

Overcoming Challenges Meeting RSR Flare Monitoring Requirements



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Background

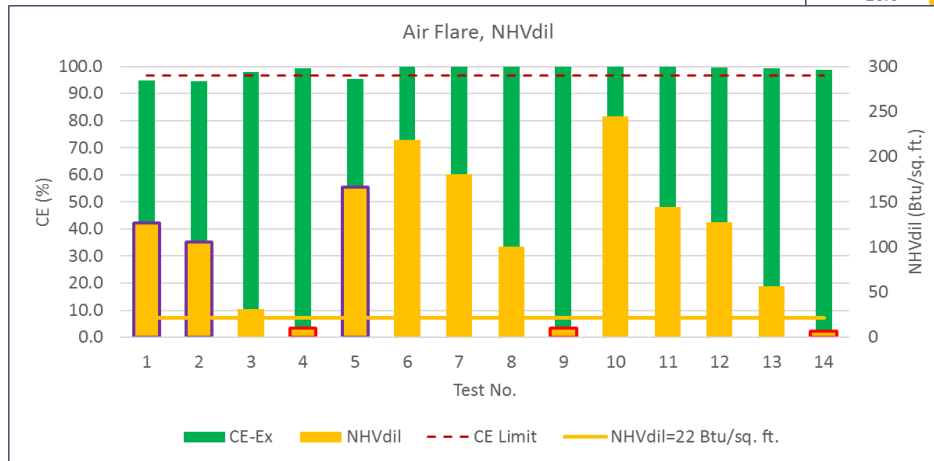
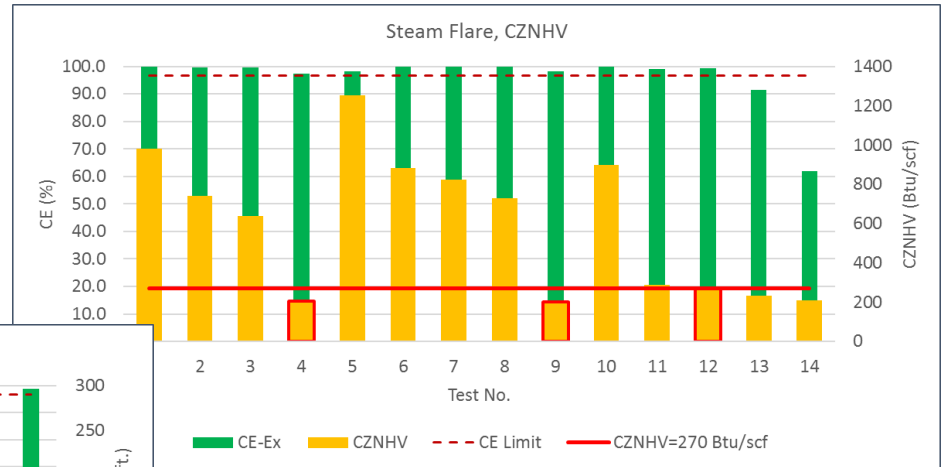
- On December 1, 2015, the U.S. EPA promulgated new Refinery Sector Rule (RSR). One of the requirements in the RSR is to continuously monitor flare performance using an indirect method (a work practice standard)
- The compliance deadline is Jan. 30, 2019
- Similar flare monitoring requirements are expected in other new regulations (e.g., the new rule for ethylene sector)

Flare Monitoring Challenges

- The indirect method specified in the RSR requires at least 10 instruments to derive a single surrogate parameter (combustion zone net heating value, or NHVcz) for compliance determination. It presents significant challenges:
 - ✓ High cost – both initial capital cost and recurring O&M cost
 - ✓ Reliability – data availability issues due to the number of instruments involved and in contact with corrosive process stream (compliance risk)
 - ✓ Latency – little time to respond or take corrective actions within the 15-minute compliance window could lead deviation or unnecessary supplemental fuel
 - ✓ Scheduling – installations need to coincide with scheduled turnaround or process shutdowns may be required
 - ✓ NHVcz may not reflect the true flare performance (CE and DRE)

NHVcz/NHVdil verses flare performance

 The indirect method may not always reflect the true flare performance



How's your progress towards the deadline?

- Some facilities will struggle to meet compliance deadline of 1/30/2019
 - ✓ Long lead times on equipment (9 months or more)
 - ✓ Missed scheduled turnarounds, requiring process shutdown to install flare monitoring equipment
 - ✓ Need run time with the equipment to derive predictive algorithms for maintaining compliance
 - ✓ If you wait until you are out of compliance you will not have time to take corrective action
 - ✓ Keeping in mind the latency of the GC/Calorimeter and sampling train
 - ✓ Need to hire personnel/contractors to service new compliance equipment
 - ✓ Need to develop Flare Monitoring Plan

What are your options if you can't meet deadline?

- Request 2-year extension under 40 CFR 63.6(i)(4)(ii)
 - ✓ Basis for the request: additional time is necessary for installation of controls and steps will be taken during the extension period to assure that persons' health will be protected
 - ✓ Request is submitted to EPA
 - ✓ Request must be submitted no later than 90 days after the effective date – This option is no longer available

What are your options if you can't meet deadline?

- Request 5-year extension under 40 CFR 63.6(i)(5)
 - ✓ Basis for the request: the affected facility has installed BACT or LAER prior to promulgation of relevant standard
 - ✓ Request is submitted to EPA
 - ✓ Request must be submitted no later than 120 days after the promulgation of the relevant standard – This option is no longer available

What are your options if you can't meet deadline?

- Request 1-year extension under 40 CFR 63.6(i)(4)(i)
 - ✓ Basis for the request: additional time is necessary for installation of controls
 - ✓ Request is submitted to delegated authority (typically state agencies)
 - ✓ Request must be submitted no later than 120 days prior to the compliance date (may be < 120 if the need arises later due to circumstances beyond reasonable control of the owner/operator)
 - ✓ Content of the request:
 - A description of the controls to be installed
 - Compliance schedule and milestones (planned project start date, completion date, the date by which compliance is to be achieved)

VISR as an Alternative Test Method

- Video Imaging Spectral Radiometer (VISR) directly and remotely measures relative concentrations of combustion products, CO₂ and unburned hydrocarbons, to calculate flare combustion efficiency (CE) in real time
- Directly measuring CE eliminates the uncertainty of using surrogate indirect parameters such as Combustion Zone Net Heating Value (NHVcz) and flare tip velocity can be used as an Alternative Test Method for the indirect flare monitoring requirements



VISR as an Alternative Test Method

- VISR directly, remotely, autonomously and continuously monitors the following flare performance metrics for demonstrating compliance
 - ✓ Combustion Efficiency (CE): 0-100%, replaces NHVcz (or NHVdil)
 - ✓ §63.670 (d) flare tip velocity
 - ✓ §63.670 (e) Combustion zone operating limit of 270 BTU/scf
 - ✓ §63.670 (f) Dilution operating limit of 22 BTU/ft²
 - ✓ Smoke index (SI): 0-10
 - ✓ Can potentially cover §63.670 (c) No visible emissions
 - ✓ Flame Footprint (FF): cross sectional area of flame in ft²
 - ✓ Can potentially cover §63.670 (b) Pilot flame presence

VISR as an Alternative Test Method

- Additional VISR flare performance metrics
 - ✓ Heat Release (HR): Amount of heat released by the flare in the MWIR region (BTU/min)
 - ✓ Flame Stability (FS): 0.1 – 1 where 1 is very stable flame
- Default temporal resolution of 1 second
- Data sent directly to DCS, PLC or data historian with no latency
- Potential for closed loop control of the flare
- Potential to monitor multiple flares with one VISR

VISR measuring good flare performance

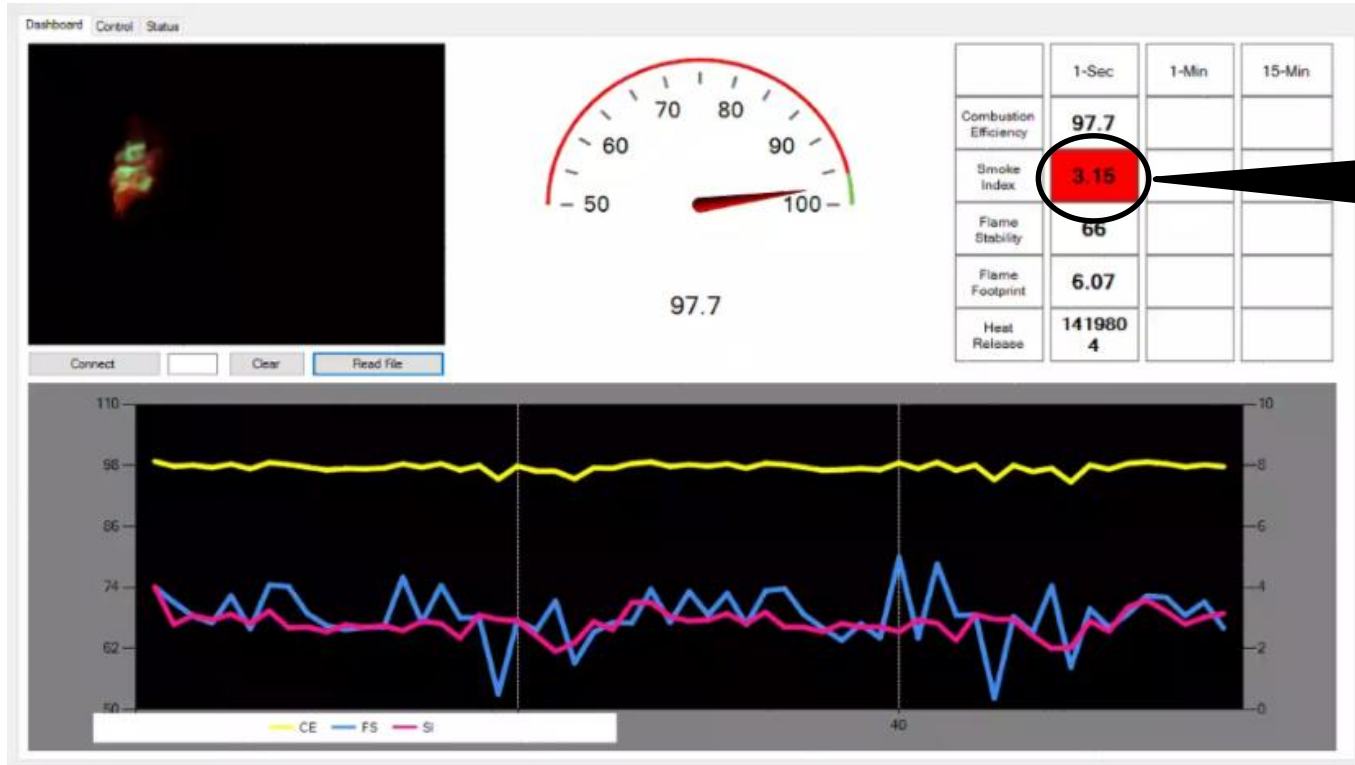


CE measured by VISR: 99.8%

Ground truth: CE measured by extractive sampling: 99.9% w/ SD of 0.4%



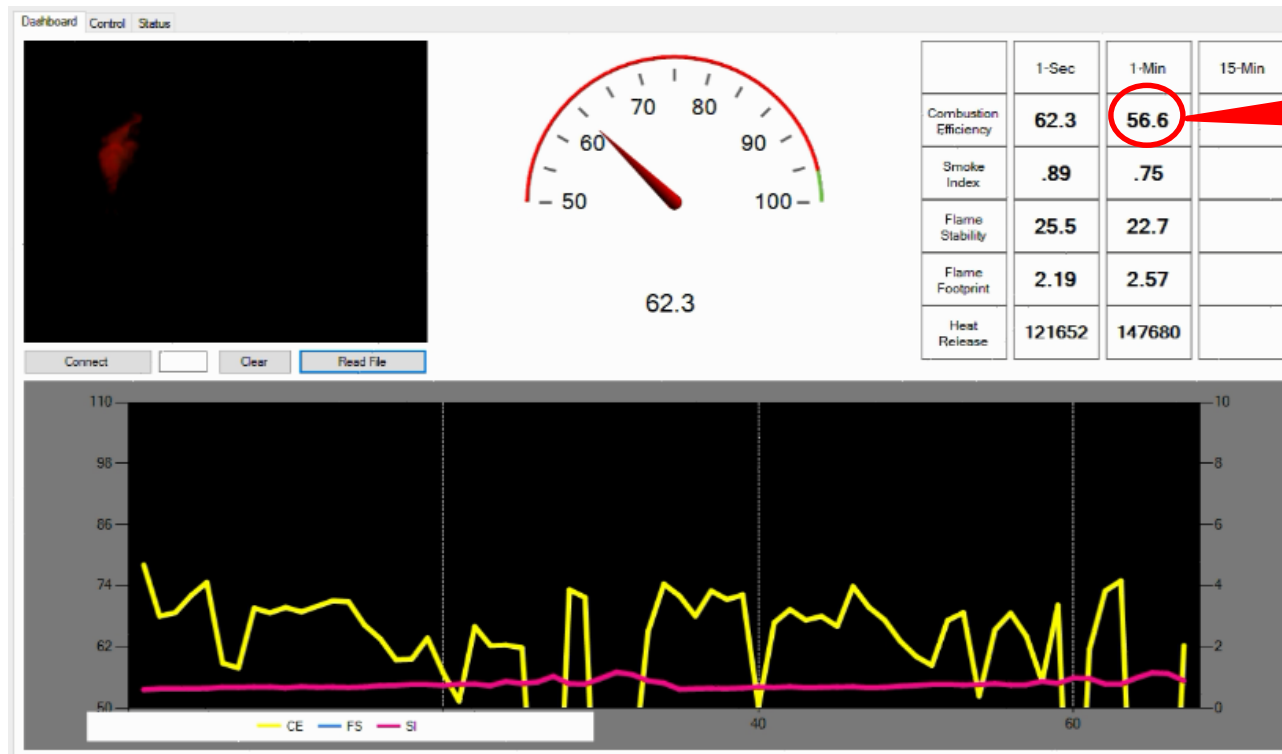
VISR measuring visible emissions (SI)



SI = 3.15,
indicating smoke



VISR measuring poor combustion (over steaming)



CE measured by VISR: 56.6%

Ground truth:
CE measured by extractive sampling:
62.0% w/ SD of 19.2%

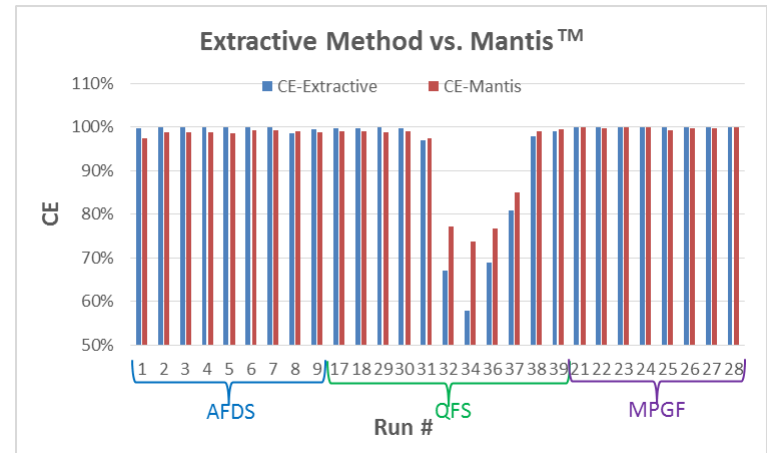


Benefits of using VISR for RSR compliance

- Cost savings
 - ✓ Reduce capital costs by 50% (or more) and virtually eliminate O&M costs
- Simple operation and installation
 - ✓ 1 instrument for compliance vs. 10-12 instruments for indirect method
 - ✓ Remote sensing, no contact with corrosive process stream
 - ✓ Installation does not require turnaround or process shutdown
- Fast response
 - ✓ 1 second resolution with no latency vs. 4-12 minute resolution with indirect method
 - ✓ Minimize deviations
- Potential for closed loop control of flare

Validation of VISR Method

- Validated using extractive method
- Seventy two (72) validation tests have been conducted, 44 of them were blind tests administered by a third party
- Wide range of process conditions and environmental conditions tested
- Overall accuracy within 1%



Summary

- Compliance deadline for Refinery RSR Flare Monitor is fast approaching
- Request for one-year extension under 40 CFR 63.6(i)(4)(i)
- Consider VISR as an Alternative Test Method
- Fast installation, lower capital cost and very low O&M
- Immediate feedback, 1-second data, no latency
- Potential for closed loop flare control
- VISR demonstration in the parking lot
- Visit Providence booth to find out more about VISR