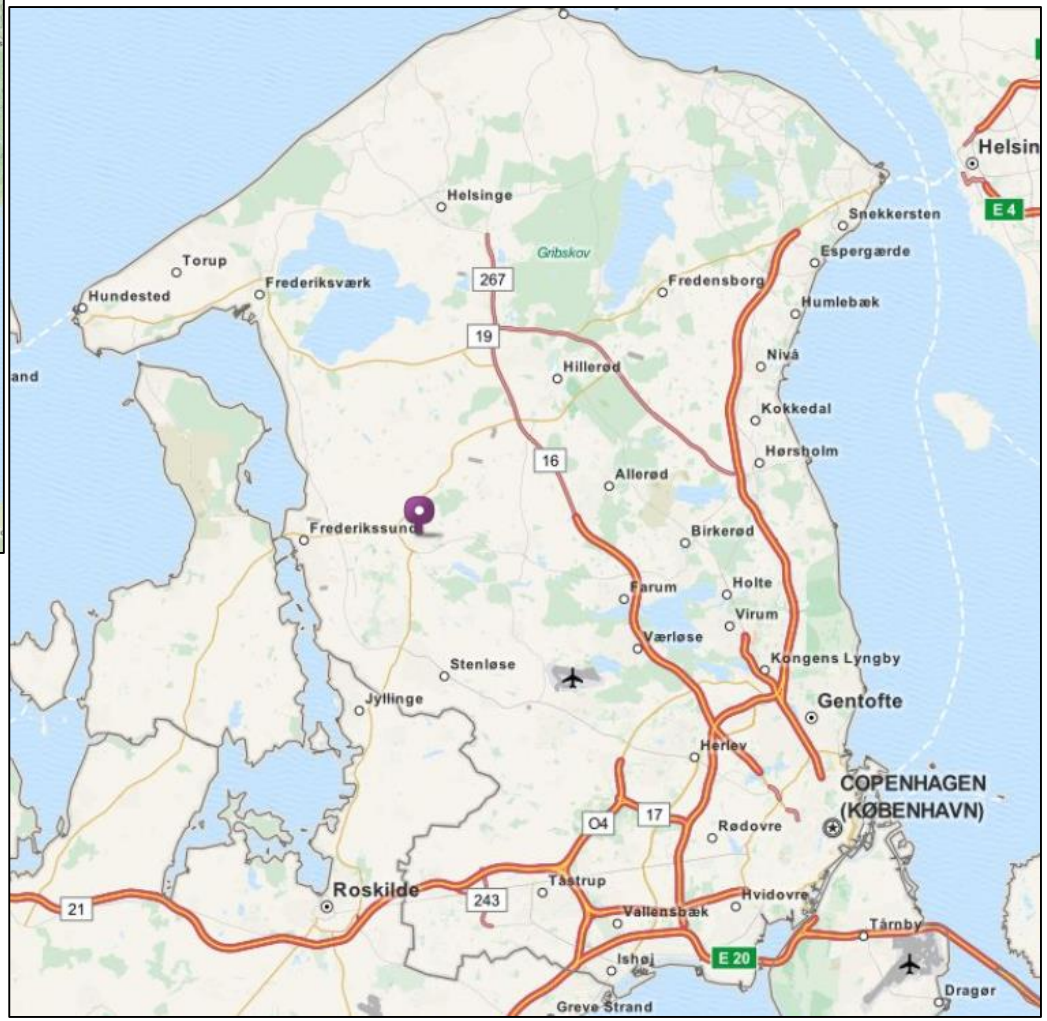
# LL MIP Response Testing




XSD

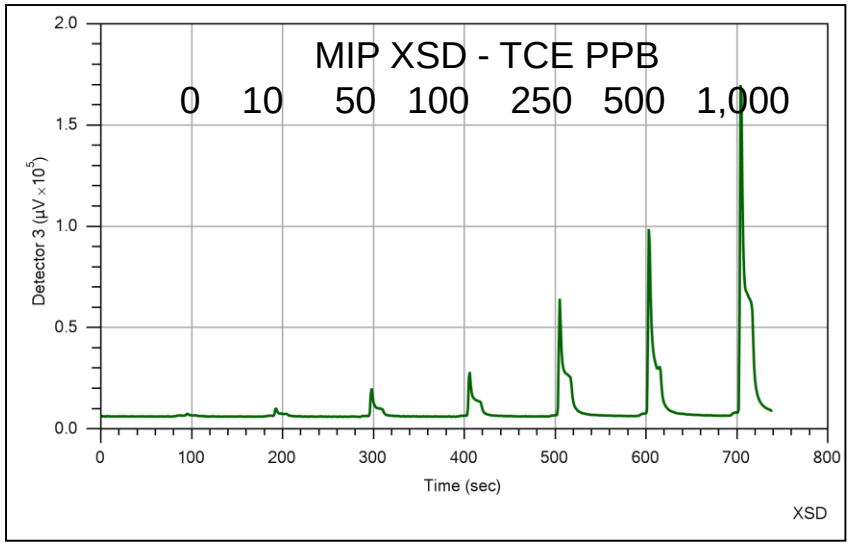
# Field Site Examples
## Slangerup, Denmark




Former Dry Cleaners
Site Contaminants Include:
PCE, TCE

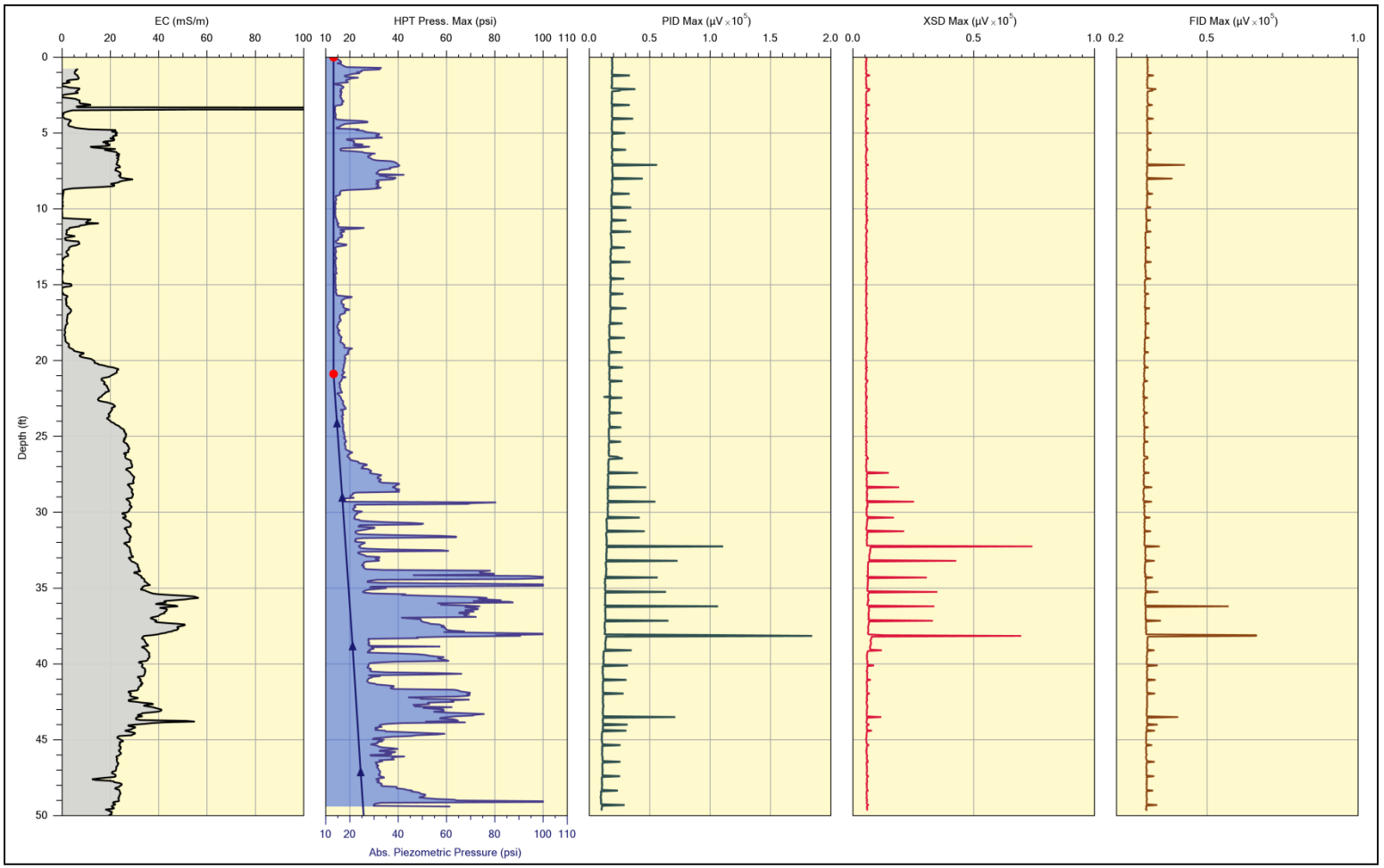
# LL MIP Response Testing



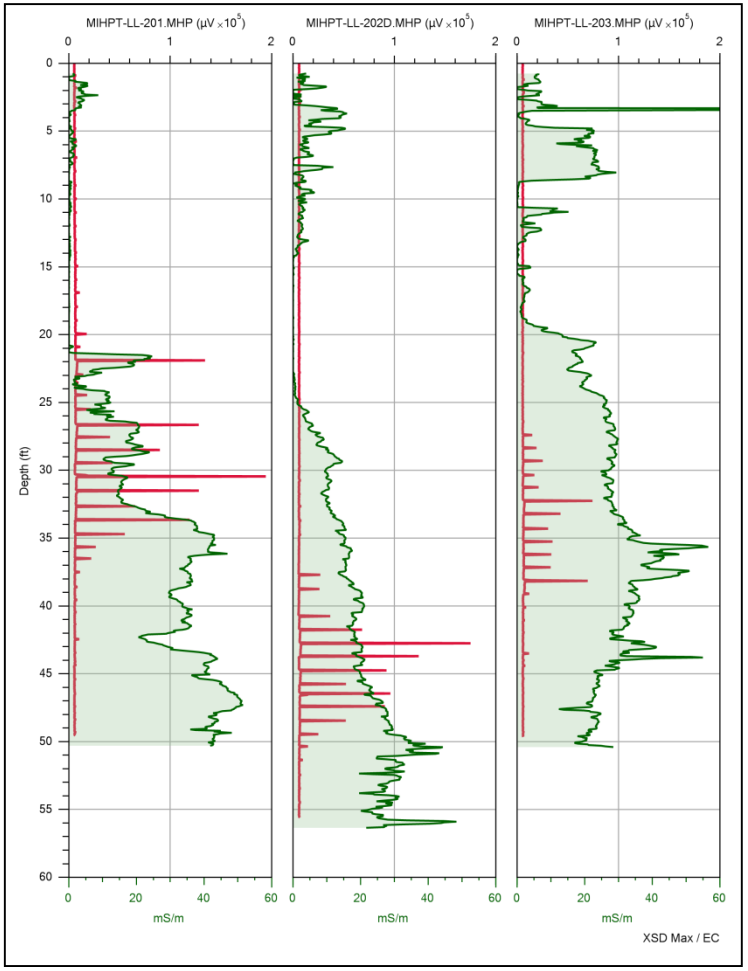

Detection limit study by a Danish LL MIP provider has shown the TCE detectable at 10ppb with the 50ppb response achievable throughout a project based upon surface response tests.

# LL MIP Logs

EC HPT PSI PID XSD FID



# LL MIP Log Cross section



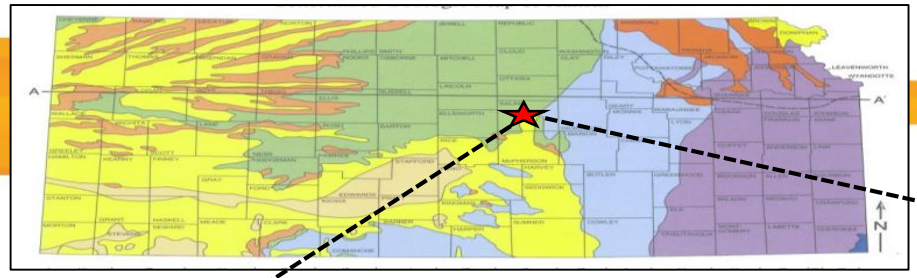

EC vs. XSD response

These 3 logs move away from the source - left to right.

The middle log is approximately 15’ higher in elevation than the other 2 logs.

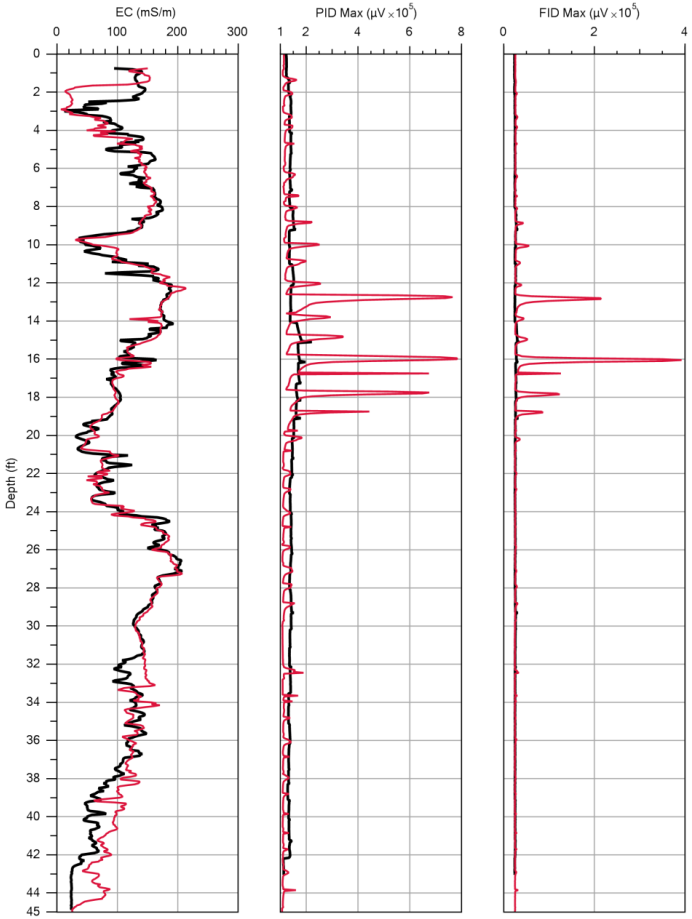
# Field Site Examples

## Salina, KS




Former Gas Station
Petroleum release

# LL MIP Logs



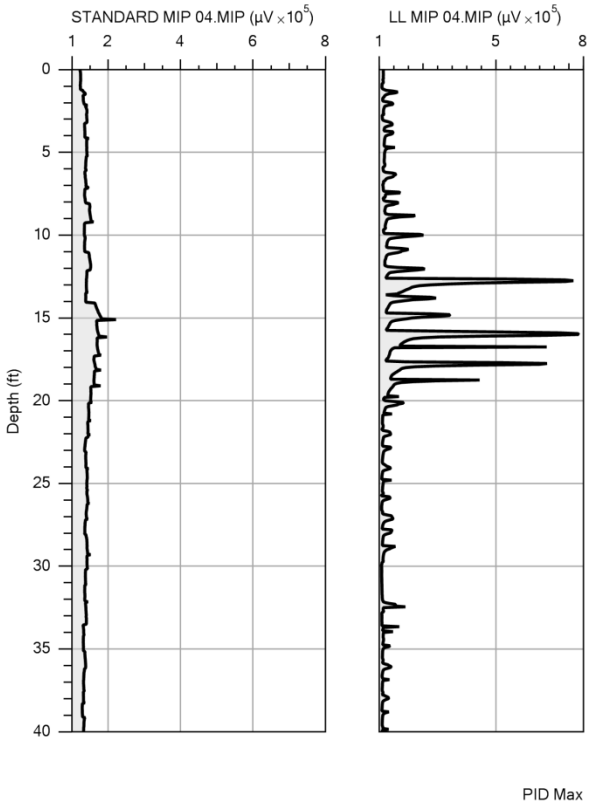

Logs were run on the edge of a hydrocarbon plume

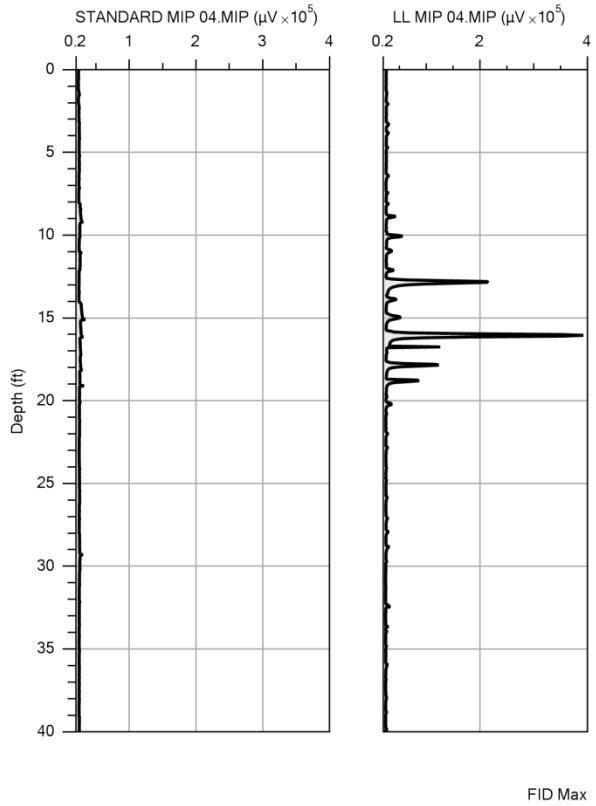
Overlay of:
LL MIP log - red
Standard MIP log - black

Detector response in fine grain lithology

# LL MIP Logs

Close up comparison of the PID & FID responses from the log on previous slide.



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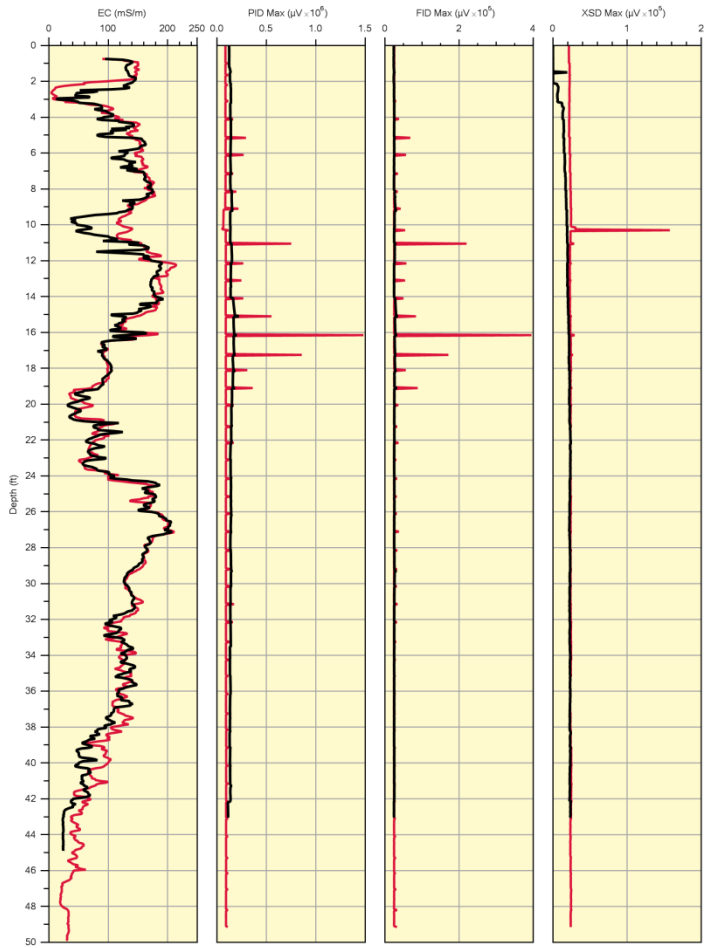


Logs were run on the edge of a hydrocarbon plume.

Overlay of:
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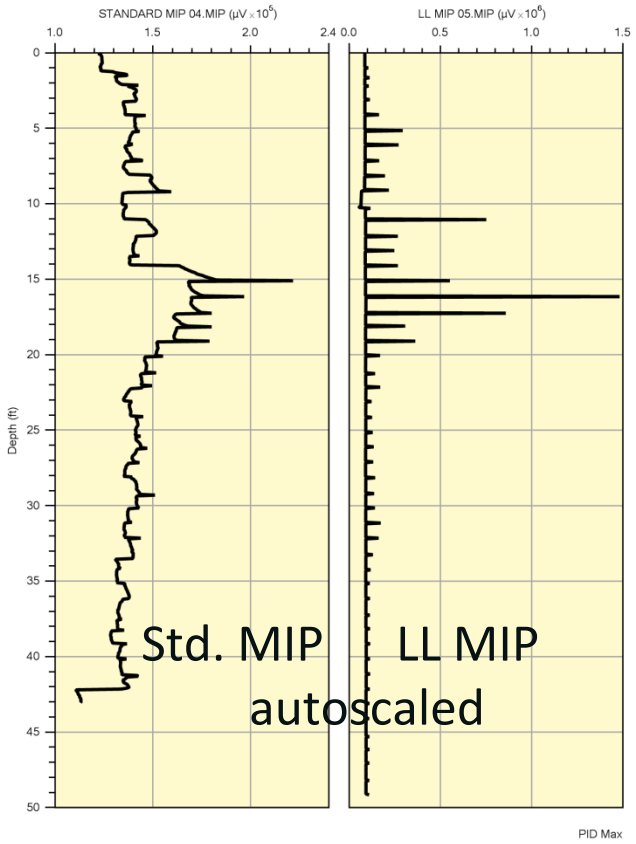
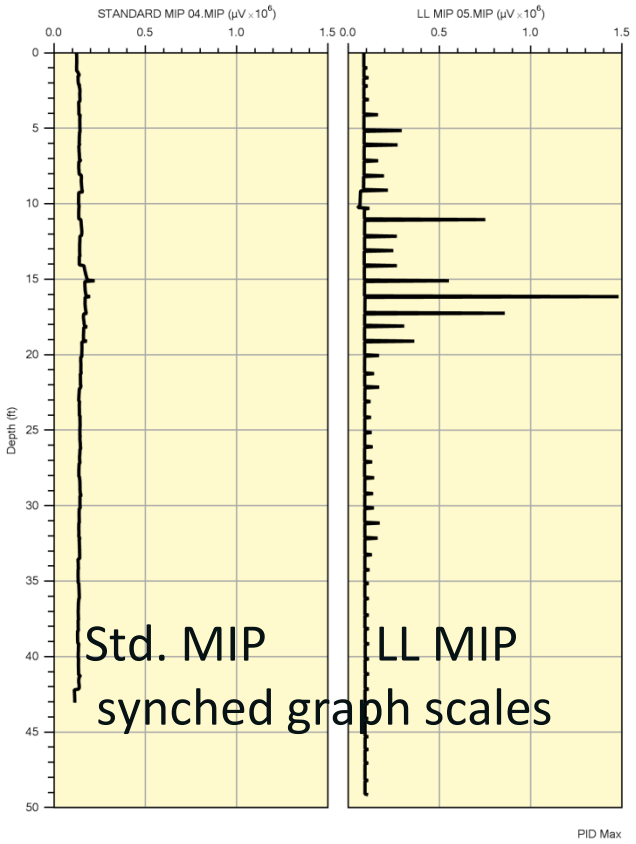
Fine Grain Lithology

# LL MIP Logs

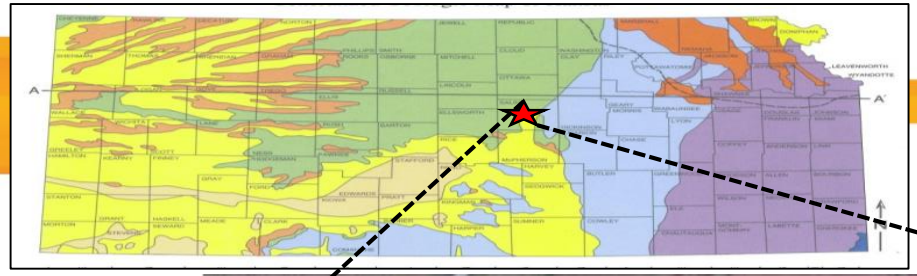
## Standard MIP PID vs. LL MIP PID Response

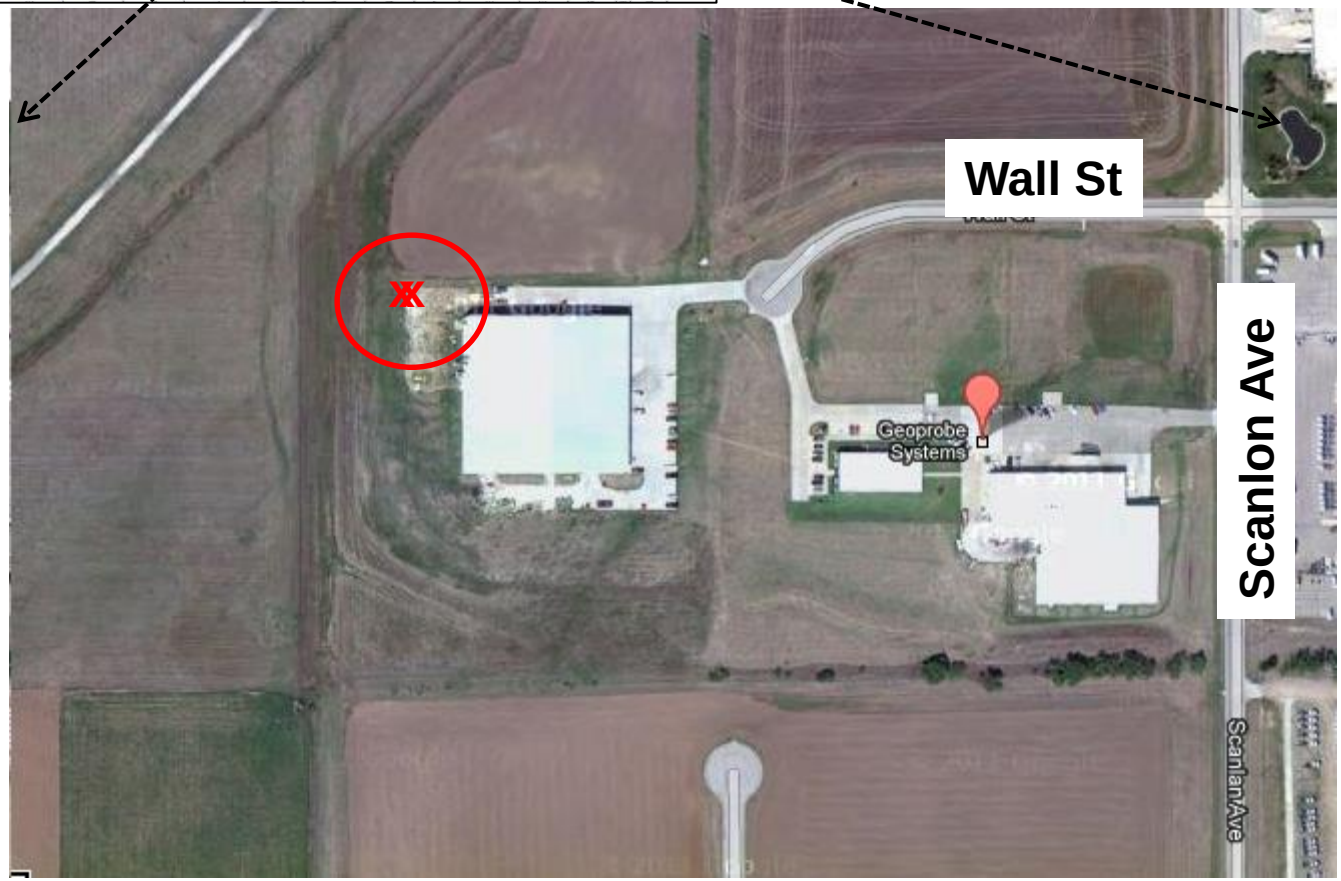


# Field Site Examples

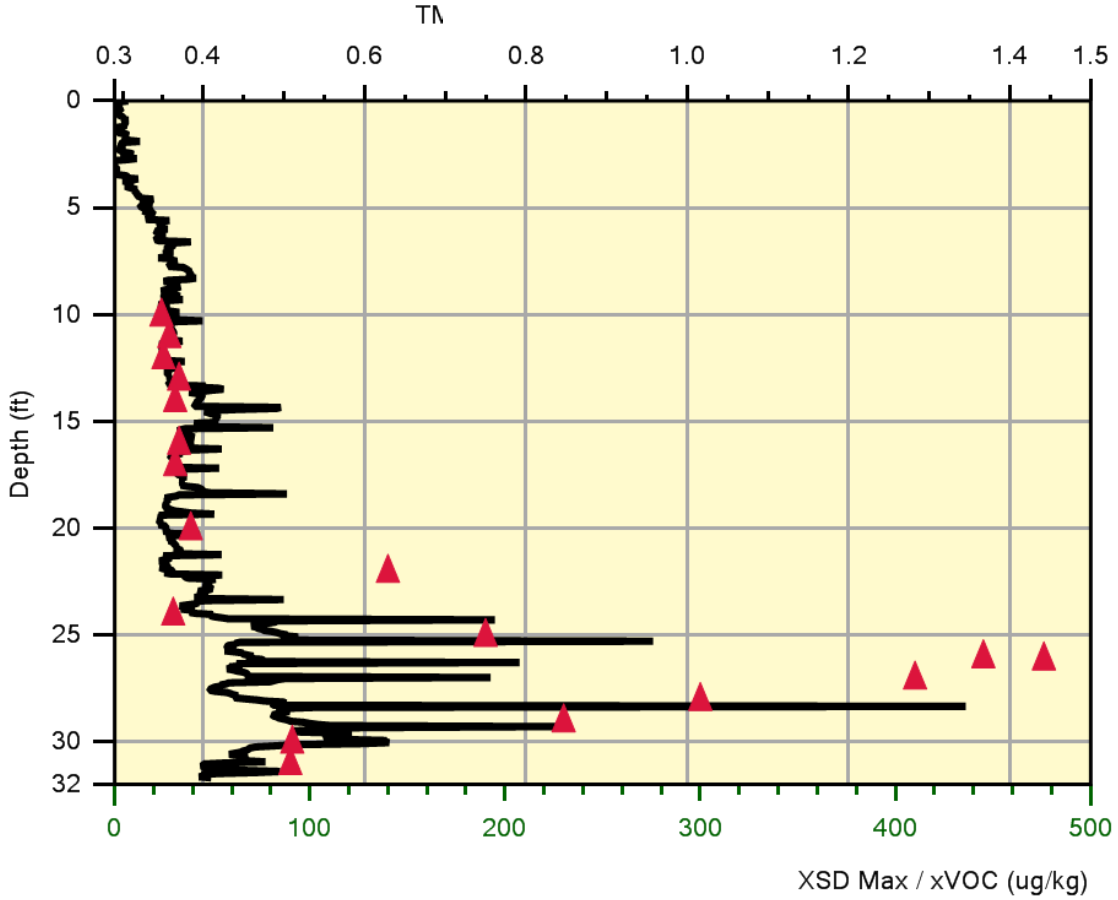
## Salina, KS






Former Military Airfield
Site Contaminants Include Primarily:
TCE, Carbon Tetrachloride

# Standard MIP-XSD Log WS19 with Soil Sample Results




Soil results 10’-20’ are all <50µg/kg

Higher soil results below 20’ correspond with higher detector signal

Soil samples contain TCE and some carbon tetrachloride.

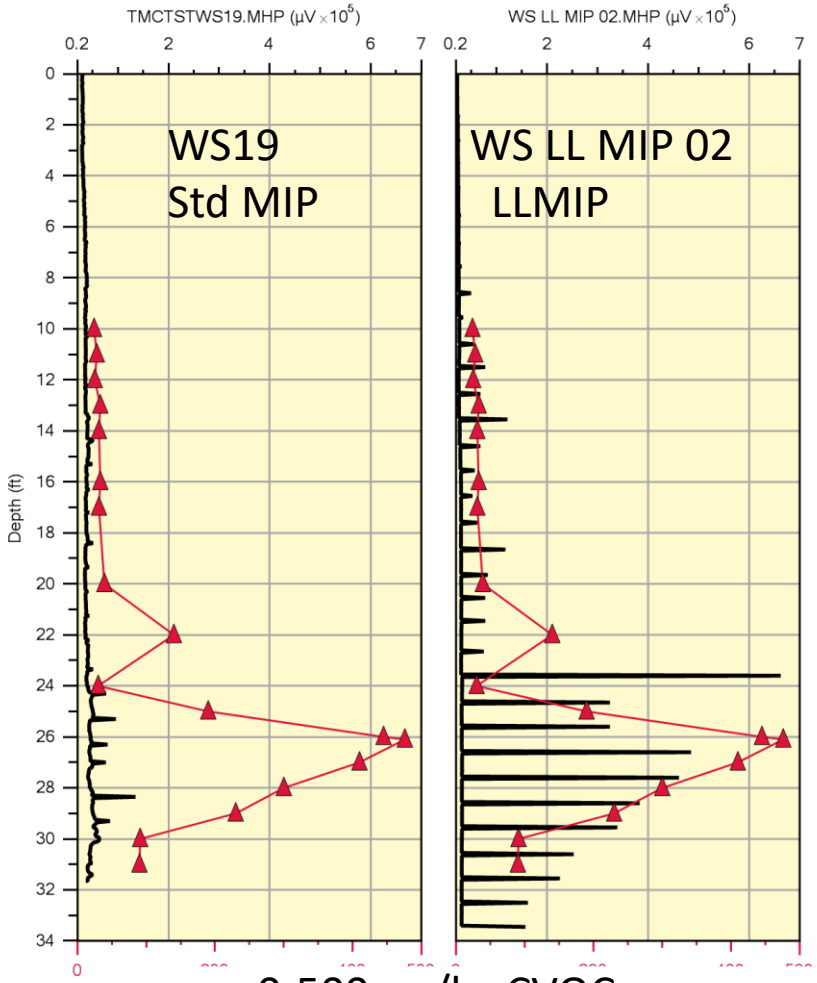
# Standard MIP – LL MIP Comparison

MIP Logs:

Logs run within 3’

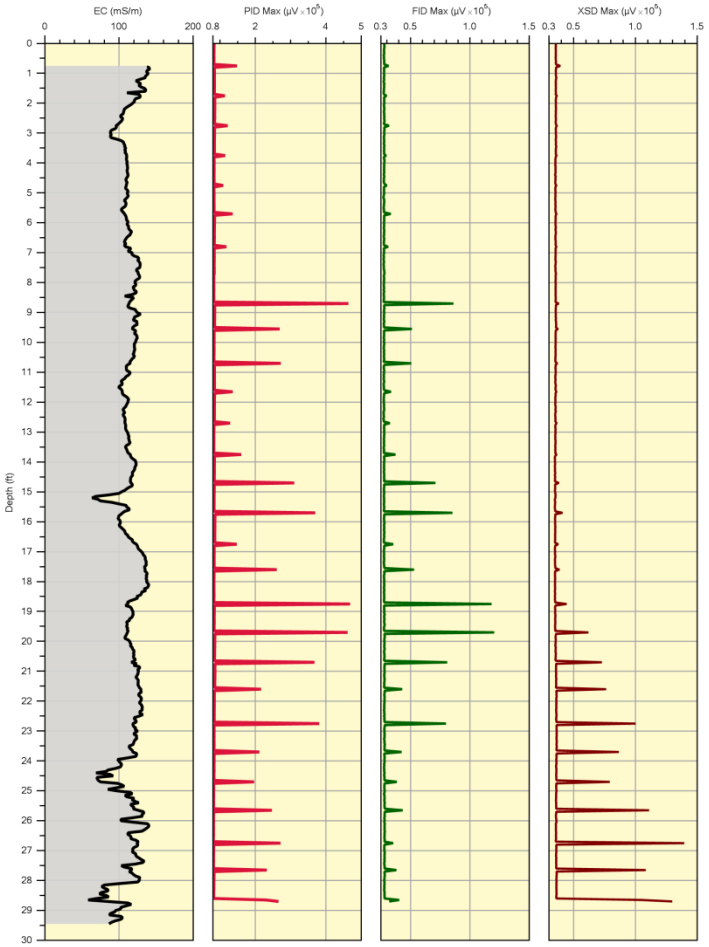
The clean XSD baseline allows the LL MIP log to expose the <50µg/kg concentrations above 20’

The readings below 20’ jump out making field decisions easier




0-500mg/kg CVOC

# LL MIP Logs



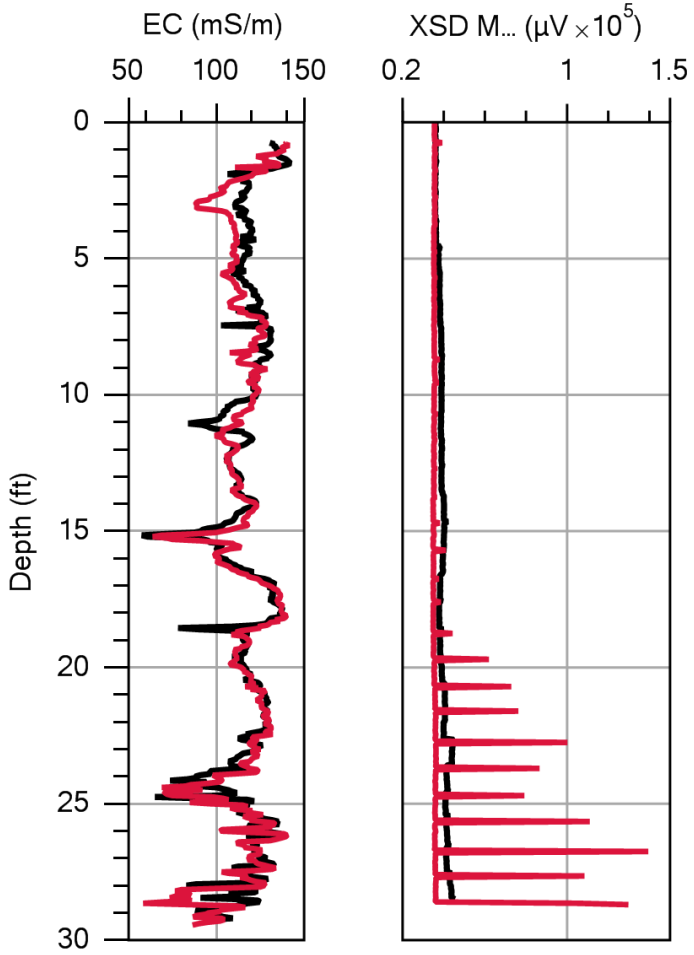

LL MIP Log in mixed hydrocarbon – CVOC plume

Graphs L-R: EC, PID, FID, XSD

Hydrocarbons to 20’
CVOCs 20-30’

Fine grained lithology

# LL MIP Logs

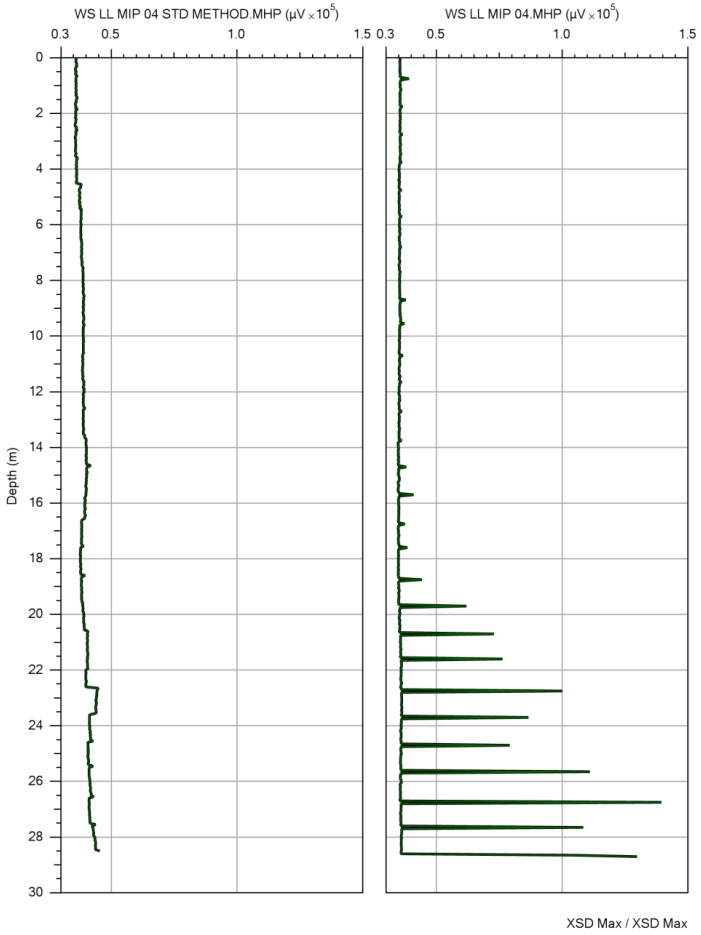



Logs on the edge of a XVOC plume

Overlay of:
LL MIP log - red
Standard MIP log - black

Fine grained lithology

# LL MIP Logs

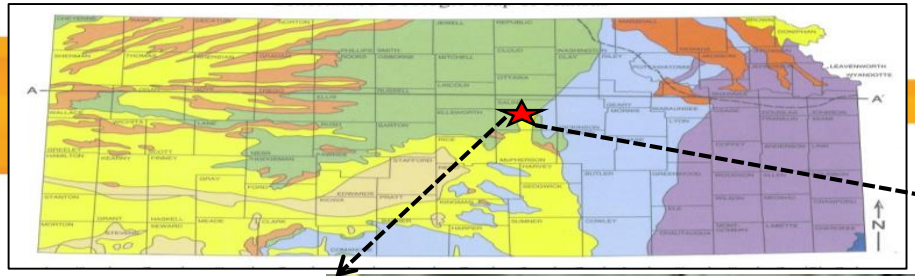



Close up comparison of the XSD responses from the log on previous slide compared to a co-located standard MIP log.

Standard MIP – left
LL MIP – right

# Field Site Examples

## Salina, KS

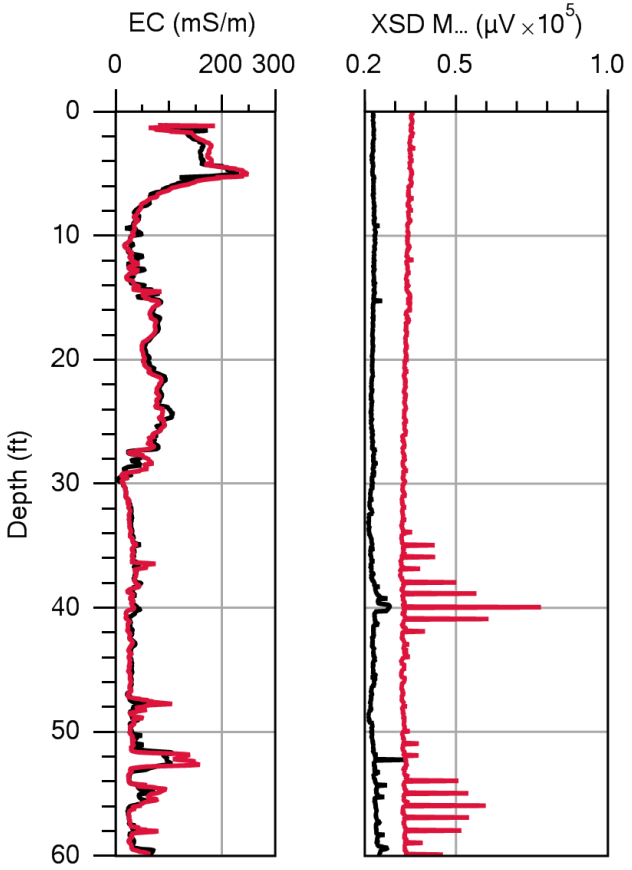


Grain Elevators


N. 5th St.

Grain Elevator Spill
Site Contaminants Include Primarily:
1,2-DCA, Chloroform and Carbon Tetrachloride

# LL MIP Logs




Logs on the edge of a XVOC Plume

Overlay of:
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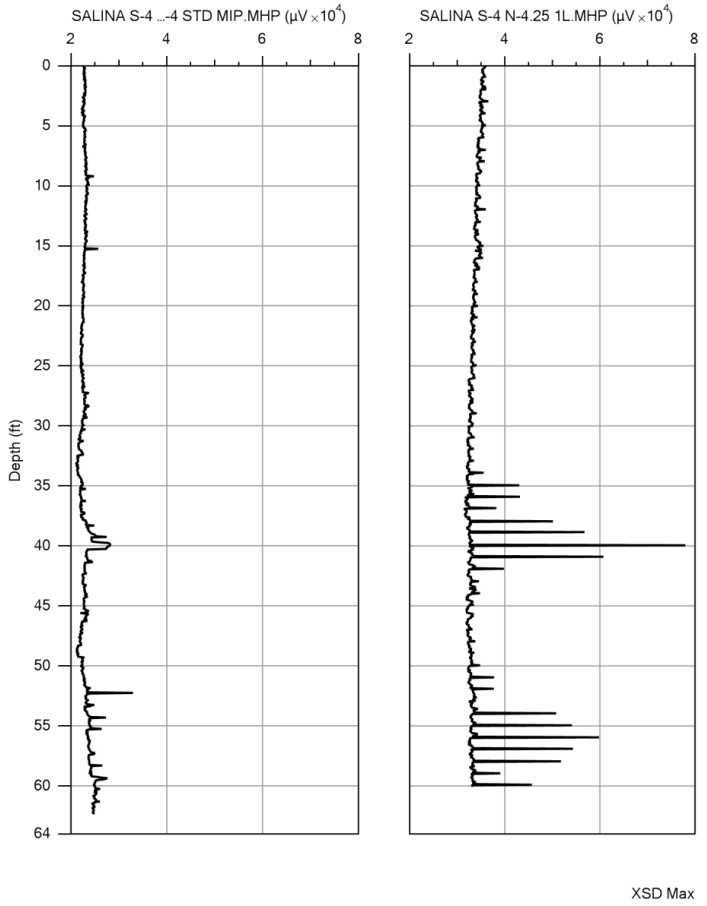
Coarse grain lithology

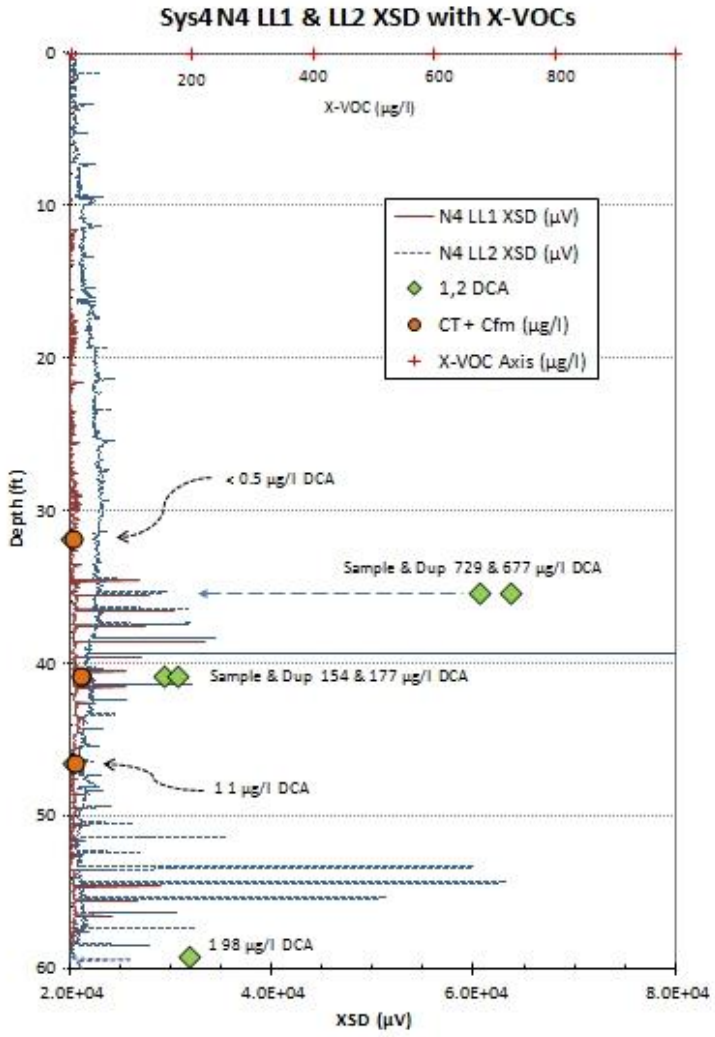
# LL MIP Logs




Close up comparison of the XSD responses from the log on previous slide.

Standard MIP – left
LL MIP – right

# LL MIP Logs

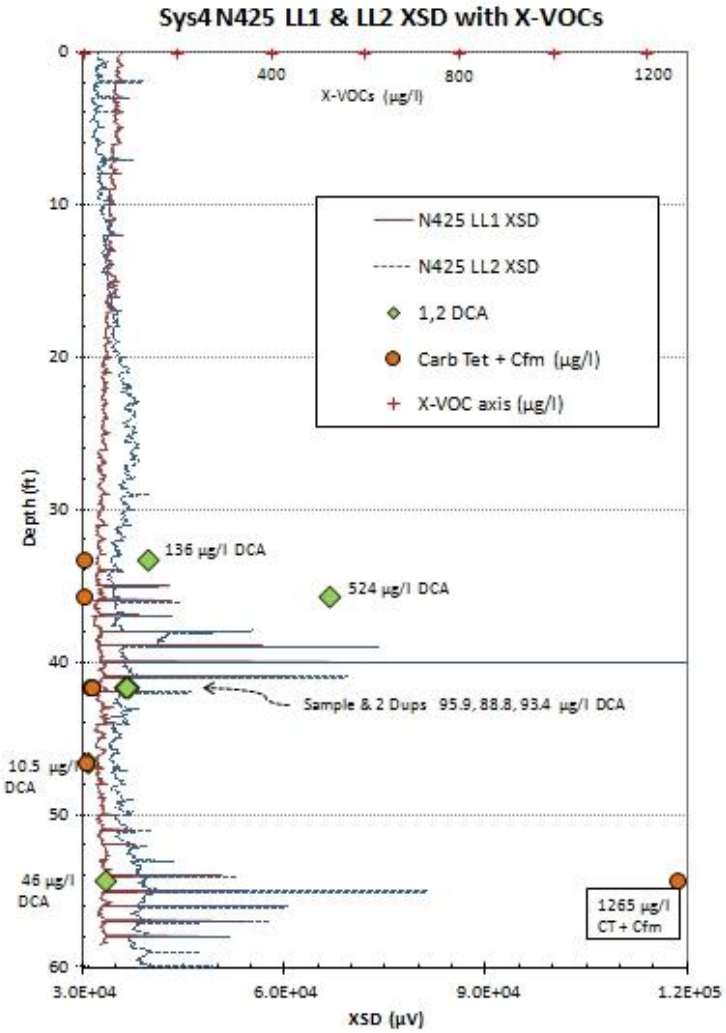



Replicate LL Logs with Analytical data

Coarse grained lithology

DCA = 1,2-Dichloroethane
CT = Carbon Tetrachloride
CFM = Chloroform

# LL MIP Logs




Replicate LL Logs with Analytical data

Coarse grained lithology

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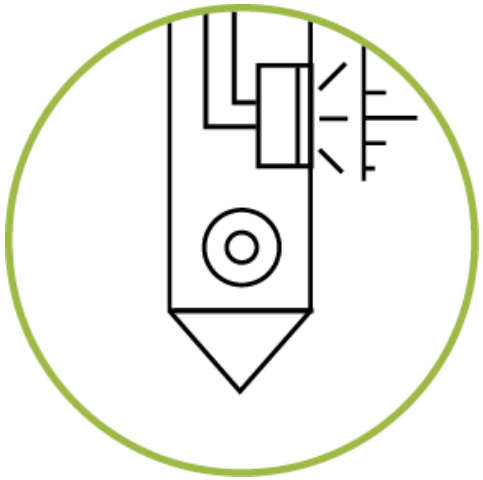
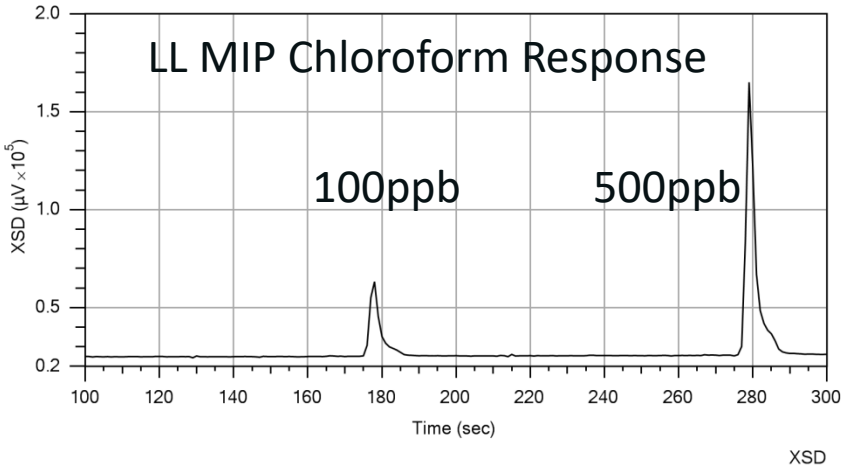
# LL MIP Method Summary



- Improves detector sensitivity ~10x
- Define plumes further with greater confidence
- Capable of tracking plumes to ≤50ppb range
- Add controller to FI based MIP system
- Increase the utilization of your MIP system
- Does not replace standard MIP logging



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