The Final Flare Requirements – Update on the Refinery Sector Rule

TROY M. BOLEY, PH.D. – SPECTRUM ENVIRONMENTAL SOLUTIONS, LLC

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MACT CC – Flare Overview

Requirements from old Subpart A

- Pilot flame monitoring
- Visible emissions
- Flare tip exit velocity

New Monitoring

- Vent Gas
- Assist Gas
- Supplemental Gas
- Composition/Net Heating Value

New Operating Limits

- Net heating value in the combustion zone
- Net heating value dilution parameter

Flare Management Plan and Continuous Parameter Monitoring System Plan

Image courtesy of Zecco

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MACT CC - Timeline

May 15, 2014: Re-Proposed refinery rule issued

June 30, 2014: Published in the Federal Register

October 28, 2014: Comment period closed after 60 day extension

December 1, 2015: Final rule published in the Federal Register

January 19, 2016 / February 1, 2016 / July 12, 2016 / December 1, 2016 / March 28, 2017: AFPM and API and EarthJustice submit various requests to EPA for reconsideration

October 18, 2016: EPA proposed some further amendments

March 19, 2018: EPA proposal for technical corrections and amendments issued

January 30, 2019: Flare compliance date (unchanged)

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Revised Definitions

Term	Current Definition	Proposed Definition
Flare Purge Gas	*Flare purge gas* means gas introduced between a flare header's water seal and the flare tip to prevent oxygen infiltration (backflow) into the flare tip. […]	*Flare purge gas* means gas introduced between a flare header's water seal and the flare tip to prevent oxygen infiltration (backflow) into the flare tip or for other safety reasons. […]
Flare Supplemental Gas	*Flare supplemental gas* mean all gas introduced to the flare in order to improve the combustible characteristic of the combustion zone gas.	*Flare supplemental gas* means all gas introduced to improve the heat content of the combustion zone. *Flare supplemental gas* does not include assist air or assist steam.

Other references in the rule refer to "supplemental natural gas" when "flare supplemental gas" was intended. These references have been revised to say "flare supplemental gas" in order to allow for more supplemental gas varieties.

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New Definition – Pressure Relief Device

Pressure relief device means a valve, rupture disk, or similar device used only to release an unplanned, nonroutine discharge of gas from process equipment in order to avoid safety hazards or equipment damage. A pressure relief device discharge can result from an operator error, a malfunction such as a power failure or equipment failure, or other unexpected cause. Such devices include conventional, spring-actuated relief valves, balanced bellows relief valves, pilot-operated relief valves, rupture disks, and breaking, buckling, or shearing pin devices.

Images courtesy of alliedvalveinc.com (left) and directindustry.com (right)

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Pressure Relief Devices

PRDs in flare service must assess installation of prevention measures as part of the flare minimization assessment (document)

A. Flow, temperature, level, or pressure indicators with deadman switches, monitors, or automatic actuators
B. Documented routine inspection and maintenance programs
C. Inherently safer designs or safety instrumentation systems
D. Deluge systems
E. Staged relief system where initial pressure relief valve (with lower set release pressure) discharges to a flare or other closed vent system and control device.

EPA has clarified that for “A”, the temperature, level, and pressure indicators can be considered three **different** prevention measures if they are independent and non-duplicative

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Steam Assisted Flares

Certain ring steam designs intentionally entrain ambient air as the steam is injected

Assessment was performed to determine at which tip diameters enough air is added by steam system to fall below 22 Btu/ft^2 limit for NHV_{dil}

- Preamble: *Effective* diameter ≥ 9 inches, comply with NHV_{cz} only
- Proposed rule: Diameter ≥ 9 inches, comply with NHV_{cz} only

Image courtesy of Zecco

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Steam Assisted Flares

For tip diameters < 9 inches with designs that intentionally entrains air, how to comply?

- Demonstrate compliance with NHV_{cz} **and** NHV_{dil}
- Estimate air flow rate using maximum air-to-steam ratio for the air entrainment system

Image courtesy of viperimaging.com

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Visible Emissions Monitoring

Revised Method 22 requirements for flares with intermittent flow.

- Initial Method 22 the first time there is flow of regulated material
- Daily Method 22 only required on days where regulated material is sent to the flare

Images courtesy of eastbaytimes.com (left) and videoblocks.com (right)

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Smokeless Capacity

How to determine when the smokeless capacity has been exceeded?

Clarification:

- FMP must specify smokeless capacity on a *15-minute block average and design conditions*
- 15-minute block average smokeless capacity will be used to determine if an RCA is required per the emergency flaring provisions

Image courtesy of thermoeng.it/

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Flare Tip Exit Velocity

EPA corrected "an error in the units" for Q_{cum} to actual to standard cubic feet. Revised equation:

$$V_{tip} = \frac{Q_{cum}}{Area \times 900}$$

Where:

V_{tip} = Flare tip velocity, feet per second

Q_{cum} = Cumulative volumetric flow over 15-minute block average period, standard cubic feet

Area = Unobstructed area of the flare tip, square feet

900 = Conversion factor, seconds per 15-minute block average

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Vent Gas Flow Monitoring

Accuracy requirements

- ±20% for flow velocities 0.1 to 1 ft/s
- ±5% for flow velocities > 1 ft/s

Image courtesy of General Electric

Issues arise meeting accuracy requirements during certain events

- Weather related power outages/surges
- Compressor shutdowns
- Hydrogen and other low molecular weight gas flaring events

Preamble: "certification of compliance for these vent gas flow meter accuracy requirements can be made based on the *typical range* of flare gas compositions expected for a given flare"

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Assist Air Flow Monitoring

Fan curves are now explicitly specified as the means of monitoring assist air.

- Previously only referenced as a required component of a complete FMP submission

Air-to-steam ratio specified for steam assisted flares which receive assist air as part of the steam system design.

Images courtesy of Zecco

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Planning and Actions needed

Conceptual System Design, Capital Plan

- Sizing and Layout
- Controls – selection of approach
- Sampling, Analytical, Monitoring Equipment Selection
- Data Management

Flare Management Plan

- Procedures Review and Minimization Assessment
- Emergency Flaring considerations (smoke & tip velocity)
- Smokeless Capacity (versus Baseline per NSPS Ja)

CPMS Monitoring Plan

- Documentation of Everything (or not?)
- All flare monitoring equipment
- QA/QC Plans
- Maintenance and Preventive Maintenance Requirements
- Data Reduction Methods

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Questions?

Troy Boley, Ph.D.

Vice President – Specialty Environmental Monitoring, Measurements, and Compliance

Spectrum Environmental Solutions, LLC

troy@spectrumenvsoln.com

770-883-7082

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