United States Environmental Protection Agency

Region 6 - Enforcement & Compliance Assurance Division

INSPECTION REPORT

Inspection Date(s):	08/03/2022	
Media Program:	Air	
Regulatory Program(s)	Title V CAA	
Company Name:	**DuPont Specialty Products USA**	
Facility Name:	**Pontchartrain Works**	
Facility Physical Location:	586 Hwy 44	
(city, state, zip code)	Laplace, LA 70068	
County/Parish:	St. John the Baptist Parish	
Facility Coordinates	30.0589, -90.5241	
Facility Phone Number	+1-985-536-5217	
Facility Contact:	Corey Blanchard	Environmental Coordinator
	corey.w.blanchard@dupont.com	
FRS Number:	110000597131	
Identification/Permit Number:	LDEQ AI 1101	
Media Identifier Number:	LA0000002209500041	
NAICS:	325110; 325192; 325212	
SIC:	2869	
Personnel participating in inspection:		
James Haynes	EPA Region 6, Air Toxics Enforcement	Physical Scientist
Colleen McCarthy	EPA Region 6, Air Toxics Enforcement	Life Scientist
Dan Hoyt	EPA OECA, Air Enforcement Division	Environmental Engineer
Jon Morris	Providence Photonics	EPA Contractor
Michael Morris	Providence Photonics	EPA Contractor
Jason Walker	DuPont Specialty Products USA	Senior EHS Consultant
Damon Williams	DuPont Specialty Products USA	EHS Manager
Brad Hill	DuPont Specialty Products USA	Production and Technical Advisor
Toni Martin	DuPont Specialty Products USA	EHS Resource
Corey Blanchard	DuPont Specialty Products USA	Environmental Coordinator
EPA Lead Inspector Signature/Date	JAMES HAYNES Digitally signed by JAMES HAYNES Date: 2023.01.27 13:13:15 -06'00'	
	James Haynes	Date
Supervisor Signature/Date	JAMES LEATHERS Digitally signed by JAMES LEATHERS Date: 2023.01.27 14:20:06 -06'00'	
	James Leathers	Date

6ENFORM-019-R8.2 (02/12/2020)

Section I – INTRODUCTION

PURPOSE OF THE INSPECTION

I, James Haynes, U.S. Environmental Protection Agency ("EPA") Region 6 inspector, arrived at the DuPont Specialty Products USA ("DuPont") – Pontchartrain Works in LaPlace, Louisiana on August 3, 2022, to conduct an unannounced Clean Air Act ("CAA") inspection. I arrived with Ms. Colleen McCarthy, EPA Region 6 inspector, Mr. Dan Hoyt, EPA OECA-AED inspector, and two EPA contractors with Providence Photonics – Mr. Jon Morris and Mr. Michael Morris. We met with DuPont representatives Mr. Jason Walker, Environmental Health and Safety Consultant, and Mr. Corey Blanchard, Environmental Coordinator. I presented my inspector credentials to Mr. Walker and notified him of our intent to conduct a CAA Partial Compliance Evaluation ("PCE"). EPA contracted Providence Photonics to conduct flare observations using the Video Imaging Spectral Radiometry ("VISR") method. The VISR method uses a multi-spectral mid-wave infrared imager to measure relative concentrations of combustion gases to calculate flare combustion efficiency.

FACILITY DESCRIPTION

DuPont - Pontchartrain operates a chemical manufacturing facility that produces paraphenylenediamine (PPDA). PPDA is a chemical that is further processed to make Kevlar at separate DuPont site. The PPDA process consists of multiple steps, including a synthesis area and a refining area. Pilot flares are used to control any emissions for each of the areas. The PPDA process generates two byproducts, benzene and 4-aminodiphenyl. Prior to 2018, DuPont sold benzene as a product. Benzene is currently sent to the hazardous waste boiler onsite. The facility generates wastewater that falls under Group 2 wastewater of the Hazardous Organic NESHAP (HON). The Group 2 wastewater is managed by deep-well injection.

DuPont operates 24-hours a day, 7-days a week with approximately 280 employees and contractors. The PPDA process is shut down for routine maintenance for 1-month, approximately two times a year.

In 2015, DuPont sold the neoprene manufacturing portion of the facility to Denka Corporation. In addition to the PPDA process, DuPont also operates a hazardous waste boiler and natural gas powerhouse to generate steam for operations across the facility.

Section II – OBSERVATIONS

After entry, Mr. Walker provided me with an overview of the site operations and current conditions. Mr. Walker stated the facility has two flares, the Synthesis Flare and the Refining Flare. Providence Photonics set up the imaging device outside the process area and began collecting data at the Refining Flare at 10:16 AM. Providence Photonics stopped collecting data at the Refining Flare at 10:31 AM. Providence Photonics began collecting data from the same location at the Synthesis Flare at 10:37 AM. Providence Photonics stopped collecting data at the Synthesis Flare at 10:53 AM. I conducted a brief closing conference with DuPont, and we exited the facility.

Section III – AREAS OF CONCERN

I observed no areas of concern at the time of inspection.

Section IV – FOLLOW UP

After EPA exited the facility, no additional information was requested or submitted.

Section V – LIST OF APPENDICES

Appendix 1 – VISR Flare Measurement Report

Appendix 1

VISR Flare Measurement Report

PROVIDENCE PHOTONICS

VISR Flare Measurement Report

Facility: Dupont – Pontchartrain Works

586 Highway 44

Laplace, LA 70068

St. John the Baptist Parish, Louisiana

Prepared for

US Environmental Protection Agency

Region 6

1201 Elm Street, Suite 500

Dallas, TX 75270

PROJECT NO. 0010-004-004

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

Table of Contents

Introduction

Through its contract 68HERC21D0007/Task Order 68HERC21F0185 with Eastern Research Group, Inc. (ERG), EPA Office of Enforcement and Compliance (OECA) and Region 6 retained Providence Photonics, LLC (Providence) to assist the inspection of the Dupont plant located at 586 Highway 44, Laplace, Louisiana, 70068. Providence measured the combustion efficiency (CE) and other performance metrics of two flares using the Video Imaging Spectral Radiometry (VISR) method.

Background

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.

1. **Combustion Efficiency (0 to 100%):** Combustion efficiency (**CE**) is a measure of the relative concentration of hydrocarbon vs. carbon dioxide in the post combustion gas plume. If there is no hydrocarbon present in the post combustion gas plume, then CE is 100%.
2. **Smoke Index (0 to 10):** Smoke index (**SI**) is a unit-less number which indicates the degree of visible emissions within the combustion envelope. A SI of 0 means no visible emissions are present while a SI of 10 means the flare has heavy black smoke. While SI only represents the degree of visible emissions within the combustion envelope, it is generally correlated to opacity and a SI above 3 generally indicates that some visible emissions are likely present outside of the combustion envelope.
3. **Flame Footprint (m^2):** Flame footprint (**FF**) is a measure of the flame size in square meters. It is not necessarily correlated to the visible flame size as the FF is determined by the Infrared radiance, not the visible flame. Note that the orientation of the flame will impact the FF as the depth of the flame will change with viewing angle.
4. **Fractional Heat Release (Btu/Hr):** Fractional Heat Release (**FH**) is a measure of the heat released from flare combustion in the spectral bands monitored by the Mantis flare monitor. Although it is not a measure of the total heat release across the entire energy spectrum, FH is expected to be correlated to the total heat release.
5. **Flame Stability (0 to 100%):** Flame stability (**FS**) is a measure of the change in radiance measured by the Mantis flare monitor in a 1-second interval. A FS of 100% indicates a flame that has a constant radiance. A low FS value (generally lower than 80%) indicates a flame with significant radiance fluctuation within 1 second interval, suggesting a less stable flame. Variability on a longer time scale will not be described by the flame stability metric.

Appendix B provides additional information on the accuracy and precision of the VISR method. More information about the VISR method and its validation is provided at https://www.providencephotonics.com/flare-monitoring.

Summary of Inspection

Inspection Date: August 2nd, 2022

Personnel:

James Haynes (EPA Region 6)
Colleen McCarthy (EPA Region 6)
Daniel Hoyt (EPA OECA)
Jon Morris (Providence)
Michael Morris (Providence)

Facility:

Dupont – Pontchartrain Works, LLC
586 Highway 44, Laplace, LA 70068

Results: ***Table 1*** below provides a summary of the VISR results. Complete results can be found in ***Appendix A***.

Date	Start Time (Local)	End Time (Local)	Site Description	Distance (m)	Temp (°C)	RH (%)	Avg Wind Speed (mph)	CE Avg (%)	SI Avg	FF Avg (m2)	FH Avg (MMBTU/HR)	FS Avg (%)
8/3/2022	10:16 AM	10:31 AM	Refining	50	28	69	2 - 4	97.63	0.36	1.9	0.03	97
8/3/2022	10:37 AM	10:53 AM	Synthesis	113	28	69	2 - 4	98.60	0.61	4.7	0.06	98

Table 1: Summary VISR Results.

Observations

The following sections describe field observations and comparisons derived from the dataset.

Field Conditions

The inspections were conducted on August 3rd, 2022. Each measurement with the VISR instrument was within the method limits for distance, as determined by the minimum plume pixels required by the QAPP. The ambient temperature was 28°C and winds were generally light, from 2 – 4 mph. Skies were clear with no precipitation.

Refining Flare

The Refining flare performance data is plotted in ***Figures 1 and 2*** below. ***Figure 1*** shows Combustion Efficiency vs. Fractional Heat Release and ***Figure 2*** shows Combustion Efficiency vs. Smoke Index. There were no visible emissions from this flare, as indicated by the Smoke Index values < 3. Average Combustion Efficiency for this measurement was 97.63% and the average Smoke Index was 0.4.

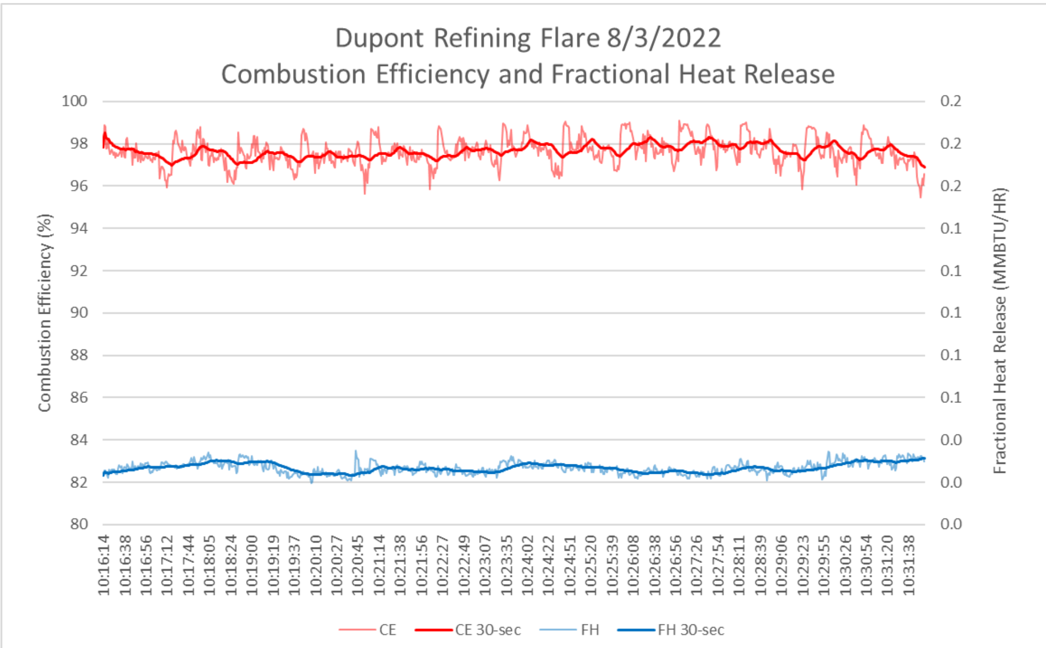


Figure 1: Combustion Efficiency and Fractional Heat Release for the Refining flare on 8/3/2022.

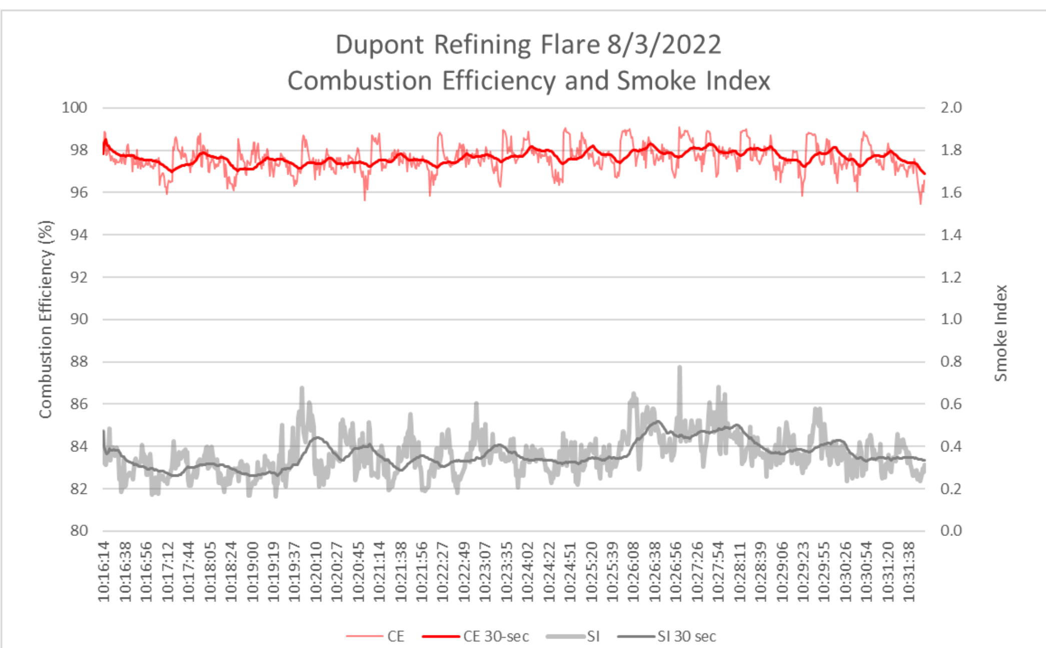


Figure 2: Combustion Efficiency and Smoke Index for the Refining flare on 8/3/2022.

Synthesis Flare

Figure 3 shows Combustion Efficiency vs. Fractional Heat Release and ***Figure 4*** shows Combustion Efficiency vs. Smoke Index for the Synthesis flare. There were no visible emissions from this flare, as indicated by the Smoke Index values < 3. Average Combustion Efficiency for this measurement was 98.60% and the average Smoke Index was 0.61.

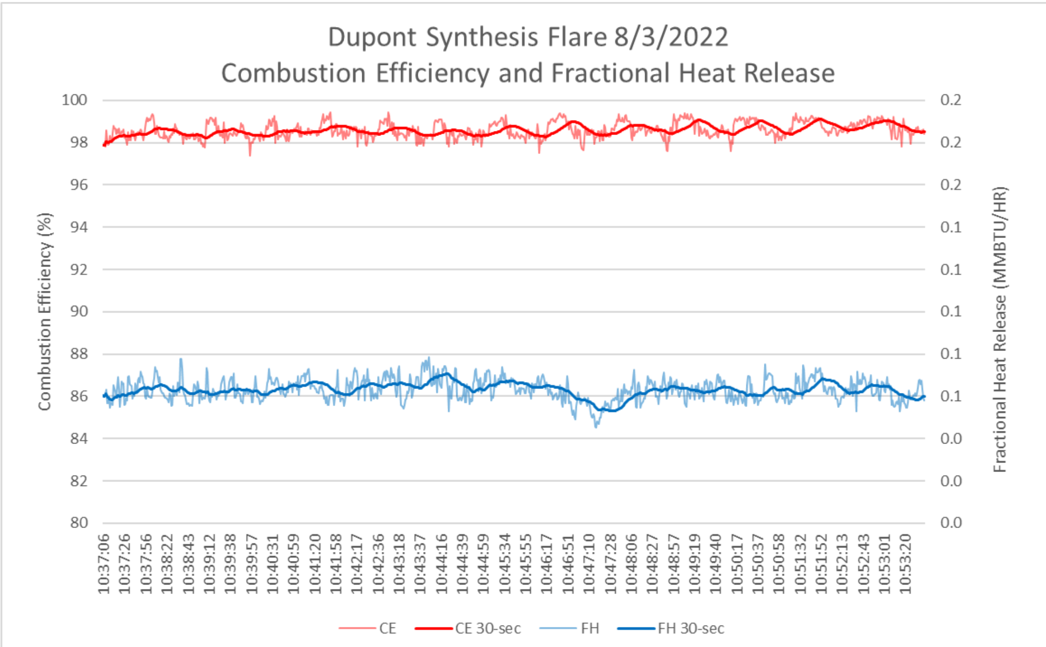


Figure 3: Combustion Efficiency and Fractional Heat Release for the Synthesis flare on 8/2/2022.

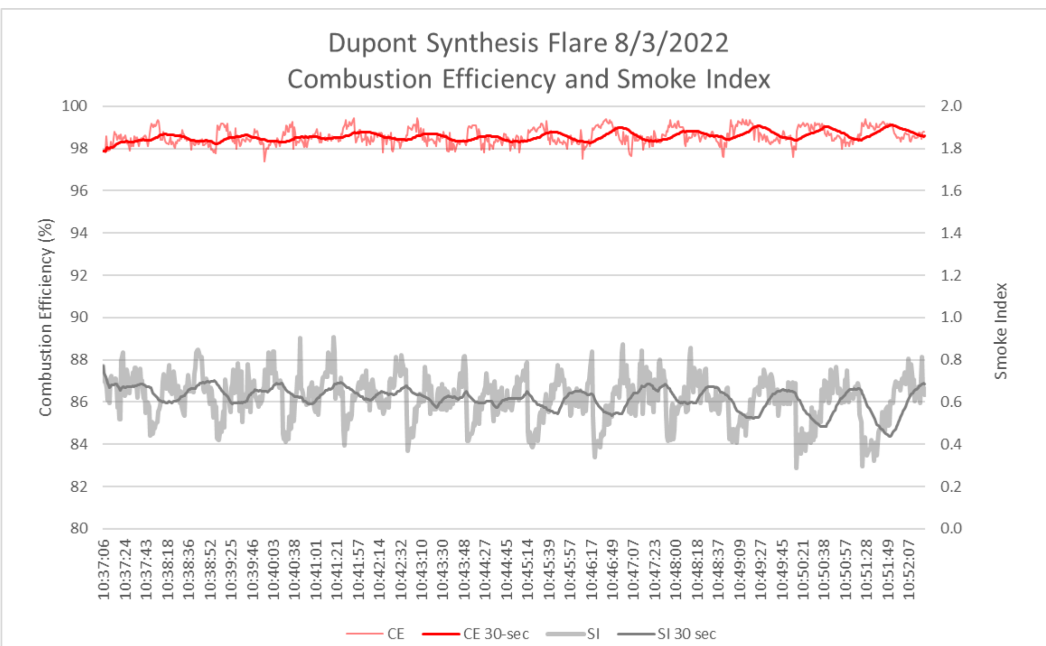


Figure 4: Combustion Efficiency and Smoke Index for the Synthesis flare on 8/2/2022.

Electronic Data Generated from the Test

The following electronic data are submitted to the US EPA Region 6 as part of this report:

- A Microsoft Excel file containing second-by-second results from the VISR instrument and averages for each measurement period.
- FLIR video recording of each flare during the inspection.

References

1. Yousheng Zeng, Jon Morris & Mark Dombrowski (2015) Validation of a new method for measuring and continuously monitoring the efficiency of industrial flares, Journal of the Air & Waste Management Association, 66:1, 76-86, DOI: 10.1080/10962247.2015.1114045

2. Yousheng Zeng, Jon Morris. (2019, April 2nd). *Precision and Accuracy of the VISR Method for Flare Monitoring*. Air Quality Measurement Methods and Technology, Durham, North Carolina, United States.

Appendix A: Results

Site Description			Site Description		Conditions				Efficiency (%)				Smoke Index (0-10)				Flare Footprint (m^2)				Fractional Heat (MMBTU/HR)				Flame Stability (%)			
Date	Start Time (CST)	End Time (CST)	Site	Description	Distance (m)	Temp (°C)	RH (%)	Wind Speed (mph)	CE Avg	CE Min	CE Max	SD	Avg	Min	Max	SD	Avg	Min	Max	SD	Avg	Min	Max	SD	Avg	Min	Max	SD
8/3/2022	10:16 AM	10:31 AM	Dupont	Refining	50	28	69	2 - 4	97.63	95.47	99.10	0.63	0.4	0.2	0.8	0.1	1.9	1.2	2.7	0.3	0.027	0.020	0.035	0.003	96.9	88.8	100.0	1.8
8/3/2022	10:37 AM	10:53 AM	Dupont	Synthesis	113	28	69	2 - 4	98.60	97.38	99.42	0.37	0.6	0.3	0.9	0.1	4.7	2.9	6.0	0.6	0.063	0.045	0.079	0.005	97.5	90.7	100.0	1.5

Table 2: Complete VISR Results.

Appendix B: Validation of the VISR method

Precision and Accuracy of the VISR Method for Flare Monitoring

Extended Abstract: ME92
Presented at the conference:
Air Quality Measurement Methods and Technology
April 2-4, 2019
Durham, NC

Jon Morris, Yousheng Zeng, and Srikanth Mutyala
Providence Photonics, Baton Rouge, Louisiana

Introduction

Industrial flares represent a large category of air emission sources for Volatile Organic Compounds (VOC), air toxics, and greenhouse gases (GHG)[1-4]. Depending on their combustion efficiency (CE), the emissions of these air pollutants can be significantly different. Despite the large contribution of flares to air emission inventories, flares are the only source category for which no EPA test or monitoring methods can be applied to directly measure their efficiency or emission rates. As a result, flare emissions in air emission inventories may carry significant uncertainties.

A method based on Video Imaging Spectral Radiometry (VISR) has been developed for testing or continuously monitoring combustion efficiency (CE) of industrial flares[5]. To validate the VISR method, tests were conducted at flare test facilities of Zeeco, Inc. (Zeeco) and John Zink Hamworthy Combustion (John Zink), both located in Tulsa, Oklahoma, in September and October 2016, respectively. The test at Zeeco included both an air assisted flare and a steam assisted flare. Twenty-eight flare conditions were tested, 14 for the air flare and 14 for the steam flare. This test is referred to as the "Zeeco Test" in this paper.

The test at John Zink was part of a program sponsored and organized by the Petroleum Environmental Research Forum (PERF), an industry consortium. PERF project 2014-10 Direct Monitoring of Flare Combustion Efficiency was created and funded by participating PERF companies to provide a test platform for various developers/vendors of flare remote sensing technologies (Invitees) to participate in a blind test to evaluate the effectiveness of each technology. The blind test was administered by John Zink. Testing began on October 17th, 2016 and continued for 10 days, concluding on October 27th, 2016. The flare tip used was the John Zink model EEF-QSC-36, which was the same flare tip used during the 2010 TCEQ Flare Study[4]. A test protocol was developed which identified a series of test conditions to evaluate various factors that could affect flare CE measurement. Only limited logistical and environmental factors were shared with the Invitees (i.e., distance from the flare, view angle with respect to flame orientation due to wind, sun in/out of the field of view, daytime/nighttime testing). Information regarding flare operations such as the type of fuel gas used, firing rates, steam rates or any other flare operating parameters was concealed from Invitees. A total of 45 test points was evaluated over the 10 days of testing. Extractive sampling was performed on each test point as the control method for flare CE measurement. The results of the extractive sampling were not provided to Invitees until Invitees submitted their won results based on their respective measurement technology. This test is referred to as the "PERF Test" in this paper.

In this paper, the precision and accuracy of the VISR method are evaluated based on the test campaigns described above.

Methods and experimental setup

The VISR flare monitor is a remote monitoring device that can be positioned at any distance as long as the flare to be monitored is in the line of sight and there are a sufficient number of pixels of the flare flame image in the VISR monitor. The distances from flare to the VISR monitor in the experiments reported here were in the range of 174 feet to 650 feet. To evaluate the performance of the VISR method, an extractive sampling system was used as a reference method. A sample extraction apparatus was suspended by a crane over the flare plume to extract combustion product gases. The sample was transported through a heated sampling line to a sample manifold in a testing trailer. The sample manifold was connected to analyzers for oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), and hydrocarbon (HC). The methods for measuring O_2, CO_2, CO, and HC were EPA Method 3A, 3A, 10, and 25A, respectively. The level of O_2 was used to confirm that the sampling probe was in the flare plume. The concentrations of CO_2, CO, and HC were used to calculate flare CE per method used in the 2010 TCEQ flare study[3].

These test campaigns covered a wide range of process conditions: two steam flares and one air flare; multiple vent gas compositions (natural gas, propane, propylene, hydrogen, in pure form or mixed with nitrogen; vent gas flow range from 10 lb/hr to 10,000 lb/hr; various steam and air assist levels resulting in combustion zone net heating value (NHVcz) in a range of 120 to 1,250 Btu/scf for the steam flares and net heating value dilution parameter (NHVdil) in a range of 6.7 to 244 Btu/ft^2 for the air flare.

The test campaigns also covered a wide range of environmental conditions: distance ranging from 174 ft. to 650 ft.; different wind speed and direction (crosswind, wind oriented towards VISR device, and wind oriented away from VISR device); daytime vs. nighttime; various sky conditions (blue sky, cloudy, moving clouds); the Sun in or out of field of view; rain, and fog.

Results and Discussions

Precision

Precision is a measure of how the results of multiple measurements by the same method scatter while the target of the measurement holds steady. This is difficult to assess for flare measurements because even when the flare operating conditions are held steady (as they were in each test point of the PERF Test), the flare CE may change due to changes in environmental conditions. Analyte spiking or quadruplet sampling described in EPA Method 301 would help to isolate the measurement method precision from the fluctuation of the target itself[6]. However, these methods are not feasible for flare measurement. Nevertheless, the measurement precision can still be evaluated using the data from the PERF test. For each PERF test condition, 4 segments of measurement were made by the extractive method and 3 segments of measurement were made by VISR while the flare operating conditions were held constant (although flare CE did fluctuate due to changes in environmental conditions). The standard deviation (SD) and relative standard deviation (RSD) can be calculated based on these replicate measurements. **Table 1** is a summary of the SD and RSD for both the VISR method and the extractive method used in the PERF Test. As shown in **Table 1**, the RSD for the VISR method is in a range of 0.07% to 1.98% with an average of 0.62%. The variation of the VISR method appears to be slightly better than the extractive method from the perspective of both the average and the range of the RSD values, suggesting that the precision of VISR is at least as good as the extractive method. Note that in both cases, the variation due to changing environmental conditions is included in the RSD as there is no practical method to separate it. Despite the inclusion of environmental changes, the RSD is more than an order of magnitude smaller than 20% as required in EPA Method 301 (Section 9.0)[6]. If a more stringent criteria is used in which the 20% limit on RSD is applied to the most relevant range of 90-100 % CE measurement (i.e., in the span of 10 % CE measurement), the criteria would be SD < 2 % CE (20% of 10% = 2 % CE). As shown in **Table 1**, the highest SD is 1.84 measured as % CE, which is lower than the SD of 2 % CE measurement and therefore satisfies the more stringent criteria.

Table 1. Relative Standard Deviation (RSD) of VISR and extractive method per PERF Test

Method	CE Avg.	CE Range	SD Avg.	SD Range	RSD Avg.	RSD Range
VISR	96.47	80.61-99.91	0.59	0.07-1.84	0.62%	0.07-1.98%
Extractive	96.41	83.50-100.00	0.83	0.00-2.61	0.88%	0.00-2.72%

The Zeeco Test did not include multiple replicated measurements under each test condition. Therefore, a precision analysis is not performed on that data.

Accuracy

The accuracy of the VISR method is evaluated based on the Zeeco Test and PERF Test. In these two tests, the flare CE was measured by both the VISR method and the extractive method. The extractive method was used as the control (reference) method. Strictly speaking, what can be assessed is the agreement between the two methods, not the accuracy of either method because the true flare CE is unknown. The agreement between the two methods can be evaluated using a statistical method. One such method is to use t-test on the differences between the paired CE measurements by VISR and extractive methods. This method is the same as the method used in EPA Method 301 to determine if there is a difference caused by different sample storage time[6] (it should be noted that the methods for bias described in Method 301 are not directly applicable because they are specifically designed for analyte/isotopic spiking or quadruplet sampling systems, which are not feasible for flare measurement). The value of the t-statistic is calculated using the following equation.

$$t = \frac{|d_m|}{\frac{SD_d}{\sqrt{n}}}$$

Where d_m and SD_d are the mean and the standard deviation of the difference of the paired samples (VISR and extractive sample), and n is the total number of samples. The resulted t-statistic value is compared to the critical value of the t-statistic with a 95 percent confidence level and n-1 degree of freedom. If the resulted t-statistic value is less than the critical value, the difference between the VISR method and the extractive method is not statistically significant, i.e., the two methods are statistically the same. The results of the t-statistical analysis for both Zeeco and PERF tests are summarized in **Table 2**. The number of samples (tests) in **Table 2** is less than the number of tests actually conducted because some tests were designed for other purposes (e.g., smoke test) and they are not included in the evaluation of the agreement between VISR and extractive methods.

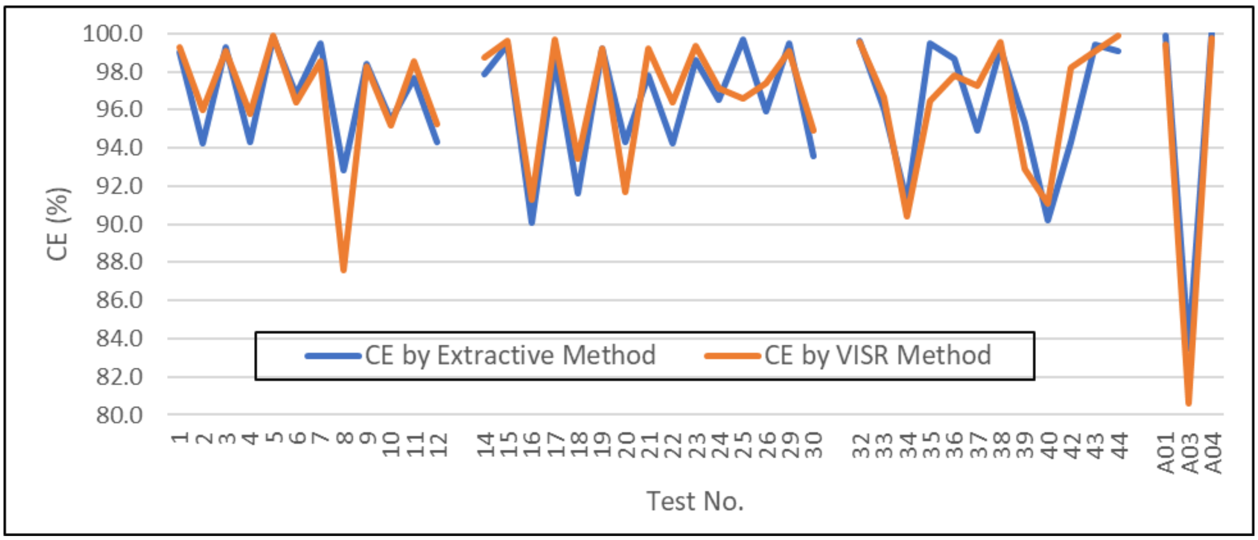
Table 2. t-Test to determine if the VISR method is different from the extractive method

	Zeeco Test (Steam Flare)	Zeeco Test (Air Flare)	PERF Test
No. of Samples, n	11	9	42
Mean Difference, d_m (% CE)	0.30	-0.21	0.07

Standard Deviation, SD_d (% CE)	1.32	0.65	1.69
t-Statistic Value	0.756	0.967	0.254
Degree of Freedom	10	8	41
t_95 Critical Value	2.228	2.306	2.020
Statistically Different?	No	No	No

As demonstrated in **Table 2**, statistically there is no difference between the flare CE measured by the VISR method and by the extractive method. The agreement between the two measurement methods can also be illustrated in **Figure 1** using the results from the PERF Test.

Figure 1. Flare CE measured by VISR method and extractive method – PERF Test results



Conclusion

Industrial flares can now be measured or continuously monitored by the VISR method for their performance, i.e., combustion efficiency (CE). The VISR method is a remote sensing method and can be deployed easily and practically. The VISR method transforms flare testing/monitoring from most difficult task (impossible in many cases) to a task that is easier than most conventional air emission testing methods. With the significant potential benefits that the VISR method can bring, it is important to characterize and understand the precision and accuracy of this method.

Through a large number of tests under various process and environmental conditions, a high precision and accuracy have been demonstrated for the VISR method. The relative standard deviation (RSD) is in the range of 0.07-1.98% with an average RSD of 0.62% for flare CE in the range from 80 to 100%. The average RSD of 0.62% is more than an order of magnitude smaller than the minimum precision target of 20% RSD set in EPA Method 301. The highest SD is only 1.84 measured as % CE.

The flare CE measured by the VISR method is in excellent agreement with the flare CE measured by the extractive method. The mean difference between the two methods is in the range of -0.21 to 0.30 measured in % CE. The t-statistic value in each of the three test groups are well below its corresponding t-test critical value, passing the t-test with a substantial margin. Keep in mind that the extractive method is suitable only in research. It is virtually impossible to deploy the extractive method to elevated flares at industrial production facilities. Having a method that can be easily deployed to industrial sites and produce highly time-resolved and accurate flare measurement results is a significant advancement.

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4. Allen, D.T. and V.M. Torres, TCEQ 2010 Flare Study Final Report, prepared for TCEQ. PGA No. 582-8-862-45-FY09-04 with supplemental support from TCEQ Grant No. 582-10-94300, 2011. http://www.tceq.texas.gov/assets/public/implementation/air/rules/Flare/2010flarestudy/2010-flare-study-final-report.pdf (accessed March 23, 2015).
5. Zeng, Y, J. Morris, and M. Dombrowski, Validation of a New Method for Measuring and Continuously Monitoring the Efficiency of Industrial Flares, J. Air & Waste Manage. Assoc. 66:76-86 (2016).
6. U.S. EPA, *Code of Federal Regulations*, Title 40, Part 63, Appendix A, Method 301, 2018.