Application Note
Hydrogen sulfide in flare gas

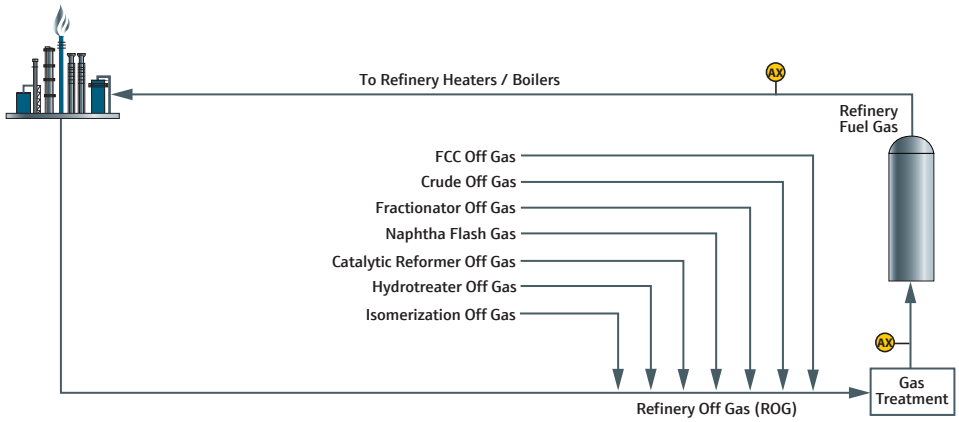
Industry:
Refining
Application Note 23302

Key Points

- 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

*www.spectrasensors.com/patents

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.



Refinery Flare Gas System

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 ppm_v. H_2S levels in refinery flare gas must not exceed 162 ppm_v 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.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have 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. SpectraSensors' 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.

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Application Data	
Target Component (Analyte)	Hydrogen Sulfide in Flare Gas
Typical Measurement Range	0-10 through 0-300 ppm*
Typical Repeatability	±0.5 ppm 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 ppm	300 ppm
Hydrogen (H_2)	25	40	65
Nitrogen (N)	0	4	20
Oxygen (O)	0.1	1	5
Carbon (CO)	0	0.5	5
Carbon Dioxide (CO_2)	0	1	5
Methane (CH_2)	15	30	55
Ethane (C_2H_4)	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
C_5+	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 SpectraSensors.

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