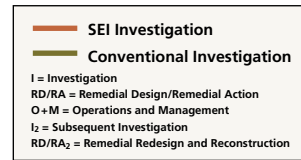
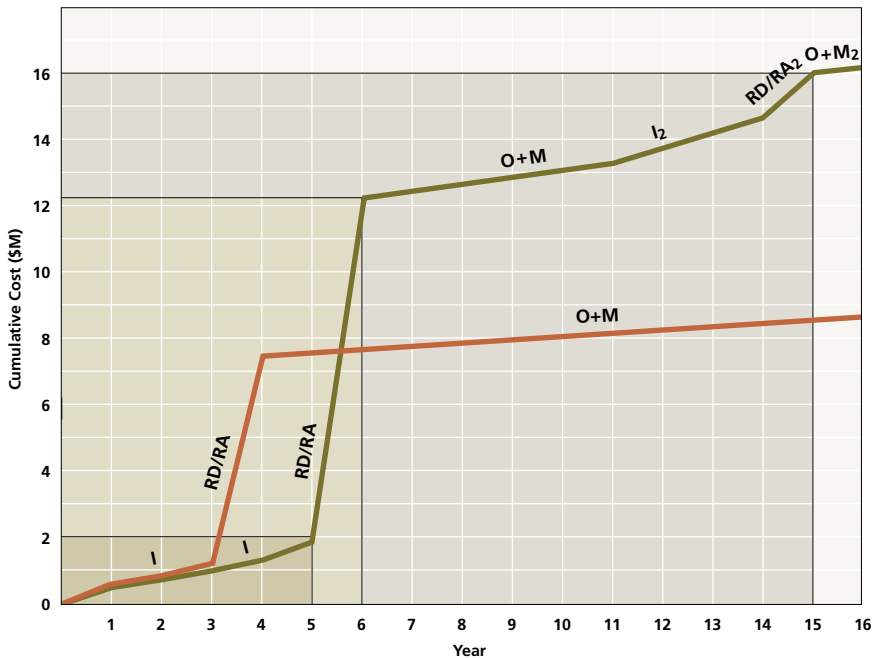


Groundwater Profiling and Mobile Laboratory Services

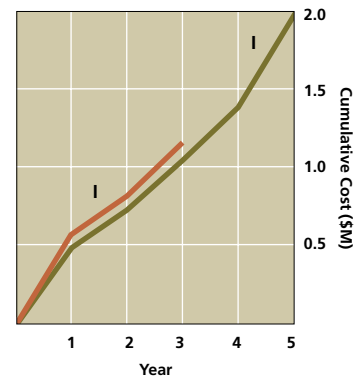
THE RIGHT ANSWERS, THE FIRST TIME

Industry leaders have embraced adaptive or expedited site characterization based on real-time data acquisition as the fastest, least expensive, and most effective way to characterize subsurface contamination. Adaptive site investigations save companies many thousands or even millions of dollars over investigations that use conventional long-screened wells and fixed laboratories.

Cumulative Costs for SEI and Conventional Investigation and Remediation



Comparison of Investigation Phase Only



Adaptive or expedited site characterization saves money over conventional methods in three ways: 1) the site characterization takes less time, 2) the mobile lab cost per sample is considerably less, and 3) the site is characterized correctly the first time, so that remediation works. At conventionally investigated sites, the first remediation strategy often fails because the contaminant source areas, flow, and transport are not well understood. This means that the site has to be reinvestigated, and a second remedy implemented.

SEI investigations can cost more initially than conventional ones, because we often analyze more samples. But we finish faster, so our cumulative costs per project are considerably lower.

SEI's Waterloo Profiler—Better than Ever

Vertical profiling of groundwater quality has become the industry standard for adaptive groundwater site investigations. The Waterloo Profiler, developed by John Cherry's research team at the University of Waterloo, is the premier tool for vertical profiling because of its short vertical sampling interval. The profiler can capture with pinpoint accuracy the significant changes in contaminant concentrations that can occur in just centimeters.

SEI's Seth Pitkin, one of the original members of the Waterloo team, has modified our Waterloo Profiler in a number of ways to make it even better than the original. His modifications include:

- Adding KPRO, a tool that provides a real-time index of hydraulic conductivity to determine the stratigraphy and best depths for sample collection, rather than relying on preset intervals
- Adding a gas drive pump to allow sample collection below the suction limit (where the water table is deeper than 27 feet below the surface)
- Modifying the screen to minimize plugging and prevent the downward drag of contaminating particles
- Using stainless steel tubing for sample collection, because it doesn't absorb/desorb contaminants and cause cross-contamination the way plastic tubing does
- Adding a measurement of hydraulic head to better characterize the flow and transport of contaminants

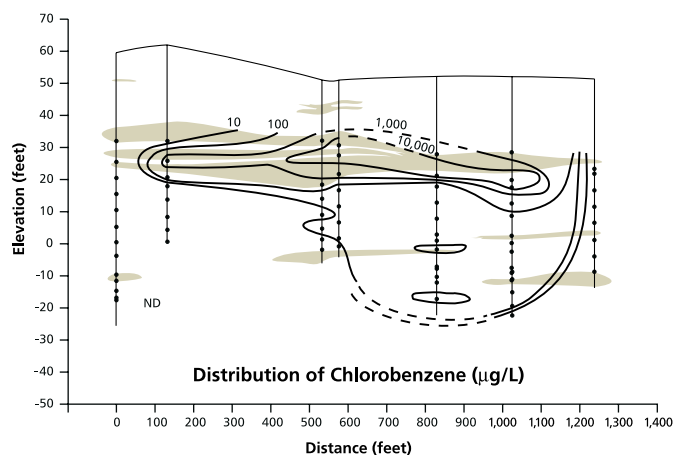
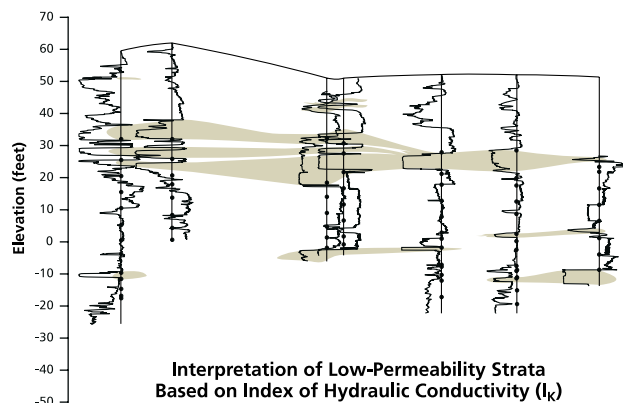
These modifications have improved the profiler's reliability and accuracy, and increased the data it obtains in real time to better capture the spatial variability of subsurface environments. In addition to the enhanced profiler, SEI has one of the most experienced crews in the field, ensuring that you get the information you need to design an effective remedy the first time.

How KPRO Saves Time and Money

What we've done at SEI is pioneer a way to measure—while sampling—the index of hydraulic conductivity (I_K) in real time. The I_K gives us valuable information about the flow of water through the subsurface stratigraphy, which plays a key role in the flow and transport of contaminants. This helps save time and money in three ways.

First, KPRO helps us select depths at which to collect samples based on changes in stratigraphy as opposed to random or predetermined “blind” intervals. The I_K and sample collection are accomplished in a single push to obtain data more quickly and cost-effectively. Second, KPRO helps us better understand the geology of the site, for the creation of more accurate flow and transport models. Finally, it tells us where impermeable zones are, so that we don't waste our time taking samples in suboptimal locations.

Using KPRO to Determine the Relationship Between Stratigraphy and Contaminant Distribution at the Ciba-Geigy Superfund Site



How SEI's Profiler Compares

Many different profiling tools, drill rigs, and crews out there claim to have the most precise, reliable, and cost-effective equipment. We've done a comparison of our profiler and the other tools available. Although ours is not the best tool for every job, we believe it is superior to the other options for most groundwater investigations.



For each collection depth, SEI records hydraulic head, specific conductance, pH, dissolved oxygen, and oxidation-reduction potential as well as the index of hydraulic conductivity.

Comparison of Groundwater Sampling Capabilities

	SEI's Waterloo Profiler	Other Waterloo Profiler Vendors	Rotosonic Drilling	Hydropunch	Cone Penetrometer*	Geoprobe Screen Point Sampler	Geoprobe MIP
Real-time hydrostratigraphy data (I_k)	Yes. Uses water to measure hydraulic conductivity.	No.	No.	No.	Yes. Infers stratigraphy from the mechanical properties of soil.	No.	No. Measures electrical conductivity only.
Multiple samples per push	Yes.	Yes.	Yes.	No.	Yes.	Yes.	Yes.
Precise point sample (screen length) <2"	Yes. 1/4"-2".	Yes. 1/4" only.	No.	No.	No.	No.	Yes.
Multiple data sets per sample (standard deliverable)	Yes. Specific conductance, dissolved O ₂ , pH, oxidation-reduction potential, I_k , rate of penetration.	No.	No.	No.	Yes. Electrical resistivity, mechanical properties of soil, total aromatics, video logging, hydraulic conductivity, rate of penetration.	No.	Yes. Electrical conductivity and detector response to volatilized compounds.
Hydraulic head measurement	Yes.	No.	Yes.	No.	Yes.	Yes.	No.
Electronic data deliverables	Yes. See above.	No.	No.	No.	Yes. See above.	No.	Yes, but detector response not in media-specific units.
Plug-resistant ports	Yes. Tip and screen modified to resist clogging.	No.	No.	No.	No.	No.	n/a
Collects water samples in low k conditions	Fair.	Poor.	Fair.	Poor.	Fair.	Fair.	No. Gas measurements only.
Collects water samples below the suction limit	Yes.	No.	Yes.	Yes.	No.	Yes.	Yes.

* Depth limitations



Our mobile laboratory handles a full suite of analytes faster and less expensively—but just as accurately—as a traditional fixed lab. Our near-real-time data helps the field team modify the sampling plan to home in on the contaminant plume more quickly.

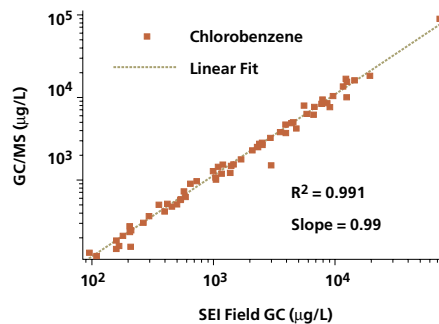
Fast Mobile Lab Delivers Fixed-Lab Quality

Our mobile field lab goes beyond screening data to provide fixed-laboratory-quality data in just minutes, instead of the days and weeks fixed labs require. Our experienced chemists can process groundwater samples for most contaminants at rates of up to 50 samples a day. With this speed, our lab can provide near-real-time data to help the team in the field decide where to sample, and when to stop.

We are most often asked to analyze samples for Volatile Organic Compounds (VOCs). The workhorse that we use is the industry standard Hewlett Packard 5890 Series II gas chromatograph (GC). We prepare and concentrate samples using a solid phase micro extraction (SPME) technique that strictly adheres to EPA SW846 8000 standards. This method is fast and provides highly accurate results (even at low ppb levels) for soil, air, and water samples.

An adaptive field investigation is only as fast as its slowest component. To minimize analytical run times, our chromatographic system uses a dual configuration with two injectors, columns, and FID detectors (we can also use PIDs and ECDs), which allows for twice the sample throughput normally achieved with a GC. For an analyte list consisting of chlorinated solvents and the BTEX compounds, we can complete a sample run, consisting of two sample results, in less than 12 minutes.

One might assume that there is a premium to pay for fixed-lab accuracy at faster-than-fixed-lab turnaround times. In fact, our analysis costs between 20 and 60 percent less per sample than a traditional laboratory.



Confirmation analysis of our mobile laboratory by conventional GC/MS fixed-lab techniques yielded a Relative Percent Difference (RPD) of 16% (the EPA acceptance criterion is 30%) and a correlation coefficient of 0.99.

Leading the Industry

At SEI, we are always working to advance our services, from lab analysis to profiling. We regularly enhance our equipment and conduct research on our materials and techniques to stay in the forefront of the groundwater profiling industry.

For more information about our groundwater profiling and mobile laboratory services, please contact us. We are happy to provide references and price quotes upon request.



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