STONE ENVIRONMENTAL
100% EMPLOYEE-OWNED

Site Characterization & Real-Time Data Collection Lessons Learned

May 13-15, 2025

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NEWMOA

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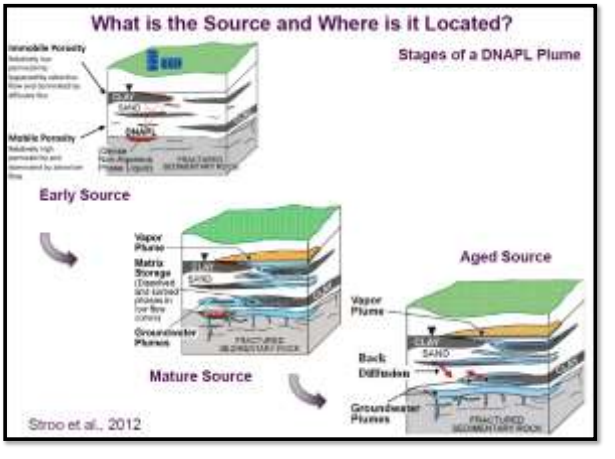
Hydrogeological Assessments – Take Homes

Traditional approaches do not (typically) accurately reflect the heterogeneity of the subsurface.

- Monitoring wells are not for investigation.
  - There are many readily available techniques to assess initial groundwater conditions.
- The scale of aquifer heterogeneity should be reflected by your methods.

Need a well-developed, detailed CSM – and test it!

- Account for:
  - Aquifer properties
  - Contaminant properties
  - Interplay of the two (storage, transport, attenuation)



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Soil Quality Investigations – Take Homes

CSM Development

- Records review, Site visit, interview site managers.
- Soil is naturally heterogenous, compounded by variability of release mechanisms and contaminant properties.
- Refine CSM as new data are available.

Select your method to fit your Objectives and Site conditions.

- Risk, Delineation, Site Closure

N. Guidi, T&B

Manage heterogeneity through sampling design!

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Vapor Intrusion Investigations – Take Homes

Iterative Approach and multiple lines of evidence

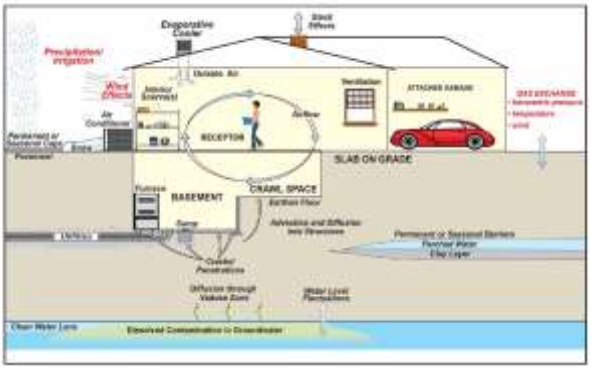
- Develop CSM (see a trend?)
- Detailed assessment of current conditions, COCs, exposures.

Sampling objectives will drive methods

- Preliminary screening, Delineation, Risk, Remedial Design, Site Closure

Quality Control Considerations

- VI is complicated enough without introducing further uncertainty.



C. Regan, H&A

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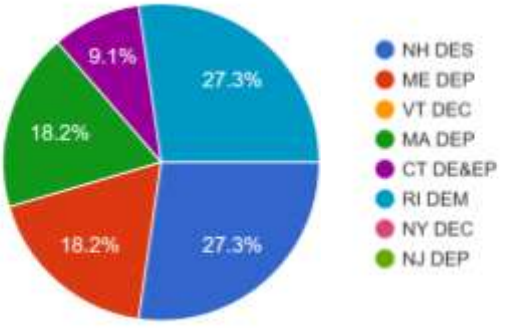
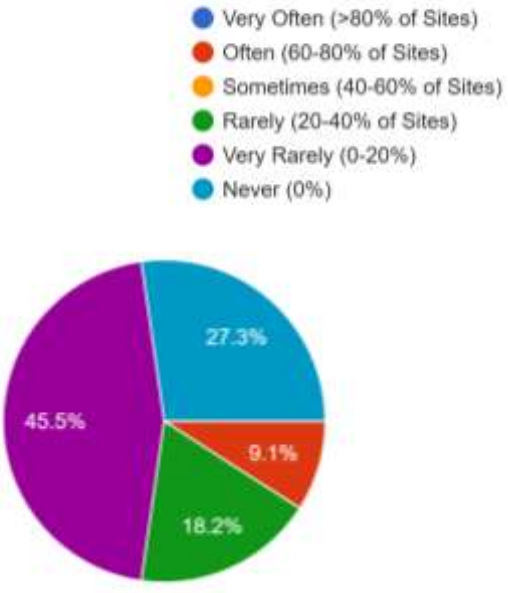
What are the Regulators Saying?





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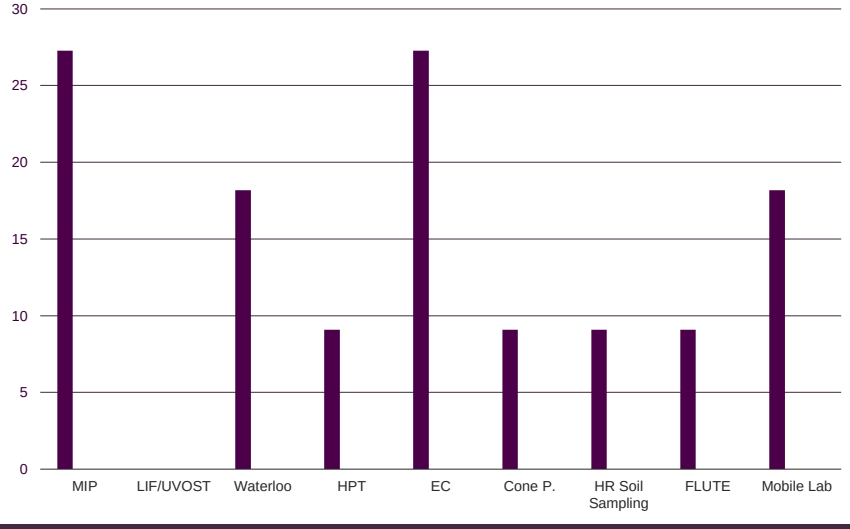
What are the regulators saying?

Which HRSC methods have you employed on Sites you manage?



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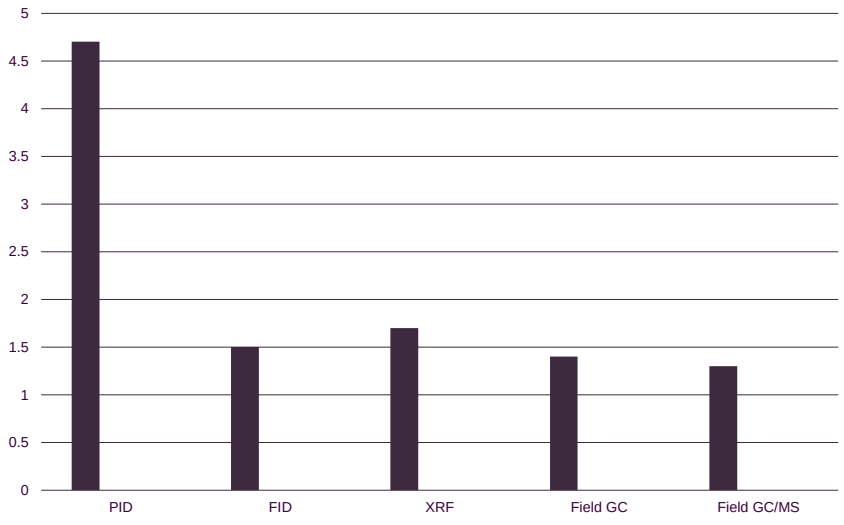
What are the regulators saying?

Field screening and analytical methods. (1 very rarely, 5 always)



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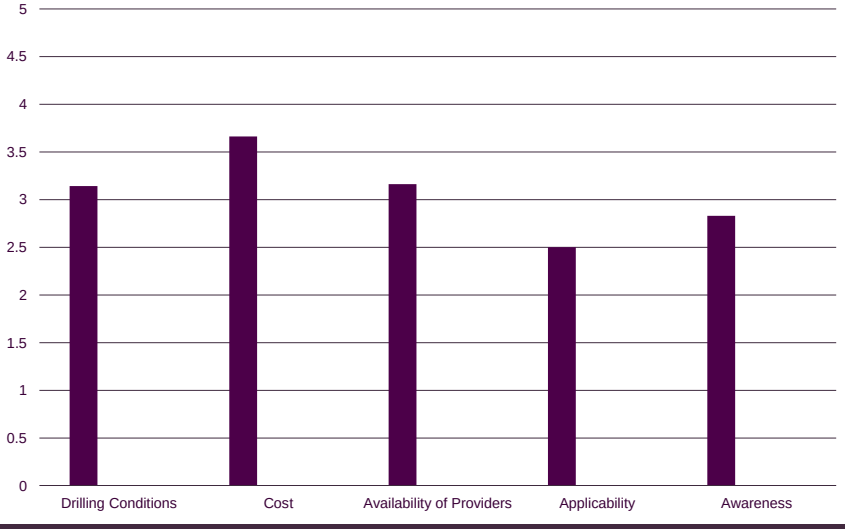
What are the regulators saying?

What factors limit the use of HRSC on your Sites? (1 very rarely, 5 always)



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Limiting Factors - Availability

Rockville, MD

COLUMBIA TECHNOLOGIES

Barre, VT
Schenectady, NY

CASCADE
DRILLING | TECHNICAL SERVICES

West Berlin, NJ

DAKOTA TECHNOLOGIES
Fargo, ND

CONETEC

S2C2

Flemington, NJ

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Limiting Factors - Cost

Item	Daily Rate	Production	Notes
MIP/MiHPT	$4,500 - $7,500	125 – 150 ft / day	Rig+HRSC, data, setup Need conf. samples
OiHPT	$5,000 - $8,000	150 – 250 ft / day	Rig+HRSC, data, setup Need conf. samples
UVOST/TarGOST	~$5,500	150 – 250 ft / day	Rig+HRSC, data, setup. Need conf. samples
Groundwater Profiling	$4,500	Varies, 4 to 10 samples/day	Rig+HRSC
Soil Coring	Rig: $1,800 - $2,200 Geologist: $1,200	90-120 ft / day	Depending on depth, construction, lithology, etc. **Lab costs extra** IDW, consumables.
Monitoring Wells	Rig: $1,800 - $2,200 Geologist: $1,200 Consumables: ~$250/well Low Flow: $1,500	3 to 6 wells / day	Depending on depth, construction, lithology, etc. **Lab costs extra** IDW, Consumables

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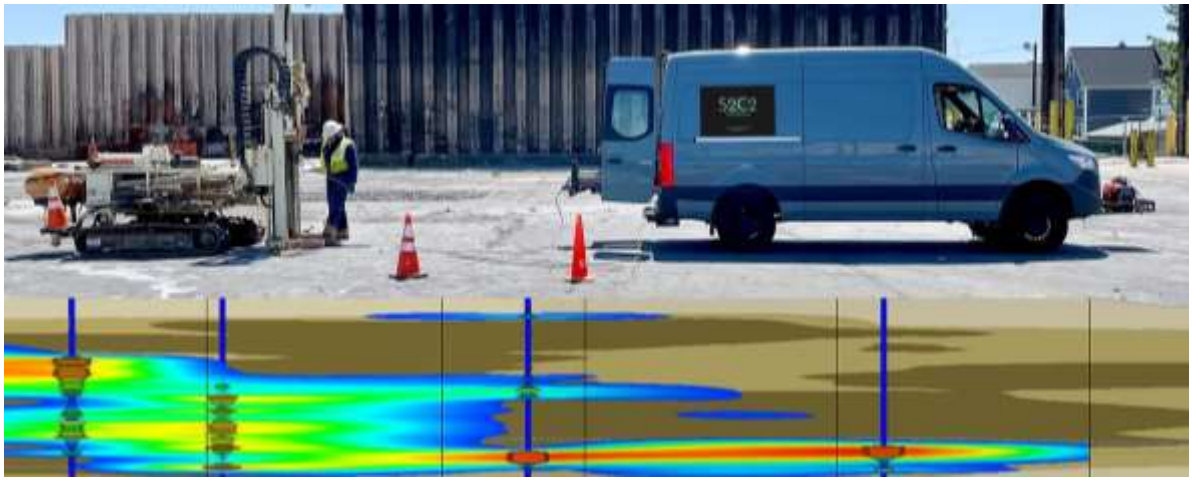
Limiting Factors – Cost

When paired with 3D-visualization, direct sensing techniques offer a more rapid, precise understanding of contaminant distribution.

Samples for accredited laboratory analyses are still needed, but they can be targeted to the most critical strata/locations.



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Limiting Factors – Applicability

Parameter	MIP	OIP	UVOST	Dye-LIF	TarGOST	GW Prof.	HR Soil Coring	NMR
CVOCs	✓			✓		✓	✓	
Light Petro.	✓	✓	✓			✓	✓	
Heavy Petro./Tar		✓	✓		✓	✓	✓	
Metals						✓	✓	
Aquifer Char.	✓	✓	✓	✓	✓	✓	✓	✓
Low Concentrations	LL MIP					✓	✓	

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Limiting Factors – Geology / Drilling Conditions


420M


5410


6712DT


7822DT


3230DT


8040DT

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HRSC Study Design - Barre Steam Laundry

12 Keith Ave., Barre Vermont

- 0.64 Acre parking lot
- Sandwiched between commercial properties and residential apartments
- Served as Barre Steam Laundry from 1900 to ~1960
- City of Barre redeveloped the Site in 2016 for metered municipal and assigned residential parking

Myth: HRSC is only for big sites.

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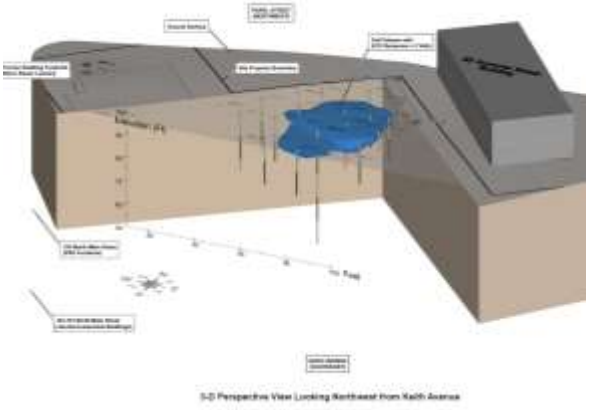
HRSC Study Design – Barre Steam Laundry

Phase II ESA

- Soil gas assessment using on-site lab (EPA Method 8260, VOCs in Tedlar)
- GPR to assess UST
- Found PCE impacts >> VIS

Site Investigation

- Soil and groundwater investigation
  - Piezos to gauge GW gradients
  - Screen point samplers (SP22) to collect GW samples.
  - Soil borings with rapid TAT on 8260
  - PCE >> SSL
- MIP
  - 2 days of MIP, 16 locations to 15-25 ft.
  - Delineated source area of PCE



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HRSC Study Design – Barre Steam Laundry

The Remedy

1. Targeted soil excavation and disposal of soil >100 mg/Kg PCE
2. Installation of engineered barriers (i.e., the parking lot)
3. Installation of an exterior water seal and vapor barrier system on exterior foundation of downgradient building.
4. SSD in new residential building.

Using dynamic work plans relying on HRSC allowed for the Site Investigation to interface with redevelopment design without delay.

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Wrap Up.

Take the time to develop a detailed CSM, Test your hypotheses, refine often

Understand your Objectives (Project and DQOs)

Presence/Absence, Delineation, Risk Evaluation, Remedial Design, Site Closure

Account for heterogeneity; use tools and resolutions that approach natural variability

Take Away "Use the right tool for the right job." – Montgomery Scott.

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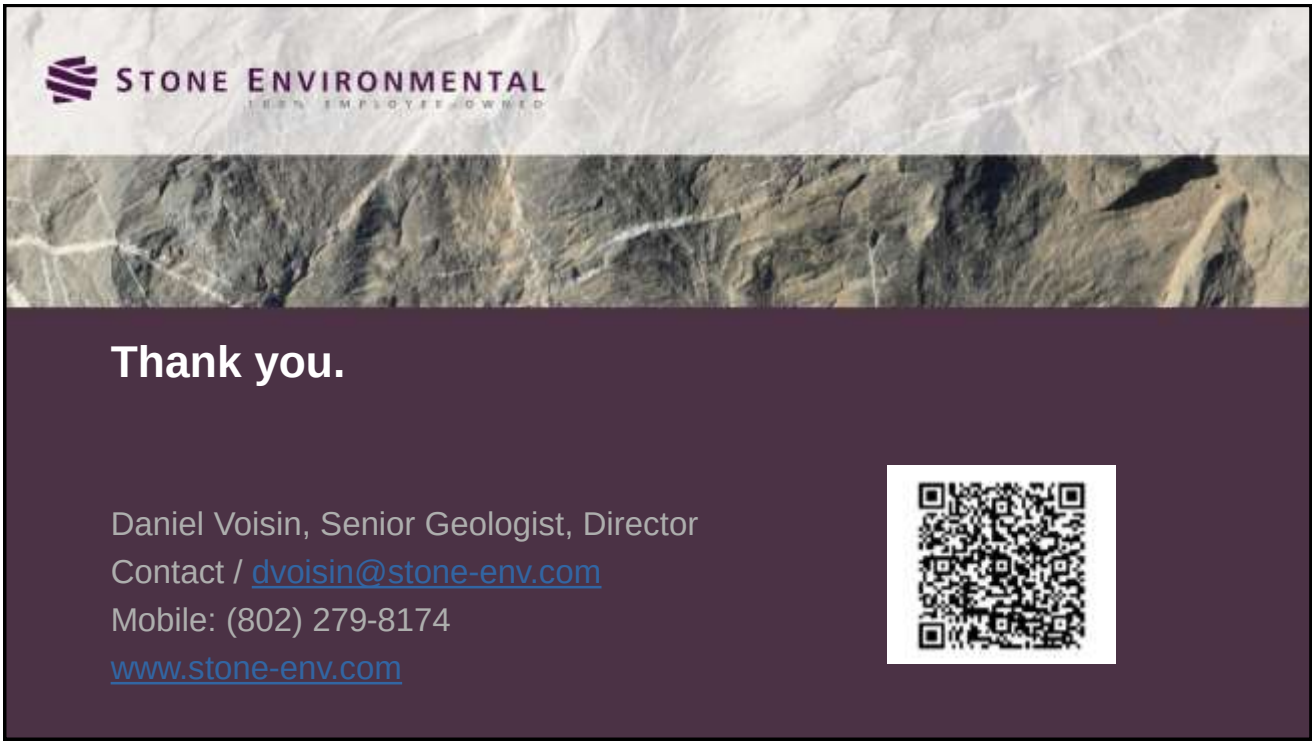

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