Heath –*Ventura*

Litigation Support · Expert Witness Testimony · Environmental Forensics

Environmental Forensics

Property owners, attorneys, lenders, regulatory agencies, and other stakeholders often disagree about the responsibility for cleaning up subsurface contamination. The primary goal of environmental forensics is to provide answers for several key contaminant-related questions commonly asked by these parties:

- Who is responsible for the release?
- What are the contaminants?
- What is the source?
- When did the release occur?

General forensic interpretation techniques performed by Heath –Ventura may be used to re-construct the history of a site, identify specific compounds present in one or more potential sources. Historical information and sophisticated combine to allow Heath - Ventura to present the results in a manner that is both scientifically defensible and clearly understood by technical and non-technical audiences.

Because forensic testing may reveal that more testing is necessary to accomplish the primary goals, Heath - Ventura uses a tiered approach to each environmental forensic investigation. The initial phase includes a preliminary evaluation to determine if the site and nature of the spill offer a reasonable opportunity for success by forensic analysis.

To avoid unnecessary costs, Heath - Ventura may recommend cursory testing to determine whether more sophisticated analysis is needed.

Heath - Ventura provides environmental forensic services for common contaminants such as chlorinated degreasing solvents and petroleum distillates.

Compound Specific Isotope Analysis: a Powerful Tool for Site Cleanup Decisions and Environmental Forensics

Compound Specific Isotope Analysis is a reasonably low cost technique to support time-critical sensitive decisions for environmental forensics, as well as soil and groundwater assessment and remediation of chlorinated solvents. Used to determine:

1) Source Identification;
2) Co-mingled Plumes; or,
3) Treatment System Optimization.

These capabilities allow for quick study of alternative treatment remedies such:

1) Natural Attenuation;
2) Enhanced Attenuation;
3) Thermally Enhanced Extraction;
4) Bioremediation Polishing; and,
5) Chemical Oxidation.

Advances in laboratory instrumentation allows for timely turnaround to facilitate site characterization and remediation decisions.

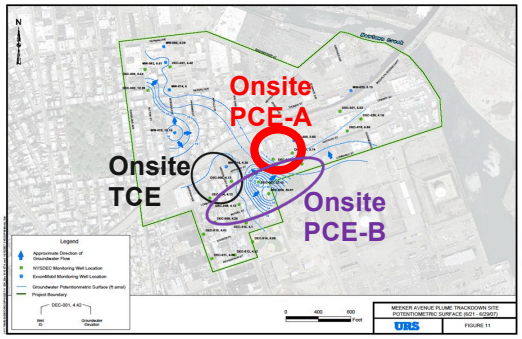
Stable Isotope Analysis

Stable isotopes represent variations in the number of neutrons in the nuclides of the same chemical element. Different isotopes of the same element (whether stable or unstable) have nearly the same chemical characteristics and therefore behave almost identically.

The mass or scale differences resulting from a variance in the number of neutrons results in partial separation of the light isotopes from the heavy isotopes during physical, chemical and biological reactions. This process is called isotope fractionation and is used in data interpretation

Compound Specific Isotope Analysis (CSIA) data can be used to distinguish between same chlorinated solvents, such as perchloroethene (PCE) and trichloroethene (TCE), from different sources. For example, CSIA can be used to determine:

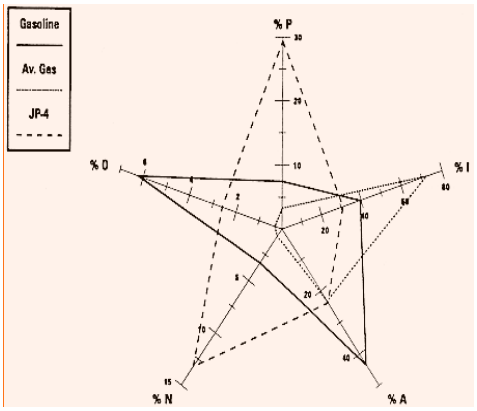
- If PCE or TCE in one plume is from one or more sources
- If PCE or TCE in separate plumes is from the same source or different sources
- If TCE in a PCE plume is from degradation of PCE, or from a separate TCE source

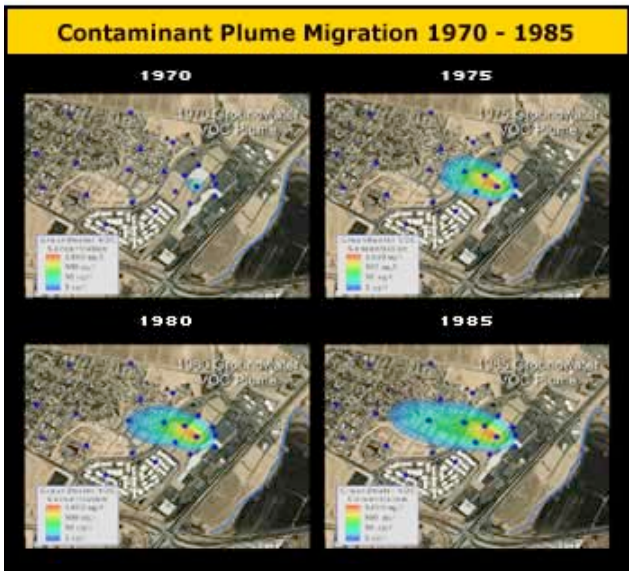


Heath - Ventura Environmental Forensics Data Interpretation

Combining these capabilities, Heath - Ventura has the expertise to use our forensic and isotope capability for:

- Determining sources of contamination to ensure that you are paying for your problems only; and
- Use of stable isotopes to better focus active remediation.





Heath - Ventura Forensics

Gregory Smith, P.E., P.G.

Mr. Smith brings over 35 years professional experience in soil and groundwater investigation and remediation as well as stable isotope data interpretation and environmental forensics. Mr. Smith is well known for his pioneering breakthroughs in the remediation of chlorinated solvents from soils and groundwater and is recognized for having successfully completed possibly the nation's first dense non-aqueous phase liquid (DNAPL) cleanup in groundwater to regulatory limits in 1999. He is well published and a recognized lecturer at international technical forums. Greg has co-authored an *Encyclopedic*

Dictionary of Hydrogeology published by Academic Press (March, 2009), and authored a chapter on thermal effects in *Electrochemical Remediation Technologies for Polluted Soils, Sediments and Groundwater*, published by John Wiley & Sons, as well as numerous technical papers in peer reviewed publications and conference proceedings. Mr. Smith has provided expert and factual witness testimony on fate and transport of environmental contaminants in groundwater in trial (Federal Court) and deposition format, and worked with researchers at the University of Southern California at Los Angeles, University of Illinois at Chicago and Argonne National Laboratory performing stable isotope surveys ($^{87}Sr/^{86}Sr$, ^{37}Cl and ^{14}C) to determine fate and transport of contaminant plumes in groundwater at sites across the U.S. and in Australia, Brazil, Spain, England, and Japan.