Trends in EPA and State Refinery Flare Enforcement©

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I. Introduction

It's late 2009. Do you know where your refinery flares are? Fact is, this is a question that the refining industry has faced for over ten years in the wake of stepped up enforcement attention by the U.S. Environmental Protection Agency ("EPA") on an array of flare-related construction, modification, and operational fronts.[1] The basic purpose of this paper is to present information on the latest trends in flare-related enforcement by EPA and the states.

We start with a general overview of current EPA enforcement initiatives based on informal discussions with agency and industry representatives. The discussion touches on specific areas of focus (e.g. flare testing/monitoring) as well as enforcement goals. We next look at recent state flare enforcement and regulations development. We look at California regulations and then look at the recently formed Texas Flare Stakeholder Group. The Texas Commission on Environmental Quality ("TCEQ"), in cooperation with the regulated community and other stakeholders, initiated a process for evaluating possible improvements in regulation of emissions from flaring events. Because of the impact this process will have in Texas and its expected influence on other states, we also present some information on the TCEQ developments as well.

Another section of the paper provides information on recent flare-related enforcement actions. This includes two EPA Region V notices of violation relating to alleged excess emissions resulting from over-steaming at steam-assisted flares: Lima Refining and CITGO Petroleum. The paper also includes a discussion of several recent judicial consent decrees and settlements.

Finally, the paper turns to the current status of the NSPS Subpart Ja rulemaking relative to flares, including the status of the related administrative petitions for reconsideration and the petitions for judicial review that were filed last year in the U.S. Court of Appeals for the District of Columbia Circuit. In addition, as background, the authors have included as an attachment to this paper their 2008 NPRA paper summarizing key points in that rulemaking, (Attachment #2).

[1] One of the earliest "shots across the bow" came in an EPA "Enforcement Alert" entitled, "Frequent, Routine Flaring May Cause Excessive, Uncontrolled Sulfur Dioxide Releases," Office of Enforcement and Compliance Assurance (2248A), U.S. Environmental Protection Agency, EPA 300-N-00-014 (revised), (October 2000). See: http://www.epa.gov/compliance/resources/newsletters/civil/enfalert/flaring.pdf . See Attachment #1.

II. Overview of New Federal and State Flare Enforcement Initiatives

EPA Flare Activities

EPA has recently been involved in numerous flare enforcement initiatives including:

- Consent Decree – Refinery Global Settlement – Flare Template
- Consent Decree – Petrochemical Global Settlement – Flare Template
- Stand-alone Consent Decree Flare Settlements
- Assistance / Oversight of Environmental Group Suits
- Flare Destruction Removal Efficiency ("DRE") Issue

Consent Decree – Refinery Global Settlement – Flare Template

For almost ten years, EPA has been involved in implementing Refinery Global Settlement Consent Decrees, which include a Flare Settlement Template as one of the marquee issues. The current Refinery Consent Decree Flare Settlement Template includes:

- 5-Year look back at Flaring Incidents (>500 pounds SO_2/24-hours), including performing Root Cause Analysis;
- Agree to designate flares as NSPS affected facilities;
- Control/Reduce/Eliminate flaring by either:
  - Install Flare Gas Recovery
  - Eliminate continuous or intermittent vents, (only allowed to vent process upset gas or relief valve leakage)
  - Operate flare as a fuel combustion device, (requires meeting 160 ppm H_2S, H_2S monitoring, flare flow monitor)

EPA has settled with 24 companies, representing 88 percent of the US refining capacity[2]. EPA has indicated that it intends to enter into a Consent Decree with all refiners.

Consent Decree – Petrochemical Global Settlement – Flare Template

EPA has entered into one petrochemical "Global Settlement" to date. Equistar Chemicals (owned by LyondellBasell) entered into a Consent Decree with EPA on July 2007[3]. The Consent Decree has similar sections to the Refinery Settlements for Benzene NESHAPs and LDAR. In addition, the Consent Decree contains an extensive settlement of Equistar's Flares. (Equistar has seven facilities, in four states with twenty-four {24} flares.)

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[2] EPA Petroleum Refinery National Priority Case Results, See Link: http://www.epa.gov/compliance/resources/cases/civil/caa/oil/index.html

[3] United States of America v. Equistar Chemicals, LP, US District Court for the Northern District of Illinois, Civil No. 1:07-CV-4045, Lodged – July 19, 2007, Entered January 28, 2008,(Attachment #3).

The flare settlement section requires Equistar to install flow monitoring, temperature and pressure monitors (to calculate exit velocities), and GC-Based Monitoring Systems on twenty-two (22) of Equistar's twenty-four (24) flares. Only two marine dock flares are exempt from installing the GC-Based Monitoring Systems. Equistar is required to calculate hourly the net heating value and exit velocity. The net heating value is not to include the contribution from pilot gas. Equistar is also required to record the GC-Based speciation of the flare vent gas two times per hour.

Equistar is required to report and investigate Flaring Incidents. The Consent Decree defines "Flaring Incident" as any release that is not authorized by federal, state, or local rules and/or a release of greater than 1,000 pounds of ethylene or propylene within a 24-hour period. For each recurring Flaring Incident, Equistar is required to perform a Root Cause Analysis and is subject to stipulated penalties as shown on Table 1 below. During the Flaring Incident, Equistar is to calculate the actual Destruction Removal Efficiency ("DRE") to determine the amount of release. For example, Texas allows a 98% DRE during normal flaring, but requires a 93% DRE if the exit velocity or net heating values are not within 40 C.F.R. §60.18 requirements[4].

Table 1
Equistar Recurring Flaring Incidents – Stipulated Penalties

VOC/VOM Emitted	Duration if: <3 hours	Duration if: 3<24 Hours	Duration if: >24 hours
<5 tons	$500/ton	$750/ton	$1,000/ton
5<15 tons	$1,200/ton	$1,800/ton	$2,300/ton, not to exceed $27,500/day
>15 tons	$1,800/ton, not to exceed $27,500/day	$2,300/ton, not to exceed $27,500/day	$27,500/day

Equistar is also required to install equipment that will reduce or eliminate startup flaring emissions. This equipment mainly consists of recycle piping and compressors to allow the recycle of streams during startups and shutdowns. Equistar estimates that it will spend over $125 million on the pollution controls required by this Consent Decree. In addition to reducing startup emissions, Equistar is to prepare site Flare Minimization Plans and is required to conduct extensive operator training to further reduce flaring emissions.

EPA has indicated that other petrochemical / chemical companies have received CAA Section 114 letters and anticipates entering into additional Consent Decrees with these companies.

[4] Texas Administrative Code ("TAC"), §115.725(d)(7).

Stand-alone Consent Decree Flare Settlements

One of EPA's current Enforcement Priorities is Industrial Flares used to reduce Air Toxics.[5] EPA has begun approaching refiners and petrochemical companies to discuss entering into a separate Flare Settlement. This initiative is the outgrowth of the Refinery and Petrochemical Global Settlements, recent flare enforcements (over-steaming), and recent civil settlements (i.e., Shell Deer Park). No one has yet settled with EPA and EPA has not publicly provided a "settlement template", but has confirmed that they are negotiating with more than one company in an effort to begin another round of flare enforcements. One can assume that EPA would like to see settlements that contain flare gas flow monitors, steam-assist or air-assist flow monitors, continuous GC/CEMs monitors, and increased stipulated penalties for specific compounds and air toxics (in addition to SO_2).

Assistance / Oversight of Environmental Group Suits

In discussing the history of various citizen/environmental group civil suits against refineries, it is apparent that EPA was assisting the groups in their cases. EPA assisted and in some situations, took over the cases, as in the apparent example of Chalmette Refining lawsuit[6]. In this case, the lawsuit was closed when EPA and the State entered into a Refinery Global Settlement Consent Decree. (Note: Plaintiffs were seeking over $200,000 in fees and expenses.)

In the Shell Deer Park Flare Settlement[7], EPA and the DOJ were provided the opportunity to review and change the Consent Decree. (Note: Plaintiffs were seeking over $800,000 in fees and expenses.) EPA and States have been involved in the settlements of the other refiners as well, (e.g., ConocoPhillips – Wood River, IL; Sunoco – Philadelphia, PA; and Murphy Oil – Meraux, LA).

This involvement adds support to the realization that EPA had begun a new Flare Enforcement Initiative.

Flare Destruction Removal Efficiency ("DRE") Issue

As is discussed later, EPA Region 5 has begun a separate flare enforcement program. The emphasis of this program is on inadequate flare gas heat content and over-steaming of flares, both of which EPA believes result in lower Flare DRE. This effort is supported

[5] U.S. Environmental Protection Agency - October 2007, FY08 – FY10 Compliance and Enforcement National Priority: Clean Air Act, Air Toxics, (See Attachment #4).
[6] St. Bernard Citizens for Environmental Quality, Inc., and Louisiana Bucket Brigade v. Chalmette Refining, LLC, US District Court for Eastern District of Louisiana, 2:04-CV-00398, (See Attachment #5).
[7] Environment Texas Citizen Lobby, Inc., and Sierra Club v. Shell Oil Company, et. al., US District Court for Southern District of Texas, Case No. 4:08-CV-00070, (See Attachment #6).

by Brian Dickens, Region V[8]. EPA's concern is that flares are not being operated properly and are violation of "*good air pollution control practice for minimizing emissions*"[9]. In situations where steam is added to the flare (to assist in flaring and prevent smoking) EPA believes the net heating value of the flare gases in the "combustion zone" are too low, resulting in lower DRE.

In addition, based on measurements of flare vent flow and steam flow, EPA has found that the flares are being operated outside of recommended steam-to-vent gas ratios. EPA has compiled several documents that attempt to demonstrate a "window of acceptable operation". The first of these documents was the 1983 EPA Flare Efficiency Study[10]. This study, which was used by EPA to set the flare requirements found in 40 C.F.R. §60.18, found that "*combustion efficiencies in the flare plume are greater than 98%*". The study later states, commenting on a figure, reproduced here as Figure 1: "*general tendencies for combustion efficiencies to decline at higher or lower than normal steam flows. This data suggests that* ***steam-to-relief gas ratios ranging from 0.4 to 1.5*** *(lb-steam per lb-relief gas) yield the best combination of combustion efficiencies*." Figure 1 demonstrates that steam-to- vent gas ratios above 3.07 are regarded as being higher than those that would represent good engineering practice.

The second document EPA references is from a 2000 Canadian Flare Study[11]. EPA has noted that this study has three main conclusions with reference to steam-to-vent ratios:

1. "From the measurements in this study it can be concluded that a major contributing factor in the poor flare efficiency is an overdose of steam at low operating loads…"
2. "clear correlation" between flare efficiency and steam rates
3. Steam-to-ethylene ratio of approximately 5.0 (5.0 lb-steam per 1.0 lb- ethylene) resulted in efficiencies of 82% and 95%. A steam-to-ethylene ratio of 11.0 resulted in a combustion efficiency near 40%.

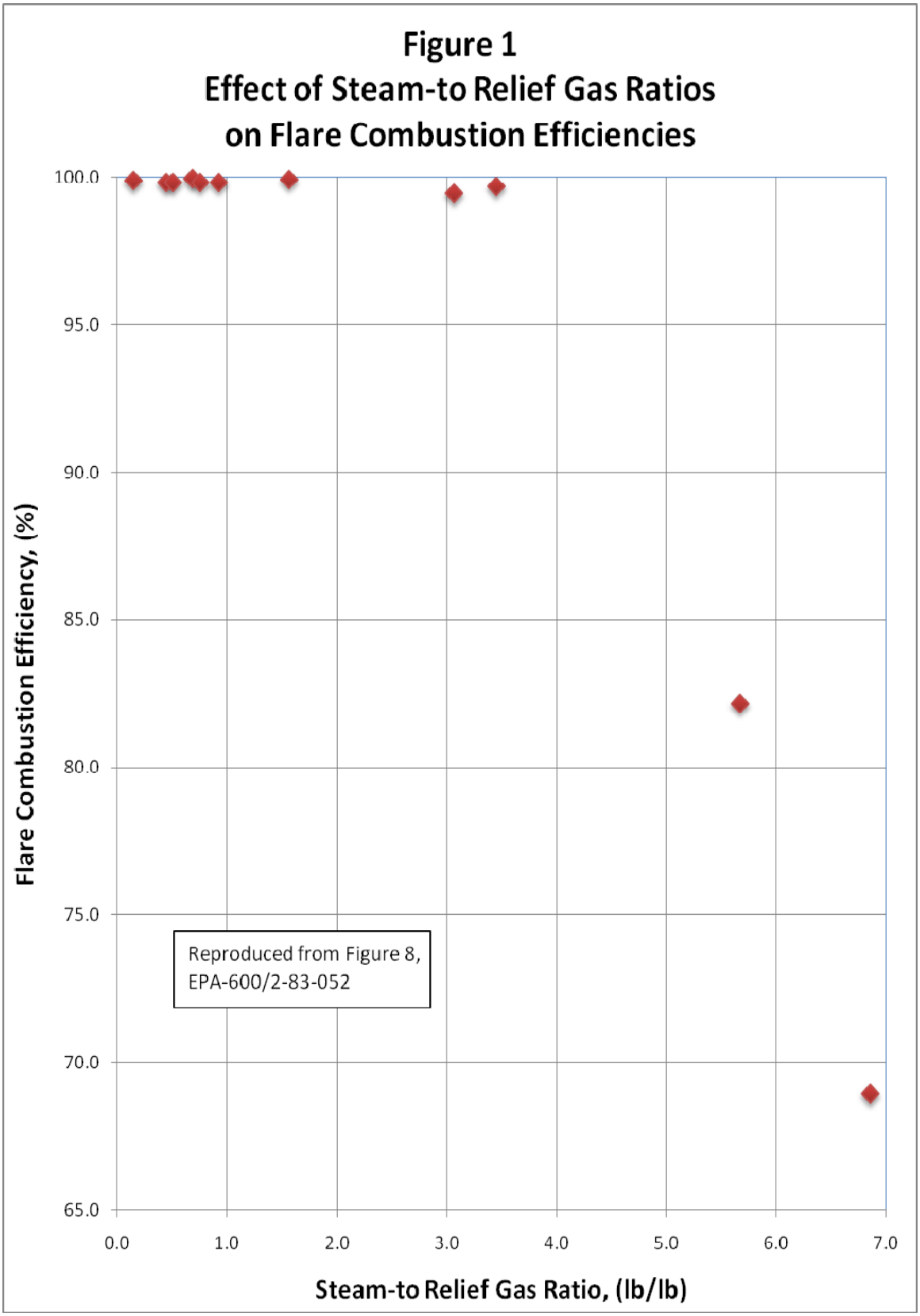
The third EPA reference is a 2006 simulation study[12]. This study used a computer model, supported by laboratory measurements to determine the combustion efficiencies of various gas streams. This study concluded that "*flame combustion*

[8] *Flare Combustion Efficiency*, Presentation to Texas Chemical Council, June 11, 2009, Brian Dickens, EPA Region V, Dickens.Brian@EPA.gov, 312-886-6073, (Attachment #7).
[9] 40 C.F.R. §60.11(d) and similar language in 40 C.F.R. §63.6(e), 40 C.F.R. §63.172(e), 40 C.F.R. §60.482-10(e), 40 C.F.R. §61.12(c).
[10] Flare Efficiency Study, EPA-600/2-83-052, July 1983, (Attachment #8).
[11] Mellquist, Johan, *Flare Testing Using the SOF Method at Borealis Polyethylene in the summer of 2000*, Chalmers University, 2001, (Attachment #9).
[12] Castineira, D., Edgar, T., Computational Fluid Dynamics for Simulation of Steam-Assisted and Air-Assisted Flare Combustion Systems, 2006, (See Attachment #10).

efficiency is strongly related to the heating value of the fuel gas and that insufficient combustion may occur … below 200 BTU/scf'.

The study also concluded that a steam-to-vent gas ratio of 2.37 resulted in essentially no combustion when burning a methane, hydrogen and nitrogen mixture.

Figure 1
Effect of Steam-to Relief Gas Ratios on Flare Combustion Efficiencies



EPA, in compliance inspections, has requested to look at the flare manufacturers operating manual that came with the flare, and/or the flare operating procedures to determine if the flare is being operated outside of the recommended operating window, (and thus failing to use "good air pollution control practices"). In these documents, EPA is looking to see if there are:

- Recommended steam-to-hydrocarbon ratio;
- List of design conditions including pounds of hydrocarbon and pounds of steam; and/or
- Minimum steam flow requirements.

EPA is using these criteria to determine if a flare is operating properly.

A fifth reference EPA is using is the API 521[13]. This document states that with respect to steam-assisted flares, "*the amount of steam required is primarily a function of the gas composition, flow rate and steam pressure and flare tip design and is normally in the range of **0.25 to 1.00***". API 521 also provided a list of recommended steam-to-vent ratios for different chemicals, presented here as Table 2.

The document describes all types of pressure-relieving and disposal systems, including flares. For steam-assisted flares, API 521 states that "the amount of steam required is primarily a function of the gas composition, flow rate, steam pressure, and flare tip design and is normally in the range of **0.25 – 1.00**". As shown on Table 2, the report provides steam-to-vent gas ratios and recommends a steam-to-vent ratio of **0.10 – 0.45** for paraffins and **0.80 – 1.00** for aromatics.

EPA has also expressed a concern regarding the net heating value of the gases in the "combustion zone" as opposed to the flare header. The federal requirements regarding net heating value are found in 40 C.F.R. §60.18. These regulations state that for steam-assisted or air-assisted flares "*the net heating value of the **gas being combusted***" shall be 300 BTU/scf or greater. The term "gas being combusted" is not defined as to whether this is the flare header gas or whether it includes steam-assist or air-assist gases. The method to determine the "net heating value of the gas being combusted" is determined in 40 C.F.R. §60.18(f)(3). However, this regulation refers to the "*net heating value of the **sample***" and does not define how the "sample" is to be taken, leaving this up to the discretion of the sampler and EPA.

In conversations with EPA and state agency personnel, it is clear there is an internal agency debate as to whether the agencies will look at the "gas being combusted" to

[13] *Pressure-relieving and Depressuring Systems*, ANSI/API Standard 521, Fifth Edition, January 2007, Addendum, May 2008.

include assist gases. Note: EPA has said if steam-assist or air-assist gases are not counted, pilot gas is also not to be included in the net heating value calculation.

Table 2
Suggested Injection Steam Rates
(Taken from API 521, Table 11)

Compound being Flared	Steam Required [a] (lb-steam per lb-compound)
Paraffins	
Ethane	0.10 – 0.15
Propane	0.25 – 0.30
Butane	0.30 – 0.35
Pentane plus	0.40 – 0.45
Olefins	
Ethylene	0.40 – 0.50
Propylene	0.50 – 0.60
Butene	0.60 – 0.70
Diolefins	
Propadiene	0.70 – 0.80
Butadiene	0.90 – 1.00
Pentadiene	1.10 – 1.20
Acetylenes	
Acetylene	0.50 – 0.60
Aromatics	
Benzene	0.80 – 0.90
Toluene	0.85 – 0.95
Xylene	0.90 – 1.00

[a] The suggested amount of steam that should be injected into the gases being flared in order to promote smokeless burning (Ringlemann 0) can be determined from this slide. The given values provide a general guideline for the quantity of steam required. Consult the flare vendor for detailed steam requirements.

State Flare Activities

California – SCAQMD (Los Angeles Area)

As one would expect, the first state refinery flare regulations were adopted in California. The South Coast Air Quality Management District ("SCAQMD") adopted the first state refinery flare rule in February 1998, "*Rule 1118 - Control of Emissions from Refinery Flares*"[14]. The rule was amended in November 2005 and has dramatically strengthened the requirements. The seven refineries (30 flares) in the SCAQMD area are now

[14] South Coast Air Quality Management District, Rule 1118 – Control of Emissions from Refinery Flares, November 2005, (See Attachment #11).

required to have continuous flow gas monitors, continuous gas heating value monitors, and semi-continuous total sulfur concentrations monitors. SCAQMD has also set Performance Targets for refiners as shown in Table 3.

Table 3
SCAQMD Flare Performance Targets[15]

Year	Flare Performance Target (tons-SO_2/MM Barrels)
2006-2007	1.5
2008-2009	1.0
2010-2011	0.7
2012+	0.5

The refiners are required to report quarterly on each flare within their refinery. There are a total of 30 flares subject to Rule 1118. Shown in Table 4 below is the latest available annual report for the SCAQMD refiners. This table shows that all of the refiners met the 2007 Performance Target. If a refiner does not meet the Performance Target in any year, then the refiner is required to prepare and submit a Flare Minimization Plan and is subject to stipulated penalties.

Table 4
SCAQMD 2007 Refiners Flare Performance[16]

Refinery - Location	2007 - Target		2007 Actuals			
	(tons/MMBBL)	(lbs-SO_2/yr)	(MMBBL/Yr)	(BPCD)	(lbs-SO_2/yr)	(tons/MMBBL)
BP - Carson	1.5	285,400	95.13	260,639	131,228	0.69
Chevron - El Segundo	1.5	285,400	95.13	260,639	98,596	0.52
ConocoPhillips - Carson & Wilmington	1.5	152,600	50.87	139,361	136,792	1.34
ExxonMobil - Torrance	1.5	164,200	54.73	149,954	128,536	1.17
Paramount - Paramount	1.5	55,000	18.33	50,228	25,824	0.70
Tesoro - Wilmington	1.5	108,200	36.07	98,813	20,180	0.28
Valero - Wilmington	1.5	88,800	29.60	81,096	51,927	0.88

The Flare Minimization Plan requires a complete description of each flare system, detailed P&IDs (Flare Mapping), and plans to reduce flaring emissions.

The stipulated penalties associated with not meeting the Flare Performance Targets are:

[15] SCAQMD Rule 1118(d)(1).
[16] See link: http://www.aqmd.gov/comply/1118/emissiondata.htm

- $25,000 per ton, if the excess emissions are less than 10% over the Performance Target; or
- $50,000 per ton, if the excess emissions are between 10% and 20% over the Performance Target; or
- $100,000 per ton if the excess emissions are greater than 20% over the Performance Target;
- Not to exceed $4,000,000 per year per refinery[17].

The SCAQMD refiners are also required to perform Root Cause Analysis (Specific Cause Analysis) for any Flare Event that has emissions that exceed either:

1. 100 pounds of VOC;
2. 500 pounds of sulfur dioxide; or
3. 500,000 standard cubic feet of vent gas combusted[18].

Refiners have to conduct a less formal Relative Cause Analysis for any other Flare Event that exceeds 5,000 standard cubic feet of vent gas combusted. Note: a Flare Event is the start of any vent gas (intentional or unintentional) that goes to the flare and ends when the flow velocity drops below 0.12 feet per second.

Annually refiners must conduct an acoustical or temperature leak survey of all pressure relief devices connected to a flare and repair the device no later than the next turnaround. For more information on the SCAQMD Flare requirements go to the following link:

http://www.aqmd.gov/comply/R1118_main.htm

California – BAAQMD (San Francisco Area)

The Bay Area Air Quality Management District ("BAAQMD") has two regulations that apply to refinery flares: Regulation 12, Rule 11, *Flare Monitoring at Petroleum Refineries,* June 2003, (See Attachment #12), and Regulation 12, Rule 12, *Flares at Petroleum Refineries,* April 2006, (See Attachment #13). BAAQMD has five refineries with 25 flares that are subject to these regulations.

[17] SCAQMD Rule 1118(d)(3)
[18] SCAQMD Rule 1118(c)(1)(D)

Regulation 12, Rule 11, Flare Monitoring at Petroleum Refineries

The purpose of this rule is to require monitoring and recording of flare emission data. It requires operators of flares at petroleum refineries to monitor the gases directed to the flare and submit a monthly report containing:

1. The total daily and monthly volumetric flow of the vent, pilot and purge gas, (velocity measured to nearest 0.10 feet per second);

2. The hourly average molecular weight of the vent gas;

3. Composition of vent gas from required sampling;

4. Calculated daily and monthly methane, non-methane and sulfur dioxide emissions; and

5. Archive video images of the flare.

This information is posted on the BAAQMD website and is available for public inspection. This file shows daily total flare vent flow, and emissions by refinery, by flare. To view this data go to the following link:

http://hank.baaqmd.gov/enf/flares/index.htm

Regulation 12, Rule 12, Flares at Petroleum Refineries

The purpose of this rule is to reduce emissions from flares at the BAAQMD refineries by minimizing the frequency and magnitude of flaring. Refiners must provide the BAAQMD with a notification of flaring and must prepare and submit a Flare Minimization Plan.

Flaring Notification: Refiners must notify the BAAQMD as soon as possible, consistent with safe operation of the refinery, if the volume of vent gas flared exceeds 500,000 standard cubic feet or 500 pounds of sulfur dioxide in a calendar day.

Flare Minimization Plans: Flaring is prohibited unless it is consistent with an approved "Flare Minimization Plan" (FMP). The FMPs[19] (which are available on the internet) must include:

1. A detailed description and technical information for each flare;

[19] *Flare Minimization Plan*, Shell Martinez Refinery, July 9, 2007 (Attachment #14).

2. A description of the equipment or procedures implemented within the last five years or planned to reduce flaring;

3. A description of prevention measures needed to perform certain refinery activities without flaring; and

4. Updated annually.

Root Cause Analysis: A Root Cause Analysis is required to be prepared and submitted any time a flare has a reportable flaring event, (>500,000 ft^3 or > 500 lb-SO_2/24-hours).

Texas – Flare Task Force

In March of this year, the TCEQ organized a stakeholder group to perform a comprehensive evaluation of all aspects of flares and to develop recommendations for future regulations. The Task Force was formed because the TCEQ had gathered information and field data that suggests some flares were not achieving the expected DRE. Field studies suggested that ambient VOC concentrations were significantly higher than reported VOC emission inventories. Using an IR camera and Differential Absorption Lidar ("DIAL") studies showed significant amounts of VOCs being emitted from flares. A link to an example video can be found at:

http://www.tceq.state.tx.us/implementation/air/rules/flare_stakeholder.html

The issues the TCEQ desires to study include meteorological conditions including wind, ambient temperature, and humidity. The TCEQ suggests that DREs may not be accurate for waste gas streams with complex VOCs. In addition, the TCEQ is also concerned with over-steaming and excessive assist-gas. One TCEQ study noted that the ratio of assist-gas to waste gas is highly variable, ranging from 2 to more than 50.

The TCEQ has indicated that as a separate topic, the agency will determine the necessity of monitoring flare operating parameters to ensure high DRE. The TCEQ has also indicated that it will review alternative control devices and review BACT evaluations to determine if flaring will remain an option to industry.

The TCEQ is planning to perform additional flare research, including direct measurement and remote sensing techniques. The plan is to assess DRE during various operating conditions studying the effect of:

- Flare gas flow rate (turndown ratios);
- Air-assist and steam-assist flow rates;
- Flare gas composition (complex VOCs);
- Limited VOCs in flare vent gas (BTU content); and
- Flare mechanical conditions.

The TCEQ staff has indicated that they will prepare draft recommendations for TCEQ management by the fall of 2009. Future rulemaking (if any) would come after that time frame.

III. Examples of Current Enforcement Cases

A. *Citgo Petroleum Corporation—Lemont, Illinois*

Issued: February 26, 2009

Issued by: USEPA Region V, (See Attachment #15)

Nature of Enforcement Action: Finding of Violation and Notice of Violation

EPA Explanation of Legal Background and Allegations:

- The Illinois SIP prohibits the release of petroleum manufacturing waste gas streams containing more than 100 ppm organic material *unless the waste stream is reduced to less than 8 lb/hr or 10 ppm of organic material, or is treated with a device that achieves a combustion efficiency of 85% or more.* (Emphasis supplied) This provision was incorporated into CITGO's Title V permit.

- The federal Clean Air Act ("CAA") also requires that certain new sources within the petroleum refining industry comply with new source performance standards ("NSPS") for Equipment Leaks of VOC in Petroleum Refineries, Subpart GGG, found at 40 C.F.R. §60.590.

- NSPS Subpart GGG cross-references the NSPS for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry at 40 C.F.R. §60.482-10(e) that states: "Owners or operators of control devices used to comply with the provisions of this subpart shall monitor these control devices [i.e. flares] to ensure they are operated and maintained in *conformance with their designs*." (Emphasis supplied) This requirement and NSPS Subpart GGG also were incorporated into CITGO's Title V permit.

- EPA found that CITGO violated the Illinois SIP, the facility Title V permit, Title V of the CAA, and 40 C.F.R. §60.590 (Subpart GGG).

- CITGO has three flares that are "steam-assisted," which means that steam is added to the waste or vent gas stream to enhance combustion and prevent the formation of smoke.

- In March 1997, API released a report (API 521) discussing proper practices for venting organic material. With respect to smoke suppression at steam-assisted flares, the report states: "the amount of steam required is primarily a function of the gas composition, flow rate and steam pressure and flare tip design and is normally in the range of 0.25 to 1.00 (lb/lb)."

- In 1983, EPA released a report (Attachment #8) on flare efficiency that was partially funded by EPA and the Chemical Manufacturers Association. The report concluded that excessive steam-to-vent gas ratios caused steam quenching of the flame during the tests which resulted in lower combustion efficiency.

- Flare 1. In response to an EPA information request, CITGO submitted data to EPA indicating that, during low vent gas flow conditions, CITGO supplied steam to Flare 1 that was more than twice the design minimum (as indicated in an accompanying Data Sheet setting forth such design minimum). *By supplying excess steam, CITGO allegedly reduced the combustion efficiency of Flare 1 on various days in 2004, 2005, and 2007 by 85% and released a waste stream to the environment with an organic material concentration greater than 10 ppm and a rate exceeding 8 lb/hr.*

- Flare 2. According to operating data CITGO provided, CITGO supplied steam to Flare 4 far in excess of the ratio recommended in the refinery Operations Manual, which provided: "Normal steam to hydrocarbon ratios are in the order of 0.2 to 0.4." *This alleged failure to adhere to the flare's design criteria on various days in 2004, 2005, 2006, and 2007 reduced the combustion efficiency of Flare 4 below 85% and released a waste gas stream to the environment with an organic concentration greater than 10 ppm and a rate exceeding 8 lb/hr.*

- Flare 5. According to data CITGO provided to EPA, and in alleged deviation from CITGO's Flare System Specification Sheet, CITGO allegedly supplied much more steam than was required for low vent gas flow conditions, and, on at least two occasions, it also supplied more steam than the maximum required under the highest flow conditions. *The failure to adhere to the flare's design on various days in 2006 and 2007 reduced the combustion efficiency of Flare 5 below 85% and released a waste gas stream to the environment with an organic concentration greater than 10 ppm and at a rate exceeding 8 lb/hr.*

B*. Lima Refining Company, Lima, Ohio*

Issued: March 20, 2009 (See Attachment #16)

Issued by: USEPA Region V

Nature of Enforcement Action: Finding of Violation

EPA Explanation of Legal Background and Allegations:

- The Finding of Violation is based on NESHAP for petroleum refineries, 40 C.F.R. Part 63, Subparts A and CC and the refinery's Title V permit.

- The Respondent is required by NESHAP Subpart A and Subpart CC, by 40 C.F.R. §60.18, and by its Title V permit to operate Flare P006 in a manner that minimizes emissions in accordance with its design.

- LRC uses Flare P006 to control emissions from process units, including emissions resulting from malfunctions and pressure relief episodes. The flare is steam-assisted, which means that steam is added to the waste, or vent gas stream to enhance combustion and prevent the formation of smoke. Stream is added in proportion to the amount of vent gas, and it is common practice to measure to the amount of steam as a ratio of the mass of steam per unit mass of vent gas (lb/lb).

- On November 21, 2008, LRC provided information to EPA in response to an EPA information request, including design documents and operating data on Flares P006 and P007 for the period from August 1, 2005 through October 31, 2008.

- LRC's Operations and Maintenance Manual for Flare P006 states that the flow rate of steam and vent gas are proportional, and sets forth the design vent gas flow rate and associated steam flow rate. Specifically, it states that the flare's design flow rates are 39,500 lb/hr of steam and 138,000 lb/hr of vent gas. These flow rates result in a steam-to-vent gas ratio of approximately 0.29 lb steam/lb vent gas at these design conditions.

- The steam-to-vent gas ratio set forth in the Operations and Maintenance Manual for Flare P006 is consistent with good engineering practice as set forth in industry, academic, and government publications concerning the operation of flares.

- *LRC provided steam to the flare far in excess of its design ratio, and added more steam than was prescribed by the Operations and Maintenance Manual given the hydrocarbon flow rates.* This excess steam resulted in steam-to-vent gas ratios exceeding 10 lb/lb as four-hour averages.

- EPA inspected the LRC refinery on July 22, 2008 and performed an inspection of the flare between approximately 10:45 and 11:15. The P006 flare was receiving vent gas at low to normal flow. The EPA inspector witnessed a steam plume exiting the flare tip. The Operations and Maintenance Manual, however, directs LRC to operate the flare during normal operation so that there is enough steam to prevent smoking, but not so much that steam is visible at the flare tip. *LRC supplied steam to the flare in an amount that exceeded the level specified by the manufacturer.*

- *This failure to adhere to the flare's design resulted in excess steam being added, which on several days in 2006, 2007, and 2008 significantly reduced the combustion efficiency of Flare P006. The reduction in combustion efficiency resulted in increased emissions.*

C. *Environment Texas Citizen Lobby, Inc., and Sierra Club v. Shell Oil Company, Deer Park Refining Limited Partnership, and Shell Chemical Limited Partnership*

Civil Action No. 4:08-cv-00070 (See Attachment #6)

1. **Settlement Payment: $5.8 million**

2. **Settlement Terms**

- Reporting of unauthorized emissions on an annual basis and the amount of excess emissions (iv.7)

- Caps on unauthorized emissions with accompanying stipulated penalties. See Table 5 below:

- Develop and implement for each flare a flare management and minimization plan comparable to the plan in effect at Shell's Martinez California Refinery (See Attachment #14).

- Flare Mapping, including baseline flow rates, composition of routine flaring, and identification of sources of hydrocarbon flows to flare.

- Enhance flare efficiency

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Table 5
Shell Deer Park - Flare Consent Decree

	Penalty		Year 1 Limit	Year 2 Limit	Year 3+ Limit
	($/lb)	($/ton)	(lb/yr)	(lb/yr)	(lb/yr)
SO_2	$1	$2,000	180,000	120,000	81,000
NO_X	$1	$2,000	21,000	14,000	9,450
VOCs	$1	$2,000	97,500	65,000	43,875
CO	$1	$2,000	63,000	42,000	28,350
H_2S	$1	$2,000	2,250	1,500	1,300
Excess, >50,000 lb	$5	$10,000			
Benzene	$50	$100,000	7,500	5,000	3,375
1,3-Butadiene	$50	$100,000	3,750	2,500	1,387
Total	$1	$2,000	300,000	200,000	135,000
Opacity		$2,500/day			

D. ***American Bottom Conservancy, Sierra Club, Environmental Integrity Project, and Natural Resources Defense Council v. ConocoPhillips Company—Settlement Agreement Dated July 25, 2008.***

1. In July 2007, Illinois EPA ("IEPA") issued to ConocoPhillips a PSD permit authorizing a coker and refinery expansion project at the company's Wood River Refinery located in Roxana, Illinois.

2. On August 22, 2007, the environmentalist organization collectively referred to a "Petitioner Parties" filed a petition for review before EPA's Environmental Appeals Board ("EAB") requesting review of the PSD permit. After dismissal of a number of claims by Petitioner Parties, the EAB, on June 2, 2008, remanded the PSD permit to the IEPA for review of issues relating to the new Delayed Coker Unit Flare and the Hydrogen Plant 2 Flare.

3. After the EPA remand, the parties reached a settlement agreement whereby the Petitioner Parties would dismiss their remaining objections to the PSD permit in exchange for certain additional requirements in the refinery flares and other specified equipment, as well as other consideration, as summarized below.

Significant settlement terms are as follows:

A. Heighted control of carbon monoxide from flares.

B. Heightened control of SO_2 and other pollutants from flares.

C. Reduction in allowable emissions for startup, shutdown, and malfunctions ("SSM") events. Flaring related to SSM events to be minimized.

D. Flare gas recovery system with redundant compressors is BACT for carbon monoxide emissions from Delayed Coker Unit Flare.

E. Adoption of certain California flare control requirements (see Section on California State Rules).

F. Incorporation of flare control requirements into federally enforceable permits.

G. Flare minimization plan for new and existing refinery flares within five years; install flow monitoring equipment in one or more flares, the cost of which will not exceed $350,000.

H. New monitoring technology for fugitive emission from tank farms and other equipment (remote sensing of atmospheric gases). Data to be available to the public.

I. Conduct facility-wide energy use review and greenhouse gas emission assessment aimed at improving efficiency and reducing carbon dioxide emissions. The refinery also committed to perform energy reduction projects aimed at reducing energy use by a voluntary target of at least 6%.

J. Develop a carbon dioxide emissions baseline inventory and tracking system.

K. ConocoPhillips to provide $3.4 million to certain environmental infrastructure initiatives, including school energy projects, aid to municipalities seeking to reduce greenhouse gas emissions, conservation of wetlands and space around refinery, and a Clean School Bus program.

To review the Settlement Agreement, see Attachment #17 to this paper.

E. *Concerned Citizens Around Murphy v. Murphy Oil USA, Inc., Civ. Action No. 08-4986, Sect. R. Mag.2, E.D. La. complaint filed November 21, 2008.*

Concerned Citizens Around Murphy ("CCAM") (represented by the Tulane University Environmental Law Clinic) originally sent a notice of intent to file a citizen suit under Section 304 of the federal Clean Air Act on July 1, 2008, alleging multiple permit exceedances and statutory violations, including failure to properly maintain pollution control devices. Most of the alleged violations centered on refinery flares and the SRU incinerator. CCAM subsequently filed suit against Murphy Oil USA, Inc. in the United States District Court for the Eastern District of Louisiana alleging the same violations and seeking injunctive relief, imposition of civil penalties, and award of attorney and expert fees. The case is presently pending[20].

IV. Current Status of NSPS Subpart Ja With Respect to Flares

A. Summary of Rulemaking

Attachment #2 to this paper is a summary of the rulemaking that the authors prepared in connection with their presentation at the 2008 NPRA Environmental Conference.

Status of Challenges to Rulemaking

As indicated in last year's paper, the rulemaking was the subject of both administrative petitions for reconsideration as well as petitions for judicial review in U.S. Court of Appeals for the District of Columbia Circuit. On September 26, 2008 (73 Fed. Reg. 55751), EPA granted the administrative petitions for reconsideration and temporarily stayed the effective date of the rule. In that action, EPA agreed to reconsider the following issues: (1) The newly promulgated definition of "modification" for flares; (2) the definition of "flare"; (3) the fuel gas combustion device sulfur limits as they apply to flares; (4) the flow limit for flares; (5) the total reduced sulfur and flow monitoring requirements for flares; and (6) the NO_X limit for process heaters. EPA also granted Industry Petitioners' and HOVENSA's request for a 90-day stay for those same provisions under reconsideration.

On December 22, 2008 (73 Fed. Reg. 78549), EPA extended the stay until the agency reaches a final decision on all of the issues for which reconsideration was granted.

[20] Concerned Citizens Around Murphy v. Murphy Oil USA, Inc., US District Court for Eastern District of Louisiana, 1:08-CV-04986.

It also has been reported that the petitions for judicial review in the D.C. Circuit also have been stayed pending a final decision by the agency on the administrative petitions for reconsideration.

B. Current Status and Impacts of Subpart Ja

EPA and industry have continued to meet since the stay to discuss the Ja issues. Recent discussions with EPA indicate that EPA hopes to issue the final rules by this fall. EPA is not providing any information as to what the final rules will look like with respect to the flares. However, based on discussions with persons "at the table" the following outcomes are likely.

1) The final flare rules will have an effective date of June 24, 2008. This is a very important date to understand. If a refinery has made any "modification" to a flare since June 24, 2008, then the flare becomes an "affected facility" and subject to the new Subpart Ja regulations. The existing regulations allow a modified flare 1 year to come into compliance with the regulation. When the new Subpart Ja regulations come out a flare that was modified after June 24, 2008 may be immediately subject to the new Subpart Ja regulations. It is possible EPA may move the applicability date to later, but December 22, 2008 is as late as would be expected. NPRA and API recommended to EPA that the "trigger date" not be the June 24, 2008 date but rather December 22, 2008.[21]

2) The definition of "flare modification" has been a vigorously debated subject, as the current proposed definition would cause the flare to be a NSPS Ja flare (including flare header) by even the most minor change, (i.e. install instrument probe, change pressure relief device, etc.). EPA has not "played" its hand yet as to how the final rules will end up. One would expect that EPA will allow minor changes to not cause the flare to not trigger applicability, however, increase in the potential flow to the flare or any change in the type of material going to the flare would subject the flare to NSPS Ja.[22]

3) One can expect that EPA will require more monitoring of the flare operation. It is likely that EPA will require flow monitoring, increased frequency of analysis of heat content, and continuous monitoring of sulfur content, (at a minimum H_2S).

[21] EPA Docket #EPA-HQ-OAR-2007-0011-315, Letter from API, NPRA & WSPA to EPA, April 8, 2009.
[22] Gigliello, Ken, EPA OECA, Letter to Julie Domike, "*Shell Deer Park Flare Letter*", April 10, 2008.

VI. Conclusion and Recommendations

There is clear evidence that EPA, state agencies, and environmental groups are focusing more attention on flares and flare emissions/releases. A refiner should begin now to better understand and better control their flares. At a minimum:

- Locate and review your flare manual received when you purchased your flare. If you don't have one or cannot find one, contact the manufacturer to see if one can be recreated.

- Compare the manufacturer's manual with the plant's operation manual to see if there are any meaningful operational differences. If there are differences, reconcile these differences so you can demonstrate that the flares are being operated in accordance with "good air pollution control practices".

- For steam-assist flares, begin to monitor steam flows (if no steam flow monitor, consider installing a steam flow monitor) and flare vent flows, (if no flare flow monitor, consider installing a flare flow monitor). Make revisions to your operating procedures to minimize the use of steam to prevent over-steaming conditions (i.e. over 3.0 lb-steam/1.0 lb-flare vent).

- For air-assist flares, consider installing flow monitors in order to be able to monitor the air to flare vent ratios.

- Understand that EPA, states, and environmental groups want no flaring of vent gases. While this may be impractical from a safety perspective, work to minimize or eliminate sources of flaring. Work to minimize emissions during startups, shutdowns, and turnarounds.

If you have any questions about this paper or about flare enforcement, please feel free to contact the writers directly. Our contact information is included below.

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Disclaimer: The information provided in this presentation is intended solely as an educational resource, does not constitute legal advice, and should not be used as a substitute for careful review of the rulemaking and enforcement actions themselves and consultation with competent legal and technical professionals as to site-specific circumstances.

This paper went to press in early August 2009. There may be significant developments between completion of the paper and the NPRA Environmental Conference. Stayed tuned …

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Attachments

(Note: Because of the number of pages in the Attachments; the Attachments will be provided to the reader in electronic format by providing a request to one of the authors)

1. "*Frequent, Routine Flaring May Cause Excessive, Uncontrolled Sulfur Dioxide Releases*", EPA Enforcement Alert Newsletter, Volume 3, Number 9 (October 2000), See: http://www.epa.gov/compliance/resources/newsletters/civil/enfalert/flaring.pdf

2. Guida, Joseph, and McAngus, Jess A., *"How the New Subpart Ja Regulations will Affect Your Refinery",* - National Petrochemical & Refiners Association, - Environmental Conference, September 2008.

3. US v. Equistar Chemical, LP, US District Court for the Northern District of Illinois, Civil No. 1:07-CV-4045, Entered January 28, 2008.

4. U.S. Environmental Protection Agency - October 2007, FY08 – FY10 Compliance and Enforcement National Priority: Clean Air Act, Air Toxics.

5. St. Bernard Citizens for Environmental Quality, Inc., and Louisiana Bucket Brigade v. Chalmette Refining, LLC, US District Court for Eastern District of Louisiana, 2:04-CV-00398, Order - Document 126, October 17, 2007.

6. Environment Texas Citizen Lobby, Inc., and Sierra Club v. Shell Oil Company, et. al., US District Court for Southern District of Texas, Case No. 4:08-CV-00070, Consent Decree and Order, April 23, 2009.

7. *Flare Combustion Efficiency*, Presentation to Texas Chemical Council, June 11, 2009, Brian Dickens.

8. *Flare Efficiency Study*, EPA-600/2-83-052, July 1983.

9. Mellquist, Johan, *Flare Testing Using the SOF Method at Borealis Polyethylene in the summer of 2000*, Chalmers University, 2001.

10. Castineira, D., Edgar, T., Computational Fluid Dynamics for Simulation of Steam-Assisted and Air-Assisted Flare Combustion Systems, 2006

11. South Coast Air Quality Management District, Rule 1118 – Control of Emissions from Refinery Flares, November 2005

12. Bay Area Air Quality Management District, Regulation 12, Rule 11, Flare Monitoring at Petroleum Refineries, June 2003.

13. Bay Area Air Quality Management District, Regulation 12, Rule 12, Flares at Petroleum Refineries, April 2005.

14. *Flare Minimization Plan*, Shell Martinez Refinery, July 9, 2007.

15. EPA letter to Harmon, Claude, CITGO Petroleum, "Finding of Violation and Notice of Violation, February 26, 2009.

16. EPA letter to Vonderembse, Gary, Lima Refining Company, "Finding of Violation, March 20, 2009.

17. ConocoPhillips Company – Wood River Refinery, Settlement Agreement, July 25, 2008.