TEXAS CHEMICAL COUNCIL

TEXAS OIL & GAS ASSOCIATION

May 8, 2009

Ms. Lindley Anderson
MC 206
Air Quality Division
Chief Engineer's Office
Texas Commission on Environmental Quality
PO Box 13087
Austin, Texas 78711-3087

RE: **Flare Taskforce: Informal Comment Submittal**

Dear Ms. Anderson:

Texas Chemical Council (TCC) and Texas Oil and Gas Association (TXOGA) appreciate the opportunity to provide comments on issues raised by the agency's industrial flare task force. Our organizations are working together to prepare more detailed comments which will be available to the agency in the near future.

TCC is a statewide trade association representing 77 chemical manufacturers with more than 200 Texas facilities. The Texas chemical industry has invested more than $50 billion in physical assets in the state and pays over $1 billion annually in state and local taxes. TCC's members provide approximately 70,000 jobs and over 400,000 indirect jobs to Texans across the state. TCC member companies manufacture products that improve the quality of life for all Americans. Chemical products are the state's largest export with over $30 billion each year.

TXOGA, the largest and oldest oil and gas association in Texas, represents 4,000 members of the oil and gas industry. The membership of TXOGA produces in excess of 90 percent of Texas' crude oil and natural gas, operates some 95 percent of the state's refining capacity, and is responsible for a vast majority of the state's pipeline mileage. The oil and gas industry employs 189,000 Texans, providing payroll and benefits of over $22 billion in the most recent data. In addition, large associated capital investments by the oil and gas industry generate significant secondary economic benefits for Texas.

The work of the agency's flare task force is of significant interest to our membership. We respectfully request your careful and thoughtful consideration of our suggestions. If you have any questions on these informal comments, please contact:

For TCC: Mike McMullen at (512) 646-6404 or Susan Moore at (832) 474 4118.
For TXOGA: Deb Hastings at (512) 478 6631 or James Murray at (281) 834 0154.

Sincerely,

Mike McMullen, TCC

Deb Hastings, TXOGA

An Overview of Texas Chemical Council's (TCC) and Texas Oil & Gas Association's (TXOGA)
Pending Detailed Comments on
Industrial Flares

Background

There are over 1000 flares in Texas according to Texas Commission on Environmental Quality. Many of these flares are used at industrial facilities to combust flammable, toxic, or corrosive vapors to less objectionable compounds. (*API 521 paragraph 6.4.1*). Flares are first and foremost safety devices designed to protect people and equipment. Such use of flares should not be discouraged through regulation. Typical flow to flare systems include: emergency (*pressure relief flows and emergency depressurization*), episodic (*venting required for maintenance or regeneration and de-inventorying for shutdown and/or startup operations*), and continuous flows (*sweep gas through flare system piping, process venting of analyzer flows, gas seals, certain types of pressure control, and PRV leakage*).

At its Flare Task Force Stakeholder Group meetings on March 30 and April 2, 2009, the Texas Commission on Environmental Quality expressed a strong interest in additional review of industrial flares for a number of reasons including:

1. A belief that flare emissions account for 60% of the highly reactive volatile organic compounds (HRVOC) reported in the Houston Galveston Brazoria special air emission inventory.
2. Flare emissions depend heavily on a flare's destruction efficiency which may vary depending on flame stability, operating conditions, flare tip size and design, the specific compounds being combusted, and gas composition.
3. Recent agency initiatives including the 2007 DIAL study in Texas City and use of the gas imaging infrared (IR) camera to conduct fence-line flare monitoring raised additional questions that might be addressed with further study.

The agency indicated tentative topics for evaluation include flare performance, flare monitoring issues, and alternative emission control; Texas Chemical Council (TCC) and Texas Oil and Gas Association (TXOGA) are pleased to offer a summary of our pending, detailed comments on these topics.

Section 1: Flare Performance

Issue:

Flare performance may be impacted by many variables including meteorology, waste gas stream flow rate and composition, operational practices dealing with steam, air and natural gas assist rates, and flare tip design. These numerous variables all play a role in ensuring adequate flare performance.

Discussion:

TCC and TXOGA believe most flares operate efficiently. The main indicator of efficient performance is a stable flare flame.

The challenge for the regulated community and for the agency is to establish a clear understanding of proper flare operation and design. This would include understanding flare efficiency from at least two aspects--1) Destruction Rate Efficiency (DRE), which measures the efficiency of the chemical destruction of the original combustible components in the flow to the flares and 2) Flare Combustion Efficiency (FCE), which measures the efficiency in completing combustion of the original combustible components in the flow to the flares. The difference between DRE and FCE is that in DRE the chemical destruction of the original components in the flow to the flares will measure whether a given component (e.g., ethylene) is completely destroyed. This destruction may, however, be accomplished by producing intermediate combustion products. In FCE, the measurement is only whether the given component (e.g., ethylene) is completely converted to CO2 and H2O.

Flare efficiency may be adversely affected by crosswinds, according to some studies in the scientific literature. Many of the studies are on small flares (< 12 inches) in wind tunnels. These types of tests are not broadly applicable to general flaring conditions in petrochemical plants where scale-up to actual conditions is difficult, if not impossible. In addition, some studies suggest that certain compositions are less affected by crosswinds. However, available data are not sufficiently comprehensive to make these conclusions for actual operating flares.

Some compounds and mixtures can be flared at higher velocities than others. If pressure assist is available, most gases can be flared at sonic velocities with no steam or air assist needed. For specific compounds and mixtures, flare designers have enough experience to design for the appropriate exit velocity range for a given mixture and flare tip design.

Tests have established that stable flare flames can be achieved resulting in efficient performance over a wide range of steam-to-fuel ratios. Steam assist rates needed for efficient performance have a wide range of effectiveness depending on the flare tip design and size, flare gas composition, available steam pressure, and steam addition system variations. Tests suggest that steam-to-fuel ratios above the smoke point and below the snuffing point result in efficient operation. A similar variation in air rates for an air assisted flare is possible. Strict adherence or control to a tight steam-to-fuel ratio is not needed as long as operation above the "smoke point" and below the "snuff point" for a specific flare system is maintained. *This operating range is most times wider than the vendor recommended range for ideal operation.*

Path Forward:

Given the large number of variables that can impact flare performance and the uniqueness of each site's equipment, a case-by-case methodology is needed to assess flare efficiency. The scale up of smaller flare test work to full scale operating flares is a problem yet to be resolved.

TCC encourages the development of a method that is capable of determining the operating window or envelope for efficient operation. It should be sensitive enough to (1) identify performance at low flows and at low and high steam-to-fuel ratios and (2) determine if crosswinds result in inefficient performance while, at the same time, understanding if mitigating measures are successful in maintaining efficient operation. Ideally the technique would utilize a remote sensing tool that could establish the operating window of efficient flare performance for any specific flare installation. We envision use of this device as analogous to a compliance test that is done on a periodic, rather than continuous basis.
Furthermore, the effects of composition and flare tip design relative to the effects of crosswinds on flare performance may warrant additional study.

Section 2: Flare Monitoring

Issue

The agency indicated in recent stakeholder meetings a desire to better understand the adequacy of existing monitoring requirements *(in particular, flare gas flow rates, net heating value, and other parameters)* and whether or not existing steam/air assist flares are adequately monitored and "maintained within manufacturer's design ranges".

Discussion

Flares are used for emergency, episodic, and continuous flows as described in the background section of this summary. The flow and composition of the stream to a flare can be highly variable, especially if the flare handles both routine and non-routine releases. In addition, flare flow and composition can vary considerably if streams are collected from multiple units and sent to the same flare. When a flare handles routine process flows as well as emergency relief flows, the flow rate may vary from a few hundred pounds per hour to several hundred thousand pounds per hour, and the flare stream could be a chemical mixture of only a relatively small number or compounds or one of potentially a hundred or more compounds.

The wide range in both the flow and the potential chemical composition leads to inherent flare monitoring challenges. Based on industries' experience in the HRVOC monitoring program, identifying a flow meter that can accurately measure the flow over such a potentially broad range of VOCs is difficult at best. A flow meter with a very broad range has a higher degree of accuracy at one end of the spectrum when compared to the other end of the spectrum. To accurately measure flare flow, this technical challenge must be overcome in a reliable and cost-effective manner.

Analyzing the flare stream composition also presents technical challenges. The time required for a Gas Chromatograph (GC) analysis increases as the number of chemical components in the stream increases. For example, the PAMS GC that TCEQ and industry use at certain ambient air monitoring sites analyze for 55 compounds and generate one data point per hour. The GC used for the HRVOC monitoring is configured to identify five compounds and is capable of generating the required data point every 15 minutes. The need for complete compositional data should be weighed against the objectives of the monitoring program because the complexity of the analysis increases dramatically with increasing requirements for additional component review. Consideration should be given to the merits of measuring other stream characteristics to provide similar flare efficiency information. For example, direct measurement of heat content can provide data to support determination of the flare's operating efficiency.

Path Forward:

The wide range in both the flow and the potential chemical composition leads to inherent flare monitoring challenges. To accurately measure flare flow over a wide range, improvements in existing flow measurement technologies are necessary. This technical challenge must be overcome in a reliable and cost-effective manner. Additional studies on analyzers, flow instruments, or computer software could lead to improvements in technologies for flow measurement.

Continuous gas composition analysis of complex chemical mixtures is neither cost-effective nor efficient. Consideration should be given to the merits of measuring other stream characteristics to provide similar flare efficiency information. For example, direct measurement of heat content can provide data to support determination of the flare's operating efficiency.

Steam assist and air assist rates needed for efficient performance have a wide range of effectiveness that is influenced by flare tip design and size, flare gas composition, and other site-specific system variations. Any regulatory schemes that might be deemed necessary should provide the flexibility to achieve program goals in a manner best suited for each operation. For example, some air assist flares may stage the air flow with multiple flow settings using a multiple air fan speed control, variable frequency fan speed control or multi-fans, louvers, etc. Other plants, for example, may not have high pressure utility air systems available for this service.

Additional work is needed to better define proper flare operation considering the complexity of this issue prior to moving-forward with additional regulatory monitoring proposals. After completion of such work, the level of detail needed in crafting such language should consider both the variability of flow and composition and the number of data points required to ensure a cost-effective monitoring program. If rulemaking is deemed necessary, it should follow closely existing requirements in 30 TAC 115.725.

Section 3: Alternatives to Flaring

A. Alternative Control Devices

Issue

The agency indicates a desire to evaluate alternative control devices.

Discussion

The majority of the present flare installations utilize an open flame concept. Flares come in various configurations, from ground or fenced flares, elevated flares, marine and boom flares, pit flares, flares utilizing assisting media, etc. The use of a particular design is dictated by specific disposal requirements for each installation as well as site specific conditions. Very rarely is the decision on use of a particular type of flare based on cost considerations only.

Three types of alternative control devices might be evaluated as an alternative to flares. These include:

- Installation of flare gas recovery systems
- Utilization of vapor combustors/thermal combustors
- Utilization of staged flares

Each of these devices has advantages and disadvantages which are discussed in more detail in the following table.

Control Device	Advantage	Disadvantage
Flare Gas Recovery	-Reduces the overall emissions, including NO_x -Reduces purchased gas requirements for facility and/or recovered gas could increase product volumes from facility. -Extends flare tip life and flare reliability and availability rates -Reduces the assisting media requirements, such as assisting gas, steam and power for air assisting flare. -Reduces the impact to the community by decreasing the effects of radiation, smoke, noise, and flame visibility.	-Could be utilized only if suitable user of recovered gas is found. -Recovery gas may not be suitable due its nature, such as: low BTU content, high content of inert gases, corrosive, toxic, high composition variation, presence of contaminants, etc. -Unable to handle high volumes -Siting constraints -High upfront capital investment -Increases complexity of the installation requiring provisions for a safe transition from gas recovery mode to emergency flaring and back -Purge gas to a stand-by emergency flare must be used to prevent air egress into flare stack
Vapor Combustor/Thermal Oxidizer	-Achieves the highest possible DRE and provides reliable destruction efficiency regardless of the gas composition or weather conditions -Superior monitoring and compliance testing ability -Reduction in overall emissions -Reduced fuel cost by employing the waste heat recovery -Less noise, hidden flame, and lower radiation -Eliminate need for use of assisting media -Eliminate CO emissions from combustion process and incoming flare gas by effective control of combustor temperature. -Post combustion flue gas treatment with use of scrubbers further reduces overall emission rates (acid components, particulates, etc.) -NO_x emissions can be reduced by employing Low NO_x technologies such a use of Low NO_x burners, Ammonia or Urea injection (NSCR) into the combustion chamber or utilizing flue gas treatment via use of SCR. -Better reliability and availability than in open flame flares.	-Increased NOx emissions if one of available NOx control technologies is not implemented. -Inability to handle high volume of flare gas due to combustor size limitations. -Increased complexity of installation when employed in combination with large open flame flare. -Siting constraints. -Cost of system. -High maintenance and operating costs.

Staged Flares	-Separates low flow from high flow. -Allows each flare to be designed and operated at the optimum combustion conditions resulting in higher destruction efficiency and lower overall emissions. -Can be added to existing flare systems, conditional to space availability, without compromising the safety function of the flare system. -If the system is based on use of ground flare then use of assisting media would not be required. -Increases the flare system reliability and availability.	-Siting constraints. -More complex controls. -More costly and difficult maintenance due to limited access to flares or flare stages. -Cost of system.

Path Forward:

No one particular control device is best suited for all petrochemical applications. Flexibility to evaluate site specific conditions should be considered. Flare minimization efforts should go hand-in-hand with evaluations of alternative devices.

It is doubtful that flares can be eliminated entirely. The potential for very large, emergency releases will continue to play a decisive factor in the use of emergency flares as essential safety devices into the future.

B. Flare Minimization Plans

Issue

The agency hopes to evaluate the benefit and possible options for flare minimization plans.

Discussion

Many petrochemical plants already have flare minimization plans in place as a best management practice. A typical plan might include:

- A discussion of planned and unplanned flaring events
- Procedures to minimize hydrocarbon flaring including, for example, mechanical reliability programs and/or event management programs
- Procedures to minimize emissions during planned shutdown (depressure) of process units or equipment
- Procedures to minimize emissions during startup (pressurization) of process units or equipment

Development of such a plan might benefit a plant by providing a review of flaring causes and a subsequent analysis of potential measures to reduce emissions from planned events.

Path Forward

Consider incentives to encourage sites to develop a flare minimization plan as a best practice. Allow any flare emission reductions achieved by implementing best management practices or other similar programs to generate emission credits that can be traded or otherwise used by the site.

C. Other alternative strategies

Issue:

The agency might consider additional research to develop alternative strategies that may result in emission reductions from flares

Discussion:

The agency might support efforts to improve design and test methods including consideration for the following:

- Improvements of the existing technologies for flow measurement. This could include analyzers, flow instruments, and computer software.
- IR Camera and DIAL side-by-side study to review flare destruction efficiencies building on the Texas Commission on Environmental Quality's remote sensing work performed in 2003.
- Flare tip design to achieve better mixing, higher destruction rates, minimize use of assisting media, reduce flame radiation rates, and flare noise.
- Improved reliability of the flare pilot and flare tip
- Improved pilot and flare tip flame detection systems.

Path Forward:

Seek grants to conduct additional research in these areas.