Breakdowns in Air Quality

Air Pollution from Industrial Malfunctions and Maintenance in Texas

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THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (http://www.environmentalintegrity.org) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws.

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Environment Texas Research & Policy Center is a statewide advocacy organization bringing people together for a cleaner, greener, healthier future.www.EnvironmentTexasCenter.org

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Tom Pelton/ Environmental Integrity Project. Cover photo: East of Houston Texas, near the Shell Oil Deer Park plant. Page 13 photo by Blas Espinosa.

Breakdowns in Air Quality

Executive Summary

Texas leads the nation in energy production. But being number one also has its downsides in terms of air pollution. Well known for its hands-off approach to environmental enforcement, Texas allows industries to release excessive amounts of air pollution when old and poorly controlled equipment breaks down and when facilities undergo maintenance work.

In 2015, 679 industrial sites in more than 100 Texas counties released more than 34,000 tons of air pollutants during 3,421 incidents of malfunctions and maintenance events, according to industry self-reported data.

The single largest pollution incident from an industrial malfunction in the Houston area last year came from Shell's Deer Park oil refinery, which released 171 tons of air pollution — including 154 tons of the carcinogen 1,3-Butadiene — during a breakdown that lasted for an hour on August 9, 2015.

From high levels of cancer-causing benzene in the heavily populated neighborhoods from Houston to the Louisiana border, to unprecedented releases of dangerous hydrogen sulfide in the West Texas oilfields, industrial facilities are releasing large amounts of air contaminants during breakdowns and maintenance. Most of this pollution is unauthorized, or well over the limits set in the facilities' permits. This unauthorized air pollution not only threatens public health and our environment, but also our confidence in the regulatory agencies charged with enforcing anti-pollution laws.

Some industrial plants release more air pollution annually during malfunctions and maintenance than they do during their routine, legally permitted operations. For example, in 2014, the Keystone Gas Plant in West Texas released 226 tons of sulfur dioxide during routine, permitted operations, but the plant released 5,493 tons of this dangerous pollutant during malfunctions. In 2015, the Keystone plant released 3,569 tons of sulfur dioxide during equipment breakdowns, including a single malfunction that lasted for six months. This natural gas processing plant, located in Winkler County on the border with New Mexico, is

the top polluting industrial plant in Texas in terms of air pollution from malfunctions and maintenance.

Nowhere is this problem more pronounced than in the oil and gas extraction industry. Oil and gas production is responsible for releasing more acid rain-causing sulfur dioxide, and more smog-causing and often toxic volatile organic compounds from malfunctions than any other industrial sector. Unlike other industrial sectors, oil and gas producers appear to treat malfunctions – and the unfettered air pollution releases that accompany these events – as a routine business practice. In fact, in 2014 (the most recent year for which comprehensive data is available) the oil and gas extraction industry released 10,021 tons of sulfur dioxide during malfunctions and maintenance, or 41 percent of the industry's entire annual emissions. (The oil and gas industry released a total of 24,192 tons.) By comparison, the oil and gas industry reported 14,171 tons of sulfur dioxide releases during routine, permitted operations.

The Dow Chemical Plant in Freeport, south of Houston, released 15,717 pounds of benzene, a carcinogen, during malfunctions and maintenance in 2015, more than any other facility in Texas.

But excessive air pollution is not confined to the oil and gas fields. Refineries and chemical plants along the Gulf Coast are among the state's worst emitters of unauthorized pollution during breakdowns and maintenance. In 2015, Dow Chemical's Freeport plant, just south of Houston, released 15,717 pounds of the carcinogen benzene during equipment malfunctions and maintenance activity, more than any other facility in the state. Five of the state's top 10 worst benzene emitters during malfunctions and maintenance are in the working class and largely African American communities in Jefferson County, near the Texas-Louisiana border.

Year after year, the same industrial plants repeatedly break down and release dangerous air pollution. For example, the Pasadena Refining System oil refinery east of Houston, currently owned by Brazil's national oil company, chronically releases high levels of unpermitted particulate matter (soot). The refinery released 76,000 pounds of this dangerous pollutant in a 45-minute period due to an operator error in January 2012, even though the facility's permit allows only 34.8 pounds per hour of soot emissions. In 2015, the Pasadena Refinery reported 92,994 pounds of soot emissions, making it the state's second highest emitter of unauthorized soot from malfunctions and maintenance. In March 2016, the refinery caught fire when a compressor exploded, injuring an employee and releasing a black cloud of soot.

State environmental regulators have the tools they need to protect our health from dangerous air pollution, but enforcement is inconsistent. In addition, the U.S. Environmental Protection

Agency can do more to see that Texas follows federal permitting rules, which prohibit industrial plants from routinely releasing excessive air pollution during malfunctions and maintenance events. Swift and consistent enforcement of laws already on the books is the most effective way for regulators to rein in rogue polluters.

EPA is conducting a national review of state air pollution control plans regarding emissions from startups, shutdowns, malfunctions and maintenance to make sure the plans protect public air quality as required by the federal Clean Air Act. Through this re-examination of State Implementation Plans, EPA should ensure that the state rules and definitions are clear, and that industries' potential to emit air pollution are reasonably controlled and subjected to the law's permitting rules, which include requirements for industries to use best available pollution controls. In addition, EPA should ensure that current and planned federal rulemaking, such as EPA's review of emissions from the nation's oil and gas plants, focus on reducing excessive emissions from malfunctions and maintenance. These recommendations are discussed more fully in Section IV of this report.

This report ranks the top worst emitters of air pollution during malfunctions and maintenance, and is based on self-reported industry numbers in the Texas Commission on Environmental Quality records. For a detailed description of these databases, see **Appendix A**, *Methodology and Data*.

Different pollutants harm people, animals, and the environment in different ways, and so we present five snapshots – based on five pollutants of concern – in Section II. Below are the state's top malfunction and maintenance air polluters for two dangerous pollutants, sulfur dioxide and benzene.

Table 1: Top Emitters of Sulfur Dioxide During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Tons
1	Keystone Gas Plant	ETC Field Services	Winkler	3,569
2	Amerada Hess Seminole Gas Plant	Hess Corporation	Gaines	1,577
3	Howard Glascock Sour Gas	ConocoPhillips	Howard	1,358
4	Goldsmith Gas Plant	DCP Midstream	Ector	970
5	Fullerton Gas Plant	DCP Midstream	Andrews	528
6	Mabee Ranch CO2 Plant	Chevron	Andrews	420
7	Shire & Gollum Production	EOG Resources	McMullen	383
8	Mallet CO2 Recovery Gas	Occidental Permian	Hockley	358
9	EWR Satellite Gas	Burlington Resources Oil & Gas Co.	Crane	260
10	Rhodes Cowden Unit Oil and Gas	Occidental Permian	Ector	231

Table 2: Top Emitters of Benzene During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Pounds
1	Dow Freeport Chemical Plant	Dow Chemical	Brazoria	15,717
2	Basf Total Fina Nafta Region Olefins Complex	Basf Fina Petrochemicals	Jefferson	13,065
3	Beaumont Oil Refinery	ExxonMobil	Jefferson	7,870
4	Beaumont Chemical Plant	ExxonMobil	Jefferson	4,332
5	Lucas Station Oil and Gas	Chevron	Jefferson	2,629
6	Chevron Phillips Sweeney Oil/Gas/Chemical Complex	Chevron	Brazoria	2,000
7	Flint Hills Resources	Huntsman Petrochemical	Jefferson	1,280
8	Lyondell Chemical Channelview	Lyondell Chemical	Harris	1,139
9	Midkiff Gas Plant	Western Gas Resources	Reagan	995
10	Formosa Point Comfort Chemical Plant	Formosa Plastics	Calhoun	993

People who live just beyond the fencelines of oil refineries and chemical plants are often exposed to pollutants including benzene, which is a known carcinogen; and sulfur dioxide and volatile organic compounds, which contribute to smog and asthma attacks.

I. An Overview

Texas makes more electricity and produces more oil and gas than any other state,[1] and leads the nation in petroleum refining and chemical production.[2] But these industries also release dangerous pollutants into the air. As shown in **Appendix B**, *Emissions by Industry Sector*, and summarized in **Table 3** below, electric power plants, oil refineries, chemical manufacturing plants, and the oil and gas extraction industry, are by far the largest major sources of emissions. These facilities release thousands of tons a year of dangerous air pollution during routine operations. But, lax enforcement by state environmental regulators and legal loopholes allow many industrial sources to emit pollution far in excess of their permit limits when facilities break down or undergo maintenance.

Table 3: Volatile Organic Compounds (VOC) and Sulfur Dioxide (SO_2) Emissions (tons) by Industry Sector, 2014

Industry Sector	VOC			SO2		
	Routine	Malfunctions	Maintenance	Routine	Malfunctions	Maintenance
Oil and Gas Extraction	19,480	2,264	462	14,171	9,171	851
Chemical Manufacturing	22,524	1,646	457	26,507	701	234
Oil Refineries	18,231	668	54	20,621	554	99
Power Plants	7,059	148	124	343,968	55	115
All Other Industries	28,933	88	329	16,749	9	5

Overall, industry-wide annual routine emissions exceed their emissions during malfunctions and maintenance activities. But, as detailed below, there are individual plants that emit more pollution during malfunctions than they do during annual routine operations. In addition, the magnitude and duration of the air pollution releases during malfunctions and maintenance make these incidents especially harmful to people and the environment, which is another reason why these pollution episodes deserve heightened scrutiny. For example:

- On January 20, 2012, the Pasadena Refinery east of Houston (currently owned by Brazil's national oil company, Petrobras) released 76,000 pounds of particulate matter, or soot, in a 45-minute period due to operator error. This was illegal because the refinery's permit allows no more than 34.8 pounds of soot per hour.[3] The company's own analysis showed that this single episode resulted in a violation of the federal health-based particulate matter standard, which means that this single, 45-minute, episode made the air in the neighborhood nearby unsafe to breathe.[4] Particulate pollution is known to cause and contribute to asthma and heart attacks.[5]

- On September 28, 2015, ExxonMobil subsidiary XTO reported releasing 11,918 pounds of hydrogen sulfide from its Means oil field facility in Andrews County near the New Mexico border. The facility is allowed to release just 0.001 pounds per hour under its permit.[6]

- Between April 15 and April 20, 2015, the BASF Total Fina Nafta Complex in Port Arthur, on the Texas-Louisiana border, released 13,065 pounds of cancer-causing benzene due to a cooling tower leak. The facility is authorized to release only 0.5 pounds per hour under its permit.[7] This single event made this chemical plant the state's number one benzene polluter in 2015.

- On the morning of August 9, 2015, Shell's Deer Park oil refinery along the Houston Ship Channel, released *154 tons* of the carcinogen 1,3-Butadiene and thousands of pounds of other smog-causing volatile compounds in a one-hour period, due to an operating error.[8]

Attempts to protect the public from short, but intense, bursts of air pollution have been undercut by regulatory loopholes and lax enforcement. Without strict regulatory oversight, many industrial plants simply disregard their air pollution limits during periods when their equipment breaks down.

While some malfunctions may be truly unavoidable, many breakdowns are the result of operator errors, poor plant design, and a lack of preventive maintenance. In the summer of 2013, the Texas Commission on Environmental Quality used aircraft equipped with infrared monitors to randomly check oil and gas sites in West and South Texas. As a result, the study found 800 storage tanks leaking volatile organic compounds, and the agency concluded, "Nearly all of the issues documented arose from human or mechanical failures."[9]

Most malfunctions and maintenance events take place over a period of hours or days. As the examples above illustrate, large amounts of pollution are released in a relatively short time. These examples call into question the wisdom of EPA's recent weakening of its enforcement policy for major polluters, called its "High Priority Violator" policy. EPA weakened the policy in 2014, so that illegal emissions are no longer considered a high enforcement priority unless the violations persist for at least a week.[10] The revised EPA policy fails to recognize

The Pasadena Refining System Inc. oil refinery, east of Houston, released 92,994 pounds of particulate matter (soot) during malfunctions and maintenance in 2015, making it the second worst in the state.

that communities downwind from plants that chronically break down are at risk from large quantities of pollution that is often released in short but intense bursts, rather than in steady and predictable amounts over longer periods of time.

In addition to unauthorized air pollution from equipment malfunctions, industrial facilities also release excessive air pollution when they start up or shut down their equipment for routine maintenance. Despite longstanding federal policies intended to distinguish unavoidable malfunctions from planned or foreseeable activities (such as maintenance or routine startups), the United States EPA has allowed Texas to blur this regulatory line. In Texas, industries are required to obtain permits for planned maintenance activities, and emissions from these permitted activities are typically reported as part of a site's "routine" emissions.

Maintenance, Malfunctions, and Routine Emissions

Emissions from planned maintenance (including most equipment startups and shutdowns) are supposed to be considered part of a plant's routine emissions, because they are a normal part of industrial operations. As such, these emissions are supposed to be controlled and limits are supposed to be set in permits.

Malfunctions, on the other hand, are supposed to be rare and unpredictable events that are out of the control of the plant operator. But Texas and the EPA have allowed industries to blur the line between routine operations and unavoidable malfunctions, and for many facilities malfunctions are the norm.

Weak Enforcement Lets Polluters Disregard The Law and Permit Limits

Maintenance Emissions Should be Measured and Capped in Clean Air Act Permits

The Clean Air Act requires industrial sources to obtain permits that set limits on the amount of air pollution a source may emit. An air permit is supposed to set a maximum cap on all emissions from the permittee's operations, including emissions from required maintenance. Permits are supposed to include all emissions and all operating scenarios, even the emissions that may occasionally be higher than during routine operations, such as when sources are undergoing routine startups and shutdowns for maintenance. As such, most of the air pollution that companies report as maintenance emissions should be subject to federal Clean Air Act permitting requirements.

Air pollution that is released during periodic maintenance, including most of the equipment startups and shutdowns that go along with required maintenance, are considered part of a plant's normal, or expected, emissions. In Texas, companies are supposed to have all their routine emissions, including emissions that result from plant maintenance, accounted for in permits. The permits are supposed to contain emission caps and have monitoring to ensure that they are meeting the permit limits.[11]

Malfunction Emissions Are Not Subject to Permits

Malfunction emissions, on the other hand, are not factored into the permit limits by the TCEQ. When they exceed permit limits, or come from sources or activities not authorized by any permit, they are illegal. Malfunctions should be rare and unpredictable breakdowns

beyond the control of the operator. Texas law accounts for the fact that complex industrial plants may occasionally experience a malfunction despite using all precautions: companies can avoid paying penalties for such air pollution violations only if they have complied with a number of strict requirements, from properly designing and maintaining their equipment, to preventing recurrences of the same problems, to taking immediate steps to correct the underlying problem and to minimize the air pollution – even if that means shutting down production.

One would expect that, across the board, industrial sectors – power plants, refineries, chemical plants, and other industries – would report far more emissions from "routine" operations than from "emission events." But this is not always the case.

Coal-fired power plants report the highest levels of routine sulfur dioxide, nitrogen oxides, and particulate matter emissions, as compared to other industrial sources. Oil refineries and petrochemical plants typically report the highest levels of routine volatile organic compound emissions in the state.

Texas Lets Industries Blur the Line Between Malfunctions and Maintenance

Unfortunately, the State of Texas allows industrial sources to exceed permitted limits when plants undergo planned maintenance, often treating these routine activities as though they are unavoidable malfunctions. Allowing industry to blur the line between routine maintenance and malfunctions only confounds regulatory scrutiny and complicates enforcement efforts.

- On August 26, 2015, ExxonMobil subsidiary XTO notified the State that it was undertaking a planned project at its Means oil and gas site in Andrews County.[12] As a result of this work, the company reported at least two major releases of hydrogen sulfide gas, including a massive release of 11,918 pounds of the dangerous acid gas on September 28, 2015, from a source that is allowed to emit no more than 0.001 pound per hour.[13]

- Energy Transfer subsidiary Regency Field Services reported that its Waha Gas Plant in Pecos County "was down for maintenance" involving the compressor from September 22, 2015 to October 8, 2015, during which time the plant flared more than 400 pounds of hydrogen sulfide and more than 18 tons of sulfur dioxide. The permit allows *zero* emissions of these two dangerous pollutants from the equipment involved. The company's maintenance report includes emissions from a power outage and a malfunctioning valve during the work.[14] Less than three weeks later, on October 17, 2015,[15] October 21, 2015,[16] and then again on October 23, 2015,[17] the plant reported malfunctions and unauthorized emissions related to the compressor.

- The Keystone Gas plant in Winkler County reported a "scheduled shutdown of the sulfur recovery unit" to conduct planned maintenance from February 11 until February 19, 2016. During that period, the plant released 488 pounds of hydrogen sulfide and nearly 23 tons of sulfur dioxide from its acid gas flare. The permit authorizes *zero* emissions of these dangerous pollutants from the flare.[18]

- On March 14, 2016, and again on March 28, 2016, the Mallet Carbon Dioxide Recovery Plant in Hockley County filed a malfunction report notifying the state that, "During normal operations, the… compressor will be taken for its annual [periodic monitoring], routing its inlet to flare."[19]

The examples above suggest that Texas industries report excessive air pollution from maintenance activities that should be subjected to state and federal air permitting requirements. Instead, the excessive emissions from what appear to be planned activities are treated as though they are unavoidable malfunctions.

Permits should accurately reflect a plant's real emissions, and should cap those emissions based on the best available anti-pollution technologies. Unfortunately, overly permissive Texas permits mask excessive emissions and make enforcement difficult. For example, the electric power industry provided the TCEQ with boilerplate text to include in coal-fired power plants' "Planned Startup, Shutdown, and Maintenance" permits. Today, almost all of Texas's roughly two dozen coal fired power plants have permits that improperly authorize unlimited levels of particulate matter, or soot, for thousands of hours per year during planned startups and shutdowns. This is a part of the reason why the power sector reports relatively low malfunction and maintenance emissions as compared to its routine emissions. Several environmental and public health groups petitioned EPA in May 2015, to revoke illegal permits and to review the state rules under which these permits were issued.[20] Almost a year later, EPA has still not responded to the Petition, and Texas's coal-fired power plants continue to release excessive levels of air pollution during startups and shutdowns, when pollution controls are not functioning.

A plume rises from the BASF Freeport Works plant in Freeport, Texas, south of Houston.

Another source of weak and unenforceable permits are definitions of key terms in Texas's air pollution rules, which are inconsistent with federal rules. For example, state definitions of the terms "emission event" (essentially any malfunction or unscheduled startup, shutdown, or maintenance activity) and "scheduled maintenance" do not match federal definitions, allowing Texas companies to avoid federal permitting requirements. Another example is the Texas definition of the term "facility." Under federal law, consistent with common understanding, a facility comprises an entire industrial site such as a factory or an oil refinery. But, under Texas's air

permitting rules, a facility is defined as a "discrete… structure, device, item, equipment, or enclosure…"[21] This definition allows companies to obtain many air pollution permits for a single industrial site, often avoiding the stringent federal anti-pollution rules required for large plants or industrial sites. For example, refineries and chemical plants in Houston have avoided the strict federal requirements aimed at cleaning up the area's unhealthy ozone (smog) levels through piecemeal expansion projects and multiple permits covering the facilities that, together, comprise a single industrial site. State regulators allow industries to obtain permits incrementally, even when the net result is a vastly expanded plant that emits more pollution than it did previously.

A related problem is the widespread use of "permits by rule." Theoretically, Texas allows small sources of pollution – for example, sources that emit less than 25 tons of sulfur dioxide or volatile organic compounds a year – to operate by simply filling out a registration form and agreeing to follow a one-size-fits-all rule. In practice, large industrial sites that report well over the 25 ton per year threshold routinely build new projects or expand existing facilities under cover of these permits-by-rule. For example, Dow Chemical's Freeport plant, which is largest chemical manufacturing complex in the Western Hemisphere, according to the company,[22] currently has 448 active permits-by-rule. Motiva has 89 active permits by rule at its Port Arthur Oil Refinery, which is the largest petroleum refinery in the United States.[23]

Lax Oversight and Poor Enforcement Allow Companies to Disregard Pollution Limits

In its Fiscal Year 2014 Annual Enforcement report, the Texas Commission on Environmental Quality reported 1,708 administrative enforcement orders for all of its environmental programs – air, water, and waste. Oil and gas production, oil refineries, and chemical manufacturing plants accounted for only 6 percent of TCEQ's fiscal year 2014 enforcement actions.[24] The Texas State Auditor's Office has found that the lack of timely enforcement by the Texas environmental agency allows violations to persist and slows penalty collection, creating a system where our regulators fail to hold polluters accountable for permit violations.[25]

Fines imposed by the state are often very small in comparison to the cost to public health and the profits generated by the industry. For example, for this report, we examined 10 Texas oil and gas plants that reported 43,326 tons of sulfur dioxide air pollution from 2009 through 2014, and found that the state had imposed $463,299 in penalties in 13 enforcement orders. That equates to about $11 per ton for the illegal pollution, which is only a tiny fraction – one or two percent -- of the $567 to $842 per ton in health-related costs caused by the emissions, including for emergency room treatment of asthma and heart attacks, as well as other health problems, according to federal and state data and a widely used scientific model for estimating public health impacts.[26]

A 2014 review of EPA' compliance database concluded that, "compared to other states, Texas has a consistently higher percentage of major industrial plants with 'high priority violations' of air pollution laws. Yet, compared to other states, Texas does far fewer comprehensive inspections of polluting facilities."[27]

When the state environmental agency does initiate an enforcement action, the results are often negligible. First, because Texas is a very large state with thousands of industrial sites, environmental inspectors rarely conduct on-site investigations. The vast majority of TCEQ's reported "investigations" are actually just file reviews, which means that state enforcement staff never leave their desks. For example, as shown in **Appendix C**, *Enforcement Data for Selected Oil and Gas Facilities, 2009 to Present*, TCEQ inspectors report 896 total "Investigations" of 15 of the largest emitters. But, only 37 of these compliance investigations were on-site inspections. The vast majority of these investigations – more than 95 percent – are "File Reviews," during which TCEQ enforcement staff simply review the company's filings to make sure they reported the event.

TCEQ enforcement is inconsistent. For example, since 2009, according to state enforcement records, the agency issued more Notices of Violation to the Keystone Gas Plant (12) than it issued to the Goldsmith Gas Plant (8). Yet, TCEQ has issued only one enforcement order against Keystone and collected less than $10,000 in penalties (a 2010 and a 2016 enforcement order are being negotiated between the TCEQ and the company as of the writing of this report). Yet, the agency issued six enforcement orders against Goldsmith and collected more than half a million dollars in penalties. See, **Appendix C**.

Texas has more industrial plants with high priority violations of the federal Clean Air Act than other states, but conducts fewer comprehensive inspections.

Since 2009, the TCEQ investigated Occidental's Mallet Carbon Dioxide Recovery Plant near Lubbock (one of the top 10 worst sulfur dioxide emitters in the state) a total of 227 times. Yet, the agency issued only 2 notices of violation in that time period, neither of which resulted in a formal enforcement order. In comparison, TCEQ investigated the Mont Belvieu Gas Plant near Houston (one of the oil and gas sector's top worst emitters of volatile organic compounds during malfunctions) only 29 times, but it issued five formal enforcement orders in that same time period. See, **Appendix C**.

Some of Texas's enforcement actions call into question the state's commitment to environmental protection. For example, to address violations of air permit limits for volatile organic compounds at the Pasadena Refinery south of Houston, the TCEQ ordered the company to amend its permit "to increase the VOC emission rates" for two of its flares, from a previous combined limit of 54.26 tons per year to a new higher limit of 79.98 tons per year.[28]

The state chose to remedy the refinery's noncompliance not by requiring the plant to comply with its permit, but rather by increasing the amount the refinery can emit.

II. The Top 10 Emitters of Air Pollution During Malfunctions and Maintenance

Different air contaminants harm people and the environment in different ways, and so this report presents five separate snapshots, each one a "top 10" list based on different pollutants of concern. The rankings below show the state's top ten industrial plants responsible for the highest levels of self-reported air pollution from malfunctions and maintenance for five pollutants of concern: sulfur dioxide; hydrogen sulfide; nitrogen oxides; benzene; and particulate matter.

These rankings are based on companies' final reports filed as part of the State of Texas Electronic Emissions Reporting System. Companies file an "emission event" report each time a plant has an unauthorized release of air pollution, whether the event is caused by an unavoidable malfunction or a planned activity such as equipment maintenance. Companies file their reports as soon as they can before or after the pollution event occurs. These reports are available on the TCEQ's Air Emission Event Report database at: http://www2.tceq.texas.gov/oce/eer/.

Oil and Gas Plants are the Top Emitters of Major Pollutants During Malfunctions

Sulfur dioxide, which comes mainly from burning fossil fuels, acidifies soil and water, and causes an array of respiratory problems.[29] Studies show correlations between short-term exposure to sulfur dioxide and increased visits to hospital emergency rooms; children, the elderly, asthmatics and those who exercise regularly are most at risk.[30]

Table 4: Top 10 Emitters of Sulfur Dioxide During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Tons
1	Keystone Gas Plant	ETC Field Services	Winkler	3,569
2	Amerada Hess Seminole Gas Plant	Hess Corporation	Gaines	1,577
3	Howard Glascock Sour Gas	ConocoPhillips	Howard	1,358
4	Goldsmith Gas Plant	DCP Midstream	Ector	970
5	Fullerton Gas Plant	DCP Midstream	Andrews	528
6	Mabee Ranch CO2 Plant	Chevron	Andrews	420
7	Shire & Gollum Production	EOG Resources	McMullen	383
8	Mallet CO2 Recovery Gas	Occidental Permian	Hockley	358
9	EWR Satellite Gas	Burlington Resources Oil & Gas Co.	Crane	260
10	Rhodes Cowden Unit Oil and Gas	Occidental Permian	Ector	231

- All of the top 10 highest emitters of sulfur dioxide during malfunctions and maintenance in 2015 are oil and gas production facilities. All but one of these plants are located in the Permian Basin oil and gas fields of West Texas, known for its sour gas (high in sulfur). Only one of the top 10, EOG Resources' Shire and Gollum facility, is located in the Eagle Ford shale area in South Texas.

- The Keystone Gas Plant, owned by Dallas-based ETC Field Services, released more sulfur dioxide during malfunctions and maintenance in 2015 than any other facility in the state. The Keystone plant released 67.5 tons of sulfur dioxide during one malfunction lasting four days, in August 2015, in an attempt to "burn out the blockage" when their pollution control equipment failed.[31] To put that in perspective, the Clean Air Act requires industrial plants to install modern pollution controls and undergo stringent air permitting when plants make changes that result in *40 tons per year* of additional sulfur dioxide emissions.

- Amerada Hess's Seminole Gas Plant in Gaines County in West Texas released the second highest amount of sulfur dioxide during malfunctions and maintenance. This plant reported more than 1,500 tons of sulfur dioxide releases in 2015 during malfunctions and maintenance, which is up from its reported 895 tons in 2014. In 2014, the plant released more than double the amount of sulfur dioxide during malfunctions and maintenance than it did during its routine operations.

- Occidental's Mallet plant in West Texas claims to be a "minor" source of dangerous sulfur dioxide. Indeed, the plant's permit authorizes approximately 16 separate emission points to release a combined 0.93 tons per year of sulfur dioxide, which is

Not only smoke and soot, but tons of sulfur dioxide, hydrogen sulfide, nitrogen oxides and benzene often pour from petrochemical plants when they malfunction. These "upset" incidents often violate the pollution limits in the state permits held by the companies, but Texas is light on enforcement and penalties.

well below the 40 ton per year threshold that makes a source a "major source" subject to certain heightened permitting requirements. Yet, in 2015, the plant released more than 375 tons of sulfur dioxide from malfunctions and maintenance. In 2014, the plant reported 229 tons of sulfur dioxide emissions during malfunctions, and another 220 tons during scheduled maintenance. The maintenance emissions alone are well over the major source threshold, and hundreds of times over the plant's permitted limits.

Hydrogen sulfide is best known as the "rotten egg" smell often associated with oil and gas production. At low levels this acid gas irritates the eyes, nose and throat, and causes breathing difficulties. Long term exposure can lead to miscarriages, poor memory and dizziness, while exposure to very high concentrations cause the immediate inability to breathe, coma and even death.[32]

Natural gas fields in New Mexico, Arkansas, West Texas and north-central Wyoming are well known for their especially high levels of hydrogen sulfide. Because the gas is heavier than air, it can pool in low-lying areas if the wind is not blowing. In February 1975, a hydrogen sulfide release killed eight people in a home near an oil and gas production site in the small West Texas town of Denver City.[33]

Table 5: Top 10 Emitters of Hydrogen Sulfide Pollution During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Tons
1	Means CO2 Discharge-Injection Oil and Gas	XTO/ExxonMobil	Andrews	46.0
2	MR Barry Batt & Water Oil and Gas	Altura Energy LTD	Hockley	45.9
3	Keystone Gas Plant	ETC Field Services	Winkler	38.0
4	Johnson GBSA UNIT CB Oil	Occidental Permian LTD	Ector	30.7
5	Amerada Hess Seminole Gas Plant	Hess Corporation	Gaines	19.9
6	Howard Glascock Sour Gas	ConocoPhillips Company	Howard	14.7
7	N Cowden Unit Test STA 4 Oil	Occidental Permian LTD	Ector	14.1
8	Regency Field Services Pipeline	ETC Field Services LLC	McMullen	13.6
9	Goldsmith Gas Plant	DCP Midstream LP	Ector	12.0
10	Big Mesa Station 142 Oil and Gas	DCP Midstream LP	Pecos	11.3

- All of the top 10 highest emitters of hydrogen sulfide during malfunctions and maintenance, except for one, are in West Texas. Ector County, which has three of the top 10 worst hydrogen sulfide emitters, was home to 148 natural gas operations in 2015.[34]

- The Keystone plant reported a single malfunction that lasted six months. The reason, according to the company: "The SRU [sulfur recovery unit] was down from December 10th [2014] to June 15th [2015] and was flaring acid gas during this shut down."[35]

Nitrogen Oxides are a group of pollutants known for causing acid rain and smog, and contributing to asthma attacks, emphysema, bronchitis, and other respiratory problems.[36] The Houston area and the Dallas-Fort Worth Metroplex rank among the nation's top 10 smoggiest cities.[37]

Table 6: Top 10 Emitters of Nitrogen Oxide Pollution During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Tons
1	Haley CTB Oil and Gas	XTO Energy	Winkler	11.7
2	Cornell-Mahoney Gas Plant	XTO Energy	Yoakum	12.6
3	Coyanosa Gas Plant	Koch Midstream Processing	Pecos	12.3
4	ETC Texas PL Pipeline	ETC Texas Pipeline	Dewitt	11.7
5	University Block9 CE Tank Batt Oil and Gas	XTO Energy	Andrews	11.0
6	Penn Unit ABCD Battery Oil and Gas	XTO Energy	Andrews	9.4
7	Midmar East Gas Plant	Coronado Midstream	Andrews	8.4
8	Agrium US Borger Nitrogen	Agrium US	Hutchinson	8.1
9	CAG Central Battery NO 448 Oil and Gas	XTO Energy	Ector	7.8
10	Beaumont Chemical Plant	ExxonMobil	Jefferson	7.1

- Oil and gas operations in West Texas and South Texas dominate the list of the state's top 10 highest emitters of nitrogen oxides during malfunctions and maintenance. Andrews County, for example, is home to three of the state's top 10 emitting facilities, releasing a combined total of 28.7 tons of smog-causing NOx in 2015.

- Agrium, a fertilizer plant in the Texas Panhandle released 8 tons of NOx in 2015 during malfunctions and maintenance, making it the state's number eight top polluter of this contaminant.

- ExxonMobil's Chemical Plant in Beaumont on the Gulf Coast is the only petrochemical plant ranked among the state's top 10 worst NOx polluters during malfunction and maintenance. In 2015, the chemical plant reported 7.1 tons of smog-forming nitrogen oxides during malfunctions and maintenance.

- XTO Energy Inc, a subsidiary of ExxonMobil, has five of the top 10 worst emitters of NOx during malfunctions and maintenance. Five West Texas XTO plants, combined, reported 54.5 tons of NOx releases during malfunctions and maintenance in 2015.

Refineries and Petrochemical Plants Release the Most Unauthorized Benzene

Benzene is a dangerous volatile organic compound released into the air from many industries that use, store, or produce petroleum products, plastics, pesticides and many other products.[38] Short term exposure to benzene can lead to dizziness, rapid or irregular heartbeat, tremors, unconsciousness and at high levels even death. Longer term exposure to benzene can cause leukemia, as well as birth defects, low birth weight and bone marrow damage.[39] A 2010 study by University of Texas School of Public Health and Texas Department of State Health Services found that women living in neighborhoods with higher than average levels of benzene are more likely to give birth to babies with serious neurological defects. [40]

Because benzene is a known carcinogen, the World Health Organization warns that there is no safe level of benzene exposure.[41] But, despite the significant health impacts posed by benzene, industrial facilities routinely release large amounts of this cancer causing chemical, well above permitted limits.

Table 7: Top 10 Emitters of Benzene During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Pounds
1	Dow Freeport Chemical Plant	Dow Chemical	Brazoria	15,717
2	BASF Total Fina Nafta Region Olefins Complex	Basf Fina Petrochemicals	Jefferson	13,065
3	Beaumont Oil Refinery	ExxonMobil	Jefferson	7,870
4	Beaumont Chemical Plant	ExxonMobil	Jefferson	4,332
5	Lucas Station Oil and Gas	Chevron	Jefferson	2,629
6	Chevron Phillips Sweeney Oil/Gas/Chemical Complex	Chevron	Brazoria	2,000
7	Flint Hills Resources	Huntsman Petrochemical	Jefferson	1,280
8	Lyondell Chemical Channelview	Lyondell Chemical	Harris	1,139
9	Midkiff Gas Plant	Western Gas Resources	Reagan	995
10	Formosa Point Comfort Chemical Plant	Formosa Plastics	Calhoun	993

- In 2015, Dow's Freeport Chemical plant, just south of Houston, released more unauthorized benzene than any other plant in the state. During a malfunction on February 2, 2015, the facility released 1,407 pounds of this cancer causing chemical over a 13 hour period, even though the facility's permit allows no more than 339 pounds.[42]

- Eight of the 10 top emitters of unauthorized benzene pollution were in three counties in the Houston and Beaumont-Port Arthur area, home to nearly 5 million people.

- All but one of the top 10 polluters are petrochemical facilities.

- ExxonMobil's oil refinery and petrochemical complex in Jefferson County released more than 12,200 pounds of benzene into the air in 2015.

- The second highest benzene polluter, the BASF Total Fina Nafta Complex in Port Arthur, released all of its reported 13,065 pounds of benzene in one event – a cooling tower leak that occurred between April 15 and April 20, 2015.

Oil Refineries Report the Most Particulate Matter from Malfunctions and Maintenance

The most dangerous form of **particulate matter** pollution comes from burning hydrocarbons, and usually refers to very small particles — less than 10 micrometers in diameter, very roughly approximating the diameter of a human hair. Because these particles are so small, they can pass through the throat and nose and get deep inside the lungs or bloodstream, causing significant health problems. In humans, studies have linked particle pollution to asthma, heart attacks and lung disease, and pre-mature death.[43]

Table 8: Top 10 Emitters of Particulate Matter (Soot) During Malfunction and Maintenance, 2015

Rank	Facility Name	Facility Owner	County	Total Pounds
1	Borger Oil Refinery	ConocoPhillips	Hutchinson	526,757
2	Pasadena Refining Systems, Inc.	Petrobras	Harris	92,994
3	Houston Chemical Plant	Texas Petrochemicals	Harris	15,326
4	Marshall Chemical Plant	Norti Americas, Inc.	Harrison	5,870
5	Valero McKee Oil Refinery	Valero	Moore	5,047
6	Owens Corning Insulating	Owens Corning	Ellis	3,561
7	Taylor Foundry Iron Casting	Taylor Foundry Company	Clay	1,579
8	Western Refining El Paso	Chevron USA	El Paso	1,500
9	Sid Richardson Carbon	Sid Richardson Carbon LTD	Hutchinson	1,329
10	Valero Three Rivers Oil Refinery	Valero	Live Oak	1,113

- In 2015, the top emitter of particle pollution during malfunctions and maintenance was Conoco Phillips' Borger Refinery in Hutchinson County in the Texas Panhandle. The refinery reported releasing more than half of a million pounds of soot pollution for the year during malfunctions and maintenance. On June 13, 2015, the Borger Refinery reported more than 143,000 pounds of soot during a single event.[44]

- Sparsely populated Hutchinson County in the Texas Panhandle is home to two of the state's top 10 highest malfunction and maintenance soot emitters. The state's worst soot polluter, the Borger Refinery, is located next to the state's number nine worst soot polluter, the Sid Richardson Carbon plant.

- The heavily populated Houston Ship Channel is home to the state's second and third highest emitters of particulate pollution from malfunctions and maintenance.

Pasadena Refining Systems, Inc., located in Houston's Pasadena neighborhood, released the second greatest volume of unauthorized soot pollution for the year, nearly 93,000 pounds. The refinery is owned by Petrobras, Brazil's national oil company, which is in the midst of legal, financial, and public relations challenges.[45] In January 2016, residents of Pasadena convened at a public hearing to oppose the state's planned renewal of an expired air pollution permit.[46] About a month later, the facility caught on fire after a compressor exploded, injuring one employee.[47]

Appendix D, *Malfunction and Maintenance Emissions in Major Metropolitan Areas,* shows the top emitters during malfunctions and maintenance in six Texas major metropiltan areas in 2015.

Appendix E, *Malfunction and Maintenance Emissions by County,* is a map of Texas showing the counties where industrial sites released excessive emissions during malfunctions and maintenance in 2015.

III. Drilling Down into the Oil and Gas Industry

The State of Texas has a long history of trailblazing when it comes to the oil and gas industry. In 1901, the Spindletop gusher near Beaumont set off an unprecedented oil rush and started the state on the path to becoming one of the world's major energy centers. The first horizontal, or slant drilled, wells were drilled in Texon, Texas in 1929.[48] For much of the 20th century an obscure state agency called the Texas Railroad Commission effectively controlled the global price of oil, by setting production rates and other limits on Texas's prolific wells.[49] And today, Texas produces more oil and natural gas than any other U.S. state.

But, unfettered oil and gas production has its downsides. Oil and gas producers have historically been exempted from important anti-pollution and right-to-know laws.[50]

As explained above, most industrial sources emit far more air pollution annually during routine operations than they do during malfunctions. This is unsurprising, because malfunctions are supposed to be rare, unpredictable events. So, for example, all of the state's oil refineries together reported 18,231 tons of "routine" emissions of volatile organic compounds (a key ingredient in the formation of ozone, or smog) in 2014, and about 668 tons from malfunctions. Similarly, all of the state's chemical plants together reported about 22,524 tons of volatile compounds during routine operations, and a much smaller amount, about 1,646 tons, during malfunctions. Likewise, for sulfur dioxide, most Texas industries reported orders of magnitude more routine emissions than they did malfunction emissions.

But not so for the oil and gas extraction industry.

Unlike the other industrial sectors, oil and gas producers reported thousands of tons per year of sulfur dioxide and volatile compounds during malfunctions.

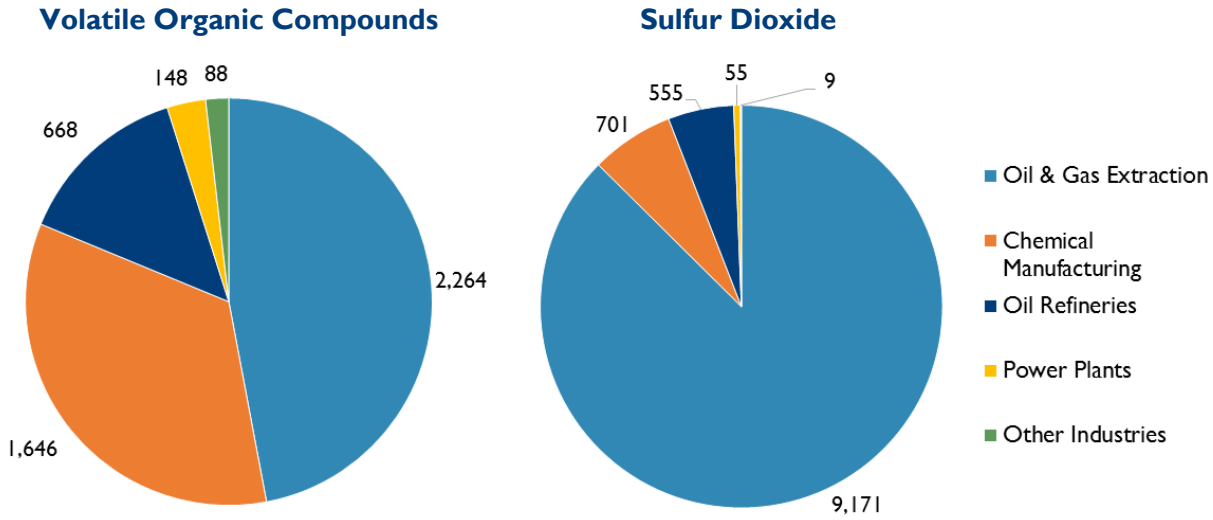
- In 2014, oil and gas producers released a whopping 9,171 tons of sulfur dioxide into the air during malfunctions, and another more than 851 tons during maintenance, for

a total of more than 10,000 tons. By comparison, the oil and gas industry reported its total annual routine emissions to be about 14,171 tons.

- In 2014, oil and gas producers reported more than 2,725 tons of volatile compounds from malfunctions and maintenance, compared to about 19,480 tons released during routine operations. By comparison, oil and gas producers emitted more volatile compounds during malfunctions and maintenance than all other Texas industrial sectors combined.

No other industrial sector comes close to the high levels of sulfur dioxide and volatile compounds released into the air from the oil and gas sector during malfunctions, as shown in **Figure 1**, below. **Appendix B** summarizes all industry sectors' reported routine, malfunction, and maintenance emissions.

Figure 1: Malfunction Emissions (tons) by Industry, 2014



It is no surprise that most of the worst sulfur dioxide emitters in the state are in West Texas's Permian Basin area. The prolific Permian Basin area, a roughly 75,000 square mile area in West Texas and southeastern New Mexico, is known for its sour (high in sulfur content) oil and gas. When equipment and processes break down at plants that process or store sour oil or gas, the result can be dangerous levels of sulfur dioxide and hydrogen sulfide. Residents of South Texas also report concerns about hydrogen sulfide from sour gas sites in the Eagle Ford Shale area.[51]

For oil and gas producers, large pollution events appear to be business-as-usual. The state's top emitter of sulfur dioxide pollution in 2014 and 2015 is the Keystone Gas Plant, owned and operated by Dallas-based Energy Transfer and its subsidiary, Regency Field Services. The Keystone plant's air pollution permit authorizes no more than 801.26 tons of sulfur dioxide emissions per year.[52] Yet, the plant reported almost seven times their permit limit, about 5,493 tons, of sulfur dioxide pollution during malfunctions in 2014.

Some oil and gas producers report more annual emissions from malfunctions than from routine operations, as shown in the bar graphs in **Figures 2** and **3**, below. In 2014, eight of the top ten highest oil and gas industry sulfur dioxide emitters released more pollution during malfunctions than during their routine operations. Five out of the top ten highest oil and gas industry emitters of volatile organic compounds released more of that pollutant during malfunctions than during their routine operations.

Figure 2: Sulfur Dioxide Emissions (tons) at the Highest Emitting Oil and Gas Facilities, 2014

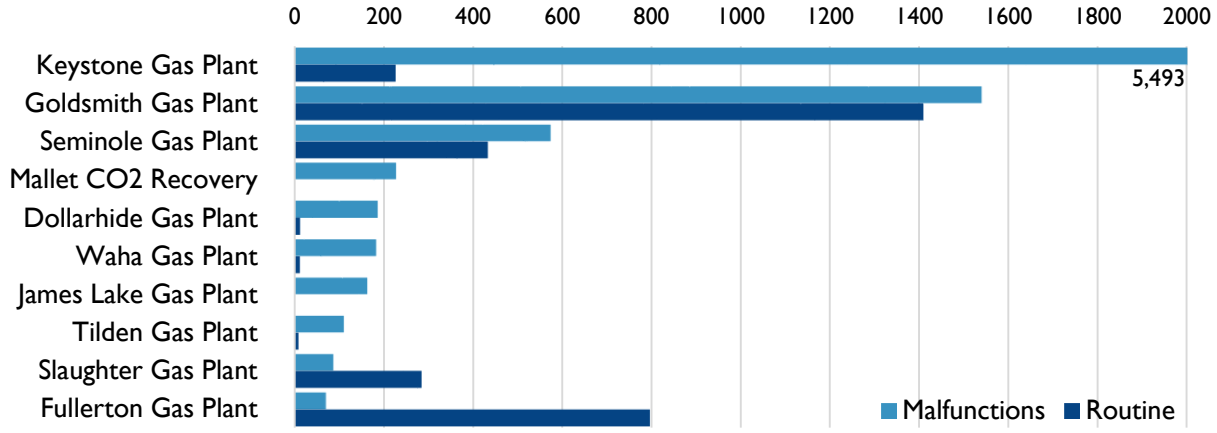
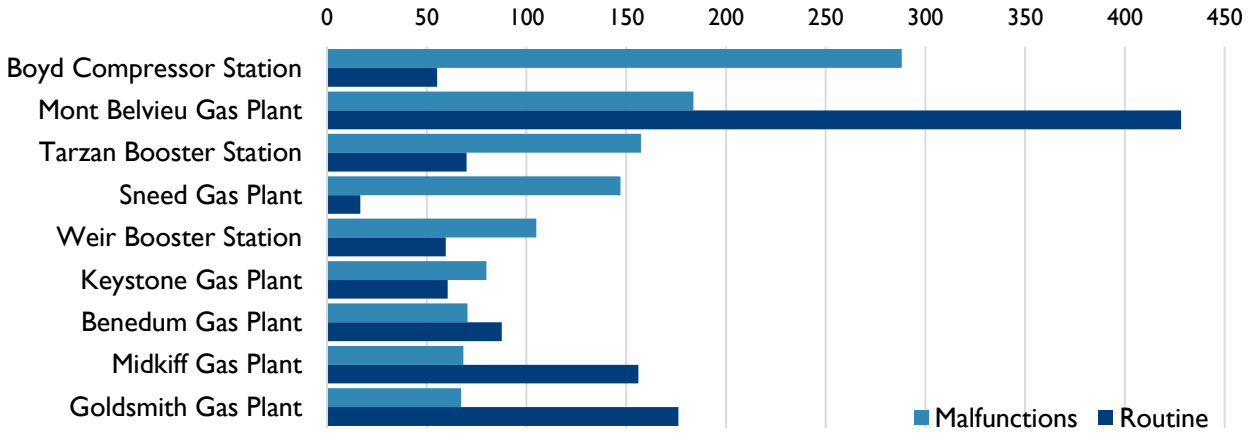
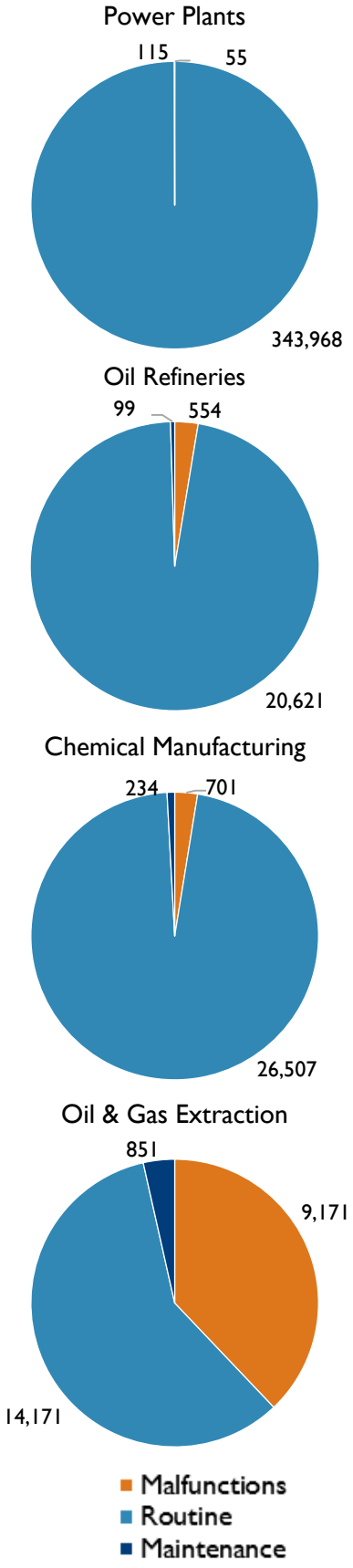


Figure 3: Volatile Organic Compound Emissions (tons) at the Highest Emitting Oil and Gas Facilities, 2014



The plants featured in this report are representative of an industry prone to running facilities that break down routinely and operate year-round in noncompliance with permitted pollution limits. The natural gas plants highlighted in this report take in sour natural gas, and remove sulfur and other impurities before putting the gas into sales pipelines. The Keystone plant, currently owned by ETC Field Services, has changed hands many times over the years, and has a history of breakdowns, including at least one explosion resulting in serious injuries.[53] But, the Keystone Gas Plant is not alone in terms of excessive malfunction emissions. As

Figure 4. SO_2 Emissions (tons) from Major Industries



detailed in this report, other oil and gas facilities – booster stations, compressor facilities, and pipelines – release excessive levels of unauthorized emissions as a result of malfunctions and maintenance.

- Targa's Boyd Compressor Station in West Texas released more volatile organic compounds during malfunctions than any other oil and gas facility in the state in 2014. In fact, the facility released 288 tons of smog-forming volatile compounds during malfunctions, more than five times the amount (55.2 tons) the facility released during its routine operations. The Boyd station has a permit that allows only 41.32 tons per year of this pollutant.[54] Compressor stations compress natural gas so that it can be transported via pipelines.

- DCP Midstream's Tarzan Booster Station in Martin County in West Texas released more volatile compounds during malfunctions (157 tons) than it did during routine operations in 2014. As the name implies, the booster station compresses and helps to transport petroleum products via pipeline downstream to chemical plants and other customers.

IV. Conclusion and Recommendations

The magnitude and duration of air pollution from malfunctions make them especially harmful to people and the environment. In addition, allowing industries to pollute the air with impunity erodes the public's confidence in the agencies charged with protecting our health, while at the same time providing no incentive for industries to clean up.

State and federal officials have the tools they need to protect our health and our environment from dangerous air pollution, and they can do more to hold accountable the industrial plants that routinely release excessive air pollution as a result of malfunctions and maintenance. Consistent and robust enforcement of laws already on the books is the most direct and effective way to rein in rogue polluters. Congress has also empowered citizens to take enforcement actions to clean up air pollution, when the government agencies charged with protecting the air we breathe fail to do their jobs. Clean Air Act "citizen suits" can force polluters and scofflaws to install modern pollution control equipment and pay penalties for air pollution violations, including examples in this report.

In addition, the U.S. Environmental Protection Agency is developing several important federal rules that could help reduce air pollution from malfunctions and maintenance.

- EPA is currently requiring 36 states, including Texas, to strengthen their rules dealing with equipment startups, shutdowns, and malfunctions.[55] EPA has set a deadline of November 2016 for the affected states to submit rule changes for EPA's review and approval. This is a step in the right direction, but the scope of EPA's review needs to be significantly expanded. As detailed in this report, the State of Texas allows industries to blur the line between malfunctions and planned (or foreseeable) maintenance. For example, most equipment startups are predictable events during which industrial plants follow a set operating procedure. These activities are not the same as malfunctions that are beyond the control of the operator. EPA should expand its review of the Texas air pollution rules regarding not only malfunctions, but also the state's byzantine rules regarding maintenance (and the equipment startups and shutdowns that accompany these activities).

- EPA should require industrial plants to fairly and accurately measure their potential to emit pollution from all normal and foreseeable operations, including maintenance and the equipment startups and shutdowns that accompany these events. EPA should require that plants control these emissions using the best available technology. EPA should require state regulators to set clear, measurable numeric limits in permits, and these emission limits be set at levels that do not degrade air quality.

- Specific to the oil and gas extraction industry, in March 2016, EPA announced the initiation of an Information Collection Rule to gather data on methane emissions from oil and gas extraction, processing, storage and transportation.[56] The high levels of reported volatile organic compound emissions during malfunctions and maintenance suggest strongly that EPA should focus on these events. Methane is often released along with other volatile compounds. EPA should focus on not only "routine" emissions, but also maintenance, and startup/shutdown, emissions. In addition, EPA should be mindful that the oil and gas industry treats many malfunctions as routine business practices, and so EPA should include all emissions in its efforts to reduce methane and other air pollution from this industry.

In addition, EPA should thoroughly review the Texas State Implementation Plan, and call on the State of Texas to comply with federal laws and policies that:

- Define "facility" as common sense and federal law dictate, not as Texas industries choose. The Texas definition of "facility" allows major sources of air pollution and industrial plants to piecemeal their pollution permits and avoid having to comply with the most protective standards.

- Allow only the smallest industrial plants – those that release truly small amounts of air pollution – to obtain permits-by-rule in lieu of actual Clean Air Act permits. Currently, Texas allows major sources of air pollution, including some of the largest oil refineries and petrochemical plants in the world, obtain dozens of permits-by-rule.

Oil and gas producers and other industries that report massive releases of air pollution on a routine basis should not be allowed to use permits-by-rule to circumvent more stringent permitting requirements.

There is no question that occasional breakdowns and releases of air pollution can happen at even the most well-maintained industrial plant. But companies should not be allowed to use malfunctions and maintenance as a blanket excuse to spew unlimited amounts of dangerous pollutants without any penalties or accountability. Strict and consistent enforcement of permit limits will not only create a financial incentive for industries to better maintain their plants and invest in modern equipment, but also protect public health and the environment.

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Appendix A. Methodology and Data

This report ranks the state's worst air polluters based on company self-reported emissions of air pollution from malfunctions and maintenance. The report is based on analyses of two separate Texas Commission on Environmental Quality databases.

First, we analyzed the 3,420 reports contained in the State of Texas Electronic Emissions Reporting System for 2015. In 2015, 679 industrial sites filed these reports each time they released air pollution resulting from malfunctions and maintenance. This database houses the reports that companies are required to file when their plants release more air pollution than their permits allow. This data is publicly accessible (http://www2.tceq.texas.gov/oce/eer/) and allows members of the public to track unauthorized releases of air pollution by county, or from any facility of interest. For this report, we analyzed the most recent full year, 2015, of available emission events. We also provide in the report, where relevant, individual examples of company reports from previous years and some recent, 2016, examples. While the details of each of the thousands of self-reported emissions events have not yet been verified by state regulators, our analyses of these reports and the raw company self-reported emissions data they contain is clear evidence of rampant and ongoing air pollution violations. We relied on the most recent full year of data, 2015, to rank the state's top rogue polluters.

Second, we analyzed a separate dataset – the Texas Emission Inventory. This data, obtained through the state's Public Information Act, provides a detailed breakdown of emissions from roughly 2,000 industrial sources. The data allow us to compare individual plant's reported routine emissions with its malfunction and maintenance emissions. In addition, the data allow us to compare the performance of entire industrial sectors. Because the TCEQ verifies and compiles annual Emissions Inventories before making the database publicly available, the most recent data available as of the writing of this report is 2014.

All of the rankings in this report, including our use of terms such as "top" or "worst" polluters, are based on company self-reported emissions from malfunctions and maintenance. The report does not rank industrial sources based on their reported routine emissions.

Company self-reported data is often subject to reporting errors. Industries may interpret the state's reporting rules and legal definitions differently. For these reasons, we invite corrections and explanations from the companies listed in this report.

Appendix B: Emissions by Industry Sector (tons), 2014

Industry Sector	SO2			VOC		
	Routine	Malfunctions	Maintenance	Routine	Malfunctions	Maintenance
Oil And Gas Extraction	14,171	9,171	851	19,480	2,264	462
Chemical Manufacturing	26,507	701	234	22,524	1,646	457
Oil Refineries	20,621	554	99	18,231	668	54
Power Plants	343,968	55	115	7,059	148	124
Pipelines, Except Natural Gas	5	-	0.0114	2,352	33	58
Motor Freight Transportation And Warehousing	9	-	0.0103	3,791	29	236
Wholesale Trade; Nondurable Goods	3	-	-	1,903	8	21
Fabricated Metal Products, Except Machinery And Transportation Equipment	11	0.0008	0.0047	1,753	5	4
Electronic And Other Electrical Equipment And Components, Except Computer Equipment	3	-	-	385	4	3
Paper And Allied Products	1,945	0.4331	-	4,099	3	3
Water Transportation	4	-	-	200	2	1
National Security And International Affairs	118	6	-	277	2	-
Rubber And Miscellaneous Plastic Products	3	-	-	2,872	1	-
Lumber And Wood Products, Except Furniture	64	0.0003	0.1363	3,369	1	2
Business Services	1	-	-	75	0.0420	0.0135
Transportation Services	2	-	-	444	0.0246	-
Stone, Clay, Glass, And Concrete Products	13,684	3	5	2,259	0.0206	0.0611
Engineering, Accounting, Research, Management, And Related Services	12	-	0.0002	74	0.0008	0.0240
Primary Metal Industries	695	0.1506	0.0024	1,062	-	2
Food And Kindred Products	86	-	-	976	-	-
Transportation Equipment	9	-	-	1,912	-	-
Industrial And Commercial Machinery And Computer Equipment	12	-	-	407	-	-
Building Construction-General Contractors And Operative Builders	3	-	-	20	-	-

Appendix B Continued

Industry Sector	SO2			VOC		
	Routine	Malfunctions	Maintenance	Routine	Malfunctions	Maintenance
Printing, Publishing, And Allied Industries	0	-	-	303	-	-
Transportation By Air	6	-	0.2285	62	-	0.0344
Wholesale Trade; Durable Goods	64	-	-	22	-	-
Educational Services	4	-	-	25	-	-
Heavy Construction Other Than Building Construction-Contractors	2	-	-	11	-	-
Health Services	2	-	-	4	-	-
Furniture And Fixtures	0.0119	-	-	46	-	-
Measuring, Analyzing And Controlling Instruments; Photographic, Medical And Optical Goods, Watches And Clocks	0.0899	-	-	32	-	-
Leather And Leather Products	0.0001	-	-	30	-	-
Miscellaneous Manufacturing Industries	0.0099	-	-	23	-	-
Insurance Carriers	0.0264	-	-	3	-	-
Apparel And Other Finished Products Made From Fabrics And Similar Materials	0.0062	-	-	22	-	-
Administration Of Economic Programs	0.0225	-	-	8	-	-
Automotive Dealers And Gasoline Service Stations	0.2659	-	-	1	-	-
Textile Mill Products				71	-	-
Automotive Repair, Services, And Parking				29	-	-
Nonclassifiable Establishments				8	-	-
Agricultural Production-Crops				2	-	-
Mining And Quarrying Of Nonmetallic Minerals, Except Fuels				0.2360	-	-
Miscellaneous Repair Services				0.0598	-	-
Coal Mining				-	-	-
Agricultural Services						
Miscellaneous Retail						
Administration Of Environmental Quality And Housing Programs						

Appendix C. Enforcement Data for Selected Oil and Gas Facilities, 2009 to Present

Facility Name	Compliance File Reviews	Compliance Investigations	Notices of Violation	Enforcement Orders	Penalties $ Assessed ($ Paid)[1]
Keystone Gas Plant *RN100238633*	66	1	12	1[2]	22,794 (9,118)
Goldsmith Gas Plant *RN100222330*	111	5	8	6	10,000 (5,000) 755,251 (377,626) 23,875 (9,550) 39,375 (15,750) 10,447 (8,358) 89,817
Seminole Gas Plant *RN103758470*	42	4	1	1	19,050 (7,620)
Mallet CO_2 Recovery Plant *RN102205119*	225	2	2	0	
Dollarhide Gas Plant *RN102523578*	44	0	4	1	3,975 (3,180)
WAHA Gas Plant *RN100211408*	71	1	7	1	938 (751)

[1] TCEQ typically assesses a penalty amount of which a portion may be specifically deferred and/or offset by a Supplemental Environmental Project.

[2] We identified three enforcement orders on TCEQ's publicly available Central Registry, but TCEQ open records staff explained that two of these dockets (one dated 2010 and another dated 2016) are unfinished and remain pending.

Appendix C Continued

Facility Name	Compliance File Reviews	Compliance Investigations	Notices of Violation	Enforcement Orders	Penalties $ Assessed ($ Paid)[1]
James Lake Gas Plant *RN107088759*	1	0	0	0	
Tarzan Booster Station *RN102534492*	16	1	4	0	
Boyd Compressor Station *RN100213701*	70	1	8	0	
Mont Belvieu Plant *RN100222900*	21	8	19	5	21,602 (10,801) 3,800 (3,040) 65,450 (26,180) 37,720 (30,176) 289,108 (115,644)
Tilden Gas Plant *RN100216621*	70	5	6	1	3,750 (3,000)
Sneed Plant *RN100217462*	7	1	7	1[3]	16,840 (13,472)
Fullerton Gas Plant *RN100218684*	40	4	8	2	3,550 (1,420) 3,125 (2,500)
South Fullerton Booster Station *RN100219641*	34	1	1	0	
Andrews Booster *RN100219047*	45	1	2	0	

[3] Enforcement Order covers three company-owned sites, including the Sneed Station.

This data was obtained from TCEQ's online Central Registry database and Open Records Requests through the TCEQ.

Appendix D. Malfunction and Maintenance Emissions in Texas Metropolitan Areas, 2015

UNAUTHORIZED EMISSIONS IN MAJOR METRO AREAS

Metropolitan Statistical Area	Volume of Reported Pollution (lbs.)	Total Number of Emission Events
Austin	32,142	11
Beaumont-Port Arthur	3,858,315	177
Corpus Christi	559,376	114
Dallas-Fort Worth	91,639	31
Houston	5,162,527	405
San Antonio	587,152	81

HOUSTON

Facilities within the Greater Houston region reported releasing more than 5 million pounds of pollution in 2015 over a course of 405 emission events. The top five reported emission events, based on total pounds of pollution reported for a single emission event in the Houston region are listed below.

5 LARGEST EMISSIONS EVENTS IN THE HOUSTON AREA

Facility Name	Facility Owner	Date	Total Pounds Emitted
Shell Oil Deer Park	Shell	8/9/15	341,508
Dow Texas Operations Freeport	Dow Chemical Company	11/1/15	302,008
Dow Texas Operations Freeport	Dow Chemical Company	3/6/15	261,945
Houston Plant	Texas Petrochemical Company	4/19/15	249,868
Blanchard Refining Galveston	Amoco Oil Company	1/13/15	223,317

Top Maintenance and Malfunction Emitters in the Houston Area

Rank	Facility Name	Facility Owner	Total Pounds
1	Dow Texas Operations Freeport	Dow Chemical Company	1,268,840
2	Shell Oil Deer Park	Shell Chemical LP	753,026
3	Blanchard Refining Galveston	BP Products North America Inc	399,455
4	Houston Plant	Texas Petrochemicals Corporation	397,982
5	Chevron Phillips Chemical	Chevron Phillips Chemical Company	282,769

BEAUMONT-PORT ARTHUR

Facilities within the Beaumont-Port Arthur region reported releasing nearly 4 million pounds in 2015 over a course of 177 events. The top five reported emission events, based on total pounds of pollution reported for a single emission event in the Beaumont-Port Arthur region are listed below.

5 LARGEST EMISSIONS EVENTS IN THE BEAUMONT-PORT ARTHUR REGION

Facility Name	Facility Owner	Date	Total Pounds Emitted
ExxonMobil Beaumont Refinery	ExxonMobil	11/1/15	873,990
Port Arthur Refinery	Huntsman Petrochemical Corp.	9/19/15	271,815
Lucas Station	Chevron	11/27/15	260,964
Port Arthur Refinery	Huntsman Petrochemical Corp.	11/28/15	156,456
ExxonMobil Beaumont Refinery	ExxonMobil	6/15/15	149,475

Top Maintenance and Malfunction Emitters in Beaumont – Port Arthur Region

Rank	Facility Name	Facility Owner	Total Pounds
1	ExxonMobil Beaumont Refinery	ExxonMobil Oil Corporation	1,063,976
2	Port Arthur Refinery	Motiva Enterprises LLC	774,544
3	Valero Port Arthur Refinery	Valero Refining Texas LP	398,723
4	ExxonMobil Oil Beaumont Chemical	Mobil Chemical Company Inc	358,087
5	Lucas Station	Chevron Environmental Management Company	260,964

CORPUS CHRISTI

Facilities in the Corpus Christi area reported releasing more than half a million pounds of air pollution in 2015 over a course of 114 events. The top five reported emission events, based on total pounds of pollution reported for a single emission event in Corpus Christi are listed below.

5 LARGEST EMISSIONS EVENTS IN CORPUS CHRISTI REGION

Facility Name	Facility Owner	Date	Total Pounds Emitted
Equistar Corpus Christi Plant	Corpus Christi Petrochemical	6/3/15	66,821
Javelina Gas Processing	Javelina Company	2/14/15	57,315
Citgo Corpus Christi Refinery	Citgo Petroleum Corp	4/15/15	52,980
Equistar Corpus Christi Plant	Corpus Christi Petrochemical	6/9/15	48,454
Equistar Corpus Christi Plant	Corpus Christi Petrochemical	6/23/15	41,031

Top Maintenance and Malfunction Emitters in Corpus Christi Area

Rank	Facility Name	Facility Owner	Total Pounds
1	Equistar Corpus Christi Plant	Equistar Chemicals LP	167,338
2	Citgo Corpus Christi Refinery	Citgo Refining and Chemicals Company LP	134,203
3	Javelina Gas Processing	Javelina Company	105,925
4	Valero Corpus Christi Refinery	Valero Refining Texas LP	48,371
5	Valero Corpus Christi Refinery	Valero Refining Texas LP	35,938

SAN ANTONIO

Facilities within the San Antonio region reported releasing more than half a million pounds of pollution in 2015 over a course of 81 emission events. The top five reported emission events, based on total pounds of pollution reported for a single emission event in the San Antonio area are listed below.

5 LARGEST EMISSIONS EVENTS IN SAN ANTONIO AREA

Facility Name	Facility Owner	Date	Total Pounds Emitted
Mars Production Facility	EOG Resources	5/8/15	59,221
Cuellar B Production Facility	EOG Resources	5/8/15	57,986
Willie Nelson - Pipesfriesenhahn	EOG Resources	5/6/15	52,595
Emil Stockhorst Mailahn Seifer	EOG Resources	5/7/15	51,019
Kuhnel – Ostrich Production	EOG Resources	5/8/15	40,470

Top Maintenance and Malfunction Emitters in San Antonio Area

Rank	Facility Name	Facility Owner	Total Pounds
1	Cuellar B Production Facility	EOG Resources Inc	96,631
2	Mars Production Facility	EOG Resources Inc	75,586
3	Emil Stockhorst Mailahn Seifer	EOG Resources Inc	68,571
4	Willie Nelson - Pipesfriesenhahn	EOG Resources Inc	65,165
5	Kuhnel-Ostrick Production Facility	EOG Resources Inc	58,492

DALLAS-FORT WORTH

The top five reported emission events, based on total pounds of pollution reported for a single emission event in the Dallas-Fort Worth area are listed below.

5 LARGEST EMISSIONS EVENTS IN DALLAS-FORT WORTH AREA

Facility Name	Facility Owner	Date	Total Pounds Emitted
Chico Gas Plant	Targa Midstream Services LLC	9/3/15	35,700
Frisco Plant	Hanson Aggregates, Inc	4/8/15	10,000
Wagner Sales Point	EOG Resources, Inc	1/20/15	9,051
Waxahachie Plant	Hanson Aggregates, Inc	6/9/15	8,000
Trend Offset Printing	Trend Offset Printing Services	6/13/15	7,443

Top Maintenance and Malfunction Emitters in the Dallas-Fort Worth Area

Rank	Facility Name	Facility Owner	Total Pounds
1	Chico Gas Plant	Targa Midstream Services LLC	35,700
2	Frisco Plant	Hanson Aggregates Inc	10,000
3	Wagner Sales Point	EOG Resources	9,051
4	Waxahachie Plant	Hanson Aggregates Inc	8,000
5	Acme Brick Denton Plant	Acme Brick Company	7,665

AUSTIN

The top five reported emission events, based on total pounds of pollution reported for a single emission event in the Austin area are listed below.

5 LARGEST EMISSIONS EVENTS IN THE AUSTIN AREA

Facility Name	Facility Owner	Date	Total Pounds Emitted
Luling Gas Plant	Davis Gas Processing	11/24/15	30,939
Luling Gas Plant	Davis Gas Processing	5/22/15	703
Samsung Austin Semiconductor	Samsung	4/30/15	358
Samsung Austin Semiconductor	Samsung	12/2/15	139
Texas Lehigh Cement	Lehigh Cement Company LP	9/1/15	1

Top Maintenance and Malfunction Emitters in the Austin Area

Rank	Facility Name	Facility Owner	Total Pounds
1	Luling Gas Plant	J L Davis	31642
2	Samsung Austin Semiconductor	Samsung Austin Semiconductor	498
3	Texas Lehigh Cement	Texas Lehigh Cement Company LP	3

Appendix E. Malfunction and Maintenance Emissions by County, 2015

Combined 2015 malfunction and maintenance emissions from emission events reported to TCEQ's State of Texas Electronic Emissions Reporting System.