Case Studies

From the U.S. Navy

Adrianne Saboya and Tim Shields
Navy PWC Environmental Department
San Diego, CA

Navy PWC Environmental Department, San Diego

- Staff of 40 professionals – geologists, engineers, geophysicists, hydrogeologists, environmental scientists
- Based in San Diego servicing west coast military bases
- PWC provides a broad range of environmental consulting services to internal Navy and Marine Corps commands.
- PWC offers Site Characterization and Penetrometer System (SCAPS) capability

SCAPS

Site Characterization and Analysis Penetrometer System

S·C·A·P·S

TRI-SERVICE

Naval Command, Control and Ocean Surveillance Center RDT&E Division

NAVFAC

Naval Facilities Engineering Command

Motivation for Integrating Triad

- Triad Dynamic Sampling and Analysis Plan enables optimal use of SCAPS on a range of environmental projects:
  - Provides the technical framework needed to realign the clean up program with available innovative technologies
  - Cultivates greater partnering relationships with regulators
- Puts into perspective the greatest source of uncertainties associated with environmental investigations
  - Promotes better representation of true site conditions

Motivation for Integrating Triad *(Cont.)*

- Supports Navy initiatives promoting use of innovative technologies and reducing site investigation and remediation costs by:
  - Reducing Work Plan / fieldwork / reporting cycle time and reducing total number of cycles
  - Reducing per sample costs to allow more accurate site characterization
  - Providing the technical umbrella for regulatory acceptance of innovative technologies exchanged through the NAVFAC Technology Transfer Program

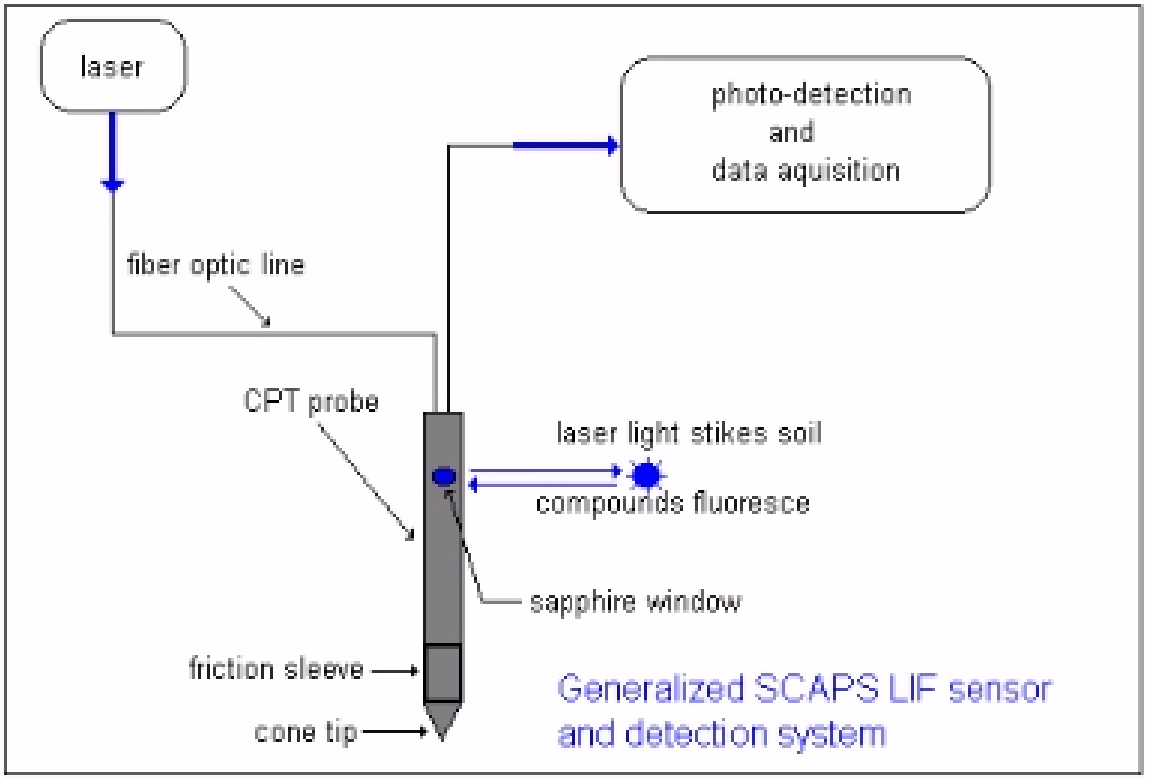
If properly implemented, the Triad approach is a strategy that allows for faster, cheaper, and yet more effective ways to conduct site investigations

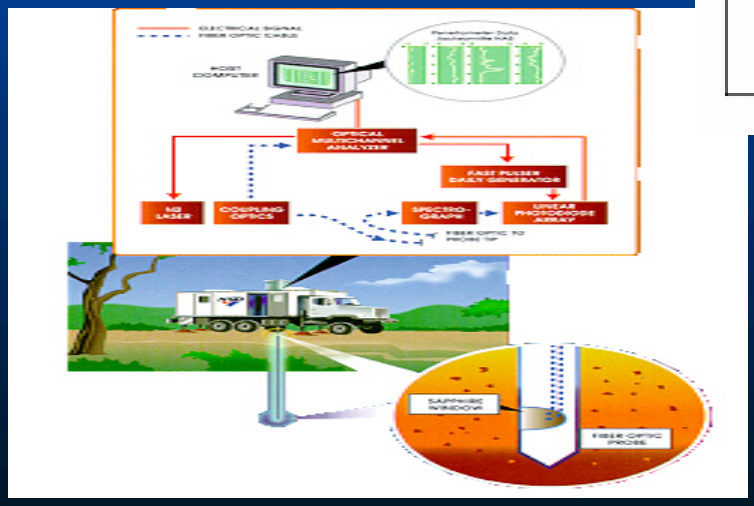
SCAPS Tools
Investigating Subsurface Contamination In Place and Real Time

- Laser induced fluorescence (LIF) for petroleum hydrocarbons
- Membrane Interface Probe and Direct Sampling Ion Trap Mass Spectrometry (MIP/DSITMS) for VOCs
- Laser Induced Breakdown Spectroscopy (LIBS) for metals (mostly lead and chromium)
- Video Microscope Probe (GeoVIS)

Petroleum Hydrocarbons
SCAPS Laser-Induced Fluorescence

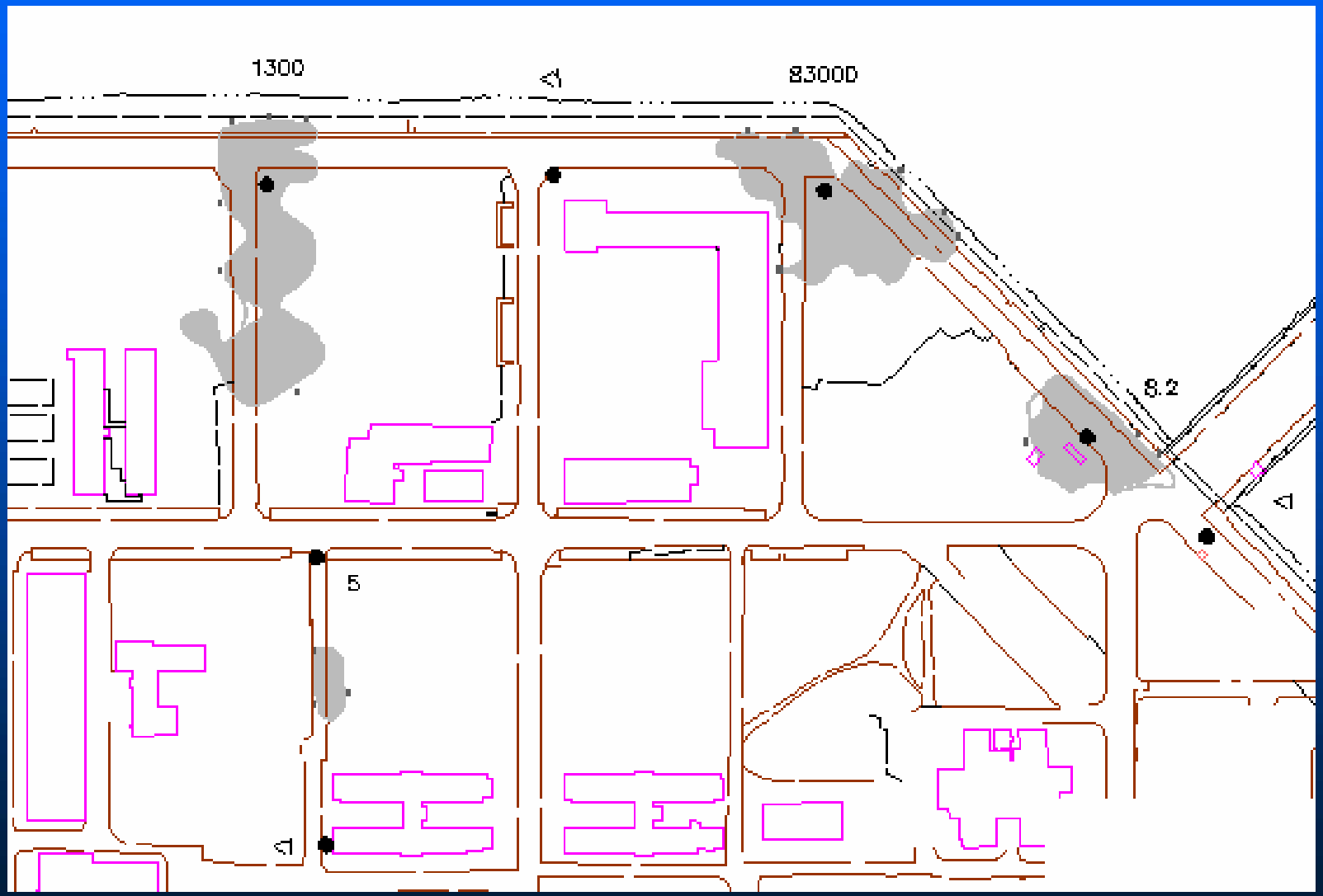
- Laser Source: Ultraviolet (308 nm) Xenon Chloride Eximer laser
- Excites 2-ring and greater Polycyclic Aromatic Hydrocarbons



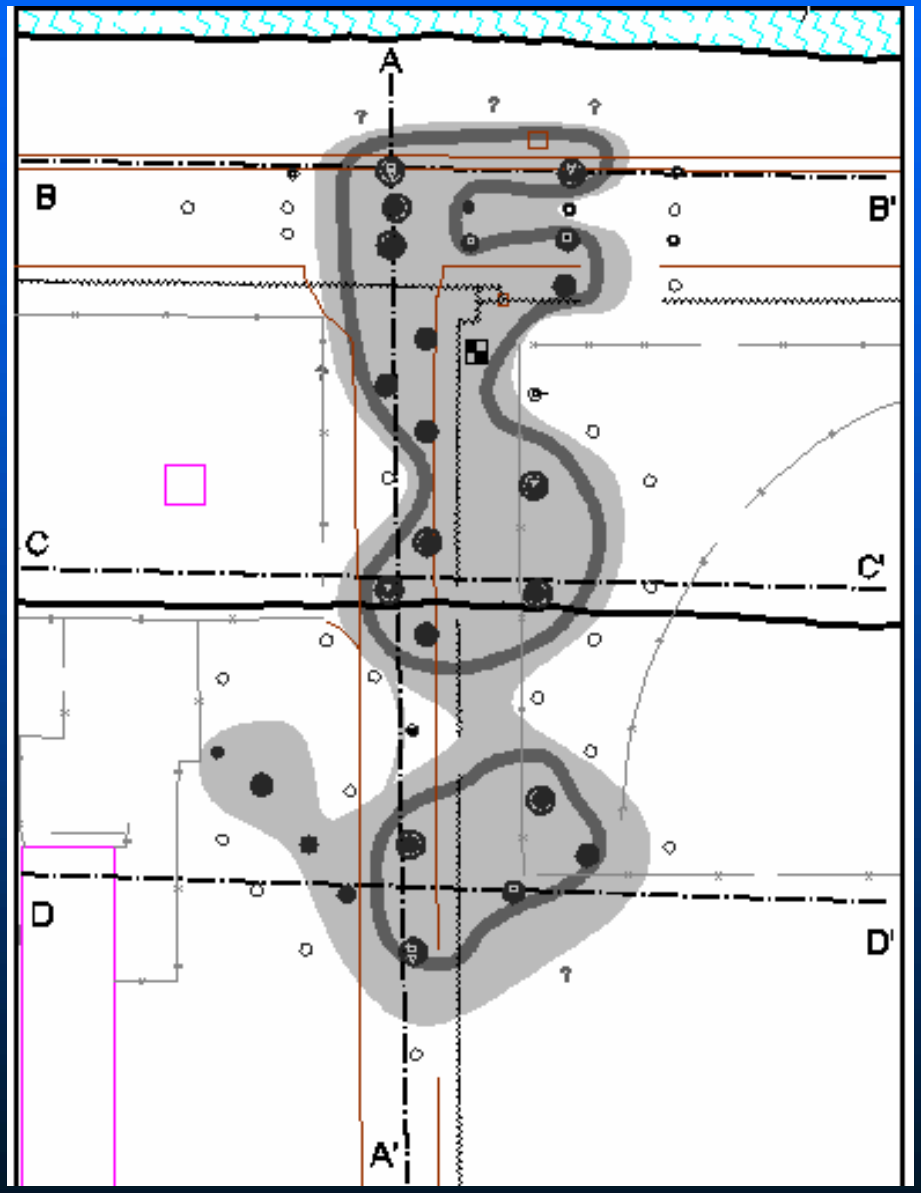


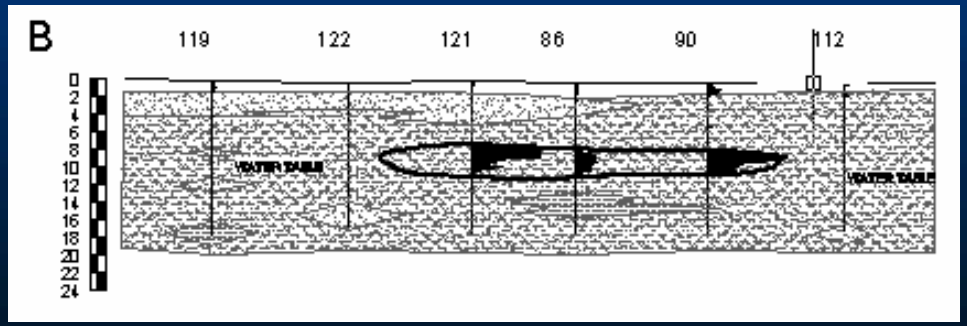
- LIF generally detects fuel concentrations greater than 100 ppm

Case #1: The Early SCAPS Approach – "Dynamic Workplan"



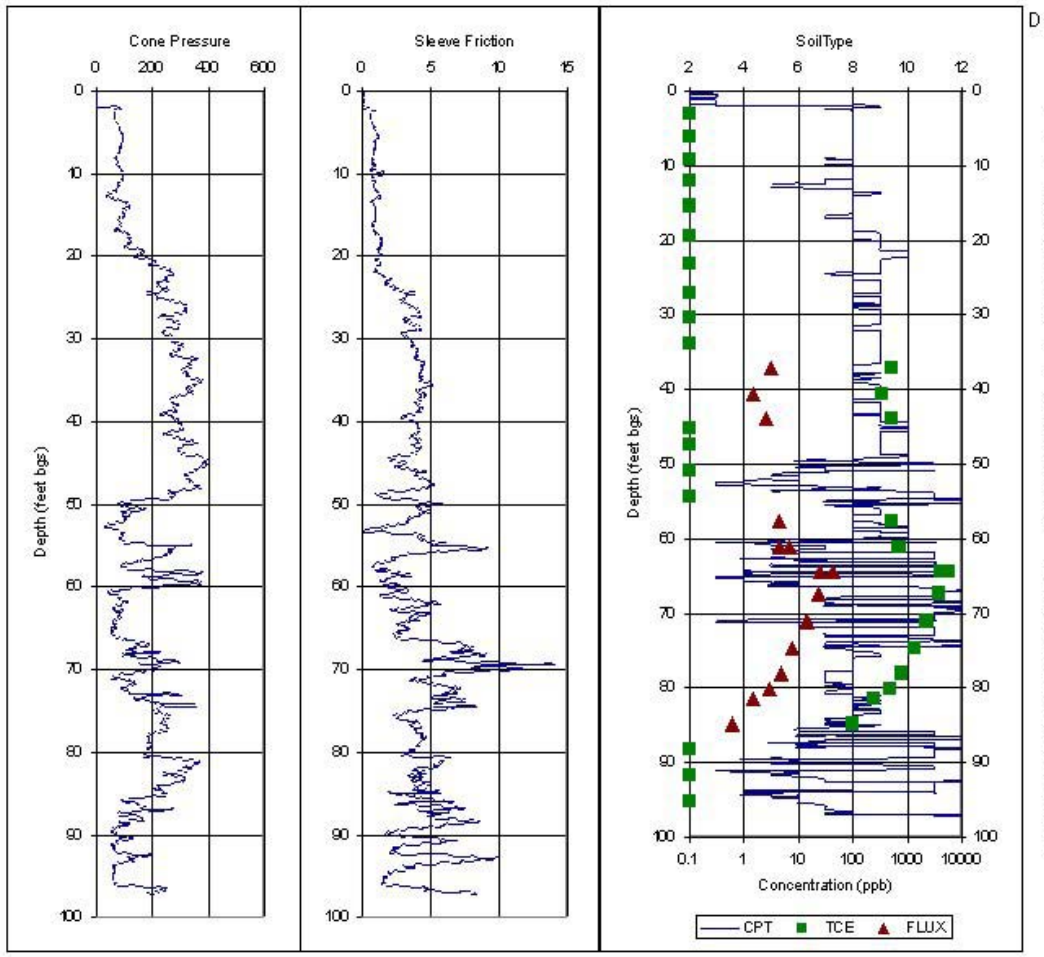
Adaptive Investigation Techniques Provide Detailed Characterization





Case #2: Technology Validation Provides Site Characterization

Membrane Interface Probe and Direct Sample Ion Trap Mass Spectrometry



Depth	TCE (ppb)
3.2	nd
6.1	nd
9.2	nd
12.1	nd
15.4	nd
19.4	nd
23.2	nd
27.0	nd
30.4	nd
33.8	nd
37.1	500
40.6	331
44.0	524
45.2	nd
47.4	nd
50.9	nd
54.3	nd
57.7	512
61.1	700
64.5	5,693

	TCE (ppb)	DCE
61.0	738	
64.4	4,217	355
67.4	3,904	333
71.1	2,294	202
74.6	1,318	nd
78.0	777	nd
80.1	485	nd
81.5	239	nd
84.8	103	nd
88.2	nd	nd
91.8	nd	nd
95.2	nd	nd

Discovering the True Source and Extent of a Plume

Traditional Phased Investigations, 1991 – 1998

Initial estimate of JP-5 and Stoddard Solvent free product plumes.

Based on wells installed during investigations in 1991 and 1993.

True nature and extent of contamination still unknown.

Product plume discovered to be larger than initial estimates after subsequent investigation.

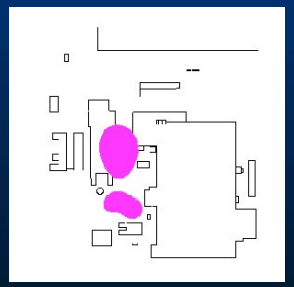
Twenty product recovery wells plus additional monitoring wells were installed.

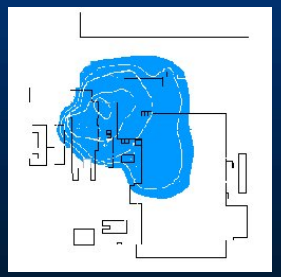
TCE (Trichloroethylene) detected during analysis of product.

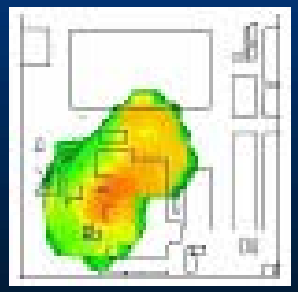
True nature and extent of contamination still unknown.

Plume of TCE dissolved in groundwater based on monitoring well sampling.

Vertical and horizontal characterization is incomplete.







Dynamic Investigations, 1998 - 2000

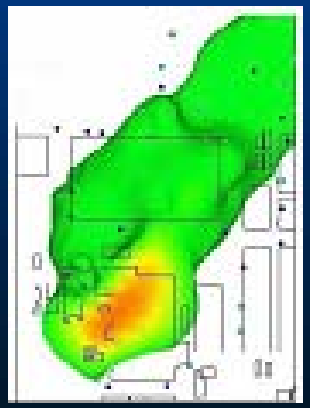
SCAPS Hydrosparge with DSITMS investigation in Summer of 1998.

Validation testing of a sensor used before the development of the MIP

Installation of temporary direct-push wells was necessary. Real time sensor was inserted into the well.

Contamination discovered deeper that previous data suggested.

True extent of contamination still unknown.

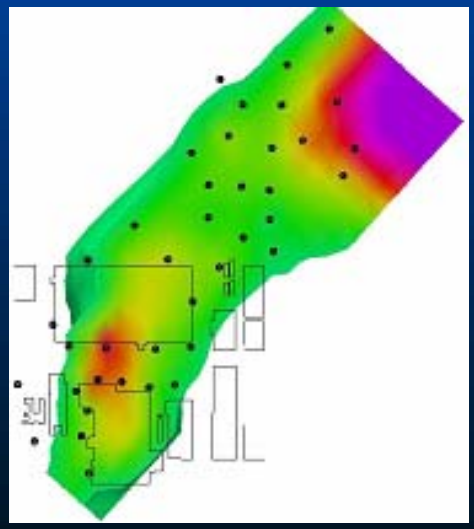


SCAPS MIP with DSITMS investigation in Summer of 1999.

Validation testing of MIP/DSITMS

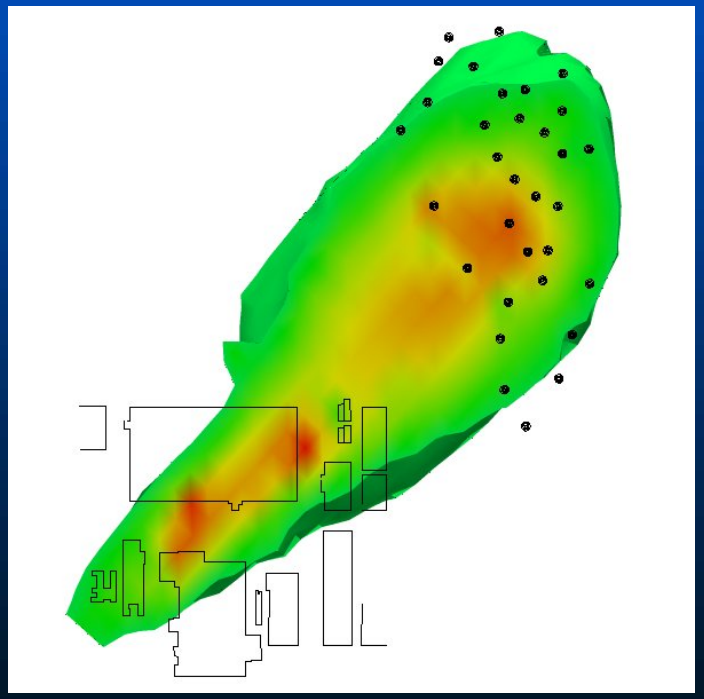
- 14 production days
- 207 measurements
- 40 Locations
- Over 2000 feet pushed.

Detected a second source downgradient.

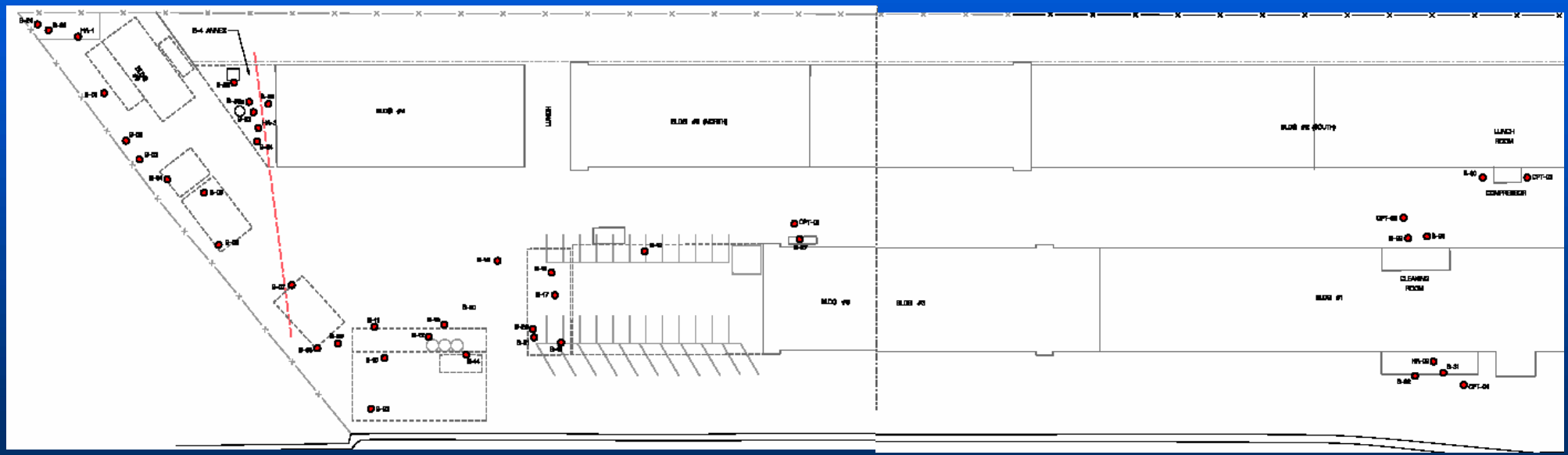


SCAPS MIP with DSITMS investigation in Spring 2000.

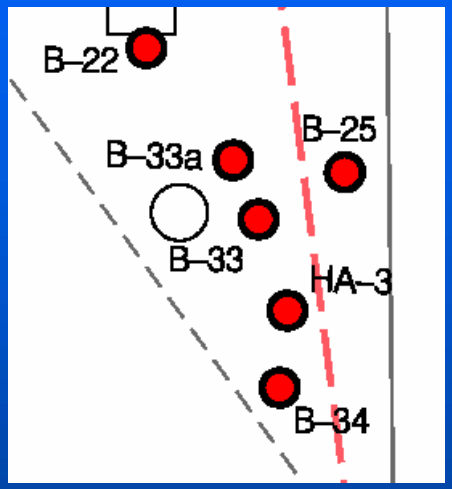
- Investigation completed
- 13 production days
- 485 measurements
- 29 locations
- Over 1900 feet pushed

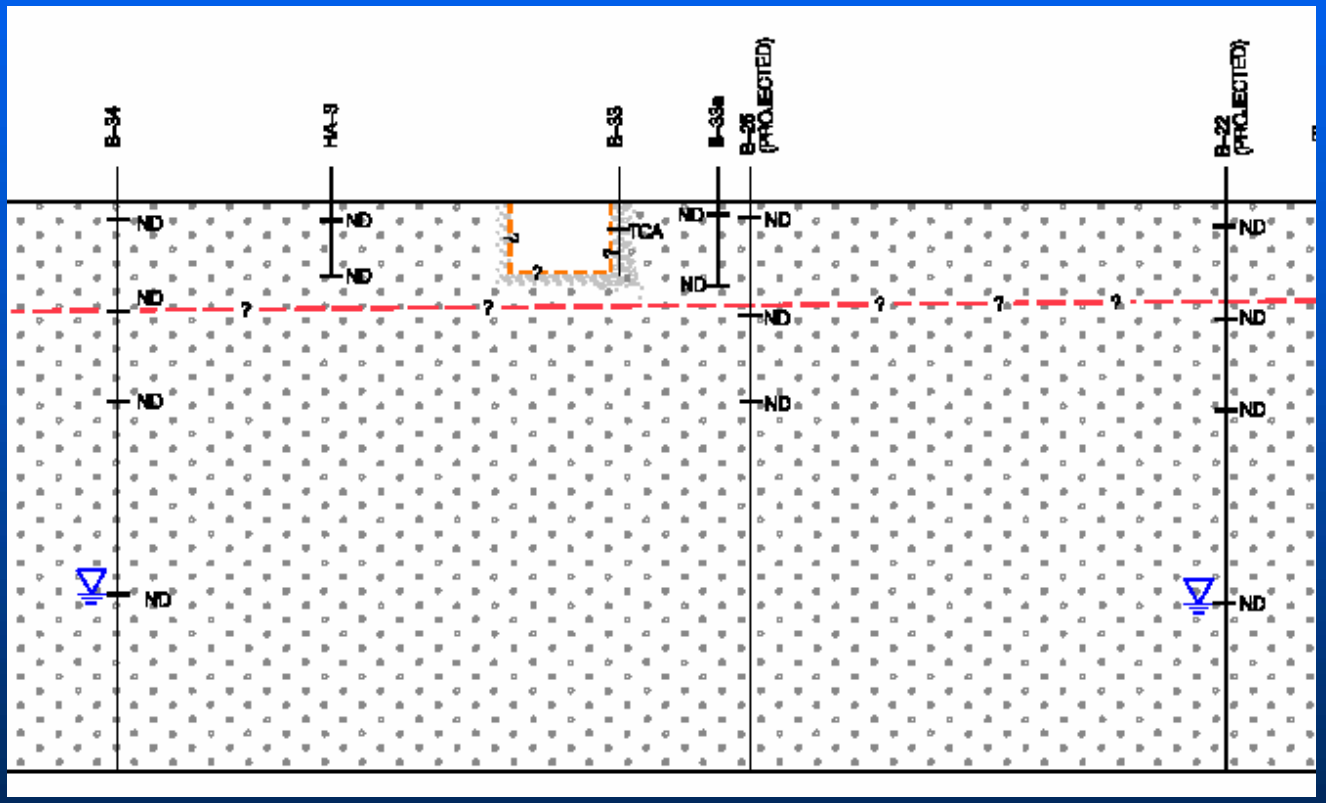


Case #3: Using "Onsite Methods and Techniques"



Real Time Technology Reduces Potential for Cross Contamination





Upcoming Triad Project

- Project end goals
  - Identification of the VOC plume area and potential source areas
- On-site tools/real-time measurements
  - SCAPS, CPT, MIP, EPA 8265.
- Regulatory Framework
  - Presentation of approach was well received by regulators