

# METHANE FROM FLARING TOOLKIT



## Measure Efficiency: Video Imaging Spectral Radiometry – VISR

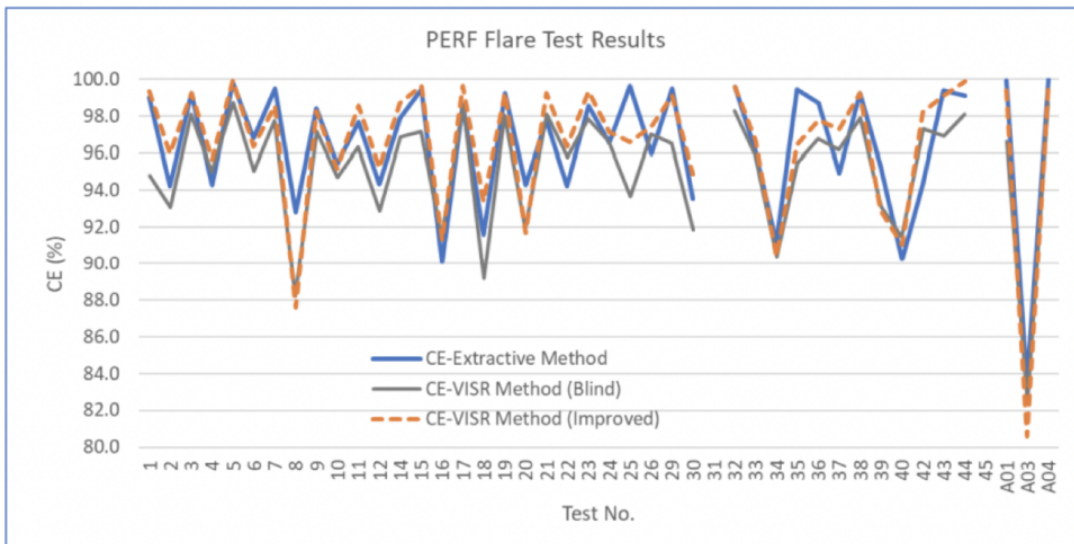
Can I measure flare efficiency? > [Measure Efficiency: Video Imaging Spectral Radiometry – VISR](#)

### Summary

A spectrometer that provides direct and real-time measurement of flare combustion efficiency by measuring the ratio of methane to carbon dioxide. It has been tested against established reference methods including extractive EPA methods typically used for stack testing. It can be permanently installed or deployed as a survey method (see separate entry). It works for flares of all sizes and locations provided the flame can be isolated within the field of view.

## How it Works

- A multi-spectral 2D imager measures radiance in the mid-wave spectrum to obtain the relative concentrations of CO<sub>2</sub> and unburnt hydrocarbons.
- Relative concentration measurement is based on spatial averaging of CO<sub>2</sub> & unburnt HC presence across the whole combustion envelope.
- Provides a real-time direct measurement of Combustion efficiency and empirically derives Destruction efficiency (to include CO and soot)
- Also provides data on flare heat release from which flare volumes can be approximated.



*Comparison between flare combustion efficiency measurements taken by extractive method and by VISR*

### Advantages



Results have been compared to the reference extractive method (with a mean difference - 0.07% in 95-100% CE range)



Tested against flares of variable size, design and with/without assist features



Quick (~30mins) setup, can be mobilised to provide measurements both onshore

& offshore or run continuously to help conform to visual impact legislation

#### Limitations

- |  |   |
|--|---|
| <p>✓ Can be run from outside process boundary, camera being positioned 100-1500ft from flare</p> <p>✓ Directly measuring CE eliminates the uncertainty of using surrogate parameters (e.g. NHVcz)</p> <p>✓ Operates in a range of environmental conditions, day &amp; night</p> <p>✓ Provides data on other flare parameters, including heat release, flame size, smoke index and flow rates</p> | <p>✗ Needs a clear line of sight of the post combustion gas with a minimum temperature of 300C</p> <p>✗ Cannot measure the concentration of CO, hence, DE has to be empirically derived</p> <p>✗ Some limitations in severe weather conditions (e.g. heavy fog)</p> |
|--|---|

#### Go Deeper

- [Vendor website: Providence](#)
- [Vendor website: Zeeco](#)
- [Press release: Lockheed Martin](#)

#### Case study

##### Research article:

Validation of a new method for measuring and continuously monitoring the efficiency of industrial flares

Yousheng Zeng, Jon Morris & Mark Dombrowski (2016)

Journal of the Air & Waste Management Association, 66:1, 76-86

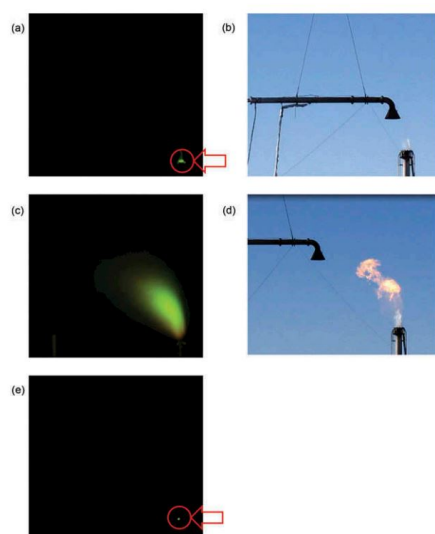


Figure 6. Images of small flare sizes and pilot: (a) IR image of Test 19; (b) visible image of test 19; (c) IR image of test 18; (d) visible image of test 18; and (e) IR image of test 13—no vent gas, lit pilot only.

## Can I measure flare efficiency?



Measure Efficiency: Predictive Feedback and Control



Measure Efficiency: Flare Simulations



Measure Efficiency: Drone equipped with single methane sensor



Measure Efficiency: Aerial measurement of flare efficiency



Measure Efficiency: Extractive method for determining flare efficiency