Source Apportionment and Quantification of Organic Pollutants from Sour Gas Facilities in Alberta, Canada

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Alberta is a major petroleum producer in the world today, and the petroleum industry in Alberta is both a source of economic income and a source of public health concern. Sour gas (H_2S – rich natural gas) facilities refine petroleum products and emit a wide range of hydrocarbon and sulfur gases. Condensation and coagulation of these gases creates fine aerosols. These aerosols and the gases themselves may contain information that can be used to identify the associated geological reservoir and/or processing facility where they were formed. This project will attempt to confirm that emissions from different oil and gas reservoirs have unique chemical and isotopic compositions that can be used for source apportionment, and attempt to identify which compounds are effective source markers.

The stable carbon isotope composition of hydrocarbons in geologic formations depends on the ^{13}C content of source materials and isotopic fractionation during compound formation. To date, little work has been done using compound-specific ^{13}C isotope analysis to apportion specific sources of atmospheric pollutants.

Non-methane hydrocarbon emissions and aerosols downwind from several sour gas processing facilities are being investigated. Organic compounds including volatile organic compounds, and particulate-form polycyclic aromatic hydrocarbons and n-alkanes will be characterized using chemical and isotopic parameters. Concentrations and isotopic characteristics of compounds sampled from individual refinery flare stack plumes will be compared to those compounds in well-mixed air at a receptor site downwind of the sources. We hypothesize that organic pollutants from sour gas processing can be characterized and their sources identified, or "fingerprinted," after long-range transport.

Development of Fractures in Multilayers of Contrasting Strength and Ductility

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The effect of mean ductility, interlayer thickness, and magnitude of shortening on fracture development in bedded rock was investigated by shortening multilayer cylinders (5 cm dia.) 4 to 14% normal to layering at 5, 25, 50 and 100 MPa confining pressures in a triaxial apparatus. Multilayers were constructed by stacking two 1.4-cm thick layers of Berea sandstone (relatively strong and brittle) with interlayers of Indiana limestone (relatively weak and ductile). Sandstone