

Assessing the Potential and Limitations of the Current “State of the Art” of CSIA-Based Forensics

Patrick McLoughlin (Pace Analytical Energy Services, Pittsburgh, PA, USA)

Background/Objectives. Forensics of chlorinated ethene plumes was previously limited to arguments based on the interpretation of concentration data. These arguments often used “extent of degradation” as a tracer of origin. Unfortunately this meant that many times forensics was only pursued when there was extensive degradation. This was an unfortunate irony: plumes with degrading contaminants were not usually the ones where forensics were most needed. There have been multiple reports of the use of CSIA to do forensics but for the typical data user it can be hard to assess the applicability of these techniques because the field of CSIA forensics has developed rapidly. Further, implementation is complicated by perceived limitations that once were very accurate but now are no longer limitations for this powerful technique.

Approach/Activities. In response to multiple inquiries about “what was possible” a primer was prepared using case studies from multiple reports for the implementation of CSIA for the forensics of tetrachloroethene (PCE) and/or trichloroethene (TCE) in groundwater. The focus of the primer is to show what is possible using the current “state of the art” in CSIA forensics. A detailed review of the origin of the isotopic signatures, the practical need for two dimensions, and the effects of degradation was compiled. Case studies are shown where there is little or no degradation, and case studies are shown where the degradation is advanced. Similarly, the effects of DNAPL sources are demonstrated, and the role of volatilization is also presented. Realistic limitations were assessed and a variety of techniques for interpreting and visualizing the data were explored.

Results/Lessons Learned. This project has produced a tool that allows the typical project manager to understand what CSIA forensics can do for them. It allows them to identify true limitations and not to be hindered by the limitations of the past. It encourages them to think of degradation as something to always be considered and not perceived either as a limitation or a necessity. This review also recognizes that CSIA data is not to be considered in a vacuum but is always to be referenced to the concentration data, the site map and the site “history.”