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Frequent, Routine Flaring May Cause Excessive, Uncontrolled Sulfur Dioxide Releases

Practice Not Considered 'Good Pollution Control Practice'; May Violate Clean Air Act

Flaring is an engineering practice that provides for process equipment to immediately release gases to a device (a flare) where they can be quickly and safely incinerated. The proper use of flares is a good engineering practice because flares can prevent damages, fires and explosions, and injuries to employees. Flaring also converts noxious and odorous gases released in emergencies to less hazardous and objectionable emissions by the burning of the gases.

Frequent and routine use of flares may not be good air pollution control practice for reducing emissions. (Photograph courtesy of Kaldair Inc.)

But EPA investigations suggest that flaring frequently occurs in routine, nonemergency situations or is used to bypass pollution control equipment. This results in unacceptably high releases of sulfur dioxide and other noxious pollutants and may violate the requirement that companies operate their facilities in a manner consistent with good air pollution practices for minimizing emissions. New "clean fuels" requirements will lead to the removal of even greater

Editor's Note: To clarify sulfur dioxide reporting requirements, this issue contains slight revisions to the sections, "Diagnosing, Preventing Excess Flaring," located on page 3 and "EPCRA Reporting Requirements for Flaring Incidents" on page 4. Please disregard the earlier issue.

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About Enforcement Alert

"Enforcement Alert" is published periodically by the Office of Regulatory Enforcement to inform and educate the public and regulated community of important environmental enforcement issues, recent trends and significant enforcement actions.

This information should help the regulated community anticipate and prevent violations of federal environmental law that could otherwise lead to enforcement action. Reproduction and wide dissemination of this publication are encouraged.

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amounts of sulfur from feed stocks. Companies should ensure they have adequate capacity to treat these pollutants without resorting to excess flaring.

Good pollution control practices include:

1. Procedures to diagnose and prevent malfunctions; and

2. Adequate capacity at the back end of the refinery to process acid gas.

At petroleum refineries, flares are used in a variety of process areas to prevent hydrocarbons and waste gases from being released directly to the atmosphere. Since hydrocarbons are the primary product at refineries, companies should make every effort to avoid sending their products up in flames. Flares, however, are also used to combust acid gas—a highly concentrated waste stream of hydrogen sulfide gas (up to 90 percent pure)—and sour water stripper gas (about 30 percent pure).

Sulfur Recovery Plants (SRPs) normally process hydrogen sulfide gas and sour water stripper gas. A sulfur recovery plant is a refinery process for producing elemental sulfur for sale but is also a part of the refinery's air pollution control systems. The process converts 95 percent or more of these hydrogen sulfide gases into elemental sulfur while reducing emissions to insignificant levels. Use of a flare for combusting acid gas instead of processing it in the SRP produces very large uncontrolled releases of sulfur dioxide (SO_2) and effectively bypasses the permitted and monitored SRP emission point. While the flare is designed to prevent the direct release of the very toxic and odoriferous hydrogen sulfide during malfunctions at the SRP, EPA has documented situations of regular or routine use of flares for acid gas incineration instead of the expected reliance on the flare only for emergencies.

One day of acid gas flaring can easily release more SO_2 than is released in a single year of permitted SRP activity. On numerous occasions, EPA has uncovered information on acid gas flaring incidents that shows that **100 tons or more of SO_2 can be released in such flaring within a 24-hour period.** A moderately sized Claus sulfur recovery plant (approximately 100 long tons of sulfur recovered per day capacity) that is subject to the New Source Performance Standards and properly operated with its pollution control device should emit no more than 250 parts per million of SO_2, **a rate that corresponds to a little less than 100 tons annually.**

Hydrocarbon Flaring Considered Fuel Gas Combustion Subject to NSPS

The NSPS defines "fuel gas" to be any gas generated and combusted at a refinery and identifies flares as NSPS affected facilities. EPA's letter to Koch Petroleum Company (Dec. 2, 1999) provides a detailed explanation of the various types of gases subject that are to NSPS requirements because they meet the definition of fuel gas (*see http://www.epa.gov/oeca/ore/aed*).

The NSPS exempts flaring of fuel gas from the standards for sulfur oxides and monitoring requirements only when there is a process upset or an emergency malfunction. (40 C.F.R.Section 60.104(a)(1)). This "plain English" exemption applies only to true emergencies, and the Agency expects other flaring to be monitored and comply with applicable emission limits.

EPA believes that many affected facilities at petroleum refineries may not be in compliance with applicable NSPS requirements (fuel gas monitoring and emission limits for fuel gas combustion devices) because of their routine reliance on flaring to control releases of hydrocarbons. The Agency also believes that, as with acid gas flaring, good air pollution control practices include investigating the causes of flaring events and taking corrective action to avoid or reduce the probability of their recurrence. One way to address these potential compliance issues may be through the proper design, operation and maintenance of flare gas recovery systems.

Health Dangers From Sulfur Dioxide

Flaring H_2S can produce high ambient concentrations of SO_2. Short-term exposures to elevated SO_2 levels while at moderate exertion may result in reduced lung function accompanied by such symptoms as wheezing, chest tightness, or shortness of breath in asthmatic children and adults. Other effects associated with longer-term exposures to high concentrations of SO_2, combined with high levels of particulate matter, can result in respiratory illness, alterations in the lungs' defenses, and aggravation of existing cardiovascular disease. Those at risk include individuals with cardiovascular disease or chronic lung disease, as well as children and the elderly.

Acid Gas Flaring

Routine or nonemergency "flaring

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of acid gas" is directing that gas away from the recovery plant, combusting it at a flare and releasing sulfur dioxide to the atmosphere. Acid gas flaring is not a federally permitted operation and should typically only occur during a malfunction (a "sudden, infrequent, and not reasonably preventable failure of equipment or processes to operate in a normal or usual manner") (40 C.F.R. Section 60.2). In EPA's experience, frequent and repetitive acid gas flaring is often not due to malfunctions. Acid gas flaring that is routine or preventable violates the NSPS requirement for operating consistent with 'Good Air Pollution Control Practices' to minimize emissions at refineries with NSPS fuel gas combustion devices and affected facilities including SRPs (40 C.F.R.Section 60.11(d)).

Chain Reaction: Upstream Upsets May Result in Downstream Malfunctions

Properly designed, operated and maintained SRPs can typically receive and treat all acid gas produced at the refinery (most also are designed to treat sour water stripper gas). These gases should not be flared except under emergency or malfunction conditions.

Upsets in upstream process equipment may result in hydrocarbons or other contaminants entering the acid gas stream. Hydrocarbons can be very disruptive to the short- and long-term operation of the SRP. Historically, not much effort has been put into investigating and correcting the root cause of contamination or upsets. Instead, incidents have been simply reported as "malfunctions." EPA, believes that repeated malfunctions for the same cause, generally, could be predicted and prevented. If flaring results from a preventable upset, EPA believes that it does not represent good air pollution control practices and that it may violate the CAA.

The Agency also believes that, as with acid gas flaring, good air pollution control practices include investigating the causes of flaring events and taking corrective action to avoid or reduce the probability of their recurrence.

Diagnosing, Preventing Excess Flaring

Repeated or regularly occurring incidents of flaring can be anticipated and should not be classified as 'malfunctions.' For example, regularly switching between high and low sulfur crude may cause fluctuations of the acid gas feed to the SRP. This can create operational problems for the SRP and/or its pollution control equipment, resulting in a perceived need to flare. These upsets should be addressed through improved operational control systems, improved and frequent training of operators, and continued optimal performance of the SRP, ***not by bypassing or flaring acid gas and sour water stripper gas***.

Another cause of flaring is inadequate capacity of the SRP and its associated tail gas unit (TGU) to process all the acid gas at the refinery. Refineries should ensure that their units have the capacity and can handle variable volumes that may occur during different production levels.

Refineries should implement the following procedures to ensure that flaring results only from a true emergency or malfunction:

BP Amoco Reduces SO_2 Emissions from Flaring Nearly 75%

From 1993 to 1995, the BP Amoco facility in Oregon, Ohio, experienced an annual average of 16 flaring incidents and released approximately 180 tons of SO_2. Under the procedures outlined in a Consent Decree with EPA, BP Amoco has been able to reduce that amount to an insignificant number (three flaring events in 1999 released a total of 49 tons of SO_2) and each event was attributable to a true "malfunction" as defined in NSPS. This was accomplished through equipment and operational changes that eliminated the root causes of such flaring. The protocol in the consent decree (*http://www.epa.gov/oeca/ore/aed*) serves as a model in balancing the concerns of Good Engineering Practice and good Pollution Control Practices for any flaring of acid gas or sour water stripper gas.

- Conduct a root-cause analysis of each flaring incident to identify if any equipment and/or operational changes are necessary to eliminate or minimize that cause so as to reduce or avoid future flaring events. As appropriate, corrective measures should be taken and implemented. If the analysis shows that the same cause has happened before, the incident should not be considered a malfunction and corrective measures should be taken to prevent future occurrences;

- Ensure there is adequate capacity at the SRP and TGU. Redundant units can prevent flaring by allow-

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ing one unit to operate if the other needs to be shut down for maintenance or an upset; and

- Prepare an accurate estimate of the total SO_2 released (using clear calculation procedures) for each acid gas flaring incident.

Identifying the root cause of the flaring incident gives the refinery the opportunity to fix the problem before it happens again. It also enables the facility to assess whether the flaring incident was caused by a true malfunction, which is considered acceptable engineering practices.

A reference procedure for evaluating if good air pollution practices are being used when future acid gas flaring events occur can be found in the Consent Decree, C.A. No. 3:97CV7790 N.D. Ohio, entered May 5, 1999 (*see http://www.epa.gov/oeca/ore/aed*).

For more information, contact Patric McCoy at U.S. EPA's Region 5 office in Chicago at (312) 886-6869, E-mail: mccoy.patric@epa.gov; and regarding federally permitted release questions, contact Ginny Phillips, Office of Regulatory Enforcement, Toxics and Pesticides Enforcement Division at (202) 564-6139,Email: phillips.ginny@epa.gov.

EPCRA Reporting Requirements for Flaring Incidents

EPCRA Section 304 requires that unpermitted releases of extremely hazardous substances in excess of their reportable quantity be reported immediately to the State Emergency Response Commission and Local Emergency Planning Committee.The flaring of hydrogen sulfide may require reporting if more than 500 pounds (the reportable quantity) of SO_2 are released within a 24-hour period. The Clean Air Act recognizes that accidents, malfunctions, start ups and shut downs may cause excess emissions even when the facility has implemented reasonable measures to avoid them. However, it is still important to alert emergency response personnel when these releases occur, as even short periods of flaring can emit large quantities of SO_2. For example, a medium-sized refinery with an SRP that processes 500 tons of acid gas each day could release as much as 40 tons of SO_2 at the flare in only one hour, more than 150 times the reportable quantity.

Useful Compliance Assistance Resources

CAA Applicability Determination Index:
http://www.epa.gov/oeca/eptdd/adi.html

Technology Transfer Network
http://www.epa.gov/ttn/

Office of Regulatory Enforcement:
http://www.epa.gov/oeca/ore/

RCRA Online:
http://www.epa.gov/rcraonline/

Compliance Assistance Centers:
http://www.epa.gov/oeca/mfcac.html

Audit Policy Information:
http://www.epa.gov/oeca/ore/apolguid.html

Small Business Gateway:
http://www.epa.gov/smallbusiness/