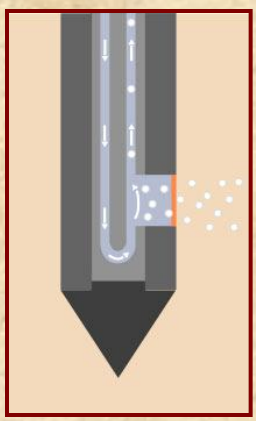
MIP System Field Test for Mid-Low Level TCE

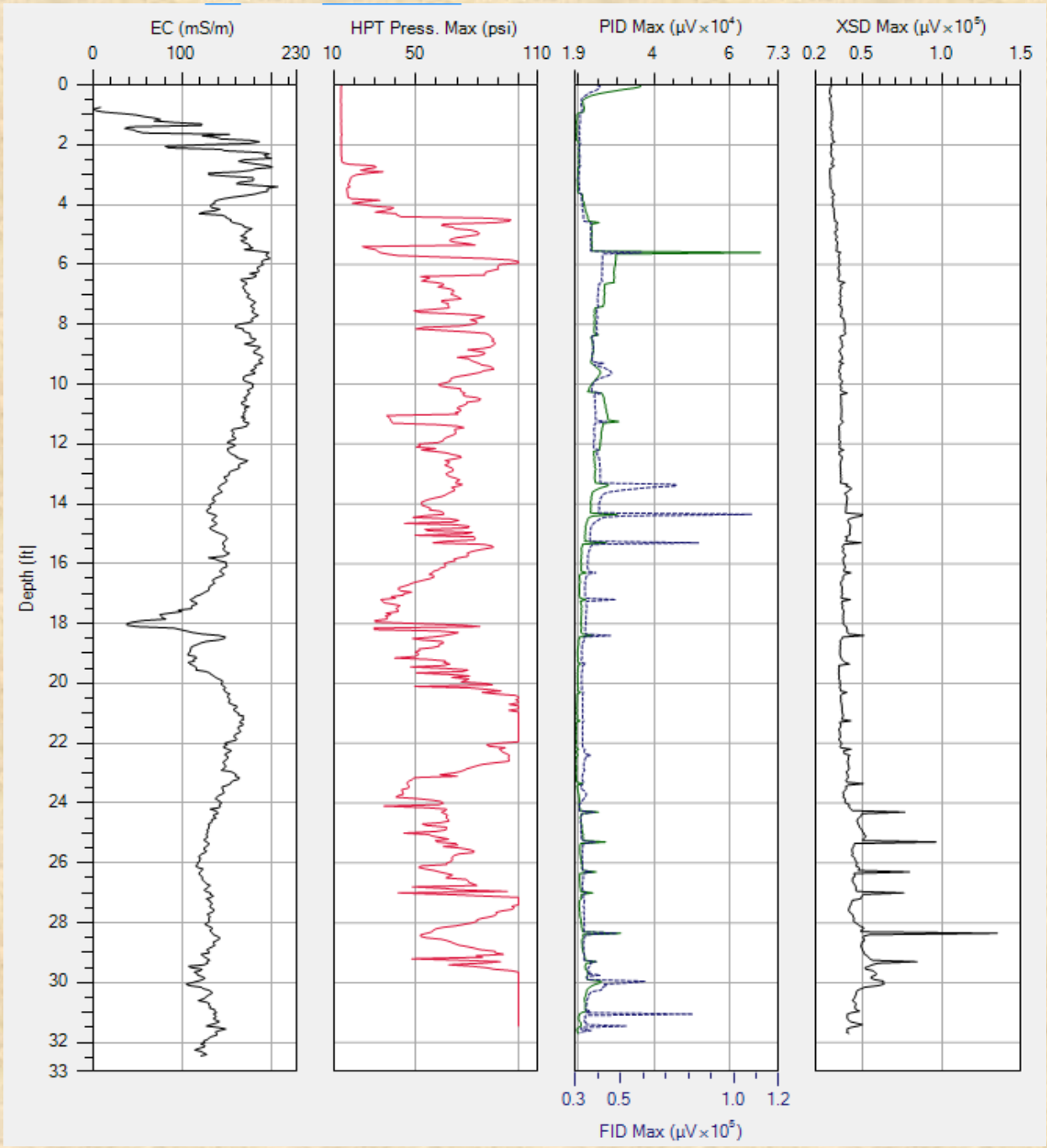
Dan Pip and Blake Slater of Geoprobe Systems® running an MIP log at the Wall St. location in Salina, KS.



Schematic of MIP Probe with VOCs penetrating the membrane.

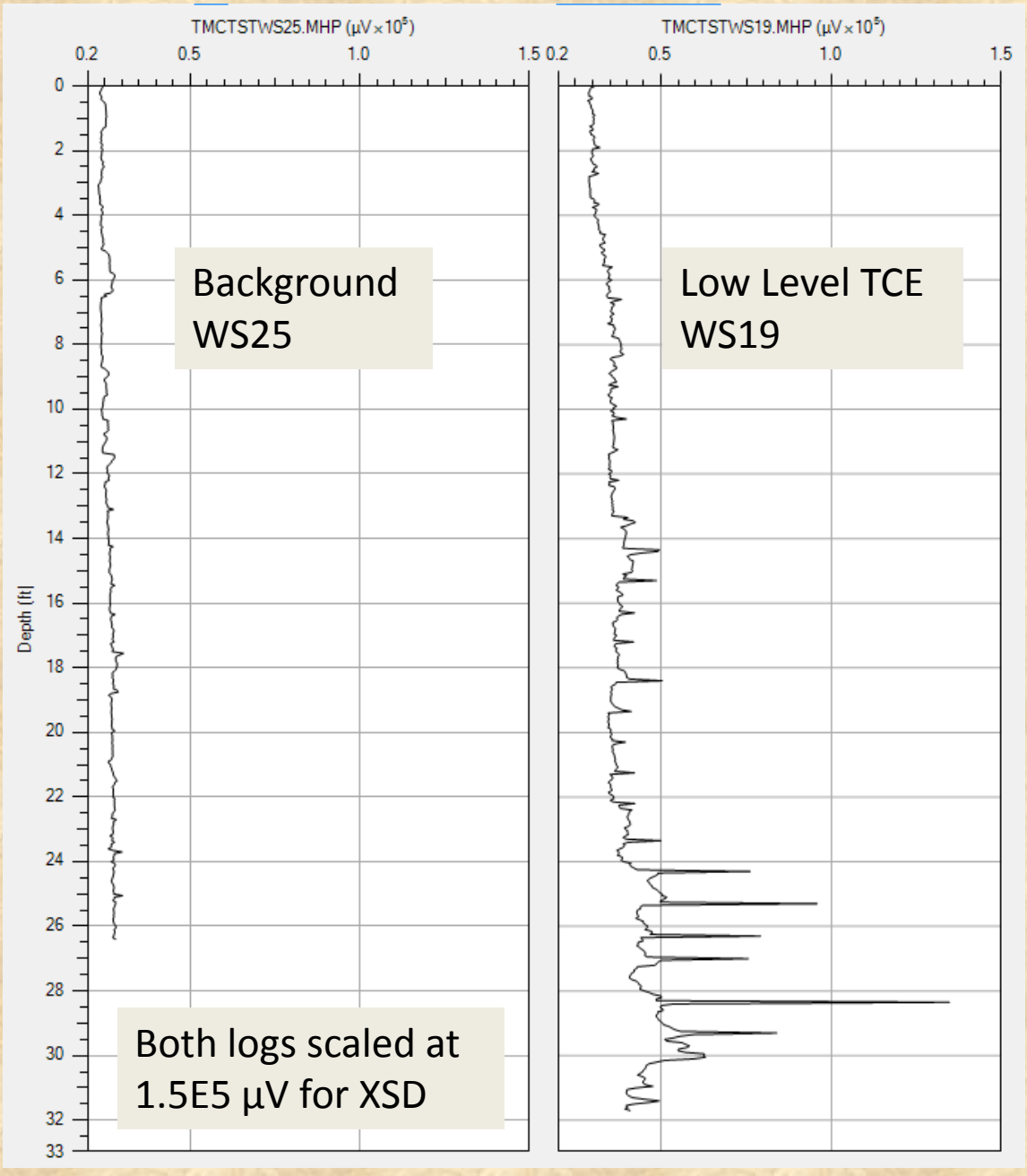
This presentation describes testing performed by Geoprobe Systems® to compare MIP log results to lab analysis of co-located soil samples. The logs and samples were obtained at a site where chlorinated volatile organic compounds (X-VOCs) were released to the soil and ground water. TCE and other solvents were used at the former air force base where releases occurred over several years, beginning during World War II. There was medium to low level X-VOC contamination (< 1 ppm) at the location studied here. The primary contaminant detected at this location was TCE (trichloroethene).

WS19 MiHPT Log



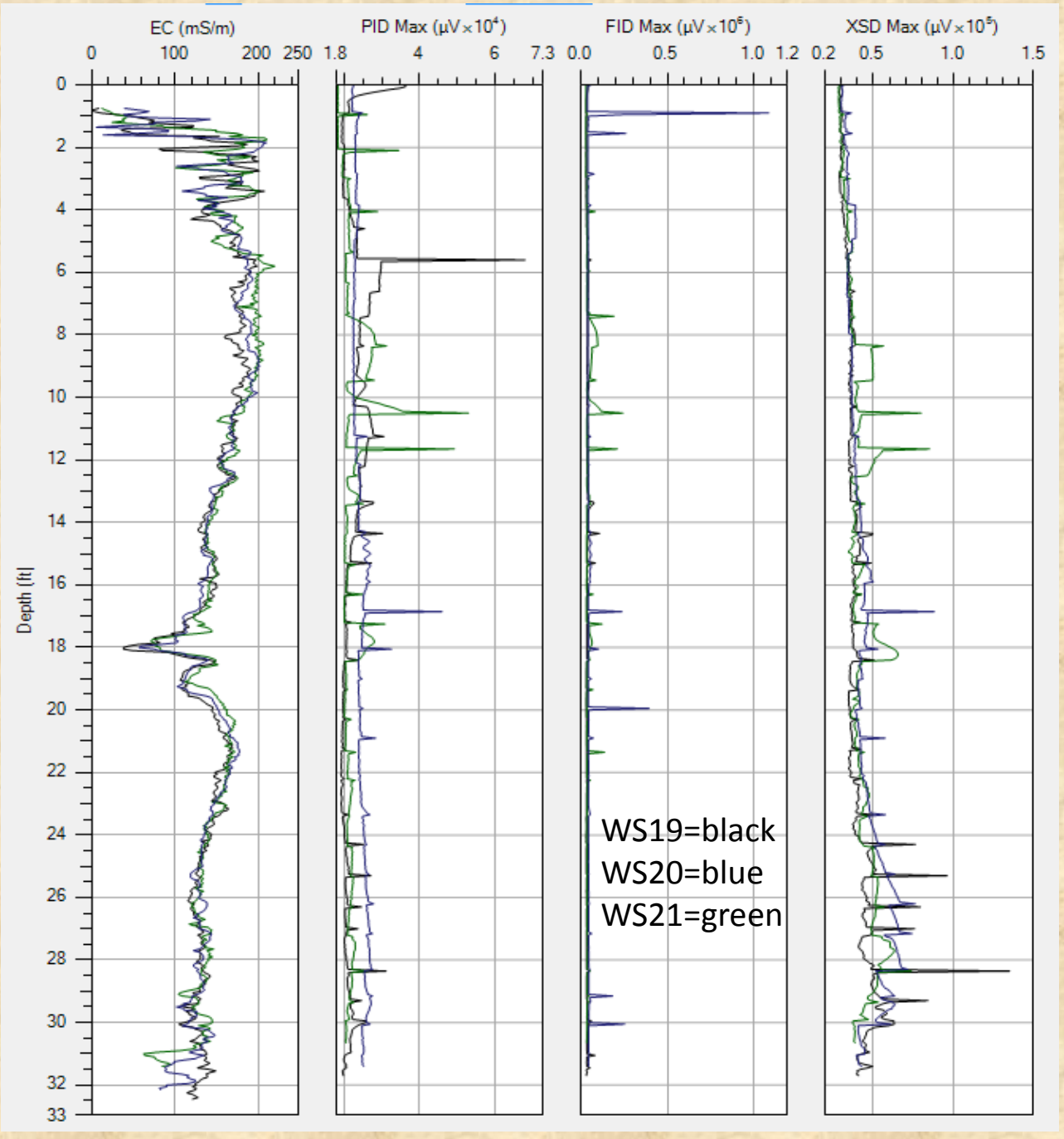
The logs presented here were obtained during field testing of the MiHPT probe under development by Geoprobe in 2011. The PID and FID responses are relatively low in this log and the XSD response (< 1.5E5µV) suggests the presence of moderate to low concentrations of chlorinated VOCs. The EC log and HPT pressure log indicate primarily fine grained materials in the formation with some coarser materials interspersed with the fines at various depths (confirmed by sampling).

Background Log Versus Low Level TCE on XSD Detector



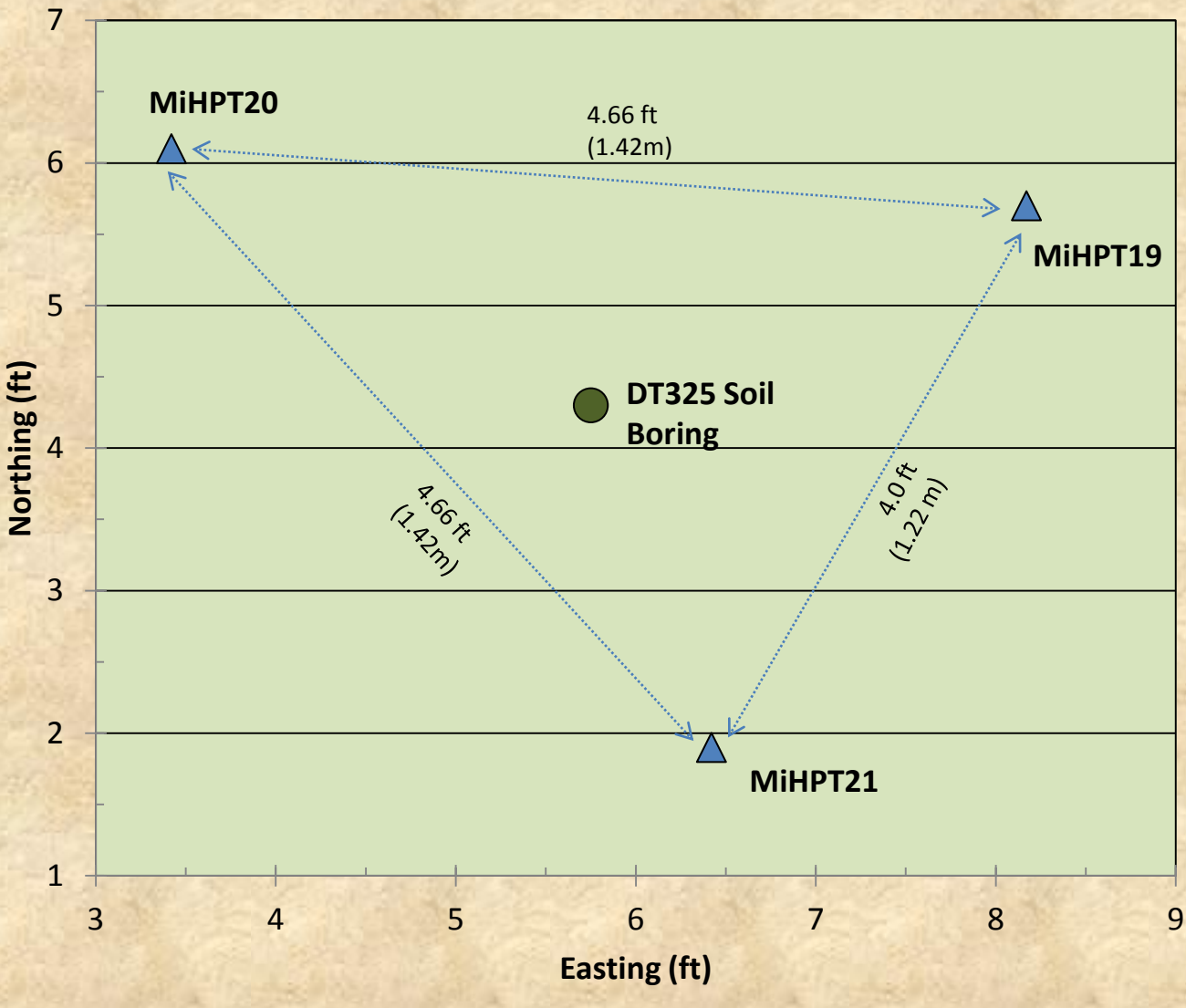
The WS19 MIP log exhibits a relatively lo level XSD response for this area of contamination. However, comparison of the WS19 log to a non-impacted location at the site (WS25) demonstrates that the WS19 MIP-XSD signal is robust and easily discernable from background signal.

Overlay of WS19, 20 & 21 Logs



Overlay of WS19 and two other logs run about one meter from this location (see map, next slide) show consistent EC results. The detector results show some variation but the XSD responses are generally consistent indicating low to medium level X-VOCs in the local formation. Based primarily on the XSD detector responses soil samples were collected from 4ft to 31ft to asses the concentrations of X-VOCs present in the subsurface.

MiHPT19, 20 & 21 Log Locations
Wall St. X-VOC Site



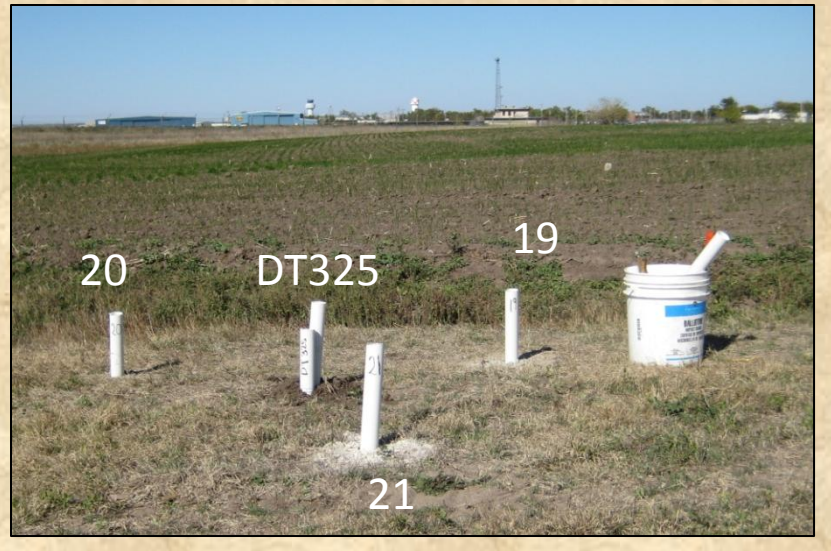


Photo of the MiHPT19, 20 & 21 log locations. Looking generally north toward the Salina airport control tower. Old source is former fire training area to the west (left) of the photo.

Using the DT325 System to Collect Soil Cores at the WS19 Location

The dual tube DT325 system equipped with a 5ft (1.52m) sample tube and PVC liner was used to collect 4ft (1.22m) long soil cores to a depth of 32ft (9.8m) between the replicate logs at the low-level X-VOC area. (See map above)

A Terra Core™ tool (En Novative Tech. Inc.) was used to collect about 5 grams of sample from a hole cut in the side of the DT325 liner at each targeted depth.

The soil core was then transferred immediately to a tared VOA vial already prepared with a stir bar and reagent grade water.

Once the transfer was completed the VOA vials were stored on ice in a cooler until delivered to the lab for analysis.

Soil Sample Analytical Results for X-VOCs

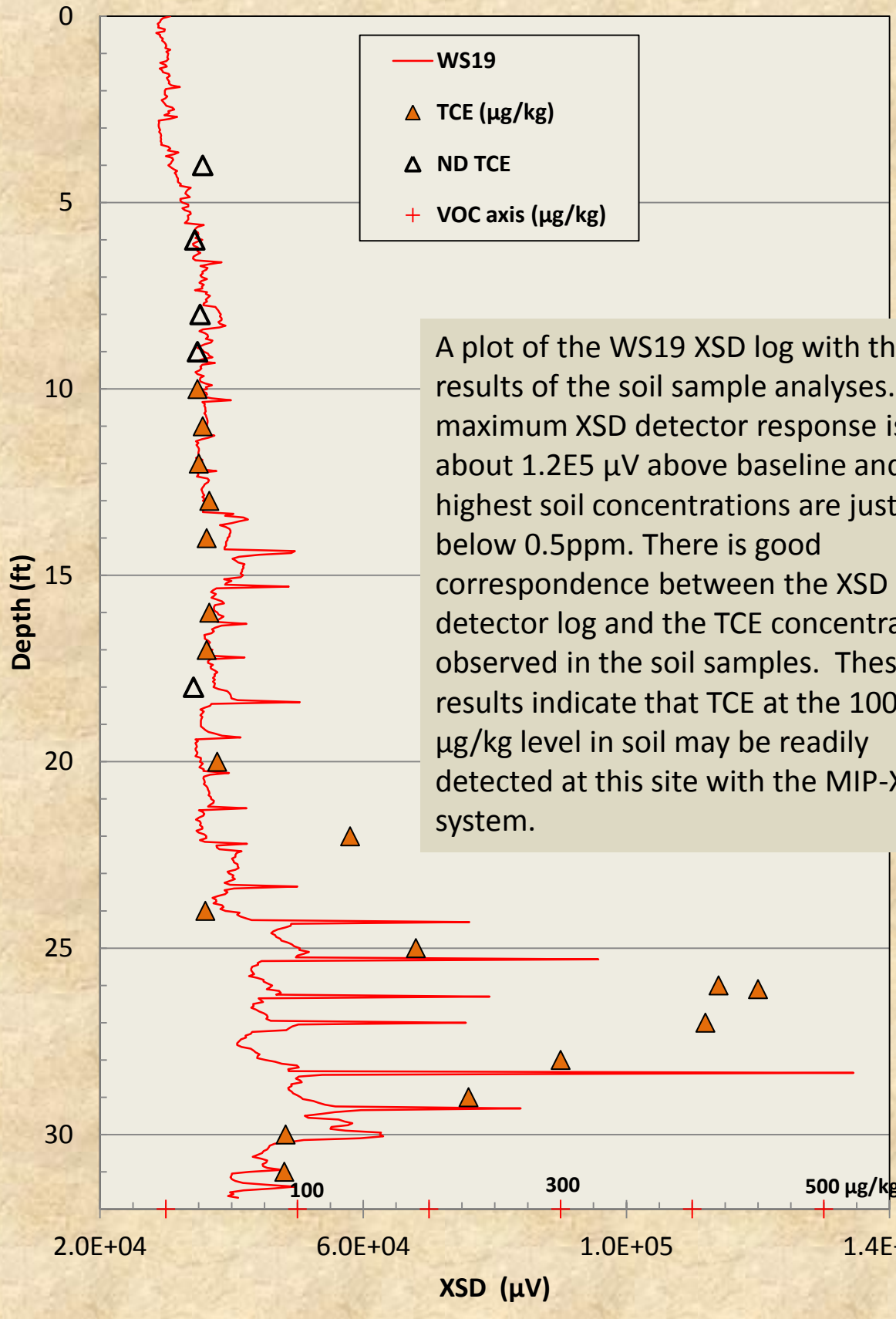
Depth (ft bgs)		CCL4 (µg/kg)		TCE (µg/kg)		Total X-VOC (µg/kg)	
4		28	ND	28	ND	28	ND
6		22	ND	22	ND	22	ND
8		26	ND	26	ND	26	ND
9		24	ND	24	ND	24	ND
10		24	ND	**24**		**24**	
11		24	ND	**28**		**28**	
12		24	ND	**25**		**25**	
13		25	ND	**33**		**33**	
14		25	ND	**31**		**31**	
16		26	ND	**33**		**33**	
17		23	ND	**31**		**31**	
18		21	ND	21	ND	21	ND
20		30	ND	**39**		**39**	
22		25	ND	**140**		**140**	
24		27	ND	**30**	QC	**30**	QC
25		26	ND	**190**		**190**	
26		**25**		**420**		**445**	
26.1	DUP	**26**		**450**		**476**	
27		30	ND	**410**		**410**	
28		18	ND	**300**		**300**	
29		24	ND	**230**		**230**	
30		23	ND	**91**		**91**	
31		26	ND	**90**		**90**	

The soil samples were submitted to Continental Analytical Services (CAS) Laboratory, Salina, KS for analysis by EPA Method 8260B GC-MS for high level VOCs. The method reporting limit ranged from about 20µg/kg to 50µg/kg (parts per billion) depending on the mass of sample recovered and other factors. Analytes: CCL4= carbon tetrachloride, TCE = trichloroethene. Chloroform was nondetect for all samples at this location.

ND = nondetect, associated number is the sample reporting limit .

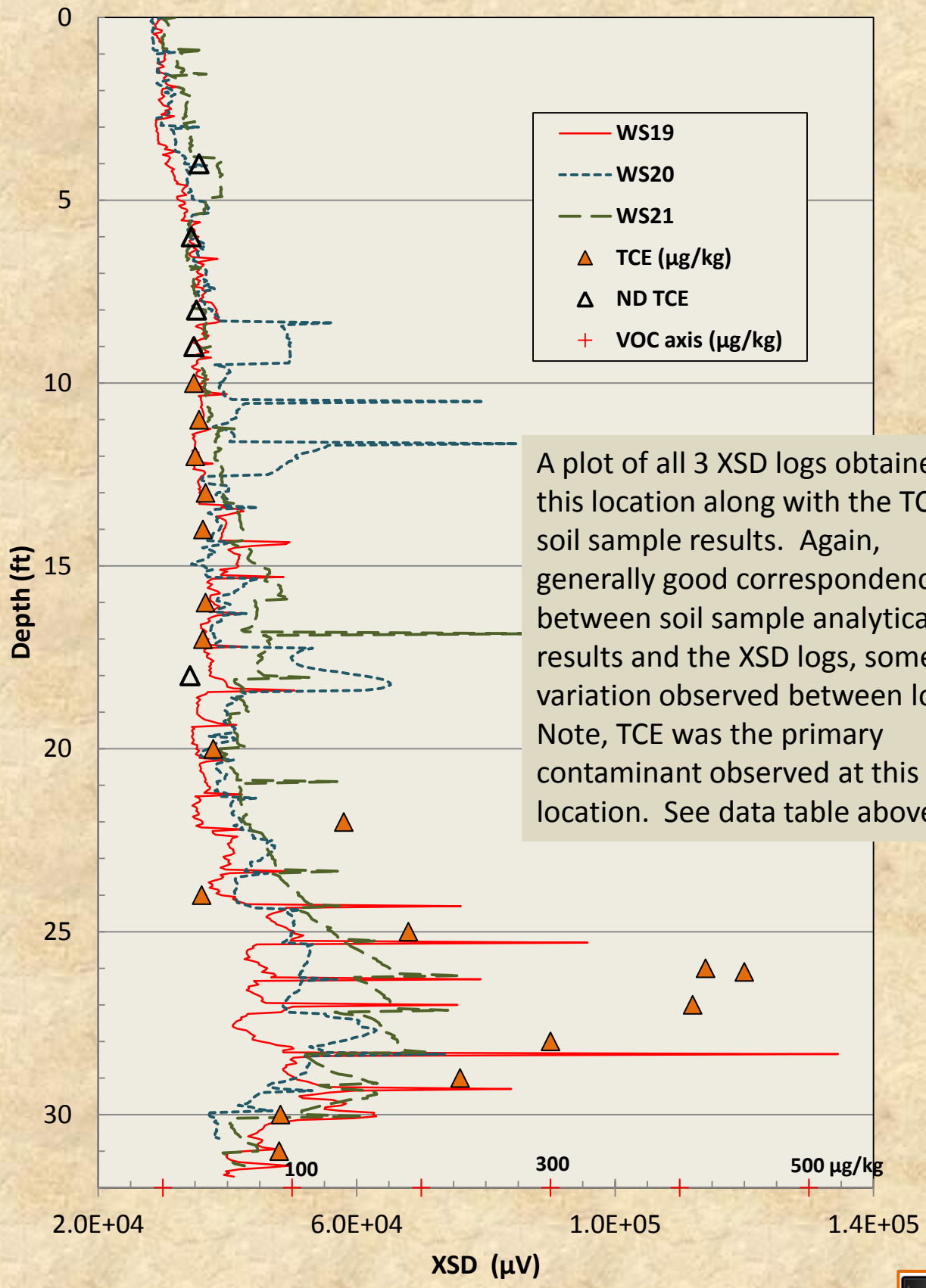
QC = matrix spike recovery was low for this sample.

XSD Log WS19 and Soil Sample Analytical Results



A plot of the WS19 XSD log with the results of the soil sample analyses. The maximum XSD detector response is about 1.2E5 µV above baseline and highest soil concentrations are just below 0.5ppm. There is good correspondence between the XSD detector log and the TCE concentrations observed in the soil samples. These results indicate that TCE at the 100 µg/kg level in soil may be readily detected at this site with the MIP-XSD system.

XSD Logs: Mid-Low X-VOC



A plot of all 3 XSD logs obtained at this location along with the TCE soil sample results. Again, generally good correspondence between soil sample analytical results and the XSD logs, some variation observed between logs. Note, TCE was the primary contaminant observed at this location. See data table above.

Summary for WS19 Low Level X-VOC Location

• The MIP-XSD system can detect trichloroethene (TCE) in the 100μg/kg to 500μg/kg concentration range in soil when maintained and operated properly. Lower detection limits may be possible under good field and optimized MIP-XSD system operating conditions.

• Replicate MIP logs with the XSD detector show generally good correspondence in detector response for moderate to low level TCE.

• Dual tube DT325 soil sampling was used to collect soil cores across the zone of positive detector response.

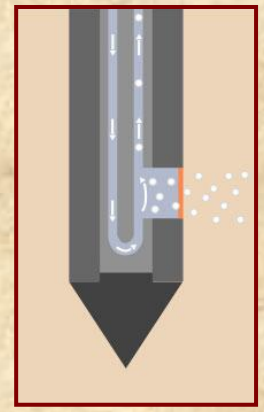
• Good correspondence is observed between the XSD detector responses and the TCE analytical results for the soil samples.

• The soil TCE results are low or nondetect over the zones where the MIP-XSD system displays little or no response above the baseline.

• The soil TCE results are positive detect over the interval where the MIP detectors show clear response in the replicate logs.

• Soil coring and sub-sampling techniques for volatiles analysis can have a substantial impact on the analytical results as well as the correspondence between MIP results and soil sample results.

• It is also important to collect the soil cores in close proximity (spatially and chronologically) to the MIP logs to get a good correlation between the MIP log and analytical results.



To learn more about the MIP system visit

www.geoprobe-di.com

MIP System Specifications for this Study:

Probe: Combined MIP-HPT Probe, PN MK6530

GC and Detectors: SRI Model 310C GC equipped with XSD detector, 10.6eV PID and FID detectors

MIP Controller Model MP6505

Field Instrument Model FI6000

Carrier Gas: N_2 at 40ml/min

Trunkline equipped with an unheated 1/16” OD x 0.04” ID stainless steel return gas line