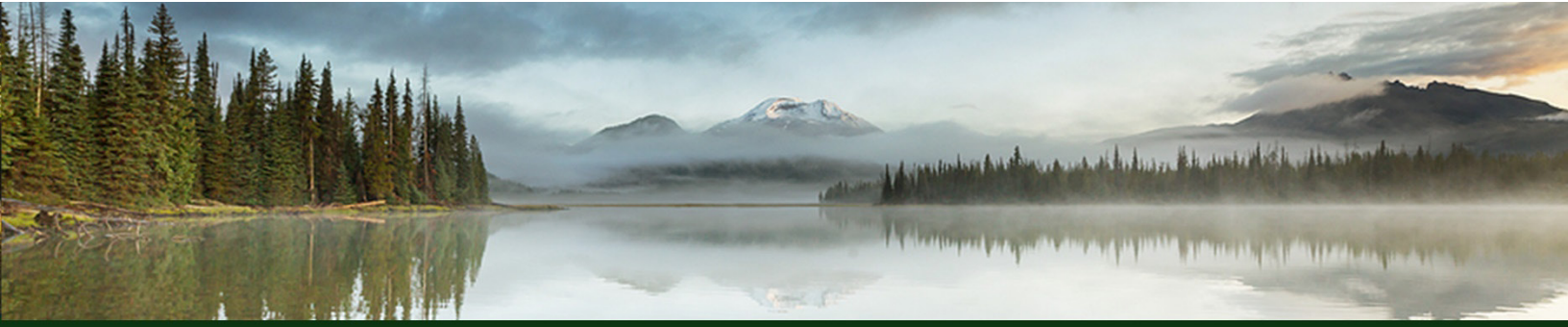

Fact Sheet

Use of Fixed Gas Data at Leaking Underground Storage Tank Sites

The Department of Environmental Quality's revised Vapor Intrusion Guidance includes changes to the evaluation process for petroleum contaminants, such as those found at Leaking Underground Storage Tank sites. These changes mean more LUST sites are conducting soil vapor investigations and collecting fixed gas data. DEQ guidance recommends collecting fixed gas data along with soil vapor samples during a soil vapor investigation. Fixed gas data can provide a line of evidence that petroleum biodegradation is occurring and decrease the number of soil vapor samples required to demonstrate the risk pathway is incomplete. Find the complete guidance on DEQ's Vapor Intrusion web page.

What are fixed gases?

Fixed gases are those gases consistently present in standard atmospheric conditions, including oxygen (O_2), carbon dioxide (CO_2) and methane (CH_4). The amount of these gases in the subsurface provides lines of evidence for evaluating the presence of aerobic biodegradation. Aerobic biodegradation of petroleum hydrocarbons attenuates the concentration of contaminants in soil vapor, which decreases the risk of human exposure (McHugh, et al., 2010; EPA, 2012; ITRC, 2014).

Why collect fixed gases?

Fixed gas measurements are key to demonstrating whether biodegradation is likely to occur at a site. It is important to characterize the conditions between a building (receptor) and contamination to develop the Conceptual Site Model. At petroleum release sites, biodegradation is a key process that can attenuate vapor concentrations and effectively render the vapor intrusion pathway incomplete. When sufficient oxygen is present, that is when aerobic conditions are present, petroleum vapor plumes can biodegrade into non-toxic byproducts such as carbon dioxide over relatively short vertical and lateral distances (ITRC, 2014; CalEPA, 2023).

At these sites it is helpful to collect subsurface measurements of fixed gases in addition to contaminant data to show that the CSM includes biodegradation. By developing a site-specific petroleum vapor intrusion CSM that integrates biodegradation, it may be possible to demonstrate the pathway is incomplete while still exceeding RBCs in groundwater or deep soil vapor samples (e.g., not at the sub-slab). See Vapor Intrusion Guidance page 26.

How to collect fixed gas data?

Fixed gases can be measured directly during the sampling event from the soil vapor well or after the sampling event in the laboratory. Field measurements are taken using a landfill gas meter. Make sure the field instrument has been properly calibrated. When collecting fixed gas readings from multiple depths within the same boring, the 5 feet reading must be collected prior to advancing the fixed gas sampling probe to the 10 feet depth. DEQ recommends the use of equipment and techniques like those used for collection of soil vapor samples to ensure the exclusion of atmospheric air from the measurements. You may want to bring a low flow air pump to the field for fixed air measurements using a land fill meter or similar device. The pump inside of the meter may not be strong enough to pull air through the sample train.

Fixed gases can also be analyzed during laboratory analysis of the vapor sample using EPA Method T0-15. Using laboratory data for fixed gas samples is slow due to laboratory processing times. Fixed gas data collected this way is also subject to QA/QC issues when the sampling container leaks.

Location of fixed gas measurements should attempt to characterize the conditions between the building and contamination, both laterally and vertically. Fixed gas readings from inside the contamination plume provide a useful baseline for comparison and can help demonstrate a gradient in concentrations. See Section 4.2.3 in the Vapor Intrusion Guidance, page 52.

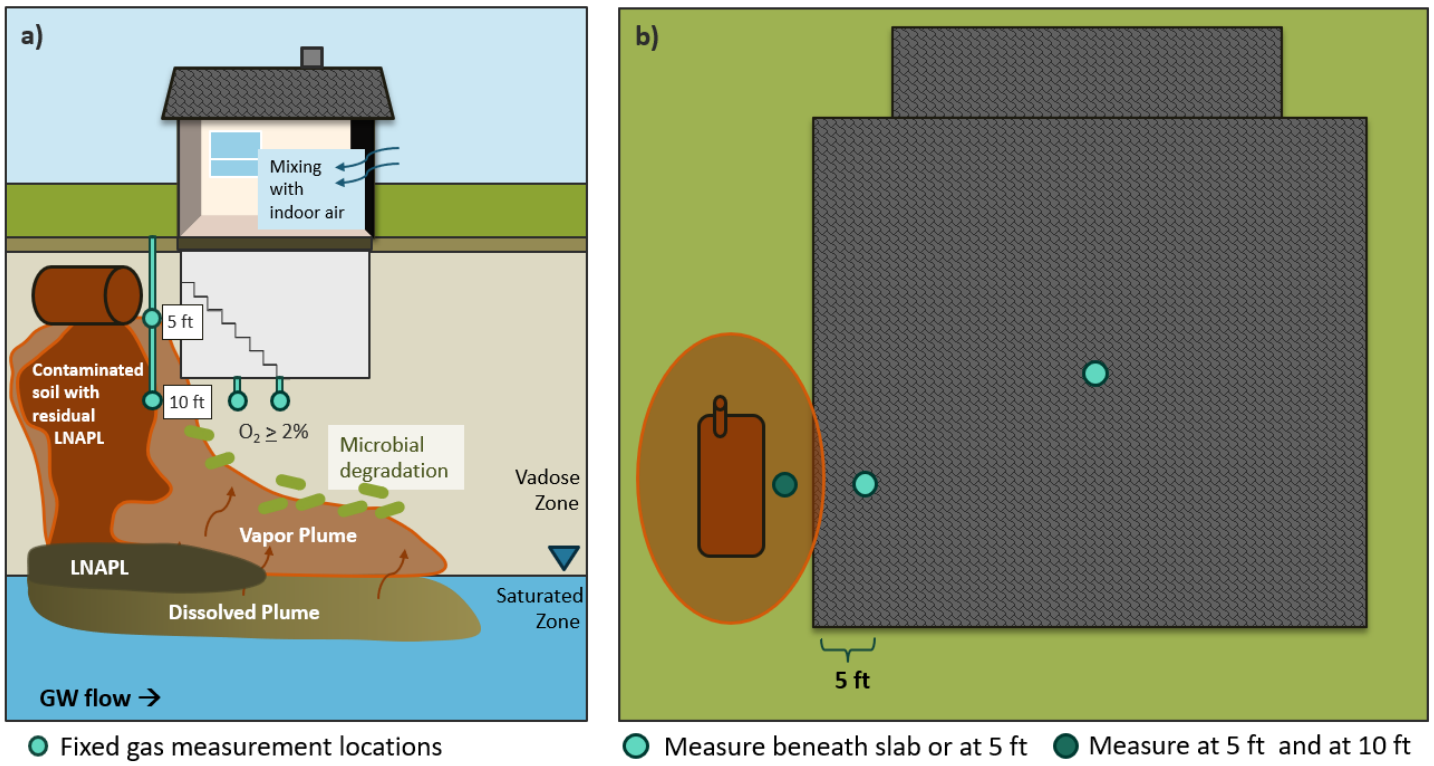

Figure 1: (a) Cross-sectional view and (b) plan view of fixed gas measurement locations to establish whether biodegradation conditions are present. Measurements beneath the building should be collected at least 5 feet in from the foundation wall.

For receptors located within 30 feet of the source, it is important to characterize the soil conditions between a building and contamination using soil vapor and fixed gas data. The fixed gas data helps demonstrate that attenuation by biodegradation is occurring and decreases the number of soil vapor samples required to demonstrate risk pathway is incomplete. Section 3.3 in the VI guidance, page 42.

Using fixed gas data as a line of evidence

Data showing a gradient in soil gas concentrations between the source area and receptors helps demonstrate that biodegradation is occurring. Generally, oxygen levels increase with increasing distance from the contamination source, while carbon dioxide, methane, and photoionization detector readings decrease. See Section 4.2.3 in the Vapor Intrusion Guidance, page 52. Oxygen concentrations greater than 2% indicate conditions that allow for biodegradation.

Program and contacts

Please discuss your vapor sampling plan with your assigned DEQ cleanup project manager and how you can use fixed gases at your LUST site.

For additional information, please email the LUST info team or call 503-229-5696.

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