

# MEASURING MERCURY IN NATURAL GAS



Frontier GeoSciences Inc. (FGS) is an advanced research and analytical laboratory specializing in the determination and characterization of trace metals in the environment.

Our unique business structure allows us to employ inventive techniques and state-of-the-art instrumentation to provide our clients with customized methods to solve even their most complex analytical issues.

Since 1992, our expertise in the source, transportation, fate, and effect of trace metals in atmospheric, geological, biological, and hydrological cycles has produced innovative and reliable analytical methods now utilized around the world.

Industry and governments alike rely upon FGS to provide accurate and precise data so that they can make informed decisions about matters of serious human and economic consequence.



**Frontier GeoSciences Inc.**

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While the origins of mercury in hydrocarbon accumulations vary widely, most natural gas streams contain at least some of this poisonous and corrosive element. For many natural gas fields, mercury contamination is limited enough that it is not an issue; however, when detectable amounts of mercury are present in production streams it can create significant problems including: aluminum heat exchanger failures, poisoned catalysts, contaminated product streams, and gas leaks.

Accurate information about mercury concentrations is critical for anyone involved in the production, transportation, or processing of natural gas.

## **PERSISTENT CONTAMINATE**

Elemental mercury is the most common form of mercury found in natural gas; however, numerous organic ( $\text{CH}_3\text{HgCH}_3$ ,  $\text{C}_2\text{H}_5\text{HgC}_2\text{H}_5$ ,  $\text{ClHgCH}_3$ ) and inorganic ( $\text{HgCl}_2$ ) compounds have been detected in naphtha and natural gas condensates. These various compounds permit mercury to escape at every boiling range and still persist in the liquid stream even as it is fractionated.

## **EQUIPMENT DEPRECIATION**

Mercury is highly corrosive to natural gas processing equipment. It forms amalgams with a variety of metals including aluminum, brass, chromium, copper, iron, nickel, and zinc that are significantly weaker than mercury-free metals causing mechanical failures and gas leakage.

The aluminum amalgam in particular is extremely corrosive as it reacts with moisture to form a metal oxide, releasing the mercury to perpetuate the corrosive process. The corrosion of aluminum by mercury can lead to the catastrophic failure of cryogenic heat exchangers and wellhead valve stems and gates.

Contaminated product streams rapidly poison expensive catalysts significantly reducing their lifetimes. Contaminated equipment used in production, transportation, and processing must sometimes be reclassified as hazardous waste resulting in higher disposal costs.

## **DIFFICULT TO ASSESS**

For all of the reasons listed above and more, accurate measurements of the type and quantity of mercury present in natural gas are critical. Even after mercury contamination has been detected and removal systems put in place, they must be constantly tested to ensure that they are performing effectively.

However, since concentrations of as little as  $0.01\mu\text{g}/\text{Nm}^3$  (1ppt) are enough to cause concern, most sampling and analytical procedures are not sensitive enough to accurately determine mercury concentrations.

Frontier GeoSciences Inc. (FGS), through its extensive experience in mercury research and analytical method development, offers a rugged, robust, and precise sampling and analytical method for measuring mercury in natural gas. Based on techniques developed for coal-fired flue gas and approved by the EPA (CAMR 40 CFR Part 75 Appendix K),

FGS can accurately and reliably determine the type and quantity of mercury in natural gas at any stage in production, transportation, or processing. These techniques are also highly efficient at evaluating costly removal systems for their effectiveness at capturing and holding mercury from natural gas streams.

### ACCURATE MEASUREMENTS

Most of the historical measurements made to date have been made using a permanganate impinger solutions. This method has proven to be both cumbersome in the field and typically uses an antiquated CVAA based analytical method.

To provide our clients with accurate data, FGS utilizes a specially designed custom-built dry sorbent trap to collect mercury from natural gas streams. The trap collects all available vapor phase mercury --elemental and oxidized forms-- when inserted into a natural gas stream and a metered amount of gas is pulled through it.



The traps are then analyzed using FGS-coauthored EPA Method 1631 Revision E, using cold vapor atomic fluorescence spectrometry (CVAFS). Mercury concentrations are determined on a mass basis ( $\mu\text{g}/\text{m}^3$ ) and then combined with gas flow data ( $\text{m}^3/\text{min}$ ) to calculate the continuous mass rate of total vapor phase mercury.

This technique is superior to all others because it can be used for short-term or continuous sampling, utilizes routine field quality control, and maintains a fast turn-around-time for results. This method provides the natural gas industry with a fast, accurate, and affordable way to quickly and comprehensively measure mercury in natural gas.

Contact FGS today to find out how we can help you with your mercury monitoring needs.



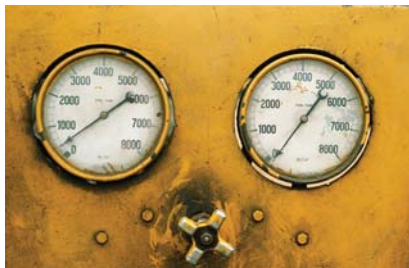
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