

## Evaluating NSZD via the Biogenic Heat Method at Complex Sites (i.e., Why Doesn't my Data Look Anything Like the Published Data?)

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The assessment of natural LNAPL biodegradation (referred to as Natural Source Zone Depletion or NSZD) is becoming increasingly important in the management of LNAPL sites. To this end, discussions advocating the use of NSZD data and describing measurement methods can be found in recent guidance from the American Petroleum Institute (API) and the Interstate Technology and Regulatory Council (ITRC) in the U.S., CRC-CARE in Australia, and CL:AIRE in the UK. Since NSZD processes are thought to occur at all LNAPL sites (CL:AIRE TB20, 2019), understanding the measurement techniques and their application at a variety of sites is beneficial in furthering the understanding of NSZD as a whole. Evaluating monitoring techniques and NSZD data in challenging site environments is one area where more research is needed.

As an introduction to NSZD, basic NSZD processes and the more common measurement techniques (CO<sub>2</sub> surface efflux, biogenic soil gas gradient, and biogenic heat) will be briefly described. The focus of the presentation will be assessment of NSZD at complex sites, such as sites with imperious surface cover, low permeability soils where vertical gas transport can be impeded, or deep LNAPL impacts. Due to the nature of these sites, NSZD measurement methods involving CO<sub>2</sub> surface efflux or soil gas gradient are either not possible or not reliable. Since natural LNAPL degradation processes release heat creating subsurface temperature anomalies, the biogenic heat method provides a possible method for evaluating NSZD processes at these sites.

Data from several case studies will be presented from sites with one of more of these complex site conditions. The results illustrate a variety of potentially problematic, complex temperature profiles, which naturally do not resemble the temperature profiles seen in typical guidance where measurement methods are described. Data collection techniques include a method which provides a "snapshot" of subsurface temperatures and a method which provides longer-term averages of subsurface temperatures. Presentation will include a comparison of temperature profiles from these sites, how NSZD occurrence/rates were determined, and how background corrections were handled. In addition, the effects geology plays on the temperature profiles, the ability to interpret results, and the success of the biogenic heat method at these complex sites will be discussed.

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Joann Dyson is an Environmental Specialist with GHD and is based in Durham, North Carolina. She has over 20 years of experience working on LNAPL-contaminated sites in the Mid-West, focusing on investigation of soil, groundwater and vapor contamination, conceptual site model development, and high-resolution site characterization. As a member of GHD's North American LNAPL technical group, her work at GHD focuses on providing company-wide NAPL support for projects world-wide. She has also been an active member of the Interstate Technology and Regulatory Council (ITRC) since 2016, preparing environmental technical guidance documents and providing online training.