Thermal NSZD: *A New Technology to Measure Natural Source Zone Depletion to Close LNAPL Sites*

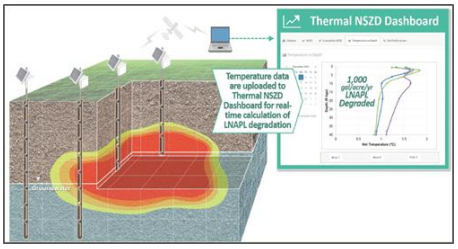
- NSZD is occurring at rates of 100s to 1000s of gallons per acre per year at all LNAPL hydrocarbon sites.
- Knowing NSZD rates can help you close sites and decommission low-performing LNAPL recovery systems.
- **Thermal NSZD** combines thermocouples, wireless data transfer, and a web site Dashboard to bring NSZD to you.

NATURE OF THE PROBLEM

- Active systems for remediation of Light Non-Aqueous Phase Liquid (LNAPL) often, after the initial period of operation, produce very little LNAPL, at very high operating costs. However, regulators are disinclined to terminate these operations. Nonetheless, reduction from natural degradation systems can be significant.
- Natural Source Zone Depletion (NSZD) - the natural loss of LNAPL due to processes such as volatilization, dissolution, and most importantly, biodegradation (ITRC, 2009) – has been shown to achieve greater LNAPL reduction than many remediation systems. Research shows that NSZD is removing LNAPL at **rates of 100s to 1000s of gallons degraded per acre per year.**
- To justify shutting down low-efficiency LNAPL remediation systems, a quantitative method is needed to confirm that LNAPL is being effectively removed by NSZD.

PROPOSED SOLUTION

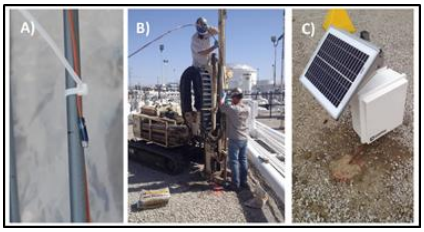
- Colorado State University (CSU) and GSI Environmental have developed a simple, inexpensive, technology for continuous monitoring called **Thermal NSZD** (patent pending).
- This technology is based on a simple concept: The heat generated by LNAPL biodegradation processes is measured using a vertical series of thermocouples and then converted to a biodegradation rate. This technology is particularly applicable for sites where the LNAPL zone is stable and poses no risk.
- The **Thermal NSZD Dashboard** is a subscription-based, secure, web-based service that automatically downloads temperature data via wireless communication every day from your Thermal NSZD Stations; performs all the necessary calculations; and gives you the "bottom line" on the gallons of LNAPL biodegraded per acre per year.



HOW IT WORKS

To implement the **Thermal NSZD** technology:

- **Step 1:** install a network of Thermal Monitoring Stations at your site. Each station consists of subsurface thermocouples installed using a direct-push rig and attached to a datalogger and wireless communication system.
- **Step 2:** automatically collect and process the data using the **Thermal NSZD Dashboard.**



BENEFITS OF THERMAL NSZD

- Lower costs and more sustainable when compared to long-term monitoring using other NSZD measurement methods and LNAPL remediation technologies.
- One-time installation of Thermal Monitoring Stations using off-the-shelf components, with minimal operations and maintenance (O&M) and no additional site visits required for sampling events.
- Continuous remote monitoring and quantitative measure of on-going NSZD rates, which can be used to compare against performance of active remediation technologies.

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