

# High-Resolution Site Characterization (HRSC):

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

**CONTEC**

Eric W. Garcia, PG, CEG, CHG  
Manager, Environmental Services



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# 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)

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<sup>®</sup>/ROST, FFD)
  - Green IF (OIP-G/TarGOST<sup>®</sup>)



# DP HRSC Technologies for LNAPL Delineation

## Hydrogeologic/Hydrostratigraphic Tools

- HPT

## Optical Screening Tools (OST's)

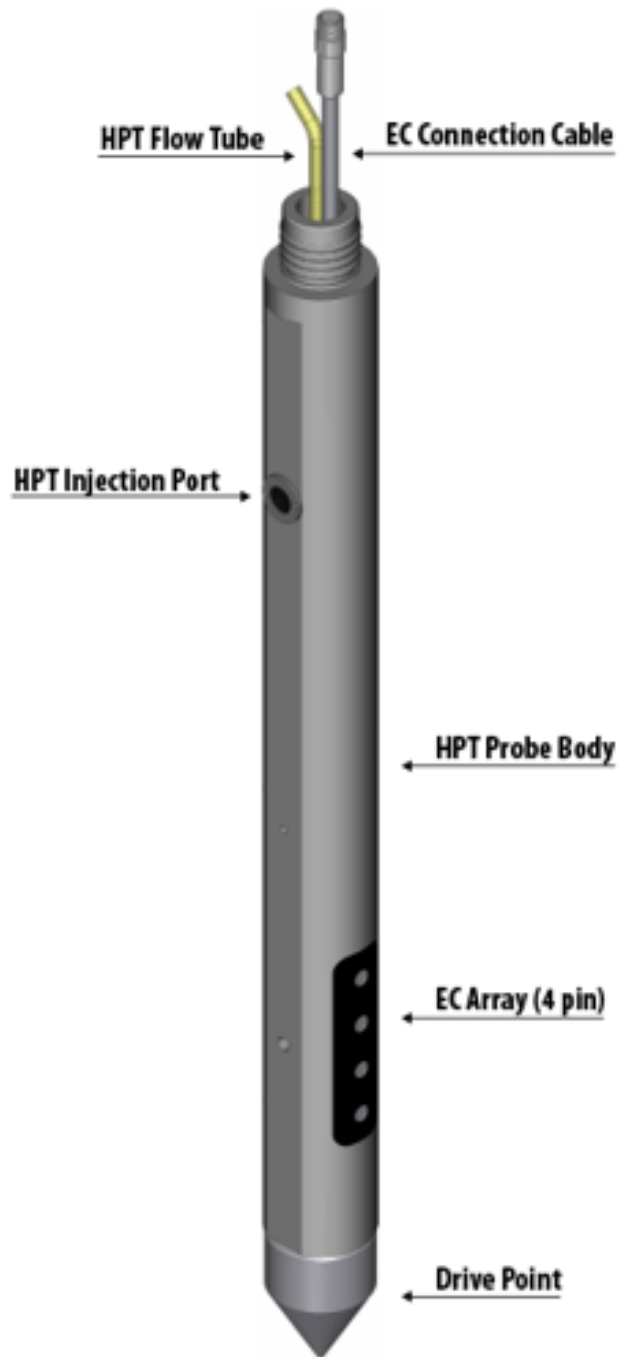
- OIP-UV & OIP-G
- UVOST & TarGOST

# Hydrogeologic/Stratigraphic Tools

## **HPT – Hydraulic Profiling Tool**

### **Formation Permeability with Depth**



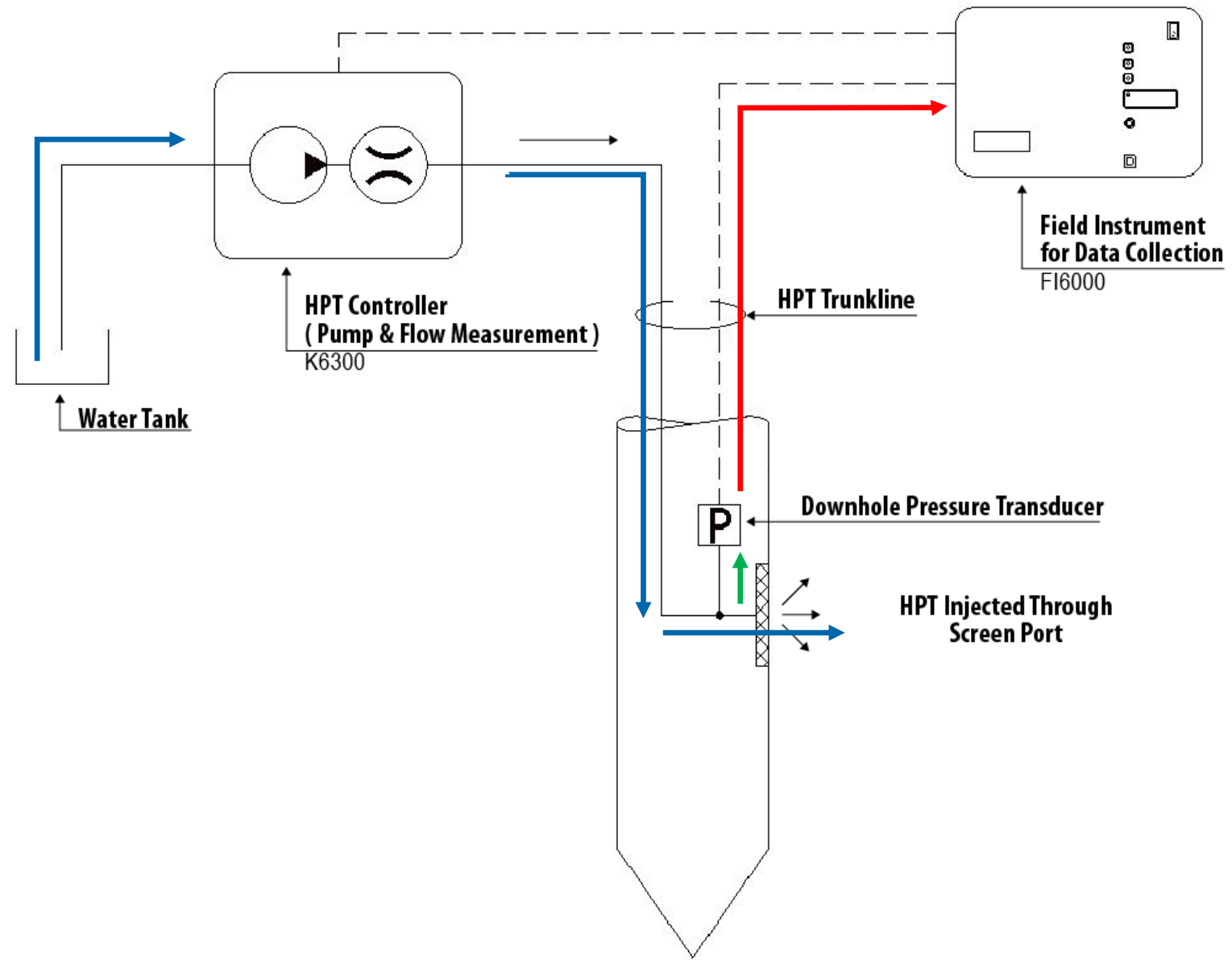


# HPT Primary Data Collected

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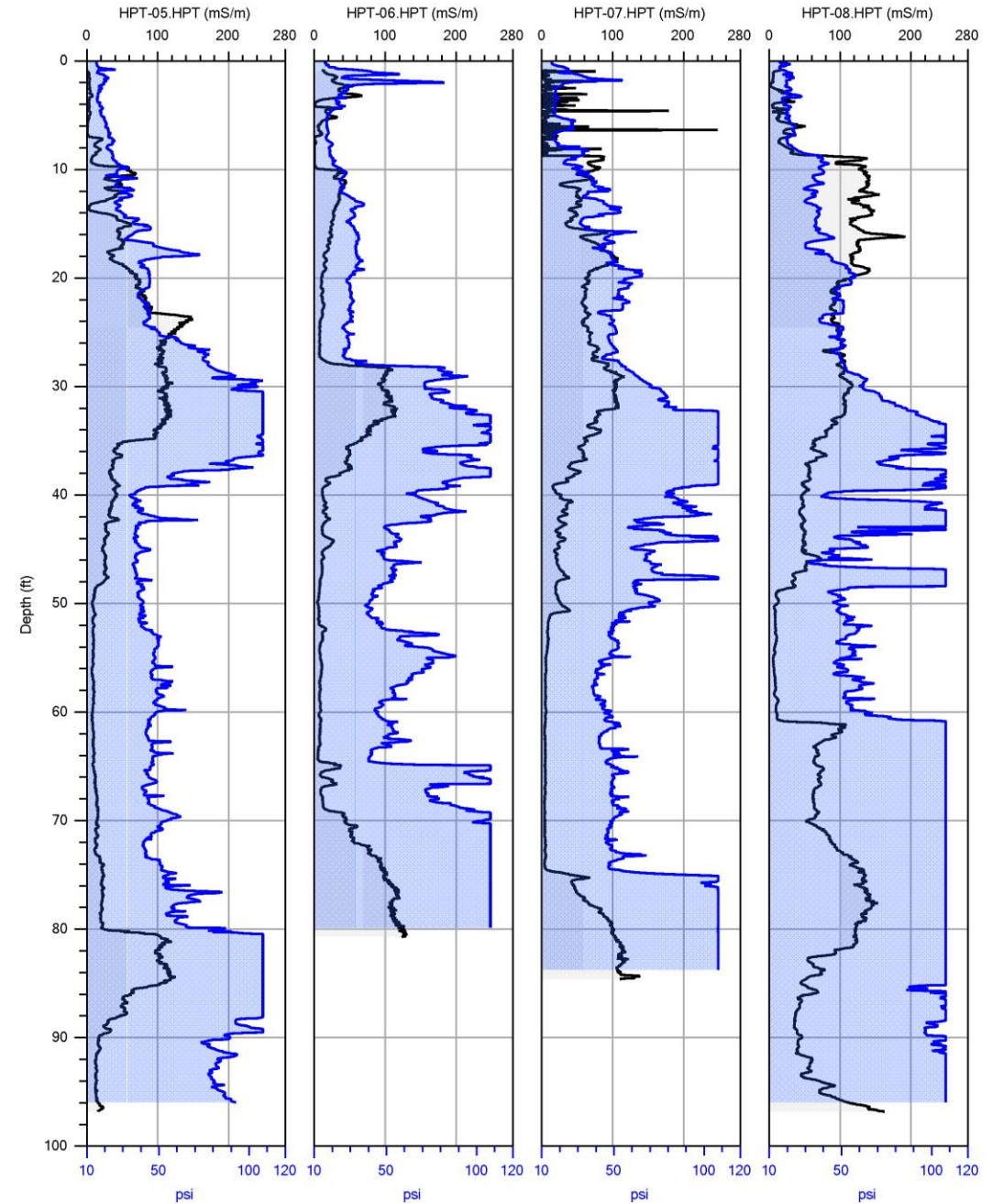
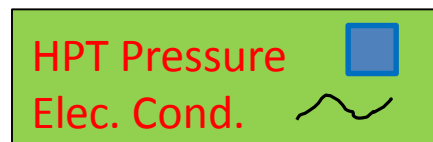
- HPT Pressure
- HPT Flow Rate
- Electrical Conductivity (EC)

# 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



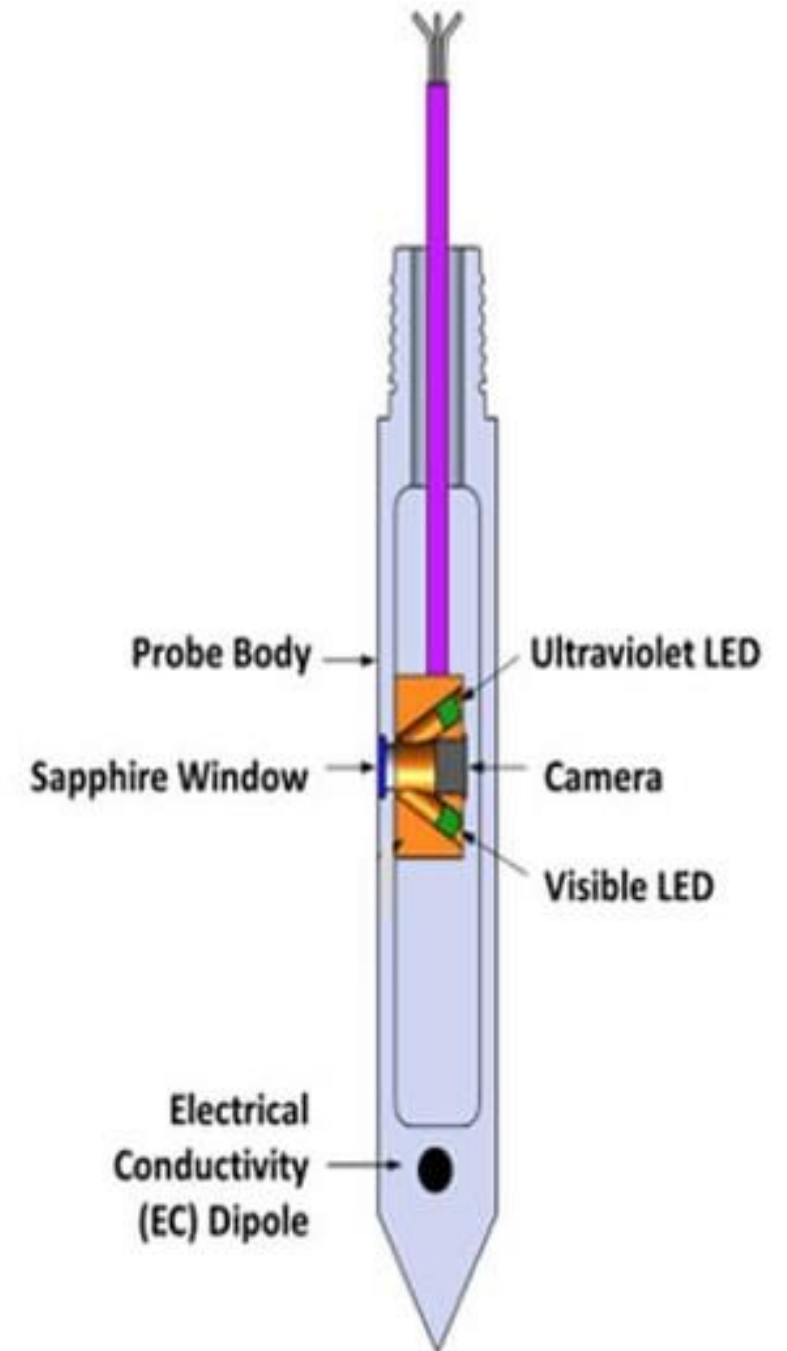
# OIP-UV

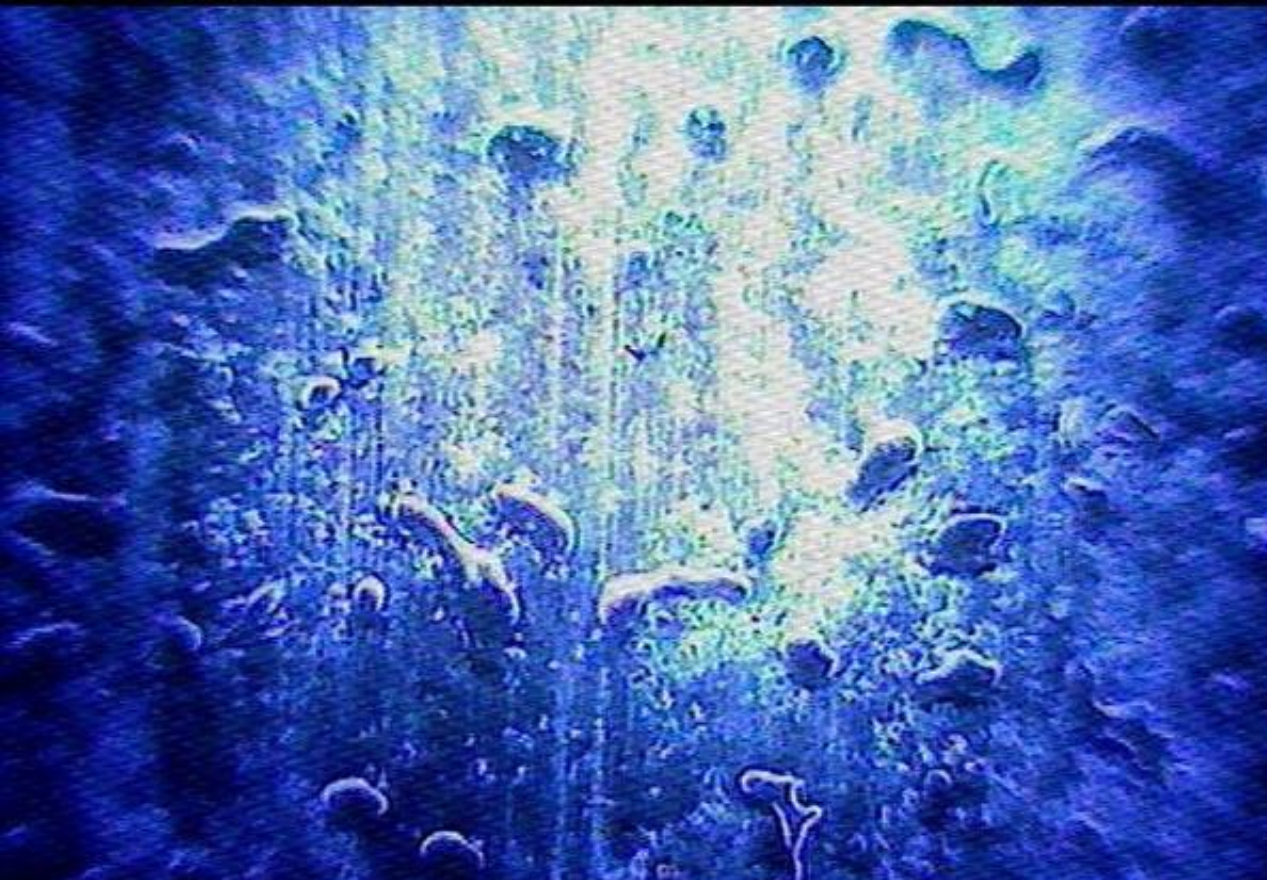
## Purpose:

- 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.

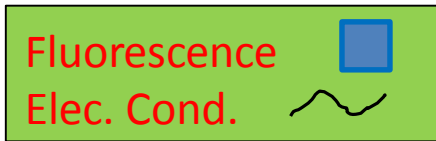
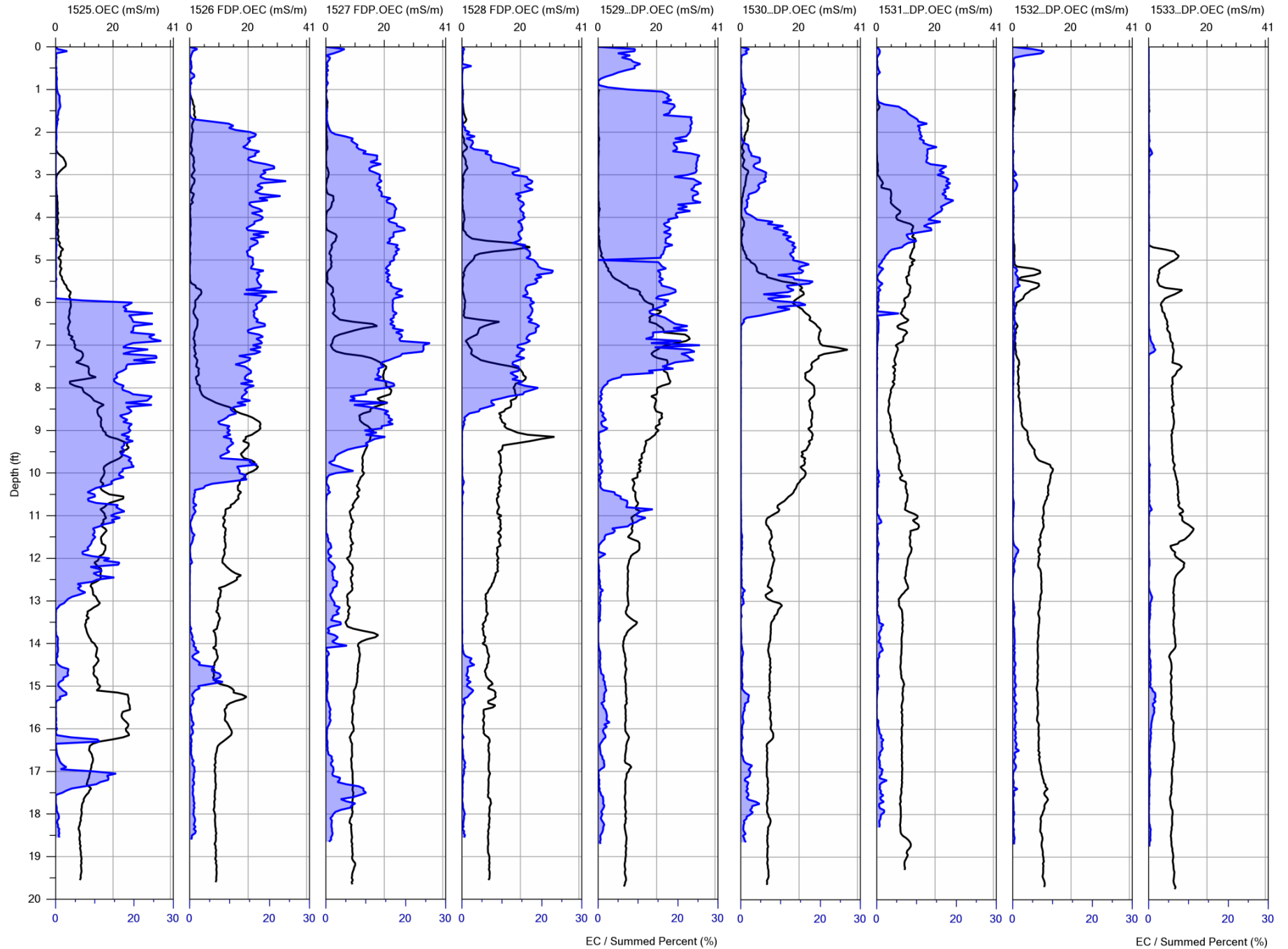




OIP-UV Visible Images

# OIP-UV

Cross-Correlation  
Section of Crude  
Oil Spill Site.



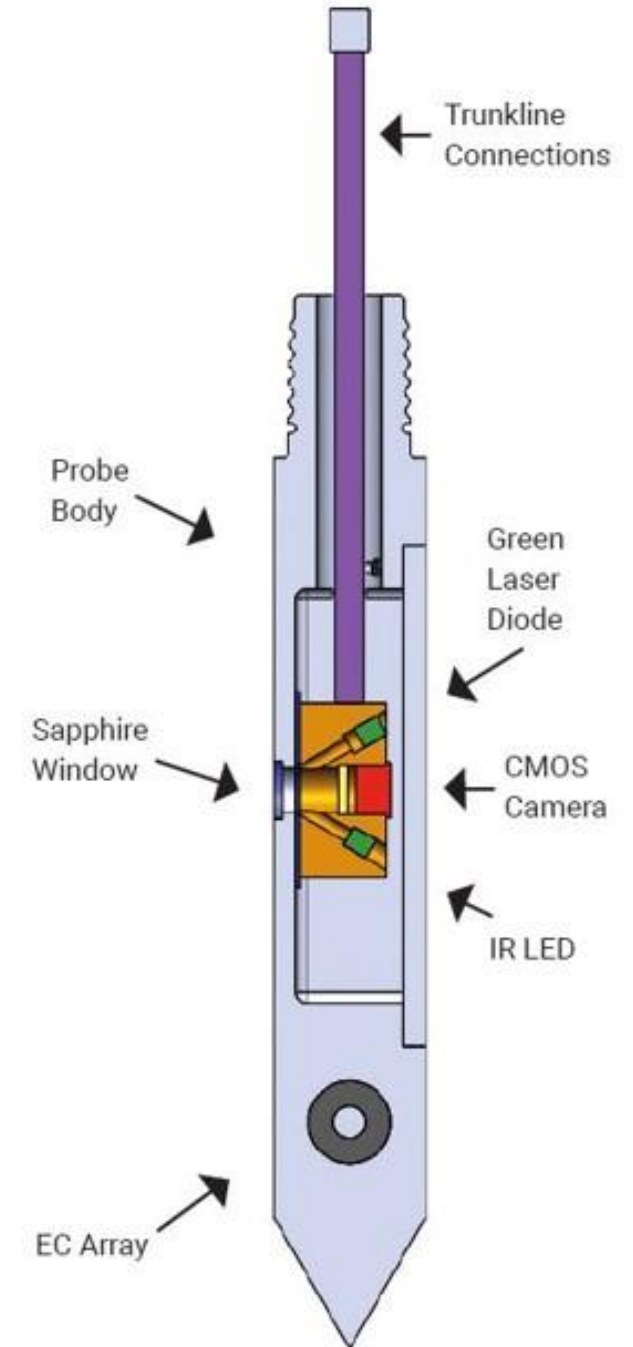
# OIP-G

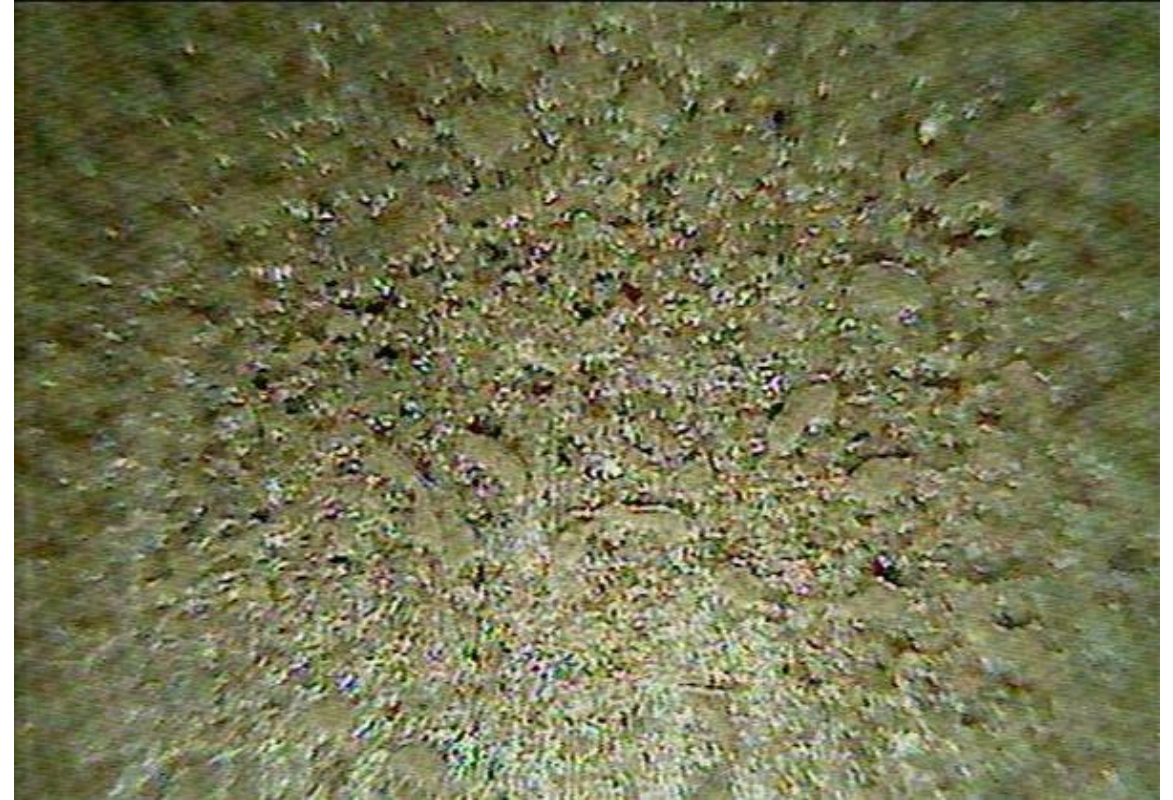
## Purpose:

- 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

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# Optical Screening Tools (OST)

**UVOST<sup>®</sup> / TARGost<sup>®</sup>**

**Induced Optical Fluorescence with Depth**





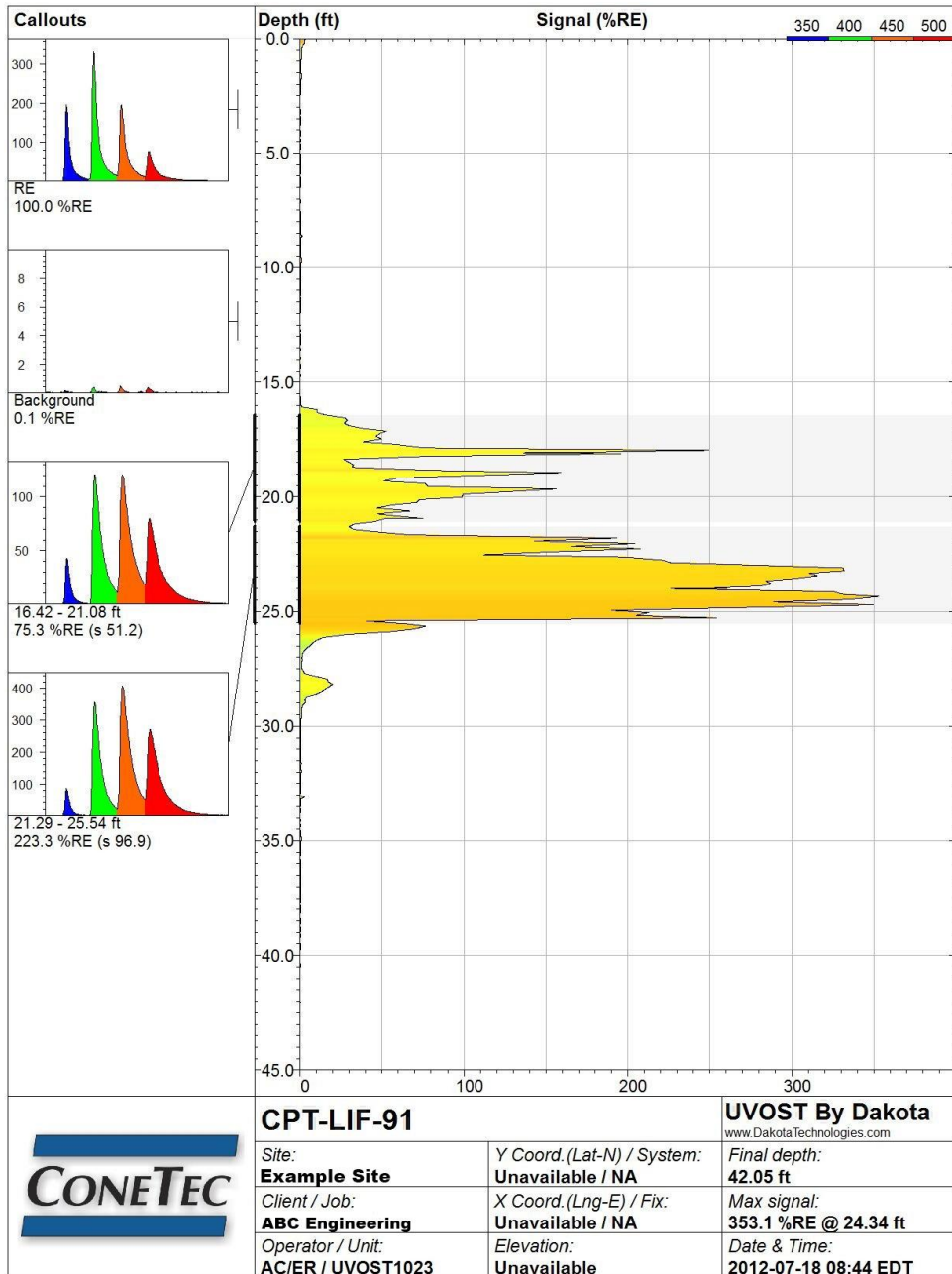
# UVOST<sup>®</sup> / TarGOST<sup>®</sup>

UVOST<sup>®</sup>

(UltraViolet Optical Screening Tool)

TarGOST<sup>®</sup>

(Tar-Specific Green Optical Screening Tool)



# UVOST®

- **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<sup>®</sup> vs OIP
- 3D/Multivariant Modeling

**Questions?**

# Contact Information

Eric W. Garcia, PG, CEG, CHG  
Manager, Environmental Services Group

ConeTec, Inc.  
820 Aladdin Avenue  
San Leandro, CA 94577

(925) 323-7498 Office  
egarcia@conetec.com

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