NEW VISIONS FOR BROWNFIELD MANAGEMENT

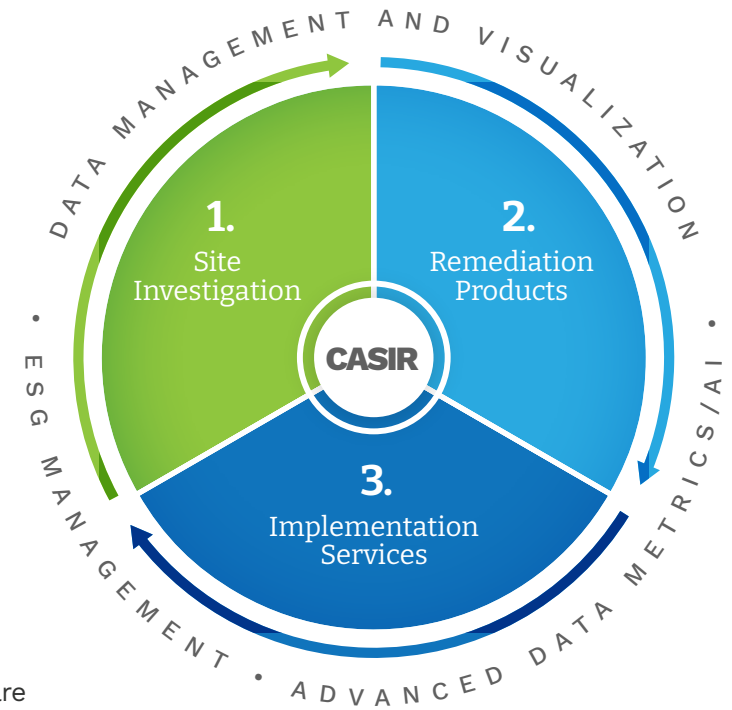
Conventional and Advanced Site Investigation and Remediation (CASIR)

MONTROSE ENVIRONMENTAL

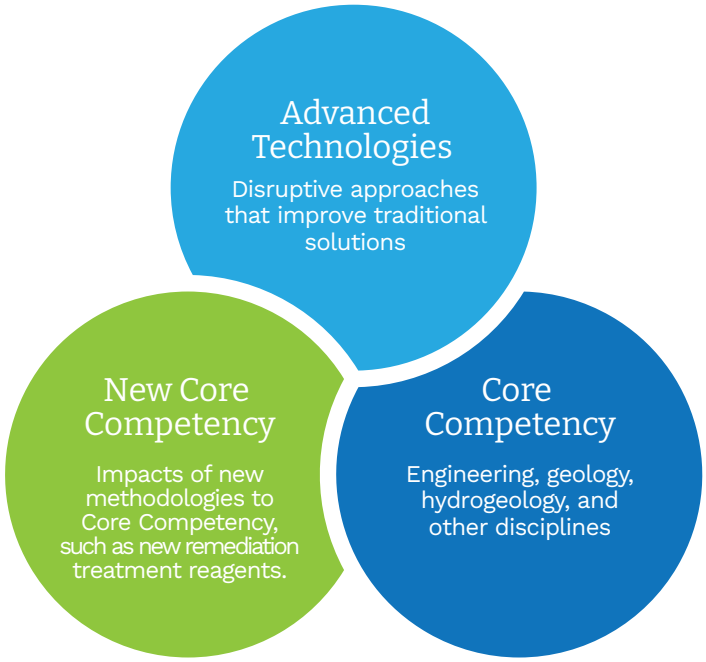
The Future of Environmental Solutions

What is CASIR?

CASIR is an acronym for Conventional and Advanced Site Investigation and Remediation. Parsing this out reveals a certain logic. First, it is absolutely critical to acknowledge that core competency is the foundation of all environmental intervention and repair. These conventional skill sets include basic engineering, geology and hydrogeology, as examples. This is the foundation upon which advanced support features are integrated.



There are many aspects of what is defined as advanced processes and methods and which are further illuminated in this treatment. Given that, there are two guideposts in CASIR. The first is to "do the ordinary better" with said support functions. The second is, in essence, why we engage in this practice. That is defined as reducing time and cost to site resolution, for our clients, whether it be closure or ongoing proper management of complex and difficult sites.



Montrose Multi-level Approach

Some First Principles of CASIR

1. In 1898, the head of the Patent Office told President McKinley he could close up shop because everything that could be invented had been. In light of the myopia of that statement, the rate of new protocols and processes has accelerated dramatically as the integration of diverse applied disciplines evolves. Also, not everything has to be invented from scratch. Some advanced methods have already been used in other fields and simply await adaptation and importation.

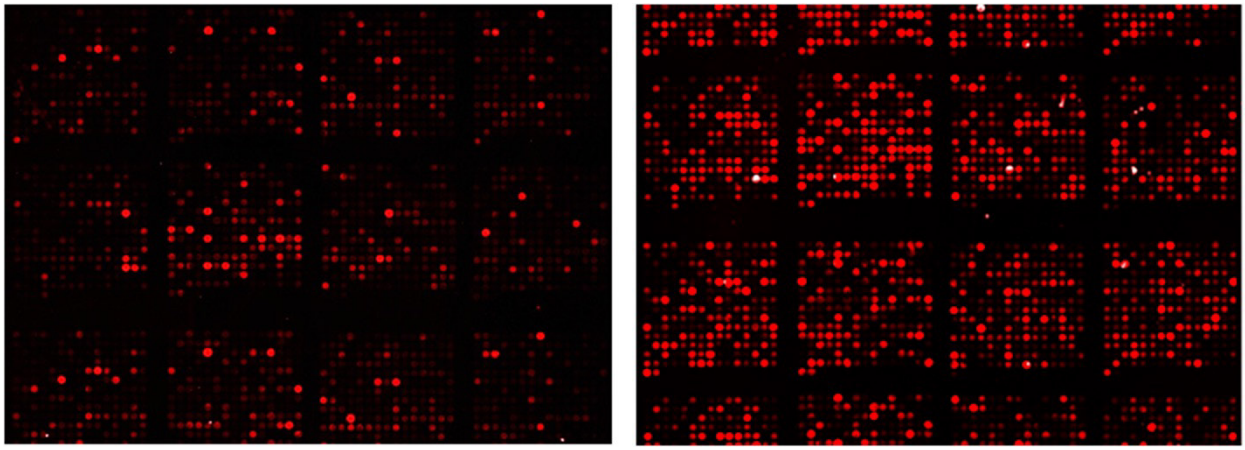
2. "Is this trip necessary"? Intervention is not always the best option given risk analysis and negotiation options. A number of advanced protocols can assist in this effort. To paraphrase Hippocrates – "Environmental physician do no harm".

3. Seek more applications of underutilized technologies and make sensible incorporation of the latest advances as they can impact remedial programs. Develop an edge to achieve desired outcomes in reducing time and cost to site resolution.

Examples of Advanced Technologies used in CASIR

Molecular Biological Tools (MBTs)

Uses an impressive raft of technologies that assess nucleic acids (DNA/RNA) and proteins, as the major examples of key biomolecules, to assess the need for and progress with bioremediation. Allows for more intelligent deployment of reagents.



DNA Microarrays to Track Enhanced Microbial Activity

Isotopic Techniques: Compound Specific Isotope Analysis (CSIA)

Establishes mechanisms and proof of contaminant degradation, by tracking shifts in isotopic composition over time that serve as indicators. Very useful in site resolution to achieve closure or monitoring protocols. Also useful in allocation matters with applications that can dissect a contaminant plume (basically a fingerprinting exercise) into its components where there is more than one potential contributor.

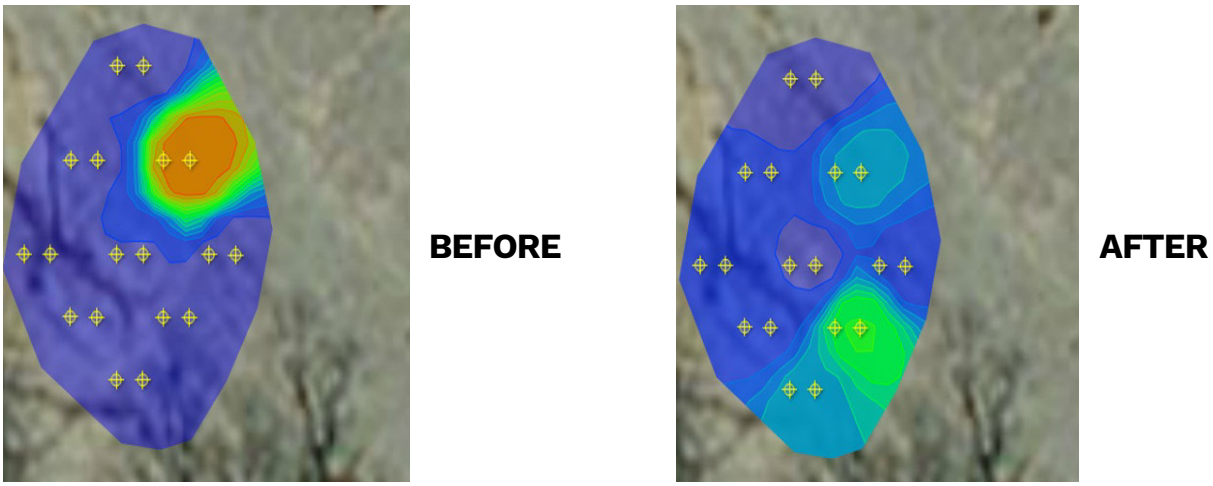
"CASIR is a welcome addition to our arsenal of strategies and protocols that address Brownfields challenges. With these tools in hand we can deliver greater value for our clients."

Chris Gdak
Brownfields & Community Revitalization Practice Leader

Mass Flux/ Mass Discharge Metrics

This assesses the true nature of the problem over time. It illuminates how much contaminant mass is in motion from the source area so that better treatment decisions can be made. Not all plumes are expansive and some are relatively stable. Understanding these dynamics can help triage sites particularly in portfolios. This also has value in customizing reagent delivery to reduce cost and ESG impact; treatment chemicals take resources to produce and deliver.

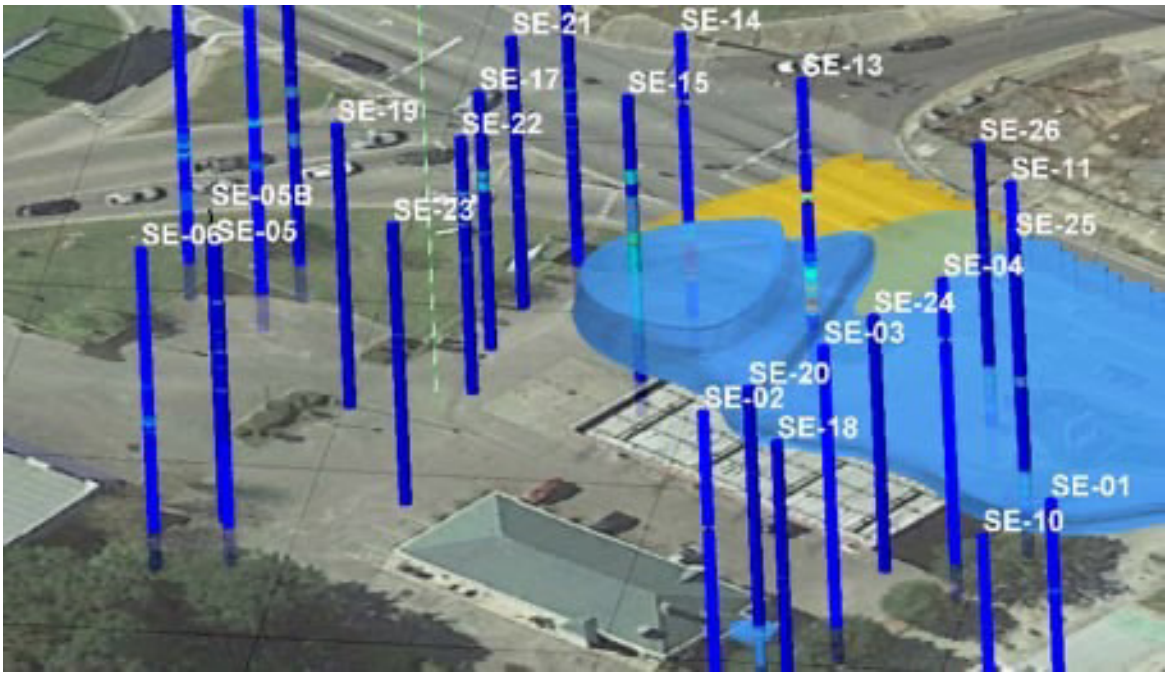
Tracking Contaminant Mass in Real Time



Before and after: Tracking the Contaminant Mass in Real Time after Intervention

High Resolution Site Characterization (HRSC)

This underutilized modality competes with the standard method of installing wells and extracting and analyzing samples in order to develop a Conceptual Site Model (CSM). The method involves deploying real time direct push methods coupled with a variety of sensor technologies or extraction of small samples for direct field testing. In essence, this enables one to know where they are to know where they are going. Problem definition and the nature of required remedial intervention is facilitated.



High Resolution Site Characterization Image with DPT and Sensor Output

Sensor Deployment

This is cutting edge technology and comes in many forms. It also ties into IoT or the Internet of Things. Advances in real time sensor for physical and chemical data has been explosive and gives not only real time data, but allows one to follow the site over time. Along with HRSC, separately or together, and important end stage process is managing the data into effective 3-D visualizations.

Advances in Vapor Intrusion (VI)

Vapor intrusion is a collateral impact at contaminated sites. While the contaminated subsurface and the remediation therein are addressed, some compounds are volatile and can migrate into enclosed structures generating a health hazard. A number of modern assessment tools have evolved in concert with sophisticated modeling protocols that better define the risks and need for intervention. In fact, sometimes what is perceived as an impact from the subsurface is really related to chemicals brought into the facility – typically in consumer products. Sorting this out has obvious value in remediation management.

Adaptive Site Management

This is a powerful quantitative "tool kit" and creates an ability to manage a site more discretely and provides better accountability to the client. A contaminated site is a moving target, because proper characterization is complicated and can change over time with new data. The fact is that these methods, that come from other industries, await more pervasive application to remediation management. Flexibility is driven by the sciences of Adaptive Site Management (ASM) and Agile Project Deployment (APD) in concert with Agile Product Life Cycle (APLC) analyses. Then, reporting out to the client, is an accountability function and is facilitated by advanced tracking protocols that include tools like Earned Value Analysis (EVA), Probabilistic Financial Modeling (PFM) and Risk Profiles (RP). Again, these advances allow us to "Do the Ordinary Better".

As a closing thought, sometimes, as witnessed in the advent of these tools, things take time to be accepted. This invokes the wisdom of the philosopher Schopenhauer who said:

"All good ideas go through three phases. First, they are ignored. Then they are ridiculed. Then they are accepted as obvious to any expert in their field".

For More Information

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