The US EPA rule 40CFR63.670 specifically targets petroleum refinery flares. The objective is to increase and ensure high combustion efficiency and minimize visible smoke. To ensure the minimum required net heating value in the combustion zone needed for proper combustion, the heat value of the waste gas into the flare must be determined. For a specific flare design, together with flow measurements of waste and auxiliary fuel gas and assisting steam or air flow, the net heating value as well as the gas velocity in the combustion zone can be monitored and controlled. The Siemens online process gas chromatograph provides heat value based on compositional speciation as part of an integrated turn-key measurement solution. Based on many installations, its long track record of functionality and ability to maintain ensures you can comply with the regulations report accurate data with confidence.

Regulation Objective:
Improved combustion efficiency
- Destruction efficiency >98%
- Combustion efficiency >96.5%

Limit visual smoke
- <5 minutes per 2 hour period

Achieved by controlling
- Flare tip velocity <60/<400 ft/sec
- Net Heating Value in combustion zone >270 BTU/scf
- Auxiliary steam or air addition

Regulatory Measurement Requirements:
Continuous Parameter Monitoring Systems (CPMS)
Measurement objective is Net Heating Value (NHV)
Results in 15 min. blocks, start at midnight

Analytical options
- Continuous speciation, ≤ 15 min.
- Composite Grab Sampler, ≤ 8 hrs.
- Continuous Calorimeter
- Continuous H₂ measurement (optional)

Continuous speciated measurement of
- H₂, Methane, Ethane, Ethylene, Propane, Propylene, i-Butane, n-Butane, Butylene, C₅+ plus components reasonably expected such as as CO, Acetylene, Propadiene, H₂S

Sample Transport and Sample Preparation
- Minimum 60° C
- Min. 2 (Calorimeter) or 3 (GC) validation standard standard inlets

Analytical Validation
- Calorimeter according manufacturers recommendations
- Process GC validation of every contributing component individually, n-Pentane for C₅+
- Process GC alternative validation method with H₂, C₁-C₅ n-Paraffins, other components assigned to closest n-Paraffin response and heat value
- H₂ Analyzer according manufacturers recommendations
Cont. Regulatory Measurement Requirements:

Analyzer Performance

- Calorimeter +/- 2% of span
- H₂ Analyzer +/- 2% over concentration measured or 0.1% v/v whichever is greater
- Process GC according 40 CFR 60 Part B Performance Spec 9 (PS 9) except
  - Validation focus is analyzer
  - Standard introduction at analyzer
  - Initial 7 day drift performance test
  - Mid-level, single daily analysis
  - Low, Mid and High level quarterly
  - Drift repeatability ≤ 10%
  - Linearity ≥ 99.5%

The refinery sector rule provides several analytical options. Calorimeter providing continuous waste gas heat value are fast. Together with flow data it permits short reaction time to optimize flare performance. However, steam or air addition needed not only depends on flow and heat value it also depends on the type of component mixture to be combusted. There is a significant difference in flare operation between presence of Paraffines, Olefins or Aromatics. Over steaming to reduce flare visibility dramatically reduces combustion efficiency which is detrimental to the objective. Hence, speciation is necessary to be able to adjust auxiliary steam and air flow and ensure destruction and combustion efficiency.

Process gas chromatographs provide that needed speciation. Either by separating and quantifying each individual component or by applying the alternative method and grouping the various constituents according their carbon number, steam or air addition can be optimized accordingly. Analytical simplicity for ease of understanding and ease of maintenance is achieved by utilizing parallel chromatography. Furthermore, compared to traditional gas chromatography it shortens the cycle time significantly.

Continuous Speciated Monitoring

On-line Process Gas Chromatograph

Utilities: Single Carrier Gas H₂
Control: Instrument Air
Design: Modular with Parallel Chromatography
Cycle times:
  - H₂ ≤ 1 min
  - N₂ 1-1.5 min
  - Air, C₁-C₅+ 1 min
  - Air, C₁-C₄+ 2 min
  - H₂, N₂, CO₂, C₁-C₅+ 3 min
  - H₂, N₂, CO₂, H₂S, C₁-C₅+ 7.5 min (Speciated Paraffin & Olefin)

Related measurements:
  - H₂S (0-300 ppm) 3 or 5 min (FPD or TCD)
  - Total Sulfur 3 min
  - Benzene 4 min

Sample Temperature: 60° C up to 110° C
Communication: AO, Ethernet Modbus, OPC
Measuring Ranges: up to 0-100%
Linearity: > 99.9 over 5 Magnitudes
Repeatability: RSD 0.2-0.6% (6 days)
Uptime: Typical > 98.5%
Validation: Auto Validation

Sample Conditioning System

(Probe, Transport, Blowback)

Design: Traditional or Smart
Temperature: 60° C or 120° C
Auto Validation: Typically 3 inlets
System Integration
  - 3-sided, Cabinet, Shelter
System Monitoring
  - Analyzer System Management

With hundreds of analyzers on flares, the MAXUM process gas chromatograph provides a proven, reliable, maintainable, and repeatable turn-key analytical flare monitoring system for satisfying the most rigorously regulatory requirements. Furthermore, assisting with in depth training enables you to support your installed measurement systems with confidence. And by having the largest dedicated analytical support group, we are able to provide expert support from remote or on site to assist you to meet regulatory compliance.