UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

DATE: OCT 15 2018

SUBJECT: CLEAN AIR ACT INSPECTION REPORT
Kensington Processing Plant

FROM: Gregory Gehrig, Environmental Engineer
AECAB (MI/WI)

THRU: Sarah Marshall, Section Chief
AECAB (MI/WI)

TO: File

BASIC INFORMATION

Facility Name: Kensington Processing Plant

Facility Location: 11543 State Route 644, Kensington, OH

Date of Inspection: September 20, 2018

EPA Inspectors:
1. Gregory Gehrig, Environmental Engineer
2. Kenneth Ruffatto, Environmental Engineer
3. Cary Secrest, Environmental Protection Specialist

Other Attendees:
1. Yousheng Zeng, Providence Photonics
2. Sri Motyala, Providence Photonics
3. Jon Morris, Providence Photonics
4. Christopher Bender, Environmental Manager, Momentum Midstream, LLC
5. Mark Hay, Plant Manager, Momentum Midstream, LLC
6. Dave Pratt, Momentum Midstream, LLC

Contact Email Address: Christopher Bender <C.Bender@m3midstream.com>

Purpose of Inspection: CAA Compliance

Facility Type: Midstream oil and gas processing facility

Facility Name: Kensington Processing Plant
Facility Location: 11543 State Route 644, Kensington, OH
Date of Inspection: September 20, 2018

Regulations Central to Inspection: SIP, NSPS and MACT

Arrival Time: 1240 hrs
Departure Time: 1605 hrs

Inspection Type:
☒ Unannounced Inspection
☐ Announced Inspection

OPENING CONFERENCE

☒ Credentials Presented
☒ CBI warning to facility provided

The following information was obtained verbally from facility personnel.

Company Ownership: The facility is owned by Utica East Ohio and operated by Momentum Midstream, LLC (Momentum). The facility has had the same ownership since it began operating in 2013.

Process Description:
The Kensington Processing Plant (Kensington) is a midstream oil and gas processing facility. Momentum processes oil and gas extracted at wells via two pipe lines. These two pipelines are the high pressure and the medium pressure pipelines. Liquids are removed by a 'slug catcher', stabilized and then sent via pipeline to a fractionation facility. Gas is cooled in cryogenic process and separated into four product streams: methane, ethane, propane and butane. There are the four cryogenic trains at this facility.

Four flares are used at this facility, although only three were operating at the time of the inspection. Observations of the flares are summarized below. Various storage vessels are also used to hold liquids, including condensate, methanol, and natural gas liquids.

TOUR INFORMATION

EPA toured the facility: Yes

Data Collected and Observations: EPA contracted Providence Photonics (Providence) of Baton Rouge, LA to conduct flare observations at Kensington using a Video Imaging Spectro-Radiography (VISR) imaging device, or VISR. VISR uses infrared sensing and imaging technology to determine the combustion efficiency (CE) of hydrocarbons combusted by a flare with a visible flame. Providence used the VISR to observe the flaring along with a dedicated standard video camera. EPA also utilized a FLIR camera to observe the flares and collect images.

Facility Name: Kensington Processing Plant
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At the time of inspection, the facility was operating normally. Observations of the flares were:

High Pressure (HP) flare – Control room data showed a rather steady vent gas (VG) flow rate of approx. 275 lb/hr to this unassisted flare. VISR observations indicated CE of approx. 99% on average.

Tank flare (associated with T001) – Very little flaring was observed from this unassisted flare during the inspection. Several short events of venting lasting a few seconds each were seen. One of these short events had noticeable visible emissions, although they all burned bright orange. VISR data showed the CE for these short events was between 90 and 99%.

Emergency flare (associated with HP stabilizer) – Only the pilot lights were visible with the FLIR, and therefore only CE readings for the pilots were collected with the VISR. This flare is air-assisted and the headers leading to it are swept with natural gas from the Kensington natural gas product delivery line.

Loadout flare – This unassisted flare was not operating at the time of inspection.

A report from Providence on the VISR data and images is provided in Appendix A.

EPA and Providence conducted a limited tour of the facility for the purposes of observing flare operations. EPA observed the flare operating parameters in the control room and took readouts detailing conditions at the time of inspection.

Field Measurements: were taken during this inspection.

RECORDS REVIEW

Five control room flare operating SCADA information printouts (taken).

CLOSING CONFERENCE

Requested documents:

None at the time of inspection.

SIGNATURES

Lead Inspector: _____ Date: 10-12-18

Section Chief: _____ Date: 10/15/18

Facility Name: Kensington Processing Plant
Facility Location: 11543 State Route 644, Kensington, OH
Date of Inspection: September 20, 2018

DIGITAL IMAGE LOG*

1. **Inspector Name:** Gregory Gehrig	2. **Date(s) of Inspection:** September 20, 2018
3. **Company/Facility Name:** Kensington Processing Plant	4. **Street Address, City, State:** 11543 State Route 644, Kensington, OH
5. **Number of Images:** 9	6. **Archival Record Location:** CD-R labeled Kensington Images 9.20.2018

Image name	Time (EDT)	Description
IMG_0147	1442	Emergency flare at distance
IMG_0148	1448	Emergency flare closer
IMG_0149	1515	HP flare
MOV_302	1411	FLIR video of Tank flare
MOV_303	1413	FLIR video of Tank flare
MOV_305	1427	FLIR video of Tank flare associated with 99.5% CE
MOV_306	1455	FLIR video of Emergency flare (imaged by G. Gehrig)
MOV_307	1517	FLIR video of HP flare
MOV_309	1529	FLIR video of HP flare

*Note additional images of flares were collected by Providence Photonics as detailed in the report in Appendix A.

APPENDIX A: FIELD NOTES AND FIELD MEASUREMENT DATA

Video Imaging Spectro-Radiography Report provided by Providence Photonics

PROVIDENCE PHOTONICS

Flare VISR Test Report

Facility: Kensington Process Plant

September 2018

Prepared for

US Environmental Protection Agency

Region 5

77 West Jackson Boulevard

Chicago, IL 60604

PROVIDENCE PHOTONICS PROJECT NO. 1198-001

PREPARED BY
Providence Photonics, LLC | 1201 Main Street, Baton Rouge, LA 70802

Table of Contents

Introduction

EPA Region 5 retained Providence Photonics, LLC (Providence) to assist the inspection of Kensington Processing Plant (Kensington Plant) located at 11543 State Route 644, Kensington, Ohio 44427. Providence measured the combustion efficiency (CE) and other performance metrics of the three flares at the Kensington Plant using the Video Imaging Spectral Radiometry (VISR) method.

The VISR method utilizes a multi-spectral mid-wave infrared imager to remotely and continuously measure relative concentrations of combustion gases. Based on these relative concentrations, flare CE is calculated. The VISR method provides continuous measurement of the following five flare performance metrics at 1-second data rate.

- **Combustion Efficiency (CE)**: This is the primary metric that VISR measures. CE is the concentration of unburned hydrocarbons relative to the concentration of carbon dioxide (CO2, the end product of combustion) in the post-combustion gases. CE is expressed in percentage. If combustion is complete and there are no unburned hydrocarbons in the post-combustion gases, CE will be 100%.
- **Smoke Index (SI)**: SI is used to indicate the level of smoke in the flare flame. It has a range of 0 to 10. When flare has no smoke, the SI is very low (generally below 1 to 2). As smoke level increases, the SI monotonically (but not linearly) increases.
- **Flame Stability (FS)**: FS is used to measure the degree of flare radiance fluctuation within 1 second, which indicates stability of the flare. It has a range of 0-100. When the FS value is in about 80 or higher, it generally indicates a very stable flare.
- **Flame Footprint (FF)**: FF represents the flame cross section area (in square feet) of the flare and associated hot post-combustion gases perpendicular to the VISR instrument. The footprint is based on the Infrared radiance, and it is generally larger than the size of the flame observed in the visible spectrum by the naked eye.
- **Heat Release (HR)**. HR measures the amount of heat released by the flare in regions of the mid-wave Infrared (MWIR) spectrum monitored by the VISR instrument. HR is reported as Btu/min. Because the HR only represents the energy released by the flare in the MWIR, the total heat released by the flare is larger than the HR metric reported by VISR.

More information about the VISR method and its validation is provided at https://www.providencephotonics.com/flare-monitoring.

Summary of VISR Test Results and Observations

Date: September 20, 2018

Personnel:

Gregory Gehrig (EPA Region 5)	Yousheng Zeng (Providence)
Kenneth Ruffatto (EPA Region 5)	Jon Morris (Providence)
Cary Secrest (EPA OECA)	Sri Mutyala (Providence)

Facility: Kensington Processing Plant

11543 State Route 644, Kensington, Ohio 44427

Location of Flares and VISR Instrument: see Figures 1-3.

Figure 1. Tank Flare.
Left: Google map with a red circle indicating the location of the flare and a red number "1" indicating the location of the VISR instrument. Distance: 150 ft.
Right: A photo of the flare taken during the test.

Figure 2. Emergency Flare.
Left: Google map with a red circle indicating the location of the flare and a red number "2" indicating the location of the VISR instrument. Distance: 213 ft.
Right: A photo of the flare taken during the test.

Figure 3. High Pressure (HP) Flare.
Left: Google map with a red circle indicating the location of the flare and a red number "3" indicating the location of the VISR instrument. Distance: 369 ft.
Right: A photo of the flare taken during the test.

Test Results and Observations – Tank Flare

Test results for the Tank Flare are summarized in Table 1. Variability (or trending) of the flare during the test can be seen in Figures 4-6. According to facility personnel, this flare is in idle condition most of time with little vent gas being sent to the flare (only pilots are lit). Figure 7 provides a snapshot of the spectral image and a visible image of the flare when it was in the idle condition. When the flare was idling, only the pilot flame was visible from the measurement position and some of these frames did not meet data quality criteria set for this test. Therefore, some 1-second CE data points were missing in Figure 4.

When tank pressure is built up to a set value, excess gas is vented to the flare (see Figure 8) and the flaring lasts less than 1-2 minutes. During the inspection, the interval between the flaring events was observed to be about 20-30 minutes. There was one flaring event which occurred while the VISR instrument was being set up. We conducted measurement for nearly 25 minutes. Towards the end of this 25-minute period, there was another flaring event – see the spikes near the right end of the FF and HR chart in Figure 5. Figure 8 includes images that correspond to the spikes (flaring) in Figure 5.

Table 1. VISR test results for the Tank Flare

	Average for the Duration (2:05 pm – 2:30 pm)	1-sec (Avg.-SD, Avg.+SD)	1-min (Avg.-SD, Avg.+SD)
Combustion Efficiency (%)	99.4	(97.0, 100.0)*	(99.1, 100.0)*
Smoke Index (unitless)	1.12	(0.02, 2.22)	(0.41, 1.89)
Flame Stability (unitless)	92.2	(85.7, 98.8)	(88.6, 95.2)
Flame Footprint (ft^2)	2.39	(0, 8.25)**	(0, 8.00)**
Heat Release (Btu/min)	31	(0, 144)**	(0, 147)**

*: When (Avg.+SD) >100, the value of 100 is assigned to the upper bound.

**: When (Avg.-SD) <0, the value of 0 is assigned to the lower bound.

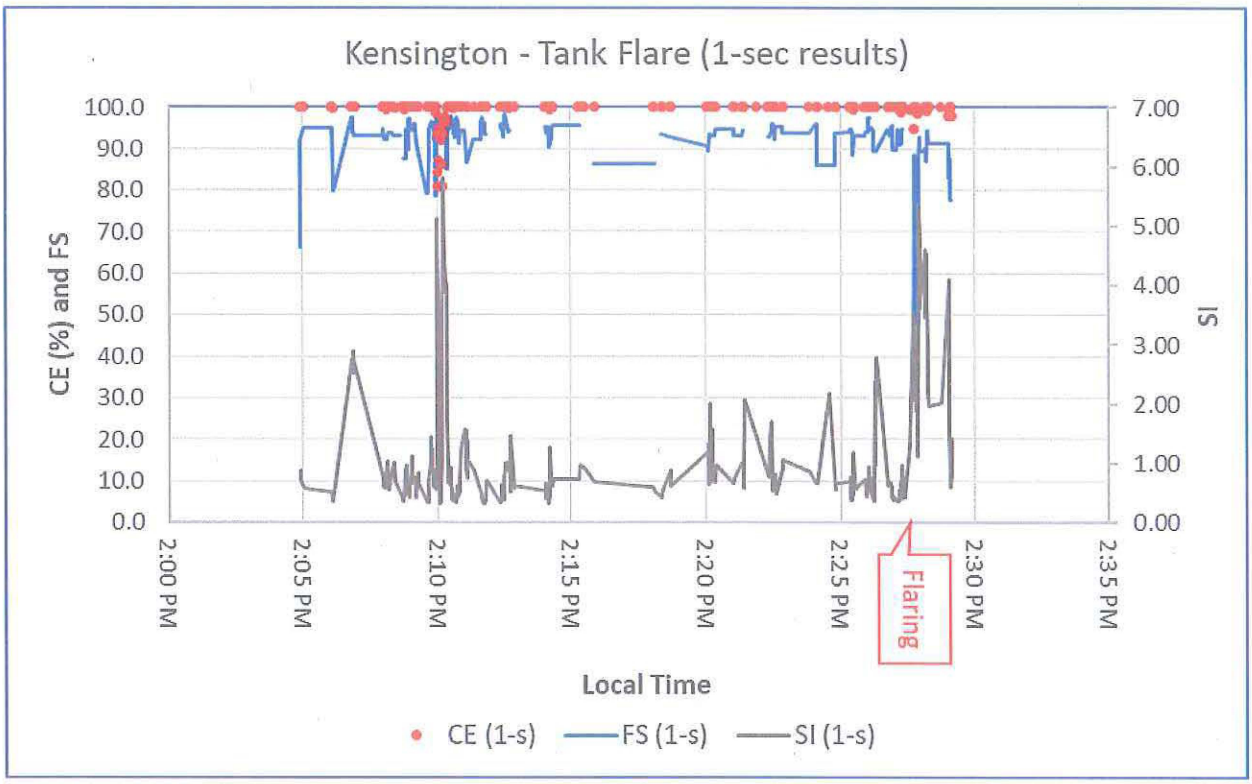

Figure 4. Tank Flare. Time series plot of 1-second results for CE, FS, and SI.

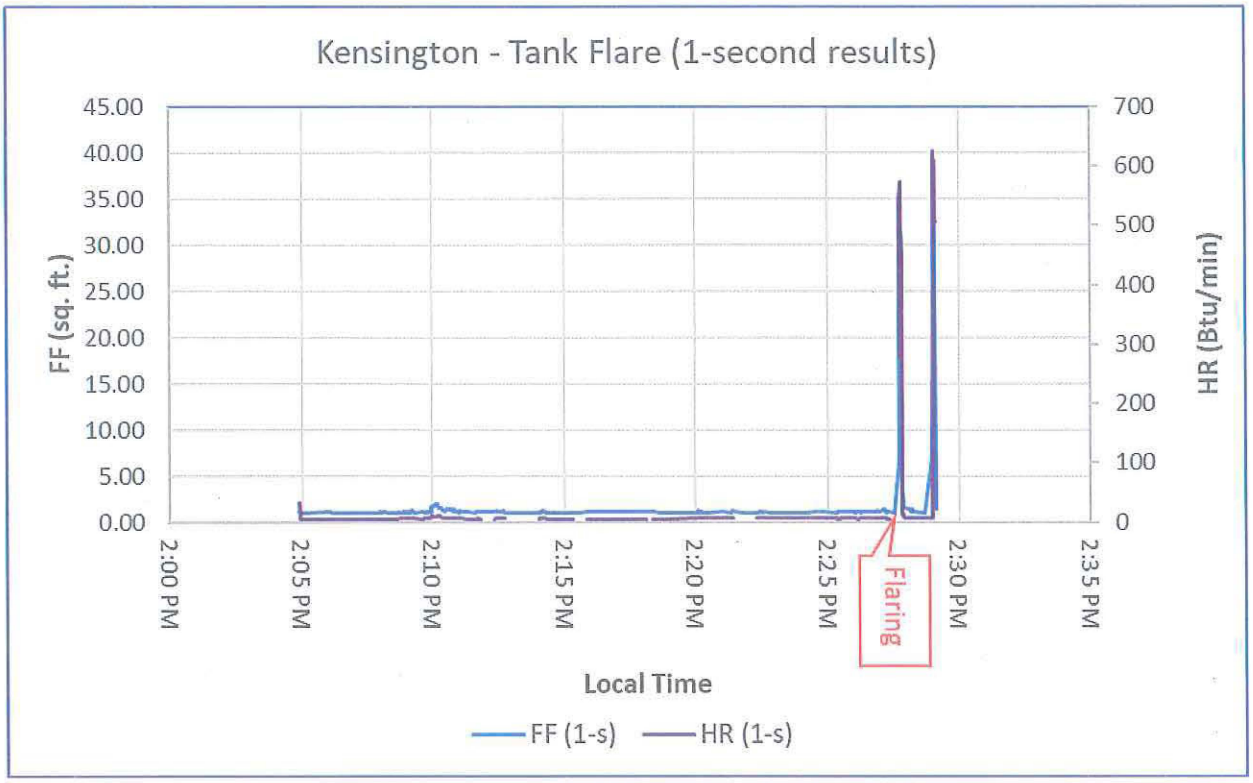

Figure 5. Tank Flare. Time series plot of 1-second results for FF and HR.

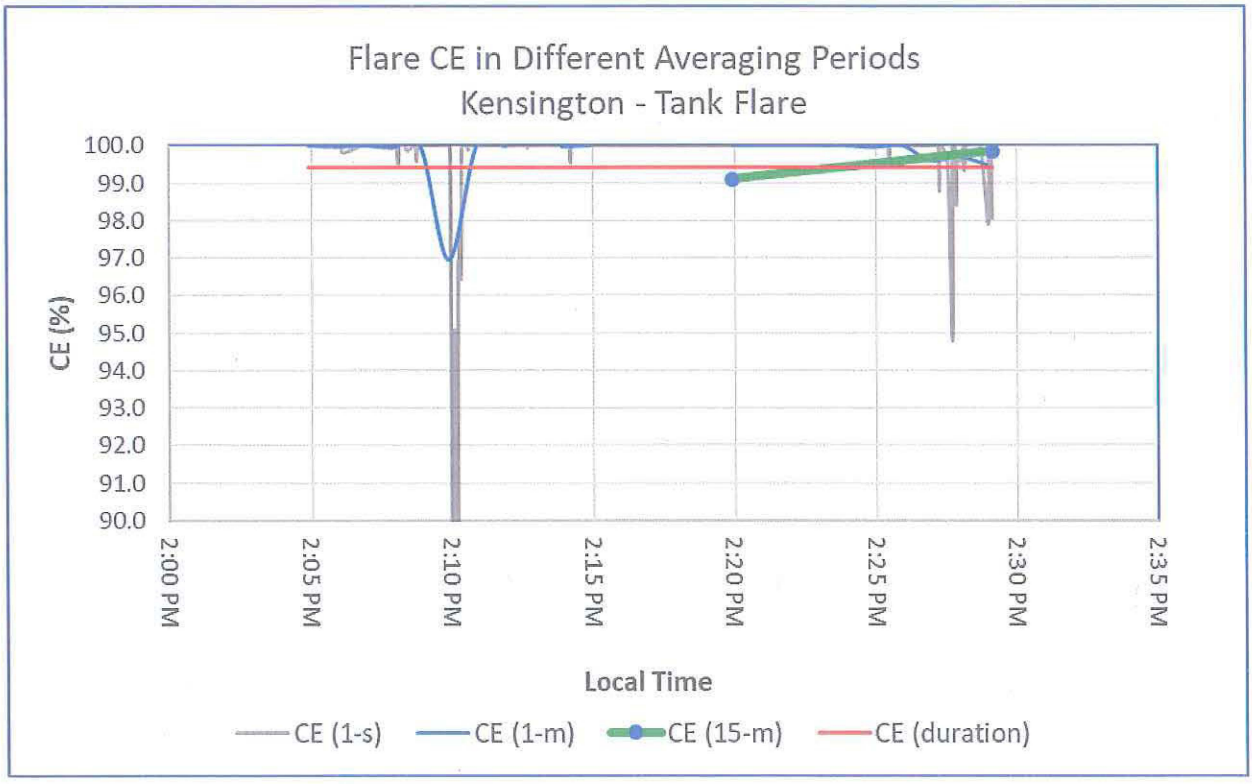

Figure 6. Tank Flare. Time series plot of CE with different averaging periods.

Figure 7. Tank Flare (idle condition).
Left: A representative composite spectral image generated by VISR instrument. Red color represents CO_2; green color represents hydrocarbon; and blue or bluish white color represents aerosol (e.g., soot) or hot solid object (e.g., the shield for the pilots).
Right: A representative image in visible spectrum.

Figure 8. Tank Flare (flaring condition).
Left: A representative composite spectral image generated by VISR instrument. Red color represents CO2; green color represents hydrocarbon; and blue or bluish white color represents aerosol (e.g., soot) or hot solid object (e.g., the shield for the pilots).
Right: A representative image in visible spectrum.

Test Results and Observations – Emergency Flare

Test results for the Emergency Flare (North Flare) are summarized in Table 2. Variability (or trending) of the flare during the test can be seen in Figures 9-11. Figure 12 provides a snapshot of the spectral image and a visible image of the flare. During the test only the flare pilots were detected (see Figure 12).

Table 2. VISR test results for the Emergency Flare

	Average for the Duration (2:56 pm – 3:02 pm)	1-sec Avg. ± SD	1-min Avg. ± SD
Combustion Efficiency (%)	99.3	(98.6, 99.9)	(98.8, 99.8)
Smoke Index (unitless)	1.46	(1.07, 1.85)	(1.17, 1.74)
Flame Stability (unitless)	86.9	(77.6, 96.2)	(83.8, 89.8)
Flame Footprint (ft^2)	1.86	(1.23, 2.50)	(1.37, 2.32)
Heat Release (Btu/min)	8	(5, 11)	(6, 10)

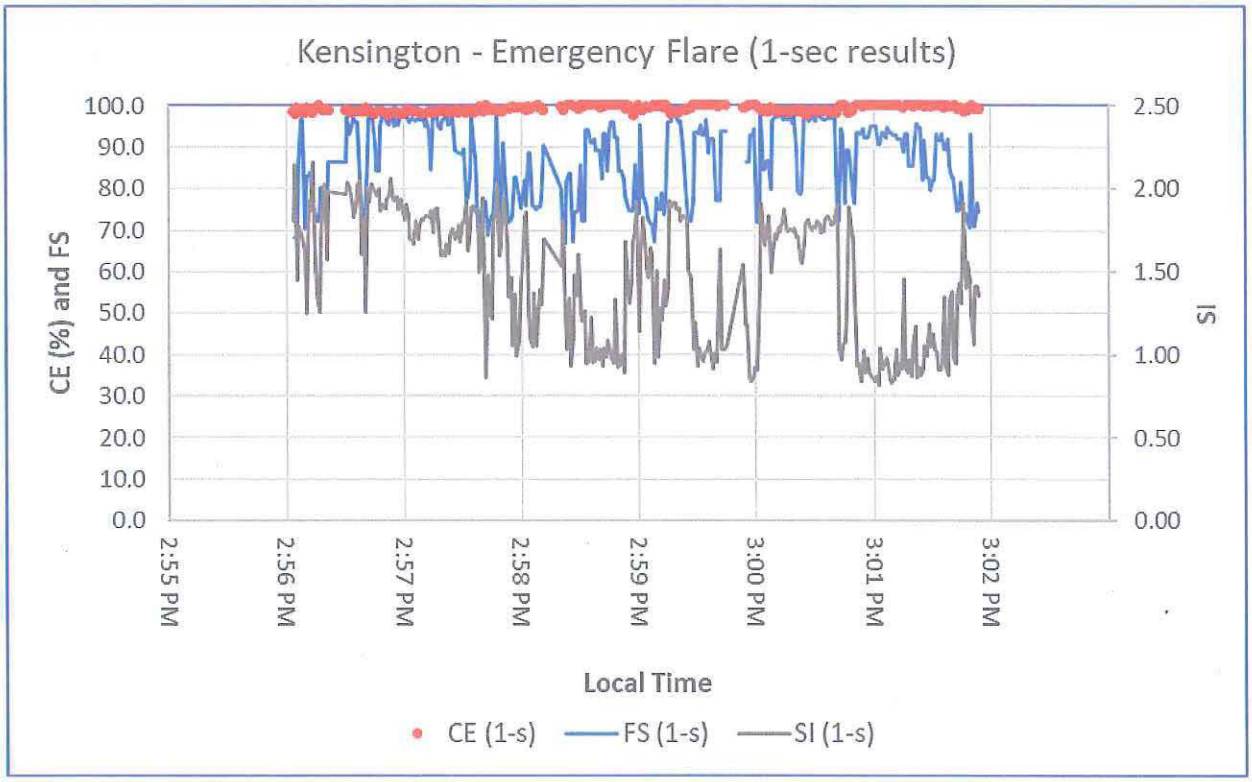

Figure 9. Emergency Flare. Time series plot of 1-second results for CE, FS, and SI.

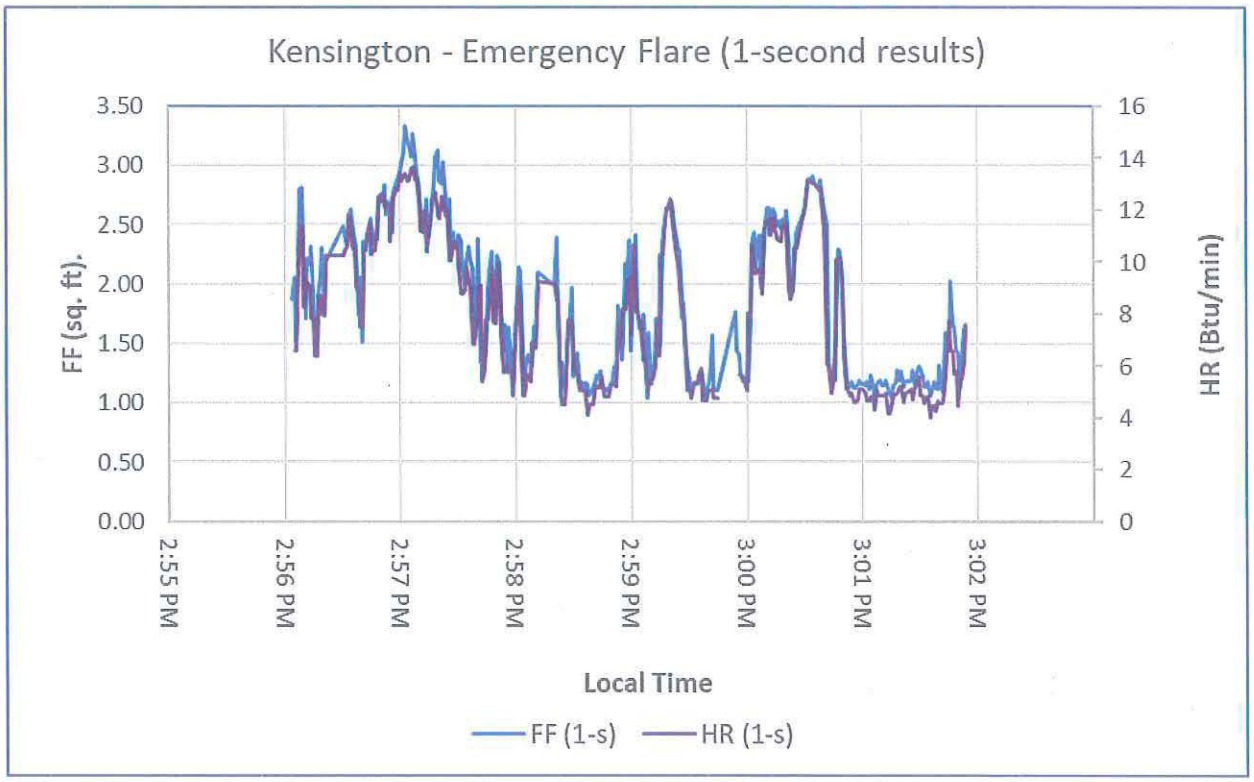

Figure 10. Emergency Flare. Time series plot of 1-second results for FF and HR.

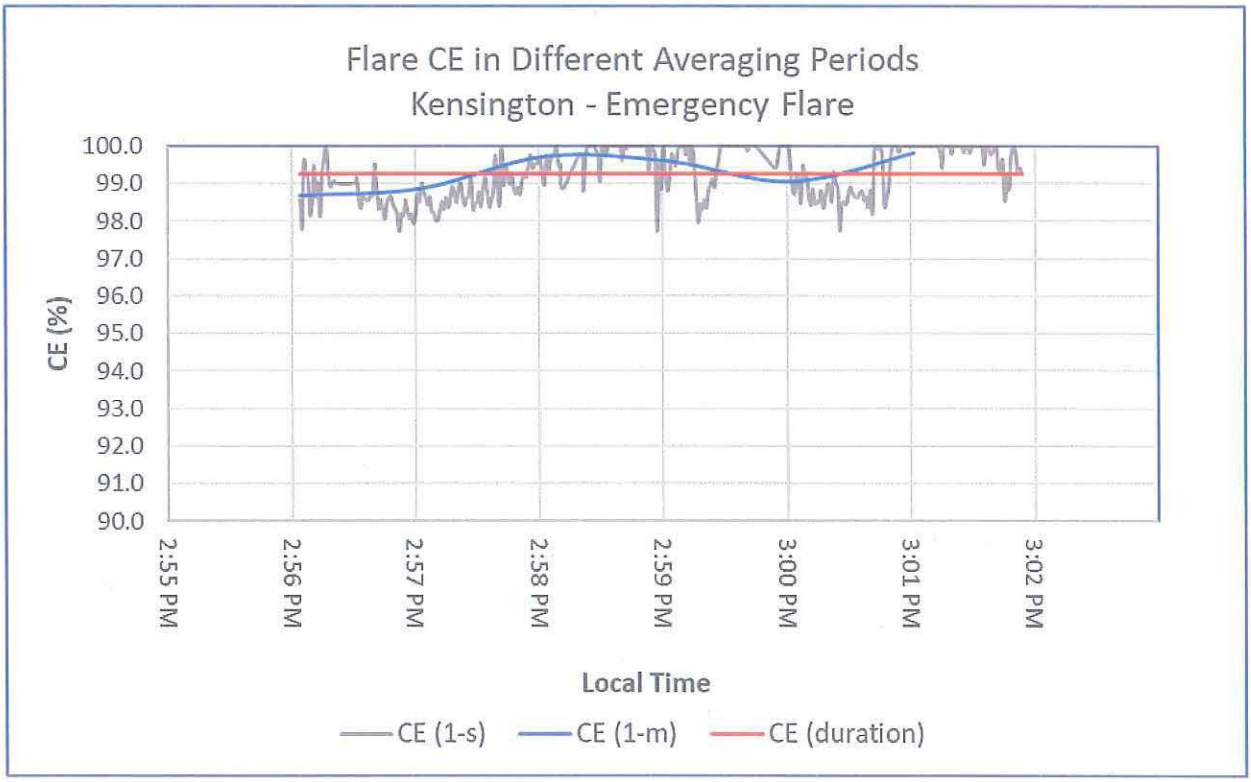

Figure 11. Emergency Flare. Time series plot of CE with different averaging periods.

Figure 12. Emergency Flare.
Left: A representative composite spectral image generated by VISR instrument. Red color represents CO2; green color represents hydrocarbon; and blue or bluish white color represents aerosol (e.g., soot) or hot solid object (e.g., the shield for the pilots).
Right: A representative image in visible spectrum.

Test Results and Observations – High Pressure (HP) Flare

Test results for the High Pressure (HP) Flare are summarized in Table 3. Variability (or trending) of the flare during the test can be seen in Figures 13-15. Figure 16 provides a snapshot of the spectral image and a visible image of the flare.

Table 3. VISR test results for the HP Flare

	Average for the Duration (3:20 pm – 3:49 pm)	1-sec Avg. ± SD	1-min Avg. ± SD
Combustion Efficiency (%)	98.9	(98.1, 99.7)	(98.4, 99.3)
Smoke Index (unitless)	1.62	(0.90, 2.34)	(1.22, 2.03)
Flame Stability (unitless)	94.6	(89.4, 99.7)	(93.2, 95.8)
Flame Footprint (ft^2)	76.91	(69.55, 84.27)	(71.22, 82.15)
Heat Release (Btu/min)	719	(634, 805)	(653, 780)

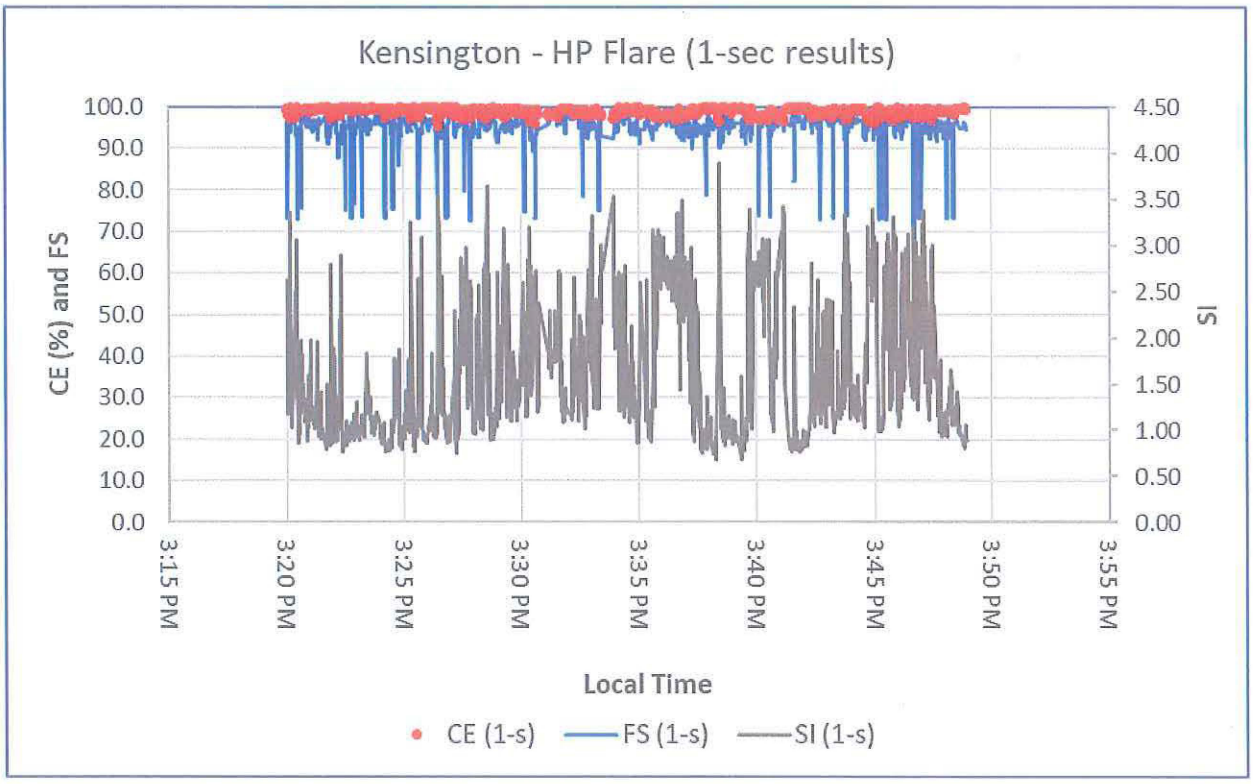

Figure 13. HP Flare. Time series plot of 1-second results for CE, FS, and SI.

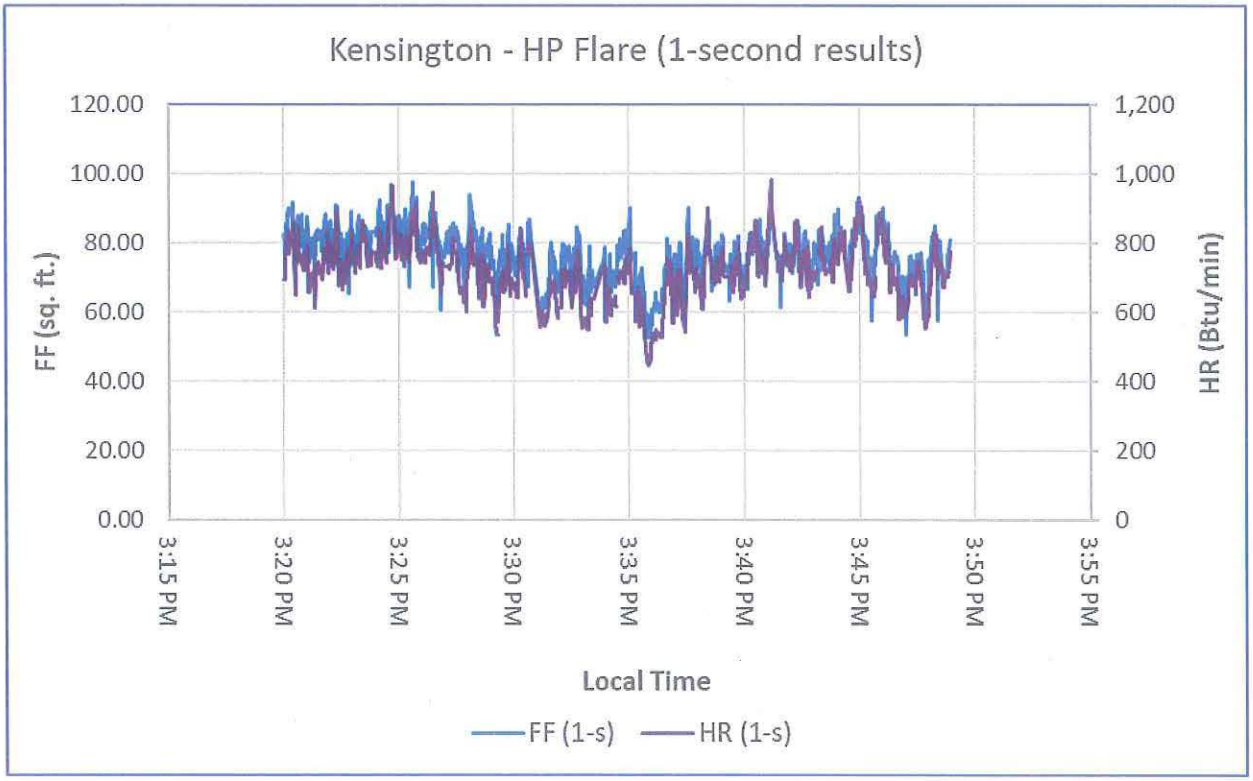

Figure 14. HP Flare. Time series plot of 1-second results for FF and HR.

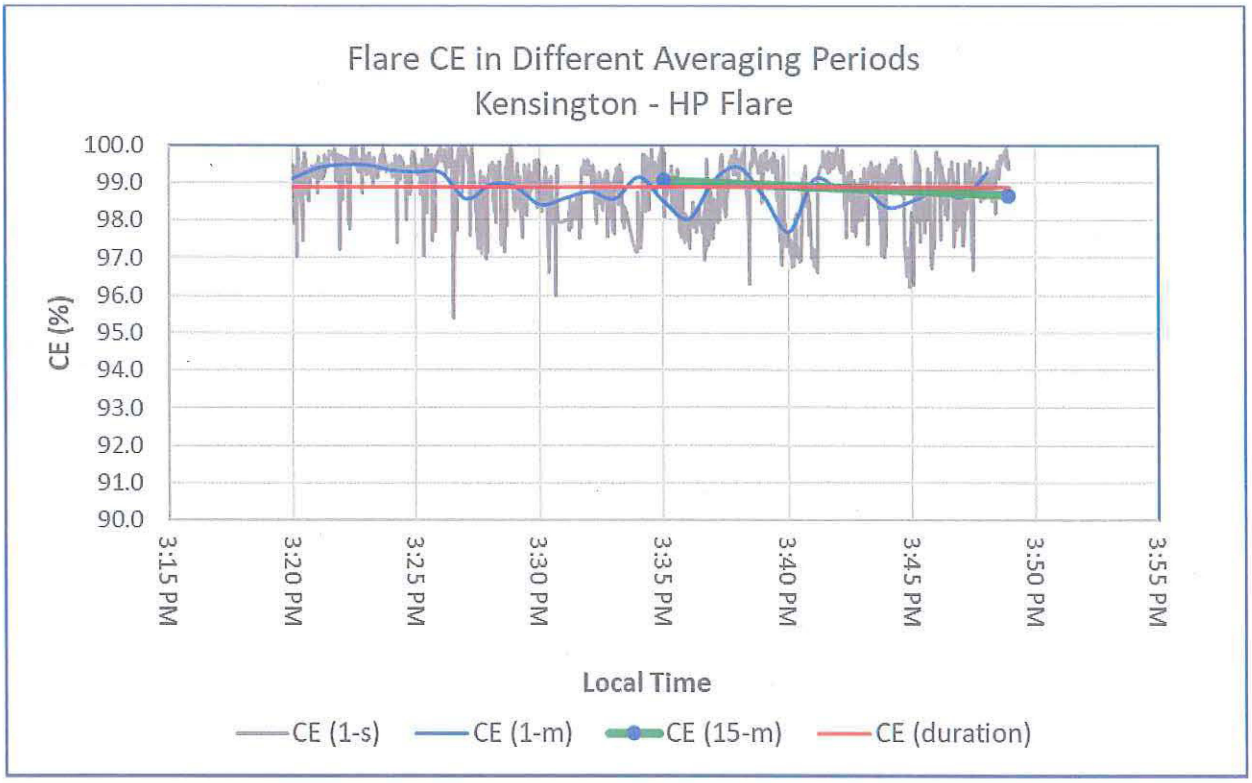

Figure 15. HP Flare. Time series plot of CE with different averaging periods.

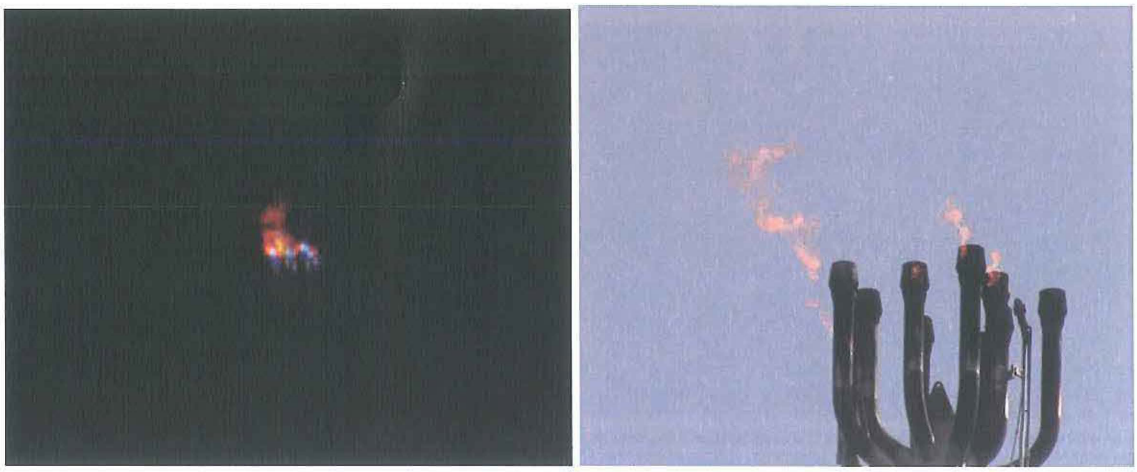

Figure 12. HP Flare.
Left: A representative composite spectral image generated by VISR instrument. Red color represents CO_2; green color represents hydrocarbon; and blue or bluish white color represents aerosol (e.g., soot) or hot solid object (e.g., the shield for the pilots).
Right: A representative image in visible spectrum.

Electronic Data Generated from the Test

The following electronic data are submitted to the US EPA Region 5 as part of this report:

- A Microsoft Excel file containing second-by-second results from the VISR instrument, derived 1-minute average results, and 15-minute average results when applicable.
- Video recording of the flare during the test, taken by a regular video camera in visible spectrum.
- Spectral video generated by the VISR instrument.

References

1. Validation of a New Method for Measuring and Continuously Monitoring the Efficiency of Industrial Flares, Y. Zeng, J. Morris, M. Dombrowski, J. Air & Waste Manage. Assoc. 66:76-86 (2016).
2. Performance Review of Remote and Direct Flare Combustion Efficiency Monitor, Y. Zeng and J. Morris, presented at American Fuel & Petrochemical Manufacturers (AFPM) 2017 Environmental Conference, Denver, Colorado, October 15-17, 2017
3. Video Imaging Spectral Radiometer (VISR) Based Flare Monitor, Y. Zeng, presented at Air Quality Measurement Methods and Technologies, Long Beach, California, November 7-9, 2017

More information about the VISR method and its validation can be found at https://www.providencephotonics.com/flare-monitoring.