

# Utilizing CPT/UVIF to Delineate Free-Phase Dowtherm® in the Subsurface

**Bryan Heath, URS Corporation (URS Diamond)**  
**Steve Shoemaker, DuPont Corporate Remediation Group**  
**Tim Cleary , Gregg Drilling and Testing**



*The miracles of science™*

# Background

**During the RFI process of a former Dowtherm® Vaporizer area, evidence of free-phase Dowtherm® was discovered.**

**Needed investigative method that would allow for quick delineation to expedite remedial decision making.**

**A Cone Penetrometer (CPT) equipped with an Ultraviolet Induced Fluorescence (UVIF) module was selected.**

- Technology used previously to delineate free-phase petroleum products but never for Dowtherm®

# What is Dowtherm®?

**Used as a heat transfer fluid in the facility's manufacturing process.**

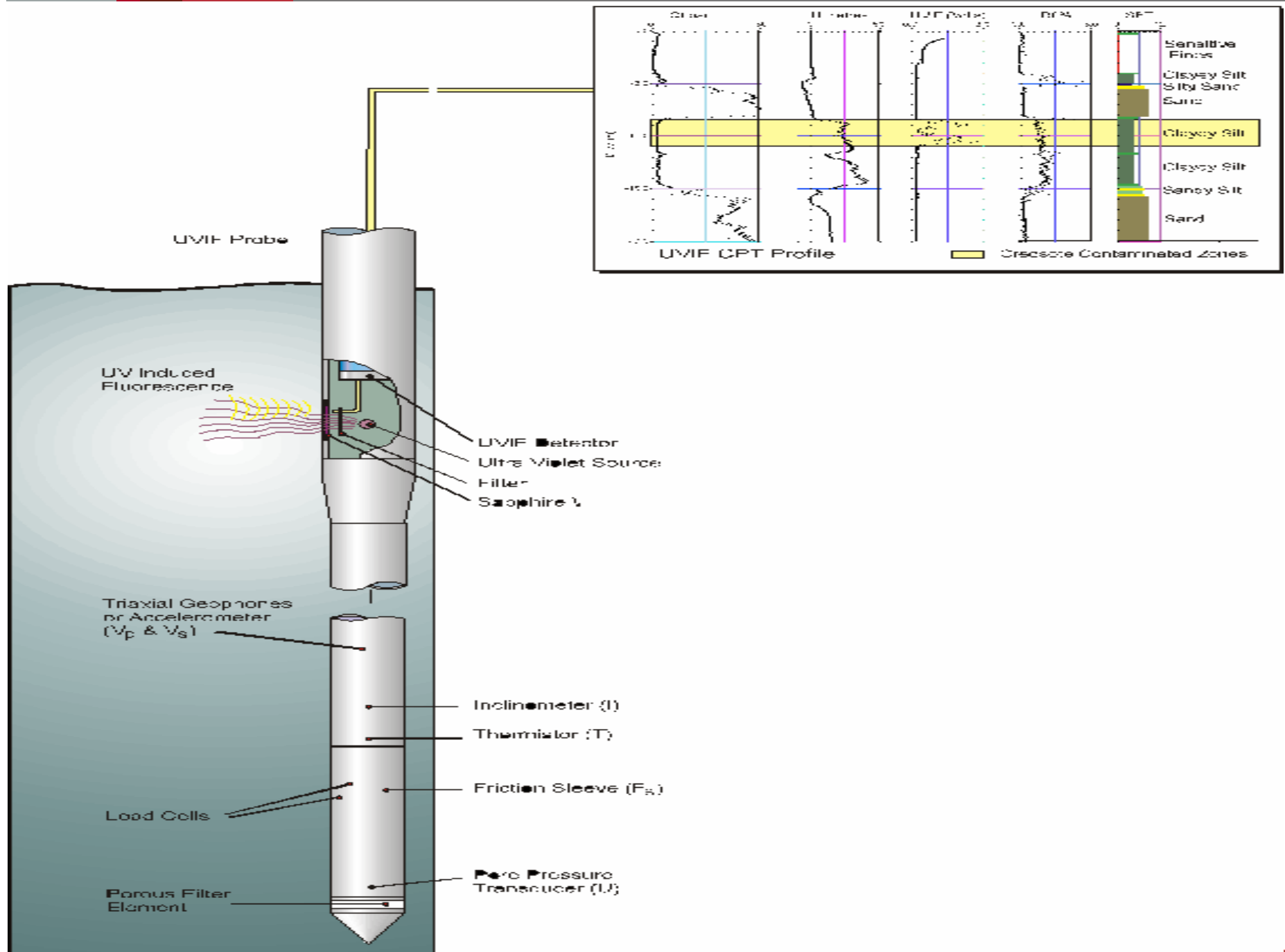
## **Dowtherm® Properties:**

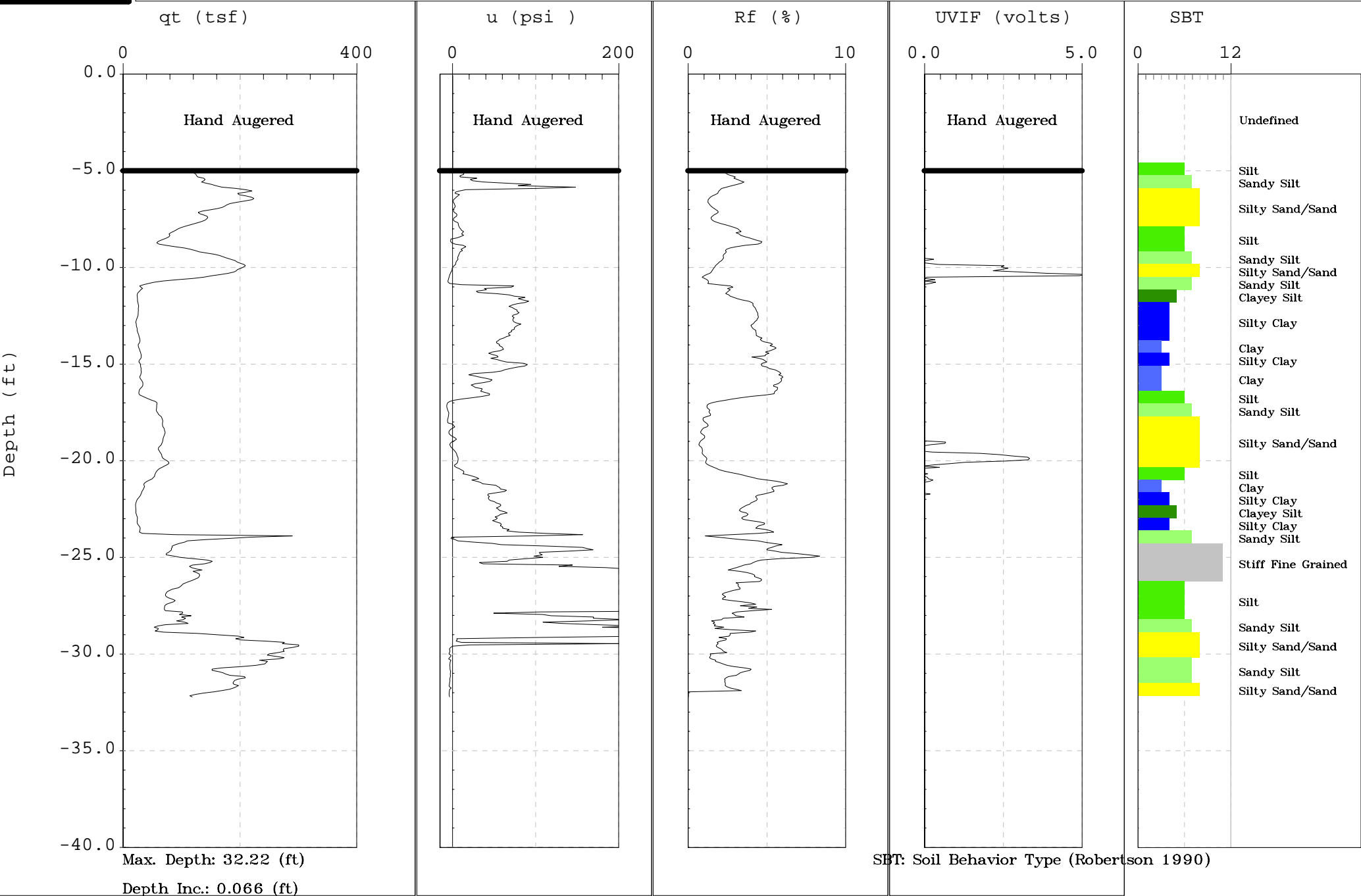
- mixture of 1,1-biphenyl and diphenyl ether (both dual ring aromatics)
- low solubility, low volatility, moderate viscosity
- specific gravity is approximately 1.07
  - Dense Non-Aqueous Phase Liquid

# What is Ultraviolet Induced Fluorescence (UVIF)?

**Works on principle that PAH's mixed with soil and/or groundwater fluoresce when irradiated with UV light**

- Hydrocarbon molecules absorb the UV light energy during radiation and immediately re-emit the light at a longer wave length (fluorescence)
- A UVIF module captures the emitted radiation and sends it to an amplifier at the surface via fiber optic cable and is recorded in real time.
- UVIF data is displayed in graphical form
- Other modules can be used to detect gasoline, aviation fuel, diesel, fuel oil, transformer oil, as well as many other hydrocarbon based products.





# Investigation Area

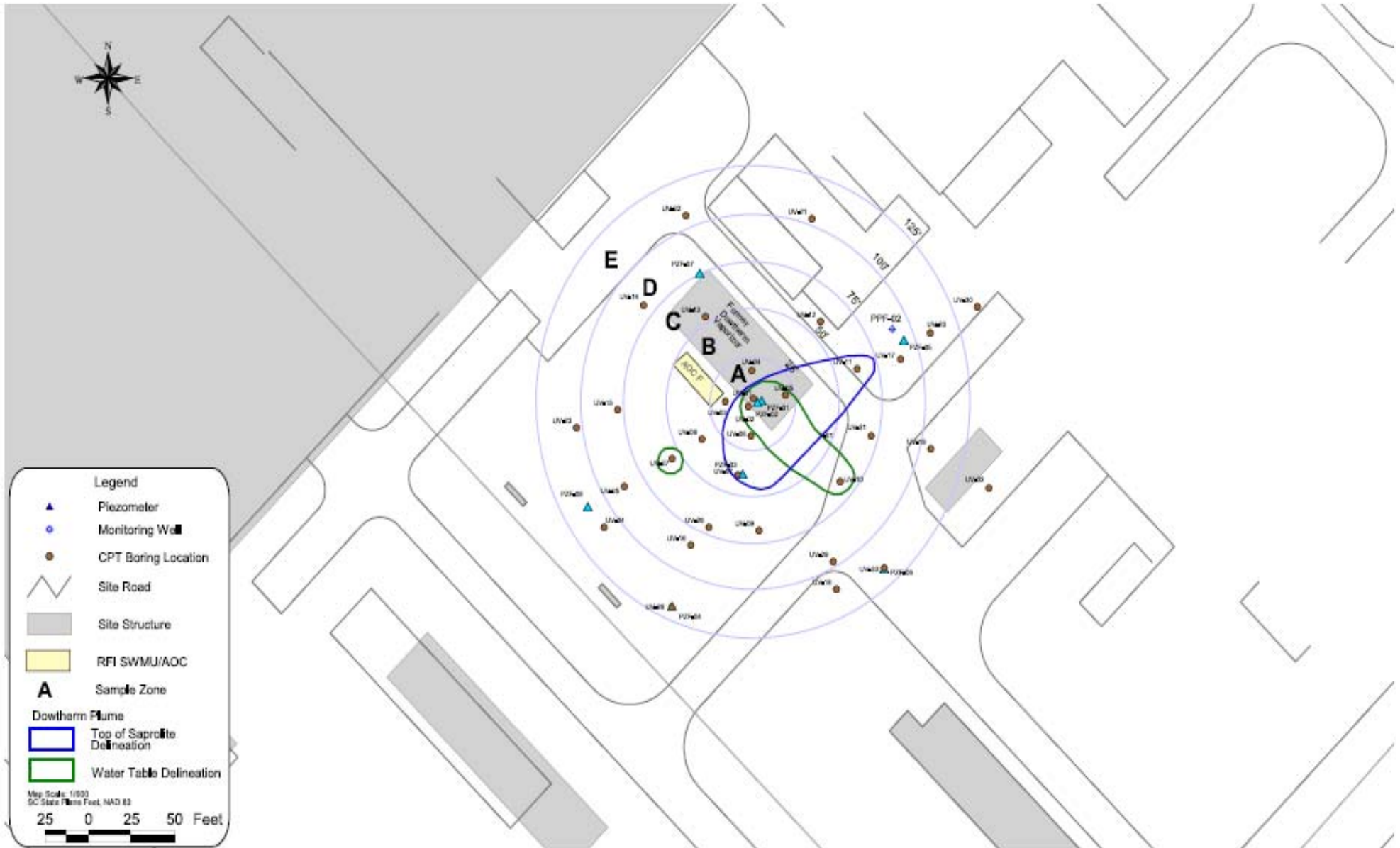


**Former Dowtherm  
Vaporizer**

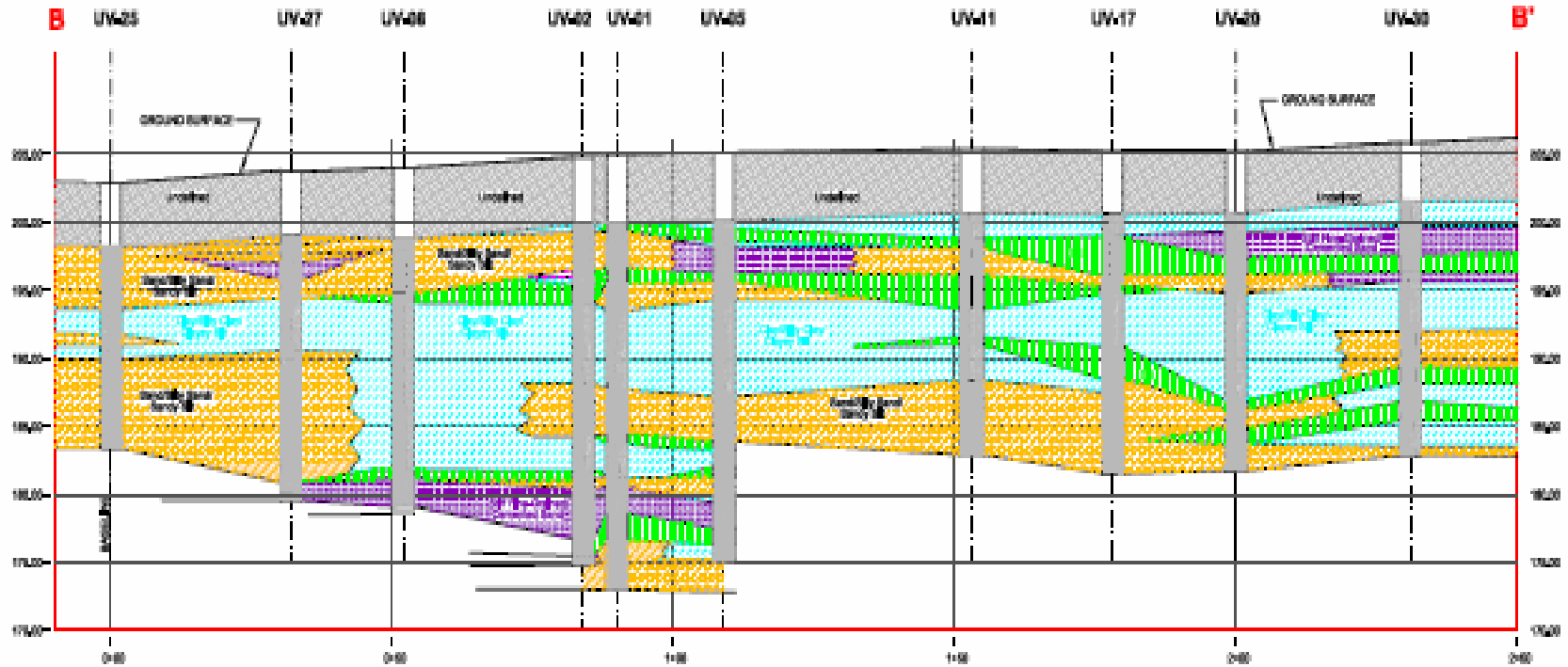
# Investigative Approach



# UVIF Delineation Results



# Lithologic Cross-Section

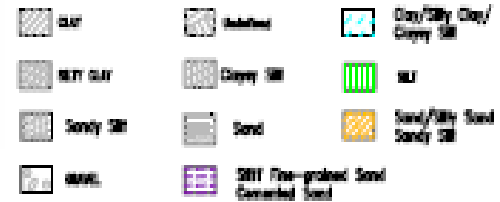


**CROSS SECTION B-B'**

2 X VERTICAL EXAGGERATION



GRAPHIC SYMBOLS



# Confirmation of UVIF Data

## Collected in-situ groundwater samples in borings which exhibited UVIF response for visual inspection

- Visual inspection confirmed presence of free-phase Dowtherm®

## Collected soil samples at same depth intervals as UVIF response

- Analytical data corresponded to concentrations indicative of free-phase Dowtherm®

## Installed piezometers screened at intervals of UVIF response

- measured 3 feet of Dowtherm® in PZ-02 approximately 20 feet bgs. (10 feet below water table)

# Results

## **Confirmed presence and delineated free-phase Dowtherm® in <5 days**

- 33 CPT borings and installation of 8 piezometers
- Sampling performed at discrete intervals based on UVIF response
  - Minimized need for analytical analysis

## **Allowed for quick remedial decision making and implementation**

- Used UVIF responses to target recovery zone
  - Number and location of extraction wells minimized

# Benefits

- **Allows for timely characterization**
  - Capable of pushing 400 to 500 feet per day
- **Minimal waste generated (<10 gallons of decon water)**
- **Allows for dynamic decision making in field**
- **Cost effective versus traditional investigative characterization methods**
  - Costs savings of ~\$22,000

# Limitations

- **Can be limited by lithology (ex: gravel layers, PWR)**
- **Better suited for longer chain hydrocarbons and multi-ring aromatics**
  - Other modules available for single ring aromatics

## Closing

**UVIF technology allowed for expedited source area characterization leading to a faster remedial strategy evaluation and implementation.**

# Questions



*The miracles  of science™*