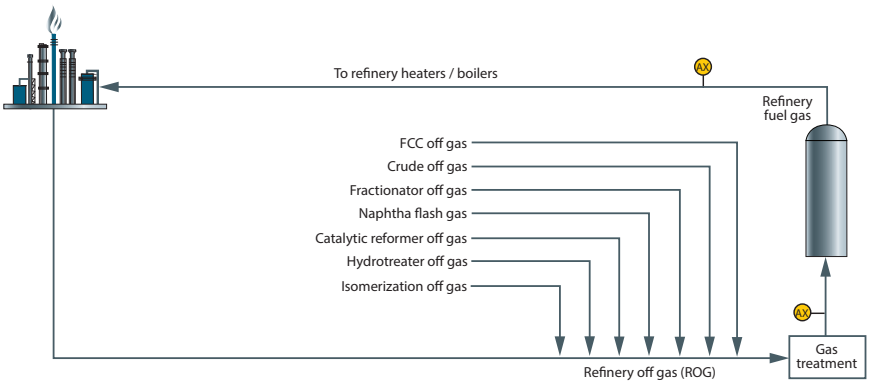
Refining: H_2S in flare gas



Refinery flare gas system

Benefits at a glance

- Meets U.S. EPA requirements for 40 CFR Part 60 Subpart Ja
- Automated 2-point daily validation check for U.S. EPA compliance
- Patented differential spectroscopy technique measures H_2S in flare gas
- Low maintenance and OPEX costs – no cylinders of carrier and combustion gases, or lead acetate tape

Refinery flare gas

Refinery flare gas is composed of a mixture of hydrogen and C_1 to C_5 hydrocarbons from different unit operations within the refinery. In the U.S. sulfur emissions from refinery flare systems are regulated under the Clean Air Act & Amendments (CAAA). The U.S. EPA is responsible for issuing regulations and applicable test methods for regulatory compliance. Regulations covering sulfur (SO_2) emissions from combustion of refinery flare gas are defined in 40 CFR 60 Subpart Ja. Similar regulations aimed at reducing SO_2 emissions have been promulgated in Europe, the Middle East, and Asia.

H_2S measurement for regulatory compliance

The U.S. EPA recognizes that measurement of H_2S gives a good approximation of the total SO_2 that is generated from combustion of flare gas. The required measurement range for H_2S in flare gas is 0-300 ppmv. H_2S levels in refinery flare gas must not exceed 162 ppmv over a three hour rolling average time period (approximately 500 lbs of SO_2 in any 24-hour period). A daily 2-point validation check is required to confirm the analyzer is operating properly within its calibration range.

Endress+Hauser's solution

Tunable diode laser absorption spectroscopy (TDLAS) is a SpectraSensors technology proven highly effective for monitoring H_2S in flare gas. TDLAS analyzers have an exceptionally fast response to changes in H_2S concentration, an important performance characteristic for continuous emission monitoring of flare gas. Endress+Hauser's patented differential spectroscopy technique enables detection and quantitation of H_2S in complex and variable refinery flare gas streams. Laser and detector components are isolated and protected from the gas stream and entrained contaminants avoiding fouling and ensuring stable long-term operation and accurate measurements.

Endress+Hauser
People for Process Automation

Application data	
Target component (Analyte)	Hydrogen sulfide in flare gas
Typical measurement cange	0-10 through 0-300 ppmv*
Typical repeatability	±0.5 ppmv or 2% of full scale (whichever is greater)*
Measurement response time	1 to ~60 seconds*
Principle of measurement	Differential tunable diode laser absorption spectroscopy (H_2S scrubber included)
Validation gas	Certified blend of H_2S in nitrogen
Validation – U.S. EPA compliant	Automated daily 2-point validation using certified standards at 20% and 80% of full scale**

* Consult factory for alternate ranges.
** Single-point validation is available for cases where U.S. EPA regulations don't apply.

Typical background stream composition			
Component	**Minimum (Mol%)**	**Typical (Mol%)**	**Maximum (Mol%)**
Hydrogen sulfide (H_2S)	0	150 ppmv	300 ppmv
Hydrogen (H_2)	25	40	65
Nitrogen (N_2)	0	4	20
Oxygen (O_2)	0.1	1	5
Carbon (CO)	0	0.5	5
Carbon dioxide (CO_2)	0	1	5
Methane (CH_4)	15	30	55
Ethane (C_2H_6)	5	8	15
Ethylene (C_2H_4)	1	6	15
Propane (C_3H_8)	1	5	15
Propylene (C_3H_6)	1	2	5
i-butane (C_4H_{10})	0	1	5
n-butane (C_4H_{10})	0	1	3
Pentanes and heavier (C5+)	0	1	5

The background stream composition must be specified for proper calibration and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component, especially H_2S, the measured component. Other stream compositions may be allowable with approval from Endress+Hauser.