Refinery Flaring in the Neighborhood

Routine flaring in the San Francisco Bay Area, the need for new regulation and better environmental law enforcement, and the community campaign to get there

A CBE Report
Communities for a Better Environment, Spring 2004

Acknowledgements:

CBE members deserve major recognition for carrying out the campaign described within, through their diligent and effective efforts to win environmental justice improvements in their communities around oil refineries.

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Appendix: Data, Studies On Flare Efficiency, How Flare Chemistry Works, How To Monitor Flares, & More

Frequently during flaring and other refinery releases my eyes become red and itchy, and I have respiratory irritation. When I leave the area, my symptoms go away.   Flaring can put out tons per day of chemicals that can affect our health.

— Allison Vogel,
Refinery Neighbor, Crockett

I am a community advocate and I see many people in my neighborhood who have asthma. We need to clean up refinery air pollution like flaring to protect our health.

— Belen Ramirez-Rocha,
Refinery neighbor, Bayo Vista

Executive Summary

Oil refinery flares were designed to be used in true emergencies to burn "excess" gases. However flares pollute by the ton routinely in the San Francisco Bay Area, can cause pollution hot spots that threaten people's health in fence line communities, and contribute significantly to regional smog. Refiners can prevent routine flaring by recycling flare gases for fuel in the refinery (using added compressors) and by fixing repeated malfunctions that cause flaring. Some have done this already. The US EPA found that repeated or regularly occurring flaring events cannot be classified as emergency malfunctions, and may be illegal under the Clean Air Act. Recent data has made it clear that non-emergency flaring commonly occurs in the Bay Area.

Refinery Flaring in the Neighborhood documents the extent of flaring pollution in the Bay Area, identifies solutions, and calls communities to action to clean up individual refineries and establish model policies. In summary:

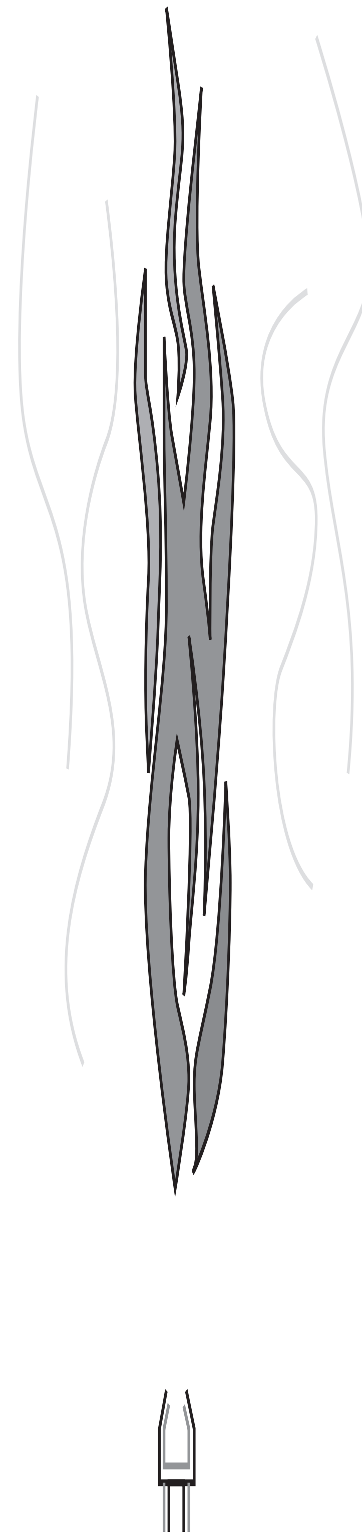
- **Flaring emissions can cause toxic hotspots and are consistent with neighbors' complaints of breathing and eye irritation** (Emissions include not only hydrocarbon emissions, but also sulfur oxides, nitrogen oxides, carbon monoxide, carbon dioxide, particulate matter, and potentially dioxins and heavy metals).
- **Oil refinery flare emissions are much larger than expected.** After a 2002 investigation, the Bay Area Air Quality Management District (BAAQMD) found flare emissions hundreds of times higher than the 0.1 tons/day previously estimated (and found higher emissions from other refinery sources as well).
- **Combustion efficiency in flares can be poor**, so emissions could be even higher and inappropriate exemptions for methane gas also cause emissions underestimations.
- **Readily available flare gas monitoring should be required** by regulatory agencies since some refineries have minimal measuring in place.
- **Routine, non-emergency flaring in the Bay Area is common and may be illegal** – Refinery flares were also found through the BAAQMD audit to be routinely used as gas disposal systems.
- **Most routine flaring is preventable, and eliminating unnecessary flaring can cut regional smog and local toxics.** Flaring prevention could cut local sulfur oxide emissions by almost 30 tons per day, and smog-forming chemicals by up to hundreds of tons per day in the San Francisco Bay Area and in California's Central Valley (which is severely impacted by Bay Area air pollution).

Recommendation: The Bay Area and other regions should adopt a new regulation banning unnecessary flaring, and provide more enforcement of existing flare regulations.

Chapter One

The Trouble With Refinery Flaring

Introduction



For decades neighbors have complained about oil refinery flaring as well as other releases, fires, and explosions, especially when the neighbors experienced breathing problems, eye irritation, nausea, and many other health impacts. But according to the oil industry, flaring is for safety, and emissions are small. The industry claims that burning gases is preferable to other options like dumping gases directly to the atmosphere. But many neighbors believe alternatives are feasible and especially distrust the huge mid-night flaring events.

To get better emissions data, in the mid 1980s, CBE successfully petitioned the state to do source testing for flaring. The resultant tests showed large emissions from flares. However, no action for controlling flaring emissions followed. Later, CBE won a commitment for adoption of a flare regulation in the Bay Area 1991 Clean Air Plan but the Bay Area Air Quality Management District never began work to carry out this commitment.

Finally in 2001, with increasing pressure from the community, the Air District agreed to do a serious study of flaring emissions, and published a draft report finding Bay Area flare emissions 200 times higher than previously believed. As a result CBE was able to win one of the only regulations in the country requiring measuring gases inside the flare, and videotaping flaring events. The next step is the adoption of a regulation eliminating unnecessary flaring. The Air District is now under great pressure to lower its flare emissions estimate, and oil industry officials have strongly opposed going forward with adoption of a regulation controlling flare emissions.

Oil refineries are inherently dirty, but CBE research finds that in the short-term their operations could be required to drastically reduce unnecessarily sloppy, wasteful, and toxic emissions. Smaller businesses with less influence would rarely be allowed to belch out the huge masses of toxic chemicals on neighbors on a regular basis, when prevention is readily available.

Neighbors are no longer willing to wait for real action to clean up the mess. This report documents not only huge emissions, potential health impacts, and prevention measures, but also repeated and unnecessary flaring events which may be illegal. The community campaign to win a strong Bay Area Clean Air Plan also includes a focused effort to control flaring once and for all, as well as other invisible refinery emissions (summarized in the Appendix).

Flaring Emissions Are Surpisingly Large

Refinery neighbors contended that frequent and large flaring events were occurring without much scrutiny, often at night. After an intensive CBE community-based campaign, the local Air District agreed to do a study. The ground-breaking results found huge volumes of gases routed to flares on a routine basis in the Bay Area (not just in emergencies as previously claimed). Before the study, the Air District had estimated flare emissions at only 0.1 tons/day. However, the draft study found 22 tons/day of hydrocarbons, and up to 27 tons/day of sulfur dioxide emissions:

	HYDROCARBONS	SULFUR DIOXIDE
CHEVRON/TEXACO- Richmond *260,000 barrels/day*	*Not included in Bay Area report because Chevron had no direct flare monitoring, and Air District was unable to confirm.*	**22.5 tons daily max** *(12/6/01)*
TESORO Avon *166,000 barrels/day*	**120 tons daily max** *(3/29/01)* (13 tons daily average[2])	**25 tons daily max** *(7/26/02)*
SHELL Martinez, *159,200 barrels/day*	**11 tons daily max** *(6/4/02)* (3 tons daily average)	**27 tons daily max** *(6/2/02)*
VALERO Benicia *144,000 barrels/day*	**40 tons daily max** *(6/3/02)* (2 tons daily average)	**13.5 tons daily max** *(6/7/02)*
CONOCO/Phillips Rodeo *77,000 barrels/day*	**134 tons daily max** *(7/10/02)* *(assumes 98% combustion efficiency— earlier estimate was 480-720 tons.)* (4 tons daily average)	**11 tons daily max** *(6/12 & 6/13/02)*
TOTAL	**22 tons/day average** *excluding Chevron, assuming 98% combustion efficiency*	(No total available)

IMPORTANT NOTE! The Air District has been put under extreme pressure by industry to drastically reduce these flare emissions estimates, based on shaky re-calculations. Re-calculations have not been finalized by the District as we go to press.

1 *Draft Technical Assessment Document: Further Study Measures, Flares*, December 2002, Alex Ezersky, Jim Karas, BAAQMD

2 Tesoro added compressors in early 2003, which caused a major reduction in flaring, reducing this number.

Flare Chemicals Have Known Health Impacts

HYDROCARBON GASES	**Can cause smog, and some hydrocarbons are very toxic** (such as leukemia-causing benzene). Ground-level ozone (smog) makes breathing difficult for sensitive individuals and normal adults.
PARTICULATE MATTER (Solid Particles)	**Particulates can cause breathing problems and increase death rates**. If a flare is smoking, particulates have formed.
PAHs (Polycyclic Aromatic Hydrocarbons)	**May cause cancer, reproductive harm, and have adverse impacts on ability to fight disease**. PAHs include compounds like anthracene and benzo(a)pyrene.
SOx (Sulfur Oxides)	**Can cause bad odors, breathing and eye irritation, induce asthma attacks**, and at higher levels, is acutely hazardous.
CO2 (Carbon Dioxide)	**Can cause global climate change**, including extreme weather, higher energy hurricanes, droughts, floods, wildfires, and rising sea levels.
CO (Carbon Monoxide)	**Can cause heart problems** - For persons with heart disease, low level exposure may cause chest pain and reduce ability to exercise.
NOx (Nitrogen Oxides)	**Can cause smog and breathing irritation**. NOx also reacts to cause toxic particulate formation and NOx in the air can substantially contribute to nitrogen pollution in water.

Other Potential Pollutants

DIOXINS form only when chlorine is present under special conditions – They are highly toxic, disrupt human & animal hormones, cause cancer, reproductive damage, and immune system damage.

HEAVY METALS – Trace levels are in crude oil going into refineries, but flare emissions are unknown. Heavy metals include lead, mercury (both neurotoxins), chromium (cancer-causing) and others.

According to a UCLA study [1]

Non-smoking refinery neighbors had worse lung function compared to people without refinery pollution in high smog areas. Impacts were even worse for children.

A USC study

Found that air pollution may actually cause asthma (and not just make it worse). [2]

A CBE health survey

Showed over 50% of the contacted households in a public housing facility next to a Bay Area refinery reporting at least one youth with asthma. Regarding this study, environmental health scientist Rachel Morello Frosch, Ph.D found:

"The KAEP [Kids Against Environmental Pollution/CBE] community survey shows reporting by community members of a high incidence of health problems. While the study is not a controlled study, the numbers people are reporting should raise questions and prompt further investigations. It indicates valid community concern about the health affects of refinery emissions and air pollution in Bayo Vista. Politicians and air management district officials need to address these concerns directly by requiring stricter emissions monitoring, forcing emission reduction efforts from large point sources in the area like the refineries, and developing an effective plan for reducing mobile source emissions. Public health officials need to better assess the short and long term health effects of this pollution on the Bayo Vista community."

1 American Journal of Public Health, 1991, "The UCLA population studies of CORD: X. A cohort study of changes in respiratory function associated with chronic exposure to SOx, NOx, and hydrocarbons," R Detels, et al, UCLA http://www.ajph.org/cgi/content/abstract/81/3/350
2 USC & CARB (California Air Resources Board) Childrens Health Study beginning 1991 & ongoing
3 State of the Neighborhood: Bayo Vista Youth Health Survey,CBE (Kids Against Environmental Pollution

Video Monitoring by Refinery Neighbor Documents Huge, Smoking Flaring Event

During a public hearing on flaring in 2002, long-time Chevron Richmond refinery neighbor Ethel Dotson challenged the refineries and the Air District to give her a video camera to document flaring, smoke, and visual evidence of the pollution regularly experienced by community members.

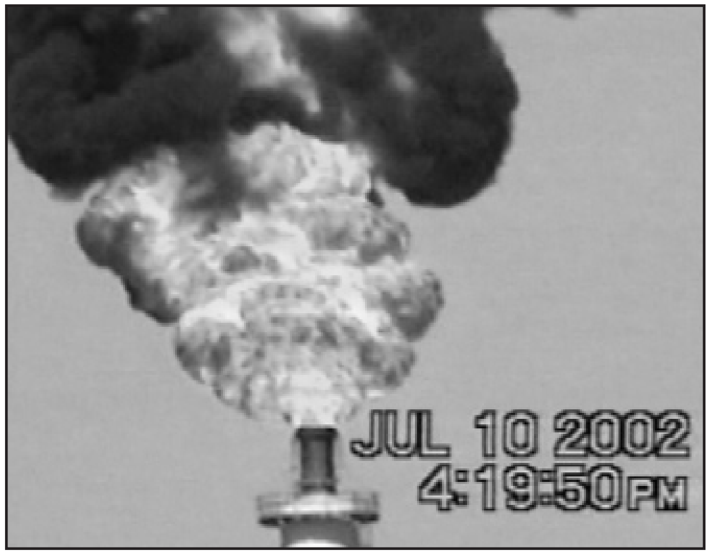
CBE urged the Air District to take this challenge seriously, since community-based monitoring can document the problems happening right under people's noses. Former Air District CEO William Norton responded almost immediately with an offer to lend an Air District camera to CBE and Ms. Dotson. This was a welcome and new approach by the District compared to previously poor relations between the community and the Air District.

Soon after, (July 10,2002), Ms. Dotson witnessed a huge cloud of flare smoke & fire near the Conoco-Phillips Rodeo refinery and started video-taping. She called CBE, and CBE called the Air District, who told us that there was a brush fire going on. This was emphatically refuted by Ms. Dotson, who informed us that she could see it was no brush fire.

Next we heard the siren go off. The Air District was finally told by the refinery what was happening. They let CBE know in a subsequent call that a complete power outage had caused the entire refinery's fuel gas to be routed to the flares, overwhelming it. Later in this report, we identify power outage as a repeated cause of flaring.

This event demonstrated video monitoring's usefulness for documenting what neighbors are experiencing. After Ms. Dotsen submitted her footage to the Air District, District staff told us that it was the best flaring footage they had. Seeing is believing that this event put out huge volumes of particulate matter and air pollution.

The huge cloud of visible particulate matter pollution from the July 10, 2002 Phillips Rodeo refinery flaring event can be seen near the Bayo Vista public housing. People near the refinery complained of red burning eyes and nausea. Invisible gaseous emissions are present as well including hydrocarbons, nitrogen oxides, carbon monoxide, and sulfur oxides. Heavy metals and dioxins may potentially be released.



After repeated flaring, CBE's community-based campaign won a Landmark Flare Monitoring Regulation!

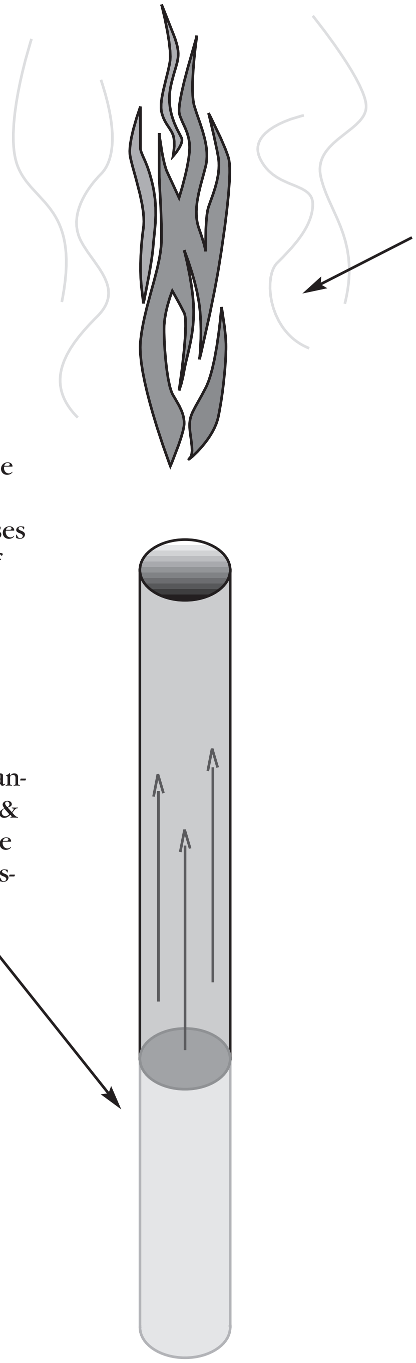
In June 2003, the Bay Area Air District adopted one of the only regulations in the country requiring monitoring (direct measurement) of flare gases, after an intensive community-based campaign. CBE members and other community members turned out for many public hearings to testify about their health problems and refinery flaring. CBE also took part in intensive Air District technical working group meetings and was able to push the rule language to a much stronger form. The resulting monitoring regulation adopted was a very important step forward. Because many pollution sources never get measured, their emissions remain uncertain, and regulations controlling these emissions never get adopted. Therefore the new monitoring rule is key, but the most important next step is adoption of regulations controlling flaring.

1

The New Rule Requires Measuring Gases Inside The Flare.

A) Gas Volume flowing inside the Flare is Measured: By measuring the velocity of gases and knowing the diameter of the flare header, the volume can be determined.

B) Concentrations of Chemicals in the Flare are Measured: Either a sample canister of flare gas is extracted & analyzed in a lab, or else more continuous & automatic measuring systems are used.



2

The Pounds Of Pollutants Coming Out Of The Flare Are Estimated:

Since it is very difficult to measure the mass of gaseous chemicals coming out of a huge and elevated flame in the atmosphere, the total pounds of flare emissions are estimated by determining the pounds of hydrocarbons inside the flare, and then multiplying by an estimated flame destruction efficiency.

The refineries generally assume at least a 98% hydrocarbon destruction efficiency in the flame, leaving only 2% or fewer hydrocarbons surviving to be emitted to the air. The other 98% of the hydrocarbons turn into CO_2 & H_2O. (Some studies show that destruction efficiency can go far lower, meaning that emissions of hydrocarbons escaping to the atmosphere are actually much higher than estimated.) Sulfur compounds (such as H_2S) don't get destroyed in the flame, they just turn into other sulfur compounds (like SO_2).

There are some more complex methods for measuring flare pollution in the open atmosphere, which would allow us to avoid relying on estimations of flare destruction efficiency. See the Appendix.

The new flare rule also requires for the first time we know of, that flaring be videotaped!

Community members won this innovative addition to the rule. Videotaping allows a visual record that mirrors what community members see. One important provision we did not win was a requirement to put the video result on the web. This would allow Air District officials to look at a website to see what's going on at the refinery instantly when community members call in a complaint about flaring. The Air District promised to reconsider video webcasting in the future. This would help prevent recurrence of past problems (where community members called in complaints and were told that nothing was happening at the refinery).

Is Flaring Legal, Can It Be Prevented?

US EPA found in general:

"Frequent, Routine Flaring May Cause Excessive, Uncontrolled Sulfur Dioxide Releases, Practice Not Considered 'Good Pollution Control Practice,' May Violate Clean Air Act," [1]

" . . . 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.

"**Good pollution control practices include:**

- Procedures to diagnose and prevent malfunctions; and
- Adequate capacity at the back end of the refinery to process acid gas."

The EPA statement above from an Enforcment Alert sums it up – routine flaring is frequent, unnecessary, and may violate the law. While most regional agencies around the country have few or no regulations controlling flaring, there are some important existing laws and regulations, including EPA's requirements that refineries use good pollution practices, instead of routinely dumping refinery gases to flares. Other rules include the Bay Area's seldom-enforced miscellaneous operations rule which limits unregulated sources to 15 lbs/day, and other rules limiting flare smoking and requiring that energy content (BTU content) be high enough not to cause poor combustion. Still others limit concentrations of hydrogen sulfide gas (H2S) inside the flare so that when the H2S is burned in the flare, the resulting noxious emissions of sulfur oxides are limited.

These existing rules need much better enforcement, and furthermore *we need new regulations adopted which go further than existing rules* since flaring is clearly a large, frequently unnecessary, and previously ignored pollution source. This chapter identifies categories of flaring which appear to violate EPA and Bay Area Air District requirements, and shows that the refineries can reduce flaring when they want to. We also reviewed refinery data and trends in flaring over the last three years. (*Also see Appendix for more detailed data.*)

1 EPA Enforcement Alert, Vol. 3, Number 9, October 2000, (Attached to Appendix)

In the Bay Area, evidence from refineries' own reports show:

EPA's Good Pollution Control Practices Appear To Be Routinely Violated

CBE found routine flaring from repeated preventable conditions (refinery monthly flaring reports to the BAAQMD, 2001-2002):

- **Repeated Equipment Breakdowns & Upsets**
  - — Chevron: Frequent compressor breakdowns
  - — Conoco & Tesoro: Repeated hydrogen-related upsets
  - — Valero: Had repeat problems with alkylation-related systems, but did not provide information on root causes of hundreds of flaring events.
- **Power Failures for All Refineries**
- **Start-Up & Shutdown For All Refineries**
- **Lack Of Compressor & Other Capacity** for handling normal daily production of gases (Vapors)
  - — Tesoro: Flaring was listed every day of the review period of 2001 to 2002. Frequently "No Cause" was listed, and "Missing Lab Data." Early in 2003, Tesoro added compressors, and flaring dropped dramatically.
  - — Shell: The flexigas flare flares continuously, because of: "Excess treated flexigas that cannot be combusted in refinery heaters."❋

Federal Clean Air Act Hydrogen Sulfide Limits Appear To Be Routinely Exceeded

Dozens of Bay Area flaring events exceeded the concentration limit for Hydrogen Sulfide (H2S) gas inside the flare (160 parts per million), in 2001-2002.

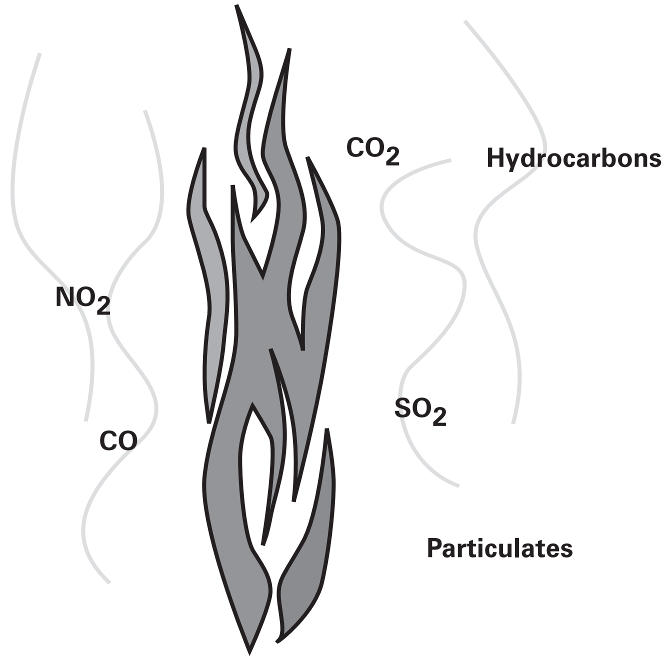
Bay Area Misc. Operations 15/Day Limit Routinely Exceeded

Dozens of Bay Area flaring events exceeded the 15 Lb/day emission limit & 300 ppm non-methane hydrocarbon concentration limit (Regulation 8 Rule 2), in 2001-2002.

❋ Flexigas is a low BTU gas (low energy) which can't be used in normal furnaces. Shell has at least one special furnace (much bigger than normal) that can burn this gas. Such furnaces are expensive but if more were installed plus a compressor, flexigas flaring could be prevented and flexigas recycled.

Refineries can capture and recycle gases instead of flaring. I've testified at many hearings asking that this be required.

— Edgar Ary,
Bayo Vista Refinery Neighbor, CBE

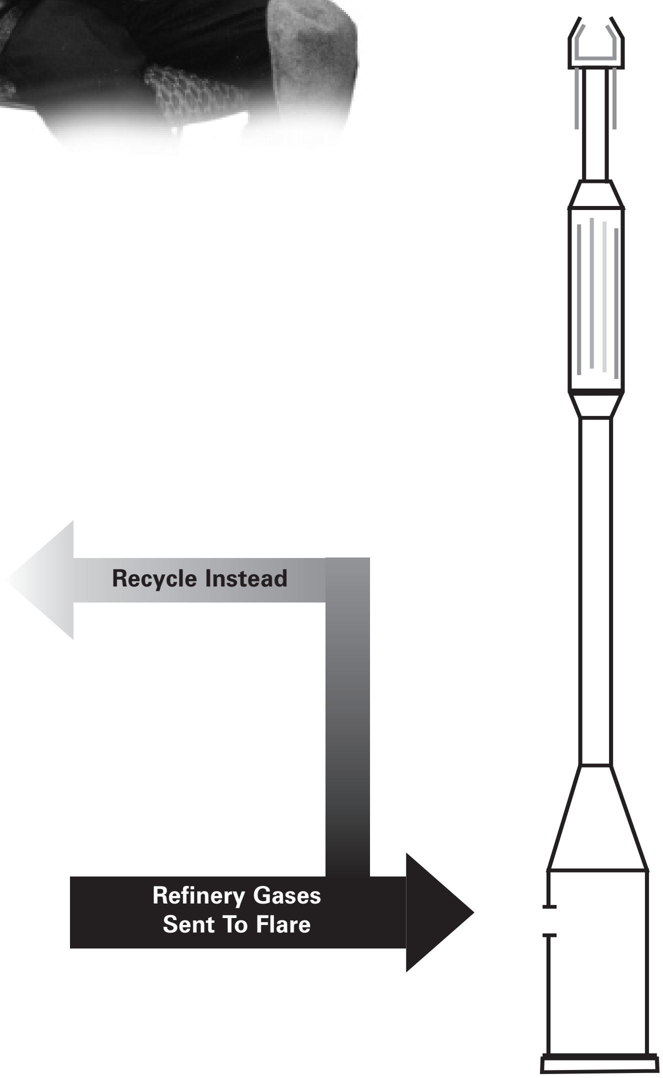


1

Routine daily flaring can be prevented by adding compressors to recycle gases to use as fuel in the refinery

2

Repeated unplanned shutdowns causing flaring can be prevented by performing a root cause analysis of the accident and permanently fixing malfunctions



Existing Rules Aren't Enforced and Have Loopholes: We Need New Rules

A new rule is long overdue and needed to make it clear that routine, preventable, and unnecessary flaring will no longer be tolerated. Neighbors are fighting to win this regulation. (See next chapter.)

Ban Routine Flaring:

Bay Area Air District (and other regions) should adopt a regulation to ban flaring except for true emergencies.

- The definition of emergencies will not include repeated or regularly occurring incidents, and will be consistent with this EPA language: *"Repeated or regularly occurring incidents of flaring can be anticipated and should not be classified as malfunctions." (EPA Enforcement Alert, Vol. 3, Number 9, October 2000)*

A root cause analysis will be required for all flaring, and repeated or regularly occurring incidents which can be anticipated and that therefore can't legitimately be classified as unpreventable malfunctions will be considered a violation. The root cause of such flaring must be corrected.

An audit will be required to determine whether there is sufficient compressor capacity,❋ and available backup systems to eliminate routine, unnecessary flaring. This would include backup systems to prevent repeated power failure and other repeated failures. If the audit finds that these systems are not in place, the regulation will require that they be put in place.

Methods for eliminating or minimizing flaring during planned startup/shutdowns will be identified & required (including storing gases & depressurizing vessels more slowly so as not to overwhelm gas recovery systems).

"In 2002 my neighbors and I could see and hear almost constant flaring from the Chevron refinery . In 2003 after all the press & public outcry, we rarely saw flaring. Since Chevron seems able to reduce flaring when they want to, why can't we adopt a regulation requiring this so they aren't allowed to slip back to business as usual later?"

— Shirley Butt, Richmond Environmental Defense

❋ Compressors are used to reduce the volume of refinery gases so they can be stored and re-used as fuel, instead of being dumped to the flare.

Chapter Three

An Effective Clean Air Campaign

"I'm involved in the Clean Air Campaign because of my health and my community. Our CBE youth project did a formal survey❋ in our neighborhood. We found over 50% of the households in Bayo Vista on the refinery fenceline reporting at least one person with asthma. We need to clean up air pollution."

— Lucia Flores, Bayo Vista

CBE has won clean up of pollution in Northern and Southern California for decades. One of our latest efforts has been a campaign to win a strong Clean Air Plan for the Bay Area. The Bay Area Air Quality Management District Ozone Attainment Plan (previously called the "Clean Air Plan") is supposed to include enough pollution reductions to bring the Bay Area into compliance with federal smog standards. A good plan will not only do that, but also clean up pollution in local neighborhoods. Since EPA rejected the Bay Area's 1999 plan after it failed and after a CBE lawsuit, the Air District was required in 2001 to go back to the drawing board and come up with a new plan. Community members have the right to intervene, and if necessary, to sue to win a strong plan.

CBE had been collecting technical data for decades on unregulated refinery pollution sources and prevention measures, our members wanted refinery pollution cleaned up, and we had strong legal handles to protect community rights. We decided to work to win a strong Bay Area Clean Air Plan. While CBE focused on the refineries , we brought together a coalition of other groups as well who have been working to win cleanup of other industrial and mobile pollution sources in the Bay Area. CBE members living near power plants in San Francisco also took part in the process, advocating for Power Plant cleanup.

So far, our campaign has won new regulations, new public processes, acknowledgement that refinery air pollution is much higher than previously believed, and that control measures are available. This chapter describes our campaign, & lists resources you could use to set up your own campaign.

❋ State of the Neighborhood: Bayo Vista Youth Health Survey,CBE

"Most people where I live are fighting for economic survival, and then we have to deal with refinery pollution too. We know there are solutions for clean up and we're not giving up until we get them."

— Maria Brown, Refinery neighbor, Bayo Vista

Protesters, barred from entry into a public hearing on the 2001 Clean Air Plan, push their way in. Photo used by permission from the Contra Costa Times, 7/19/2001 ("a chance to clear the air") Photographer Karl Mondon/Times.

CBE's Bay Area 2001 Clean Air Plan Campaign

1999	Weak Clean Air Plan adopted by Bay Area Air District (despite objections)
Feb 2001	US EPA rejects the Plan and requires the Air District to develop a new 2001 plan. EPA cites measures identified by CBE in our EPA lawsuit as ways to make pollution reductions.
May-Nov 2001	CBE members take over Air District workshop to demand more community input to develop the plan after Air District repeatedly refused to take more time
	CBE documents emissions and pollution prevention measures for refinery, power plant, transportation, and other air pollution problems, and documents violations of health standards.
	Air District develops various new drafts of weak Clean Air Plan
	A hundred CBE members and coalition partners protest the plan at public hearings (amid extensive media coverage) and eloquently describe the devastation from asthma and air pollution they experience.
	State Air Resources Board rejects the plan as a result, and criticizes the BAAQMD public process for insufficient community input.
	Air District agrees to hold community meetings on the plan in response to community outcry.
	The Air District adds control measures to the plan and "refinery further study measures" on sources CBE identified (flares, wastewater ponds, tanks, pressure relief devices, and more), but the plan still doesn't include enough reductions.
	State Air Resources Board approves the Plan on condition that the local Air District add 26 more tons of reductions.
	CBE files lawsuits on the plan which (although improved) violates state and federal laws.

2002	CBE is invited to join Air District technical working group on "refinery further studies." Phillips 66 has level 3 (major) Flaring incident, with Shelter-in-Place. Many other flaring events continue on a frequent basis at the other refineries. CBE community members launch post card drive to clean up refineries and speak out at Air District Flare workshop.
2003	Air District staff reports to Board that flare emissions are 200 times higher than originally in inventory as a result of "refinery further studies." CBE members urge adoption of new regulations, and give flowers to Board and staff in recognition of progress. State Court Judge in CBE lawsuit orders Air District and Metropolitan Transportation Commission to cut hydrocarbons by 26 tons per day by developing a plan within 60 days in response to CBE and TRANSDEF lawsuit. (Case was appealed but recently settled in March 2004.) BAAQMD Board of Directors adopts landmark flare monitoring regulation which requires sophisticated gas measurement within the flare and videomonitoring of flaring. CBE community members turned out in numbers to urge this adoption. (June 4th, 2003)
2004	CBE members are fighting an ongoing battle to win adoption of controls on flare emissions. Such a regulation is due for consideration soon.

Flaring At Some Bay Area Refineries Has Gone Down Substantially Since CBE's Clean Air Campaign Started, and:

o The Air District brought in a community-friendly CEO and improved the public process, regularly hosting meetings in impacted neighborhoods and during evening hours.

o CBE won acknowledgement that refinery emissions from unregulated marine loading, wastewater ponds, and blowdown systems are far higher than previously believed, providing us with more leverage to win new regulations controlling those sources in the ongoing campaign

o In a favorable settlement of our Clean Air Plan lawsuit, the Air District agreed to do a rulemaking process to evaluate emissions and controls on these refinery sources and flares, and to bring the information to their Board of Directors in public hearings.

o Air District and other officials attended our "Toxic Tours" in polluted neighborhoods, and got to know neighbors.

CBE's 1-2-3 Punch for Social Justice

It seems uncommon for non-profits to use all three of these powerful tools together but we think more should try it. Some national groups are isolated from the grass-roots, and smaller grassroots groups do not always have access to scientists and lawyers.

CBE works to combine grassroots organizing, science, and the law. CBE has found that community-based action, detailed scientific documentation of pollution and solutions, and hard-hitting legal action are effective and flexible tools. Although courts aren't very amenable to community involvement, and jargonistic scientific proceedings are made for insiders, these tools are dynamite if the scientists and lawyers are working for the community.

And when the law is not on the community's side, grassroots pressure can win campaigns where lawyers and scientists hopelessly fail. Even if decision-makers ignore good science and legal duties, it's harder for them to ignore hundreds of neighbors confronting them. Public pressure is the real power. To build community power, recruiting skilled organizers to help can make a major difference in getting enough folks involved. Organizers can also help provide leadership training to develop community expertise for the long term.

The community knows what the local problems are first-hand and can eloquently describe them. Experts can help out. In the end, community members also need to decide when to skip bureaucratic processes that are going nowhere, and when to go straight for direct action.

1

Organizing

2

Science

3

and Law

Steps for Cleaning Up Flares in Your Town

(it works on most other problems too!)

Organize, Organize, Organize:

o Knock on people's doors to get your neighbors involved

o Hold a community meeting & form a group

o Create a plan of action with clear goals

Document the facts:

o People's experience of health impacts near refineries

o Visual documents (videotape & pictures of flaring)

o Gather emissions data, flaring dates, etc. (you can request information pursuant to Freedom of Information Act)

Find experts who believe in your cause to help:

o Organizers: Experienced organizers have special skills to bring folks together & provide you with needed training.

o Lawyers: They can identify any violations of the law, & protect your rights to participate in public processes.

o Scientists: They can evaluate data on industrial processes, health impacts of chemicals, pollution prevention, etc.

Invite the news to get your story out:

o Invite reporters (from TV, radio, & newspapers) to hearings, schedule press conferences, and/or send out press releases.

Meet with government decisionmakers:

o Let them know how important your issue is, ask if they will support your proposals, and hold them accountable.

Bring your neighbors out to testify:

o Push for new regulations through public hearings eliminating unnecessary flaring & requiring that emissions be measured.

Keep track of & evaluate your progress

United We Stand: Coalitions Can Strengthen Campaigns

The Birth of the EJACQ Coalition (Environmental Justice Air Quality Coalition)

CBE and the following organizations together formed an Environmental Justice coalition of groups fighting to protect air quality in the Bay Area, particularly in communities of color and low income neighborhoods overburdened by pollution problems. The group members are able to bring together their individual knowledge and expertise on each local pollution source, at the same time banding together to win a strong regional Clean Air Plan for the whole Bay Area. The coalition has also been key in winning meaningful processes for public participation, and has provided community presentations to public decisionmakers, including the Air District Board of Directors, through "Toxic Tours." These tours allowed many decisionmakers to see actual conditions in polluted neighborhoods, rather than relying on a three-minute public testimony at hearings located far from the neighborhoods and at times when few people are able to attend.

EJACQ now includes the following core groups:

- Chester St. Block Club Association (West Oakland);
- Chinese Progressive Association (San Francisco);
- Citizens for West Oakland Revitalization, (West Oakland)
- Communities for a Better Environment (Oakland);
- Coalition for West Oakland Revitalization (Oakland)
- Environmental Law and Justice Clinic/Golden Gate Law University (San Francisco);
- Greenaction for Health & Environmental Justice (San Francisco);
- Health and Environmental Justice Project of Silicon Valley Toxics Coalition (San Jose);
- Literacy for Environmental Justice (San Francisco);
- PUEBLO (Oakland);
- Urban Habitat (Oakland);
- West County Toxics Coalition (Richmond);
- Youth United for Community Action (East Palo Alto).

Other groups also took part in the Clean Air Plan and related processes (partial list):

- Art & Revolution
- Asthma Advocates, Contra Costa County Health Dept.
- American Lung Association
- Bay View Hunters Point Advocates (San Francisco);
- Contra Costa Building & Construction Trades Council
- Community Health Initiative
- CSE (Communities for a Safe Environment), (a local Martinez organization)
- Destiny Arts
- LOP (Laotian Organizing Project of the Asian Pacific Environment Network, APEN)
- Richmond Greens
- SEA (The Shoreline Environmental Alliance)
- Sierra Club, Richmond
- SOUL (School of Unity & Liberation)
- TRANSDEF, (Transportation Defense)
- Visual Element

Training Programs Can Help Develop Your Group's Skills

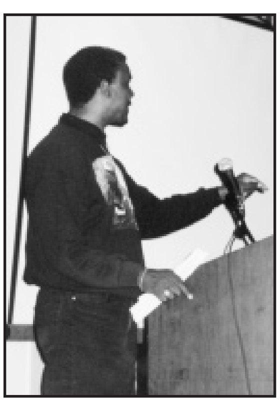
Every group has its own area of expertise and experience, but we can all be helped by more training. CBE works to develop our own training programs for staff and members and we also take advantage of other groups' training programs. Many resources are out there – you do not have to reinvent the wheel!

Examples of training resources:

- The Spin Project – How to work with the media to get your message out, 77 Federal Street, 2nd floor, San Francisco, CA 94107, Phone: 415-284-1420, www.spinproject.org
- SOUL – School of Unity & Liberation - Political Education & Organizing, 1357A 5th Street, Oakland, CA 94607 510-451-5466, soul@youthec.org
- The Ruckus Society – Direct action/non-violent civil disobedience, 369 15th St., Oakland, CA 94612, Phone: 510-763-7078, www.ruckus.org
- Highlander Research & Education Center – Political Education & Organizing, 1959 Highlander Way, New Market, TN 37820, Phone: 865/933-3443, hrec@highlandercenter.org
- CBE – Some of our curricula listed below are not published yet for outside use. CBE members have used them extensively. (Contact us for public availability.)
  - o Refineries 101
  - o Communities Resisting Environmental Racism
  - o Air Pollution 101 & Bucket Brigade Training
  - o Intro to Organizing

Books & Reports:

- CBE Reports:
  - o NORAN Community Action Handbook
  - o State of the Neighborhood: Bayo Vista Youth Health Survey
  - o Holding Our Breath: The Struggle for Environmental Justice in Southeast Los Angeles
- SPIN Works: A media guidebook for communicating values and shaping, opinions by Robert Bray from The SPIN Project
- Organizing for Social Change: Midwest Academy Manual for Activists, Seven Locks Press, PO Box 25689, Santa Ana, CA 92794, 800/354-5348
- Petroleum Refining for the Non-Technical Person by William Leffler, PennWell Publishing Company, 1421 South Sheridan Road / PO Box 1260, Tulsa, Oklahoma, 74101



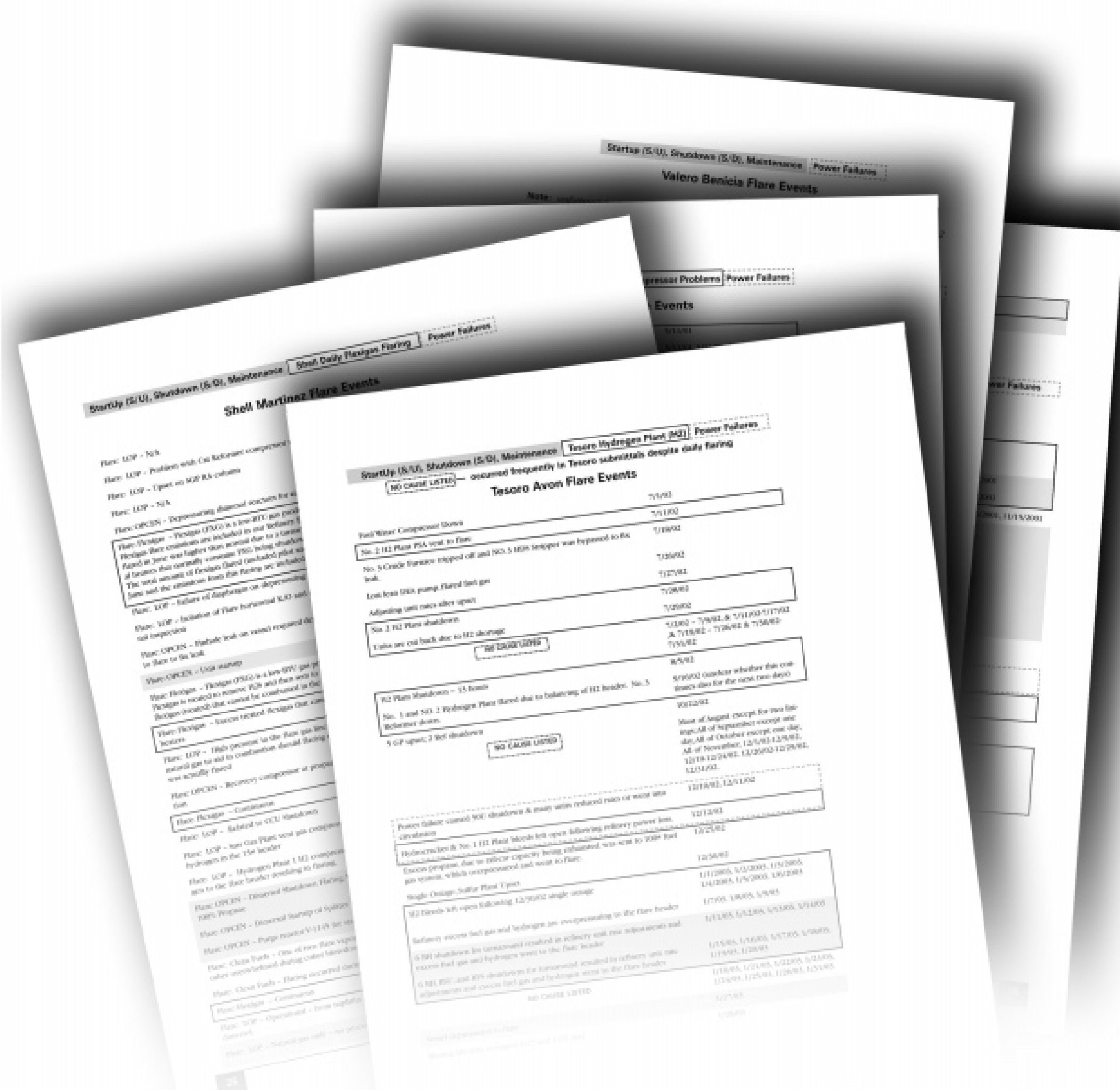
"The West County Toxics Coalition has been fighting refinery pollution for decades. We want to see the end of flaring in our community.

Henry Clark, West County Toxics Coalition

Data; Studies on flare efficiency; How flare chemistry works; How to monitor flares; and more

CBE Analysis of Refinery Monthly Reports Shows Routine Flaring from Repeated Breakdowns, Shutdown, & Preventable Conditions at Bay Area Refineries (2001-2002)

We compiled the following data from monthly flaring reports submitted to the BAAQMD by the refineries. We were looking for patterns and causes of flaring. We found repeated routine flaring caused by the same breakdowns, repeated shutdown flaring caused by power failure, and repeated flaring associated with Startup & Shutdown in general. These are examples – at the time of the evaluation, not all the monthly reports were available to us, and the completeness of the available data varied depending on the refinery. In addition, the data was not available in electronic form, so it had to be entered by hand. Therefore, additional analysis with more data for each refinery would allow more comparison between refineries, and may identify additional problems. However, even with the data available, patterns of causes of repeated flaring appeared frequently.



StartUp (S/U), Shutdown (S/D), Maintenance | Chevron's Compressor Problems | Power Failures

Chevron-Texaco Richmond Flare Events

K-1060 mechanical failure (#3 cylinder down); K-1070 also down	5/11/01
K-1060 mechanical failure	5/12/01, 5/13/01, 5/14/01
K-1060 has loose cylinder liner; S/D [Shut/Down] to prevent further damage.	7/12/01
North Yard (NY) off Flare Gas Recovery (FGR) due to Plant start-up	6/1/02, 6/2/02, 6/28/02,
Shutdown NY FGR compressor for planned cutover work	6/4/02, 6/5/02,
Shutdown NY FGR compressor for planned FGR compressor maintenance work	6/10/02,
Loss of NY recycle compressor	6/7/02
NY FGR system overpressured	6/6/02, 6/8/02, 6/9/02, 6/10/02,
Plants off of NY FGR for maintenance work	6/18/02,
South Yard (SY) FGR compressor power supply problem. Vent gas recovery compressor mechanical problems.	6/4/02, 6/5/02, 6/6/02, 6/7/02, 6/8/02, 6/9/02, 6/10/02, 6/11/02, 6/15/02, 6/18/02, 6/25/02, 6/27/02, 6/28/02, 6/30/02
Safety lifted on Alkaline wash drum.	6/10/02
Debutanizer Column level bridal bleeder valve leak	6/10/02, 6/11/02,
Vessel Pressure Relief Device Leak	6/13/02
Flaring due to vessel PSV lifting	6/19/02
NY FGR compressor shut down due to high temperature. (Flare names: FCC, SISO, NISO, RLOP)	7/01/02, 7/2/02
NY FGR compressor repairs and modifications to prevent plugging (Flare names: FCC, SISO, NISO, RLOP)	7/02/02, 7/3/02, 7/4/02, 7/5/02, 7/6/02, 7/7/02, 7/8/02, 7/9/02
FGR compressor power supply problem. Vent gas recovery compressor mechanical problems. (Flare name: D&R)	7/01/02, 7/02/02, 7/3/02, 7/4/02, 7/5/02, 7/6/02, 7/7/02, 7/8/02, 7/9/02, 7/10/02
South Isomax off FGR [Fuel Gas Recovery] due to K-1060 down for maintenance – the 1st stage suction failed	8/17/02, 8/18/02, 8/19/02, 8/20/02, 8/21/02, 8/22/02
Volume in flare header intermittently exceeded maximum capacity of recovery compressors –this release is under the Continuous Release Report (CRR) initiated on 07/03/02	9/28/02, 9/29/02
4 Cat clean up for maintenance (D&R flare)	10/01/02, 10/02/02
Emergency shutdown of Refinery on October 21, 2002 due to unplanned power outage, and subsequent plant startup and maintenance that occurred from October 22 to October 29, 2002	10/21/02, 10/22/02, 10/23/02, 10/24/02, 10/25/02, 10/26/02, 10/27/02, 10/28/02, 10/29/02
K-3950 was shut down for maintenance work (D&R flare)	11/12/02, 11/13/02, 11/14/02, 11/19/02, 11/20/02, 11/21/02, 11/22/02
R-50 shutdown for planned maintenance work – Under CRR SOES 01-6732 (NISO flare)	12/1/02, 12/04/02, 12/05/02, 12/10/02
FCC off FGR due to K-1060 bad motor bearing (FCC flare)	1/2/03, 1/3/03, 1/4/03, 1/5/03, 1/6/03, 1/7/03, 1/8/03, 1/9/03
TKC Shutdown for maintenance (CRR)	1/2/03, 1/3/03, 1/9/03
TKN/ISO Shutdown for maintenance (CRR)	1/18/03, 1/19/03, 1/18/03, 1/20/03, 1/21/03, 2/3/03, 2/11/03,

K-1600 shutdown for PLC card failure	2/13/03
D&R shutdown for maintenance work (CRR)	2/22/03
FCC upset due to electrical problems	2/23/03

StartUp (S/U), Shutdown (S/D), Maintenance | **Conoco's Hydrogen Plant (H2)** | **Power Failures**

Conoco-Phillips Rodeo Flare Events

Unit 110 upset H2	1/19/2001
U110 H2	4/04/2001
U110 S/U [StartUp] H2	6/22/2001, 6/23/2001
U110 S/D [Shut Down] H2	7/17/2001, 7/18/2001
U110	9/26/2001, 11/13/2001, 11/15/2001
MP-30 S/D	3/15/2001
MP-30/U200 S/D	3/16/2001
MP-30 S/U	6/02/2001
G-503 Compressor venting to flare, Circulated compressor for shutdown of Plant 2 & 3, Unit 240. Put compressor back in service at 00:30 on 7/3/02	7/2/02
G-503 Compressor venting to flare, Light material in the flare system. At 23:25 circulated G-503 due to high flow to the blowdown system. Unicracker in the process of startup.	7/3/02
G-503 Compressor venting to flare, Circulated G-503 flare compressor due to high flow/low gravity.	7/4/02
Miscellaneous – Steam system failure.[1] Note: See reports to BAAQMD for detailed, more accurate calculations.	7/10/02, 7/11/02
U-267, U200-G503, Start-up after unplanned shutdown. Circulated G-503 Flare Compressor due to U-240 Hydrogen Plant start-up	7/13/02
U240 Plant 2 & 3, Plant No. 3 leak & fire on exchanger E-309A. Plant 2/3 Startup	7/16/02, 7/17/02
U-228 Isomerization, Unit being started up after sd caused by the loss of H2	7/24/02
U228 GB-250/U200 G-503, Circulated G-503 Compressor due to GB-250 electrical failure shutdown (H2 recycle compressor) (10:40). Start-up after completion of MP-30 shutdown. G-503 flare compressor was put back in flare service after MP-30 completed purging to blowdown. (19:45)	8/1/02

1 The entire refinery shut down on this date – resulting in a huge flaring event.

Shell Martinez Flare Events

Flare: LOP – N/A	6/22/02
Flare: LOP – Problem with Cat Reformer compressor resulted in flaring	6/23/02, & 6/24/02 (twice same day)
Flare: LOP – Upset on SGP RA column	6/26/02
Flare: LOP – N/A	6/27/02
Flare: OPCEN – Depressuring dimersol reactors for air cooler cleaning	6/4/02 (three times same day)
Flare: Flexigas – Flexigas (FXG) is a low-BTU gas produced in the Flexicoker. Flexigas flare emissions are included in our Refinery Emissions Cap. Flexigas flared in June was higher than normal due to a turnaround that resulted in several heaters that normally consume FXG being shutdown for most of the month. The total amount of flexigas flared (included pilot and purge) for the month of June and the emissions from this flaring are included here for completeness.	All of June
Flare: LOP – Failure of diaphragm on depressuring valve on HCU 2nd stage	7/9/02
Flare: LOP – Isolation of Flare horizontal K/O and seal pots for required internal inspection	7/18/02 – 7/19/02
Flare: OPCEN – Pinhole leak on vessel required depressuring of LPG n vessel to flare to fix leak	7/25/02
Flare: OPCEN – Unit startup	7/29/02
Flare: Flexigas – Flexigas (FXG) is a low-BTU gas produced in the Flexicoker. Flexigas is treated to remove H2S and then sent to refinery heaters as fuel. Excess flexigas (treated) that cannot be combusted in the heaters must be flared.	7/1/02-7/31/02W
Flare: Flexigas – Excess treated flexigas that cannot be combusted in refinery heaters	8/1/03 - 8/31/03
Flare: LOP – High pressure in the flare gas line leads to the introduction of natural gas to aid in combustion should flaring occur; however, no process gas was actually flared	9/11/02, 9/19/02, 9/28/02, 9/30/02
Flare: OPCEN – Recovery compressor at propane truck loading rack malfunction	9/9/02-9/16/02
Flare: Flexigas – Continuous	9/1/03 – 9/26/03
Flare: LOP – Related to CCU Shutdown	10/6/02
Flare: LOP – Sats Gas Plant vent gas compressor J-168 lost suction due to hydrogen in the 15# header	10/12/02
Flare: LOP – Hydrogen Plant 1 H2 compressor J-103 had a PSV relieve hydrogen to the flare header resulting in flaring.	10/18/02
Flare: OPCEN – Dimersol Shutdown Flaring, Vessel Depressuring –assumed 100% Propane	10/6/02-10/12/02
Flare: OPCEN – Dimersol Startup of Splitter Column –assumed 100% propane	10/20/02
Flare: OPCEN – Purge reactor V-1145 for startup – assumed 100% propane	10/31/02
Flare: Clean Fuels – One of two flare vapor recovery compressors down and other overwhelmed during coker blowdown	9/25/02
Flare: Clean Fuels – Flaring occurred during coker blowdown/stream stripping	10/9/02
Flare: Flexigas – Continuous	10/1/03 - 10/31/03
Flare: LOP – Operational – from naphtha degasser – believed source was dimersol	11/18/02 (twice same day)
Flare: LOP – Natural gas only – no process gases. Starting up CCU	11/19/02 (twice same day) & 11/20/02

Flare: OPCEN – Dimersol Flaring during startup- assumed 100% Propane	11/1/02 & 11/3/02
Flare: OPCEN – Flaring during Hydrogen Plant 2 startup	11/15/02
Flare: OPCEN – Treated fuel gas to flare during CCU startup	11/19/02
Flare: Clean Fuels – No Flaring at CF Flare in November	
Flare: Flexigas – Continuous	11/1/03 - 11/30/03
Flare: LOP – Brief flaring event from fuel gas blend drum – PG&E vent only	12/2/02
Flare: LOP – H2 Flaring from Lube Hydrotreater #1	12/10/02
Flare: LOP – Power outage caused hydrogen system upset and release of hydrogen psv into flare header	12/16/02
Flare: LOP – Power outage caused upset in 15# vent gas header and release of two psv's into flare hdr	12/16/02
Flare: LOP – NHT trip during startup-depressure to flare	12/20/02
Flare: LOP – CFH Upset	12/20/02
Flare: OPCEN – Leak to flare off tandem seal on dimersol pump	12/2/02 & 12/4/02
Flare: OPCEN – depressure dimersol pump to flare for maintenance	12/11/02, twice
Flare: OPCEN – treated coker dry gas to flare from fuel gas blend drum	12/28/02, twice
Flare: Clean Fuels – No flaring in December	
Flare: Flexigas – Continuous	12/1/03 - 12/31/03
Flare: LOP – Natural gas to the flare	1/20/03
Flare: OPCEN – Flexicoker shutdown	1/1/03
Flare: OPCEN – Natural gas, N2 & steam purge of taps	1/12/03 - 1/16/03
Flare: OPCEN – Flexicoker startup	1/17/03
Flare: OPCEN – Flaring of 2" pipes from start-up manifold to V-1151; material is C3/C6	1/22/03
Flare: OPCEN – Coke Dry gas to the flare due to HP-3 Shutdown	1/30/03
Flare: OPCEN – Unknown – not able to find the source	1/31/03
Flare: Flexigas – Continuous	1/1/03 - 1/31/03
Flare: Clean Fuels – Flaring during coker blowdown/J205 down	1/5/03 & 1/6/03
Flare: Clean Fuels – Debutanizer upset	1/20/03 & 1/21/03
Flare: Clean Fuels – HP-Trip	1/30/03
Flare: LOP – Cat Reformer Unit Vent to the flare	2/2/03
Flare: LOP – Natural gas to the flare – instrument malfunction	2/7/03
Flare: OPCEN – Purge through F101 in preparation for FXU startup; material is fuel gas	2/11/03
Flare: Clean Fuels – DCU gas plant inadvertently depressured to the flare via the main fractionator overhead accumulator. This occurred during DCU shutdown.	2/12/03
Flare: Clean Fuels – Operational upset resulted in liquid to compressor knock out pots –shut down the flare gas recovery compressors	2/12/03
Flare: Flexigas	2/1/03 - 2/28/03
Flare: Flexigas – Additional Flexigas flaring due to fuel imabalance as a result of heaters being shutdown for turnaround	2/13/03

StartUp (S/U), Shutdown (S/D), Maintenance | Tesoro Hydrogen Plant (H2) | Power Failures

NO CAUSE LISTED — occurred frequently in Tesoro submittals despite daily flaring

Tesoro Avon Flare Events

Foul Water Compressor Down	7/1/02
No. 2 H2 Plant PSA vent to flare	7/11/02
No. 3 Crude Furnace tripped off and NO. 3 HDS Stripper was bypassed to fix leak.	7/18/02
Lost lean DEA pump, flared fuel gas	7/26/02
Adjusting unit rates after upset	7/27/02
No. 2 H2 Plant shutdown	7/28/02
Units are cut back due to H2 shortage	7/29/02
NO CAUSE LISTED	7/2/02 – 7/9/02, & 7/11/02-7/17/02 ,& 7/19/02 – 7/26/02 & 7/30/02-7/31/02
H2 Plant Shutdown ~ 13 hours	8/5/02
No. 1 and NO. 2 Hydrogen Plant flared due to balancing of H2 header. No. 3 Reformer down.	9/16/02 (unclear whether this continues also for the next two days)
5 GP upset; 2 Ref shutdown	10/22/02
NO CAUSE LISTED	Most of August except for two listings; All of September except one day, All of October except one day, All of November, 12/1/02-12/9/02, 12/19-12/24/02. 12/26/02-12/29/02, 12/31/02,
Power failure caused 50U shutdown & many units reduced rates or went into circulation	12/10/02, 12/11/02
Hydrocracker & No. 1 H2 Plant bleeds left open following refinery power loss.	12/12/02
Excess propane, due to rail-car capacity being exhausted, was sent to 100# fuel gas system, which overpressured and went to flare.	12/25/02
Single Outage; Sulfur Plant Upset	12/30/02
H2 bleeds left open following 12/30/02 single outage	1/1/2003, 1/2/2003, 1/3/2003, 1/4/2003, 1/5/2003, 1/6/2003
Refinery excess fuel gas and hydrogen are overpressuring to the flare header	1/7/03, 1/8/03, 1/9/03
6 BH shutdown for turnaround resulted in refinery unit rate adjustments and excess fuel gas and hydrogen went to the flare header	1/11/03, 1/12/03, 1/13/03, 1/14/03
6 BH, BSU, and RFS shutdowns for turnaround resulted in refinery unit rate adjustments and excess fuel gas and hydrogen went to the flare header	1/15/03, 1/16/03, 1/17/03, 1/18/03, 1/19/03, 1/20/03
NO CAUSE LISTED	1/10/03, 1/21/03, 1/22/03, 1/23/03, 1/24/03, 1/25/03, 1/26/03, 1/31/03
Vessel depressured to flare	1/27/03
Missing lab data, averaged 1/27 and 1/29 data	1/28/03

Valero Benicia Flare Events

Note: *unfortunately, for this refinery, there were hundreds of flaring events reported for 2001 and 2002 without any explanation of a root cause. Therefore the short list found below does not indicate fewer flaring problems at this refinery, but indicates instead, less reporting of the cause of flaring from this refinery compared to other refineries' reports.*

Power failure & recovery afterwards, causing flaring	6/4-6/10/02
DHFU N2 cooldown. Shutdown flare gas compressor	6/23/02, 6/24/02
Cat Feed Hydrofiner (CFHU) startup	7/1/02
CFHU unscheduled compressor shutdown	7/2/02
Hydrocracker unscheduled shutdown	7/19/02
Hot weather fuel gas containment	7/23/02
Hydrocracker startup	7/26/02
Buildup of non-condensibles in ALKY refrigeration system required venting to flare to regain control	8/17/02
Vented ALKY C3/C4 splitter reboiler leak to flare header.	9/5/02
Shut down ALKY C3/C4 splitter to repair reboiler leak. Vented light ends buildup from refrigeration section to maintain control	9/16/02 & 9/18/02
Shut down Cat gas compressor for maintenance	9/27/02
Shut down Heavy Cat Naphtha Hydrofiner for catalyst changeout	1/12/03
Cooled down Heavy Cat Naphtha Hydrofiner reactor with nitrogen	1/13/03
Naphtha Reformer Unit Startup,	2/18/03

Comparing # of Days of Flaring and Total Volume of Gases Flared, 2001-2003, Some Refineries' Flaring Appears Down, Others Not

In the following chart, CBE compared the total volume of gases for each year, and the number of days of flaring for each year. We compared volume of gases instead of pounds of emissions from year to year as a way to work on common ground, since the refineries have challenged emissions estimates and data accuracy varies from refinery to refinery. There is somewhat less controversy when it comes to volumes of gas flared. We can use the volume data & number of days of flaring at each refinery over the years to see whether flaring trends are up or down. (However, these numbers cannot be used to determine the impact of pounds of chemicals from flaring in the community.)

As we expected, data suggests that flaring has decreased, but we did not see reductions at all refineries. We credit flaring reductions to the community campaign, including intense public scrutiny over the last three years. Here are some results we found:

- Chevron flaring appears to have decreased but Chevron's data was based on calculations performed by Chevron, not on actual measurements of gas volume reaching the flare, as it is for the other refineries. Chevron has had less monitoring equipment in the flare headers than other refineries. While Chevron's calculations are difficult to verify, neighbors near Chevron have reported to us that in 2003 they saw flaring much less frequently, whereas they noticed that Chevron used to flare almost continuously. Unfortunately, based on the Bay Area District's reports, more flaring activity has occurred in December 2003 and January 2004 not included in available data.
- According to the data, Tesoro has historically, and continues to send the highest total volume of constituents to its flares compared to the other refineries (with the exception of Shell's flexigas flare). However, Tesoro significantly reduced its flare volume after it added large compressors in early 2003.
- Shell's total volume of flaring has increased over the past two years with the exception of flaring at its flexigas flare which appears to have remained the same, based on available data. Shell flares from its flexigas flare almost daily. Shell's volumes provided in the data for flares other than the flexigas flare were still substantially lower than those reported for Tesoro.
- Valero's neighbors have noted ongoing substantial accidental releases in the year 2003. Based on available data, it is difficult to determine whether flaring has decreased, but it appears to have remained high both in terms of total volume flared and number of days.
- ConocoPhillips flaring appeared substantially down in 2003 compared to 2002, but more data is needed to reach a sound conclusion.

To compile this data, we received monthly reports and databases from BAAQMD through public records requests, and added up each flaring event on a daily basis.

2001 to 2003: Some Refineries' Flaring Appears Down, Others Not
Comparing Total Volume of Gases Flared & Number of Days of Flaring Over Time

	2001 Volume (Standard Cubic Feet)	2002 Volume (Standard Cubic Feet)	2003 Volume (Standard Cubic Feet)	Does flaring appear Up or Down? (according to available data) Volume (Standard Cubic Feet)
Chevron-Texaco	**171 Million** 8 months' data avail	**162 Million** 12 months' data avail	**17 Million** 10 months' data avail	**Appears DOWN Substantially**, but end-of-2003 flaring not included
Tesoro	**3621 Million** 12 months' data avail	**5202 Million** 12 months' data avail	**599 Million** 8 months' data avail	**GREATLY DOWN BUT STILL HIGH**, & data is incomplete
Shell Flexigas Flare	**2897 Million** 8 months' data avail	**11266 Million** 12 months' data avail	**5635 Million** 7 months' data avail	**NOT LIKELY DOWN** since flare works continuously. (but has low VOC content)
Shell Other Flares	**11 Million** 12 months' data avail	**16 Million** 12 months' data avail	**29 Million** 6 months' data avail	**UP** but started out lower than other refineries
Valero	**173 Million** 7 months' data avail	**258 Million** 12 months' data avail	**138 Million** 6 months' data avail	**MAY BE DOWN SOME** (but unclear since partial year's data available).
Conoco-Phillips	**47 Million** 12 months' data avail	**330 Million** 11 months' data avail	**11 Million** 6 months' data avail	**APPEARS DOWN SUBSTANTIALLY**, but data is incomplete
	# of Days	# of Days	# of Days	# of Days
Chevron-Texaco	**114** 8 months' data avail	**136** 12 months' data avail	**46** 10 months' data avail	**APPEARS DOWN SUBSTANTIALLY**, but data is incomplete
Tesoro	**Every day** 12 months' data avail	**Every day** 12 months' data avail	**Almost everyday** 8 months' data avail	**APPEARS SAME**
Shell Flexigas Flare	**Everyday** 8 months' data avail	**Everyday** 12 months' data avail	**Every day** (except for shutdown) 7 months' data avail.	**APPEARS SAME**
Shell Other Flares	**171** 12 months' data avail	**97** 12 months' data avail	**58** 6 months' data avail	**NOT GREATLY DOWN** (only partial year's data available).
Valero (previously Exxon)	**Almost every day** 7 months' data avail	**283** 12 months' data avail	**At least 228** 6 months' data avail	**NOT GREATLY DOWN** (only partial year's data available).
Conoco-Phillips	**19** 11 months' data avail	**122** 11 months' data avail	**29** 6 months' data avail	**APPEARS DOWN SUBSTANTIALLY**, but data is incomplete

How Chemical Reactions In Flare Flames Work

While flares are meant to get rid of "waste" gases, they just turn the gases into other chemicals.

Hydrocarbon gases burned in the flare turn into carbon dioxide (CO_2) and water (H_2O), but can also form carbon monoxide (CO), complex hydrocarbons (including toxic benzopyrene, naphthalene, and phenylthiophene) and soot and some of the hydrocarbons can escape combustion. (Hydrocarbons are simply molecules made of varying amounts of hydrogen and carbon. They include methane, propane, butane, octane, benzene, toluene, xylene, and many others.) Sulfur compounds are also routinely emitted. Another problem: if heavy metals are present they will not be destroyed by the flame; and if chlorine compounds are present, dioxins could form.

■ **If combustion efficiency was perfect (100%)**, all the Hydrocarbon fuel and Oxygen (O_2) in the flare would turn into CO_2 (Carbon Dioxide[2], causing climate change) and H_2O (water):

Hydrocarbon + O_2 ➠ CO_2 + H_2O

(Methane example: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$)

(Octane example, a gasoline component: $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$)

■ **In reality combustion is never perfect & burning can't destroy the pollution**. Hydrocarbons remain, and CO (carbon monoxide), & soot can form.

Hydrocarbon + O_2 ➠ CO_2 + H_2O + CO + Hydrocarbon GAS or SOOT

While many refinery flares are designed to be efficient, recent evidence shows that under some conditions (low energy content of gases flared, flares overwhelmed, incorrect steam ratio, high winds, poor mixing, etc.), combustion efficiency can go far below the 98% efficiency usually assumed (even down to 50%). With incomplete combustion, some hydrocarbons aren't burned, some react to form new hydrocarbons (such as soot particulates in a smoking flare), and toxic carbon monoxide gas can form instead of carbon dioxide.

■ **Hazardous H_2S (hydrogen sulfide) gas in the flare is turned into SO_2** (sulfur dioxide, a smelly irritant to the respiratory system and eyes) even with perfect combustion, and NOx is abundantly formed.

2 Carbon Dioxide (CO_2) is naturally occurring in our atmosphere, but has been building up in our atmosphere for over a hundred years, because we burn so much hydrocarbon fuel (fossil fuels), causing CO_2 combustion byproduct. This causes our atmosphere to absorb more of the sun's radiation. Most scientists now believe that climate change caused is already occurring because of CO_2 & other pollution.

Flare Combustion Efficiency Can Be Poor Causing Emissions To Drastically Increase

Combustion efficiency is key in determining emissions. High efficiencies are usually used to calculate flare emissions (98% or even 99.5%), but newer evidence indicates that combustion can go much lower under certain conditions (as low as 50%). Lowering efficiency a little bit can greatly increase emissions. If efficiency goes from 98% down to 96%, that means the remaining hydrocarbon emitted to the air goes up from 2% to 4%, or doubles. Even with high efficiency, since the volume of gases going to flares can be huge, even a small percentage unburned can equal huge emissions. The studies below used special techniques (optical sensors) to determine emissions to the air and combustion efficiency. This topic is being debated, with industry claiming that combustion efficiency should be considered 98% on average and even higher. EPA generally uses 98% efficiency, based on earlier studies. Here are a few examples indicating lower than the standard 98%:

SWEDISH STUDIES: One not yet published study using passive FTIR techniques (light-beams), "found flare combustion efficiencies generally above 99%, but for one flare, combustion efficiency was found down to 92% "because of flame instability".[3] Another Swedish study found: "**The results showed that the efficiency are high, approx. 98%, at high loads (1100 kg/h), but low, 50-90%, at low loads**. The emissions varied about 20–50 kg/h independent of load."[4] (This means emissions of about 44-110 lbs/hr, or at this rate all day, emissions could be over a ton a day from one flare with low load/low efficiency.)

TEXAS REGULATION: **A flare monitoring regulation in Texas requires that for certain non-ideal combustion conditions, a flare combustion efficiency of 93% must be assumed**, based on the mid-point of a range of combustion efficiencies found in earlier studies.

LEAHEY ALBERTA STUDY: "The usual assumption is that combustion processes associated with flares efficiently convert HCs and sulfur compounds to relatively innocuous gases such as CO2, SO2, and H2O. It has been shown, however, that **these processes can be efficient only at low wind speeds because the size of the flare flame, which is an indicator of flame efficiency, decreases with increasing wind speed**." Therefore, the flaring process could routinely result, during periods of moderate to high wind speeds, in appreciable quantities of products of incomplete combustion such as anthracene and benzo(a)pyrene, which can have adverse implications with respect to air quality."[5]

BLACKWOOD STUDY: "While this study shows efficiencies well above 90%, the efficiency varies over a wide range within a given time period. Compliance with continuous emission rates may be very difficult when a flare is used. **When the process gas contains hazardous substances, public safety may be jeopardized**." [6]

3 Email from Karl Loos, Scientific Advisor, Shell Global Solutions, US, to Kindra Snow, May 1, 2002, regarding "Flare Efficiency Results from Moerdijk" which CBE received after a public records request to the Bay Area Air District, regarding BP studies.

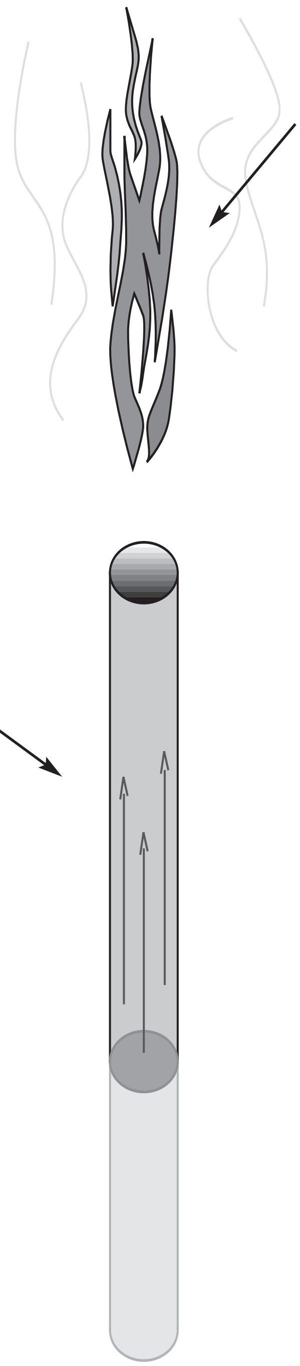
4 Email from Gunnar Barrefors, Swedish Environmental Protection Board, to Jim Karas, April 16, 2003, "VOC emissions from petroleum refineries" and a regarding Chalmers University of Technology study, email received by CBE from public records request to the Bay Area Air District.

5 Douglas M. Leahey and Katherine Preston, Jacques Whitford Environment limited, Calgary, Alberta, Canada, "Theoretical and Observational Assessments of Flare Efficiencies," Journal of the Air & Waste Management Association, Volume 50, December, 2001

6 Thomas R. Blackwood, Healthside Associates, Ballwin, Missouri, "An Evaluation of Flare Combustion Efficiency Using Open-Path Fourier Transform Infrared Technology," Journal of the Air & Waste Management Association, Volume 50, October, 2000

Simple Flare Monitoring Measures Gases Inside The Flare

You cannot just put a sample bag over a flaming flare stack a hundred feet up in the air. That's why there is so much controversy about flare emissions. What methods are used to measure such a difficult source out in the air? The sampling inside the flare stack measures the volume of gases flowing by, and samples are taken to determine what chemicals are there in what concentrations. However, while it is extremely useful to know what is going on inside the flare there are also methods to measure gases directly in the open air.



1

The New Rule Requires Measuring Gases Inside The Flare.

A) Gas Volume flowing inside the Flare is Measured: By measuring the velocity of gases & knowing the diameter of the flare header, the volume can be determined

B) Concentrations of Chemicals in the Flare are Measured: Either a sample canister of flare gas is extracted & analyzed in a lab, or else more continuous & automatic measuring systems are used.

2

The Pounds Of Pollutants Coming Out Of The Flare Are Estimated:

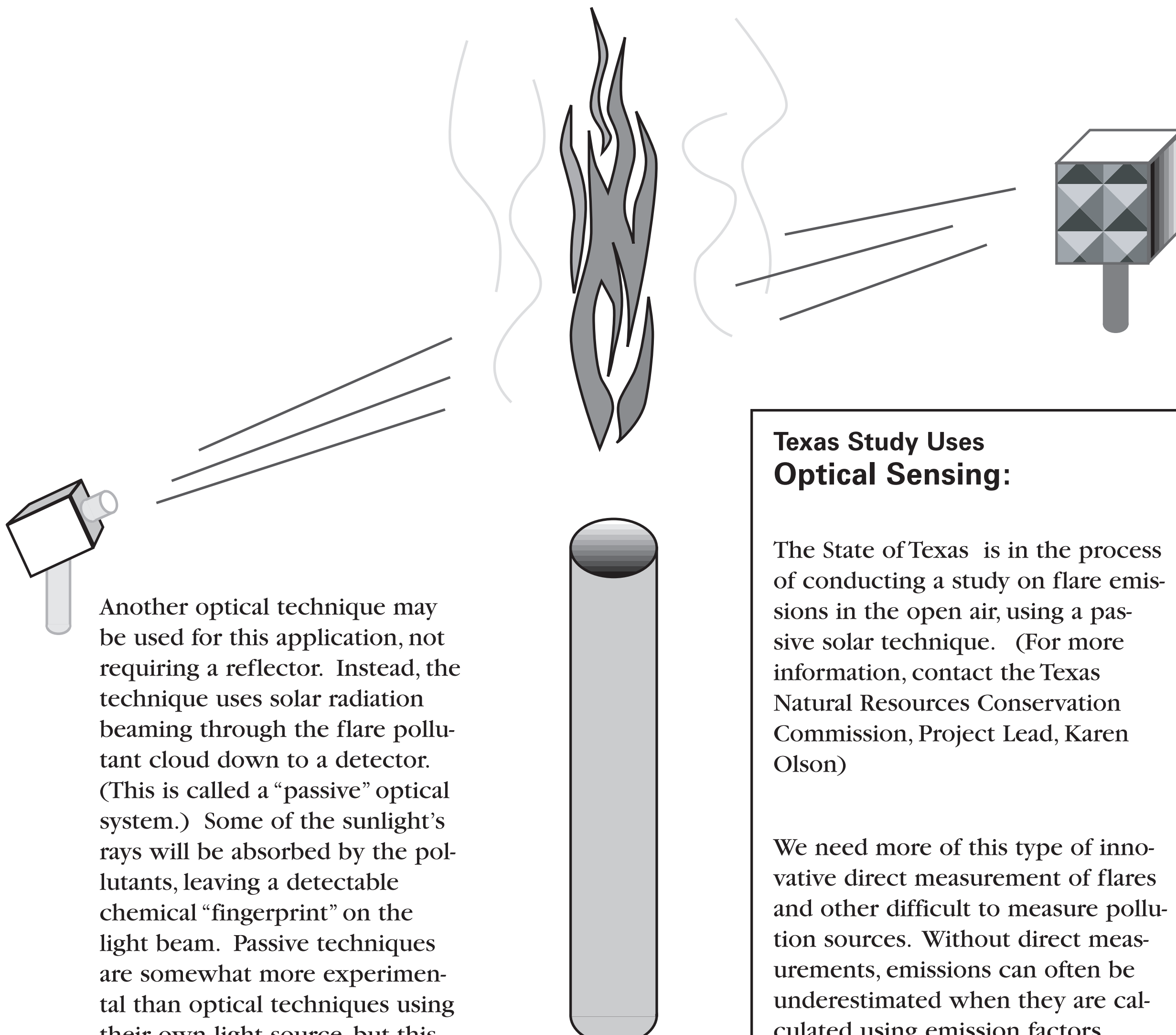
Since it is very difficult to measure the mass of gaseous chemicals coming out of a huge & elevated flame in the atmosphere, the total pounds of flare emissions are estimated by determining the pounds of hydrocarbons inside the flare, and then multiplying by an estimated flame destruction efficiency.

The refineries generally assume at least a 98% hydrocarbon destruction efficiency in the flame, leaving only 2% or fewer hydrocarbons surviving to be emitted to the air. The other 98% of the hydrocarbons turn into CO_2 & H_2O. (Some studies show that destruction efficiency can go far lower, meaning that emissions of hydrocarbons escaping to the atmosphere are actually much higher than estimated.) Sulfur compounds (such as H_2S) don't get destroyed in the flame, they just turn into other sulfur compounds (like SO_2).

There are some more complex methods for measuring flare pollution in the open atmosphere, which would allow us to avoid relying on estimations of flare destruction efficiency.

Special Optical Techniques Can Measure Flare Emissions In The Open Air

Optical sensing devices using light beams are one method for measuring flare gases in the open air after they are burned in the flare flame. Flares represent special difficulties for measuring since they have huge, elevated flames. Optical monitoring systems are one possibility. Standard optical sensors shoot a light beam through the open air and through a pollution plume, then to a mirror, which reflects it back to a detector. These systems measure the "fingerprint" which different chemicals imprint on the light beam. (Each chemical absorbs light at a different frequency, leaving a unique fingerprint.) However, it would be hard to put a reflector high enough in the air to cause the beam path to go through the pollutant plume. However, some flares are not terribly elevated, so it may be possible to use this technique. In the Bay Area, there are some flares that are only 30 feet off the ground.



Another optical technique may be used for this application, not requiring a reflector. Instead, the technique uses solar radiation beaming through the flare pollutant cloud down to a detector. (This is called a "passive" optical system.) Some of the sunlight's rays will be absorbed by the pollutants, leaving a detectable chemical "fingerprint" on the light beam. Passive techniques are somewhat more experimental than optical techniques using their own light source, but this technique is being used on flares in Europe and in Texas.

Texas Study Uses
Optical Sensing:

The State of Texas is in the process of conducting a study on flare emissions in the open air, using a passive solar technique. (For more information, contact the Texas Natural Resources Conservation Commission, Project Lead, Karen Olson)

We need more of this type of innovative direct measurement of flares and other difficult to measure pollution sources. Without direct measurements, emissions can often be underestimated when they are calculated using emission factors. Sometimes emission factors can rely too much on studies done under average or optimal conditions and may not reflect worst case conditions that can occur.

A Santa Barbara study[7] found that the need for flaring can be mostly eliminated by increasing gas recovery (except in the case of true emergencies). According to the study, total vapor recovery can be designed to mostly eliminate flaring:

"An example of a total vapor recovery system installed in a Canadian refinery is shown … This system recovers flare manifold vapors into this refinery's fuel gas system. In this particular system, if the recovery vapor exceeds the refinery fuel gas demand, flaring still occurs. This is a rare occurrence at this facility, because fuel gas demand is much larger than all anticipated flaring events.

"Various methods can be used to reduce the amount of flared gas including:

- Partial vapor recovery systems
- Better process control which may include the following:
- Pilot operated relief valves
- Equipment or process unit redundancy
- Automatic shutdown systems to prevent process unit over pressure and relief to the flares
- Operational changes to reduce the frequency of inadvertent process vessel over-pressure episodes"

An Audit of Compressor Capacity should be Performed, and Refineries should be Required to have Sufficient Compressor Capacity to Allow Recycling of Gases when Possible

The chart on the following page was excerpted from the Air District Technical Assessment Document (TAD, page 11) on flaring. It lists the different flares at each Bay Area refinery, the Design Capacity (the amount of gases that the flare can burn without being overwhelmed), and last, the amount of compressor capacity the refineries have in order to divert gases away from the flares back for recycling.

This chart was made before Tesoro added large amounts of compressor capacity in order to reduce flaring. Tesoro is listed with a large number of flares capable of burning huge amounts of gases, but with smaller compressor capacity for the purpose of preventing the need to route gases to the flares. After Tesoro added compressor capacity, flaring was substantially reduced. The chart shows multiple additional flares at the other refineries without compressor capacity. For example:

- Shell's LPG Loading Flare, FXG Flare and HC Flare & Valero's Acid Gas Flare and Butane Flare are all listed with "No gas recovery compressor;"
- Other refinery flares which have some compressor capacity may have insufficient capacity.

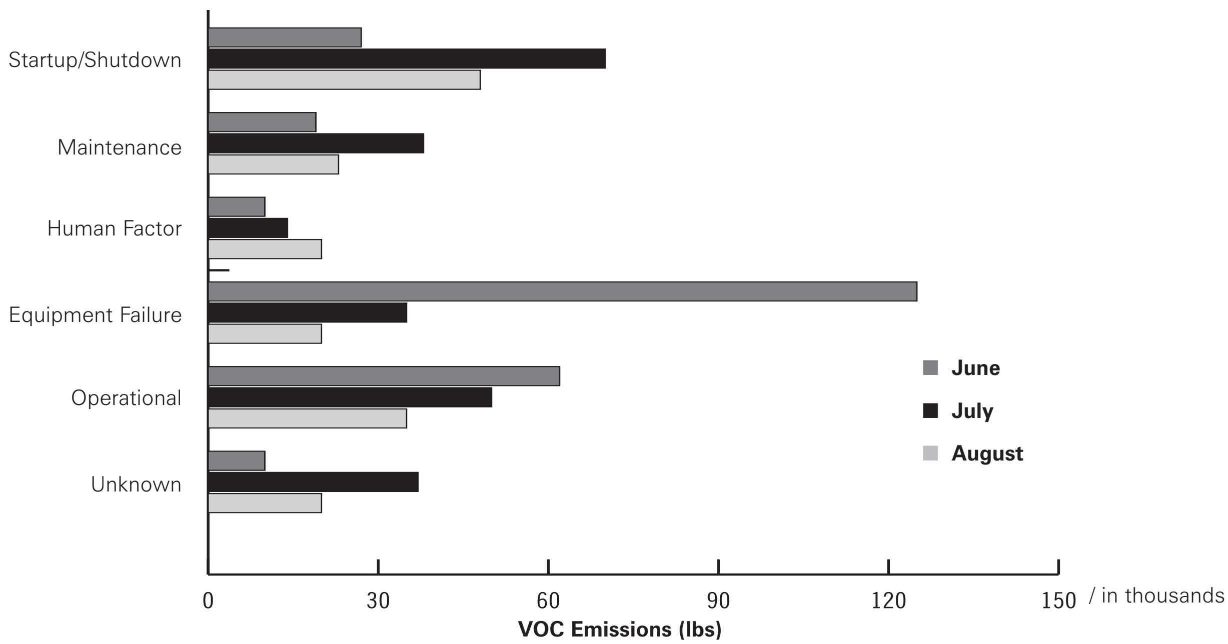
Beyond having sufficient compressor capacity, refineries also need to be set up to be able to use the gases recycled

7 "Flare Study, Phase I Report," Santa Barbara Air Pollution control District, July, 1991.

	Flare	Design Capacity	Comments
Chevron	LSFO High Level	400,000 lbs/hr 605,000 btu/hr	One compressor with a capacity of 2.4 MMSCFD services these two flares.
	Waste Gas Flare	1,100,000 lb/hr 3,000,000 btu/hr	Two compressors each with a capacity of 2.0 MMSCFD serve as backup.
	South Isomax	3,585 bbl/hr 2,315,000 btu/hr	Two compressors each with a capacity of 4.0 MMSCFD service these six flares
	North Isomax	3,585 bbl/hr 2,315,000 btu/hr	
	FCC Flare	2,540 bbl/hr 4,515,000 btu/hr	
	Alkane Flare	2,315,000 btu/hr	
	Alky Flare	900 bbl/hr 31 MMbtu/hr	
	Lube Flare	500,000 bbl/hr 341,000 btu/hr	
	LSFO Low Level	50,000 lb/hr	This flare is disconnected and not used.
Shell	LPG Loading Flare	1,048,000 btu/hr	No gas recovery compressor
	LOP Auxiliary Flare	1,048,000 btu/hr 111,400 btu/hr	Two compressors each with a capacity of 1.5 MMSCFD service these flares
	LOP Main Flare	1,600,000 btu/hr 222,000,000 cuft//hr	
	FXG Flare	10,080 MMbtu/hr	No gas recovery compressor
	HC Flare	25 MMbtu/hr	No gas recovery compressor
	Delayed Coking	4,000,000 btu/hr	Two compressors each with a capacity of 4 MMSCFD service these flares
	VRS #2	309,000,000 btu/hr	1.6 MM SCFD compressor capacity
	VRS #3	108,000,000 btu/hr	2.1 MM SCFD compressor capacity
	VRS #1	108,000,000 btu/hr	1.1 MM SCFD compressor capacity
Phillips	C-1 Flare	6,6000,000 btu/hr 14,050,000,000 btu/hr	3.12 MMSCFD compressor capacity
	C-602 Flare	31,000,000 btu/hr	4.5 MMSCFD compressor capacity
Tesoro	East Air Flare	950,000,000 btu/hr	One compressor with a capacity of 2.0 MMSCFD services these six flares.
	Tank 691Safety	30,000 lbs/hr	
	North Coker Flare	100,000 lbs/hr	
	South Coker Flare	100,000 lbs/hr	
	Emergency Flare	9,770,000,000 btu/hr	
	West Air Flare	950,000,000 btu/hr	
	Ammonia Flare	2,670,000,000 btu/hr	No gas recovery compressor
Valero	Acid Gas Flare	Not available	No gas recovery compressor
	Butane Flare	16,000 lb/hr	No gas recovery compressor
	South Flare	12,000,000 lb/hr	6.0 MMSCFD compressor capacity
	North Flare	Not available	6.0 MMSCFD compressor capacity

Bay Area Air District's Assessment Shows Many Categories Of Preventable Flaring

The Air District's Draft Technical Assessment Document (page13) included the following 2002 data:



This chart shows many flaring causes from categories for which there are known prevention methods, including at a minimum these categories:

- "**Equipment Failure**" is often preventable, especially the repeated malfunctions seen in Bay Area data. Many of these events are preventable through root cause analysis and fixing repeated failures, and having sufficient backup systems. This was the largest category from the chart above.
- "**Startup/Shutdown**" may include unplanned Startup/Shutdowns, which are mainly caused by equipment failure (see discussion above). Human error can also cause unplanned startup/shutdown flaring. Many can be prevented through failsafe controls that don't allow operators to make certain errors. Planned Startup/Shutdown flaring is often argued as a harder type to prevent, because if many units are shutdown, there may be no place to recycle gases in the refinery. However, it appears that the refineries can reduce flaring from this category too. (For many Bay Area refineries, flaring frequency in 2003 was reportedly down even during planned Startup/Shutdown compared to earlier years due to the increased attention to the problem of flaring by the refineries because of the public outcry.) Some methods for preventing this type of flaring include depressurizing vessels slower so that smaller amounts of gases are released at a time from vessels during shutdown, increasing the likelihood that these gases can be recycled instead of flaring. Another innovative method discussed by representatives of the Conoco-Phillips Rodeo refinery uses vessels designed to store gases in certain cases of shutdown, by designing vessels with higher pressure ratings for pressure relief devices, and thicker metal.
- "**Operational**" is assumed to mean daily routine flaring. This can be caused by insufficient compressor capacity and is also preventable. The Tesoro refinery had a large amount of this type of flaring, and reduced it drastically when more compressor capacity was added.

Should methane (a hydrocarbon) continue to be exempt from air quality regulations just because there are naturally occurring sources of methane?

NO ➠ Refineries also emit very large amounts of methane. A Harvard study found that it may be a big contributor to smog formation (as well as global warming).

Methane is produced by naturally occurring sources, by cattle and also by the petroleum industry. It is generally exempted from control in industrial regulations. In the case of flaring, this makes it harder to make sure there is compliance with existing hydrocarbon controls, because first the amount of methane must be subtracted from the rest of the hydrocarbons which are subject to regulation. The Bay Area refineries claim that a large portion of their hydrocarbon emissions are actually methane and should not be included in emission estimates. Everyone is arguing about the relative ratios of these gases in the flare.

The Harvard study, summarized below, indicates that perhaps methane should not be considered any differently from other hydrocarbons, and should be subject to regulation too. The Harvard study found:

> *"Methane (CH4) emission controls are found to be a powerful lever for reducing both global warming and air pollution via decreases in background tropospheric ozone (O3) "*

(*Linking ozone pollution and climate change: The case for controlling methane*. Fiore, et al, Harvard University, 2002)

The report was summarized in Environmental Science & Technology, Dec. 1, 2002:

> *"Aggressive efforts to improve urban air quality could be undermined by rising levels of methane, a compound more closely linked to global warming than air pollution. Using a global model of tropospheric chemistry, researchers at Harvard University, Argonne National Laboratory, and the U.S. EPA determined that higher methane levels could increase ozone background levels worldwide, lead to a greater frequency of days with high ozone levels in the summer, and produce a longer "season of ozone pollution days."*
>
> *"It is already known that methane is a major source of worldwide tropospheric ozone background concentrations, and this study supports that finding. However, the surprise is that a 50% reduction in anthropogenic methane in their scenario is as effective as a 50% drop in anthropogenic NOx concentrations at lowering summer afternoon ozone levels over the United States." (page 452A)*

Just Because Flare Pollution Is So Visible, Don't Forget Other Refinery Pollution Sources:

In addition to flaring, other refinery sources we identified were studied by the Air District as a result of our community-based Clean Air Campaign. The studies resulted in much better data on the following sources, showing the need for additional regulation. ‡ CBE reports on these sources are planned for the future.

Invisible Refinery Pollution Sources are also Worse than Expected	Hydrocarbon Emissions: Amount in Air District Inventory before Community Clean Air Campaign	Hydrocarbon Emissions: Current Air District Emissions Estimate
Blowdown Systems Blowdown systems are supposed to remove liquids entrained in refinery gases before these gases are blown to the flare for combustion. But at one Bay Area refinery (Tesoro), they left out the flare for blowdown systems and instead allow the gases to blow directly to the atmosphere!	0 tons per day	**7 tons per day average**, 25-130 tons maximum
Pressure Relief Devices These are a special kind of valves on tanks, railcars, process vessels, etc. which open if the pressure gets too high, to keep these containers from exploding. PRVs can be vented to gas recovery systems, and venting to the atmosphere can be banned. Requirements for installation of rupture disks and monitoring is also key.	0 tons per day	**1 ton per day average** (approximately), 9 tons average per release, 150 tons maximum one-time release known
Loading of Marine Vessel Cargoes which are exempt from Bay Area regulations When refinery ships are filled with liquid fuels, vapors are forced out into the air unless vapor recovery systems are present. It has become clear that certain cargoes exempt from control requirements can cause significant emissions which could be prevented if the Air District regulation required control of all cargoes.	0 tons per day from unregulated cargos	**Up to 4.3 tons per day** from loading one marine vessel with unregulated cargo; Higher with multiple loads
Wastewater Systems Refinery wastewater ponds contain toxic petroleum products which evaporate into our air. Vapors can also leak from water collection systems and piping before they even reach the ponds. Ponds can be enclosed, leaks in collection systems can be sealed, and pollution prevention programs can stop water systems from being polluted in the first place.	3.5 tons per day for whole system	**4 tons per day for half of the system**, second half to be assessed later. Large diesel component of wastewater is completely unassessed – emissions could go ten times higher.

EPA Publication Highlights Illegal Flaring Practices

United States Environmental Protection Agency | Office of Enforcement and Compliance Assurance (2248A) | EPA 300-N-00-014 (revised)

EPA **Enforcement Alert**

Volume 3, Number 9 | Office of Regulatory Enforcement | October 2000

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.

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

Continued on page 2

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

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.

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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Enforcement Alert

Continued from page 1

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/