Building Conceptual Site Models That Work
(a.k.a., Why Doesn’t My Site Clean Up)

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Dajak, LLC
The Problem: Data Density

- Poor conceptual site models waste money
- Standard practice: tens of data points
- Wells are expensive
- Insufficient data is hard to overcome
- Treadmill: sites do not clean up
You Gotta Be Kidding

Massachusetts Military Reservation, Cape Cod, MA

10,000 wells
Good data density
Too expensive, not sustainable
The Solution: Scan First

X-ray of Skull
nydailynews.com

3-D Seismic Image of North Sea
dgi.com
Building Conceptual Site Models That Work

GeoTrax Survey™ provides ultra-high resolution 10,000 to 100,000 data points
Rigorous data integration
150 projects in N. America, Eur., Asia & Australia
Most projects cost $50,000 to $100,000
Confirmed existing CSM <10%
Data Acquisition

- Always 56 small electrode stakes
- Always in a straight line
- Always evenly spaced
Depth where highest PID reading was detected

MW - 3

MW - 2

Thin caliche layer caused refusal of Geoprobe rig

Depth where highest PID reading was detected

Submerged LNAPL “Blob”

Approximate Depth To Groundwater

Trapezoidal image

Depth is 20% of surface length

Unlimited depth
70 Images at Railroad Site

2-D Data Fences
Aestus, LLC

Collaborative effort improving CSMs

Unique scanning tool from Oklahoma State U.

Rigorous data integration

Yields expedited site closure at lower cost
Same Equipment, Same Transect

Standard ERI

GeoTrax Survey™

Confirmed by EPA Ada Lab
Drillable Image

Halihan et al, 2005
Tens of Thousands of Data Points

Each data point (pixel) equals sum of:

1. Biological activity
2. Fun stuff people add
3. Groundwater
4. Soil and rocks
Typical Electrical Properties

- Salt Water: Less resistive (More conductive)
- Bioactivity
- Clay, Silt, Sand, Rock: Ohm-meters (units of resistivity)
- Aqueous Phase Contaminants: More resistive (Less conductive)
- Non-Aqueous Phase Liquids
Typical Applications

- LNAPL, DNAPL & aqueous phase
- Impacts to surface water bodies
- Sub-aqueous sediments
- Landfills
- Substrate injections
- Bioactivity evaluation
Temporal Monitoring

1. Initial Image
2. Change in fluid distribution
3. Subsequent Image
4. Calculate differences
5. Shows change over time

Halihan et al, 2011
Technology Limitations

- Electrical properties only
- Data integration is necessary
- Process is labor intensive & iterative
- Multiple surveys for temporal monitoring
- Must accommodate infrastructure
GeoTrax Survey™ Process

Phase 1: Scanning & Visualization

- Data acquisition & processing
- Data integration
- 2-D and 3-D visualization
- Interim report
Phase 2: Day of Discomfort

- CSM will dramatically change
- Can be uncomfortable
- Be prepared
- Develop confirmation sampling program
Phase 3: Updated CSM

- Confirmation drilling
- Data integration
- Collaborative update of CSM
- Final report
Case Studies

1. Vapor intrusion – LNAPL
2. Bioremediation – DNAPL
Hobart, OK, Vapor Intrusion

Halihan et al, 2005b
GeoTrax Survey™ Locations

Legend:
- ![Confirmation Monitoring Wells, Locations are Approximate](image-url)
- ![GeoTrax Survey Location and Orientation](image-url)

- Car Club
- Welding Shop
- County Maintenance Building
- Department of Human Services

Confirmation Monitoring Wells, Locations are Approximate
GeoTrax Survey Location and Orientation
Depth where highest PID reading was detected

MW-3

MW-2

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Depth where highest PID reading was detected

Submerged LNAPL “Blob”

Approximate Depth To Groundwater

GeoTrax Survey™ Image GS-008
Solid 3-D Model Site Visualization

Hobart Site: Resistivity Defined NAPL in Subsurface
Resistivity Isoshell: \( \geq 40 \) ohm-meters
CSM That Works

Hobart Site: Resistivity Defined NAPL in Subsurface Plan View: North Up

3-D Model Horizontal Slice at ~23’ BGS
Site History

- Dry cleaners - 1945 to 1977
- Bioremediation injectates - 2002
- Soil excavation - 2004
- Aestus scan - 2009
Conductive Zone of Degradation – Vadose Zone

Halihan et al, 2012
Results

- Visualization of enhanced bioactivity
- Newly delineated DNAPL
- Plume deeper than thought
- Existing monitoring wells unsatisfactory
- Stakeholders can appreciate complexity
GeoTrax Survey™: CSMs That Work

- Scan first
- Ultra-high resolution
- Tens of thousands of data points
- Robust data integration
- Expedited site closure
- Accurate CSMs save money
Stop Drilling Blind
Contact Information

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