

METHANE FROM FLARING TOOLKIT



Measure Efficiency: Extractive method for determining flare efficiency

Can I measure flare efficiency? > [Measure Efficiency: Extractive method for determining flare efficiency](#)

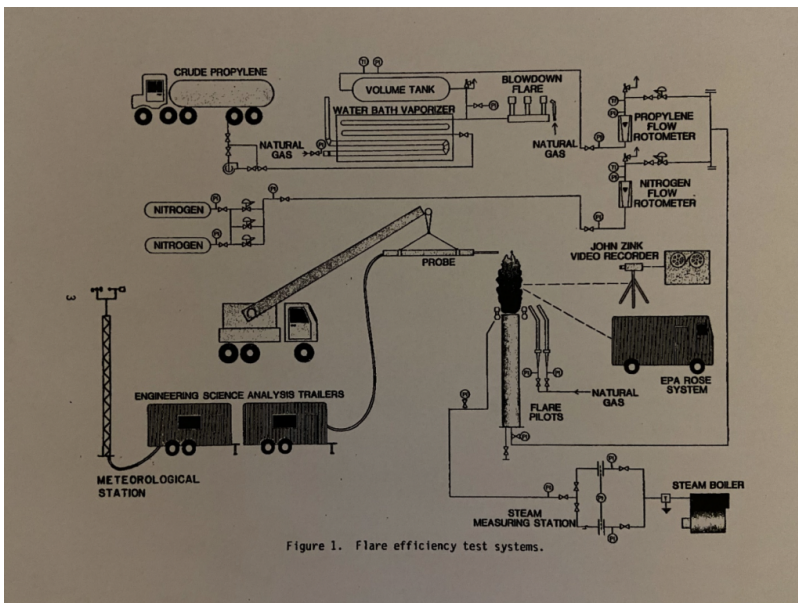
Summary

has for several decades been considered the nearest technique to a reference method for measuring flare combustion efficiency and destruction efficiency. The method involves taking gas samples in the vicinity of a test flare by means of an extractive hood suspended over the flare. Gas samples are analysed for hydrocarbons and combustion products by means of gas chromatography (GC-MS).

The key advantage is the ability to directly measure the composition of gas relative to reference gases. However, the limitations are that it is resource intensive, requires experienced operators and specially built test facilities. It cannot be deployed in the field to measure combustion from existing flares. Test facilities do not cover the full range of flare sizes in use today.

How it Works

- A sampling probe takes gas samples directly from the flare and feeds it to the sampling facilities. The probe is normally lowered in to the path of the flare by means of a crane (see photograph)
- Gas stream is typically analysed using continuous gas chromatography analysers.
- It provides a direct measurement of combusted gas composition, hence, does not rely on secondary parameters for destruction efficiency.



Advantages



Chromatography analysers are mature technology with the capability to provide accurate continuous measurements traceable to calibration gases with a known level of uncertainty

- ✓ Experimental facilities have been configured to cover a wide range of flare types and gas mixtures including those using assist gases
- ✓ It allows a direct calculation of combustion and destruction efficiencies based on measured gas compositions rather than using secondary parameters
- ✓ Sampling probe can be designed to operate during a wide range of weather conditions
- ✓ Extractive sampling enables the operator to measure the composition of any gas of interest

Limitations

- ✗ It is a highly resource intensive method requiring personnel to operate the system and the presence of mobile or permanent laboratory facilities nearby for sampling and analysis
- ✗ Positioning of the extraction hood is critical to the success of the method
- ✗ Whilst considered the nearest thing to a reference method, the technique is not taking all of the gases from the combustion zone and so the area that is being sampled has to be considered representative of the total flare
- ✗ The position of the sampling may need to be adjusted once the wind conditions change to take representative samples
- ✗ Cannot be field deployed – and therefore cannot measure flares under operational conditions (such as over water) or over extended time periods
- ✗ Very few facilities exist in the world that can offer this measurement as a service

- [Early EPA research in to the design of extractive test facilities](#)
- [Texas Commission on Environmental Quality 2010 report](#)
- [Aerodyne](#)

Case study

Texas Commission on Environmental Quality (TCEQ) has conducted a thorough study in 2010 ([TCEQ 2010 Flare Study](#)) of various flare destruction efficiency measurement techniques using extractive sampling as a reference method. It was also used to investigate optimal operating parameters for air and steam assisted flares.

Figure 1 shows that while steam is used to increase the flare performance, excessive steam supply to the flare tip can dramatically reduce the flare destruction efficiency. Figure 2 indicates the results obtained using extractive sampling method, which allows to directly measure different gas species compositions.

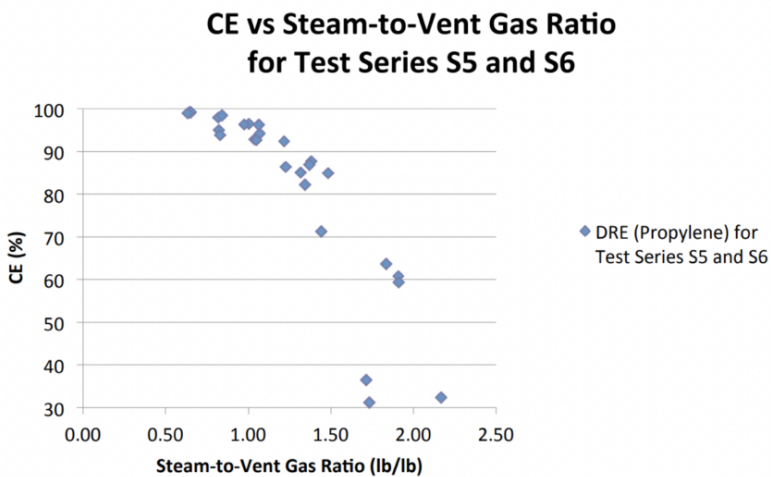


Figure 1. Plot showing the negative impact that excessive steam supply can have on combustion efficiency ([TCEQ 2010 Flare Study](#))

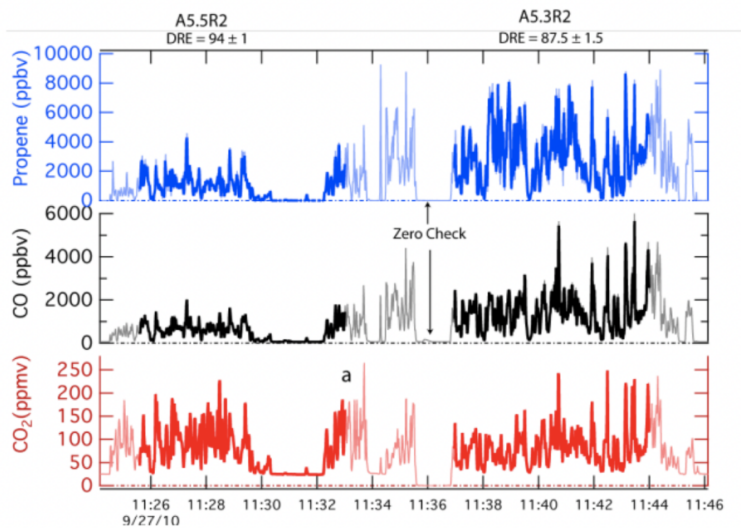


Figure 2. Plot indicating continuous measurement of flared gas emissions obtained by extractive sampling measurement (TCEQ 2010 Flare Study)

Can I measure flare efficiency?



Measure Efficiency: Predictive Feedback and Control



Measure Efficiency: Flare Simulations



Measure Efficiency: Aerial measurement of flare efficiency



Measure Efficiency: Drone equipped with dual CH4 and CO2 sensors



Measure Efficiency: Drone equipped with single methane sensor