



HLT Hilase

## APPLICATION NOTE

# H<sub>2</sub>S Control in Gas and Oil Production using TDL with Photo Acoustics

The concentration of H<sub>2</sub>S in petroleum reservoirs has increased over the years, with several reservoirs around the world turning sour. This is mainly caused by sulfate-reducing bacteria, which enter the reservoir during seawater injection. Another cause is thermal cracking of sulfur in crude oil to H<sub>2</sub>S, which occurs when steam injection is applied for enhanced oil recovery systems. When sour reservoirs are tied in to older assets, controlling H<sub>2</sub>S also proves valuable. It is well known that controlling H<sub>2</sub>S partial vapor pressure in a system is critical to prevent sulfide stress corrosion cracking and health, safety and environmental problems due to emission of H<sub>2</sub>S into the atmosphere during storage. Many oil companies worldwide face this issue, so much is published on corrosion risks and options for H<sub>2</sub>S removal.

An article written by Krishaswamy Rajagopal, Rogério Lacerda, Ivan Slobodcicov and Eugenio Campagnolo, entitled "Modeling and simulation of hydrogen sulfide removal from petroleum production lines by chemical scavengers", provides essential information about the use of scavengers in production lines. This application note presents our solutions for online monitoring of H<sub>2</sub>S to optimize production and scavenger dosing. Overdosing is costly and may cause severe corrosion during the

refining stage. The previously-mentioned article provides a well-formed explanation of how distribution of H<sub>2</sub>S will appear throughout the oil-water and gas phase, all the way from the reservoir up to the third-stage phase separator on the platform. From this paper it can be concluded that there is a correlation between pressure and temperature. This paper describes the implementation of continuous online measurement and control of the process.

### H<sub>2</sub>S MEASUREMENT IN SEPARATOR PROCESSES

Hobré Instruments, which specializes in process H<sub>2</sub>S analyzers, has worked closely with oil companies over the years, and provides a proven technology to monitor H<sub>2</sub>S in oil and gas production.



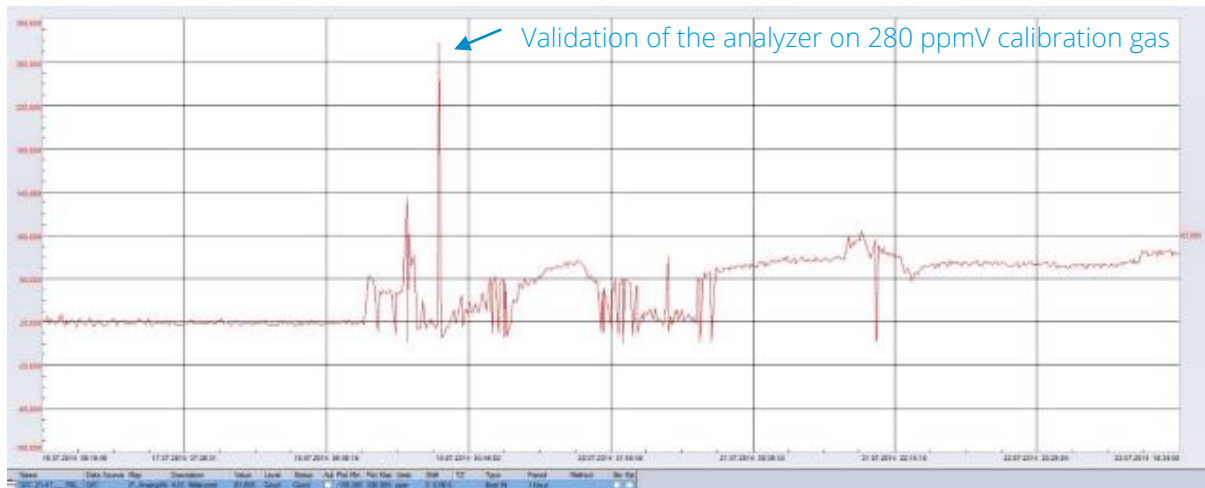
The preferred method for assets that contain a degasser flash vessel or three-phase separator is online measurement in the gas phase. For this type of wet gas application, Hobré has designed reliable sample conditioning solutions requiring close-to-

zero maintenance. By using the HLT Hilase TDL with Photo Acoustics Analyzer with a heated cell, oil producers have the ability to control their process close to the operating limits of processing and pipes.

This method maximizes efficiency of crude oil production in sour well applications. For scavenger-injection applications, injection performance and quantity of chemicals can be monitored.

With process simulations of the system, models can be designed and verified to correlate gas phase measurement to H<sub>2</sub>S concentrations in the oil and water phase. This technology ensures high reliability, accuracy and availability, with the additional benefit of low cost of ownership.

Figure 1. H<sub>2</sub>S process trend on second stage separator



A major Norwegian company has been applying this technology for over three years and has reported an availability of close to 100% on its asset's second stage separators. Operators are using the same measurement technique to control H<sub>2</sub>S levels in exported crude oil. Repeatability of gas phase measurement on exported crude in combination with modeling has proven to be more effective than laboratory methods.

## MULTIPHASE STREAMS WITHOUT PROCESS SEPARATION

For some assets, measurement in the gas phase of the separator is not possible. In this case, a sample flow from the three-phase fluid is taken through a fast loop to the H<sub>2</sub>S analyzer. With free gas present in the sample, the gas will be flashed at a controlled pressure and temperature, or at process pressure, and this concentration can be used to calculate the

H<sub>2</sub>S partial vapor pressure and correspondingly the H<sub>2</sub>S concentration in the oil and water phase.

## METHOD FOR CRUDE OIL FROM SEPARATORS AND/OR STRIPPING VESSELS

For measurement in treated crude oil without free gas and low water concentration, a fixed sample amount is stripped with nitrogen. The stripper system is designed for to be more than 98% efficient. Gas phase measurement with injection volume and stripper gas flow is used to calculate H<sub>2</sub>S concentration in ppm (wt). Oil phase measurement is typically used in midstream pipelines. By measuring H<sub>2</sub>S levels before crude oil enters storage tanks instead of using Head space measurement in the tank, complications can be detected early.

The HLT Hilase can also be used for Gas phase measurement in natural gas treatment and export lines. This technology provides a 0–10 ppm H<sub>2</sub>S range and ±0.3 ppm repeatability with optional integrated water measurement. For more information, see our separate application note: "H<sub>2</sub>S Analysis in Sales Gas".

Our objective is to work in close collaboration with oil and gas producers to design outstanding, application-specific solutions. This approach is crucial in the upstream oil and gas sector, as specific analytical professional knowledge is often required from suppliers operating in green and brownfield projects.

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