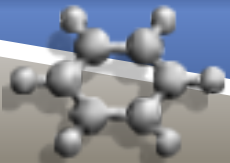


# UTILIZING HIGH RESOLUTION SITE CHARACTERIZATION (HRSC) TECHNOLOGIES TO IMPROVE CONTAMINATED SITE MANAGEMENT

Oct. 20, 2015

ARC 2015

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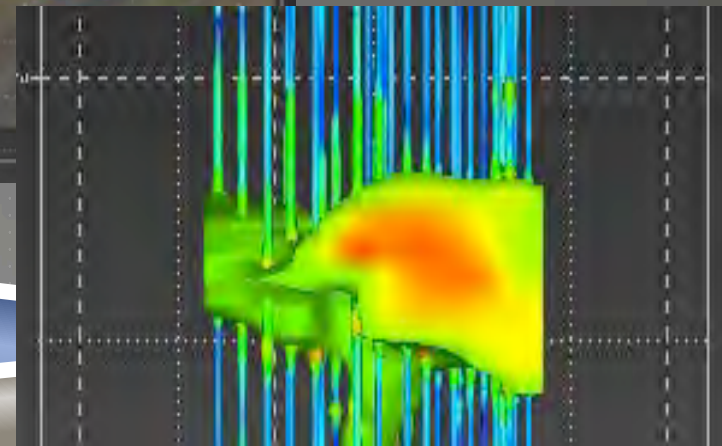
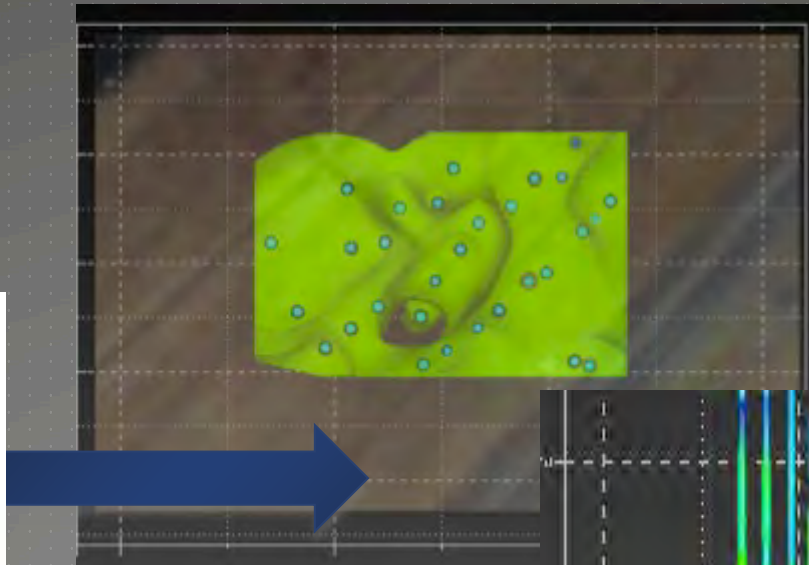
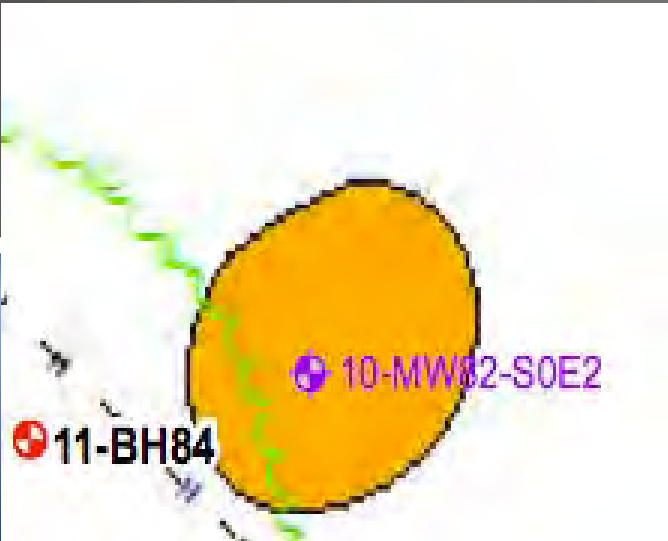
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# HRSC – Definition

- ▶ USEPA, 2013

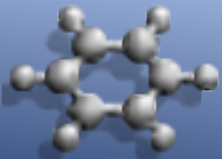
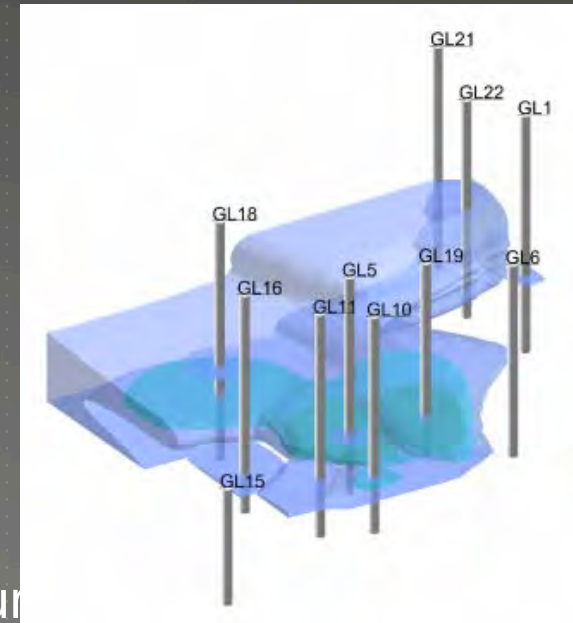
“High-resolution site characterization (HRSC) strategies and techniques use scale-appropriate measurements and sample density to define contaminant distributions, and the physical context in which they reside, with greater certainty, supporting faster and more effective site cleanup.”

SCALE & EXTENT  
DATA D&D



# HRSC tools – Improving the Science

- ▶ Appropriate Scale and Extent
- ▶ Data density & diversity
- ▶ Real-time data - Direct imaging
- ▶ Relevant at all stages
- ▶ Site-specific & adaptable
- ▶ Collaborative data
- ▶ Actionable information
- ▶ Minimal site impacts & no lasting infrastructure
- ▶ REDUCE uncertainty, INCREASE speed – cost effective results



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# HRSC – Technologies

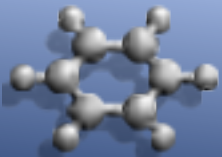
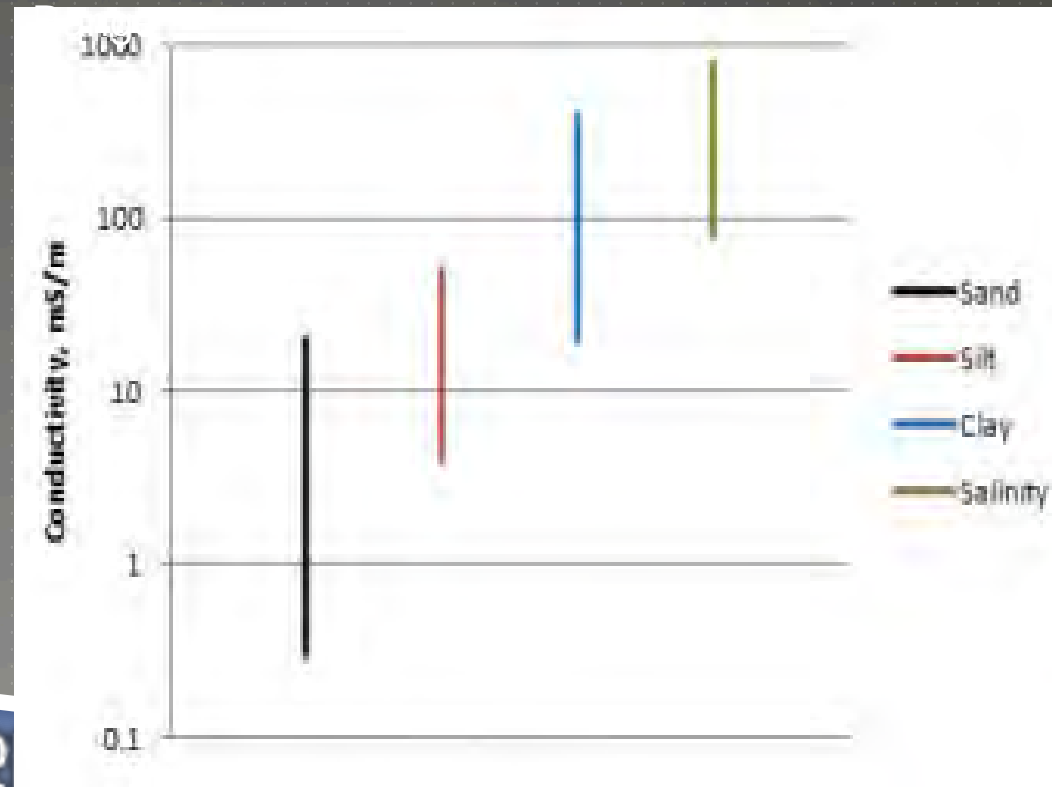
- ▶ HRSC employs innovative technologies to achieve a clearer understanding of contaminated site dynamics leading to more cost-effective management solutions.
- ▶ In-situ, direct image probing devices:
  - ▶ EC – Electric Conductivity
  - ▶ HPT – Hydraulic Profiling Tool
  - ▶ LIF – Light Induced Fluorescence
  - ▶ MIP – Membrane Interface Probe
    - ▶ Utilize down-hole probes on the end of hollow drill rods.
    - ▶ Connect with an umbilical to surface.
    - ▶ Direct pushed/hammered.
    - ▶ All vertically log real-time data with depth.



# EC – Electric Conductivity Probe

- ▶ The EC tool measures soil conductivity. This information is used to characterize site stratigraphy and groundwater TDS (Total Dissolved Solids).
- ▶ The probe operates by running a known current through the soil and measuring the voltage, this is used to calculate conductivity in mS/m (milli-Siemens per meter.)

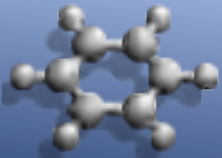
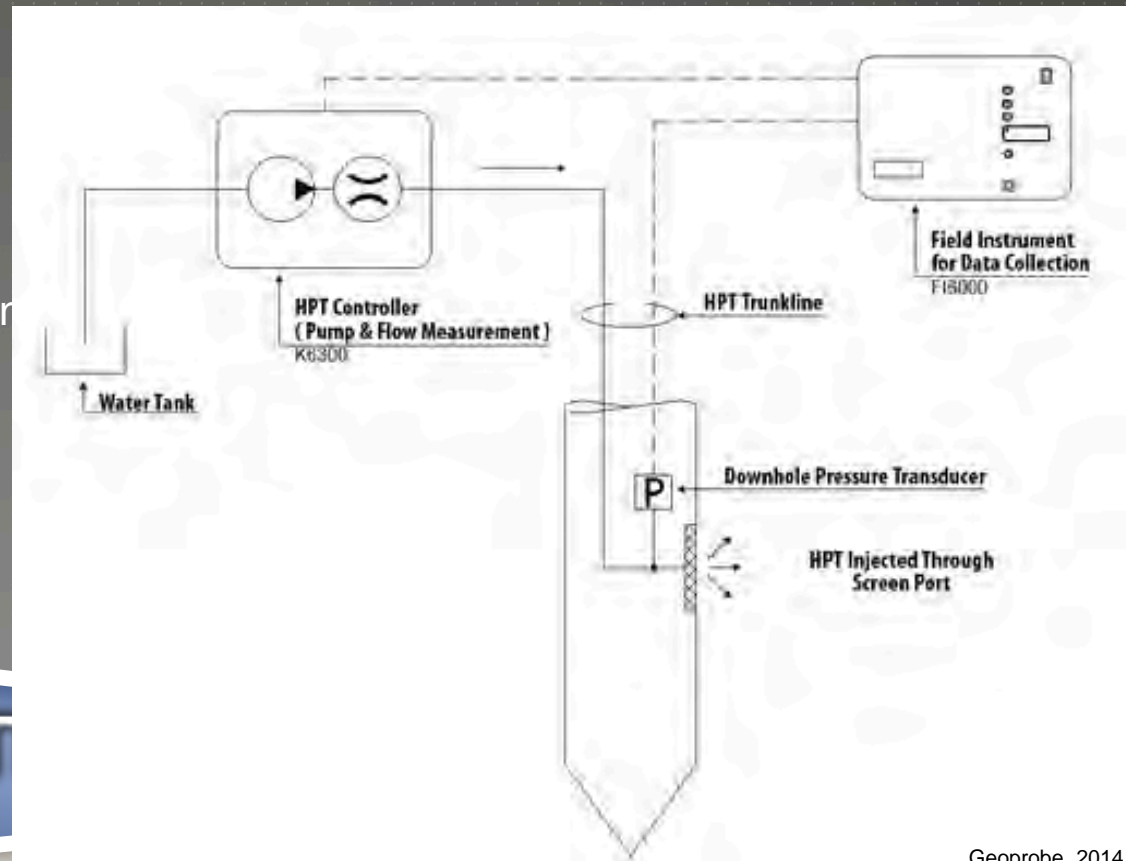
General Soil Conductivity



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# HPT – Hydraulic Profiling Tool

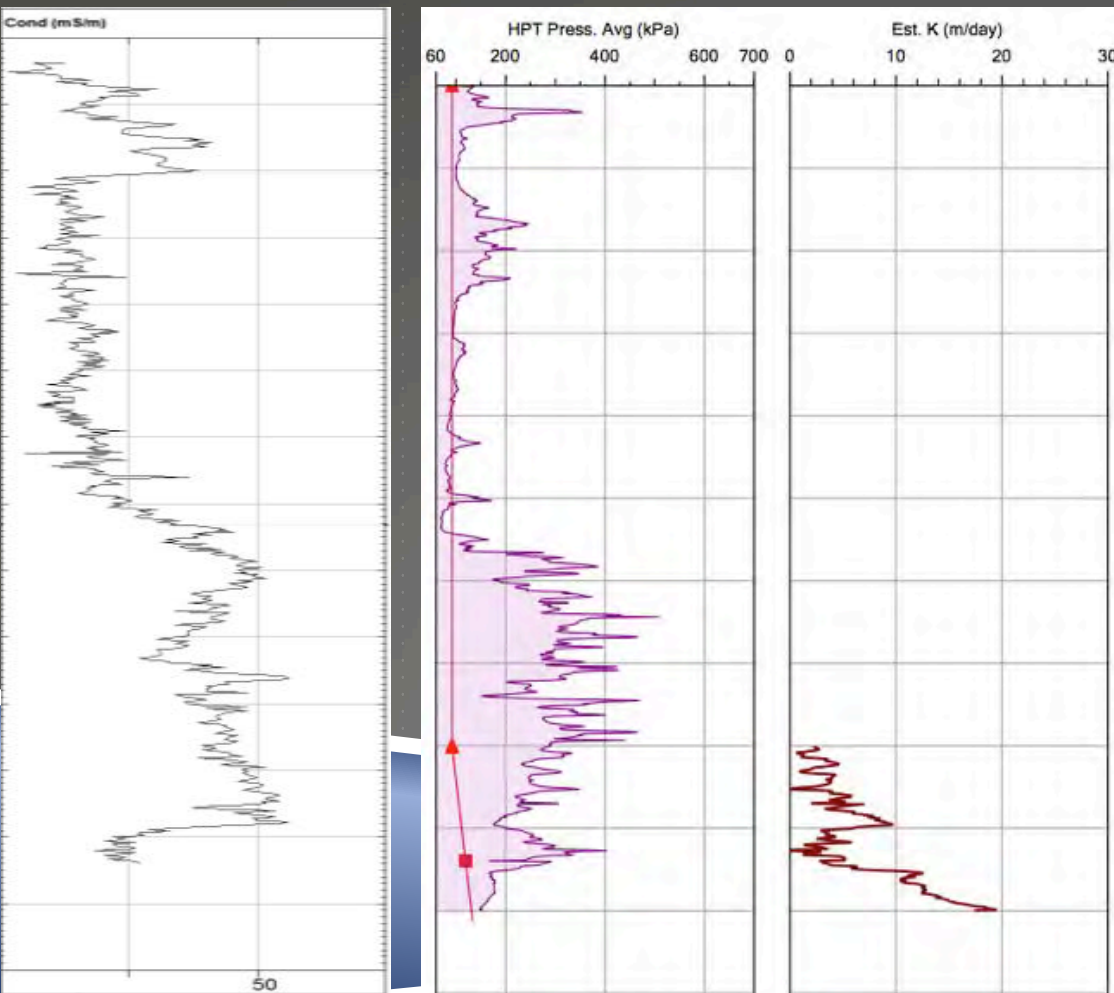
- ▶ The HPT measures changes in the required pore entry pressure of the stratum. This correlates with media permeability and allows for vertical profiling of hydrostratigraphic information.
- ▶ The HPT delivers water to the subsurface through the probe head. A transducer in the probe measures the required injection pressure and hydrostatic pressure.



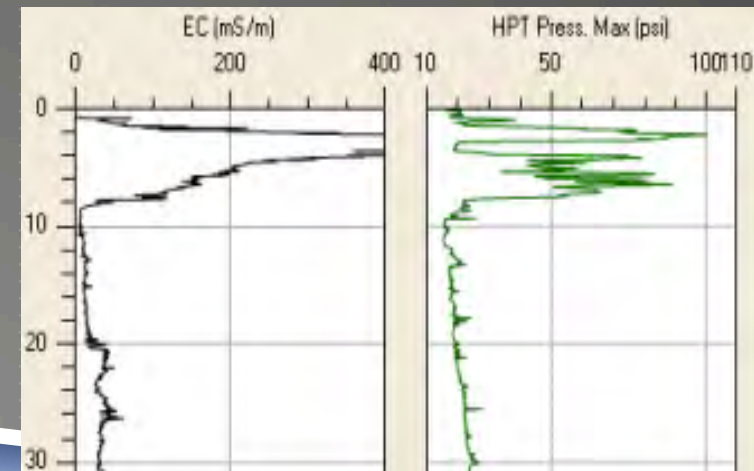
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# EC & HPT DATA - RESIDENT MEDIA PROPERTY ANALYSIS

Scale appropriate measurements of media properties influencing contaminant mobility and distribution.

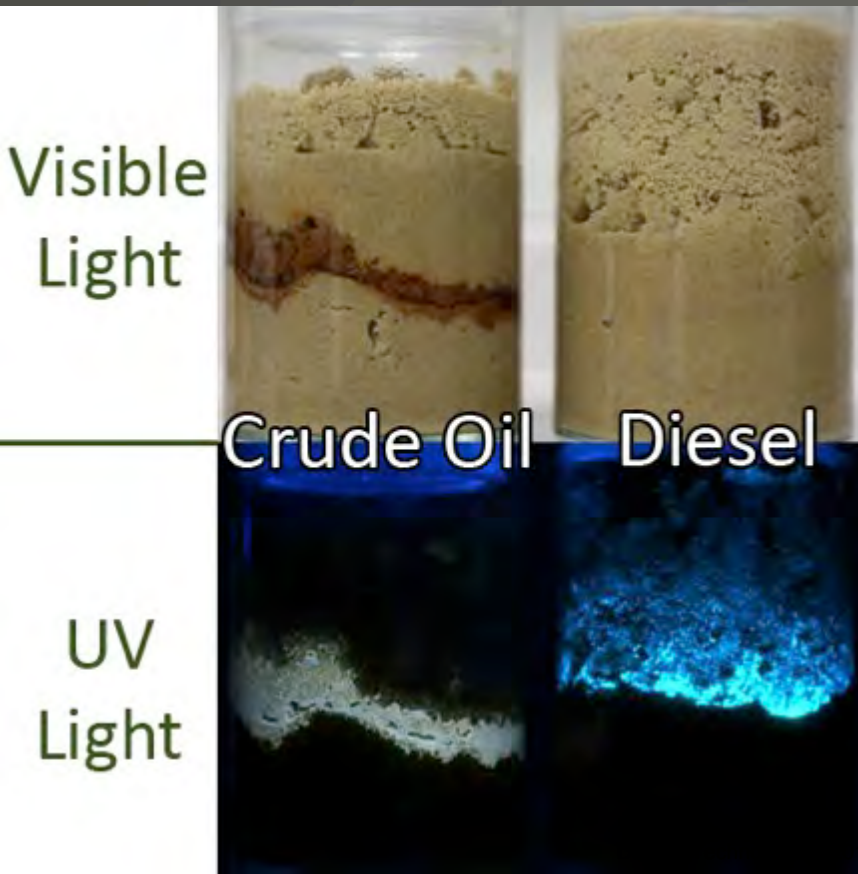


- ▶ EC and HPT tandem use.
  - ▶ Delineation of ionic plumes and stratigraphy.
  - ▶ Migration pathways.
  - ▶ Remediation planning.

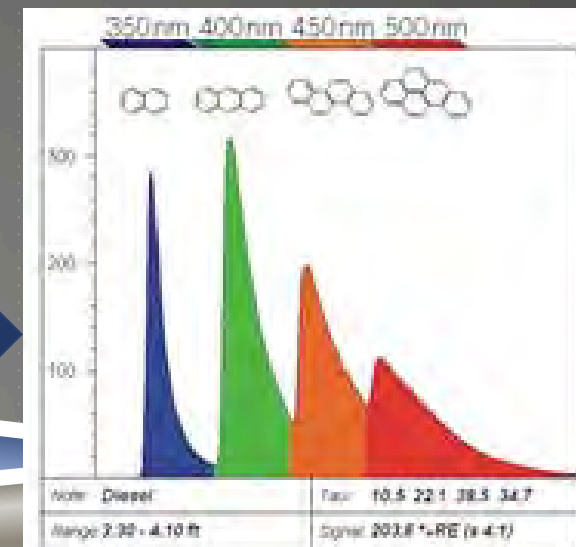


# LIF – Light Induced Fluorescence

- ▶ Utilizes in-situ fluorescence spectroscopy to locate Free Phase Petroleum Hydrocarbons.
- ▶ Dakota Technologies UVOST.



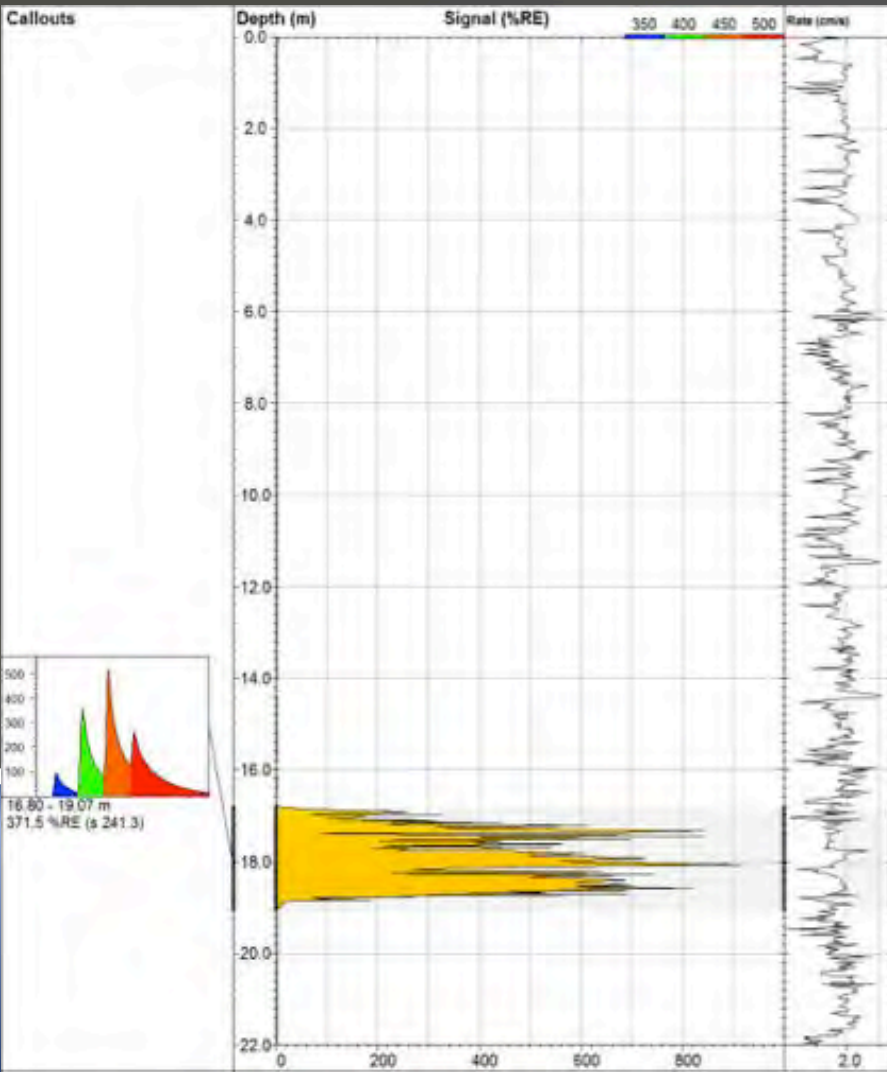
- ▶ Operation is based on two principles:  
Fluorescence – PAHs  
NAPL & PAH partitioning



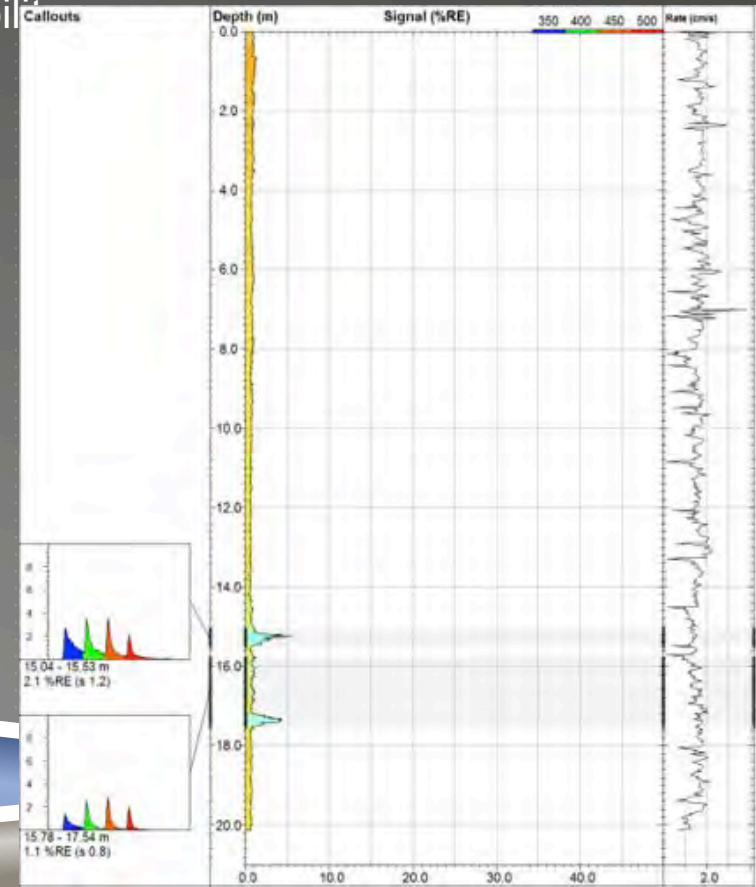


# LIF – Light Induced Fluorescence

- ▶ Provides semi-quantitative and qualitative data.



- ▶ Delineation of free phase petroleum products.
- ▶ Qualitative petroleum analysis.
- ▶ Recoverability

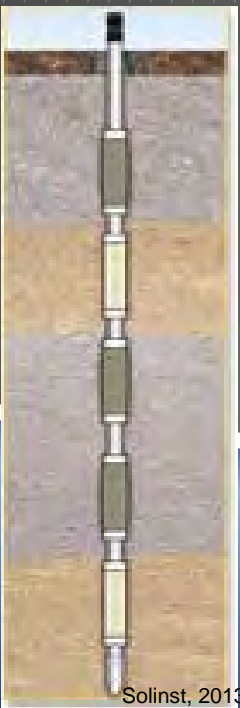
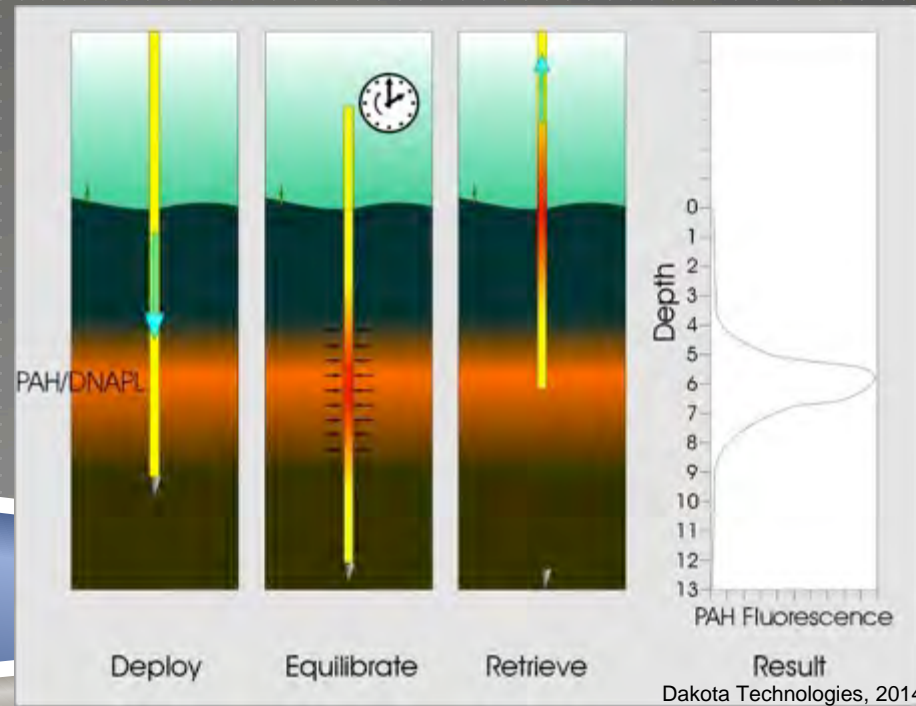


# INNOVATIVE TOOLS & METHODOLOGIES

- ▶ Other HRSC tools are available.
  - ▶ Tailored for the environment, contaminant, metric.
- ▶ HRSC is not just a suite of technologies – involves strategies, methodologies and management/field practices.

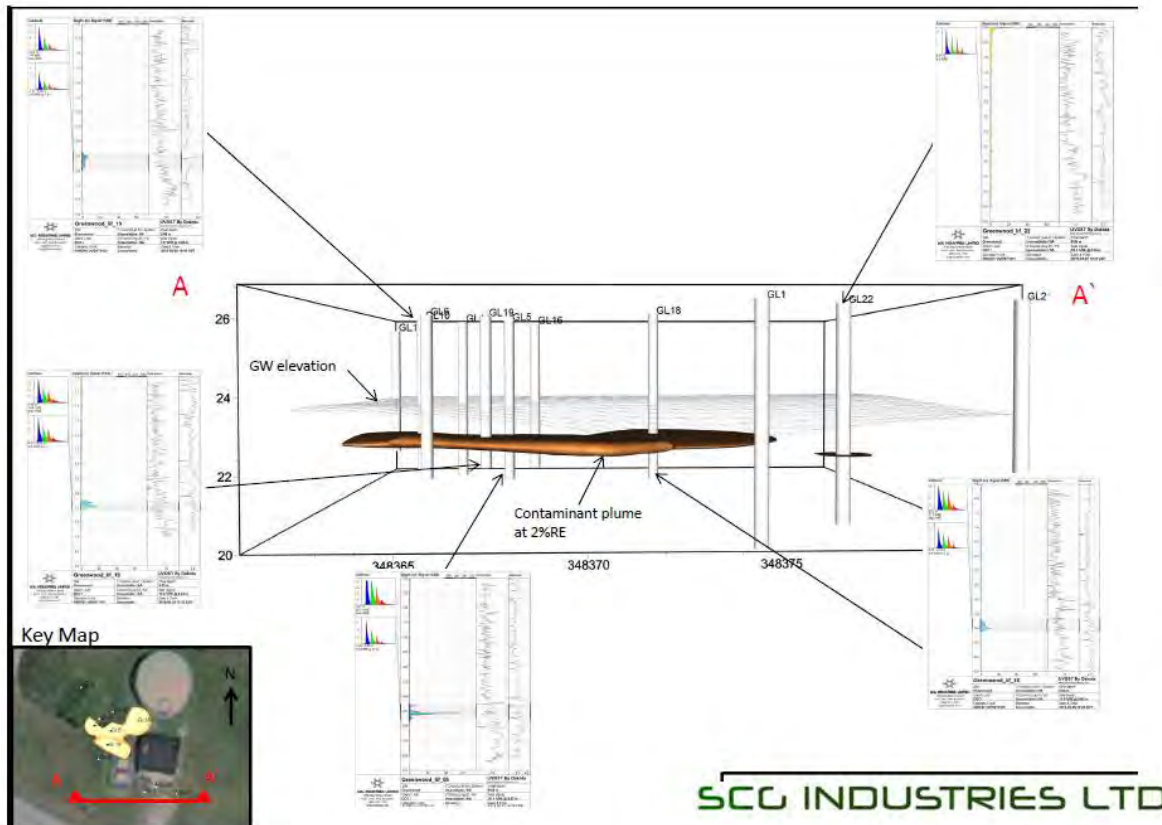
Tools:

CPT  
DPT “Grab” Sampling  
Passive Diffusion  
Samplers  
Multi-level GW Systems  
Geophysical Surveys



# DATA INTERPRETATION & SYNTHESIS

- ▶ Results - context & interpretation.
- ▶ Correlation & Integration.
- ▶ Workable & Compatible.



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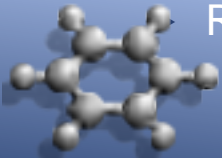
# HOW DOES IT COME TOGETHER?

- ▶ Example of HRSC tool use at a Federal Contaminated Site.
  - ▶ Previous characterization and ongoing monitoring.
  - ▶ Historic contamination: Release from an underground fuel line - Avgas and Jet fuel.
  - ▶ Deep, unconfined aquifer – “Silty-sand”.
  - ▶ SCG: Multi-phase Extraction Systems (MPE) were installed to remediate free phase, vapour phase and sorbed phase petroleum hydrocarbon contamination.
- ▶ Success! But is there more to the story?



# USE OF HRSC TECHNOLOGIES

- ▶ MIP, LIF, HPT used in tandem with EC & Confirmation sampling.
- ▶ Data:
  - ▶ Delineation of the dissolved phase plume.
  - ▶ Delineation of the LNAPL plume.
  - ▶ Hydrogeological dynamics influencing contaminant distribution and mobility.
    - ▶ Tools together provide a three dimensional spatial analysis of contaminant mass concentrations, contaminant phase distribution and r dynamics.
- ▶ SCG's Objectives:
  - ▶ Further refinement of the Conceptual Site Model (CSM)
  - ▶ Enhance the optimization of current MPE systems.
  - ▶ Recommendations for further remediation efforts.

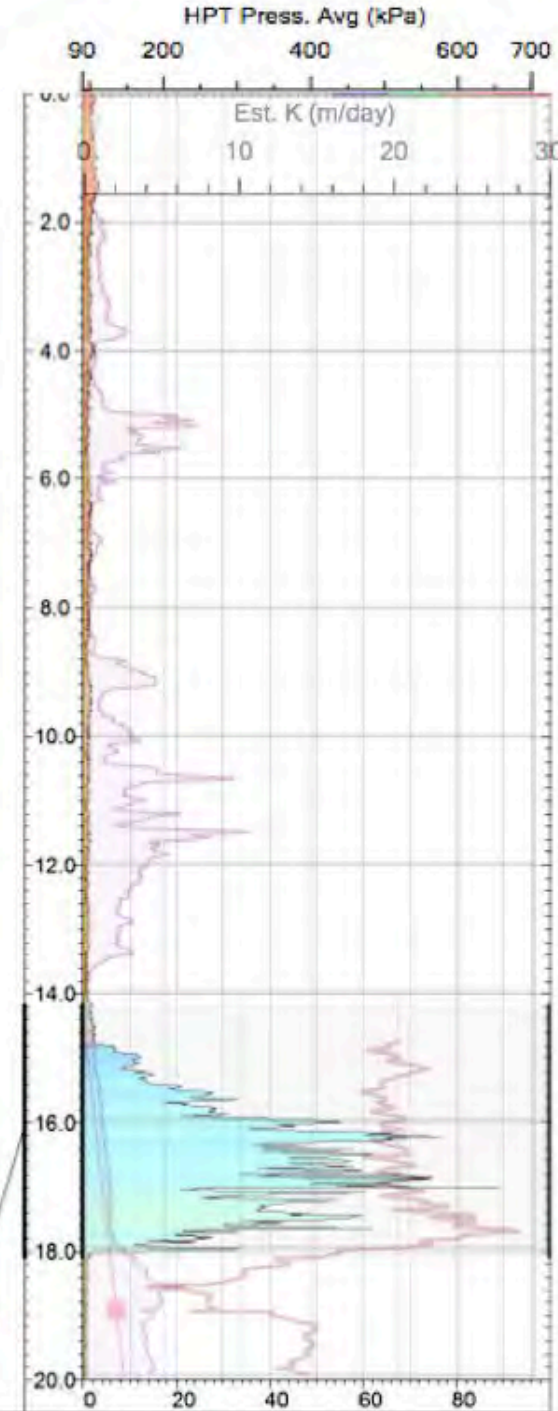
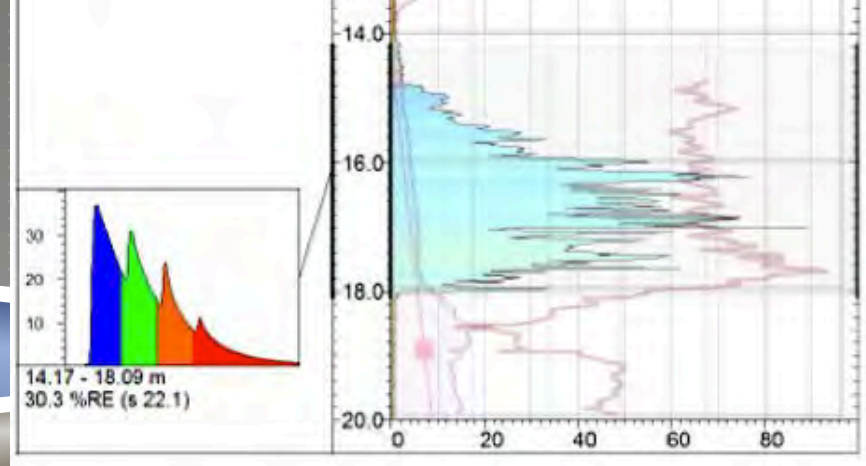
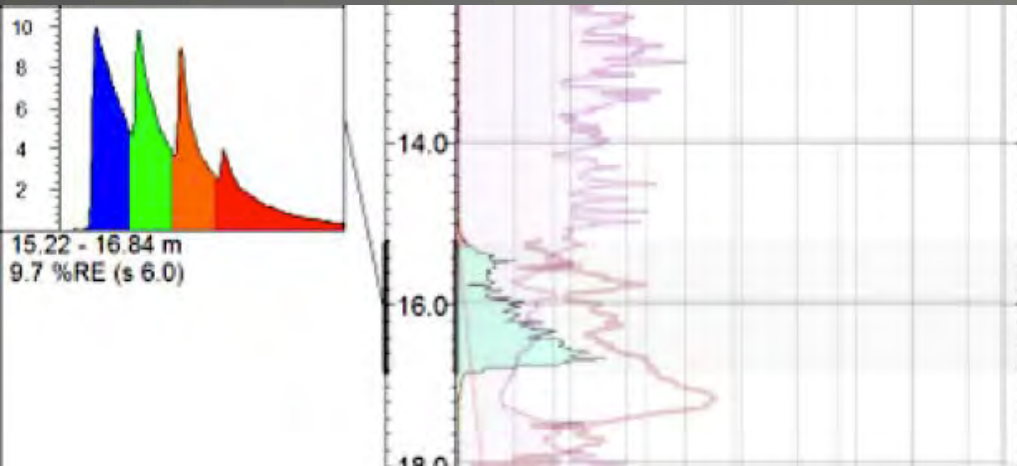


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# RESULTS

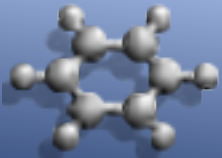
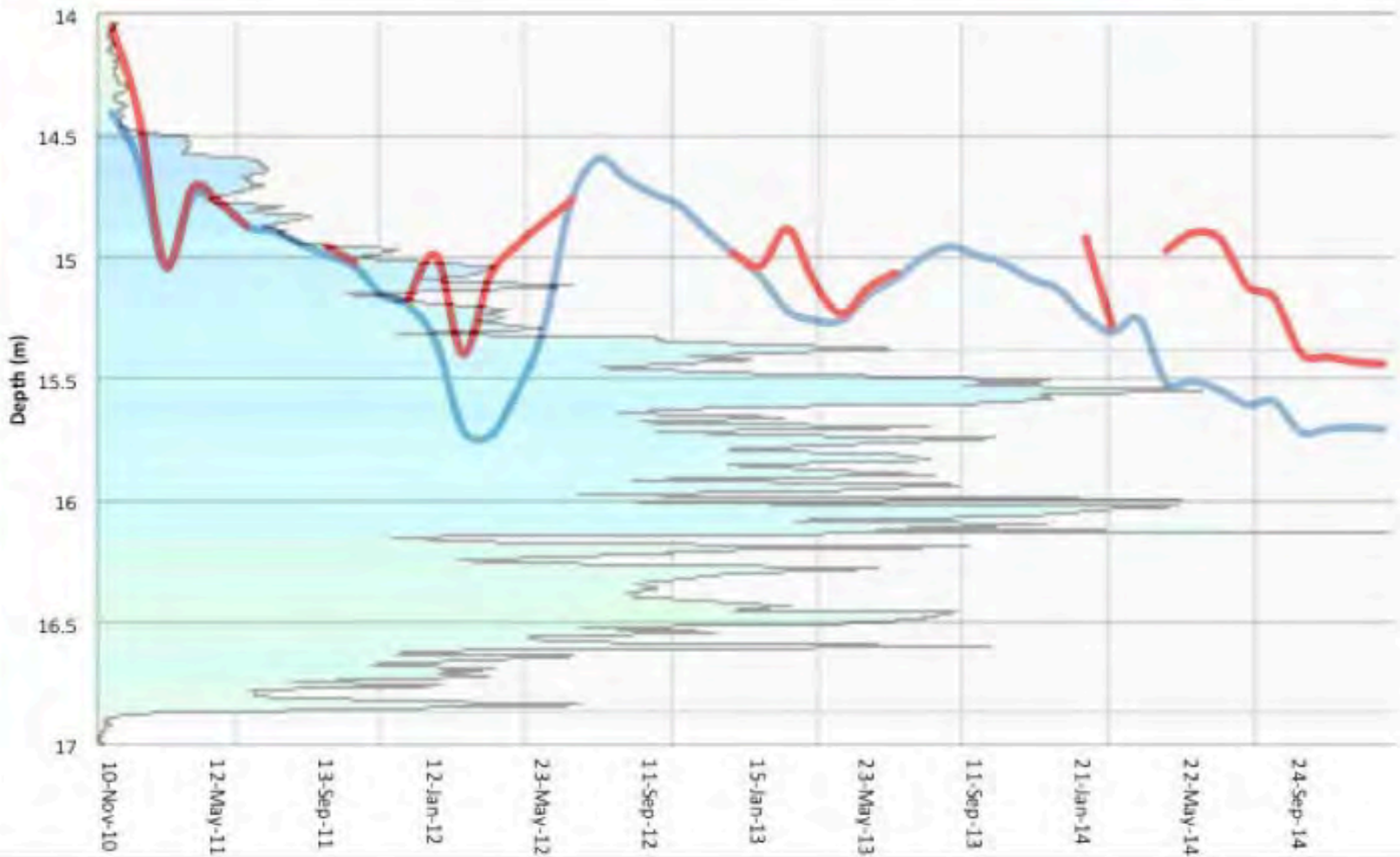
Heterogeneous distribution of LNAPL mass and recoverability.

- ▶ Down-gradient vs. source zone.
- ▶ LNAPL correlation with permeability.
- ▶ Targetable recovery locations in 3 dimensional space – optimized MPE operation.
- ▶ Effective recommendations based on evidence, not inference.



# LIF Overlay on Measured in well Artificial LNAPL Thickness

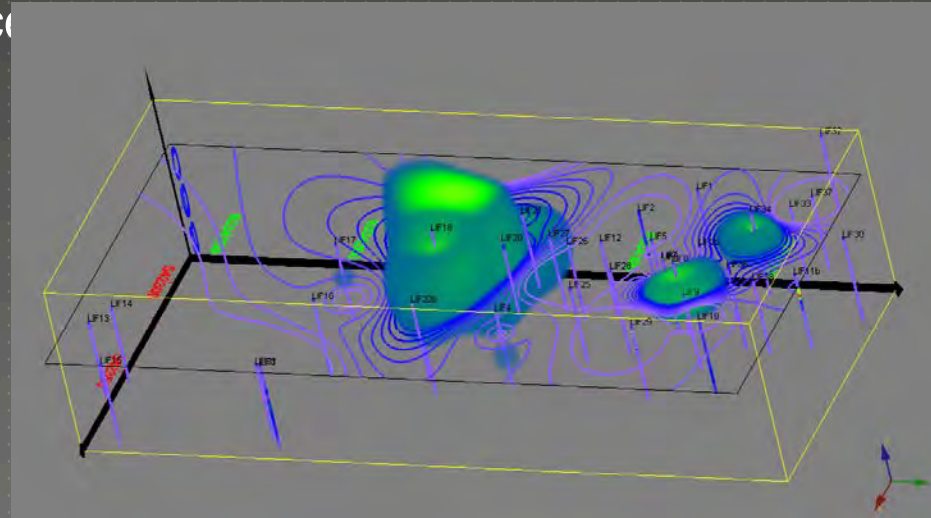
— GW/LNAPL (or AIR) Interface  
— LNAPL/AIR Interface



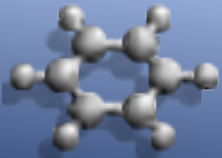
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# SUCCESSSES & FUTURE DEVELOPMENT

- ▶ Adaptable programs & wide acceptance
- ▶ Previously unidentified impacts.
  - ▶ No more inferences!
- ▶ Correlation with threshold values.
- ▶ Conceptual Site Modeling.



- ▶ Development of highly mobile delivery device (SCG & RMC).
- ▶ Improving analytical capacity.
  - ▶ Novel sampling methodologies
  - ▶ Data analysis & synthesis



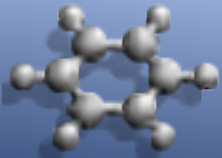
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# QUESTIONS?

- ▶ Feel free to contact us:
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- ▶ [www.scgindustries.com](http://www.scgindustries.com)
- ▶ 1 (506) 674-1081

## THANK YOU.



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