High-Resolution Site Characterization (HRSC):

Innovative Direct-Push Technologies for the Rapid Delineation of Subsurface Petroleum Hydrocarbon Impacts

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26th International Petroleum Environmental Conference
October 7-9, 2019 * San Antonio, Texas, USA
Overview

• What is HRSC?
• DP HRSC Technologies
• DP HRSC Technologies for LNAPL Delineation
High-Resolution Site Characterization (HRSC)

What is HRSC?
High-Resolution Site Characterization (HRSC)

Methodologies & Technologies

- Enhanced Site Details
- Reduce Uncertainty (SCM)
- Best Management Practice
- Data Density
  - Data Quality Objective
  - Sample Efficiency
High-Resolution Site Characterization (HRSC)

HRSC is NOT a Replacement of Analytical Sampling

Supplement, Support, Improve
High-Resolution Site Characterization (HRSC)

- No/Reduced IDW’s
- Better Analytical Data Quality (Selection)
- Better Analytical Data Definition (Data Density)
- Reduction in Iterative Events (Project Time)

\[
\text{Time} = $$
\]
DP High-Resolution Site Characterization (HRSC)

- Fast, Continuous, Real-time Profiling
- High Resolution – 0.05 ft (1.5 cm)
- Digital Output
HRSC Data Density Example

“Traditional” Methodology
30 Borings, 10 Wells, 10 Years
120 Soil & 400 GW Samples = 520 Data Points

DP HRSC Methodology
10 DP Locations to 50 Feet (3 Days)
10 Locations x 20 Samples/Foot x 7 Channels = >70,000 Data Points
High-Resolution Site Characterization (HRSC)

Direct-Push HRSC Technologies
Direct-Push HRSC Technologies

• Hydrogeologic/Stratigraphic
  • Cone Penetration Testing (CPT)
  • Hydraulic Profiling Tool (HPT)
  • Soil Electrical Conductivity (EC)

• Chemical
  • Membrane Interface Probe (MIP)

• Optical
  • UVIF (OIP/LIF/UVOST®/ROST, FFD)
  • Green IF (OIP-G/TarGOST®)
DP HRSC Technologies for LNAPL Delineation

Hydrogeologic/Hydrostratigraphic Tools
  • HPT

Optical Screening Tools (OST’s)
  • OIP-UV & OIP-G
  • UVOST & TarGOST
Hydrogeologic/Stratigraphic Tools

HPT – Hydraulic Profiling Tool
Formation Permeability with Depth
HPT Primary Data Collected

- HPT Pressure
- HPT Flow Rate
- Electrical Conductivity (EC)
HPT
Principals of Operation
HPT

Cross-Correlation Section of Soil EC and HPT Pressure Response.
HPT – Hydraulic Profiling Tool

- Common Uses:
- Determine Static Water Level
- Hydraulic Conductivity ($K_{est}$)
- Formation Permeability
- Migration Pathways
- Groundwater Specific Conductance in sands
Optical Screening Tools (OST)

OIP – Optical Image Profiler

Induced Optical Fluorescence with Depth
OIP – Optical Image Profiler

OIP-UV
• UV Light IF

OIP-G
• Green Light IF
OIP-UV

Purpose:
• UV induced fluorescence of NAPL hydrocarbons in soil.

Method:
• UV light directed at the soil
• Hydrocarbons present fluoresce.
• An Image of the soil is captured.
• Analyzed for fluorescence.
• Visible light images may also be obtained.
OIP-UV Visible Images
OIP-UV

Cross-Correlation Section of Crude Oil Spill Site.
OIP-G

Purpose:
• Green light induced fluorescence of NAPL hydrocarbons in soil.

Method:
• Green light directed at the soil
• Hydrocarbons present fluoresce.
• An Image of the soil is captured.
• Analyzed for fluorescence.
• IR light images may also be obtained.
OIP-UV Visible Images
Optical Screening Tools (OST)

UVOST® / TARGost®

Induced Optical Fluorescence with Depth
UVOST® / TarGOST®

UVOST®
(UltraViolet Optical Screening Tool)

TarGOST®
(Tar-Specific Green Optical Screening Tool)
• **Purpose:**
  UV laser induced fluorescence of NAPL hydrocarbons in soil.

• **Method:**
  • UV light directed at the soil
  • Hydrocarbons present fluoresce
  • Response is recorded with depth
TarGOST®

Purpose:
• Green laser induced fluorescence of Tar DNAPL (Coal Tar, Creosote, etc.).

Method:
• Green light directed at the soil
• Tar DNAPL present fluoresce
• Response is recorded with depth
DP HRSC – Closing Thoughts

• UVIF Technologies do not detect dissolved-phase
  ✔ Use of additional technologies, e.g. MIP
• UVOST® vs OIP
• 3D/Multivariant Modeling
Questions?
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