

Flare Gas Analysis

Fast Fact

Net Heating Value, H₂S and Total Sulfur with One Analyzer Safe, Low-Sulfur Validation Standards

With flare emissions regulations increasing in 2019, the industrial mass spectrometer's ability to rapidly measure the complete flare gas composition is more important than ever.

Flare streams often contain waste gas from several process units, and the composition can change dramatically from one minute to the next. The MAX300-AIR measures Net Heating Value (NHV), hydrogen sulfide, and Total Sulfur in dynamic vent gas streams and delivers the data to the control system in real-time. It is optimized for the 24-7 analysis of complex gas samples with hydrocarbon and sulfur concentrations that swing from ppm to high-percent levels.

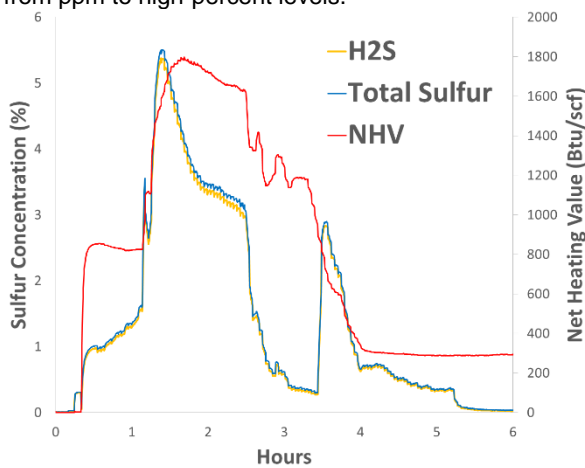


Figure 1. Net Heating Value and Sulfur in refinery flare gas reported by the MAX300-AIR. These data were recorded during a high-sulfur event and calculated from a fully speciated analysis consisting of 31 individual components. Total composition analysis time is <20 seconds.

MAX300-AIR Real-Time Gas Analyzer Specifications:

- 24-7 Automated Flare Monitoring
- >99% Demonstrated Uptime
- High-Range Sulfur Validations Use <300 ppm H₂S
- HF Acid Resistant Configuration Available
- Low Maintenance
- No Carrier, Detector or Dilution Gases Required
- Monitor Multiple Flares with a Single Analyzer



Figure 2. The MAX300-AIR, real-time mass spectrometer. For refinery flare compliance, the analyzer is often configured with a Hazardous Area Certification and corrosive-resistant materials that perform well with high-level H₂S and HF acid, according to site requirements.

Refinery Flare Gas Measurements

- Net Heating Value (NHV)
- H₂S (1 ppm to 100%)
- Total Sulfur (1 ppm to 100%)
- Real-Time Speciated Flare Composition to enable effective Root Cause Analysis

Real-time Speciated Data from a Refinery Flaring Event

These three data sets were recorded simultaneously using a single MAX300-AIR on a refinery flare stream.

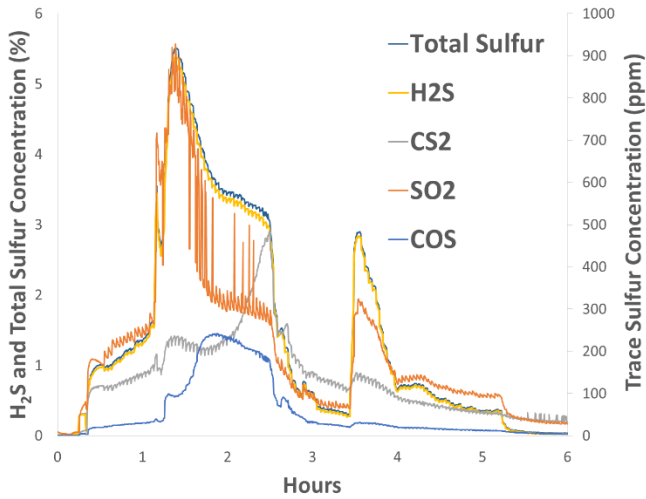


Figure 3. Total Sulfur was calculated from the sum of 10 speciated sulfur concentrations. The top contributors are shown but several others were present at ppm levels, at times contributing significantly to the Total Sulfur number.

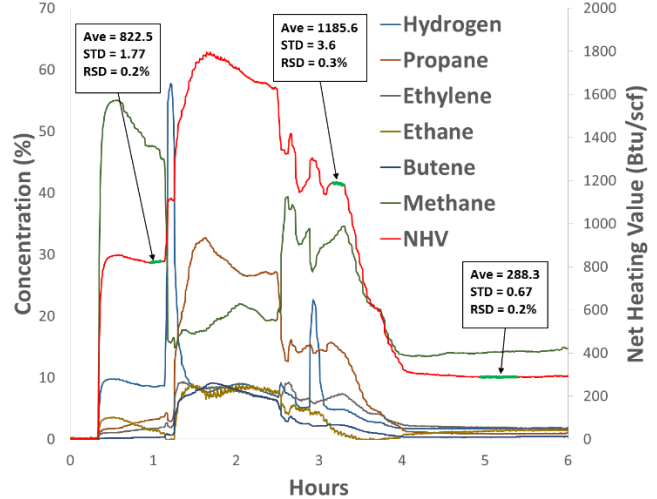


Figure 4. NHV changes rapidly as regulated material is sent to a refinery flare. Of the 14 hydrocarbons being measured, the 5 primary contributors to NHV are shown along with hydrogen. As the NHV value changes, the MAX300-AIR maintains a fixed, high precision, $\pm <0.4\%$, as demonstrated by the Relative Standard Deviation (RSD) calculated for three sections of the trend.

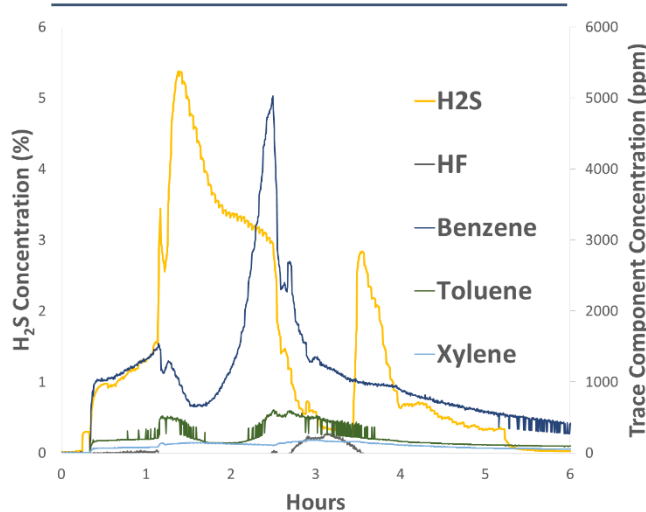


Figure 5. Trace components, along with the H₂S trend, provide valuable insight into the root cause of the flaring event.

Updates to the Refinery Sector Rule (RSR) require operators to maintain a Net Heating Value (NHV) ≥ 270 Btu/scf in the combustion zone when regulated material is sent to the flare. Compliance will require real-time analysis of the vent gas NHV, so that the refinery can detect changes and rapidly apply supplemental gas and steam, as needed, within the regulated 15 minute window. The MAX300-AIR provides fully-speciated composition updates several times per minute. NHV is automatically calculated from hydrogen and hydrocarbon concentrations, while H₂S and Total Sulfur are available for NSPS Subpart Ja compliance. The full composition of the flare sample indicates which process units contributed to the upset, making root cause analysis and corrective action planning fast and accurate.

Table 1. A comparison of flare gas analysis technologies

Flare Gas Analyzers	RSR 40 CFR 63.67		40 CFR 60 Subpart Ja			Additional Measurements		Operation		
	Net Heating Value (Btu/scf) Updates in Seconds	Speciated Hydrogen	H ₂ S (0-300 ppm)	Total Sulfur (0-100%)	High-Range Sulfur Validation can use ppm H ₂ S	Full Speciated Composition	Measures HF	No Dilution Required	Low Maintenance	No Carrier or Detector Gas Required
MAX300-AIR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calorimeter	✓							✓		
TDL			✓	*					✓	✓
PUV				✓						
GC-FPD		✓	✓	✓						
GC-TCD		✓	✓					✓		

*Total Sulfur with TDL is typically accounted for by a correlation method using manual sampling and laboratory analysis

