

# INDUSTRIAL UPSET POLLUTION: WHO PAYS THE PRICE?

An Analysis of the Health and  
Financial Impacts of Unpermitted  
Industrial Emissions



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Bottom left and right photos on cover taken by Sam Kittner. Bottom center photo taken by Beth O'Brien.

This report is dedicated to the memory of Representative Joe Moreno of Houston and Dr. Marvin Legator of Galveston whose passing this year are a great loss to the citizens of Texas.

Representative Moreno embodied integrity and ethics in the State Legislature, fighting for the best interests of the public. A priority for Representative Moreno in the 79<sup>th</sup> Legislature was passing legislation to clean up the air in Houston. He proposed a bill to increase air monitoring at the fence lines of industrial complexes and make health effect screening levels (ESLs) enforceable standards. The tragic loss of Representative Moreno this year not only affects his family, friends, and constituents, but all those in the state of Texas for he was truly a legislator that stood for principals and the common good.

Dr. Marvin Legator was a pioneer in environmental toxicology. He founded the Division of Environmental Toxicology in the Department of Preventive Medicine and Community Health at the University of Texas Medical Branch in 1976 and served as its Director until 1999. Dr. Legator developed methods for assessing the health effects on communities from exposures to air toxics and fought for communities and individuals affected by preventable toxic exposures. During the 79<sup>th</sup> Legislative session, Dr. Legator helped to educate the Houston Delegation on the importance of strengthening our state's effects screening levels.

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## EXECUTIVE SUMMARY

This study, *Industrial Upset Pollution: Who Pays the Price?*, is the first to examine the impact of unpermitted air emissions on both human health in Texas and on healthcare costs to the state's taxpayers. This study also evaluates the role of the Texas Commission on Environmental Quality (TCEQ) in protecting the state's residents when polluting industries far exceed the emission allowances in their permits through emission events, otherwise called "upsets."

Our study is far from being the definitive, final word on how unpermitted air emissions are endangering many Texas communities and costing taxpayers additional health-related expenses. However, we examined twenty upset events in great detail, and we believe there is sufficient evidence to show the health and economic costs from unpermitted emissions are significant and unnecessary. Our findings should obligate state policymakers to ensure the TCEQ does more to prevent and minimize damage from unpermitted air emissions.

Why is it vital we take a close look at "upsets" or unpermitted emissions? Upsets and other unpermitted emissions from start-up, shutdown, and maintenance operations at oil refineries and chemical plants dramatically affect communities surrounding the facilities. The air emissions from upset events are often more harmful to the local communities than emissions from routine operations at facilities because upsets release large amounts of concentrated toxic pollutants in short periods.

These unpermitted air emissions from upset events largely escape oversight of the TCEQ. They are not subject to health effects reviews or emission minimization requirements included in the permitting process. Industrial facilities in Texas release thousands of tons of air emissions that are not included in their permits annually through upsets and other unpermitted emissions. The Clean Air Act defines many of the air contaminants released during upsets as hazardous air pollutants. This is of greatest concern in communities where the state's industrial facilities are concentrated, such as areas of the Texas Gulf Coast.

Some facilities in this study emitted particular carcinogens during upset events that exceeded the amount of the carcinogen released through annual routine operations by more than 1,000%. One facility in this study reported their annual hazardous air pollutants emitted during emission events and start-up, shutdown, and maintenance activities were more than 3,700% the hazardous air pollutants released during annual routine operations. The sheer amounts of air toxics emitted during these events warrant the need for strong enforcement of such industrial activities.

The residents of Nueces and Jefferson Counties, where many industrial facilities are located on the Texas coast, have higher death rates from cancers associated with industrial pollution. Cancer costs the state an estimated \$14 billion annually; approximately \$5 billion of this cost are direct expenditures. Texas taxpayers pay 47 percent of the cost for all cancer treatments.

Upset pollution also leads to respiratory diseases, decreased lung function, and exacerbations of asthma attacks. The rates of hospital admissions for adult and pediatric asthma in Nueces County are

significantly higher than the Texas average. Hospital admissions for chronic obstructive pulmonary disease in Jefferson County are also significantly elevated compared to the state average. Annual asthma-related costs for the state of Texas are an estimated \$763 million. The annual asthma-related costs in Nueces and Jefferson Counties are more than \$17 million.

The acute health effects from upset events and unpermitted emissions can keep children home from school and force parents to miss work, thus costing the economy in lost productivity. Public Citizen's study involved a statistical analysis of the attendance rates at nearby schools following upset events at an industry facility. The analysis found several schools have dramatic decreases in attendance rates following upset events at a nearby refinery. All of the schools showed some decreases in attendance rates, and in some cases, the schools' attendance rates on the Monday following an upset event were in the lowest 5% of attendance rates for all Mondays in the entire school year.

Unpermitted air emissions further jeopardize the ability of Dallas/Fort Worth, Houston and other urban areas to meet federal air quality standards. Upset events sometimes release large quantities of air contaminants that are contributors to ozone formation. Non-compliance with the federal air quality standards and the subsequent loss of federal funds as a result could cost the state \$11.9 to \$25.9 billion in health-related and economic losses annually.

Our study shows that while the TCEQ does have some tools to prevent unpermitted air emissions, it rarely uses them. For example, industry reported 7,533 upset events to the TCEQ in 2004. Less than one percent of these events resulted in financial penalties and TCEQ only required companies to submit corrective action plans for nine out of the 7,533 events. TCEQ often blatantly ignores industries that willfully violate the law, such as when a company reports flaring poor-quality product that should have been disposed of as hazardous wastes, or when an upset occurs solely because of human error.

A recent study by the State Auditor of Texas found that when TCEQ does issue penalties violators on average are only fined 19% of the economic benefit gained from polluting. Therefore, in the less than one percent chance the TCEQ fines a company for illegal emissions events, they will only penalize the polluter an average 19% of the money gained from violating the law. Consequently, there is little, if any, deterrence for facilities to control their unpermitted emissions.

TCEQ does not require ambient air monitors to measure for harmful concentrations of pollutants next to facilities that continually release unpermitted emissions. These facilities can report having upset conditions on average every other day, including emissions events that emit large quantities of ozone contributors in one of the state's non-attainment areas, and still not have monitors next to their facilities that measure for ozone or air toxics.

The TCEQ fails to inspect plants for years, claiming the facilities have good programs and it is not necessary. Three of the facilities that the TCEQ claims have good enough programs they did not need inspections for over three years reported emitting more than 1,500,000 pounds of criteria air pollutants from a combined 240 unpermitted events in just one year. They also reported emitting more than 1,403,948 pounds of toxic air releases to the EPA's Toxic Release Inventory in one year.

The TCEQ determines which industrial facilities receive permits to operate, what emission limits they must meet, and what pollution controls they must include. TCEQ also has the responsibility of enforcing the regulations in the permits they issue and monitoring facilities for compliance with state laws and agency rules. Clearly, the TECQ could be doing a much better job of meeting its responsibilities, especially regarding the adverse impact of unpermitted emissions. To that end, Public Citizen proposes twelve recommendations.

## RECOMMENDATIONS

**1. All routine or predictable emissions should be subject to all permitting requirements.** When sources go through permitting, they must estimate their total emissions, must show that they are reducing those emissions through use of the best technologies, must evaluate the effects of the emissions on ambient air standards and on local health. All routine or predictable emissions—including emissions from scheduled startup, shutdown, and maintenance—should be subject to all permitting requirements. This will provide a public notice process for ensuring that these emissions are minimized and that the impacts of such emissions are fully considered.

**2. No routine or predictable emissions should qualify for an exemption or defense to penalties.** While TCEQ is always free to exercise its enforcement discretion, any affirmation defense to penalties for excess emissions should be extremely narrow. Excess emissions, whatever their cause, affect the surrounding community, and overall air quality. There are clear costs to such emissions in terms of community health and safety. To the extent that emissions are routine or predictable and could be considered at permitting, they should not be subject to an affirmative defense.

**3. TCEQ should increase monitoring at the fence lines of facilities, especially for air toxics, and require additional monitoring for facilities reporting continual excess emissions.** TCEQ found in its own study that facilities are under-reporting actual emissions, so regulators cannot assume that the only upset events are those industry reports. Furthermore, there is extensive evidence that suggests emissions from flares are underestimated. While facilities generally assume 98-99% efficiency from flares, studies show that this approach makes no allowance for real world operating variables. Thus, flares are releasing more harmful emissions than estimated by industry. Monitors need to record the actual emissions.

**4. All excess emissions should be promptly reported.** Communities have a right to know what is in the air they are breathing. Communities also know an upset has occurred because they can see it, hear, or smell it. They need quick access to information about the pollutants emitted during the upset so that they can decide how to respond. The online emissions database is an excellent tool. TCEQ should eliminate any exemptions from reporting requirements in the rules (such as those for non-opacity emissions from certain boilers and turbines) and should ensure that all excess emissions are being incorporated into the online system promptly.

- 5. TCEQ should fine companies that illegally pollute and ensure penalties are substantial enough that violators are not profiting from polluting.** Penalties must act as a deterrent to future violations and thus, take into account the economic benefit gained from violating the law.
- 6. TCEQ should levy mandatory fines so enforcement penalties are easily calculated and collected.** If emissions from upset events exceed a certain threshold, penalties and enforcement action should be automatic.
- 7. Require Supplemental Environmental Projects (SEPs) to benefit directly the communities affected by the associated violations.** Furthermore, require that SEPs contributing to air monitoring networks enhance the network by increasing the parameters measured by the air monitors. If a regulated entity contributes monetarily to a monitoring network because they violated the law, the funds should go towards a monitor at the boundary of the entity's facility if one does not currently exist and enhancing the parameters that monitor measures if one does exist.
- 8. TCEQ should require facilities to do preventative maintenance and better training of their employees.** The state must conduct detailed inspections at these industrial facilities annually. State inspectors should also conduct drive by inspections at night when facilities are most likely to have upset conditions.
- 9. TCEQ must force companies that have regular, repeat upsets to install equipment to prevent such events from reoccurring.** This includes requiring facilities to have back-up power systems. If an accident happens once, TCEQ should require the facility to identify the cause, propose, and implement a strategy to prevent it from happening again. If it happens twice, the TCEQ should require installation of new equipment to prevent excess emissions from another repeat of the same event.
- 10. The state should allow cities and counties the right to sue the TCEQ and polluting companies if laws are not properly enforced.** The agency rules need clarification that affirmative defense provisions do not affect citizen or EPA enforcement. Any affirmative defense is an exercise of TCEQ's enforcement discretion and cannot affect the ability of citizens or EPA to bring their own enforcement actions as provided by the Clean Air Act.
- 11. Make health effects screening levels (ESLs) enforceable standards so TCEQ will take enforcement action against a facility emitting air contaminants at levels that harm the health of the public.** Regardless of the cause of excess emissions, they may affect ambient air quality and the health of local residents.
- 12. Require the modeling for State Implementation Plans (SIPs) include air contaminants from emission events and start-up, shutdown, and maintenance activities.** The emissions from these events can lead to quick ozone formation and therefore modeling must consider them. The current TCEQ database records all upset emissions and the times of the events. TCEQ air modelers should have access to create database queries of hourly emissions that include those highly reactive volatile organic compounds and volatile organic compounds emitted during upset events.

## BIG STATE, BIG POLLUTION



Texas prides itself on having big characteristics. Texas has big wide-open spaces, big cities, a big population, and even big trucks. Texas also has big pollution that puts the health of our large population at risk and costs the state of Texas billions of dollars each year. There are approximately 2,000 major sources of air pollution in Texas releasing more recognized and suspected carcinogens into the air than in any other state in the nation<sup>1</sup>.

It is common knowledge that Texas is in violation of federal air quality standards for ozone pollution. Texas' non-attainment areas include the metropolitan regions of El Paso, Houston/Galveston/Brazoria, Dallas/Fort Worth, Beaumont/Port Arthur, and San Antonio. In addition, the urban regions of Corpus Christi, Victoria, Austin-San Marcos, Tyler, and Longview-Marshall are "near non-attainment." Citizens in these regions of the state are at risk to health problems because of high ozone pollution, and the state is at risk of losing federal funding due to the deadlines approaching for non-attainment with the federal air quality standards. However, only giving attention to the regions with ozone exceedances ignores numerous toxic territories in Texas and ignores an abundant amount of other dangerous contaminants released into the air daily.

Toxic air pollution that contributes to public health problems, such as cancer and respiratory disease, is at levels higher than recommended by the federal government in areas across the state. The federal government leaves much of the responsibility of protecting the public from these toxins to the states, and since there is not a direct consequence of losing federal funding from high air toxic levels, the public's health does not appear to be a top priority for state officials. State policy makers and regulatory agencies

place attracting new business and industry to the state above concerns of air pollution leading to cancer, birth defects, and many other adverse health effects in Texas citizens.

This report will discuss the air pollution released during air emission events from industrial facilities, otherwise known as “upsets,” and the subsequent consequences to individuals and the state. The report will highlight the acute and chronic health effects of the air contaminants emitted during upset events and show the elevated rates of health problems in areas of the state with concentrated industry. While proving direct causation requires complex epidemiological studies and detailed statistical analyses, those are beyond the scope of this study. This report will show that there is a correlation between upset events, ozone exceedances, increased school absences, and elevated rates of asthma and cancer in communities most affected by industrial air pollution.

Young Texans are at even greater risk. Children have increased exposure to many air pollutants compared to adults because of a higher breathing rate, higher levels of physical activity and children spend more time outdoors than adults do. In 2002, more than 207,000 children went to schools within a two-mile radius of a chemical plant or refinery in Texas. In one year, 139 industrial facilities near Texas schools exposed children to 43.4 million pounds of toxic pollutants<sup>2</sup>. Exposing youth to these toxics daily can affect citizens and governments with the personal and financial costs associated with learning difficulties, increases in school absences, cancer cases, and respiratory diseases.

Air pollution has significant economic implications that this report will discuss at greater length in later sections. Citizens living around industrial facilities endure adverse health impacts daily, becoming a part of their way of life, but both individuals and the state bear a financial burden from the health effects of air toxics. The citizens most impacted by pollution are predominately people in poverty. A 2005 Texas Comptroller report, “The Uninsured: A Hidden Financial Burden on Texas Employers and Communities,” uses a three-year average from 2002-2004 and finds 38% of Texans are living below the 200% poverty line and 24.7% of Texans do not have health insurance<sup>3</sup>. Texas is the state with the largest share of uninsured. Texas also leads the nation for having the highest percentage of uninsured children at 22%, and Medicaid covers another 28% of children.<sup>4</sup> Much of the costs of the uninsured are ultimately transferred to those who do have health insurance through increased premiums and to the taxpayers who pay for uncompensated care in public hospitals and other programs.

While the state can boast of having the most attractive business climate in the nation for 2004,<sup>5</sup> without properly regulating the toxic emissions produced by our industries, Texas citizens loose, and the quality

of life in Texas diminishes. Comparing 2002 data from the EPA's Toxic Release Inventory (TRI), Texas ranked in the worst 10% for being one of the dirtiest states in the nation. Texas also ranked in the worst 10% for the following categories: total environmental releases, air releases of recognized carcinogens, air releases of recognized developmental toxicants, and air releases of recognized reproductive toxicants<sup>1</sup>.

## WHAT ARE UPSET EVENTS?

Upsets are allegedly unpreventable emissions events at industrial facilities that cause them to emit more pollution than allowed by their permits. Permits are the documents that authorize regulated entities to operate and establish that the emissions levels are safe. In some cases, annual upset emissions from a facility can equal 50 times a facility's annual emissions from routine operations<sup>6</sup>. The emissions released during upset events include a mixture of toxic chemicals. The hazardous air pollutants emitted by the BASF FINA facility in Port Arthur during 2003 emission events and scheduled maintenance, startup, and shutdown (EE/SMSS) activities totaled 3,723% of the hazardous air pollutants released during their routine operations in 2003.

Since emissions released during upset events are not included in permit limits, the Texas Commission on Environmental Quality (TCEQ) does not include these air contaminants in permit reviews. Permit reviews evaluate the proposed emissions from a regulated entity to determine the health impacts to the surrounding communities and the necessary pollution controls. Upset emissions are likely not included in a facility's potential to emit and, thus, allows facilities to avoid federal requirements they might otherwise be required to meet such as installment of pollution controls.

The large amounts of concentrated toxic emissions industrial facilities release during upset events directly affect communities living on the fence lines. They can see the consequences of uncontrolled industrial emissions; they smell it and even taste it. These communities complain of burning throats and eyes, difficulty breathing, and skin rashes. People living in the shadow of industry can often list off friends and neighbors who suffer, or have died, from rare cancers and birth defects.



The duration of emission events vary as well as the quantities and concentrations of air toxics released. Upset events can emit tons of pollutants over short periods, such as minutes, hours, or a day. There are also upset events that release toxins over the periods of days and even weeks. The persistent, intermittent concentrations of air contaminants can give rise to both chronic and acute toxicological concerns. These emissions also contribute to cumulative exposures over time that increases the risk of harmful effects<sup>7</sup>. In later sections, the report will go into more detail about the significant adverse health effects of upset pollution.

Industrial facilities in Texas have thousands of upsets a year. They claim most are unavoidable accidents, but upsets are often due to lack of good engineering and management practices. Causes of upsets include equipment breakdowns, called malfunctions, and unplanned maintenance, startups or shutdowns of equipment. Industry's upset reports to the Texas Commission of Environmental Quality also show that upsets occur because of human error, leaks, and unplanned power failures. The frequency of upset events suggests they may be part of normal operating procedures and avoidable emissions.

The Texas Health and Safety Code defines "upsets" as emissions events, or unscheduled maintenance, startup, or shutdown activities, that result in unauthorized emissions of air contaminants from emissions points<sup>8</sup>. Facilities are required to report the contaminants released during upset events if those emissions exceed a reportable quantity of unauthorized emissions<sup>9</sup>. If an upset event surpasses these threshold quantities, the regulated entity must only estimate the amount of pollutants released into the air<sup>10</sup>. TCEQ has no means of validating such estimates; they must rely on the facilities, which have considerable flexibility to underestimate their emissions or not report upset events entirely.

Furthermore, industry estimates these emission releases using flare combustion assumptions that are often inaccurate and not based on real world situations. *Industry Professionals for Clean Air*, a group of petroleum and petrochemical industry professionals, released a report in May 2005 asserting, "The improper representation of flare emissions leads to a large, unquantified shortfall in emissions estimates for routine flare use and significant flaring events." The group is concerned that flare emissions of air toxics and



contaminants that contribute to ozone formation are substantially greater than industry predicts or the state agency permits<sup>11</sup>.

TCEQ has full authority to pursue enforcement actions against all unauthorized emissions; however, TCEQ excuses upsets if they meet certain criteria<sup>12</sup>. These affirmative defenses, identified in Title 30 of the Texas Administrative Code §101.222(b), include criteria such as: the unauthorized emissions were beyond the control of the owner or operator; they did not stem from any activity or event that could have been foreseen and avoided; and, they could not have been avoided by good design, operation, and maintenance practices<sup>13</sup>. In fiscal year 2003, industry reported 7,520 upset events to the TCEQ, which in turn issued only 30 notices of enforcement (NOE). In 2004, TCEQ issued 65 NOE for the 7,533 upset events reported by industry<sup>14</sup>. This report will address the extent to which TCEQ uses its enforcement authority to deter upset events and identify how well the law is working to protect the health of Texans.

Beginning January 31, 2003, the upset events reported to TCEQ by industry became available online to view by the public. In conducting our analysis of the negative effects upsets inflict on communities located in areas of industrial concentration, we worked with the local groups Citizens for Environmental Justice (CFEJ) in Corpus Christi and Community In-Power and Development Association Inc. (CIDA) in Port Arthur, Texas.



Suzie Canales of Citizens for Environmental Justice, a local citizens group in Corpus Christi and member of the Refinery Reform Campaign and Bucket Brigade, looks at the monitoring results from an air sample she took on Refinery Row in Corpus Christi.

The leaders of these two groups, Suzie Canales (CFEJ) and Hilton Kelly (CIDA), approached Public Citizen for support because the state agency responsible for protecting them is not responsive to their needs. Both citizen groups are part of the Refinery Reform Campaign and Bucket Brigade, which consists of community groups living on the fence lines of industrial facilities and fights excessive pollution from refineries around the world.

## CORPUS CHRISTI, TEXAS



Corpus Christi is a major Gulf Coast petrochemical center and The Port of Corpus Christi is now the sixth busiest port in the United States in terms of annual tonnage. Corpus Christi is home to numerous industrial facilities that report having hundreds of upset events each year. Many of these industrial facilities are located in an area of the city called “Refinery Row.” In 2004, industry in TCEQ’s Region 14, which includes Corpus Christi, reported having 710 upset events that released 3,055,893 pounds of pollutants into the region’s air. This number of upsets accounts for 9.4% of all the upsets reported by industry that year<sup>14</sup>.

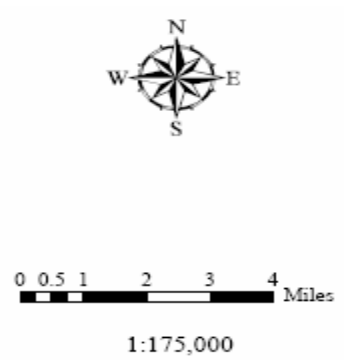
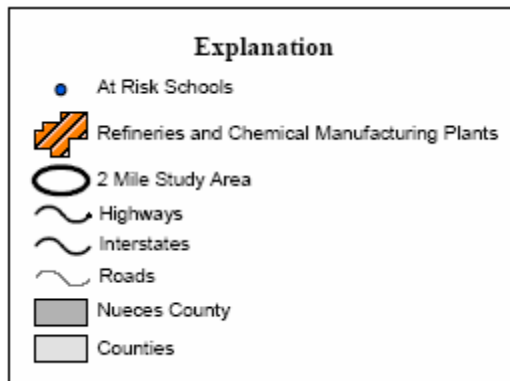
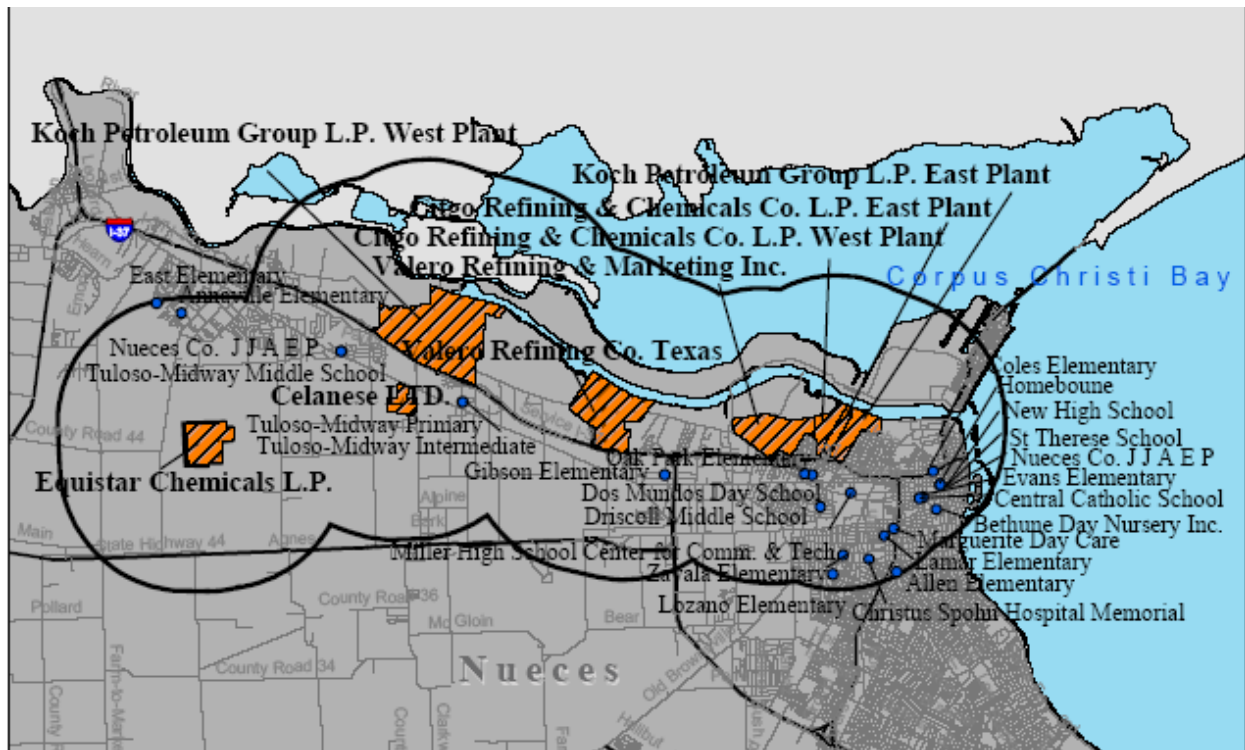
Minority and poorer communities are more likely to live in polluted environments, work in hazardous occupations, and have a higher proportion of pollution-intensive industries and hazardous waste sites near their homes<sup>15</sup>. Using the 2002-2004 three-year average, 47% of Corpus Christi area residents are below the 200% poverty line and 28.3% do not have health insurance<sup>3</sup>. The burden of pollution on minorities and people of low income in Corpus Christi is much greater than the state as a whole. The greatest predictors for residents burdened by criteria air pollutants in Corpus Christi are low-income families and people below poverty. Non-high school graduates, working class individuals, and people of color are the most burdened by toxic chemical releases<sup>16</sup>.

*“Communities that live by refineries and chemical plants are burdened daily from toxic emissions that these facilities release from everyday operations. In addition, under the cover of darkness, people are routinely assaulted as they sleep from pollution from flares so bright they light up the sky and toxic clouds of hazardous chemicals that leave the plants and invade the community. In the slim chance a company is caught and fined, the fines are so low that the polluter profits from breaking the law. Why do the polluters profit and the people have to pay the price with their health?”*

-Suzie Canales, Citizens for  
Environmental Justice

In Nueces County, 10,512 children went to school within a two-mile radius of chemical plants or refineries in 2002. Seventy-four percent of these children were Hispanic. The diagram below shows the location of industrial facilities in Nueces County and the schools located within a 2-mile radius.

**Schools near Refineries and Chemical Plants in Nueces County<sup>1</sup>**



<sup>1</sup> "A is for Air Pollution Part II: The Toxic Threat to Texas Schools." Refinery Reform Campaign and Sustainable Energy and Economic Development (SEED) Coalition. March 2003.

The upset events analyzed in the following sections are examples of air releases that occur on a regular basis in Corpus Christi. Suzie Canales of Citizens for Environmental Justice brought some of the events to our attention and others Public Citizen selected from the TCEQ's Air Emission Event database. The time-consuming nature of the study restricts an analysis of every refinery and chemical plant and every upset event in the region. Public Citizen does not hold the opinion that the industrial facilities identified in this report are any worse or better than the other industrial entities in Corpus Christi that the report does not mention.

### Valero Refinery- West Plant

Valero Energy Corporation is a Fortune 500 company based in San Antonio, Texas, with approximately 20,000 employees and expected revenues of \$55 billion<sup>17</sup>. In April of 2005, Valero announced it would acquire Premcor Inc., making Valero the largest refiner in North America. With this acquisition, Valero will have total assets of \$25 billion and annual revenues of nearly \$70 billion<sup>18</sup>.

Valero purchased its Corpus Christi West Refinery in 1981 and placed it into service in 1984. Since that time, the throughput capacity at the refinery has more than tripled. In 2001, Valero acquired its East Plant, located less than a mile from the West facility. The combined feedstock throughput capacity of the two plants is approximately 340,000 barrels per day<sup>19</sup>.



Picture of Valero Refinery from Valero's company website

In 2003, Valero West reported emitting 7,520,040 pounds of criteria air pollutants during routine operations. An additional 800,640 pounds of criteria air pollutants resulted from emission events and scheduled maintenance, start-up, and shutdown activities (EE/SMSS)<sup>20</sup>. According to the EPA's Toxic Release Inventory (TRI) Valero West reported emitting 268,904 pounds of toxic chemicals into the air in 2003. As mentioned previously, upset events are a huge source of emissions. From January 31, 2003, to December 31, 2004, Valero West submitted 125 upset reports to TCEQ's Air Emission Event Database<sup>21</sup>.

Valero West ranks in the worst 10% for being one of the dirtiest facilities in the US, when comparing the environmental releases reported to the 2002 Toxic Release Inventory. It also ranks in the worst percentile for facilities with the most air releases of recognized reproductive toxicants. Valero West is in worst 20%

for facilities with the most air releases of recognized carcinogens, recognized developmental toxicants, and recognized reproductive toxicants<sup>22</sup>.

The chart on the following page illustrates the large amounts of chemicals released during specific upset events at Valero Refinery's West Plant in Corpus Christi. Valero submitted the data to TCEQ's Air Emission Event database. It is critical to note that these are only a few examples of the 125 upset events reported by this facility from January 31, 2003 to December 31, 2004. The families living around the facility must endure the toxic pollution released during these events in addition to the contaminants emitted through routine operations and the emissions from other nearby industrial sites.

The Valero West upset examples highlighted were all caused from pinhole leaks or malfunctioning equipment, and the maintenance, startup, and shutdown activities associated with fixing them. According to the causes submitted to the Air Emission Event database by the facility, it is common for emissions from a single upset event to arise from multiple problems.

For example, the stated cause for the upset event that took place from September 21-26, 2004, was a

pinhole leak in the regenerator that resulted in shutting the HOC unit down. During start-up of the unit, a valve stuck in the closed position and required shutting the HOC down again to free it. Then during the subsequent start-up, the wet gas compressor thrust bearings malfunctioned. The HOC was shutdown once again to replace the bearings. The facility listed this exact same cause on four separate emission event reports.

The times associated with these reports are 09/21/04, 3:00pm – 09/23/02, 4:00am; 09/22/04, 6:00am – 09/24/04, 5:24pm; 09/26/04, 10:23am – 09/26/04, 11:23am; 09/26/04, 4:00pm –

09/26/04, 5:00pm. In the one hour, from 5:00 to 6:00pm on

September 26, the plant released 18,849 pounds of the highly reactive volatile organic compound butane, 6,351 pounds of carbon monoxide, and 791 pounds of nitric oxide. Since these separate emission event reports were all due to the same cause and occurred in the same time span, this report counts them as a single upset event.



Picture courtesy of Denny Larson of the National Refinery Reform Campaign

**Examples of Air Contaminants Released during Upset Events at  
Valero Corpus Christi Refinery- West Plant**

| Air Contaminants<br>Emitted<br>(quantities in<br>pounds) | <i>Upset emissions<br/>caused by a<br/>pinhole leak and<br/>subsequent<br/>malfunction<br/>during start-up<sup>23</sup></i> | <i>Upset emissions<br/>caused from<br/>maintenance to<br/>repair pinhole<br/>leak and valve<br/>malfunction<sup>24</sup></i> | <i>Upset emissions<br/>caused from<br/>maintenance to<br/>repair pinhole<br/>leak<sup>25</sup></i> | <i>Upset emissions<br/>caused from<br/>maintenance to<br/>replace a motor<sup>26</sup></i> |
|--|---|--|--|--|
|  | 9/21/04, 3:00pm -<br>9/26/04, 5:00pm  | 7/12/04, 5:00pm -<br>7/18/04, 7:30pm   | 5/20/04, 2:04pm -<br>5/20/04, 9:16pm   | 12/14/03, 4:00pm -<br>12/19/03, 2:36pm   |
| 1,3-Butadiene  | 5.06  |  |  |  |
| Ammonia  |   |  | 3.22   | 2.5  |
| Butane   | 19,006.47   | 17.45  | 400.82   |  |
| Butenes  | 792.49  | 21.14  | 0.18   |  |
| Carbon monoxide  | 14,820.16   | 60,312.26  | 2,256.39   | 10,670.68  |
| Ethylene   | 180.56  |  |  |  |
| Hexane   | 531.48  | 44.85  | 53.96  |  |
| Hydrogen sulfide   | 31.57   | 1.02   | 591.13   | 1,314.16   |
| Isobutane  | 519.63  | 169.8  | 36.71  |  |
| Isobutene  | 270.36  | 27.39  | 2.36   |  |
| Isopentane   | 250.35  | 19.33  | 38.79  |  |
| Nitric oxide   | 1,024.94  | 2,828.33   | 120.46   | 2,113.73   |
| Nitrogen dioxide   | 113.88  | 314.26   | 13.38  | 234.86   |
| Pentane  | 32.55   | 0.91   | 46.23  |  |
| Propane  | 175.15  | 3,331  | 191.11   |  |
| Propylene  | 570.51  | 101.63   | 0.07   |  |
| Sulfur dioxide   | 2,912.58  | 2,024.25   | 54,523.49  | 121,211.96   |
| VOCs   |   |  |  | 3,795  |
| Opacity  | 30%   |  |  |  |
| <b>Totals (lbs.)</b>                                     | <b>41,237.74</b>  | <b>69,213.62</b>   | <b>58,278.3</b>  | <b>139,342.89</b>  |
| <b>Totals (tons)</b>                                     | <b>20.62</b>  | <b>34.61</b>   | <b>29.14</b>   | <b>69.67</b>   |

In July 2004, **57,764 lbs. of carbon monoxide** was released into the air in less than 3 days. Carbon monoxide can cause harmful effects to the central nervous system.

**Hydrogen sulfide** released during these events equaled **63%** of the total amount released during 2003 annual routine emissions.

During only 7 hours on May 20, 2004, **sulfur dioxide** was released in quantities totaling **14%** of the annual sulfur dioxide emissions from routine operations. The **sulfur dioxide** released during the upset event from December 14-19, 2003 totaled **30%** of the annual sulfur dioxide emissions.

These upset events released large amounts of sulfur dioxide into the air. The upset event from December 12 through 19 occurred from maintenance to replace a motor due to high vibrations. This incidence caused 121,212 pounds of sulfur dioxide emissions. The amount equals 30% of the total sulfur dioxide released during routine operations for the entire year of 2003 at the Valero West Refinery.

Valero West reported two separate emission events caused by maintenance mid-July 2004. On July 12, 2004, the facility conducted maintenance to repair a pinhole leak on the HOC reactor effluent line, and 30 minutes after the emissions from that event ended on July 15 Valero reported another emission event due to maintenance to replace a malfunctioning valve. On July 13, two TCEQ investigators conducted a Surveillance and Monitoring investigation where they drive by the facilities and note any unusual flaring or odors. There were 4,752 pounds of nitrogen oxides and sulfur dioxide released into the air around this time but the investigators did not note any odors near the Valero West facility. During this period, the refinery also emitted 57,764 pounds of carbon monoxide according to the emission event report, but the investigators did not report observing any flaring when they drove by the site<sup>27</sup>. Another site Surveillance and Monitoring investigation took place the morning of July 15, 2004. The investigators did note intermittent flaring at the Valero West facility but no violations were associated with the investigation<sup>28</sup>.

On May 20, 2004, in a period of only seven hours, the facility released 54,523 pounds of sulfur dioxide into the air. The cause of this upset event was the shutting down of a compressor for maintenance to repair a pinhole leak. Sulfur dioxide can have harmful health effects on the respiratory system and can aggravate asthma. In large quantities, it can hurt the eyes, nasal passages, and lungs; it can eat away iron and steel, turn leaves of plants yellow, and make the air hazy<sup>29</sup>. Sulfur dioxide released in high concentrations in a short amount of time, as on May 20, 2004, is especially dangerous.

As already mentioned, children are more vulnerable to air pollution than adults are because they have a higher breathing rate, spend more time outside, and because their lungs are still developing through adolescence<sup>30</sup>. Increases in air pollution can lead to decreases in school attendance rates. Gibson Elementary is within a two-mile radius of the Valero Refinery West Plant<sup>2</sup>. By analyzing the resultant wind direction at the CAMS 635 air monitor near the West Plant at the time of the upset event, and the location of both the plant and Gibson Elementary, it is assumed the emissions released during the event blew to the northeast of Gibson Elementary at wind speeds varying between 8.4 and 15.5 mph. The max wind speed that occurred at the CAMS 635 monitoring site on May 20 was at 4pm when children are arriving home from school.

The average percentage of children in attendance at Gibson Elementary for the 2003-2004 school year is 94.5%. On Thursday, May 20, 2004, when Valero West experienced the upset event from approximately 2 pm until 9 pm, the attendance rate was 94.6%. The day after the upset event took place the attendance rate dropped to 93.1%, and the following Monday even more children were absent, when there was an attendance rate of 92.8%. While this does not prove a direct causation between the upset event and an decrease in school attendance, it does show a correlation. The upset events at Valero's East Plant will further demonstrate this association.

### Valero Refinery's East Plant

In 2002, the latest data available, Valero East reported emitting 17,121,580 pounds of criteria air pollutants during routine operations, and an additional 472,500 pounds of criteria air pollutants through emission events and scheduled maintenance, start-up, and shutdown activities<sup>31</sup>. Valero East reported 550,505 pounds of toxic air releases to EPA's Toxic Release Inventory for 2003. From January 31, 2003, until December 31, 2004, Valero East reported 73 upset events to TCEQ's Air Emission Event database.



Picture of upset event at Valero East taken by Suzie Canales of Citizens for Environmental Justice

According to its air releases in the 2002 Toxic Release Inventory, Valero East ranks in the worst 10% for being one of the dirtiest facilities in the US. Valero East also ranks in the worst percentile for facilities in the US with air releases of recognized carcinogens, recognized developmental toxicants, and recognized reproductive toxicants<sup>32</sup>.

There are seven elementary schools, one middle school, and one high school within a two-mile radius of Valero Refinery's East Plant. Analyzing the school attendance rates at these schools following upset events at Valero East provides statistical evidence that a correlation exists between upset events and increases in school absences. Every one of the schools had a decrease in attendance the days following the particular upset events investigated for this report.

Recent time-series analyses suggest that the onset of certain health effects and mortality can occur for an entire week following an increase in certain air contaminants.<sup>33</sup> For other contaminants the onset of specific health effects is more likely to occur in the days following the emission event rather than immediately after<sup>34</sup>. A study funded by the Health Effects Institute found associations between nonfatal cardiac events and increases in particulate matter, nitrogen dioxide, sulfur dioxide, and carbon monoxide. The amount of time between an increase in an air contaminant and the onset of the cardiac event depended on which air contaminant was involved. Increases in relative risk of 5-10% were associated with nitrogen dioxide the same day and up to two days after exposure, two to four days after carbon monoxide exposure, and two days after sulfur dioxide exposure. Onset of a non-fatal cardiac event was associated with increased particulate matter (2.5) levels two days before the event. These findings may explain why increases in school absences on Monday are associated with an upset event on a Friday.

The three upset events examined at Valero East all took place in a little over one month and were each caused by a compressor shutting down. On April 2, 2004, the Elliot compressor shut down due to the failure of an electric motor. On May 7, 2004, the Elliot compressor shut down again because of an electrical short of the underground wiring. These two events caused the release of 83,274 pounds of pollution in 14 hours, averaging 7 hours per event. This included 72,969 pounds of sulfur dioxide. Preceding the May 7 release was an upset event that took place over night on May 5 and released an additional 12,672 pounds of sulfur dioxide into the air. The cause of this upset event was a Vacuum Jet compressor shutting down due to vibrations.

Overall, during these three upset events, the facility released 96,987 pounds of air emissions classified as respiratory toxicants<sup>35</sup>. These are chemical substances that if exposed to can cause adverse effects on the respiratory system, which consists of the nasal passages, pharynx, trachea, bronchi, and lungs. Respiratory toxicity can include a variety of acute and chronic pulmonary conditions, including local irritation, bronchitis, pulmonary edema, emphysema, and cancer. Many chemicals that are toxic to the respiratory system are also toxic to the central nervous system. During these upsets, 95,953 pounds of the emissions were neurotoxicants. Exposure to these chemicals can induce confusion, fatigue, irritability, and other behavior changes<sup>35</sup>.

The chart below illustrates the quantity of air contaminants Valero East reported emitting during these three upset events as well as the associated times and causes for the events.

**Examples of Air Contaminants Released during Upset Events at  
Valero Corpus Christi Refinery- East Plant**

| Air Contaminants Emitted (quantities in pounds) | Upset emissions caused by the Elliot Compressor shutting down <sup>36</sup> |  | Upset emissions caused by the Vacuum Jet Compressor shutting down <sup>37</sup> |
|---|---|--|---|
|   | 4/02/04<br>5:36am<br>- 4/02/04<br>11:11am                                   | 5/07/04<br>4:24am-<br>5/07/04<br>11:48am | 5/05/04<br>9:36pm -<br>5/06/04<br>5:36am  |
| Butane, N-                                      | 440   | 356.03                                   | 24.45   |
| Butene  | 125   | 100.72                                   | 3.97  |
| Carbon monoxide                                 | 1,717   | 1,615.87                                 | 106.65  |
| Cis-2-butene                                    | 45  | 36.55                                    | 0.82  |
| Ethylene  | 48  | 59.59                                    | 3.06  |
| Hexane  | 1,073   | 616.64                                   | 34.9  |
| Hydrogen sulfide                                | 489   | 302.18                                   | 129.31  |
| Isobutane                                       | 80  | 64.54                                    | 3.48  |
| Isobutylene                                     | 95  | 76.71                                    | 4.34  |
| Isopentane                                      | 151   | 114.9                                    | 9.55  |
| Nitrogen dioxide                                | 24  | 22.37                                    | 1.48  |
| Nitrogen Monoxide                               | 214   | 201.35                                   | 13.29   |
| Pentane, N-                                     | 325   | 247.33                                   | 21.22   |
| Propane   | 502   | 625.8                                    | 29.97   |
| Propylene                                       | 189   | 235.18                                   | 10.01   |
| Sulfur Dioxide                                  | 45,098  | 27,871                                   | 12,672  |
| Trans-2-butene                                  | 62  | 49.82                                    | 1.33  |
| <b>Totals (lbs.)</b>                            | <b>50,677</b>   | <b>32,596.58</b>                         | <b>13,069.83</b>  |
| <b>Totals (tons)</b>                            | <b>25.34</b>  | <b>16.3</b>                              | <b>6.54</b>   |

The **hexane** released in the less than 21 hours these events occurred accounted for **1559%** of the hexane released during all of 2003's annual routine emissions.

**Hexane** is a hazardous air pollutant, suspected developmental toxicant, neurotoxicant, respiratory toxicant, and reproductive toxicant<sup>38</sup>.

Symptoms of exposure include irritation of eyes, nose; nausea, headache; peripheral neuropathy; numb extremities, muscle weakness; dermatitis; dizziness; chemical pneumonitis<sup>39</sup>.

**85,641 lbs.** of **sulfur dioxide** were released during these three events. Sulfur dioxide is an extreme respiratory irritant and can cause asthma exacerbations<sup>40</sup>.

Sulfur dioxide is also a suspected cardiovascular or blood toxicant, developmental toxicant, gastrointestinal or liver toxicant, neurotoxicant, and respiratory toxicant<sup>37</sup>.

According to the C98 and C199 air monitors on the dates of the upset events, the wind was blowing in the direction that would carry the contaminants southeast of the refinery at resultant wind speeds between six and twelve miles per hour. The C98 monitor recorded high wind gust during these upset events, up to 32 mph for the April 2 upset, up to 16 mph for the May 5 upset, and up to 21 mph for the May 7 upset. These figures show it is probable the emissions dispersed over the neighborhoods where children attend the elementary schools Oak Park, Evans, Coles, Lamar, Lozano, and Zavala. Also in the path of the emissions are Driscoll Middle School and Miller High School.



Picture of house and school's basketball court in Hillcrest neighborhood located on "Refinery Row" In Corpus Christi

Gibson Elementary is also included in this analysis even though the wind direction at the time of the upset does not indicate the emissions blew directly over the school. This does not mean the emissions did not disperse over neighborhoods where children attend Gibson. Furthermore, Suzie Canales of the group Citizens for Environmental Justice says the winds in Corpus Christi typically shift in circular patterns. Gibson is located less than 2 miles away from Valero East and had significant absences on the days following the upset events; thus, there may be an association between the upset events and the subsequent drop in attendance rates.

Considering the attendance rates at the nine schools mentioned on the three days following the April 2 upset event, 60% of the days had a lower attendance rate than the average rates at those schools for the 2003-2004 school year and 63% were lower than average on the three school days following the May 7 upset. Public Citizen calculated the average change between all Mondays attendance rates at each of the schools compared to that schools' average attendance rate for the school year. We then compared these variations to the differences between the attendance rates on the Mondays following the upset events with the schools' yearly attendance rates. Remarkably, seven of the nine schools had a difference between their Monday attendance rates after the April 2 event that was more than one standard deviation<sup>41</sup>. This means the attendance rates on these particular Mondays were at least lower than 68% of the other Mondays during the 2003-2004 school year at each of those schools.

For example, Lozano Elementary's average attendance rate for the 2003-2004 school year is 97%. The standard deviation for Lozano is 2.83 and represents the average spread between all Mondays' attendance rates and the yearly attendance rate for the school year. This means 68% of the Mondays' attendance rates during the year will be within the range of 94.94% and 99.06%. Lozano's attendance rate on the Monday following the April 2 upset was 93.3%; this is less than the spread using one standard deviation. Lamar Elementary had an attendance rate that was more than two standard deviations less than the norm. This demonstrates that while 95% of the Mondays during the school year at Lamar will have attendance rates between 89.14% and 97.63%, the attendance rate on Monday, April 5, was 88.4%.

Similar findings occurred on the Mondays following the May 7 upset event. Six of the schools had attendance rates on those days that were more than one standard deviation from the norm. Three of these schools were three-tenths a percentage point or less from being more than two standard deviations away from their Monday averages. Gibson Elementary's attendance rate Monday, May 10, was more than two standard deviations from the norm, showing that the attendance rate that day was lower than 95% of the other Mondays during the 2003-2004 school year.



Picture courtesy Sam Kittner

Public Citizen also calculated the average change in attendance rates between Fridays and Mondays at each of these schools for the 2003-2004 school year and compared those with the changes during these upset events. Four of the nine schools after the April 2 upset event had a change in attendance rates from Friday to Monday that were more than one standard deviation from the norm. After the May 5 and May 7 upsets, seven of the nine schools had a change in attendance that was more than one standard deviation from the norm.

For example, at Zavala Elementary during the 2003-2004 school year the average difference between a Friday and Monday's attendance rates was a decrease of 0.764. The standard deviation for Zavala calculates to be 1.32; meaning that the average spread around the average difference between Mondays and Fridays' attendance rates is 1.32 percentage points. The significance of this is that 68% of Mondays' attendance rates during this school year will vary from 2.08 less than the previous Fridays' rates and 0.556 more than the previous Fridays' rates. Using two standard deviations shows that 95% of the

Mondays' rates will vary between 3.4 percentage points less than the previous Fridays' attendance rates and 1.88 points more than the Fridays' rates. The change between the attendance rates at Zavala Elementary on Friday, May 7, and Monday, May 10, was a decrease of 3.4 percentage points. This decrease was equal to the lower bound of the spread using two standard deviations.

While these figures do not prove direct causation between the upset events and the subsequent decreases in attendance rates at the schools near the Valero East refinery, they do show there is a statistical correlation that warrants further study. If upset events are keeping Texas children at home from school, they are critically damaging our youth and our economy. Not only does it mean children are losing valuable education time, but there are also losses in productivity associated with the parents of young children who must stay home from work to watch them. The decreases in attendance rates following the April 2 upset are even more concerning because this is a time in the school year elementary students take their Texas Assessment of Knowledge and Skills (TAKS) tests. If students are not able to pass such standardized tests they are not allowed to advance to the next school grade.

The chart on the following page shows the average yearly attendance rates at the schools within a 2-mile radius of Valero East and the attendance rates on the days prior to and following the upset events discussed above. It also highlights the rates that vary statistically from the norm for each school.

Attendance rates bolded are those that occurred after the associated upset event and are less than the school's yearly average attendance rate. Those that have an asterisk next to them are the Monday attendance rates that are more than one standard deviation less than the expected range for a Monday's attendance at that particular school. Two asterisks denote a rate that is more than two standard deviations less than expected. Lastly, the Monday attendance rates in italics are those whose decrease in attendance from Friday is greater than one standard deviation of the difference statistically projected.



A refinery's flare emitting air contaminants at midnight while nearby residents sleep. During this particular emissions event all flares at the refinery were in use but the facility did not report an upset event to TCEQ's Air Emission Event Database. It is not clear how many upset events industries in Texas do not report to TCEQ, but it is likely an astounding amount.

### Attendance Rates at Schools on days before and after the Valero East Upset Events<sup>42</sup>

| Schools within a 2-mile radius of the Valero East Refinery | Average Attendance Rates for the 2003-2004 School Year | Times and Dates of Upset Events  |                 |   |                 |
|--|--|----------------------------------|-----------------|---|-----------------|
|  |  | 4/02/04 5:36am – 4/02/04 11:11am |                 | 5/05/04 9:36pm – 5/06/04 5:36am; 5/07/04 4:24am – 5/07/04 11:48am |                 |
|  |  | Day : Date                       | Attendance Rate | Day : Date  | Attendance Rate |
| Coles Elementary   | <b>96%</b>   | Thurs: 4/1/04                    | 94.2            | Wed: 5/5/04   | 96.4            |
|  |  | Fri: 4/2/04                      | 97.3            | Thurs: 5/6/04   | 96.4            |
|  |  | Mon: 4/5/04                      | <b>94.1*</b>    | Fri: 5/7/04   | 96.8            |
|  |  | Tues: 4/6/04                     | <b>95.2</b>     | Mon: 5/10/04  | <b>93.2*</b>    |
| Evans Elementary   | <b>96.4%</b>   | Thurs: 4/1/04                    | 94.8            | Wed: 5/5/04   | 98.3            |
|  |  | Fri: 4/2/04                      | <b>94.9</b>     | Thurs: 5/6/04   | <b>95.1</b>     |
|  |  | Mon: 4/5/04                      | <b>94.4*</b>    | Fri: 5/7/04   | <b>96.2</b>     |
|  |  | Tues: 4/6/04                     | 96.5            | Mon: 5/10/04  | <b>94.4*</b>    |
| Gibson Elementary  | <b>94.5%</b>   | Thurs: 4/1/04                    | 95.6            | Wed: 5/5/04   | 94.1            |
|  |  | Fri: 4/2/04                      | 94.7            | Thurs: 5/6/04   | 96.4            |
|  |  | Mon: 4/5/04                      | <b>89.1*</b>    | Fri: 5/7/04   | <b>93.5</b>     |
|  |  | Tues: 4/6/04                     | 96.1            | Mon: 5/10/04  | <b>88.4**</b>   |
| Lamar Elementary   | <b>94.8%</b>   | Thurs: 4/1/04                    | 96.9            | Wed: 5/5/04   | 92.5            |
|  |  | Fri: 4/2/04                      | 95.4            | Thurs: 5/6/04   | <b>93.1</b>     |
|  |  | Mon: 4/5/04                      | <b>88.4**</b>   | Fri: 5/7/04   | <b>93.4</b>     |
|  |  | Tues: 4/6/04                     | <b>93.3</b>     | Mon: 5/10/04  | <b>92.5</b>     |
| Lozano Elementary  | <b>97%</b>   | Thurs: 4/1/04                    | 97.7            | Wed: 5/5/04   | 95.5            |
|  |  | Fri: 4/2/04                      | <b>96.4</b>     | Thurs: 5/6/04   | 97.3            |
|  |  | Mon: 4/5/04                      | <b>93.3*</b>    | Fri: 5/7/04   | 97.5            |
|  |  | Tues: 4/6/04                     | 97              | Mon: 5/10/04  | <b>93.2*</b>    |
| Oak Park Elementary  | <b>96.2%</b>   | Thurs: 4/1/04                    | 96.2            | Wed: 5/5/04   | 96.3            |
|  |  | Fri: 4/2/04                      | 97.8            | Thurs: 5/6/04   | <b>95.9</b>     |
|  |  | Mon: 4/5/04                      | <b>95.8</b>     | Fri: 5/7/04   | 96.2            |
|  |  | Tues: 4/6/04                     | 96.4            | Mon: 5/10/04  | <b>93.8*</b>    |
| Zavala Elementary  | <b>96.2%</b>   | Thurs: 4/1/04                    | 98.1            | Wed: 5/5/04   | 96.9            |
|  |  | Fri: 4/2/04                      | 96.8            | Thurs: 5/6/04   | 97              |
|  |  | Mon: 4/5/04                      | <b>95</b>       | Fri: 5/7/04   | 96.3            |
|  |  | Tues: 4/6/04                     | 97.7            | Mon: 5/10/04  | <b>92.9*</b>    |
| Driscoll Middle School                                     | <b>93.5%</b>   | Thurs: 4/1/04                    | 93.8            | Wed: 5/5/04   | 92.3            |
|  |  | Fri: 4/2/04                      | <b>92.5</b>     | Thurs: 5/6/04   | <b>92.8</b>     |
|  |  | Mon: 4/5/04                      | <b>90.1*</b>    | Fri: 5/7/04   | <b>90.4</b>     |
|  |  | Tues: 4/6/04                     | <b>92.1</b>     | Mon: 5/10/04  | <b>91.8</b>     |
| Miller High School   | <b>89.8%</b>   | Thurs: 4/1/04                    | 91.4            | Wed: 5/5/04   | 90.8            |
|  |  | Fri: 4/2/04                      | <b>88.7</b>     | Thurs: 5/6/04   | 90.6            |
|  |  | Mon: 4/5/04                      | <b>86.2*</b>    | Fri: 5/7/04   | 92.1            |
|  |  | Tues: 4/6/04                     | 90.4            | Mon: 5/10/04  | <b>89.7</b>     |

Either the Elliot Compressor or the Vacuum Jet Compressor unexpectedly shutting down caused all three upset examples that occurred within the period of approximately one month at the Valero East Refinery. In-between these events, on April 20, 2004, Valero East reported emissions from a scheduled shutdown of these two compressors and the IR Compressor. This event caused the release of 48,101 pounds of pollution, which included 44,375 pounds of sulfur dioxide. The facility emitted 33,457 pounds on April 20, and another 10,918 lbs. from 6pm on April 21 to 11pm on April 22.

Again the wind direction recorded at the C98 monitor shows these emissions were dispersed over the neighborhoods where children attend the elementary schools within a 2-mile radius of Valero East. This event took place most of the day on a Tuesday and again on the following night. Half of the schools highlighted in the chart on the following page show a decrease in attendance on Wednesday and/or Thursday, and all of the schools show a decrease in attendance on Friday and/or Monday.

#### **Air Contaminants Released during a Scheduled Shutdown Event at Valero East Refinery**

| <i><b>Air Contaminants<br/>Emitted<br/>(quantities in pounds)</b></i> | <b>Emissions Released during<br/>Scheduled Shutdown of the<br/>Vacuum Jet Compressor,<br/>Elliot Compressor, and<br/>IR Compressor<sup>43</sup></b> |
|---|---|
|   | <b>4/20/04, 1:00am - 6:36pm,<br/>10:48pm - midnight;<br/>4/21/04, 6:00pm - 4/22/02, 10:48pm</b>   |
| <b>Butane, N-</b>   | 323.82  |
| <b>Butene</b>   | 41.33   |
| <b>Carbon Monoxide</b>  | 1,153.14  |
| <b>Cis-2-butene</b>   | 13.58   |
| <b>Ethylene (gaseous)</b>   | 42.57   |
| <b>Hexane</b>   | 148.63  |
| <b>Hydrogen sulfide</b>   | 462.69  |
| <b>Isobutane</b>  | 150.4   |
| <b>Isobutylene</b>  | 34.47   |
| <b>Isopentane</b>   | 105.51  |
| <b>Nitrogen dioxide</b>   | 18.08   |
| <b>Nitrogen monoxide</b>  | 162.74  |
| <b>Pentane, N-</b>  | 167.74  |
| <b>Propane</b>  | 718.43  |
| <b>Propylene (Propene)</b>  | 163.38  |
| <b>Sulfur dioxide</b>   | 44,375.30   |
| <b>Trans-2-butene</b>   | 19.01   |
| <b>Totals (lbs.)</b>  | <b>48,100.82</b>  |
| <b>Totals (tons)</b>  | <b>24.05</b>  |

**Attendance Rates at Schools before and after Valero East's Scheduled Shutdown Event<sup>42</sup>**

| Schools within a 2-mile radius of the Valero East Refinery | Average Attendance Rates for the 2003-2004 School Year | Times and Dates associated with Upset Event   |                        |
|--|--|---|------------------------|
|  |  | 4/20/04, 1:00am - 6:36pm, 10:48pm - midnight;<br>4/21/04, 6:00pm - 4/22/04, 10:48pm |                        |
|  |  | <i>Day : Date</i>   | <i>Attendance Rate</i> |
| Coles Elementary   | <b>96%</b>   | Tues: 4/20/04   | 97.6                   |
|  |  | Wed: 4/21/04  | 96.4                   |
|  |  | Thurs: 4/22/04  | <b>95.6</b>            |
|  |  | Fri: 4/23/04  | 96.4                   |
|  |  | Mon: 4/26/04  | <b>93.6*</b>           |
| Evans Elementary   | <b>96.40%</b>  | Tues: 4/20/04   | 96.6                   |
|  |  | Wed: 4/21/04  | 97                     |
|  |  | Thurs: 4/22/04  | 97.1                   |
|  |  | Fri: 4/23/04  | <b>94.9</b>            |
|  |  | Mon: 4/26/04  | 96.6                   |
| Lamar Elementary   | <b>94.80%</b>  | Tues: 4/20/04   | <b>94.3</b>            |
|  |  | Wed: 4/21/04  | 94.9                   |
|  |  | Thurs: 4/22/04  | 95.8                   |
|  |  | Fri: 4/23/04  | <b>91.6</b>            |
|  |  | Mon: 4/26/04  | <b>93.1</b>            |
| Gibson Elementary  | <b>94.5%</b>   | Tues: 4/20/04   | 95.2                   |
|  |  | Wed: 4/21/04  | 97.8                   |
|  |  | Thurs: 4/22/04  | <b>92.7</b>            |
|  |  | Fri: 4/23/04  | 94.9                   |
|  |  | Mon: 4/26/04  | <b>92</b>              |
| Oak Park Elementary  | <b>96.20%</b>  | Tues: 4/20/04   | 96.2                   |
|  |  | Wed: 4/21/04  | 97.5                   |
|  |  | Thurs: 4/22/04  | 97.4                   |
|  |  | Fri: 4/23/04  | <b>96.5</b>            |
|  |  | Mon: 4/26/04  | <b>95.8</b>            |
| Zavala Elementary  | <b>96.20%</b>  | Tues: 4/20/04   | 96.2                   |
|  |  | Wed: 4/21/04  | 97.4                   |
|  |  | Thurs: 4/22/04  | 97.2                   |
|  |  | Fri: 4/23/04  | <b>95.7</b>            |
|  |  | Mon: 4/26/04  | 97                     |
| Driscoll Middle School                                     | <b>93.50%</b>  | Tues: 4/20/04   | 94.4                   |
|  |  | Wed: 4/21/04  | <b>93.1</b>            |
|  |  | Thurs: 4/22/04  | <b>92.6</b>            |
|  |  | Fri: 4/23/04  | <b>90.7</b>            |
|  |  | Mon: 4/26/04  | <b>91.7</b>            |
| Miller High School   | <b>89.80%</b>  | Tues: 4/20/04   | 90.9                   |
|  |  | Wed: 4/21/04  | <b>88.7</b>            |
|  |  | Thurs: 4/22/04  | <b>88.1</b>            |
|  |  | Fri: 4/23/04  | <b>86.9</b>            |
|  |  | Mon: 4/26/04  | <b>88.4</b>            |

## Flint Hills Resources Refinery

Flint Hills Resources (FHR) operates an East and a West plant in Corpus Christi. The original refinery at the FHR West site began operating in 1952, but since then owners have changed multiple times and the capacity of the refinery has increased. Koch Refining Company purchased the West plant in 1981 and the East plant in 1995. Flint Hills Resources is a wholly owned subsidiary of Koch Industries, Inc. FHR's



Picture of Flint Hills Resources from the FHR company website

corporate website states the Koch Petroleum Group was renamed Flint Hills Resources in 2002 out of a desire to better compete and pursue opportunities in the refinery and chemical industries. Today, both plant sites together process about 300,000 barrels of crude oil and other feedstocks daily<sup>44</sup>.

The FHR West plant reported releasing 8,471,460 pounds of criteria pollutants during routine operations in 2002, the latest year that data was available. An additional 257,880 pounds of criteria pollutants resulted from emission events and scheduled maintenance, startup, and shutdown activities (EE/SMSS) during that same year<sup>45</sup>. This adds up to a whopping 8,729,324 pounds of criteria pollutants released during 2002 from the FHR West facility alone. This plant released 584,539 pounds of toxic chemicals during 2003 operations according to the EPA's Toxic Release Inventory (TRI).

Using the 2002 TRI data and comparing FHR West to other industrial facilities in the country, FHR West ranks in the worst 10% for being one of the dirtiest facilities in the nation regarding total environmental releases. FHR West also ranks in the worst percentile of all facilities in the US for increased cancer risk from total air and water releases, for air releases of recognized carcinogens, for air releases of recognized developmental toxicants, and for air releases of recognized reproductive toxicants<sup>46</sup>.

FHR West plant reported 42 emission events to the TCEQ Air Emission Event database from January 31, 2003, to December 31, 2004. The site reported 24 events during the first five months of 2005. While the actual number of emission event reports is far less than those reported from the Valero Refinery, it is important to consider several factors. First, having a lower number of upset events does not mean there were a lower number of harmful emissions released into the air. For example, an upset event at FHR West on September 21, 2004, emitted 139,839 pounds of pollutants including 133,990 pounds of carbon

monoxide. The health effects from acute carbon monoxide exposure range from non-specific flu-like symptoms, such as headache, dizziness, nausea, vomiting, weakness, and confusion, to coma and death from prolonged or intense exposure<sup>47</sup>.

Secondly, FHR often submits their upset emissions from all sources at the site in a single report to the TCEQ. This is probably the most notable reason why FHR submits less upset reports than other industrial facilities. For most of the emissions event reports submitted to TCEQ by the facilities Public Citizen investigated in this study each submittal contained only one emissions source at the site and the associated air contaminants released from that single source. This means a company can submit any number of emissions event reports for air releases that all occurred from a single cause. The number of event reports submitted with the upsets mentioned in this study ranged from one to fourteen. The average number was 4.4 but the median was three and the mode, the amount most frequently submitted, was one. FHR accounted for half of the single reports.

Malfunctioning equipment or human errors were the causes for FHR West upset events Public Citizen investigated. As previously mentioned, on September 21, 2004, the plant released 133,990 pounds of carbon monoxide into the atmosphere over the period of thirty-three hours. The cause of the upset event was a pressure transmitter that malfunctioned on the Wet Gas Compressor. FHR reported that the pressure transmitter's cap was not tightly secured and there was no record of work on the transmitter requiring the removal of the cap. Their emissions report to TCEQ states, "Consequently, there is no way to determine at what time after its installation sometime prior to 1995 that the cap became loose." This means that plant officials at the site have not checked this transmitter over the period of ten years. Had the refinery done preventative maintenance and made sure the cap was secure there is a possibility the upset event could have been avoided, thus saving the nearby community from enduring the exposure to approximately 134,000 pounds of carbon monoxide.

On November 29, 2003, an upset occurred that released more than 5,700 pounds of carbon monoxide, 1,000 pounds of nitrogen oxides, 2,700 pounds of sulfur dioxide, and almost 6,000 pounds of volatile organic compounds (VOCs), in a period of eighteen hours. Opacity reached 45% during the upset event. FHR reported the cause of this event was an "operator errantly opened a 1.5-inch low point bleeder allowing the release of an estimated 5,945 pounds of vaporized slurry oil." In order to isolate the release and end the event, FHR shut down the West Fluid Catalytic Cracking Unit.

An electrical relay associated with the VRU Wet Gas Compressor possibly malfunctioned at FHR West on August 28, 2003 and caused the release of 33,947 pounds of air contaminants over 9 hours. On the initial emissions report, FHR stated the Wet Gas Compressor shutdown due to a perceived amperage imbalance. A day later FHR submitted a maintenance report to TCEQ stating that because of the investigation into the August 28 emissions event FHR discovered the possible malfunction of an electrical relay and performed maintenance to replace it. This necessary maintenance released an additional 470 pounds of nitrogen oxides and sulfur dioxide combined<sup>48</sup>. The subsequent day, on August 30, FHR had to startup the unit that was shutdown to replace the relay and this released 1,693 pounds of contaminants<sup>49</sup>.

The federal Clean Air Act defines 4,333 pounds of the contaminants released during the August 28, 2003 upset event as hazardous air pollutants. While criteria air pollutants are also harmful to the health of humans, hazardous pollutants are those that can cause cancer and other serious health effects. During the nine hours of this event, FHR West emitted 130 pounds of benzene into the air and 4,203 pounds of hexane. Benzene is a recognized carcinogen, developmental toxicant, and reproductive toxicant. It is also a suspected toxic to the cardiovascular and blood system, endocrine system, gastrointestinal or liver, immune system, respiratory system, and skin or sense organs<sup>50</sup>. Hexane is a suspected developmental toxicant, neurotoxicant, reproductive toxicant, and respiratory toxicant<sup>38</sup>. The symptoms of hexane exposure include irritation of eyes and nose, nausea, headache, numb extremities, muscle weakness, dermatitis, dizziness, and chemical pneumonitis<sup>39</sup>.

In addition to these potentially harmful health effects, many of the contaminants released can lead to ozone formation. Ozone can form when the weather is hot and stagnant, and there are nitrogen oxides and volatile organic compounds in the air. FHR West released 9,800 pounds of highly reactive volatile organic compounds (HRVOCs) and an additional 5,527 pounds of volatile organic compounds (VOCs) into the atmosphere during this upset event.



Picture taken by Cindy Pena, member of Citizens for Environmental Justice in Corpus Christi

**Examples of Air Contaminants Released during Upset Events at  
Flint Hills Resources West Plant**

| Air Contaminants<br>Emitted<br>(quantities in<br>pounds) | Upset emissions<br>caused by<br>malfunction of a<br>pressure<br>transmitter <sup>52</sup> | Upset emissions<br>caused by human<br>error <sup>53</sup> | Upset emissions<br>caused by<br>malfunction of<br>electrical relay <sup>54</sup> |
|--|---|---|--|
|  | 9/21/04, 12:23am -<br>9/22/04, 9:30am   | 11/29/03, 3:13pm -<br>11/30/03, 9:00am                    | 8/28/03 12:26pm -<br>8/28/03 9:40pm  |
| Ammonia  | 95  |   |  |
| 1-Butene   |   |   | 502  |
| Benzene  | 4.2   |   | 130.02   |
| Butane (N-)  | 49  |   | 4,197.9  |
| 1-Butene   | 44  |   |  |
| Carbon monoxide  | 133,990   | 5,724.8   | 947.8  |
| Cis-2-butene   | 37  |   | 230.1  |
| Ethylene   | 33  |   | 896.9  |
| Hexane   | 120   |   | 4,203.2  |
| Hydrogen sulfide   | 8.3   |   | 2,762  |
| Isobutane  | 152   |   | 1,379.7  |
| Isobutene  | 20  |   | 159.5  |
| Isopentane   | 68  |   | 1,323.3  |
| Nitrogen dioxide   | 43.5  | 45.87   | 149.24   |
| Nitrogen oxide   | 819   | 871.5   |  |
| Particulate Matter                                       | 975   |   |  |
| Pentane (N)  | 11  |   | 1,789.1  |
| Propane  | 91  |   | 9,831.3  |
| Propylene  | 261   |   | 3,435.1  |
| Sulfur dioxide   | 3,047   | 2,746.7   | 1,632  |
| Sulfur trioxide  | 36  |   |  |
| Trans-2-butene   | 6   |   | 377.3  |
| VOCs   | 16  | 5,945   |  |
| Opacity  |   | 45%   |  |
| <b>Totals (lbs.)</b>                                     | <b>139,839</b>  | <b>15,333.87</b>  | <b>33,946.46</b>   |
| <b>Totals (tons)</b>                                     | <b>70</b>   | <b>7.7</b>  | <b>17</b>  |

**133,990 lbs.** of *carbon monoxide* were released during the Sept. 21, 2004, upset event.

*Carbon monoxide* is a recognized developmental toxicant, which can cause adverse effects on a developing child. Carbon monoxide is also a suspected of being toxic to the cardiovascular or blood, nervous, respiratory, and reproductive systems<sup>51</sup>.

The **health effects** from acute **carbon monoxide** exposure range from non-specific flu-like symptoms such as headache, dizziness, nausea, vomiting, weakness, and confusion, to coma, brain damage, and death from prolonged or intense exposure<sup>55</sup>.

In only nine hours on August 28, 2003, FHR West emitted **130 lbs. of benzene** and **4,203 lbs. of hexane**. Benzene and hexane are hazardous air pollutants; both are either recognized or suspected of causing adverse health effects to a developing child and are toxic to the respiratory and reproductive systems. Benzene is known to cause cancer in humans while hexane is alleged to be toxic to the nervous system.

## EXAMPLES OF UPSET EVENTS IN PORT ARTHUR, TEXAS

Ever since January 10, 1901, when Spindletop blew and oil began gushing 200 feet into the air, the Beaumont-Port Arthur region was forever changed. Some people refer to the area of Port Arthur, Beaumont, and Orange as the “Golden Triangle.” Regional employment relies heavily on petroleum-based industries and shipping through area ports. However, the “black gold” does not mean all the residents of Port Arthur in Jefferson County enjoy in the riches that oil can bring.

Along with the industry comes a massive amount of pollution. Approximately 15% of all the industrial upsets reported to TCEQ in 2004 came from facilities in Region 10, which includes the cities of Port Arthur and Beaumont. These 1,126 upset events released 9,494,012 pounds of air contaminants<sup>14</sup>. When comparing toxic chemical releases, Jefferson County ranks in the worst 10% for being one of the dirtiest counties in the country. It also ranks in the worst percentile for total environmental releases, increased cancer risk from air and water releases, increased noncancer risk – meaning other adverse health effects—from air and water releases, air releases of recognized carcinogens, air releases of recognized developmental toxicants, and air releases of recognized reproductive toxicants<sup>56</sup>.

*“I feel the big polluters must shoulder the responsibility of protecting the people living on the fence lines from the toxic chemicals they emit. Each year refineries and chemical plants dump tons of poisonous gases and chemicals that are out of compliance with state and federal laws and it’s time to stop. There needs to be monitoring east, west, north, and south about 1/8 mile on either side of each major polluter in our communities.”*

-Hilton Kelley, Community In-power and Development Association, Inc.



Dr. Marvin Legator, former professor of environmental toxicology at the University of Texas Medical Branch at Galveston, completed a health study in Port Arthur demonstrating the impacts of industrial emissions on the community. When comparing the Port Arthur residents' symptoms of twelve diseases to those of a control group in Galveston, Dr. Legator told the *Texas Observer* magazine, "Without question the people in Beaumont and Port Arthur are suffering from many more health problems, especially neurological and respiratory diseases, than those in Galveston. The concentration of heavy industry there is having an enormous impact on their lives, and this study proves that to be the case."<sup>57</sup>

Exposure to upsets occurs on average five times a week for the neighborhoods of Beaumont/Port Arthur according to a study conducted by Wilma Subra in December of 2000. The study found that industry's records revealed 75% of the upsets were avoidable if the refineries installed up-to-date pollution control technology and new valves<sup>58</sup>.



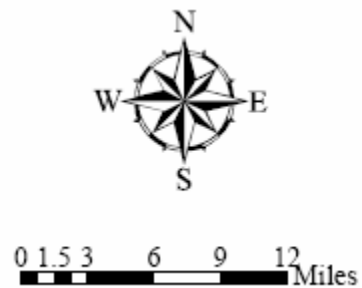
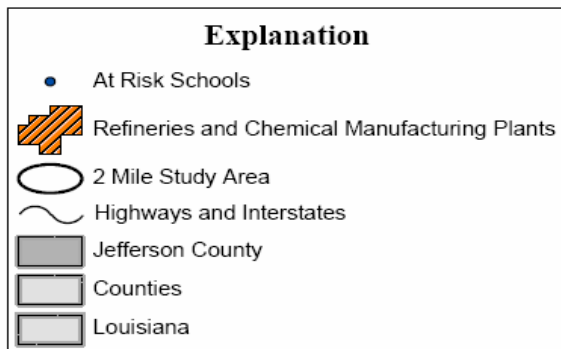
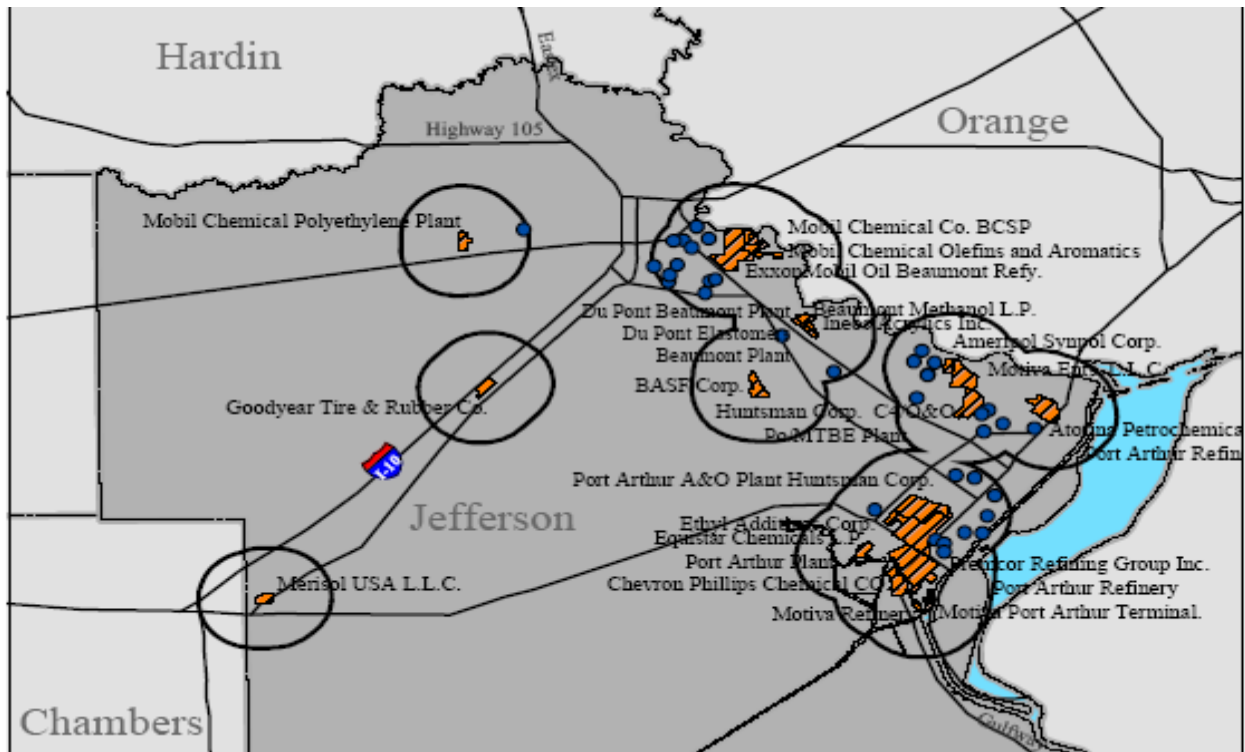
Picture courtesy Sam Kittner

In 2002, 21,800 children went to school within 2-miles of a chemical plant or refinery in Jefferson County. Of these children, 44% were African American<sup>2</sup>. People of color are more burdened by pollution than other residents of Jefferson County. This is especially true concerning proximity to facilities releasing criteria air pollutants. Criteria air pollutants are also more of a burden on children below the poverty line and people of low income in Jefferson County<sup>59</sup>.

The three-year average for people without health insurance in Beaumont/Port Arthur from 2002-2004 is 25%, and 33% of the local residents are below 200% poverty. The area's unemployment rate average is 9.5%<sup>3</sup>.

The map on the following page illustrates the location of industrial facilities in Jefferson County and the schools located within a 2-mile radius of the facilities.

**Schools near Refineries and Chemical Manufacturing Plants in Jefferson County<sup>2</sup>**



<sup>2</sup> “A is for Air Pollution Part II: The Toxic Threat to Texas Schools.” Refinery Reform Campaign and Sustainable Energy and Economic Development (SEED) Coalition. March 2003.  
Map is from 2000 data, and therefore BASF FINA is not included on the map.

Below are examples of upset events from three industrial facilities in Port Arthur, Motiva Enterprises, BASF FINA, and TOTAL Petrochemicals USA, Inc.

### **Motiva Enterprises Port Arthur Refinery**

The Port Arthur Refinery was Texaco's first refinery, built in 1903. Motiva Enterprises has operated this plant since 1998. Motiva Enterprises LLC is a joint venture formed in 1998 between Saudi Refining Inc. and Shell Oil Company. Located primarily in the eastern and southern United States, Motiva operations include 3 refineries, 9,400 Shell and Texaco-branded gasoline stations, and ownership interest in 47 refined product storage terminals<sup>60</sup>. The three refineries include two in Louisiana and one in Port Arthur that have a combined processing capacity of 725,000 barrels per day. Motiva has approximately 2,900 employees and more than 24 billion in sales revenue for 2004<sup>61</sup>.

The Port Arthur Refinery currently processes more than 235,000 barrels of crude oil per day and employs approximately 860 people with an additional 600 contract workers<sup>62</sup>. In 2003, the refinery emitted 14,924,200 pounds of criteria air pollutants during routine operations and an additional 648,400 pounds during emission events and maintenance, start-up, and shutdown activities (EE/SMSS). This means the facility released 15,572,486 pounds of criteria pollutants into the air in the period of one year<sup>63</sup>.

According to Motiva's 2003 Emission Inventory, the refinery released 48,804 pounds of hazardous air pollutants (HAPs) during routine operations and an additional 124,632 pounds during EE/SMSS activities. The HAPs emitted during emission events and scheduled maintenance, startup, and shutdown (EE/SMSS) activities calculate to be 255% of the total HAPs emitted through annual routine operations.

Motiva reported releasing 343,921 pounds of toxic air releases during 2003 to the EPA's Toxic Release Inventory (TRI). This amount is almost three times the quantity of TRI air releases Motiva reported in 2002, which was 89,498 pounds. Comparing their 2002 total environmental releases in TRI to other facilities across the nation, Motiva ranks in the worst 10%, showing it is one of the dirtiest facilities in the country<sup>64</sup>.



As previously mentioned, emission events are a large source of hazardous air pollutants at the Motiva Port Arthur Refinery. From January 31, 2003, to December 31, 2004, Motiva reported 86 upset events to the TCEQ's Air Emission Event database; 58 of these events occurred during eleven months in 2003. Public Citizen's study will focus on the upset events that took place in April of 2003 when Motiva submitted seventeen emission event reports, two maintenance reports, one excess opacity report, and two emission reports that are undefined in the TCEQ Air Emission Event database. All but one of these 22 events took place in the latter half of April.

On April 14, 2003, a 2.4 electrical transformer failed, causing loss of power to the refinery for nine minutes. According to Motiva's emission event report, the power failure started a chain of events that affected the supplies of instrument air, boiler feedwater, and steam to the entire facility. Over the next 24 hours, the refinery would emit 274,438 pounds of air contaminants into the air over the El Vista neighborhood. The event released the majority of these pollutants from 5:00pm until 5:18pm on April 14, including 107,280 pounds of hexane, 24,607 pounds of butene, 29,424 pounds of heptane, 11,834 pounds of isobutane, 37,538 pounds of pentane, and 14,992 pounds of propylene. Also emitted in these eighteen minutes was anywhere from 500 to 5,000 pounds of contaminants such as hydrogen sulfide, methane, ethylene, butadiene, propane, ethane, and carbon monoxide.

These pollutants can cause serious health effects for the people in their path. Hexane is a hazardous air pollutant that is toxic to the nervous, respiratory, and reproductive systems. It can also have adverse effects on a developing child, such as birth defects or even death of a fetus in a pregnant woman. The 78,796 pounds of heptane, isobutene, and pentane released can all be toxic to the central nervous system, inducing confusion, fatigue, irritability and other behavioral changes. Propylene is toxic to the respiratory system. The other contaminants mentioned are all toxic to certain systems of the body<sup>65</sup>.

Many of these pollutants are contributors to ozone formation; ozone also leads to adverse health conditions such as causing breathing problems and aggravating asthma. During this upset event, Motiva emitted 45,234 pounds of highly reactive volatile organic compounds (HRVOCs) and 107,692 pounds of volatile organic compounds (VOCs). These pollutants combine with nitrogen oxides on hot sunny days to form ground-level ozone. Unfortunately, it was not possible for Public Citizen to determine if these emissions led to increased ozone because the wind was blowing away from the active air monitors at the time of the upset event. In October of 2004, a new monitor located to the southeast of the Motiva refinery became active.

The morning after the power failure, from 6:00am to 8:00am on April 15, 2003, Motiva released 17,800 pounds of particulate matter during a unit start-up. Particulate matter can be extremely toxic, depending on the type and form of the particles. Over the last decade, thousands of studies have been published, showing a strong relationship between particle pollution, illness and hospitalization, and premature death<sup>66</sup>. Short-term exposure occurs when particle pollution levels are particularly high over a period of a few hours to a few days. This type of exposure can result in death from respiratory and cardiovascular causes, increased number of heart attacks, inflammation of lung tissue, and increased hospitalization and emergency room visits for acute respiratory ailments and cardiovascular disease<sup>66</sup>.

The approximately nine tons of particulate matter released during the morning of April 15 happened at the same time children were going to school and waiting at bus stops. Increased hospitalization for asthma among children and increased severity of asthma attacks in children are both linked to short-term exposure to particulate pollution<sup>66</sup>.

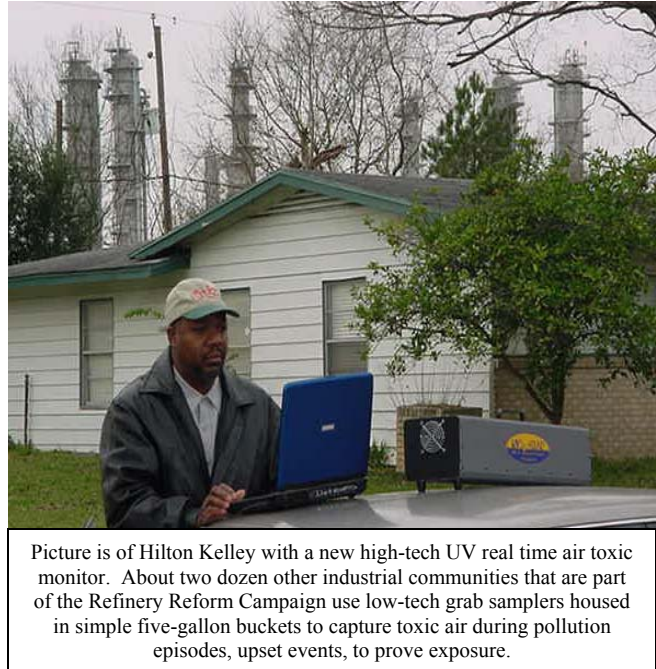
A few days later, from approximately 11:00pm on April 19 until a little before 5:00am on April 20, Motiva released an additional 4,260 pounds of air contaminants. The emissions report submitted by the refinery states that the April 14 upset event allowed catalyst to backup and ultimately caused the Fluid Catalytic Cracking Unit No. 3 (FCCU3) to shut down. While starting the unit back up, the report states a valve in a drain line was partially open “though operators thought they had confirmed the valve was closed by trying to manually close it.” This allowed oil to leak into a flare drum, where it went into the flare stack, atomized into droplets, and then exited the flare without being fully combusted.

With the initial amount of toxic chemicals released in such a short amount of time from this upset on April 14, 2003, it is not surprising that many residents of Port Arthur called the TCEQ to complain. In fact, citizens submitted 32 complaints that day to the Region 10 office. Fifteen residents complained of heavy black smoke, eleven identified the flares the smoke was coming from, and ten other complainants identified the polluting source. Multiple people complained of health effects, such as headaches and concern about an asthmatic child. More than fifteen complained of odors or fumes, and one citizen complained of soot falling on cars.

An investigator for the Region 10 TCEQ office investigated the citizen complaints from 6:00pm until 10:30pm on April 14<sup>67</sup>. The investigation report states all of the flares operated by Motiva and Huntsman were observed in use and smoking. The investigator noted odors at various times that evening. However, he did not have a portable air monitor to detect what chemicals were actually present to know if there was

imminent danger to human health. At one point during the on-site investigation a Motiva official measured the hydrocarbons in the air and found those to be 5.12 parts per million.

Hilton Kelly, director of Community In-Power and Development Association Inc. (CIDA) arrived at the scene prior to the TCEQ investigator and began going door-to-door warning people to remain inside and shut their windows or to leave the area quickly. Mr. Kelly, whose organization is part of the Refinery Reform Campaign and Bucket Brigade, took a bucket air sample at the scene of the upset event. A lab test of the air sample revealed levels of benzene at 4.2 ppbv. This value is above the levels of concern for the Texas long-term health effects screening level at 0.923 ppbv, the EPA Region 6 screening level of 0.0769 ppbv, the Texas short-term screening level at 3.69 ppbv, and the ATSDR intermediate minimal risk level at 1.47 ppbv. Additional chemicals detected in the air sample included toluene, propane, isobutene, n-butane, ethanol, 2-methylbutane, n-pentane, 2-methylpentane, isooctane, and others<sup>68</sup>.



Picture is of Hilton Kelley with a new high-tech UV real time air toxic monitor. About two dozen other industrial communities that are part of the Refinery Reform Campaign use low-tech grab samplers housed in simple five-gallon buckets to capture toxic air during pollution episodes, upset events, to prove exposure.

The TCEQ official at the scene contacted the citizens initiating complaints and informed them of the cause of the upset. There was concern that the wind speed might decrease so the investigator recommended senior citizens remain indoors and not conduct strenuous activities that evening. The investigation report states the steady winds carried most of the emissions over the El Vista community. In conclusion, it asserts odors were strong and objectionable but were very intermittent, and as a result, the investigation did not confirm nuisance conditions.

The fact that such a large upset event releasing approximately 438,000 pounds, the equivalent to 219 tons, of pollutants from the Motiva Refinery did not result in a violation against the facility, not even a nuisance violation, shocked Public Citizen. According to TCEQ's policies, a nuisance odor exists if an odor is emitted in such concentration and duration as to: a) be injurious to or adversely affect human health, welfare, animal life, vegetation, or property, or b) interfere with normal use and enjoyment of animal life, vegetation, or property. It continues to say if there is documentation of any adverse effect or injury, the source should be required to take measures to mitigate the odor, and the regional office should

initiate appropriate enforcement action against the responsible party. If there is not confirmation of such adverse effects, then the TCEQ uses a chart to evaluate the frequency, intensity, duration, and offensiveness of the odor, and to determine whether the evidence in the case constitutes a nuisance violation.

In our opinion, the fact that 32 citizens complained, many citing specific health effects, and the fact that the facility reported emitting massive quantities of toxic chemicals, indicates the emissions were in such concentration and duration to be injurious to or adversely affect human health. The determination by the TCEQ investigator that an odor did not last in the duration to constitute a nuisance condition is irrelevant. Large quantities of toxic emissions in short periods mean the contaminants are more concentrated and potentially more harmful to human health.

In addition to the toxic pollution emitted from the Motiva refinery, local citizens had another 17,038 pounds of contaminants released into the air they breathe by the neighboring Huntsman Petrochemical plant. The power station failure at Motiva affected the steam supply to Huntsman and caused an upset event to occur from 5:30pm on April 14 to 8:06pm on April 15. Yet another upset event occurred at the Motiva refinery at the same time as the one detailed above. Motiva submitted three emission event reports stating the wet gas compressor shut down twice: a bad level indicator caused the first shutdown and a high differential press caused the second shutdown. On April 15, 2003, from 7:46pm – 11:38pm, 3,282 pounds of contaminants went into the air, and the refinery released another 1,219 pounds from that time until April 16 at 11:38pm.

The following week, Motiva reported another upset event; human error was the cause for this release of 4,280 pounds of nitrogen oxides. Motiva stated on its emissions event report that the shutdown of Huntsman's light olefins unit caused excess gas in the system. On April 25, the nitrogen oxides at one of Motiva's boiler stations exceeded the permit limits and set off a high-level alarm but the operators at that station did not notify the operators at the other power station. Therefore, the other operators were not aware of the elevated nitrogen oxide levels and did not take corrective action before emissions exceeded the permitted level. This time the wind was blowing in the direction of the C28 air monitor located northeast of Motiva, anywhere from one to ten miles per an hour. The upset began at noon on April 25 and ended at 11:31am the following day. Interestingly the monitor measured its second highest ozone reading during this time.

The chart on the following page shows the breakdown of emissions released during these upset events.

**Examples of Air Contaminants Released during Upset Events at  
Motiva's Port Arthur Refinery**

| <b>Air Contaminants<br/>Emitted<br/>(quantities in<br/>pounds)</b> | <b>Upset emissions<br/>caused by<br/>electric<br/>transformer<br/>failure<sup>69</sup></b> | <b>Upset<br/>emissions<br/>caused by<br/>Wet Gas<br/>Compressor<br/>Shutting<br/>down<sup>70</sup></b> | <b>Upset<br/>emissions<br/>caused by<br/>human error<sup>71</sup></b> |
|--|--|--|---|
|  | <b>4/14/03, 4:39pm -<br/>4/15/03, 5:19pm;<br/>4/19/03, 10:58pm<br/>- 4/20/03, 4:42am</b>   | <b>4/15/03,<br/>7:46pm-<br/>4/16/03,<br/>11:38pm</b>   | <b>4/25/03,<br/>12:01pm -<br/>4/26/03,<br/>11:31am</b>                |
| <b>Butadiene</b>   | 432  |  |   |
| <b>1,3-BUTADIENE</b>   | 2  | 4  |   |
| <b>Butane</b>  | 1,035  | 245  |   |
| <b>Butene</b>  | 25,605.2   | 308  |   |
| <b>Butylene</b>  | 13   |  |   |
| <b>Carbon Monoxide</b>   | 2,122.5  | 280  |   |
| <b>Cis-2-butene</b>  | 0.2  |  |   |
| <b>Ethane</b>  | 3,071  |  |   |
| <b>Ethylene</b>  | 2,201  | 64   |   |
| <b>Heptane</b>   | 29,424   |  |   |
| <b>Hexane</b>  | 107,692  | 946  |   |
| <b>Hydrogen</b>  | 168.6  |  |   |
| <b>Hydrogen sulfide</b>  | 1,960  | 36   |   |
| <b>Isobutane</b>   | 11,886   |  | 428   |
| <b>Isobutylene</b>   | 0.2  |  | 3,852   |
| <b>Isopentane</b>  | 22   |  |   |
| <b>Methane</b>   | 1,925  |  |   |
| <b>Nitrogen dioxide</b>  | 34.5   | 4  | 428   |
| <b>Nitrogen oxide</b>  | 318  | 34   | 3,852   |
| <b>Particulate Matter</b>  | 17,800   |  |   |
| <b>Pentane</b>   | 37,727   | 354  |   |
| <b>Pentene</b>   | 288  | 177  |   |
| <b>Propane</b>   | 5,272  | 155  |   |
| <b>Propylene</b>   | 15,945   | 283.5  |   |
| <b>Sulfur dioxide</b>  | 13,753   | 1,610  |   |
| <b>Trans-2-butene</b>  | 0.3  |  |   |
| <b>Opacity</b>   | 15%  |  |   |
| <b>Totals (lbs.)</b>   | <b>278,697.5</b>   | <b>4,500.5</b>   | <b>4,280</b>  |
| <b>Totals (tons)</b>   | <b>139.35</b>  | <b>2.25</b>  | <b>2.14</b>   |

107,692 lbs. of hexane was emitted on April 14, 2003 in only 18 minutes; totaling 54% of the annual hexane emissions from routine operations.

Hexane is a hazardous air pollutant, suspected of causing birth defects, damage to the respiratory, reproductive, and central nervous system<sup>35</sup>.

Symptoms of exposure include irritation of eyes, nose; nausea, headache; peripheral neuropathy; numb extremities, muscle weakness; dermatitis; dizziness; chemical pneumonitis<sup>39</sup>.

During these upset events, Motiva emitted 46,138 pounds of highly reactive volatile organic compounds (HRVOCs) and 108,660 pounds of volatile organic compounds (VOCs). HRVOCs and VOCs are contributors to ozone formation.

**Particulate Matter:** damages lungs, increases asthma attacks, aggravates bronchitis, reduces lung function growth in children, and contributes to premature death and increased emergency room visits for people with respiratory and cardiac problems.

## BASF FINA Petrochemicals

BASF Corporation is the North American affiliate of BASF AG in Germany. In North America, 2004 sales were approximately \$11 billion and the company employs about 10,000 people<sup>72</sup>. The BASF FINA Petrochemicals complex in Port Arthur is home to the world's largest naphtha steam cracker, built from 1998 to 2001. The project was a joint venture between BASF Corporation ATOFINA Petrochemicals; the BASF FINA complex is located adjacent to the ATOFINA Port Arthur Refinery<sup>73</sup>.

BASF FINA reported emitting 1,986,880 pounds of criteria air pollutants during routine operations in 2003. The facility released an additional 2,323,980 pounds during emission events and scheduled maintenance, start-up, and shutdown activities (EE/SMSS). This adds up to 4,310,860 pounds of criteria air pollutants released by the complex in the period of one year.

The facility reported emitting 9,787 pounds of hazardous air pollutants (HAPs) during routine operations in 2003 and 364,353 pounds through EE/SMSS. This means the hazardous air pollutants released during upset events and SMSS account for an astonishing 3,723% of those released during normal operating procedures<sup>74</sup>. Those additional HAPs are not included in permit emission limits and, therefore, the permit reviewers at TCEQ do not evaluate the impact of those releases on the health of nearby citizens.

According to the EPA's Toxic Release Inventory, BASF FINA released a total of 1,341,400 pounds of toxic air releases in 2003. Using 2002 TRI data to compare BASF FINA to other industrial facilities across the nation, BASF FINA ranks in the worst 10% for being one of the dirtiest facilities according to total environmental releases. It also ranks in the worst percentile for having a high cancer risk score associated with its air and water releases, for air releases of recognized carcinogens, for air releases of recognized developmental toxicants, and for air releases of recognized reproductive toxicants<sup>75</sup>.

From the time TCEQ made the Air Emission Event database available online— January 31, 2003, until December 31, 2004—BASF FINA reported having 347 emission events. In the first five months of 2005, they reported sixty-six events. Dividing the number of reports over the period BASF FINA submitted them means the plant is experiencing upset conditions on average 48% days of the year.

Public Citizen focused on four separate events attributable to two different causes, lightning storms, and human error. On July 30, 2004, BASF FINA reported an upset that resulted in the release of 152,215 pounds of air contaminants, including 92,508 pounds of carbon monoxide. According to the emission

event report, at approximately 7:00am, the site experienced a thunderstorm in which lightning struck an area of the plant's electrical system and induced a false signal in the cooling tower temperature transmitters. The event tripped several of the facility's units, and over the next three days over 152,000 pounds of contaminants spewed into the air, including 7,220 pounds of hazardous air pollutants.

Less than two months later, a similar event occurred. BASF FINA reported that during a lightning storm associated with Tropical Storm Ivan, the site experienced a series of instrument faults caused by the intense lightning, which activated the Emergency Shutdown System. The facility reported that several systems shutdown during the storm and resulted in flaring from various systems within the plant. This upset event released 127,011 pounds of contaminants into the air, including 52,428 pounds of carbon monoxide and 22,815 pounds of ethylene. These emissions included almost 15,000 pounds of air pollutants that the federal government deems hazardous.

1,3-Butadiene is a recognized carcinogen, recognized developmental toxicant, and a recognized reproductive toxicant. It also is a suspected cardiovascular or blood toxicant, gastrointestinal or liver toxicant, neurotoxicant, respiratory toxicant, and skin or sense organ toxicant<sup>76</sup>. During these two events, BASF FINA released 10,384 pounds of this hazardous air pollutant. The amount released during the five days that these upset events took place accounts for 652% of the 1,3-Butadiene released during BASF FINA's routine emissions in 2003.

Additionally, the facility emitted the carcinogens benzene and styrene in quantities of 4,144 pounds and 118 pounds, respectively. These are two very toxic chemicals. Styrene is suspected of causing every category of adverse health effect, described in more detail in a later section of this report, and benzene is a recognized carcinogen, developmental and reproductive toxicant, as well as a suspected cardiovascular or blood toxicant, endocrine toxicant, gastrointestinal toxicant, respiratory toxicant, skin or sense organ toxicant, and toxic to the immune system. These upset events also released toluene and xylene, which are both toxicants in all but two health effects categories.

Many of the contaminants released into the air during these two events are contributors to ozone formation, approximately 113,500 pounds, most of which are highly reactive volatile organic compounds (HRVOCs). It is very likely that these contaminants caused an ozone spike in the region of the facility. During the July 30 to August 2 upset, conditions were hot and winds were stagnant according to the C119 monitor, but there is no way to determine if ozone exceedances occurred because that monitor does not measure for ozone. However, according to the EPA's AirNow Air Quality maps there was a rise in ozone

on both July 31 and August 1, 2004. This report will further discuss the significance of HRVOC emission events at industrial facilities in ozone exceedances in a later section.

It is disturbing a new facility such as BASF FINA did not include a back-up power system in the entity's design. As a result, in just these two incidences, 280,000 pounds of pollutants went into the Port Arthur air. It is worth noting that during these two lightning storms, which caused BASF FINA to endure massive upset events, no other industrial facilities in the entire Jefferson County reported upset events due to either of these storms. It is also alarming there is not a monitor that measures for air toxics or ozone next to a facility that reports upset events on average every other day and is a facility that releases large amounts of highly reactive volatile organic compounds (HRVOCs) and hazardous air pollutants (HAPs).

On September 30, 2004, at 9:55am, BASF FINA reported an upset that resulted in the release of 38,244 pounds of air contaminants, including 4,679 pounds of HAPs. The reported cause was that the adjacent ATOFINA facility was experiencing a series of alarms associated with the pumps that provide feed to the Ethylene Cracker. There were no physical problems with the pumps, but the facility still needed to address the alarms. This task should not have affected the operation of the pumps. The electrical and systems support staff were testing the alarm system, and while doing so the pumps shutdown. The pumps were in hand control on this day so the operator proceeded to restart the pumps; however, initiation of the heater shutdown sequence had begun. Human error caused this upset, and therefore it was avoidable.

While operators were returning a heater to service just two weeks after the September 30 event, three compressors shutdown due to a low temperature indication. BASF FINA believes there was a slug of condensate/cold steam in the pipe and pushed through the system. Human error caused this upset event because the slug of condensate indicates the unit was not ready for start-up. The facility emitted 142,809.4 pounds of pollutants from 7:24pm, October 15, until 12:27pm, October 17, 2004. In less than one month, human error caused the release of almost 182,000 pounds of pollutants, including 25,089 pounds of hazardous air pollutants. This upset included the release of 4,656 pounds of toluene, 10,229 pounds of 1,3-Butadiene, and 4,870 pounds of benzene. All are extremely toxic chemicals. The 810 pounds of the toxic xylene was 1113% of the total amount emitted through 2003 routine operations at the facility.

Methyl Acetylene is a suspected neurotoxicant and the total released during these two events equaled 1110% of the amount released during 2003 routine operations. BASF FINA emitted 71,558 pounds of

HRVOCs during these events and 19,354 pounds of other ozone-forming chemicals, including VOCs and nitrogen oxides.

The facility released extremely large quantities of carbon monoxide during the four emission events described. The total amount was 215,888 pounds and equaled over 48% of the total carbon monoxide emissions released by BASF FINA in 2003 through routine operations. Carbon monoxide is a harmful toxic, known to cause adverse effects on a developing child, and a suspected toxic to the central nervous system, reproductive system, respiratory system, and cardiovascular system.

The chart on the following page lists the contaminants emitted during the associated upset events reported by BASF FINA. The chart also shows how the amounts released during the events caused by lightning storms or by those caused by human error relate to the facility's total 2003 emissions from routine operations.

The far right column of the chart lists the contaminants released during three separate emission events that occurred in the period of three days. All of these events were due to the flaring of poor-quality propylene product. On November 10, 2004, contamination occurred when the propylene product from the Olefins Conversion Unit was being placed in the pipeline. The following day on November 11, there was a dead leg in the line that contained some off-spec material that entered the system and produced a less desirable propylene product. Flaring of the product occurred from 7:06am to 11:06am. BASF FINA flared poor-quality propylene product again the next day, November 12, from 5:00am until 9:00am when the operation technician received an alarm indicating an increase in carbon monoxide concentration in the product.

It is illegal to flare poor-quality product, but nonetheless, BASF FINA did so three days in a row, resulting in the release of 17,340 pounds of air contaminants. Propylene is a suspected respiratory toxicant; the facility emitted 9,000 pounds during these three days. The other releases included 5,500 pounds of carbon monoxide, 820 pounds of nitrogen oxides, and 2,020 pounds of propane, a suspected neurotoxicant and respiratory toxicant.

**Examples of Air Contaminants Released during Upset Events at  
BASF FINA NAFTA REGION OLEFINS COMPLEX**

| Air Contaminants<br>Emitted<br>(quantities in<br>pounds) | Upset emissions<br>caused by lightning<br>storms |                                    | As a % of<br>Annual<br>Routine<br>Emissions | Upset emissions<br>caused by human<br>error |                                      | As a % of<br>Annual<br>Routine<br>Emissions | Upset<br>emissions<br>from flaring<br>poor-quality<br>product |
|--|--|------------------------------------|---|---|--------------------------------------|---|---|
|  | 7/30/04 -<br>8/02/04 <sup>77</sup>               | 9/23/04 -<br>9/25/04 <sup>78</sup> |   | 9/30/04 -<br>10/02/04 <sup>79</sup>         | 10/15/04 -<br>10/17/04 <sup>80</sup> |   | 11/10/04 -<br>11/12/04  |
| 1,2-Butadiene  | 16   |                                    |   |   |                                      |   |   |
| <b>1,3-BUTADIENE</b>                                     | 5,834  | 4,550                              | <b>652%</b>                                 | 4,613                                       | 5,616                                | <b>643%</b>                                 |   |
| 1-Butene   | 52   |                                    |   |   |                                      |   |   |
| 1-Butyne   | 22   |                                    |   |   |                                      |   |   |
| Acetylene  |  | 232                                | <b>176%</b>                                 | 16  | 595                                  | <b>463%</b>                                 |   |
| Benzene  | 712  | 3,432                              | <b>167%</b>                                 |   | 4,870                                | <b>197%</b>                                 |   |
| Butane   | 346  |                                    | <b>465%</b>                                 |   | 1                                    |   |   |
| Butane, N-   | 1,669  | 1,524                              |   | 1,621                                       | 1,872                                | <b>459%</b>                                 |   |
| Butylene   | 9,826  | 7,513                              |   | 7,560                                       | 9,278                                |   |   |
| Cis-2-butene   | 11   |                                    |   |   |                                      |   |   |
| Carbon Monoxide  | 92,508   | 52,428                             | <b>32.30%</b>                               | 15,336                                      | 55,616                               | <b>16%</b>                                  | 5,500   |
| Ethylene   | 14,055   | 22,815                             | <b>146%</b>                                 | 2,389                                       | 24,384                               | <b>106%</b>                                 |   |
| Hexane   |  | 2,940                              | <b>193%</b>                                 | 66  | 3,769                                | <b>231%</b>                                 |   |
| Hexane, n  | 643  | 52                                 |   | 0   | 519                                  |   |   |
| Isobutane  | 12   |                                    |   |   |                                      |   |   |
| Isobutene  | 52   |                                    |   |   |                                      |   |   |
| Methyl Acetylene   |  | 505                                | <b>865%</b>                                 | 105   | 543.2                                | <b>1110%</b>                                |   |
| Nitrogen dioxide   | 639  | 203                                | <b>2%</b>                                   | 106   | 383                                  | <b>0.80%</b>                                | 70  |
| Nitrogen oxide   | 12,133   | 6,867                              |   | 2,017                                       | 7,285                                |   | 750   |
| Pentene  | 3,957  | 4,610                              |   | 18  | 6,175                                |   |   |
| Propadiene   |  | 505                                |   | 105   | 543.2                                |   |   |
| Propane  | 275  | 1,682                              | <b>367%</b>                                 | 1,868                                       | 3,341                                | <b>977%</b>                                 | 2,020   |
| Propylene  | 9,361  | 12,843                             | <b>116%</b>                                 | 2,424                                       | 11,800                               | <b>74%</b>                                  | 9,000   |
| Styrene  |  | 118                                | <b>237%</b>                                 |   | 170                                  | <b>341%</b>                                 |   |
| Sulfur dioxide   |  | 404                                | <b>31%</b>                                  |   | 583                                  | <b>44%</b>                                  |   |
| t-2-butene   | 15   |                                    |   |   |                                      |   |   |
| Toluene  | 31   | 3,227                              | <b>99%</b>                                  |   | 4,656                                | <b>141%</b>                                 |   |
| Vinylacetylene   | 46   |                                    |   |   |                                      |   |   |
| Xylene   |  | 561                                | <b>771%</b>                                 |   | 810                                  | <b>1113%</b>                                |   |
| <b>Totals (pounds)</b>                                   | <b>152,215</b>                                   | <b>127,011</b>                     |   | <b>38,244</b>                               | <b>142,809.40</b>                    |   | <b>17, 340</b>  |
| <b>Totals (tons)</b>                                     | <b>76.12</b>                                     | <b>63.51</b>                       |   | <b>19.122</b>                               | <b>71.41</b>                         |   | <b>8.67</b>   |

|  |
|--|
| <b>TOTAL Petrochemicals USA, Inc. (ATOFINA Petrochemicals, Inc.)</b> |
|--|

TOTAL Petrochemicals began operations in 1956 as American Petrofina, Inc. with the \$10 million investment of Petrofina S.A. headquartered in Belgium. Since then the company has made numerous acquisitions, merged, and changed its name multiple times. In 2000, TotalFina acquired Elf Aquitaine, creating the fourth largest petroleum company in the world. ATOFINA became the name for the worldwide chemicals division and the company changed its name to ATOFINA Petrochemicals, Inc. That same year, the North American Headquarters relocated to Houston, Texas. On October 1, 2004, ATOFINA Petrochemicals changed its name again to TOTAL Petrochemicals USA, Inc. For simplicity reasons we will call the company TOTAL in this report,<sup>81</sup> however at the time of the upset events highlighted, the company's name was ATOFINA Petrochemicals.

TOTAL acquired the Port Arthur Refinery, originally built in 1936, in 1973 from BP Oil Corporation. Currently, the refinery employs 435 workers and has a capacity of 240,000 barrels per day<sup>82</sup>. TOTAL also has 40% ownership of the BASF FINA Petrochemicals LP Naphtha Steam Cracker and 16% ownership of Sabina Petrochemicals LLC, built in 2003 next to the BASF FINA and TOTAL facilities in Port Arthur.

The TOTAL Port Arthur Refinery reported emitting 7,448,080 pounds of criteria air pollutants during routine operations in 2003, and an additional 3,818,680 through emission events and maintenance, start-up, and shutdown activities (EE/SMSS). This adds up to a total 11,266,750 pounds of criteria air pollutants released in 2003 by the TOTAL Refinery<sup>83</sup>. In 2003, the refinery emitted 330,575 pounds of toxic chemicals according to EPA's Toxic Release Inventory.



From January 31, 2003, until December 31, 2004, TOTAL Petrochemicals submitted 247 emission event reports to TCEQ. The facility submitted an additional 56 in the first five and a half months of 2005. Public Citizen examined two upset events that took place in June of 2003 that both resulted from leaks.

TOTAL reported an upset occurring from June 12, 2003, 2:00pm, until June 18, 2003 at 1:00am. The stated cause for this event was a leak from the Sulfur Recovery Unit No. 3 that appeared to result from back burn or back flash of product into a spare 2-inch optic nozzle between the reactor brick and shell. This one leak caused the TOTAL facility to release 256,193.4 pounds of sulfur dioxide and 7,162.3 pounds of hydrogen sulfide into the air in five and a half days.

Partially occurring during the same period, another emission event reported by TOTAL released 354,255.3 pounds of sulfur dioxide and 3,941 pounds of hydrogen sulfide into the air. The cause of these emissions was two separate leaks from the Sulfur Recovery Unit No. 1 Thermal Reactor. This event started on June 14 at 8:30am and lasted for exactly 5 days, ending on June 19, 8:30am.

Together these two emission events lasted only six and a half days and released 610,449 pounds of sulfur dioxide and 11,103 pounds of hydrogen sulfide. This amount is the equivalent to 42% of the annual sulfur dioxide released from 2003 routine emissions and 81% of the hydrogen sulfide released that same year. Both chemicals are toxic to certain systems of the human body, especially in such high concentrations. In addition to the short and long-term health effects of sulfur dioxide, it also contributes to the formation of acid rain.

It is worth noting that from June 3 to June 12, TOTAL released 95,108 pounds of sulfur dioxide because a bird flying between electrical power lines caused an electrical trip-out of the equipment within the refinery. This same month, the facility released another 2,241 pounds of sulfur dioxide in only an hour and twenty minutes; the cause for this upset was a leaking valve.

Some of TCEQ's ambient air monitors measure for sulfur dioxide, however, only one air monitor is located near TOTAL Petrochemicals and BASF FINA and it is very limited in the parameters it measures. The wind direction at the time of these upset events does cause the emissions to blow over the C119 monitor and even possibly the C303 monitor, if the wind speed was strong enough to carry the emissions, but neither of those monitors measure for sulfur dioxide, hydrogen sulfide, or ozone. The closest air monitor that measures sulfur dioxide is in West Port Arthur. There are some indications that during the month of June when the winds were blowing TOTAL's emissions towards West Port Arthur in the direction of the C98 air monitor, and the wind gusts were high, that there may be an association between the sulfur dioxide emissions from the upset events and spikes in ambient air quality of sulfur dioxide. However, those precise associations are beyond the scope of this report.

**Examples of Air Contaminants Released during Upset Events at  
TOTAL Petrochemicals Complex**

Three leaks caused the release of **11,103 lbs.** of **hydrogen sulfide** in less than 7 days. This amount equals **81%** of the total hydrogen sulfide emissions released in 2003 through routine operations.

| <b>Air Contaminants Emitted (quantities in pounds)</b> | <b>Upset emissions caused from a leak in the Sulfur Recovery Unit<sup>84</sup></b> | <b>Upset emissions caused from two leaks in the Sulfur Recovery Unit<sup>85</sup></b> |
|--|--|---|
|  | <b>6/12/03, 2:00pm - 6/18/03 1:00am</b>  | <b>6/14/03 8:20am – 6/19/03 8:20am</b>  |
| <b>Hydrogen sulfide</b>                                | 7,162.3  | 3,941   |
| <b>Nitrogen dioxide</b>                                | 0.06   |   |
| <b>Nitrogen oxide</b>                                  | 56.75  | 83.24   |
| <b>Sulfur dioxide</b>                                  | 256,193.4  | 354,255.3   |
| <b>Totals (lbs.)</b>                                   | <b>263,412.51</b>  | <b>358,279.54</b>   |
| <b>Totals (tons)</b>                                   | <b>131.71</b>  | <b>179.14</b>   |

In less than 7 days, these three leaks emitted **610,449 lbs.** of **sulfur dioxide**. This amount equals **42%** of the 2003 annual sulfur dioxide emissions released during routine operations.

**Hydrogen sulfide** is a suspected cardiovascular or blood toxicant, neurotoxicant, reproductive toxicant, and respiratory toxicant. Exposure can cause adverse effects on the cardiovascular (heart and blood vessels) or hematopoietic (blood) systems, on the respiratory system, on the nervous system, and can cause adverse effects on the male and female reproductive systems<sup>86</sup>.

Symptoms of exposure include irritation in the eyes or respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance<sup>39</sup>.

**Sulfur dioxide** is a suspected cardiovascular or blood toxicant, developmental toxicant, gastrointestinal or liver toxicant, neurotoxicant, and respiratory toxicant. Exposure can cause various adverse effects to the respiratory system, central nervous system, and in a developing child<sup>87</sup>.

Symptoms of exposure include irritation of the eyes, nose, and throat; rhinorrhea (discharge of thin mucus); choking, cough; reflex bronchoconstriction<sup>88</sup>. Short-term exposure irritates and restricts airways, causes tightness in the chest, and reduces mucus clearance. Long-term studies suggest the health effects of long-term exposure are bronchitis and the suppression of the immune system<sup>87</sup>.

## **THE CONSEQUENCES OF UPSET EMISSIONS: HEALTH EFFECTS AND FINANCIAL IMPLICATIONS**

As illustrated above, industrial facilities release tons of additional air pollution into our state's air annually through upset events. These emissions can cause adverse health effects, defined by the National Center for Environmental Health's (NCEH) Disease Control and Prevention division as chronic or acute health conditions that affect the well-being of an individual or community. The NCEH measures effects in terms of illness and death that are understood in terms of environmental, psychological, physiological, or genetic factors and conditions that predispose an individual to the development of a disease or health condition.

The Environmental Protection Agency set health-based standards for six criteria air pollutants, carbon monoxide, nitrogen oxides, sulfur dioxide, particulate matter, ozone, and lead. All of these criteria pollutants are harmful to human health and the environment. The national Clean Air Act identifies 188 hazardous air pollutants (HAPs), called air toxics. Upset emissions often include large amounts of air toxics, and as mentioned in this report, sometimes in quantities that are more than 3,700% the annual HAPs released through normal operations. This section will discuss the health impacts of hazardous air pollutants in more detail.

### **Hazardous Air Pollutants**

Hazardous air pollutants (HAPs), or air toxics, are the 188 chemicals identified by the Clean Air Act that cause or may cause cancer and other serious health effects such as birth defects, and respiratory tract and neurological illnesses. The Clean Air Act's goal is to reduce the lifetime cancer risks from hazardous air pollutants to one in one million. The monitoring for air toxics is much more limited than the monitoring system for criteria pollutants so there is less data on ambient air quality concerning hazardous air pollutants. However, limited monitoring data does suggest many cities have concentrations of some HAPs that may exceed the goals of the Clean Air Act<sup>30</sup>.

The US EPA estimated the concentration of hazardous air pollutants in every locality in the nation to help identify air pollution problems. Environmental Defense's Scorecard combines the EPA estimates with data on chemical toxicity to estimate the cancer risks posed by HAPs in counties across the country<sup>3</sup>. The

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<sup>3</sup> A risk estimate is not equivalent to a count of actual cancer cases and by itself does not prove that chemicals in the local air caused any specific cancer.

added cancer risk per million people from HAPs in Texas is 550<sup>89</sup>. This added cancer risk is 380 in Nueces County<sup>90</sup>, and in Jefferson County, it is an astonishing 670<sup>91</sup>. This means the added cancer risk in Jefferson County from hazardous air pollutants is 670 times higher than the goal of the Clean Air Act.

Using information from scientific literature and toxicological databases, Environmental Defense's Scorecard provides listings of chemicals with evidence of a potential to affect human health adversely, such as causing cancer, harming the immune system, leading to respiratory disease, and contributing to birth defects. Definitions for each category of toxicity are in the boxes below. Following the definitions is a chart that shows the amount of air toxics sorted by health effect that industrial facilities released into the air of Texas, Nueces County, and Jefferson County in 2002. On the subsequent page is a chart that lists all of the air contaminants emitted during in the upset events investigated for this report. The chart identifies each category of health effect that is associated with the contaminants released. Research to identify whether a chemical is a recognized toxicant, rather than suspected, is very limited and therefore the chart does not distinguish between recognized or suspected for each form of toxicity.

### **TYPES OF HEALTH EFFECTS FROM TOXIC INDUSTRIAL CHEMICALS**

#### **CARCINOGENS**

More than one million new cancer cases were diagnosed in 2001, according to the National Center for Environmental Health. Hundreds of chemicals are capable of inducing cancer in humans or animals after prolonged or excessive exposure. There are many well-known examples of chemicals that can cause cancer in humans. Chemically induced cancer generally develops many years after exposure to a toxic agent. A latency period of as much as thirty years has been observed between exposure to asbestos, for example, and incidence of lung cancer.

#### **DEVELOPMENTAL TOXICANTS**

Approximately 17% of children less than eighteen years of age have a developmental disability, and one in thirty-three US babies born has a birth defect. Developmental toxicants are agents that cause adverse effects on the developing child. Effects can include birth defects, low birth weight, biological dysfunctions, or psychological or behavioral deficits that become manifest as the child grows. Maternal exposure to toxic chemicals during pregnancy can disrupt the development or even cause the death of the fetus. Exposure of pregnant women to mercury lowers birth weight and can cause severe brain damage in children. While developmental toxicity usually results from prenatal exposures to toxicants experienced by the mother, it can also result from paternal exposures. For example, the occupational exposure of men to vinyl chloride has been associated with increased rates of spontaneous abortion in their wives. Early postnatal contact with toxicants can also affect normal development.

### **REPRODUCTIVE TOXICANTS**

Exposure to chemical substances can cause adverse effects on the male and female reproductive systems. Reproductive toxicity may be expressed as alterations in sexual behavior, decreases in fertility, or loss of the fetus during pregnancy. A reproductive toxicant may interfere with the sexual functioning or reproductive ability of exposed individuals from puberty throughout adulthood. Toxicants that target the female reproductive system can cause a wide variety of adverse effects. Changes in sexual behavior, onset of puberty, cyclicity, fertility, gestation time, pregnancy outcome, and lactation as well as premature menopause are among the potential manifestations of female reproductive toxicity: all can disrupt a woman's ability to reproduce successfully. Toxicants that target the male reproductive system can affect sperm count or shape, alter sexual behavior, and/or increase infertility.

### **CARDIOVASCULAR TOXICANTS**

Exposure to chemical substances can cause adverse effects on the cardiovascular (heart and blood vessels) or hematopoietic (blood) systems (Cardiovascular or Blood Toxicity). Exposure to cardiovascular toxicants can contribute to a variety of diseases, including elevated blood pressure (hypertension), hardening of the arteries (arteriosclerosis), abnormal heartbeat (cardiac arrhythmia), and decreased blood flow to the heart (coronary ischemia). Lead, carbon disulfide, arsenic, cadmium, ozone, and vinyl chloride have all been implicated in the etiology of cardiovascular disease. Exposure to hematopoietic toxicants can reduce the oxygen carrying capacity of red blood cells, disrupt important immunological processes carried out by white blood cells, and induce cancer. Chronic exposure to benzene (a component of gasoline fuel) leads to the decreased production of all types of blood cells, and ultimately to leukemia, a cancerous proliferation of white blood cells.

### **ENDOCRINE TOXICANTS**

Endocrine disruptors are exogenous chemicals that interfere with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body. Many endocrine-disrupting chemicals have been shown to be carcinogenic. It has been hypothesized that endocrine-disrupting chemicals may contribute to the incidence of some hormone-related cancers<sup>92</sup>. Exposure to endocrine toxicants can cause adverse effects on the endocrine system, which is comprised of the organs and glands that secrete hormones. Hormones control normal physiological processes, maintaining the body's homeostasis. Compounds that are toxic to the endocrine system may cause diseases such as hypothyroidism, diabetes mellitus, hypoglycemia, reproductive disorders, and cancer.

### **GASTROINTESTINAL OR LIVER TOXICANTS**

Exposure to chemical substances can cause adverse effects on the gastrointestinal tract, liver, or gall bladder (gastrointestinal and liver toxicity). The gastrointestinal tract is the site of entry for chemicals that are ingested. Exposure to halogenated aromatic hydrocarbons, including chlorobenzene and hexachlorobenzene, and metals such as lead, mercury, arsenic, and cadmium can cause anorexia, nausea, vomiting, abdominal cramps, and diarrhea. The liver is frequently subject to injury induced by chemicals because of its role as the body's principal site of metabolism. Necrosis, or liver cell death, is a common effect of acute exposure to chemicals.

### **IMMUNOTOXICITY DEFINITIONS**

Immunotoxicity is defined as adverse effects on the functioning of the immune system that result from exposure to chemical substances. Altered immune function may lead to the increased incidence or severity of infectious diseases or cancer, since the immune system's ability to respond adequately to invading agents is suppressed. Identifying immunotoxicants is difficult because chemicals can cause a wide variety of complicated effects on immune function. Observations in humans and studies in rodents have clearly demonstrated that a number of environmental and industrial chemicals can adversely affect the immune system. Exposure to asbestos, benzene, and halogenated aromatic hydrocarbons such as polybrominated biphenyls (PBBs), polychlorinated biphenyls (PCBs), and dioxins (TCDD) can lead to immunosuppression in humans. Toxic agents can also cause autoimmune diseases, in which healthy tissue is attacked by an immune system that fails to differentiate self-antigens from foreign antigens.

### **KIDNEY TOXICANTS**

Exposure to chemical substances can cause adverse effects on the kidney, ureter, or bladder (Kidney Toxicity). The kidney is unusually susceptible because of its role in filtering harmful substances from the blood. Toxic injury to the kidney is known to occur because of exposures to halogenated hydrocarbons, such as carbon tetrachloride and trichloroethylene, and the heavy metals cadmium and lead. Some of these toxicants cause acute injury to the kidney, while others produce chronic changes that can lead to end-stage renal failure or cancer.

### **NEUROTOXICANTS**

Neurological disorders strike an estimated fifty million Americans each year. Exposure to chemical substances can cause adverse effects on the nervous system (Neurotoxicity). Chemicals toxic to the central nervous system can induce confusion, fatigue, irritability, and other behavioral changes. Chemicals toxic to the peripheral nervous system affect how nerves carry sensory information and motor impulses from the brain to the rest of the body.

### **RESPIRATORY TOXICANTS**

Respiratory system diseases represented 8.7% of all hospitalizations in Texas in 2002, with 232,619 hospital discharges<sup>93</sup>. Exposure to chemical substances can cause adverse effects on the respiratory system, which consists of the nasal passages, pharynx, trachea, bronchi, and lungs. Respiratory toxicity can include a variety of acute and chronic pulmonary conditions, including local irritation, bronchitis, pulmonary edema, emphysema, and cancer. It is well known that exposure to environmental and industrial chemicals can impair respiratory function. Ground-level ozone, the main component in smog, causes breathing problems, aggravates asthma, and increases the severity and incidence of respiratory infections. Acute exposure to respiratory toxicants can trigger effects ranging from mild irritation to death by asphyxiation. Prolonged exposure to respiratory toxicants can cause structural damage to the lungs, resulting in chronic diseases such as pulmonary fibrosis, emphysema, and cancer.

### SKIN OR SENSE ORGAN TOXICANTS

Exposure to chemical substances can cause adverse effects on skin or the sense organs (Skin or Sense Organ Toxicity). The sense of smell is impaired by exposure to cadmium and nickel. Hearing loss occurs after occupational exposure to lead. Exposure to gases like ammonia, chlorine, and formaldehyde causes eye irritation; organic solvents can damage vision. Contact with toxic agents can also cause acute and chronic skin diseases, including dermatitis and photosensitization.

### TOXIC AIR RELEASES IN TEXAS<sup>1</sup>, NUECES COUNTY<sup>94</sup>, AND JEFFERSON COUNTY<sup>56</sup>

#### 2002 Toxic Release Inventory Air Pollution Releases sorted by Health Effect<sup>4</sup>

| Toxicant                  | Pounds of Air Releases in Texas | Pounds of Air Releases in Nueces County | Pounds of Air Releases in Jefferson County |
|---------------------------|---------------------------------|---|--|
| Carcinogens               | 14,111,204                      | 558,747                                 | 1,571,836                                  |
| Cardiovascular or Blood   | 32,406,508                      | 1,054,984                               | 4,094,419                                  |
| Developmental             | 43,251,443                      | 1,565,358                               | 6,295,932                                  |
| Endocrine                 | 10,017,586                      | 280,346                                 | 933,178                                    |
| Immunotoxicants           | 21,511,736                      | 979,790                                 | 2,028,213                                  |
| Kidney                    | 31,043,475                      | 1,321,904                               | 3,495,495                                  |
| Gastrointestinal or Liver | 49,525,433                      | 1,679,913                               | 4,886,669                                  |
| Neurotoxicants            | 71,463,870                      | 2,116,311                               | 8,977,547                                  |
| Reproductive              | 39,476,832                      | 1,214,415                               | 6,581,058                                  |
| Respiratory               | 86,365,543                      | 2,611,169                               | 10,871,052                                 |
| Skin or Sense Organ       | 56,258,239                      | 1,725,425                               | 5,668,308                                  |

**Jefferson and Nueces Counties account for 15% of the carcinogens released into the state's air during 2002.**

16% of the neurotoxicants released in Texas went into the air of Jefferson and Nueces Counties.

**20% of the state's emissions that are toxic to the reproductive system were released in Jefferson and Nueces Counties.**

<sup>4</sup> Quantities of recognized and suspected toxicants are combined for each health effect. Some chemicals are associated with more than one health effect, so their releases may be counted multiple times in this table.

**The Hazardous Air Pollutants Released during the Corpus Christi and Port Arthur Upset Events analyzed in this report and their Associated Health Effects<sup>95</sup>**

| Air Contaminants   | Carcinogens | Cardiovascular or Blood Toxicants | Developmental Toxicants | Endocrine Toxicants | Gastrointestinal or Liver Toxicants | Immunotoxicity | Kidney Toxicants | Neurotoxicants | Reproductive Toxicants | Respiratory Toxicants | Skin or Sense Organ Toxicants |
|--------------------|-------------|-----------------------------------|-------------------------|---------------------|-------------------------------------|----------------|------------------|----------------|------------------------|-----------------------|-------------------------------|
| 1,3-Butadiene      | √           | √                                 | √                       |                     | √                                   |                |                  | √              | √                      | √                     | √                             |
| Acetylene          |             |                                   |                         |                     |                                     |                |                  | √              |                        | √                     |                               |
| Ammonia            |             |                                   |                         |                     | √                                   |                |                  | √              |                        | √                     |                               |
| Benzene            | √           | √                                 | √                       | √                   | √                                   | √              |                  |                | √                      | √                     | √                             |
| Butadiene          | √           | √                                 | √                       |                     | √                                   |                |                  | √              | √                      | √                     | √                             |
| Butane (N-)        |             |                                   |                         |                     |                                     |                |                  | √              |                        |                       |                               |
| Carbon monoxide    |             | √                                 | √                       |                     |                                     |                |                  | √              | √                      | √                     |                               |
| Ethane             |             |                                   |                         |                     |                                     |                |                  |                |                        | √                     |                               |
| Ethylbenzene       | √           | √                                 | √                       | √                   | √                                   |                | √                | √              | √                      | √                     | √                             |
| Ethylene           |             |                                   |                         |                     |                                     |                |                  | √              |                        | √                     |                               |
| Heptane (or n-)    |             |                                   |                         |                     |                                     |                |                  | √              |                        |                       |                               |
| Hexane             |             |                                   | √                       |                     |                                     |                |                  | √              | √                      | √                     |                               |
| Hydrogen           |             |                                   |                         |                     |                                     |                |                  |                |                        | √                     |                               |
| Hydrogen sulfide   |             | √                                 |                         |                     |                                     |                |                  | √              | √                      | √                     |                               |
| Isobutane          |             |                                   |                         |                     |                                     |                |                  | √              |                        |                       |                               |
| Methane            |             |                                   |                         |                     |                                     |                |                  |                | √                      |                       |                               |
| Methyl Acetylene   |             |                                   |                         |                     |                                     |                |                  | √              |                        |                       |                               |
| Nitric oxide       |             | √                                 | √                       | √                   |                                     | √              |                  | √              | √                      | √                     | √                             |
| Nitrogen dioxide   |             | √                                 | √                       | √                   |                                     | √              |                  | √              | √                      | √                     | √                             |
| Nitrogen monoxide  |             | √                                 | √                       | √                   |                                     | √              |                  | √              | √                      | √                     | √                             |
| Nitrogen oxide     |             | √                                 | √                       | √                   |                                     | √              |                  | √              | √                      | √                     | √                             |
| Octane             |             |                                   |                         |                     |                                     |                |                  | √              |                        |                       |                               |
| Particulate Matter | √           | √                                 | √                       |                     |                                     |                |                  |                | √                      | √                     |                               |
| Pentane            |             |                                   |                         |                     |                                     |                |                  | √              |                        |                       |                               |
| Propane            |             |                                   |                         |                     |                                     |                |                  | √              |                        | √                     |                               |
| Propylene          |             |                                   |                         |                     |                                     |                |                  |                |                        | √                     |                               |
| Styrene            | √           | √                                 | √                       | √                   | √                                   | √              | √                | √              | √                      | √                     | √                             |
| Sulfur dioxide     |             | √                                 | √                       |                     | √                                   |                |                  | √              |                        | √                     |                               |
| Sulfur trioxide    |             |                                   |                         |                     |                                     |                |                  |                |                        | √                     | √                             |
| Toluene            |             | √                                 | √                       |                     | √                                   | √              | √                | √              | √                      | √                     | √                             |
| VOCs               | √           |                                   | √                       |                     |                                     |                |                  |                | √                      |                       |                               |
| Xylene             |             | √                                 | √                       |                     | √                                   | √              | √                | √              | √                      | √                     | √                             |

## CANCER

Cancer is a large group of diseases distinguished by the uncontrolled growth and spread of abnormal cells. In the United States, it is estimated more than 1.3 million people were diagnosed with cancer in 2004. An estimated 84,530 diagnoses occurred in Texas alone, and another 34,830 died from the disease in Texas<sup>96</sup>. Four sites account for more than half of all cancers, those sites are lung and bronchus, colon and rectum, breast for females and prostate for men<sup>97</sup>.

According to EPA's Toxic Release Inventory, industrial sources released 6,290,451 pounds of carcinogens into the Texas air in 2002. There are approximately sixty chemical or physical agents known to cause cancers in humans. Interaction between chemicals or genetic influences can enhance the carcinogenicity of environmental agents. The degree of risk from pollutants depends on the concentration, intensity, and duration of exposure. Most carcinogenic exposures occurring during childhood or adolescence will more likely result in occurrence of cancer during adulthood because of the substantially higher incidence and larger latent periods associated with the majority of carcinogens<sup>98</sup>.

Childhood cancer is rare, with less than one percent of all cancers occurring before the age of 15; however, cancer remains the second leading cause of death among Texas children ages one to fourteen. Cancer is diagnosed in approximately 1,100 children and young adults under the age of 20 each year in Texas. Familial and genetic factors account for no more than 5–15% of different categories of childhood cancers. Lymphoid leukemia was the leading type of cancer diagnosed in children under age 20 in Texas during the years 1997–2000, accounting for a quarter of all cancers in children ages one to fourteen<sup>97</sup>. Leukemias represent approximately 30% of childhood cancers, cancer of the brain and central nervous system account for another 22%, and lymphomas make up 11%. Together these types of cancer explain 63% of childhood malignancies<sup>99</sup>.

Epidemiologic studies suggest that residents living in industrial areas may be at increased risk for certain cancers. Industrial facilities discharge a wide range of potentially carcinogenic pollutants into the atmosphere. A review of epidemiologic studies in the US and other countries found evidence linking increased cancer risk and residential proximity to smelters, industrial complexes, and other local emission sources. There is also evidence for higher risk of leukemia and lymphoma among persons living near industrial facilities in the US<sup>92</sup>.

Scientists know that repeated exposures to low doses of carcinogens may increase susceptibility to cancer by causing the accrual of genetic mutations over time. There is also growing evidence that exposures to very low doses of some endocrine-disrupting chemicals can cause cancer and that developing fetuses and infants may be particularly vulnerable. Several chemicals and chemical classes have possible links to breast cancer, including styrene<sup>92</sup>. It is also probable 1,3-Butadiene causes lymphoma and leukemia cancers<sup>99</sup>. Some industrial chemicals and chemicals related to gasoline show links with cancer of the lung and bronchus, pancreas, and urinary bladder<sup>97</sup>.

As previously mentioned, the Clean Air Act's goal is to keep the additional cancer risk in an area to one in one million. Texas has eleven hazardous air pollutants (HAPs) where the added cancer risk to the population is greater than one in one million. In Jefferson County, the cancer risk is greater than one in one million for fourteen different HAPs, and in Nueces County, nine HAPs have a greater cancer risk than one in one million. The added cancer risk in Texas from benzene is 35 added cases per a million people. In Jefferson County, this figure is 54 added cases per a million people, and in Nueces County, it is 36 additional cases of cancer. For 1,3-Butadiene the added cancer risk in Texas<sup>89</sup> is 13 per one million people, the added risk in Jefferson County<sup>91</sup> is 41 cases, and in Nueces County<sup>90</sup> it is 9.5 cases.

Numerous epidemiological studies ascertain that benzene is a carcinogen. Benzene is a genotoxic carcinogen for which no threshold limit exists. There are four key occupational cohort studies demonstrating an association between benzene and leukemia, specifically acute non-lymphocytic leukemia, also known as acute myeloid leukemia. In the four large cohorts that detailed benzene exposure, there was an excess mortality from cancer of the blood and lymphatic system. Long-term exposure to benzene can also cause bone marrow depression<sup>100</sup>.

Benzene is on the TCEQ Air Pollutant Watch List for both Corpus Christi and Port Arthur<sup>101</sup>. George Volz, the Region 10 director, and Buddy Stanly, the Region 14 director, each received interoffice memos from the TCEQ Toxicology Division in September 2004 informing them that the average annual concentrations for benzene at certain air monitors in their regions were higher than the state's long-term health effects screening levels (ESLs). The state cannot guarantee that adverse health effects will not result if an air contaminant exceeds its associated ESL. While the measurements at the two Region 10 sites were almost 150% higher than the long-term ESL and the measurements at the Corpus Christi Huisache site were sometimes approximately 200% the long-term ESL, both memos stated after further investigation the levels of benzene were determined to be within the acceptable risk range<sup>102</sup>.

Considering there is no real safe level of exposure to benzene and the levels of leukemias in Jefferson and

Nueces Counties are much higher than the state average, Public Citizen finds these memos questionable and concerning.

The impact caused by cancer affects almost everyone in Texas. The devastation occurs at many levels, not only for those suffering with the disease, but for their loved ones, employers and others. The Texas Comprehensive Cancer Control Coalition commissioned a study to determine the financial impact of cancer to the state of Texas. The box below summarizes the results. Direct costs include costs of hospitalization, inpatient physician services, outpatient care and freestanding cancer treatment centers, emergency services, home health and hospice care, cancer screening, and retail pharmaceuticals, and expenditures of state agencies, non-profit groups, and private foundations. The calculation of indirect costs includes those associated with lost productivity due to illness and disability, as well as ‘lost opportunity costs’—the value of future productivity estimated to be lost to the state based on premature death due to cancer<sup>103</sup>.

**The Cost of Cancer in Texas (1998 figures)**

Direct Costs = \$4,884,100,000

Indirect Costs = \$9,118,300,000

**Total Costs = \$14,002,400,000**

There is a tremendous economic burden from cancer. The estimated \$14.0 billion in 1998 due to cancer represents a significant portion of health care costs to the state. Of the medical costs associated with cancer in Texas, Medicare paid 42% and Medicaid covered 5%<sup>103</sup>.

The Texas Cancer Data Center calculates the death rates for cancers by race and gender for all counties of the state<sup>104</sup>. The Center only calculates rates if six or more deaths occurred during a year from a specific cancer<sup>5</sup>. As previously mentioned, the death rates of leukemia are higher than the state average in Jefferson and Nueces Counties. Comparing the leukemia death rates for all races in Jefferson County to the state rates for all races, Jefferson County males had rates higher than the state during eight of the years

<sup>5</sup> Rates are per 100,000 and age-adjusted to the 2000 US standard.

spanning 1990 to 2000 and Jefferson County female rates were higher six of those years. Some of the rates in Jefferson County during these years were more than double the rates of the state.

Benzene exposure is specifically associated with myeloid leukemia. Myeloid leukemia death rates in Jefferson County were higher than the state average for every year they were calculated. As with the leukemia rates, some of these were also more than double the state averages. When comparing cancer death rates by race categories in Jefferson County to the state rates for the same races, the statistics are

Non-Hispanic White males in Jefferson County have a death rate from myeloid leukemia that is sometimes more than double the state's death rate.

even more alarming. For example, where the state death rates for leukemia in Non-Hispanic White males for the years of 1995, 1996, and 1997, were 11.9, 12.1, and 12.2 respectively, the rates for Non-Hispanic White males in Port Arthur for the same years were 20.2, 18.5, and 26.4. While statistical significance is beyond the scope of this report, it is obvious the rates are much higher than the state average.

Similar observations hold true for cancer death rates in Nueces County. The Texas Cancer Data Center calculated leukemia death rates for Hispanic males in Nueces County for the years of 1991, 1993, and 1994. These rates were 14.7, 14.2, and 19.3 respectively, compared to 7.2, 6.3, and 7.8 for Hispanic males statewide. This demonstrates that the death rates from leukemia in Nueces County Hispanic males are more than twice the state rates for Hispanic males. The

higher death rates from leukemia are not only true for Hispanics in Nueces County, but also for Non-Hispanic White males and females. In the four years for which leukemia death rates are available, every single year is higher than the state average and all but one are more than double or almost double the state rate for that same year.

For every year the death rates from leukemia are calculated for Hispanic males in Nueces County, they are more than double the death rates for Hispanic males across the state.

Death rates in Jefferson and Nueces Counties for cancers of the respiratory system are also much higher than the state. For all races in Jefferson County, the death rates of respiratory system cancers are higher for males and females during all but one year between 1990 and 2000. Both Non-Hispanic White males and African American males have a higher death rate than the state rates for Non-Hispanic White males and African American males during all but two of the years between 1990 and 2000. African American woman in Jefferson County compared to African American women across the state have a higher death rate from respiratory system cancers for every year from 1990 to 1999. There is only one year that this

data is available for Hispanics in Jefferson County; the death rate for Hispanics statewide was 53.6, and in Jefferson County, it was 124.4. This represents 232% of the state's death rate from respiratory system cancer.

The statistics are equally alarming for Nueces County. While the death rates of respiratory cancers for all races are higher than the state for more than half of the years from 1990 to 2000, the rates are more frequently higher than the state when comparing races separately. Non-Hispanic White women have higher rates than the state for ten of the eleven years and Non-Hispanic White males do for eight of the years. Hispanic males have higher death rates from respiratory system cancers during nine of the years and Hispanic females eight of the years spanning 1990 to 2000.

Of the seven years in which rates are available, there is only one year that the death rate from respiratory cancers in Nueces County African American males is lower than the state's death rates for African American males, with the rates being as high as 197% the state rates. The rates for African American females are particularly disconcerting. The Texas Cancer Data Center only calculated these death rates for the years 1990, 1991, and 1992. The state death rates for African American women with cancer of the respiratory system were 37.9, 38.7, and 40.6 for these respective years. In comparison, the death rates in Nueces County were 89.9, 113.5, and 109.5. These rates are 237%, 293%, and 270% of the state's rates for those years respectively. In is important to note here that the number of African American women who died from respiratory cancer in 1990 was six, the lowest death number the Texas Cancer Data Center will use to calculate a death rate, and for the other two years, the number of deaths was seven. With six deaths in Nueces County, the rate was 237% of the state's rate. Thus, it leads one to believe that in the four years there were four deaths the rates were likely higher than the state rates as well.

African American women in Nueces County have annual death rates from cancers of the respiratory system that are almost 300% the corresponding death rate for the entire state of Texas in certain years.

The chart on the following page covers the years 1990 to 2000 and compares the death rates from all types of cancers in Nueces and Jefferson Counties to the state death rates from all types of cancers. The chart categorizes the death rates by gender and race. The death rates in bold are those rates that are higher than the state's rate for that particular category.

**Comparison of Death Rates from Cancer in Texas, Nueces County, and Jefferson County<sup>6</sup>**

| RACE               | YEAR | NUECES COUNTY |              | JEFFERSON    |              | STATE OF TEXAS |        |
|--------------------|------|---------------|--------------|--------------|--------------|----------------|--------|
|                    |      | Male          | Female       | Male         | Female       | Male           | Female |
| All Races          | 1990 | <b>316.7</b>  | <b>188.5</b> | <b>333.9</b> | <b>181.2</b> | 284.2          | 166.2  |
|                    | 1991 | 257.7         | <b>188.9</b> | <b>303.1</b> | <b>189.8</b> | 274.8          | 167.9  |
|                    | 1992 | <b>279.1</b>  | 163.9        | <b>314.7</b> | <b>174.6</b> | 278.3          | 170.2  |
|                    | 1993 | <b>298.7</b>  | <b>187.4</b> | <b>337.6</b> | <b>183.4</b> | 288.6          | 167.5  |
|                    | 1994 | <b>304.8</b>  | 167.2        | <b>322.9</b> | <b>186.8</b> | 280.3          | 170.4  |
|                    | 1995 | 270.3         | <b>173.4</b> | <b>328.3</b> | <b>178.7</b> | 273.4          | 169.6  |
|                    | 1996 | <b>269.5</b>  | <b>169.3</b> | <b>295.7</b> | <b>193.4</b> | 267.7          | 168.4  |
|                    | 1997 | 254.4         | 164.0        | <b>294.0</b> | <b>174.2</b> | 266.8          | 164.6  |
|                    | 1998 | 226.3         | 151.3        | <b>280.8</b> | <b>191.8</b> | 258.8          | 163.7  |
|                    | 1999 | 216.5         | 150.9        | 259.7        | <b>172.1</b> | 262.3          | 163.0  |
|                    | 2000 | <b>265.7</b>  | 154.6        | <b>292.4</b> | 161.8        | 249.9          | 162.1  |
| African American   | 1990 | <b>583.7</b>  | <b>229.6</b> | 369.3        | <b>235.2</b> | 405.5          | 203.3  |
|                    | 1991 | <b>529.9</b>  | <b>305.0</b> | 360.7        | <b>260.3</b> | 390.5          | 212.0  |
|                    | 1992 | <b>419.5</b>  | <b>253.2</b> | <b>436.8</b> | <b>216.0</b> | 415.5          | 208.6  |
|                    | 1993 | <b>652.0</b>  | <b>284.9</b> | 433.9        | <b>267.1</b> | 437.0          | 214.7  |
|                    | 1994 | 356.0         | 111.0        | <b>443.6</b> | <b>238.8</b> | 416.9          | 215.6  |
|                    | 1995 | <b>631.5</b>  | <b>304.6</b> | <b>418.7</b> | <b>230.9</b> | 414.9          | 218.2  |
|                    | 1996 | 253.0         | 204.2        | <b>441.8</b> | <b>266.8</b> | 403.7          | 213.1  |
|                    | 1997 | <b>495.6</b>  | 92.8         | <b>424.3</b> | 209.8        | 406.5          | 212.3  |
|                    | 1998 | 207.7         | <b>239.8</b> | <b>440.7</b> | <b>235.4</b> | 405.3          | 208.2  |
|                    | 1999 | <b>412.3</b>  | 199.4        | 330.3        | <b>221.5</b> | 400.4          | 218.0  |
|                    | 2000 | 305.7         | 195.3        | 352.2        | 178.3        | 363.3          | 205.3  |
| Hispanic           | 1990 | <b>249.5</b>  | <b>151.6</b> | -            | -            | 204.9          | 129.0  |
|                    | 1991 | <b>209.9</b>  | <b>170.3</b> | -            | <b>144.5</b> | 189.9          | 129.4  |
|                    | 1992 | <b>232.8</b>  | 96.7         | -            | 126.9        | 199.8          | 130.3  |
|                    | 1993 | <b>232.5</b>  | <b>146.6</b> | <b>288.8</b> | -            | 206.1          | 119.8  |
|                    | 1994 | <b>246.2</b>  | <b>140.1</b> | -            | 120.6        | 208.2          | 133.2  |
|                    | 1995 | <b>211.5</b>  | 121.3        | 158.2        | -            | 204.9          | 125.6  |
|                    | 1996 | <b>219.4</b>  | <b>122.5</b> | -            | -            | 196.4          | 122.3  |
|                    | 1997 | <b>249.5</b>  | <b>125.8</b> | -            | <b>125.5</b> | 198.8          | 123.5  |
|                    | 1998 | 195.0         | 113.6        | 124.7        | -            | 200.6          | 124.7  |
|                    | 1999 | <b>197.0</b>  | <b>128.6</b> | 96.8         | 92.5         | 189.4          | 118.6  |
|                    | 2000 | <b>261.6</b>  | <b>146.0</b> | -            | -            | 193.7          | 126.8  |
| Non-Hispanic White | 1990 | <b>348.0</b>  | <b>209.4</b> | <b>330.5</b> | <b>171.3</b> | 287.7          | 170.0  |
|                    | 1991 | 269.0         | <b>198.7</b> | <b>300.6</b> | 168.7        | 280.6          | 171.8  |
|                    | 1992 | <b>304.9</b>  | <b>204.1</b> | <b>292.2</b> | 163.7        | 281.1          | 174.4  |
|                    | 1993 | <b>322.6</b>  | <b>213.7</b> | <b>309.7</b> | 165.5        | 291.3          | 172.7  |
|                    | 1994 | <b>348.8</b>  | <b>196.6</b> | <b>292.7</b> | 172.7        | 282.9          | 173.2  |
|                    | 1995 | <b>289.8</b>  | <b>199.9</b> | <b>306.6</b> | 166.9        | 274.6          | 173.7  |
|                    | 1996 | <b>315.0</b>  | <b>208.0</b> | 260.4        | 169.3        | 271.7          | 173.8  |
|                    | 1997 | 248.1         | <b>198.5</b> | <b>272.3</b> | 165.6        | 269.1          | 168.7  |
|                    | 1998 | 252.0         | <b>176.7</b> | 241.8        | <b>178.2</b> | 258.4          | 167.7  |
|                    | 1999 | 223.9         | 165.1        | 252.5        | 161.7        | 268.9          | 168.6  |
|                    | 2000 | <b>266.5</b>  | 162.8        | <b>284.5</b> | 161.8        | 253.6          | 167.0  |

<sup>6</sup> Rates are per 100,000 and age-adjusted to the 2000 US standard. Rates not calculated if death number is 5 or less.

## CRITERIA POLLUTANTS

The EPA has set health-based standards for criteria air pollutants, called the National Ambient Air Quality Standards (NAAQS). While there has been significant air quality improvements since the creation of the Clean Air Act, there are still many areas in the country and in Texas where levels of air pollution are above the national standards. Furthermore, as science and technology improve, we are learning that levels of air pollutants once thought to be safe can actually lead to health problems. The sections below describe the six criteria air pollutants in more detail.

### **Carbon Monoxide**

Carbon Monoxide (CO) is a colorless and odorless gas formed when carbon in fuel is not burned properly. Carbon monoxide is poisonous even to healthy people at high levels in the air. People who breathe high levels of carbon monoxide can develop vision problems, reduced ability to work or learn, reduced manual dexterity, and difficulty performing complex tasks. At extremely high levels, CO can cause death. Carbon monoxide affects the central nervous system and can cause harmful effects by reducing oxygen delivered to the body's organs, like the heart and brain, and tissues. Carbon monoxide also contributes to the formation of ozone, smog, which can trigger serious respiratory problems.

In 2002, 998,000 pounds of carbon monoxide were released in Texas through routine industrial emissions.

### **Nitrogen Oxides**

Nitrogen oxides (NOx) are a group of highly reactive gases. Many forms of these gases are colorless and odorless; however, nitrogen dioxide often combines with particles in the air resulting in a reddish-brown layer over urban areas. Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. Various compounds and derivatives are in the family of nitrogen oxides, such as nitrogen dioxide, nitric acid, nitrous oxide, nitrates, and nitric oxide. Nitrogen oxides are the only criteria pollutant to increase since 1970 when EPA began tracking criteria pollutants; since 1970, NOx has increased 10%. Nitrogen oxides are the main ingredient in ozone, otherwise called smog. Nitrogen oxides react with ammonia, moisture, and other compounds in the air to form nitric acid and related particles, such as nitrate particles, acid aerosols, and nitrogen dioxide. These substances affect breathing, the respiratory system, damage lung tissue and cause premature death. Small particles penetrate deeply into sensitive parts of the lungs and can worsen respiratory disease and aggravate existing heart disease.

In 2002, 1,204,000,000 pounds of nitrogen oxides were released in Texas through routine operations at industrial facilities.

### **Sulfur Dioxide**

Sulfur dioxide is prevalent in all raw materials, including crude oil. Sulfur oxide gases forms by burning fuel containing sulfur and when extracting oil from gasoline. Sulfur dioxide dissolves in water vapor to form acid, and interacts with other

In 2002, 1,610,000,000 pounds of sulfur dioxide were released into Texas air from routine operations at industrial facilities.

gases and particles in the air to form sulfates that can be harmful to people and their environment. The EPA encourages communities to learn about the types of industries in their area and work with local industrial facilities to address pollution control failures or process upsets that could result in peak levels of sulfur dioxide. Sulfur dioxide contributes to respiratory illness, especially in children and the elderly, and aggravates existing heart and lung diseases. Short-term peak levels, high levels emitted over a short period such as a day, can be particularly problematic for people with asthma, causing temporary breathing difficulty.

### **Particulate Matter**

Particulate Matter (PM) includes dust, dirt, soot, smoke, and liquid droplets found in the air. Some release directly into the air and others may form in the air from the chemical change of gases. Particulates form indirectly when gases from burning fuels react with sunlight and water vapor.

In 2002, Texas industry reported emitting 132,000,000 pounds of PM (10) through routine industrial emissions.

The EPA's PM Research Program states that there are many replications of scientific studies proving adverse health effects from particle pollution in the US and around the world. Exposure to particulate matter is associated with increased morbidity. Extended exposure to particulate matter can lead to chronic diseases and/or shortened life span. Particulate matter is associated with serious health effects, including aggravated asthma, increased respiratory symptoms like coughing and difficulty or painful breathing, chronic bronchitis, decreased lung function, and premature death. Particulate matter is associated with increased hospital admissions and emergency room visits for people with heart and lung disease. It is also associated with increases in work and school absences.

### **Ozone**

While the air contains oxygen that consists of two atoms, ozone is a gas composed of three oxygen atoms. This chemical instability may lead to the ill effects ozone can have on public health, especially making asthma worse and making the lungs work less effectively<sup>10530</sup>.

In 2002, 310,000,000 pounds of VOCs, contributors to ozone formation, were released through routine operations at industrial facilities in Texas.

A chemical reaction between nitrogen oxides and volatile organic compounds (VOCs) in the presence of heat and sunlight creates ground level ozone. Ozone forms in hot, dry, stagnant

conditions and is sometimes called the “summertime air pollutant.” Wind carries ozone and the pollutants that form it hundreds of miles away from their original sources.

Ozone triggers a variety of health problems even at very low levels. Low levels can aggravate asthma, reduce lung capacity, and increase susceptibility to respiratory illnesses like pneumonia and bronchitis. Ozone irritates lung airways and causes inflammation, wheezing, coughing, and breathing difficulties. Repeat exposure to ozone pollution for several months may cause permanent lung damage.

Researchers at the Yale School of Forestry and Environmental Studies published a study in *The Journal of the American Medical Association* in November of 2004 that found increases in air pollution directly linked to higher death rates in cities. Reducing such ozone pollution by 35% on a given day could save 4,000 lives a year. The study found a statistically significant association between short-term changes in ozone and mortality on average for 95 large US urban communities, which include 40% of the total US population<sup>106</sup>.

Industrial emissions are major sources of nitrogen oxides, volatile organic compounds (VOCs), and highly reactive volatile organic compounds (HRVOCs) that lead to ozone formation. Transient high ozone events are rapid increases in ozone concentration, followed either immediately or after a few hours by rapid decreases in ozone concentration. These events are characteristic of the Houston area and studied extensively in the last five years. Industrial point sources co-emit high concentrations of reactive hydrocarbons (especially ethylene, propylene, and butadiene) with nitrogen oxides (NO<sub>x</sub>). The resulting industrial plumes containing both hydrocarbons and NO<sub>x</sub> have very high ozone productivities. A report titled *Accelerated Science Evaluation of Ozone Formation in the Houston-Galveston Area* found that high concentrations of hydrocarbons in industrial plumes originating from the Houston Ship Channel attributed to the highly efficient ozone production in those plumes, and such plumes were primary sources of the transient high ozone events observed at ground monitors. These high hydrocarbon concentrations in the plumes may be due to routine emissions that current emission inventories are not accounting for or upset events.<sup>107</sup>

A follow up study conducted by the Center for Energy and Environmental Resources at the University of Texas at Austin found that upset events emitting HRVOCs and possibly VOC emission events have the potential to contribute significantly to ozone formation in the Houston-Galveston area (HGA). The study used time series analyses to compare average annual flow rates for air pollutant emissions with those released during reported emission events. The results indicate that the magnitude and frequency of

HRVOC event emissions are an important element in accurately reflecting HRVOC emission patterns in HGA, particularly in Harris, Brazoria, Galveston, and Chambers counties<sup>108</sup>.

The chart below identifies the highly reactive volatile organic compounds, volatile organic compounds, and nitrogen oxides that the upset events analyzed in this report released.

### Chemicals Released in the Upset examples that Contribute to Ozone Formation

| CHEMICAL          | Highly Reactive Volatile Organic Compounds (HRVOCs) | Volatile Organic Compounds (VOCs) | Nitrogen Oxides |
|-------------------|---|-----------------------------------|-----------------|
| 1,2-Butadiene     |   | √                                 |                 |
| 1,3-Butadiene     | √   |                                   |                 |
| 1-Butene          | √   |                                   |                 |
| Butadiene         | √   |                                   |                 |
| Butane (N-)       | √   |                                   |                 |
| Butene            | √   |                                   |                 |
| Butylene          | √   |                                   |                 |
| Cis-2-butene      | √   |                                   |                 |
| Ethylene          | √   |                                   |                 |
| Hexane            |   | √                                 |                 |
| Isobutene         | √   |                                   |                 |
| Isobutylene       | √   |                                   |                 |
| Isopentane        |   | √                                 |                 |
| Nitrogen dioxide  |   |                                   | √               |
| Nitrogen monoxide |   |                                   | √               |
| Nitrogen oxide    |   |                                   | √               |
| Propadiene        |   | √                                 |                 |
| Propylene         | √   |                                   |                 |
| Trans-2-butene    | √   |                                   |                 |
| VOCs              |   | √                                 |                 |

## The Cost of Nonattainment with National Ambient Air Quality Standards

Ground level ozone increases medical expenses and losses in productivity and efficiency throughout the economy. The EPA also imposes mandated penalties for areas that do not comply with ozone standards. These sanctions include limiting new facility development by requiring corresponding reductions in emissions from other sources at greater than a one-to-one ratio and withholding federal highway funds from affected areas. Texas has five ozone non-attainment areas: El Paso, Houston/Galveston/Brazoria, Beaumont/Port Arthur, San Antonio, and Dallas/Fort Worth, and five near non-attainment areas: Corpus Christi, Victoria, Austin-San Marcos, Tyler, and Longview-Marshall. These regions represent more than 70% of the state's population, 76.4% of aggregate employment, 83.4% of personal income, 83% of gross state product, and nearly 85% of the manufacturing activity in Texas. What occurs in these regions affects all parts of the state due to the integrated nature of the Texas economy<sup>109</sup>.

In 2002, The Perryman Group released an economic and fiscal impact assessment of non-compliance with our State Implementation Plan (SIP). The chart below demonstrates the costs related to health effects of non-attainment. The analysis estimates the annual aggregate losses to Texas in terms of medical expenses, lost time and productivity, and other health-related factors.

### The Annual Impacts of Health-Related Costs and Related Losses Associated with Non-Compliance of the Clean Air Act Amendments on Business Activity in Texas<sup>7</sup>

| Low Case Scenario <sup>8</sup>                 | High Case Scenario <sup>9</sup>                |
|--|--|
| <b>\$6.3 billion</b> in Total Expenditures     | <b>\$13.7 billion</b> in Total Expenditures    |
| <b>\$3.2 billion</b> in Gross Product          | <b>\$7.0 billion</b> in Gross Product          |
| <b>\$2.2 billion</b> in Personal Income        | <b>\$4.8 billion</b> in Personal Income        |
| <b>56,356</b> Permanent Jobs                   | <b>123,763</b> Permanent Jobs                  |
| <b>\$157.4 million</b> in State Fiscal Revenue | <b>\$345.7 million</b> in State Fiscal Revenue |

<sup>7</sup> It is important to remember these are annual estimates and persist over an extended period of time.

<sup>8</sup> The Low Case is the lower bound estimate derived from the Environmental Protection Agency analysis

<sup>9</sup> The High Case is the upper bound estimate derived from the Environmental Protection Agency analysis

Researchers from the EPA and Abt Associates, a governmental research and consulting firm, calculated the health-related and financial benefits of attaining the 8-hr national ozone standard considering the ozone monitors that failed to meet the current ozone standard of 80 parts per billion for the fourth highest maximum 8-hr ozone concentration. During the years of 2000-2002, between 36 and 56% of the nation's ozone monitors failed to comply. It is interesting that the estimated benefits for 2000 and 2001 are similar in magnitude, while the results for 2002 are roughly twice that of the two previous years. The average of health impacts across the 3 years includes annual reductions of 800 premature deaths, 4,500 hospital and emergency department admissions, 900,000 school absences, and more than 1,000,000 minor restricted activity days. The simple average of benefits across the 3 years is \$5.7 billion<sup>10</sup>.

As previously mentioned in the section on particulate matter, particle pollution causes a broad range of public health problems. Not only does exposure worsen asthma and cause wheezing, coughing and respiratory irritation in anyone with sensitive airways, but it also triggers heart attacks, cardiac arrhythmias and premature death<sup>11</sup>. In 1999, Sonoma Technology, Inc. conducted a study determining the health costs of various pollutants in the Houston area<sup>12</sup>. The study found that exposure to fine particle pollution can lead to the premature death of as many as 435 persons per a year in the region<sup>10</sup>. By reducing premature deaths, the study estimates the region would save \$2.5 billion a year. Factoring in other related costs, the study states through regional compliance with the clean air standards for ozone and particulates, the city could save approximately \$2.9 to \$3.1 billion per year<sup>11</sup>.

## ASTHMA

Exposure to criteria air pollutants at certain levels can exacerbate asthma in children and adults, as well as lead to other adverse respiratory effects such as respiratory tract illness and decreased lung function<sup>30</sup>. Asthma is a chronic condition that arises when the main air passages of the lungs become inflamed and narrowed making breathing difficult<sup>13</sup>. Asthma is a serious health problem in the US and Texas. It is one of the most common and costly diseases and has a substantial impact on health, quality of life and the economy.

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<sup>10</sup> Mortality numbers are very conservative because they do not include children or adults under the age of 30.

<sup>11</sup> Illness costs are conservative because they do not include the costs of cancer and other major illnesses are not assessed and, with one exception (chest pain among asthmatic children), costs of illness among children are not included.

Estimations of the annual cost of asthma in the US are nearly \$18 billion. Direct costs account for nearly \$10 billion, with hospitalizations as the single largest portion of direct costs, and indirect costs of \$5 billion, such as lost earnings due to illness or death<sup>114</sup>. Below are more facts about asthma in the US and in Texas from the American Lung Association and from the Asthma and Allergy Foundation of America.

### **National Impact**

- 20 million Americans have asthma
- Asthma is the 3<sup>rd</sup> leading cause of preventable hospitalizations

### **Annually Asthma Causes:**

- 5,000 deaths
- 15 million missed school days
- 14.5 million missed work days
- 2 million Emergency Room visits
- 500,000 hospitalizations
- More than 10 million outpatient visits

### **National Asthma Costs: Direct & Indirect**

- \$18 billion

### **Texas Figures**

- 1.1 million Texans have asthma
- In 2002, asthma accounted for 25,500 hospitalizations
- Asthma is a one of the top ten reasons for hospitalization in children 1-17 yrs.
- In 1998, total costs of asthma were \$763 million, including \$435 million direct medical expenses and \$328 million indirect costs
- In 1999, Texas Medicaid program treated more than 123,000 asthma patients costing the state \$41.6 million

The Texas Department of State Health Services defines preventable hospitalizations as “the inpatient treatment of conditions for which timely and effective use of primary care should reduce the risk of hospitalization.” In 2001, diseases of the respiratory system were the fourth most common reason, by body system, for hospitalizations in Texas. Measures of chronic respiratory conditions included chronic obstructive pulmonary disease and adult asthma. Chronic obstructive pulmonary disease was one of the 10 most frequent causes of hospitalization through the emergency room. The three charts below show the hospital admissions for the state of Texas, Nueces County, and Jefferson County in 2002 for adult asthma, pediatric asthma, and chronic obstructive pulmonary disease<sup>113</sup>.

### Hospital Admissions in Nueces and Jefferson Counties compared to the State of Texas<sup>12</sup>

| Adult Asthma     | Hospital Admissions | Population | Observed Admissions per 100,000 Population | Risk-Adjusted Admissions per 100,000 Population |
|------------------|---------------------|------------|--|---|
| State of Texas   | 13,824              | 15,678,989 | 88.2                                       | 95.2  |
| Nueces County    | 244                 | 226,363    | <b>107.8</b>                               | <b>112.3<sup>13</sup></b>                       |
| Jefferson County | 182                 | 185,485    | <b>98.1</b>                                | <b>101.9</b>                                    |

| Pediatric Asthma | Hospital Admissions | Population | Observed Admissions per 100,000 Population | Risk-Adjusted Admissions per 100,000 Population |
|------------------|---------------------|------------|--|---|
| State of Texas   | 11,775              | 6,100,904  | 193  | 170.4   |
| Nueces County    | 293                 | 88,333     | <b>331.7</b>                               | <b>295.6<sup>13</sup></b>                       |
| Jefferson County | 94                  | 63,405     | 148.3                                      | 136.5   |

| Chronic Obstructive Pulmonary Disease | Hospital Admissions | Population | Observed Admissions per 100,000 Population | Risk-Adjusted Admissions per 100,000 Population |
|---------------------------------------|---------------------|------------|--|---|
| State of Texas                        | 33,771              | 15,678,989 | 215.4                                      | 259   |
| Nueces County                         | 526                 | 226,363    | <b>232.4</b>                               | 248.5   |
| Jefferson County                      | 730                 | 185,485    | <b>393.6</b>                               | <b>389.8<sup>13</sup></b>                       |

Asthma costs individuals as well as the state. According to a report by the Texas State Comptroller released in 2001, asthma patients in 1998 could generate hospital bills up to \$46,000 per visit and more than \$100,000 in annual asthma-related spending per patient. In 1999, the Texas Medicaid program treated more than 123,000 asthma patients at a cost of \$41.6 million<sup>15</sup>. The Seton Medical Health Plan states a doctor visit for a mild asthma attack costs the plan \$150 while an emergency room visit for a full-blown asthma attack can cost the plan \$10,000<sup>16</sup>.

Asthmatics that do not have health insurance have a serious financial burden. Not only can doctor appointments, hospitalizations, and emergency room visits cost in the thousands of dollars, but the daily medication needed for asthma is very expensive. Medication taken on a regular basis to control asthma attacks ranges from \$66 to \$443. Depending on the severity and frequency of attacks, a person with

<sup>12</sup> Observed and risk-adjusted hospital admissions per 100,000 people that are higher than the state are bolded.

<sup>13</sup> Risk adjusted admission rate is significantly higher (based on 99% confidence interval) than Texas average.

asthma may need several types of these medications. Medicine that asthmatics take as needed range in costs from \$11 to \$898<sup>117</sup>.

The chart below illustrates the direct and indirect costs of asthma for the state of Texas, and Nueces and Jefferson Counties. The data is in 1998 figures and the source is the Asthma and Allergy Foundation of America.

### **Annual Asthma-Related Costs for the Texas, Nueces County, and Jefferson County<sup>118</sup>**

|                         | <b>Estimated Prevalence (per 1,000 population)</b> | <b>Persons with Asthma</b> | <b>Direct Medical Expenditures (\$1,000)</b> | <b>Indirect Costs (\$1,000)</b> | <b>Total Costs (\$1,000)</b> |
|-------------------------|--|----------------------------|--|---------------------------------|------------------------------|
| <b>Texas</b>            | 5.52   | 1,015,100                  | 434,915                                      | 328,065                         | <b>762,979</b>               |
| <b>Nueces County</b>    | 5.54   | 17,200                     | 7,362  | 5,535                           | <b>12,896</b>                |
| <b>Jefferson County</b> | 7.14   | 6,800                      | 2,647  | 1,643                           | <b>4,290</b>                 |

As this section and previous sections of this report demonstrated, the cost of pollution is high. Not only must the state of Texas risk federal funding consequences if it does not reach attainment with the federal air quality standards for ozone, but there are significant financial implications associated with the health effects of pollution. Reducing air pollution from industrial sources will lead to a better quality of life for Texans and save individuals and governments in the state billions of dollars by reducing the medical expenses associated with the adverse health effects, such as asthma and cancer, and by reducing lost productivity through missed work and school days.

### **Is the State Protecting Industry or Citizens?**

If you are an industry, Texas is a good place to operate. To put it bluntly, Texas is good for business because business is a top priority for Texas leaders. The interests of industry often come before the health of Texas citizens and the quality of natural resources in state politics. However, this trend cannot last forever; it dramatically inhibits Texas's ability to be sustainable, economically and environmentally. From a business perspective, without a healthy workforce, adequate quality of life, and natural resources, Texas will not be able to attract industries in the future or keep the ones that are currently located in the state.

On average, the state government spends only 0.6% of its budget on environmental programs, and this year the amount appropriated to the Texas Commission on Environmental Quality (TCEQ) is under 0.4%. This appropriation amount is less than one-third the average among the fifty states in the country<sup>119</sup>. As the responsibilities of the TCEQ intensify from year to year with the increasing number of regulated entities, the state government continues to cut the agency's budget, and the violations TCEQ issues to the entities it regulates continue to decrease. In 2000, TCEQ issued 12,918 Notices of Violation and in 2004, the agency issued 9,891; this is a 24% decrease<sup>120</sup>.

With approximately two-thousand major industrial sources of air pollution in the state of Texas, TCEQ has only 129 air inspectors. Region 14, the region including Corpus Christi, has thirteen inspectors for air and Region 10, the Beaumont/Port Arthur area, has twenty air quality inspectors<sup>121</sup>. EPA delegates the responsibility of inspecting major industrial facilities to the state. The director of TCEQ's Region 14, Buddy Stanley, told the *Fort Worth Star-Telegram* in 2004 when referring to full-scale inspections that if his office feels an industrial facility has a really good program, they skip them a year. The article stated that the Valero Refinery in Corpus Christi had not had a full-scale investigation in three years and one month and the Flint Hills Resources Refinery in four years and two months<sup>122</sup>. Considering the amount of pollution these industrial facilities emit, and the massive number of unauthorized emission events, the lack of full-scale investigations by the state's regulating authority is extremely disturbing.

In 2004, industry reported 7,533 upset events to TCEQ; this is slightly up from the 7,520 reported in 2003. Sixty-five of the 7,533 reported in 2004 resulted in a potential financial consequence by receiving a Notice of Enforcement (NOE). That number is up from only thirty in 2003<sup>14</sup>. This means that if a facility has an upset event, the likelihood a penalty will result is less than one percent, and in 2003, it was less than half of one percent. An NOE is a notice that the agency is pursuing an enforcement action. It is common for the agency to include numerous violations in a final enforcement action, called an agreed order. However, this is misleading to the public because it appears as if the agency is initiating a huge penalty against a facility when really it is for numerous violations spanning multiple years.

Factoring in the economic benefit a facility gains for violating the law makes this statistic even more astounding. The State Auditor investigated the TCEQ's enforcement practices in 2003 and found that on average, a violator is only penalized 19% of the economic benefit gained through non-compliance. For example, if a facility saves \$150,000 by burning poor-quality product in the flares and causing an upset event rather than disposing of it properly, in the less than one percent chance the upset results in a

penalty, TCEQ may only fine the facility \$28,500<sup>123</sup>. Common business sense in this situation tells you what decision an industrial entity will make.

In 2004, approximately 1.5% of the upset events in the state resulted in an immediate response from TCEQ. In Corpus Christi, TCEQ did not respond immediately to any upset events, but in the Beaumont/Port Arthur region, this occurred for forty-two events. Of all of the 7,533 upset events in 2004, the TCEQ only determined ten of them had excessive emissions. This determination is up to the discretion of the TCEQ's executive director, and is the only situation where the agency automatically requires the facility to implement a Corrective Action Plan (CAP). TCEQ approved nine CAPs in 2004<sup>14</sup>. According to the compliance history reports for the facilities investigated in this study, the agency does not categorize any of these facilities as having chronic excessive emissions events.

Only one of the upset events Public Citizen investigated in this report resulted in any form of enforcement action<sup>14</sup>. On a recent agreed order between TCEQ and BASF FINA, finalized in March of 2005, TCEQ made seventeen allegations against BASF FINA. Each allegation included multiple violations spanning from 2001 to 2004. For example, allegation number four states that the facility failed to report emission events occurring on December 26, 2001, February 5-6, 2002, April 8-May 11, 2002, October 8, 2002, February 8, 2003, and September 13, 2003. This same allegation asserts BASF FINA failed to determine if the emission events on September 13, 2002, February 21, 2004, and July 30, 2004, were reportable and failed to submit notifications to the regional office within twenty-four hours after discovery<sup>124</sup>. We can only assume the July 30, 2004 emission event listed is the one that we identified as releasing 152,215 pounds of air contaminants into the air. However, it is difficult to believe BASF FINA would not be able to determine that such a large upset event was reportable.

As part of this agreed order, BASF FINA was able to offset half of the \$1,944,600 penalty by contributing the amount to Supplemental Environmental Projects (SEPs). SEPs are projects intended to improve the quality of the environment where violations occur. However, it is ironic that often these projects do not directly benefit the communities damaged by the corresponding violations, and the facilities contributing

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<sup>14</sup> Public Citizen cannot assert this claim with certainty because of the state of the TCEQ's central file records when we conducted our investigation. Furthermore, after we were not able to find the applicable files searching through the central records, we requested a listing of all of the violations associated with each of the facilities in this report from the Information Resources Division. TCEQ's website states they provide such a service for a fee. However, an Information Resources employee told us that TCEQ does not have the resources to support such information requests anymore. As a result, we searched agreed orders to see if any of the upset events in our study resulted in violations included in the agreed orders. One of the State Auditor's findings in the December 2003 report was "poor file management limits the availability of information for public participation." Public Citizen can attest to this finding as being true.

to the SEPs use them to their advantage by calling attention to the money they are contributing to the local region. Part of the BASF FINA SEP is to give \$97,230 to the Southeast Texas Regional Air Monitoring Network. TOTAL Petrochemicals had a similar SEP in May 2004 when the facility offset \$58,750 of an air violation penalty by contributing that amount to the local monitoring network. The title of the SEP was Environmental Enhancement. Public Citizen agrees that the monitoring network needs funding; yet, the purpose of these SEP funds are only to maintain the already existing monitoring network. It is absurd that TOTAL and BASF FINA will contribute a combined \$155,980 to the monitoring network and still avoid having a monitor next to their adjacent complexes to measure for ozone, air toxics, or even any ambient measurements of criteria air pollutants. Environmental Enhancement is a misleading title for this SEP.

It is debatable if TCEQ acts in the best interests of the public; Public Citizen will argue it does not. Taking into account that none of the upset events in this report qualified as excessive events or as violations, except for possibly one that was a reporting violation and not a violation for illegally polluting. In addition, all of the facilities we analyzed have good compliance records according to TCEQ. We do not feel the agency is adequately protecting the citizens or the environment in Texas. TCEQ treats industry as if they are the customer and the customer is always right.

## CONCLUSION

This study shows a stunning failure of our state environmental regulatory agency, which has an obligation to the citizens of Texas to protect them from harmful air contaminants. The report gives examples of avoidable upset events that release tons of hazardous air pollutants into the air Texans breathe. Many of the upset events identified were the result of human errors, power failures, and malfunctions. All of which the TCEQ has the authority to pursue enforcement actions against or require injunctive relief.

TCEQ does not follow the laws that give them authority to take enforcement actions against companies that illegally pollute. TCEQ allows companies to break the law and both TCEQ and the companies know it. TCEQ does not issue penalties to deter violators; they allow companies to profit from harming the health of the community. Penalties are minimal and the agency allows violators to deduct the cost of compliance from the penalty amount and benefit economically from polluting. TCEQ does not have an adequate monitoring system; they let the facilities that release the most air toxics and highly reactive volatile organic compounds get away without having nearby monitors that measure for such

contaminants. Thus, it is even harder for TCEQ to take enforcement actions because the proof of air quality exceedances is not available.

The SEPs that are part of enforcement actions often do not benefit the affected communities. When 32 citizens complained of a huge upset event, causing them to have respiratory problems and soot to fall on their cars, TCEQ investigators would not even issue a nuisance violation. By not enforcing the law, TCEQ is not ensuring facilities operate using best management practices. Industrial entities are using inefficient technologies and do not have sufficient back up systems installed. Citizens cannot rely on the TCEQ to protect their health or the quality of their environment.

When a poll shows 74% of Texans believe that laws protecting the environment are not strong enough or are not enforced strictly enough, yet the legislators' voting records do not reflect these opinions, something is wrong. Large industry plays a big role in campaigns and there is no cap on contributions by businesses or PACs in Texas<sup>119</sup>. It is evident the majority of state legislators and the governor favor industry over the health of Texans, and it is clear the people in power at TCEQ do as well. Industry in Texas has a lot of political power. Unfortunately, for Texas citizens this means our State Legislature is not holding TCEQ accountable to their job of protecting the environment and public health, and as a result, TCEQ is not holding polluters accountable for illegally poisoning the air in the state.

## RECOMMENDATIONS

**1. All routine or predictable emissions should be subject to all permitting requirements.** When sources go through permitting, they must estimate their total emissions, must show that they are reducing those emissions through use of the best technologies, must evaluate the effects of the emissions on ambient air standards and on local health. All routine or predictable emissions—including emissions from scheduled startup, shutdown, and maintenance—should be subject to all permitting requirements. This will provide a public notice process for ensuring that these emissions are minimized and that the impacts of such emissions are fully considered.

**2. No routine or predictable emissions should qualify for an exemption or defense to penalties.** While TCEQ is always free to exercise its enforcement discretion, any affirmation defense to penalties for excess emissions should be extremely narrow. Excess emissions, whatever their cause, affect the surrounding community, and overall air quality. There are clear costs to such emissions in terms of

community health and safety. To the extent that emissions are routine or predictable and could be considered at permitting, they should not be subject to an affirmative defense.

**3. TCEQ should increase monitoring at the fence lines of facilities, especially for air toxics, and require additional monitoring for facilities reporting continual excess emissions.** TCEQ found in its own study that facilities are under-reporting actual emissions, so regulators cannot assume that the only upset events are those industry reports. Furthermore, there is extensive evidence that suggests emissions from flares are underestimated. While facilities generally assume 98-99% efficiency from flares, studies show that this approach makes no allowance for real world operating variables. Thus, flares are releasing more harmful emissions than estimated by industry. Monitors need to record the actual emissions.

**4. All excess emissions should be promptly reported.** Communities have a right to know what is in the air they are breathing. Communities also know an upset has occurred because they can see it, hear, or smell it. They need quick access to information about the pollutants emitted during the upset so that they can decide how to respond. The online emissions database is an excellent tool. TCEQ should eliminate any exemptions from reporting requirements in the rules (such as those for non-opacity emissions from certain boilers and turbines) and should ensure that all excess emissions are being incorporated into the online system promptly.

**5. TCEQ should fine companies that illegally pollute and ensure penalties are substantial enough that violators are not profiting from polluting.** Penalties must act as a deterrent to future violations and thus, take into account the economic benefit gained from violating the law.

**6. TCEQ should levy mandatory fines so enforcement penalties are easily calculated and collected.** If emissions from upset events exceed a certain threshold, penalties and enforcement action should be automatic.

**7. Require Supplemental Environmental Projects (SEPs) to benefit directly the communities affected by the associated violations.** Furthermore, require that SEPs contributing to air monitoring networks enhance the network by increasing the parameters measured by the air monitors. If a regulated entity contributes monetarily to a monitoring network because they violated the law, the funds should go towards a monitor at the boundary of the entity's facility if one does not currently exist and enhancing the parameters that monitor measures if one does exist.

**8. TCEQ should require facilities to do preventative maintenance and better training of their employees.**

The state must conduct detailed inspections at these industrial facilities annually. State inspectors should also conduct drive by inspections at night when facilities are most likely to have upset conditions.

**9. TCEQ must force companies that have regular, repeat upsets to install equipment to prevent such events from reoccurring.**

This includes requiring facilities to have back-up power systems. If an accident happens once, TCEQ should require the facility to identify the cause, propose, and implement a strategy to prevent it from happening again. If it happens twice, the TCEQ should require installation of new equipment to prevent excess emissions from another repeat of the same event.

**10. The state should allow cities and counties the right to sue the TCEQ and polluting companies if laws are not properly enforced.**

The agency rules need clarification that affirmative defense provisions do not affect citizen or EPA enforcement. Any affirmative defense is an exercise of TCEQ's enforcement discretion and cannot affect the ability of citizens or EPA to bring their own enforcement actions as provided by the Clean Air Act.

**11. Make health effects screening levels (ESLs) enforceable standards so TCEQ will take enforcement action against a facility emitting air contaminants at levels that harm the health of the public.**

Regardless of the cause of excess emissions, they may affect ambient air quality and the health of local residents.

**12. Require the modeling for State Implementation Plans (SIPs) include air contaminants from emission events and start-up, shutdown, and maintenance activities.**

The emissions from these events can lead to quick ozone formation and therefore modeling must consider them. The current TCEQ database records all upset emissions and the times of the events. TCEQ air modelers should have access to create database queries of hourly emissions that include those highly reactive volatile organic compounds and volatile organic compounds emitted during upset events.

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