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SOURCE IDENTIFICATION OF STRAY GASES BY GEOCHEMICAL FINGERPRINTING

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Abstract

Source identification of a stray gas, defined here as a gas which appears where it is not expected, can generally be accomplished using geochemical fingerprinting. Geochemical fingerprinting uses the inherent chemical and isotopic composition of the gas, compared to gases from known sources, to establish the origin of the gas. In the case of methane, a commonly encountered stray gas, analysis of the relative concentrations of the stable carbon isotopes, ^{13}C and ^{12}C, and the stable hydrogen isotopes, ^{1}H and ^{2}H (deuterium) provide valuable information as to the mechanism via which the gas was formed. This analysis is widely used as a method of distinguishing thermogenic methane (natural gas and coal gas) from microbial methane (swamp gas, marsh gas, sewer gas, landfill gas, etc.). This data can also be used to differentiate microbial methane formed by the two primary metabolic pathways of fermentation (mostly near-surface gases) and carbon dioxide reduction (typically deeper gases).

The naturally-occurring and anthropogenic radioactive isotopes of carbon and hydrogen, ^{14}C or radiocarbon, and ^{3}H or tritium, can provide definitive information as to the age and nature of the source material from which methane formed. For example, methane formed by the microbial decomposition of organic waste in a landfill can be readily distinguished from swamp gas or marsh gas by its elevated ^{14}C concentration and from sewer gas by its elevated tritium concentration.

For gas injected into an underground natural gas storage reservoir, an even more effective way of identifying the storage gas is to add a tracer or tag to the gas. The currently being developed TRAGEN™ Process provides for the continuous on-site generation of ethylene (not a natural component in pipeline gas) using the natural gas itself as the feedstock. The occurrence of ethylene in stray gases will then provide an effective way of identifying migrated storage gas.