Case Study: Confirmation of TarGOST® Laser-induced Fluorescence DNAPL Delineation with Soil Boring Data

Marc B. Okin

Sean M. Carroll
William R. Fisher

Dakota Technologies, Inc. Randy W. St. Germain

The International Symposium & Exhibition on the Redevelopment of Manufactured Gas Plant Sites
April 6, 2006
Reading, England

TarGOST® Technology: How Does it Work?

- Developed & operated by Dakota Technologies, Inc.
- TarGOST® = Tar-specific Green Optical Screening Tool
- Based on laser-induced fluorescence – specific to PAH molecules, the primary component in MGP – related tars, oils (DNAPL)
- Rapid pulses of green laser light (approximately 10 ns) are emitted into the ground 20 to 50 times per second (20-50 Hz)
TarGOST Technology: How Does it Work?

- Response time and amplitude contribute to the fluorescence “signature” of the DNAPL
- In the absence of PAH molecules, green light is rapidly reflected and recorded by the first optical sensor (blue peak)
- Nearly continuous readings (2-cm intervals) produces thorough coverage
- Approximately 45 minutes per 30-foot probe (~ 300 ft/day)
TarGOST Offers Unique Advantages over Traditional Approaches

- Rapid pace enables dense data collection
- Real-time data produces smart & flexible field approach
- Data product:
  - spatially dense
  - semi-quantitative
  - Vertically continuous
- Results in fewer mobilizations, reduced uncertainty, reduction in long-term investigative costs and generates no investigative-derived waste

Case Study: Site Overview

What We Understood: Prior Conceptual Site Model

- Geology: Fill / alluvium / glacial till
- River located adjacent to Site (thought to sit on top of alluvium surface)
- Prior investigation results:
  - DNAPL present in monitoring wells & suggested in on-site soil borings
  - Off-site DNAPL presence suggested; however delineation elusive using conventional methods
Prior Conceptual Site Model

Investigation Scope

- **TarGOST delineation:** 70 probes on land (CPT rig, 8 days); 53 in River from small barge (Geoprobe, 4 days)
- **Field geologist directed investigation** and used GPS to capture position
- **Soil borings/monitoring wells:** some used for confirmation of TarGOST results
- **Core sampling using large-diameter Geoprobe sampler:**
  - Conducted at impacted locations
  - Cores submitted for fluorescent photography

![Prior Conceptual Site Model Diagram]
Fluorescent Core Photography

Results - Summary

- DNAPL Delineation:
  - Thicker DNAPL zones on-site (near historical operational structures);
  - Thinner “stringers” in permeable zones fingering outward from source areas

- Observed multiple fluorescence signatures:
  - Lighter fraction (More mobile?)
  - Two DNAPL types
Investigation Results

Revised Conceptual Site Model
Results: Source Area DNAPL Delineation

NOTE: ~ ~ ~ = Estimated glacial till surface

Results: DNAPL Delineation

Adjacent to Holder Foundation

Along riverbank

NOTE: ~ ~ ~ = Estimated glacial till surface
River Sediment TarGOST Results

Near shore: DNAPL seams of varying thickness
Mid-river: thin DNAPL seam

NOTE: = Estimated glacial till surface

DNAPL Signatures
DNAPL Signatures

Analysis of TarGOST Performance

- TarGOST provided rapid, real-time DNAPL delineation
  - Results correlate well with observational & analytical data
  - Data density provides good understanding of extent
  - “Real-time” nature enhances efficiency (reduces chance of re-mobilization)
  - Very effective for conceptual site model development & refinement
Conclusions

- TarGOST has a place in the arsenal of tools for DNAPL Assessment
  - Build other investigational phases around TarGOST results (use soil borings to define vertical extent)
  - Best used as “First shot” at “hot-or-not” DNAPL delineation to identify problem areas.
  - Can be effective in middle of assessment phase – fill data gaps (as it was in this investigation)
  - * Understand limitations of TarGOST “range of vision”:
    • Gasoline, solvent impacts will not be detected using TarGOST.

THANK YOU FOR YOUR ATTENTION