

Breakdowns in Enforcement

Texas Rarely Penalizes Industry for Illegal Air Pollution Released During Malfunctions and Maintenance



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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.

ENVIRONMENT TEXAS

Environment Texas (<http://www.environmenttexas.org/>) advocates for clean air, clean water, and preservation of Texas' natural areas on behalf of approximately 5,000 members statewide.

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Breakdowns in Enforcement

Executive Summary

For years, petroleum refineries, chemical factories, power plants and other industries in Texas have argued that they should not be held responsible for much of the air pollution they release because they claim a loophole from permitted limits for industrial malfunctions or maintenance. But the law and increasingly the courts do not support such a claim. An example of this was the April 26, 2017, decision by a federal judge in Houston to penalize ExxonMobil \$20 million for emitting 10 million pounds of pollutants from its Baytown refining and chemical complex during malfunctions and maintenance over eight years.¹ It is significant, however, that this penalty was not initiated by the state of Texas, but instead by a lawsuit brought by local residents represented by Environment Texas and the Sierra Club.

The State of Texas claims primary responsibility for enforcing antipollution laws, but itself rarely takes action against companies for allowing dangerous amounts of soot, sulfur dioxide, benzene and other pollutants to escape from plants during what industry calls “upset” events. A review of five years of state records by the Environmental Integrity Project and Environment Texas shows that the state imposed penalties on less than 3 percent of the illegal pollution releases (588 out of 24,839) reported by companies during maintenance or malfunctions from 2011 through 2016, even though the incidents released more than 500 million pounds of air pollution.

The penalties assessed by Texas for this illegal pollution amounted to the equivalent of only three pennies per pound. The small size and infrequency of these fines is a major problem, because operators are less likely to spend the money required to fix known plant issues when fines for illegal pollution are not severe enough to offset the economic benefit of delaying investment in plant repairs and upgrades.

This report uses state data to spotlight Texas’s worst industrial air polluters in 2016, based on unauthorized air pollution releases. The data is the most recent available that companies self-reported to the state for emissions that resulted from equipment breakdowns, operator error, and maintenance activities.



Texas fined industries an average of three pennies per pound for illegal air pollution released during industrial malfunctions and maintenance from 2011-2016, not enough to provide a financial incentive to repair problems or upgrade plants.

Key examples of illegal pollution releases in 2016 that have not yet resulted in penalties include:

- Between February 24 and March 3, 2016, at the Amerada Hess Seminole Gas Processing Plant in West Texas (Gaines County), a loose wire and operator error resulted in a plant shutdown and release of 578 tons of sulfur dioxide. According to a report filed by the company, the shutdown might have been avoided, but the plant's "alarm was configured improperly" and operators did not become aware of the problem until it was too late.
- In 2016, the Houston Refinery, owned by LyondellBasell, reported five separate illegal releases that individually exceed the total amount of such pollution the plant discharged in 2015. For example, a leaking connection at the plant released 54,286 pounds of volatile organic compounds in less than an hour and a half on May 2, 2016. Short, intense pollution spikes like this pose a serious threat to millions of Houstonians, including the 316,000 people who live within five miles of the plant.
- In January and February of 2016, an oil and gas operator in Garden City, Texas, reported production in excess of what the facility's equipment was capable of capturing. This resulted in the release of 300,000 pounds of natural gas volatile organic compounds (VOCs) and 800 pounds of benzene, a carcinogen, from the facility's storage tanks.

TABLE 1: UNAUTHORIZED AIR POLLUTION RELEASED DURING MALFUNCTIONS AND MAINTENANCE EVENTS, BY REGION (2016)

Rank	TCEQ Region	Number of Events	Total pounds
1	Midland (Region 7)	2,004	34,395,147
2	Houston (Region 12)	453	5,233,162
3	Beaumont-Port Arthur (Region 10)	171	2,163,025
4	San Antonio (Region 13)	90	1,795,947
5	Amarillo (Region 1)	101	1,597,254
6	San Angelo (Region 8)	62	1,087,974
7	Lubbock (Region 2)	168	1,046,692
8	Corpus Christi (Region 14)	232	961,863
9	Tyler (Region 5)	106	818,367
10	Laredo (Region 16)	106	544,337
11	Waco (Region 9)	34	303,676
12	Abilene (Region 3)	38	194,343
13	Dallas/ Fort Worth (Region 4)	109	32,149
14	Harlingen (Region 15)	20	19,132
15	El Paso (Region 6)	3	9,822
16	Austin (Region 11)	23	1,010
Total		3,720	50,203,900

Many Polluters Improperly Claim Exemptions

A significant problem across Texas is that supposedly small sources of air pollution, like oil and gas wells, release as much pollution during equipment breakdowns as large factories – but escape factory-style regulation because they claim to be minor or “insignificant” polluters. For example, under state and federal law, sources that emit less than 25 tons of sulfur dioxide and volatile organic compounds each year can claim an exemption from the Clean Air Act’s more stringent permitting requirements that call for modern air pollution control equipment and public notice. Many facilities that have claimed this exemption in reality emitted more than 25 tons of these pollutants during malfunctions and maintenance events during 2016, meaning that they violated applicable emission limits. Of the 96 sites statewide that reported more than 25 tons of sulfur dioxide emissions during maintenance and malfunction in 2016, almost half — 47 — improperly claimed to be “insignificant sources” that are exempt from the more protective permitting requirements.

The result is that large amounts of air pollution are threatening public health, but are not being taken into account by Texas regulators as they issue permits and assess the air quality across the state.

Solutions to the Problem

Among this report’s recommendations are the following:

- 1) Texas should require all sources, but especially repeat violators, to provide evidence supporting any claim that malfunctions resulting in illegal pollution releases are not preventable before deciding not to pursue enforcement actions for penalties and cleanup.
- 2) If the same equipment at a repeat violator regularly malfunctions causing illegal air pollution releases, the state should require that equipment be replaced and assess penalties of sufficient magnitude to provide the operator with a real incentive to upgrade faulty equipment.
- 3) Texas should determine if all industrial facilities that emit more than 25 tons of sulfur dioxide or volatile organic compounds in a year obtained appropriate Clean Air Act permits. If they did not, the state should require the operators to apply for such permits, notify the public, and install up-to-date pollution control equipment.
- 4) The Texas Commission on Environmental Quality (TCEQ) and U.S. Environmental Protection Agency should subject plants that repeatedly cause pollution “upset”

events among interconnected clusters of oil and gas facilities to more serious enforcement scrutiny and should require more air pollution monitoring and better notification of the public about potentially dangerous releases.

- 5) In general, Texas should more vigorously and consistently penalize illegal pollution releases to create a stronger financial incentive for plant owners to upgrade their facilities and protect public health.

The Texas Approach to Enforcement

Government enforcement actions to address pollution releases during malfunctions and maintenance are infrequent in Texas. And when the state does take action, the penalties assessed are far below what the law allows.

TABLE 2: PENALTIES ASSESSED BY TEXAS FOR ILLEGAL POLLUTION RELEASES DURING MALFUNCTION AND MAINTENANCE, 2011 - 2016

Year	Number of Events	Number of Events Receiving TCEQ Penalties	Percentage of Events Penalized
2011	4,266	144	3.3%
2012	3,315	127	3.8%
2013	4,844	113	2.3%
2014	4,262	87	2.0%
2015	4,432	97	2.1%
2016	3,720	20	0.53%

The TCEQ has assessed administrative penalties totaling \$13,501,340 for illegal releases during breakdowns and maintenance occurring since 2011, amounting to approximately \$0.03 for each pound of pollution released during these events. To put this total in context, combined penalties assessed by the TCEQ for illegal pollution released during malfunctions and maintenance events since 2011 for *all sources in Texas* is seven million dollars less than the penalty imposed on ExxonMobil by a federal court in a recent suit brought by Environment Texas and Sierra Club for violations at *three* of the company's sources located in Baytown, Texas over eight years, starting in 2005.² Indeed, the total penalties assessed by the TCEQ for emission events at all Texas sources since 2011 is even less than the economic benefit that a single company, ExxonMobil, enjoyed by delaying equipment improvement projects at its Baytown plants that could have prevented many of the illegal releases that were the subject of the lawsuit.³

Because administrative penalty orders issued by the state do not outweigh the economic benefit of foregoing repairs and equipment upgrades necessary to prevent illegal releases of air pollution, Texas polluters have little incentive to take even modest steps to limit avoidable pollution from malfunctions and maintenance events.

TABLE 3: TOP 10 AIR POLLUTERS DURING MALFUNCTIONS AND MAINTENANCE, 2016

Rank	Facility Name ⁴	Facility Owner	County	Total Pounds
1	Amerada Hess Seminole Gas Processing*	Hess Corporation	Gaines	5,804,678
2	James Lake Gas Plant*	James Lake Midstream	Ector	2,225,651
3	Howard Glasscock Sour Gas Injection Facility*	ConocoPhillips	Howard	2,109,365
4	Goldsmith Gas Plant*	DCP Operating	Ector	1,142,342
5	Houston Refining	LyondellBasell	Harris	995,866
6	Freeport Chemical Plant	Dow Chemical Company	Brazoria	984,549
7	Chalk South Battery	ConocoPhillips	Howard	978,434
8	Mabee Ranch CO ₂ Plant	Chevron USA	Andrews	854,915
9	Pembroke Compressor Station	Targa Pipeline	Upton	787,333
10	Cedar Bayou Plant	Chevron Chemical	Harris	734,907

Each of the top four sources of illegal pollution by volume during malfunction and maintenance events in 2016 also emitted more than one million pounds of illegal pollution during maintenance, malfunctions, and equipment breakdowns in 2015:

Facility Name	Total Pounds	Sulfur Dioxide	Hydrogen Sulfide	VOC
Amerada Hess Seminole Gas Processing	3,761,094	3,195,151	40,320	150,331
James Lake Gas Plant	1,284,850	1,230,580	13,361	40,908
Howard Glasscock Sour Gas Injection	5,168,467	5,110,530	55,603	2,334
Goldsmith Gas Plant	2,638,928	2,028,830	24,844	50

Amerada Hess's Seminole gas processing plant accounts for approximately *10 percent* of all illegal pollution released in Texas during malfunction and maintenance events in 2016. Despite this source's over-sized contribution to illegal air pollution in 2016 and its abysmal track record in 2015, and despite several recent citations for failing to properly report illegal emission spikes, the TCEQ has not assessed a cent in penalties against Amerada Hess for violations at the Seminole facility since 2010. The TCEQ has never issued an enforcement order assessing penalties against the James Lake Gas Plant or the Howard Glasscock Sour Gas Injection Plant. While the TCEQ has issued three enforcement orders assessing a total

of \$139,639 in penalties against the Goldsmith Gas Plant for illegal pollution released during preventable or improperly reported malfunctions dating back to 2011, these penalties constitute a small fraction of the penalties the Clean Air Act authorizes and have not led the plant to make the improvements in equipment and operator training necessary to prevent these breakdowns.

LyondellBasell's Houston Refinery experienced an alarming uptick in the amount of illegal pollution released during plant malfunctions and breakdowns from 2015. This increase is troubling, because the Houston Refinery is located adjacent to the Galena Park and Pasadena communities. Approximately 316,000 people live within five miles of the plant.⁵ In 2015, the Houston Refinery released 42,105 pounds during breakdowns and maintenance activities. In 2016, the Houston Refinery reported five separate illegal releases that individually exceed the total amount of illegal pollution released in 2015. For example, a leaking connection at the Houston Refinery released 54,286 pounds of volatile organic compounds *in less than an hour and a half* on May 2nd, 2016. Short intense pollution spikes like this pose a serious threat to those who live nearby and downwind. Three separate power outages during 2016 resulted in the release of an additional 846,108 pounds of pollution.

Cities and Counties Are Being Stripped of Local Control

Given the state's unwillingness to hold polluters to account, community groups and local governments have stepped up to enforce clean air laws. In response, industry lobbyists have worked to change the law to shield themselves from local anti-pollution efforts. For example, in 2015, Texas Governor Greg Abbott signed House Bill 1794 which severely restricts local governments from enforcing pollution laws and caps penalties on pollution lawsuits brought by local authorities.⁶ Then, in June 2017, Governor Abbott signed a law forcing city and county officials to notify the state before filing a pollution case. The law gives the state 90 days to preempt local authorities. In this way, the state and the big polluters work together to block cities and counties from protecting the public.

These new laws have real-world impacts. For example, Harris County is currently suing Petrobras' Pasadena Refinery for illegal pollution that forced a shutdown of the Houston Ship Channel on July 25, 2016, and forced residents of the Galena Park neighborhood to shelter in place.⁷ But efforts like this by local governments to protect their own residents will likely be prohibited in the future, with laws that allow the state to shield big polluters.

The Public Can Enforce the Law When Government Fails

Lax enforcement by state regulators and new laws aimed at thwarting local control make it more important than ever for members of the public to exercise their rights to stop illegal pollution. The Clean Air Act allows affected neighbors to take polluters to court, under the law's "citizen suit" provision. This is exemplified in a recent court case against ExxonMobil in which a Houston judge fined the company nearly twenty million dollars for illegal pollution from Exxon's Baytown, Texas refinery and chemical plants.⁸ The case, brought by Environment Texas and Sierra Club on behalf of their members living nearby, addressed repeated illegal pollution releases at ExxonMobil's Baytown Complex, the largest integrated petroleum refinery and petrochemical production facility in the United States. After the groups filed their lawsuit in 2010, ExxonMobil officials asked the state to step in, in an effort to head off the community groups' lawsuit. The TCEQ's former chief of enforcement testified that ExxonMobil actually wrote the first draft of the state's enforcement order, and that ExxonMobil had significant input into any changes the agency tried to make to it.

Not surprisingly, the state's enforcement order went easy on the company. The TCEQ fined the world's largest publicly traded oil company just \$1.1 million for violations resulting in the release of more than 100,000 pounds of illegal pollution and allowed Exxon to pay a small pre-set monetary penalty for post-order violations at the Baytown Complex regardless of how many days an illegal pollution release lasted or how many permit limits it violated.⁹ The environmental groups' case went to the Fifth Circuit Court of Appeals¹⁰ before District Court Judge David Hittner ordered ExxonMobil to pay a fine of \$19.95 million. This total was one and a half times the economic benefit the court determined that ExxonMobil enjoyed by delaying equipment improvement projects that could have prevented many of the illegal pollution releases addressed by the lawsuit.

Breakdowns at Oil & Gas Facilities Cause Chain Reaction Pollution

Approximately one-fifth of the total illegal pollution released as a result of breakdowns, malfunctions, and maintenance in 2016 in Texas — nearly eleven million pounds — occurred at oil and gas facilities as a result of complications elsewhere in the supply pipeline. In other words, oil and gas facilities released massive quantities of air pollution (commonly from flares and storage tanks) because of breakdowns at an upstream or downstream facility.

Unauthorized Emissions From Downstream of Upstream Malfunctions and Maintenance, 2016 (Total Pounds)	
Sulfur Dioxide:	7,880,133
Volatile Organic Compounds:	1,005,772
Hydrogen Sulfide:	102,343
Total:	10,982,833

Breakdowns at Texas gas plants that extract natural gas liquids and remove sulfur compounds from raw field gas are the most common cause of unauthorized flaring at oil and gas production facilities. These natural gas processing plants hold the top four spots in this report's total top ten sources of illegal pollution during malfunctions and maintenance. Thus, gas plant malfunctions are particularly dangerous, because they can cause large direct releases of sulfur dioxide, hydrogen sulfide, and volatile organic compounds while at the same time triggering massive air pollution and wasted natural gas at interconnected well sites, pipelines, compressor stations, and storage facilities.

For example, on October 9, 2016, ConocoPhillips's Howard Glasscock Sour Gas Injection Facility released 5,978 pounds of hydrogen sulfide and 551,398 pounds of sulfur dioxide during a botched process shutdown beginning on October 9, 2016.¹¹ Because upstream sources were unable to send product to the Glasscock plant for processing, seven hydrocarbon storage facilities and satellite stations began flaring that resulted in the release of an additional 21,410 pounds of sulfur dioxide and 1,514 pounds of hydrogen sulfide. Similarly, on September 26, 2016, maintenance activities at DCP's Goldsmith Gas Plant near the city of Odessa led to the release of 1,130 pounds of pollution over the course of 120 hours. While direct releases from the Goldsmith Gas Plant were relatively low, other facilities linked to the plant flared an additional 246,446 pounds of pollution while the Goldsmith Gas Plant was offline.

The state has made no effort to protect the public from these massive cluster events. Texas does not even consider these events when they issue permits. Nor does the state monitor air quality in the areas where oilfield air pollution is greatest. The single sulfur dioxide monitor in the Permian Basin region of West Texas only began operating in December 2016 and is located in Howard County, directly adjacent to Alon's Big Spring Refinery. In its first few months of operation, the monitor has already recorded five instances where hourly sulfur dioxide levels exceeded the federal health-based ambient air quality standard. These unhealthy air pollution levels can be correlated with significant illegal air pollution releases from nearby oil and gas sources, including acid gas injection facilities and hydrocarbon storage tanks.

Allegedly “Small” Sources Release Massive Levels of Pollution

The Clean Air Act prohibits the construction of new sources of pollution, or modifications to existing facilities, if they would cause air pollution levels to exceed health-based National Ambient Air Quality Standards,¹² among other requirements. The most serious consideration is given to proposed “major sources” of air pollution, which have the potential to emit certain levels (either 100 or 250 tons, depending on the type of facility) of any federally regulated air pollutant during a year.¹³ These major pollution sources are allowed to operate, but only if they use the best available pollution controls so as not to threaten public health or degrade air quality. “Minor sources” are subject to some of the same requirements as major sources, though their permits are typically less stringent and easier to obtain than they are for major sources. Finally, there are so-called “insignificant sources.”¹⁴ The state lets these “insignificant sources” operate with very little oversight; these sources can avoid public notification requirements, and they do not have to demonstrate that they will use the most up-to-date pollution controls.

Our review of the 2016 data reveals that sources across the state that emit significant quantities of illegal air pollution during malfunction and maintenance events are improperly claiming permitting exemptions reserved for “insignificant sources.” Even though many of these sources emit pollution at rates far exceeding applicable major source thresholds, they have avoided the more stringent public notice and pollution controls the law mandates for significant sources of pollution. Requiring these sources to install the best available pollution controls – such as vapor recovery units, modern flares and newer storage tanks – could substantially reduce the occurrence and seriousness of illegal pollution releases during malfunction and maintenance events.

In 2016, 96 industrial sites released 25 tons or more of sulfur dioxide during malfunction and maintenance events. Of these 96 sites, nearly half (47), claimed to be “insignificant sources,” meaning that they told the state that the facilities would emit less than 25 tons of sulfur dioxide over any twelve month period.¹⁵ Of these 47 sources, which together emitted more than 10 million pounds of sulfur dioxide in 2016, many violated the 25 ton limit by a wide margin. For example, five of the top ten emitters of illegal sulfur dioxide pollution claimed an “insignificant source” exemption. Of the 43 sources that released 25 tons or more of volatile organic compounds during malfunction and maintenance events in 2016, 11 improperly claimed insignificant source exemptions. Together, these eleven sources released more than 1.3 million pounds of volatile organic compounds in 2016. One of these eleven sources was a top ten emitter of unauthorized illegal organic compound pollution in 2016. See Tables 4 and 5.

TABLE 4: SIGNIFICANT SULFUR DIOXIDE POLLUTION RELEASED BY “INSIGNIFICANT SOURCES”

2016 Rank	Operator	Source Name	County	2015 Unauthorized Emissions (tons)	2016 Unauthorized Emissions (tons)	Permit Limit (tons) ¹⁶
2	ConocoPhillips	Howard Glasscock Sour Gas Injection Facility	Howard	2,555	1,038	25
4	ConocoPhillips	Chalk South Battery	Howard	284	428	
7	Chevron USA	Mabee Ranch CO2 Plant	Andrews	420	391	
8	ConocoPhillips	Chalk North Battery	Howard	156	254	
10	Chevron USA	J.T. McElroy 202 Tank Battery	Crane	302	227	

TABLE 5: SIGNIFICANT VOLATILE ORGANIC COMPOUNDS POLLUTION RELEASED BY “INSIGNIFICANT SOURCES”

2016 Rank	Operator	Source Name	County	2015 Unauthorized Emissions (tons)	2016 Unauthorized Emissions (tons)	Permit Limit (tons) ¹⁷
8	Benedum Gas Partners	McElroy Compressor Station	Upton	192	130	25

These so-called “insignificant sources” have emitted more illegal pollution during maintenance and malfunction events than all but a handful of recognized major sources in Texas during 2016. Indeed, a single “insignificant source,” ConocoPhillips’s Howard Glasscock Sour Gas Injection Facility, illegally emitted more than *two million pounds* of sulfur dioxide, nearly doubling the amount of illegal sulfur dioxide pollution emitted by *all sources* in heavily industrial Harris County during 2016.¹⁸

The state’s 2016 data demonstrates that these emissions were not the result of isolated, unforeseeable, and quickly repaired malfunctions. Instead, many sources spewed pollution into the air during malfunctions that, when added together, lasted from more than a week to more than five months.

Owner/Operator	Facility Name	# of Hours	# of Days
ConocoPhillips	Chalk North Battery	3,896	162
ConocoPhillips	Chalk South Battery	2,393	99
Chevron USA	Mabee Ranch CO2 Plant	1,688	70
Chevron USA	J.T. McElroy 202 Tank Battery	669	27
ConocoPhillips	Howard Glasscock Sour Gas Injection Facility	920	38
Benedum Gas Partners	McElroy Compressor Station	223	9

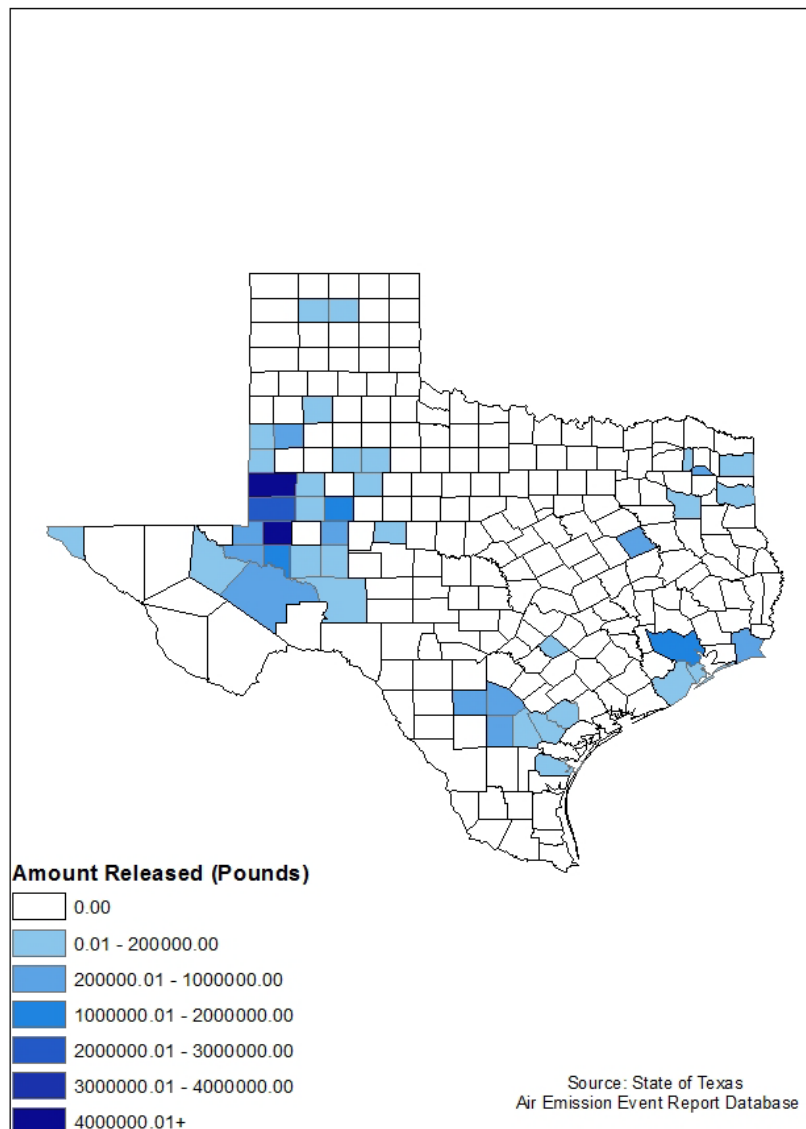
Repeated and extended events like these are foreseeable, preventable, or both. Despite serious, repeated, and extended upset events at these so-called insignificant sources, a review of TCEQ's records indicates that the state has never undertaken an enforcement action against any of the sources listed in Tables 4 and 5 for emitting unauthorized air pollution or failing to obtain a permit to authorize these foreseeable emissions.¹⁹

Top Texas Polluters in 2016

Metropolitan Area Pollution Profiles

In 2016, oil and gas facilities and other industrial sites in West Texas, centered around the Midland-Odessa area, released more unauthorized pollution during malfunction and maintenance events than any other metropolitan area in the state. Sulfur dioxide pollution from oil and gas facilities accounts for the great majority of the pollution in this area, although large levels of dangerous hydrogen sulfide and volatile organic compounds were also reported.

Unauthorized Sulfur Dioxide Air Pollution 2016



The heavily-populated and highly industrialized Houston and Beaumont-Port Arthur regions ranked second and third in terms of illegal air pollution released during malfunctions and maintenance in 2016. The air pollution profile for these areas is dominated by volatile organic compounds released by the many large refineries and chemical plants located there.

Unauthorized Volatile Organic Compounds Air Pollution 2016

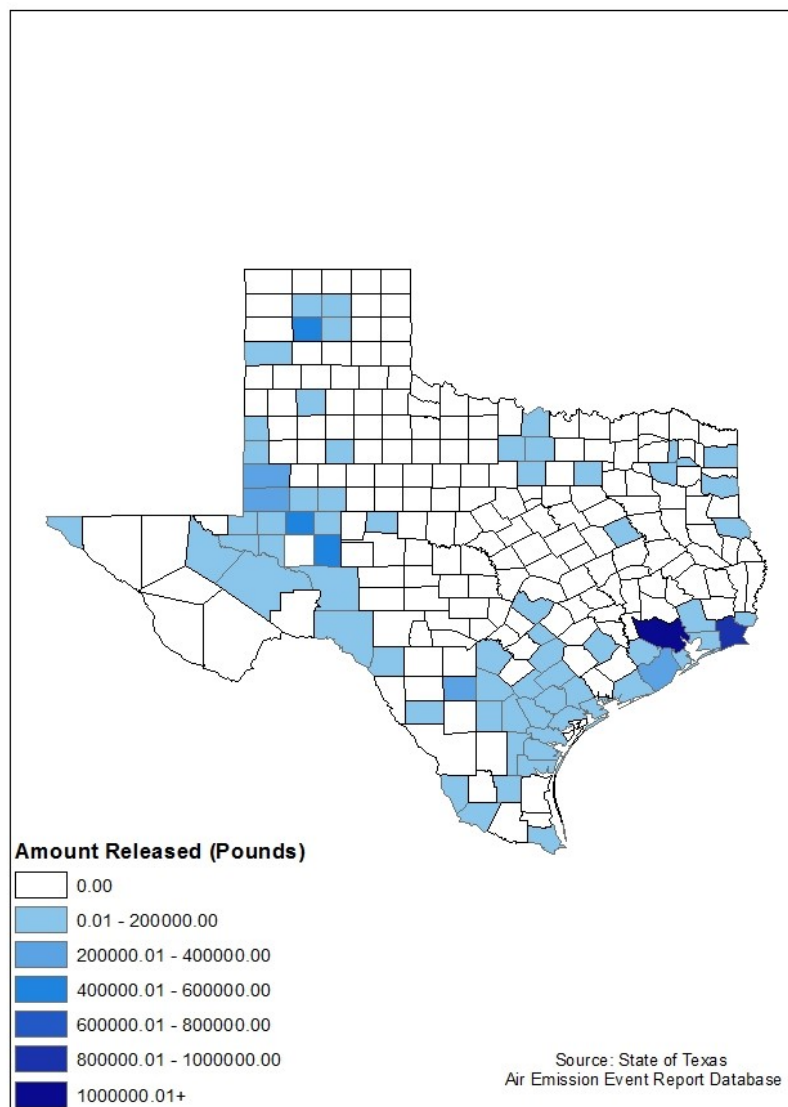


TABLE 6: TOP SOURCE OF UNAUTHORIZED EMISSIONS DURING MALFUNCTIONS AND MAINTENANCE EVENTS, 2016 (BY POLLUTANT)

Pollutant	Facility Name	County	Pounds
Sulfur Dioxide (SO ₂)	Amerada Hess Seminole Gas Processing Plant	Gaines	4,959,334
Volatile Organic Compounds (VOCs)	Targa Pipeline's Pembroke Compressor Station	Upton	785,093
Hydrogen Sulfide	Amerada Hess Seminole Gas Processing	Gaines	57,315
Benzene	Chevron Chemical Cedar Bayou Plant	Harris	33,229
Particulate Matter	Pasadena Refinery	Harris	70,131

Top Polluters, Ranked by Pollutant

This section of the report identifies the top sources of illegal air pollution during malfunctions and maintenance events in 2016 by pollutant, provides a description of the dangers associated with each pollutant, and provides analysis to put these rankings in context.

Benzene

TABLE 7: TOP 10 UNAUTHORIZED BENZENE EMITTERS DURING MALFUNCTION AND MAINTENANCE EVENTS, 2016

Rank	Source	Owner/Operator	County	Pounds
1	Cedar Bayou Plant	Chevron Chemical	Harris	33,229
2	Beaumont Refinery	ExxonMobil	Jefferson	3,382
3	Rebel Gas Plant	ETC Texas Pipeline	Glasscock	2,632
4	Freeport Chemical Plant	Dow Chemical	Brazoria	2,493
5	NAFTA Region Olefins Complex	BASF Fina	Jefferson	1,972
6	Beaumont Chemical Plant	ExxonMobil	Jefferson	1,918
7	LAB Chocolate Bayou Plant	Huntsman Petrochemical	Brazoria	1,868
8	Texas City Chemical Plant	Ineos USA	Galveston	1,005
9	Pembroke Compressor Station	Targa Pipeline	Upton	901
10	Corpus Christi West Plant	Flint Hills Resources	Nueces	840

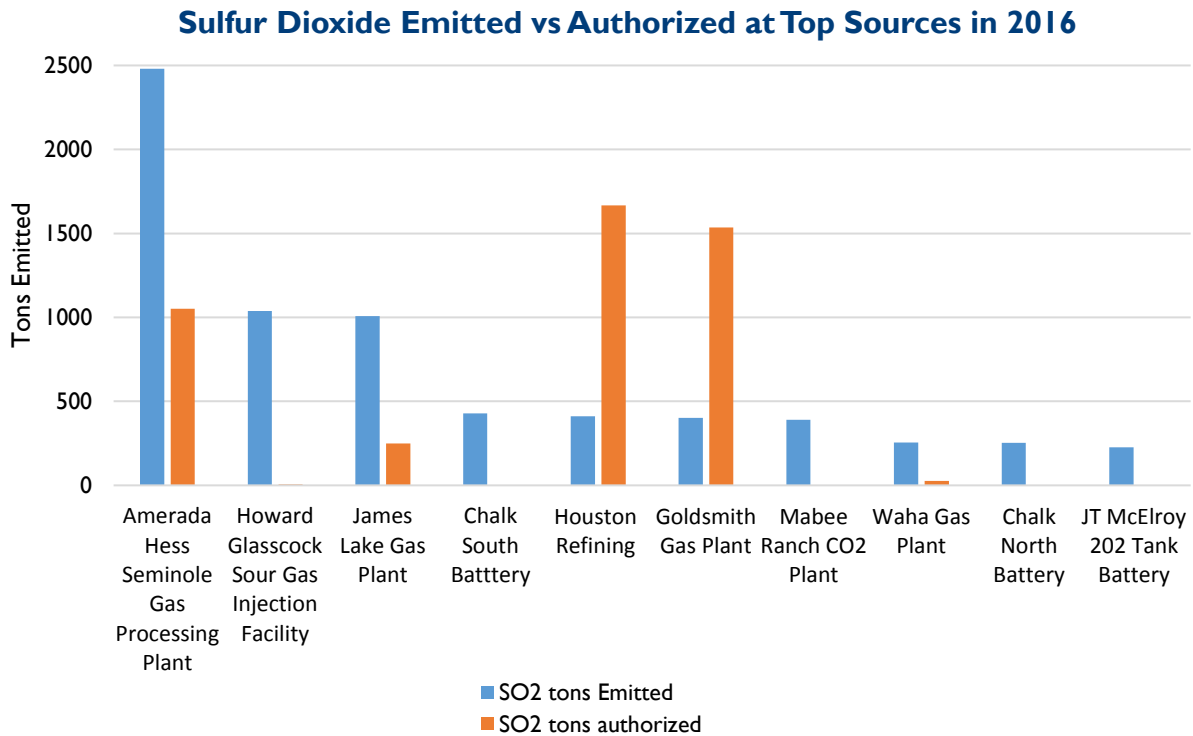
Benzene is a dangerous volatile organic compound released into the air from industries that use, store, or produce petroleum products, including fuel, chemicals, plastics, and pesticides. Short-term exposure to benzene can lead to dizziness, rapid or irregular heartbeat, tremors, unconsciousness and at high levels even death. Longer term exposure to benzene can cause leukemia, birth defects, low birth weight, and bone marrow damage. 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.²⁰ The World Health Organization warns that there is no safe level of benzene exposure.²¹ But, despite the significant health impacts posed by benzene, industrial facilities routinely and illegally release large amounts of this cancer-causing chemical during malfunctions and maintenance.

Chevron Chemical's Cedar Bayou Plant was the top source of illegal benzene pollution in Texas during malfunctions and maintenance events in 2016, accounting for more than half of the total benzene released during such events statewide. This plant is located on the Houston Ship Channel, in Baytown, Texas. Approximately two thirds of the Cedar Bayou plant's illegal benzene emissions occurred during a series of breakdowns in the final two months of 2016. According to the report filed by Chevron Chemical, the Company was unable to determine with certainty the cause of the plant's largest illegal benzene release, stating that the accident was "due to an apparent loss of . . . pressure to the charge gas compressor." The plant's remaining significant benzene releases all occurred in August and also resulted from compressor problems.

Sulfur Dioxide

TABLE 8: TOP 10 UNAUTHORIZED SULFUR DIOXIDE EMITTERS DURING MALFUNCTION AND MAINTENANCE EVENTS, 2016

Rank	Facility Name	Owner/Operator	County	Pounds
1	Amerada Hess Seminole Gas Processing Plant	Hess Corporation	Gaines	4,959,334
2	Howard Glasscock Sour Gas Injection Facility	ConocoPhillips	Howard	2,076,520
3	James Lake Gas Plant	James Lake Midstream	Ector	2,014,879
4	Chalk South Battery	ConocoPhillips	Howard	855,155
5	Houston Refining	LyondellBassell	Harris	822,028
6	Goldsmith Gas Plant	DCP Operating	Ector	803,088
7	Mabee Ranch CO ₂ Plant	Chevron USA	Andrews	781,964
8	Waha Gas Plant	Mobil	Pecos	510,962
9	Chalk North Battery	ConocoPhillips	Howard	508,642
10	JT McElroy 202 Tank Battery	Chevron USA	Crane	453,371



Sulfur dioxide is a toxic gas that also causes respiratory problems. It is known for its irritating smell, and is released into the air by industrial sources burning fossil fuels, including flaring at oil and gas facilities. Sulfur dioxide acidifies soil and water and causes an array of respiratory problems. 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.

A large portion of illegal sulfur dioxide emissions were the result of malfunctions and process irregularities at clusters of interconnected oil and gas facilities in the West Texas Permian Basin counties.

Hydrogen Sulfide

TABLE 9: TOP 10 UNAUTHORIZED HYDROGEN SULFIDE EMITTERS DURING MALFUNCTION AND MAINTENANCE EVENTS, 2016

Rank	Facility Name	Owner/Operator	County	Pounds
1	Amerada Hess Seminole Gas Processing Plant	Hess Corporation	Gaines	57,315
2	Rhodes Cowden Unit Central Battery	Oxy USA	Ector	43,814
3	Howard Glasscock Sour Gas Injection Facility	ConocoPhillips	Howard	22,513
4	James Lake Gas Plant	James Lake Midstream	Ector	21,871
5	Yates Gas Plant	Kinder Morgan	Pecos	16,212
6	Goldsmith Gas Plant	DCP Operating	Ector	10,073
7	North Cowden Unit Test Station 10	Occidental Permian	Ector	9,918
8	Chalk South Battery	ConocoPhillips	Howard	9,271
9	Houston Refining	LyondellBassell	Harris	8,640
10	Mabee Ranch CO ₂ Plant	Chevron USA	Andrews	8,311

Hydrogen sulfide is best known for 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 breathing problems, coma and even death. 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 this 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.

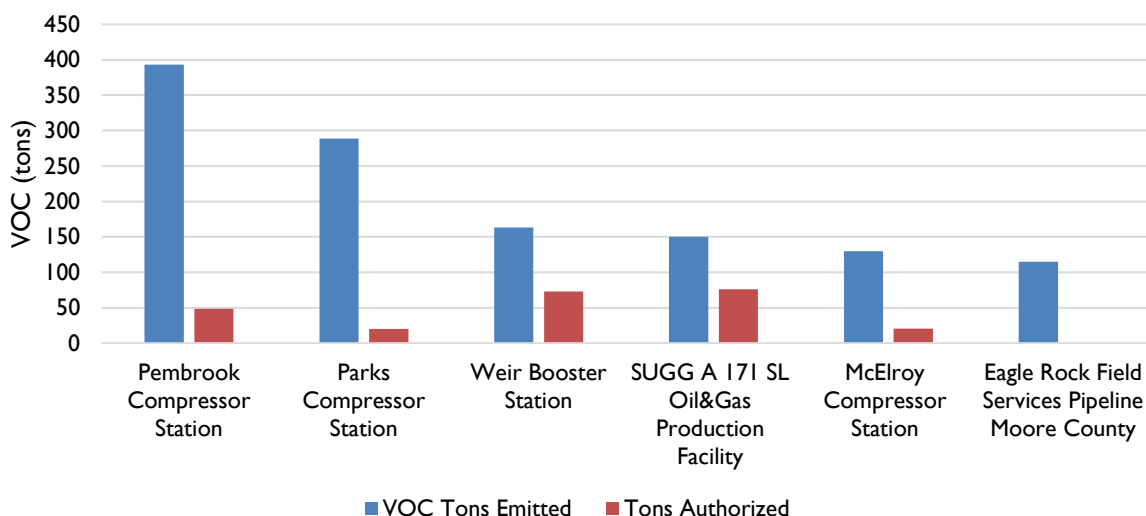
All but one of the top ten sources of hydrogen sulfide pollution—the Houston Refinery—are located in oil producing Permian Basin.

Volatile Organic Compounds

TABLE 10: TOP 10 VOLATILE ORGANIC COMPOUND EMITTERS DURING MALFUNCTION AND MAINTENANCE EVENTS, 2016

Rank	Facility Name	Owner/Operator	County	Pounds
1	Pembroke Compressor Station	Targa Pipeline	Upton	785,093
2	Parks Compressor Station	Targa Pipeline	Midland	578,160
3	Fain Gas Plant	Pioneer Natural Resources	Potter	546,725
4	Beaumont Refinery	ExxonMobil	Jefferson	468,755
5	Cedar Bayou Plant	Chevron Chemical	Harris	396,509
6	Weir Booster Station	DCP Operating	Upton	325,840
7	Sugg A 171 SL Oil and Gas Production Facility	Laredo Petroleum	Reagan	300,800
8	McElroy Compressor Station	Benedum Gas Partners	Upton	260,481
9	Moore County Pipeline	Eagle Rock Field Service	Moore	230,109
10	Freeport Chemical Plant	Dow Chemical	Brazoria	229,673

VOC Malfunction and Maintenance Emissions vs. Total Authorized



Volatile Organic Compounds (VOCs) are a class of chemicals that includes many different hazardous air pollutants and known carcinogens, like benzene. The primary sources of VOC are petroleum refineries, chemical plants, and oil and gas extraction and processing operations. According to the National Institutes of Health, “short-term exposure to volatile organic compounds can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reactions, nausea, and memory impairment,” while “long-term exposure to volatile organic compounds can cause damage to the liver, kidneys, and central nervous system.” VOCs are also a key component of smog. Volatile Organic Compounds, including hazardous air pollutants, are often released in large

and concentrated doses from flares and leaking tanks and pipes during malfunction and maintenance events at industrial sources in Texas.

Targa Pipeline's Pembroke Compressor Station was the top emitter of illegal Volatile Organic Compound emissions during malfunction and maintenance events in 2016. This unmanned station located near the cities of Odessa and Midland in Upton County is authorized to emit 48.25 tons of Volatile Organic Compounds over the course of an entire year.²² The Pembroke station emitted more than three times this amount during two illegal releases lasting less than three days.²³

Particulate Matter

TABLE 11: TOP 10 UNAUTHORIZED PARTICULATE MATTER EMITTERS DURING MALFUNCTION AND MAINTENANCE EVENTS, 2016

Rank	Facility Name	Owner/Operator	County	Pounds
1	Pasadena Refinery	Pasadena Refining	Harris	70,131
2	Waxahachie Plant	Owens Corning	Ellis	22,816
3	Houston Plant	ExxonMobil	Harris	13,370
4	Borger Refinery	ConocoPhillips	Hutchinson	13,261
5	Big Springs Refinery	Alon USA	Howard	4,812
6	Marshall Plant	Cabot Norit Americas	Harrison	3,042
7	Houston Refinery	LyondellBassell	Harris	2,758
8	Valero McKee Refinery	Diamond Shamrock	Moore	1,491
9	La Porte Complex	Equistar Chemicals	Harris	548
10	Corpus Christi West Plant	Flint Hills Resources	Nueces	440

Particulate matter (microscopic particles of soot) can cause adverse respiratory consequences and also trigger a range of cardiovascular problems, including heart attacks and strokes. Particulate matter can also trigger premature birth, stunt lung development in children, and increase the risk that they develop asthma.

The top illegal emitter of particulate matter during malfunction and maintenance events in 2016 is the Pasadena Refinery, which is owned by Brazil's Petrobras Corporation. This mid-sized refinery is located next to the Galena Park and Pasadena communities on the heavily developed and populated Houston Ship Channel. This refinery has been a source of concern for nearby residents for several years. For example, an incident at the refinery on July 25, 2016 led to the closing of the Washburn Tunnel and the Houston Ship Channel, and resulted in a shelter in place order for the Galena Park community. This incident is the subject of a pollution lawsuit filed in March 2016, by Harris County²⁴ A separate lawsuit has been filed in federal court by Environment Texas and Sierra Club seeking penalties for other illegal pollution releases at the Pasadena Refinery since December 2011.

Unauthorized Air Pollution is Avoidable

Largest Sulfur Dioxide Release in 2016 Resulted from Improperly Configured Alarm

The largest illegal release of sulfur dioxide in 2016 occurred between February 24 and March 3 at the Amerada Hess Seminole Gas Processing Plant in Gaines County. This incident began with a loose piece of wire on a plant panel, and due to operator error, resulted in a total plant shutdown. The emissions released from the plant's emergency flare over these eight days far exceed the amount of pollution the plant is authorized to flare over the course of an entire year.

SEMINOLE GAS PLANT EMISSION EVENT, FEB 24-MAR 3, 2016

Pollutant	Malfunction Emissions (Tons)	Annual Permit Limit (Tons)
Sulfur Dioxide	577.86	23.15
Hydrogen Sulfide	7.48	0.24
VOC	38.56	2.19
Carbon Monoxide	31.82	2.77
Natural Gas	62.98	0

According to the report filed by Amerada Hess, the shutdown might have been avoided, but the plant's "alarm was configured improperly" and operators did not become aware of the problem until it was too late. Making matters worse, at the time of this event, the plant's emergency flare—which is supposed to control pollution released during plant malfunctions—was not lit (another violation of the plant's air permit). Because the flare was unlit, uncontrolled pollution was vented directly into the air for approximately two hours as the plant shut down. Once the pilot light was re-lit, flaring of unauthorized pollution continued for six days.

Pasadena Refinery Leak Releases Dangerous Pollutants into Neighboring Communities

A leak on a part of a refinery called a catalytic cracker at the Pasadena Refinery outside Houston led to a concentrated release of 2,108 pounds of volatile organic compounds, 1,046 pounds of particulate matter, and 2,261 pounds of sulfur dioxide into the neighboring Galena Park and Pasadena communities during a nine hour stretch beginning on the evening of July 16, 2016. This was one of a series of malfunctions at the Pasadena Refinery in 2016, which made it the state's highest emitter of illegal particulate matter emissions during malfunction and maintenance.

Open Tank Drain Leads to Release of 146,160 Pounds of VOC

Shell Oil's Deer Park complex east of Houston, which includes a petroleum refinery and a chemical plant, released 140,402 pounds of hazardous air pollution²⁵ during malfunctions and maintenance in 2016, more than any other source in Texas. Nearly all of this pollution was released when chemicals began pouring out through an open drain on a storage tank at the complex. Illegal emissions resulting from this event, which began on April 13, 2016, continued for 94 hours where more than 143,482 people live within five miles of the complex.

SHELL OIL REFINERY AND CHEMICAL PLANT, DEER PARK, APRIL 13, 2016 EMISSION EVENT²⁶

Hazardous Air Pollutant	Pounds Released
2,2,4-Trimethylpentane	128,621
Hexane	7,308

Conclusion

Massive amounts of air pollution caused by industrial malfunctions, equipment failures, and maintenance are harmful to people's health and the environment. These unauthorized releases of air pollution expose people living nearby and downwind to concentrated doses of dangerous pollutants and toxic chemicals. Unfortunately, Texas rarely penalize industries for these violations. Nor are these chronic events taken into account when environmental regulators issue permits or when they assess the state's air quality.

The State of Texas's unwillingness to pursue enforcement actions that would significantly and consistently punish companies for illegal pollution erodes the public's confidence, while at the same time providing no incentive for polluters to clean up. State and federal officials have the tools they need to protect public health and our environment from dangerous air pollution, and they can and should do more. Enforcement should not be the responsibility solely of community groups that are forced to take polluters to court. The state should step up and do its job.

There is no question that occasional malfunctions can happen, even at well-maintained industrial plants. But, as this report demonstrates, excessive pollution from foreseeable and avoidable events is all too common. Moreover, many chronic polluters are hiding behind legal loopholes, claiming to be small or insignificant sources to avoid stricter controls and public scrutiny.

So long as the cost of non-compliance is less than the cost of addressing problems that lead to repeated plant breakdowns, operators will avoid paying to upgrade their facilities to reduce their illegal pollution. 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.

Recommendations:

The Texas Commission on Environmental Quality should:

- Require all pollution sources, especially repeat violators, to provide evidence supporting claims that malfunctions resulting in illegal pollution releases are not preventable before the state decides not to pursue enforcement actions and penalties.
- For repeat violators with faulty equipment responsible for illegal pollution releases, mandate that the equipment be replaced.

- Impose penalties of sufficient magnitude and consistency on polluters to provide the companies with real incentives to upgrade and modernize their plants.
- Subject oil and gas facilities that trigger pollution “upset” events among clusters of connected plants to more serious enforcement scrutiny.
- Install and operate more air pollution monitors in regions prone to clusters of pollution releases from oil and gas facilities, and provide the public with better information about the resulting air quality impacts.
- Financially penalize so-called “insignificant sources” of pollution that nonetheless emit more than 25 tons of sulfur dioxide or volatile organic compounds during any 12-month period.
- Determine if all facilities that emit more than this amount of pollution ever obtained Clean Air Act permits. If they did not, the state agency should require the operator to apply for such permits and install appropriate pollution control equipment.

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 analysis of the reports filed with the State of Texas Electronic Emissions Reporting System for 2016. This database houses the reports that companies are required to file when their plants release air pollution during malfunctions and unauthorized maintenance events. This data is publicly accessible (<http://www2.tceq.texas.gov/oce/eer/>) and allows members of the public to track illegal releases of air pollution by county, or from any facility of interest.

For this report, we analyzed the most recent full year, 2016, of available emission events. We also provide in the report, where relevant, individual examples of company reports. While the details of each of the thousands of self-reported emissions events have not been quality assured 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. 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. Importantly, this 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.

This report's review of state enforcement orders and penalties relies on publicly available data. We reviewed all available enforcement orders (typically called “agreed orders”) issued by the TCEQ through the TCEQ's Integrated Database (<http://www14.tceq.texas.gov/epic/eCID/>). Additional information about enforcement orders issued by the TCEQ was obtained from the TCEQ's Annual Enforcement Report for 2016 (<https://www.tceq.texas.gov/compliance/enforcement/enforcement-reports/annenfreport.html>).

Regarding VOC emissions: Due to the TCEQ's practice of issuing multiple permits establishing limits for common pieces of equipment at major sources of air pollution, we were unable to determine—with reasonable certainty—how much VOC pollution the Fain Gas Plant, the Beaumont Refinery, the Cedar Bayou Chemical Plant, and the Freeport Chemical Plant are authorized to emit. The Environmental Integrity Project has challenges pending before EPA regarding this deficiency in Texas's permitting practices. See, e.g., Petition to Object to and Issue or Deny Title V Permit Nos. O1668 and O1669 Issued by the Texas Commission on Environmental Quality at 7-30. Available electronically at: https://www.epa.gov/sites/production/files/2017-06/documents/shell_deer_park_petition2017.pdf

APPENDIX B. TOP 2016 POLLUTERS BY METROPOLITAN STATISTICAL AREA, MALFUNCTIONS AND MAINTENANCE

Rank	Facility Name	Metropolitan Area	Total lbs
1	FAIN GAS PLANT	AMARILLO	546725
2	CARGRAY RESIDUE COMPRESSOR STATION	AMARILLO	105958
3	BURNETT MAIN AND B COMPRESSOR	AMARILLO	53248
4	CARGRAY BOOSTER 43	AMARILLO	29936
5	DCP MIDSTREAM PIPELINE CARSON	AMARILLO	12258
1	LULING GAS PLANT	AUSTIN	710
2	SAMSUNG AUSTIN SEMICONDUCTOR	AUSTIN	300
1	EXXONMOBIL BEAUMONT REFINERY	BEAUMONT-PORT ARTHUR	675319
2	TOTAL PETRO CHEMICALS & REFIN.	BEAUMONT-PORT ARTHUR	391544
3	PORT ARTHUR REFINERY	BEAUMONT-PORT ARTHUR	252016
4	HUNTSMAN PORT NECHES	BEAUMONT-PORT ARTHUR	198963
5	VALERO PORT ARTHUR REFINERY	BEAUMONT-PORT ARTHUR	194044
1	EQUISTAR CORPUS CHRISTI PLANT	CORPUS CHRISTI	146550
2	JAVELINA GAS PROCESSING FACILITY	CORPUS CHRISTI	85070
3	CITGO CORPUS CHRISTI REFINERY	CORPUS CHRISTI	69197
4	CITGO CORPUS CHRISTI REFINERY	CORPUS CHRISTI	53457
5	VALERO CORPUS CHRISTI REFINERY	CORPUS CHRISTI	45136
1	OWENS CORNING INSULATING SYSTEM	DALLAS	22876
2	GOFORTH PROCESSING PLANT	DALLAS	4049
3	REDI MIX FRISCO	DALLAS	2500
4	FRISCO PLANT	DALLAS	555
5	FIVE STAR CUSTOM FOODS	DALLAS	354
1	HOUSTON REFINING	HOUSTON	995866
2	DOW TEXAS OPERATIONS FREEPORT	HOUSTON	984549
3	CHEVRON PHILLIPS CHEMICAL CEDA	HOUSTON	734907
4	EXXON MOBIL BAYTOWN REFINERY	HOUSTON	432846
5	SHELL OIL DEER PARK	HOUSTON	273334
1	JAMES LAKE GAS PLANT	MIDLAND-ODESSA	2225651
2	GOLDSMITH GAS PLANT	MIDLAND-ODESSA	1142342
3	PARKS COMPRESSOR STATION	MIDLAND-ODESSA	578160
4	GSAU 2 2 BATTERY	MIDLAND-ODESSA	307388
5	NORTH COWDEN REINJECTION COMPR	MIDLAND-ODESSA	293856
1	TEXSTAR FIELD SERVICES PIPELINE	SAN ANTONIO	89277
2	RIO GRANDEBOSQUEBRAZOS FACILITY	SAN ANTONIO	69549
3	NECHES PEDERNALES PRODUCTION F	SAN ANTONIO	55293
4	PAISANO 1H AND 2H SABRE CLIP I	SAN ANTONIO	53383
5	PICKENS B 17H PRODUCTION FACIL	SAN ANTONIO	46171

Endnotes:

¹ Final judgment, *Environment Texas Citizen Lobby Inc. and Sierra Club vs. ExxonMobil Corporation*, et, al
<https://www.documentcloud.org/documents/3679447-170426-Exxon-Environmental-Suit-FINAL-JUDGEMENT.html>

² Final judgment, *Environment Texas Citizen v. ExxonMobil Corporation*:
<https://www.documentcloud.org/documents/3679447-170426-Exxon-Environmental-Suit-FINAL-JUDGEMENT.html>

³ *Id.* (“Accordingly, the Court finds that Exxon received an economic benefit of \$14,249,940 from the delayed implementation of the improvement projects”).

⁴ An “*” indicates that the source was a top ten emitter of illegal pollution during malfunctions and maintenance events in 2015.

⁵ Population data obtain using EPA’s EJScreen website: <https://www.epa.gov/ejscreen>

⁶ <https://www.texastribune.org/2015/05/20/senate-backs-bill-cap-pollution-payouts/>

⁷ <http://www.houstonpress.com/news/harris-county-attorney-vince-ryan-seeks-to-stop-century-old-pasadena-refinerys-pollution-9246666>

⁸ *See note 1.*

⁹ https://www.tceq.texas.gov/assets/public/comm_exec/agendas/comm/backup/Agendas/2012/2-22-2012/2336air.pdf

¹⁰ *Environment Texas v. ExxonMobil*, 824 F.3d 507 (5th Cir. 2016).

¹¹ <http://www2.tceq.texas.gov/oce/eer/index.cfm?fuseaction=main.getDetails&target=245228>

¹² 42 U.S.C. § 7410(a)(2)(C) and (D); 40 C.F.R. § 51.160(b).

¹³ 40 C.F.R. § 51.166(b)(1)(i). Sources that are considered “major” if they emit or have the potential to emit more than 100 tons of a federally-regulated pollutant include: Fossil fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input, coal cleaning plants (with thermal dryers), kraft pulp mills, portland cement plants, primary zinc smelters, iron and steel mill plants, primary aluminum ore reduction plants (with thermal dryers), primary copper smelters, municipal incinerators capable of charging more than 250 tons of refuse per day, hydrofluoric, sulfuric, and nitric acid plants, petroleum refineries, lime plants, phosphate rock processing plants, coke oven batteries, sulfur recovery plants, carbon black plants (furnace process), primary lead smelters, fuel conversion plants, sintering plants, secondary metal production plants, chemical process plants (which does not include ethanol production facilities that produce ethanol by natural fermentation included in NAICS codes 325193 or 312140), fossil-fuel boilers (or combinations thereof) totaling more than 250 million British thermal units per hour heat input, petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels, taconite ore processing plants, glass fiber processing plants, and charcoal production plants. Other kinds of sources are considered major if they emit or have the potential to emit more than 250 tons of any federally-regulated pollutant in a year.

¹⁴ 30 Tex. Admin. Code § 106.1

¹⁵ *See*, 30 Tex. Admin. Code § 106.4(a)(1) (listing general emission limits).

¹⁶ Some kinds of Insignificant Sources are allowed to or required to submit permit registrations that establish even lower limits for sulfur dioxide and volatile organic compound emissions. However, no Insignificant Source may emit more than 25 tons of sulfur dioxide or volatile organic compounds in a year. 30 Tex. Admin. Code § 106.4(a)(1).

¹⁷ *See note 16.*

¹⁸ According to the TCEQ’s upsets data, sources in Harris County emitted 1,191,080 pounds of unauthorized sulfur dioxide in 2016. The Howard Glasscock Sour Gas Injection Facility emitted 2,076,520 pounds of unauthorized sulfur dioxide in 2016.

¹⁹ Records indicate that the TCEQ has issued Notices of Violation to Chalk South Battery, Chalk North Battery, and the J.T. McElroy 202 Tank Battery for failure to properly report upset events, but the TCEQ has not undertaken an enforcement against any of the listed sources for emitting unauthorized pollution.

²⁰ <https://ehp.niehs.nih.gov/wp-content/uploads/119/3/ehp.1002212.pdf>

²¹ <http://www.who.int/ipcs/features/benzene.pdf>

²² Standard Permit No. 131976.

²³

<http://www2.tceq.texas.gov/oce/eer/index.cfm?fuseaction=main.getDetails&target=226353> ,

<http://www2.tceq.texas.gov/oce/eer/index.cfm?fuseaction=main.getDetails&target=235784>

²⁴ An asterisk indicates that the source was also a top ten illegal emitter by volume in 2015.

²⁵ Hazardous Air Pollutants are pollutants known to cause cancer and other serious health impacts. The Clean Air Act requires EPA to regulate industrial facilities that emit these pollutants. See, <https://www.epa.gov/haps>

²⁶

<http://www2.tceq.texas.gov/oce/eer/index.cfm?fuseaction=main.getDetails&target=231417>



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