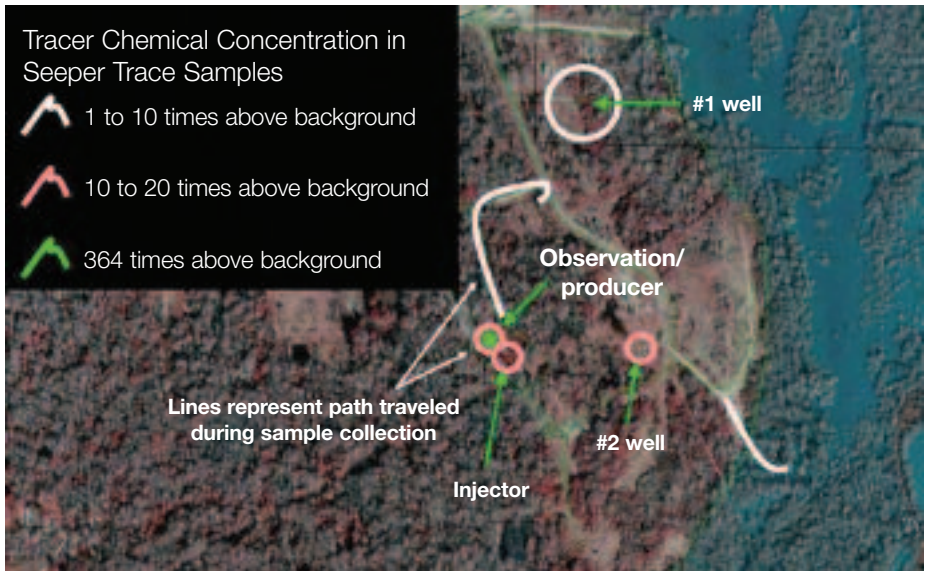


Seeper Trace Leak Detection for In-Situ Gas Storage, Sequestration and EOR Sites

Praxair Services has developed a method that can scan a site and identify potential gas movement to the ground surface



The unique Seeper Trace leak detection method utilizes an active sampling device to collect representative sub-surface soil gas from the ground surface without disturbing or penetrating the ground.

Sequestration of Carbon Dioxide (CO₂) and Enhanced Oil Recovery (EOR)

Tracer chemicals are commonly added to CO₂ during sequestration pilot studies to monitor the movement of the CO₂. The injection breakthrough to observation wells can be determined regardless of the background concentration of CO₂, which may be present from previous EOR activities. Different breakthrough curves of the tracer in multiple observation wells help determine potential flow patterns that impact the injection of CO₂ for sequestration or oil recovery. For cases with multiple injection points, a different tracer can be put in each injection well. This will provide the ratio of contribution (percentage) of each injection well in a given production. *Seeper Trace* leak detection samples collected in areas of potential leakage pathways (wells or geologic anomalies) can quickly identify potential areas of movement of gas to the surface. Depth profile samples can be collected to establish the concentration gradient to positively identify if the source is above or below ground.

In-Situ Natural Gas Storage

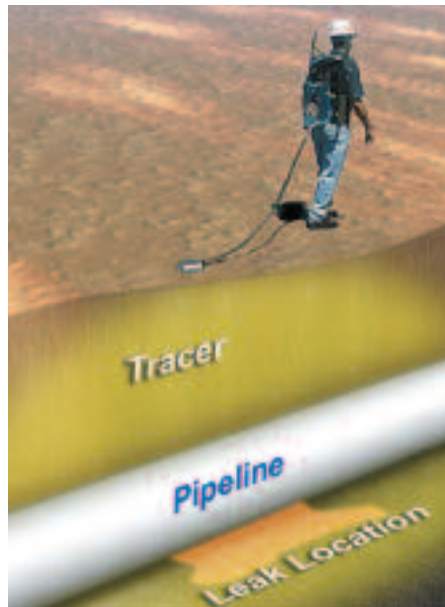
The addition of tracer to underground natural gas storage facilities can help answer a variety of questions.

- **Identification of Faulty Wells.** If gas is detected in near-surface water wells or monitoring wells, the injection well providing the pathway to the surface can be positively identified.
- **Identification of Communication Between Strata.** If tracer chemicals are detected in strata either above or below the injection zone, the approximate area of the communication between strata may be indicated by the identity of the tracer.
- **Identification of the Injected Gas.** The tracer chemicals provide a positive means of source identification where the injection needs to be distinguished from background or existing gas in the formation.



An on-site laboratory capable of detecting tracers at their global ambient concentrations (parts per quadrillion range) can be used to immediately verify any detection of tracer. Also, real-time results from the on-site laboratory can be used to direct an investigation to potentially pinpoint the source of tracer chemicals and CO₂ or natural gas escaping to the air at the ground surface. This sampling method has been successfully used to detect and locate leaks from underground cross-country pipelines and underground natural gas storage facilities. It was also successfully demonstrated at the Frio, Texas sequestration site.

Leaks in pipelines can be quickly identified and located using the Seeper TraceSM leak detection technology. Tracer chemicals are added directly to the product in the pipeline or in water during hydrotesting. Samples are collected along the pipeline and analyzed. The detection of the tracer chemicals indicate leakage. Shorter sampling intervals allow for precise leak location.



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