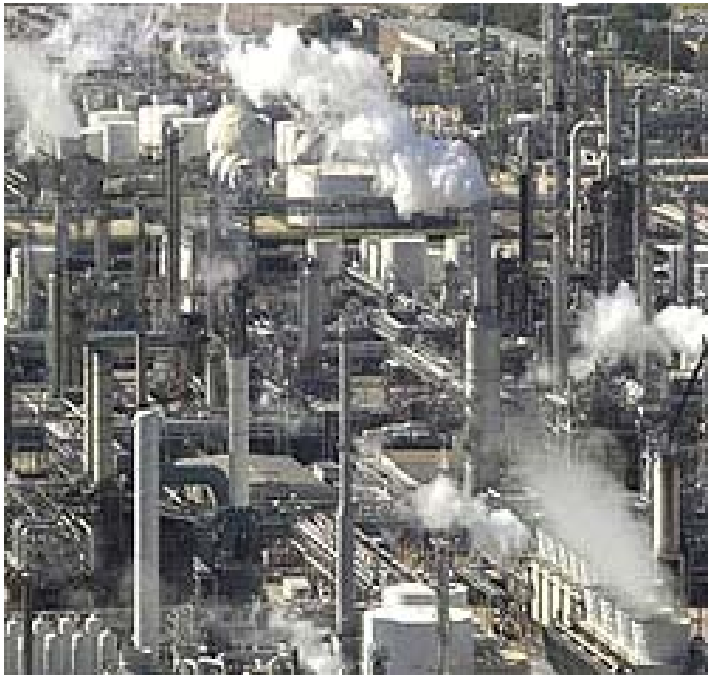
Air Toxics:
What you don't know CAN hurt you

What are Air Toxics?

Air Toxics are the 188 Hazardous air pollutants (HAPs) identified by the Clean Air Act known or suspected to cause cancer or other serious health effects

Why Care about Air Toxics?

- Carcinogens
- Developmental Toxicants
- Reproductive Toxicants
- Cardiovascular or Blood Toxicants
- Endocrine Toxicants
- Gastrointestinal or Liver Toxicants
- Immunotoxicants
- Kidney Toxicants
- Musculoskeletal Toxicants
- Neurotoxicants
- Respiratory Toxicants
- Skin or Sense Organ Toxicants



How Does Brazoria Co. Rank?
U.S. Rankings, Chemical Releases

Health Effects	U.S. Rank Brazoria County	Total 2004 Air & Water Emissions (pounds)	U.S. Zip Code Rank 77541 Freeport-Jones Creek-Clute	Total 2004 Air & Water Emissions (pounds)	U.S. Rank Texas	Total 2004 Air & Water Emissions (pounds)
Carcinogens	#4	928,811	#15	469,177	#1	10,619,097
Developmental Toxicants	#29	574,340			#2	9,306,377
Reproductive Toxicants	#11	489,610	#28	137,882	#2	4,856,026
Neurotoxicants	#22	4,179,426	#44	2,505,716	#1	76,217,308
Respiratory Toxicants (Air only)	#74	4,449,368			#4	89,551,196

Amounts: U.S. EPA Toxic Release Inventory, 2004. Analysis: “Toxic Pollution and Health,” U.S. PIRG, March 2007.

#1 for Releases of Dioxins

	Top County Brazoria	Top Facility Dow Chemical Co Freeport Facility	Top Zip Code 77541 Freeport-Jones Creek-Clute	Top State Texas
U.S. Rank	#1	#1	#1	#1
Total 2004 Air & Water Emissions	525.87 grams	525.00 grams	525.37 grams	839.24 grams

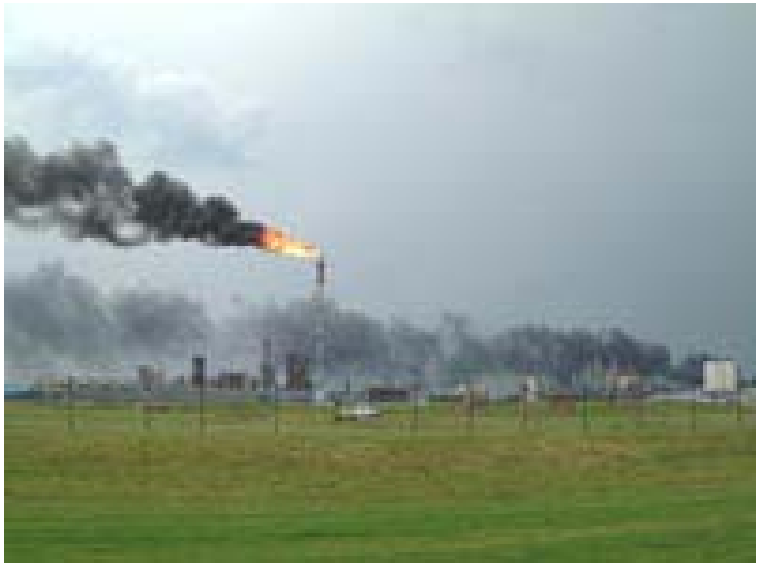
Long regarded as among the most toxic chemicals known to science, dioxins can alter the growth and development of cells and lead to adverse effects on reproduction and development, suppression of the immune system, and cancer.

What are the Sources of Air Toxics? Top 5 Facilities

Facility	Fugitive Air Emissions	Point Source Air Emissions	Total Air Emissions
DOW CHEMICAL CO FREEPORT FACILITY	264,920	218,392	**483,312**
CONOCOPHILLIPS CO SWEENY REFINERY COMPLEX	252,624	156,558	**409,182**
LYONDELL CHEMICAL CO CHOCOLATE BAYOU CHEMICALS PLANT	107,785	84,778	**192,563**
INEOS USA LLC CHOCOLATE BAYOU PLANT	72,490	78,328	**150,818**
CHEVRON PHILLIPS CHEMICAL CO LP SWEENY COMPLEX	73,370	29,581	**102,951**

Source: US EPA 2005 Toxic Release Inventory

What are the Sources of Air Toxics? Upset Events



BP in Texas City on Christmas Day

- Allegedly unpreventable emission events at industrial facilities
- Cause plants to emit more pollution than allowed by their permits
- Can equal 50 times the emissions from annual routine operations
- Not included in permit reviews and evaluated for health impacts
- Avoid federal requirements such as installment of pollution controls

More Reasons to be upset about Upsets…

- Thousands of upsets a year release thousands of tons of additional pollution
- Duration varies from minutes to weeks
- Release various quantities and concentrations of air toxics
- Persistent, intermittent concentrations of toxics give rise to both acute & chronic health effects
- Cumulative exposures over time increase risk of harmful effects

Examples of upset events at Valero-East Refinery in Corpus Christi

Air Contaminants Emitted (quantities in pounds)	*Upset emissions caused by the Elliot Compressor shutting down*[36]		*Upset emissions caused by the Vacuum Jet Compressor shutting down*[37]
	4/02/04 5:36am - 4/02/04 11:11am	**5/07/04 4:24am- 5/07/04 11:48am**	**5/05/04 9:36pm - 5/06/04 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
Totals (lbs.)	**50,677**	**32,596.58**	**13,069.83**
Totals (tons)	**25.34**	**16.3**	**6.54**

Hexane is a ***hazardous air pollutant***. 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.

Sulfur dioxide is an ***extreme respiratory irritant*** and can cause asthma exacerbations. These three events released **85,641 pounds** of sulfur dioxide.

Examples of upset events at TOTAL Petrochemcials (Atofina) in Port Arthur

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.

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

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.

Top 10 Air Toxics Released in Brazoria County

Air Toxic	Fugitive Air Releases	Point Source Air Releases	Total Air Releases
Benzene	132,949	114,738	**247,687**
N-Hexane	169,091	68,162	**237,253**
1,3-Butadiene	83,496	104,643	**188,139**
Toluene	78,235	41,647	**119,882**
Chlorine	28,530	87,599	**116,129**
Styrene	41,714	23,937	**65,651**
Xylene (mixed isomers)	36,777	23,953	**60,730**
Hydrochloric Acid (after 1995 "Acid Aerosols" only)	36,727	18,068	**54,795**
Ethylbenzene	27,885	20,509	**48,394**
Cumene	2,820	18,729	**21,549**

Source: US EPA 2005 Toxic Release Inventory

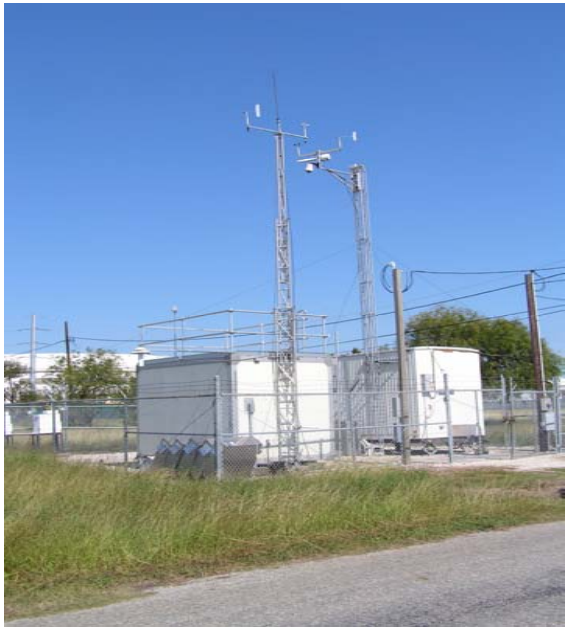
Health Effects Associated with Top 10 Air Toxics

Air Contaminants	Carcinogens	Cardiovascular or Blood Toxicants	Developmental Toxicants	Endocrine Toxicants	Gastrointestinal or Liver Toxicants	Immunotoxicity	Kidney Toxicants	Musculoskeletal Toxicants	Neurotoxicants	Reproductive Toxicants	Respiratory Toxicants	Skin or Sense Organ Toxicants
Benzene	√	√	√	√	√				√	√	√	√
N-Hexane			√						√	√	√	
1,3-Butadiene	√	√	√		√				√	√	√	√
Toluene		√	√		√	√	√		√	√	√	√
Chlorine		√			√		√		√		√	√
Styrene	√	√	√	√	√	√	√		√	√	√	√
Xylene (mixed isomers)		√	√		√	√	√		√	√	√	√
Hydrochloric Acid (1995 and after "Acid Aerosols" only)					√	√		√			√	√
Ethylbenzene	√	√	√	√	√		√		√	√	√	√
Cumene					√				√			√

What are the consequences?
Children at Risk

In 2002, more than 207,000 children went to schools within a two-mile radius of a chemical plant or refinery in Texas.

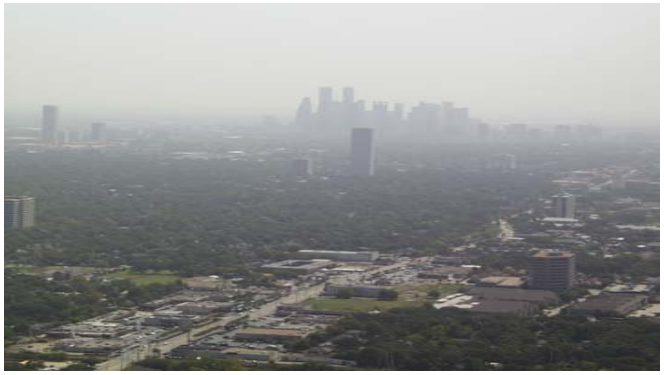
During 2002, 139 industrial facilities near Texas schools exposed children to 43.4 million pounds of toxic pollutants.



This monitor ranked first in the entire state of Texas for benzene emissions in 2002 and has continuously recorded high benzene levels since it began operating in 1997. At one point, the intersection next to this monitor was a school bus stop.

Upsets and School Attendance

- Statistical analysis of attendance rates at nearby schools following upset events shows upsets may cause children to miss school
- All of the schools had decreases in attendance rates on days following an upset and multiple schools had dramatic decreases
- In some cases, attendance was in the lowest 5% for the school year on the days following the upset event in question

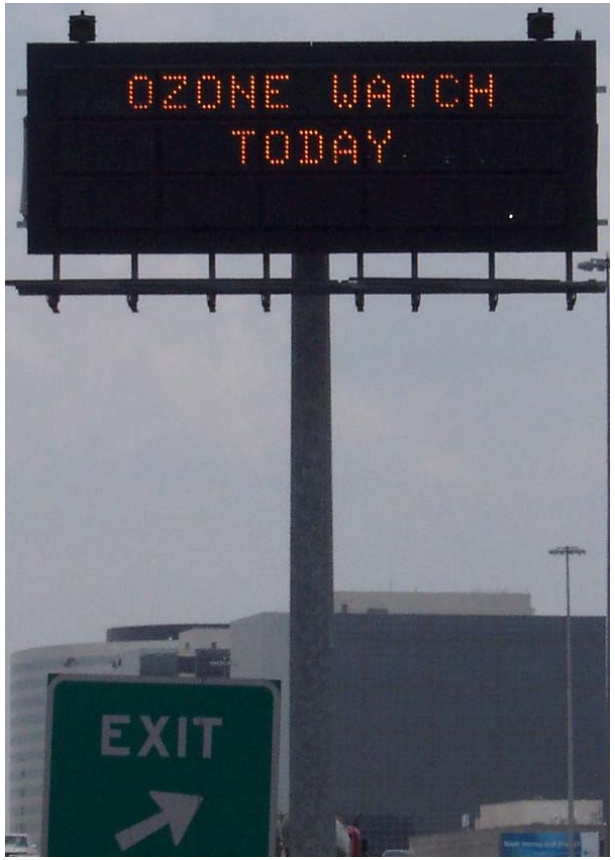


Upsets and Ozone

- Industrial emissions are major sources of nitrogen oxides, volatile organic compounds (VOCs), and highly reactive volatile organic compounds (HRVOCs) that lead to ozone formation.
- Plumes containing both high hydrocarbons (especially ethylene, propylene, and butadiene) and nitrogen oxides have very high ozone productivities.
- Studies found plumes originating from the Houston Ship Channel were the 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 currently emission inventories are not accounting for or upset events.

Chemicals from Upset Events that Contribute to Ozone

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		√	



Brazoria County, State of the Air 2006 Ozone Grade: F

Populations at Risk

- Pediatric Asthma: 6,368
- Adult Asthma: 14,114
- Chronic Bronchitis: 7,972
- Emphysema: 2,835
- Cardiovascular Disease: 59,711
- Diabetes: 12,482
- Total Population: 271,130
- Population Under 18: 75,183
- Population 65 and Over: 23,494

Health Effects: Asthma

- In 2001, diseases of the respiratory system were the fourth most common reason, by body system, for hospitalizations in Texas
- Chronic obstructive pulmonary disease was one of the ten most frequent causes of hospitalization through the emergency room

Chronic Obstructive Pulmonary Disease Brazoria County vs. Texas

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	**259.0**
Brazoria County	495	185,574	266.7	**326.2****

**Risk adjusted admission rate is significantly HIGHER (based on 99% confidence interval) than Texas average.

Source: Department of State Health Services, Center for Health Statistics, Texas Health Care Information Collection. Texas Inpatient Hospital Discharge Data, 2002.

Health Effects: Cancer

- 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
- Epidemiologic studies suggest that residents living in industrial areas may be at increased risk for certain cancers
- 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

Health Effects: Cancer

Houston Dept. of Health & Human Services
January 2007 Study

- Found a 56% increased risk of acute lymphocytic leukemia among children living within 2 miles of the Houston Ship Channel compared to children living more than 10 miles away.
- Found that children living in areas with the highest estimated levels of 1,3-butadiene had increased risks compared to children living in the areas with the lowest estimated levels of 1,3-butadiene:
  - 40% higher for developing any type of leukemia
  - 38% higher for developing acute lymphocytic leukemia
  - 153% higher for developing acute myeloid leukemia

Health Effects: Cancer Risks

- The Clean Air Act's goal is to keep the additional cancer risk in an area to one in one million
- The added cancer risk per million people from Hazardous Air Pollutants in **Brazoria County** is **520**
- Brazoria County has 12 HAPs where the added cancer risk to the population is greater than one in one million
- The added cancer risk from benzene is 28 added cases per a million people
- For 1,3-Butadiene, the added cancer risk is 8.6 per one million people
- The greatest increased cancer risk comes from diesel emissions where the added cancer risk is 410

Source: www.scorecard.org

Brazoria Co. Cancer Incidence Rates Statistically Significantly Higher than State Rates

Profile of Cancer Incidence (Top 5 Leading Types of Cancer)

1999 through 2003

Male	Cases	Rate County	Rate State
Prostate	742	174.0*	149.9
Lung	454	104.7*	93.0
Colon & Rectum	289	68.0*	59.9
Bladder	167	42.5*	29.9
Oral Cavity & Pharynx	106	20.9*	16.2
All Sites	2,735	615.9*	542.4

Female	Cases	Rate County	Rate State
Breast	709	132.6*	119.3
Lung	330	65.0*	51.1
Colon & Rectum	235	46.7	41.7
NHL	99	19.4*	15.7
Uterus	86	15.9	18.8
All Sites	2,252	428.7*	389.5

Rates are average annual rates per 100,000 population and are age-adjusted to the 2000 U.S. standard population.
An asterisk appearing next to the county rate indicates that the rate is statistically significantly different from the state rate. Significance tests were not race-adjusted, therefore significant differences could be due to a different race/ethnic distribution in the county relative to the state. NHL=Non-Hodgkin's Lymphoma.
Source: DSHS Texas Cancer Registry 1995-2003 Incidence File as of 12/23/2005.

Health Effects: Birth Defects

Texas Dept. of State Health Services July 2006 Study

- Found that birth defects were **84% higher** in Nueces County (the area of concern) when compared to the rest of the state

- Found that severe cases of birth defects were **17% higher** in Nueces County when compared to the rest of the state

Birth Defect Rates

		Texas (1,827,317 live births)		Brazoria County (20,542 live births)	
	Birth Defect	Cases	Prevalence[2] (95% CI)[3]	Cases	Prevalence (95% CI)
	Ventricular septal defect	8267	45.24 (44.27-46.22)	71	34.56 (26.99-43.60)
	Patent ductus arteriosus	8025	43.92 (42.96-44.88)	59	28.72 (21.86-37.05)
	Atrial septal defect	7580	41.48 (40.55-42.42)	53	25.80 (19.33-33.75)
*	Hypospadias or epispadias	5162	28.25 (27.48-29.02)	72	35.05 (27.42-44.14)
	Obstructive genitourinary defect	4182	22.89 (22.19-23.58)	39	18.99 (13.50-25.95)
	Pyloric stenosis	3333	18.24 (17.62-18.86)	28	13.63 (9.06-19.70)
	Trisomy 21 (Down syndrome)	2292	12.54 (12.03-13.06)	17	8.28 (4.82-13.25)
	Cleft lip with or without cleft palate	1949	10.67 (10.19-11.14)	17	8.28 (4.82-13.25)
	Microcephaly	1303	7.13 (6.74-7.52)	8	3.89 (1.68-7.67)
	Pulmonary valve atresia or stenosis	1296	7.09 (6.71-7.48)	11	5.35 (2.67-9.58)
	Hydrocephaly	1291	7.07 (6.68-7.45)	12	5.84 (3.02-10.20)
*	Cleft palate alone (without cleft lip)	1054	5.77 (5.42-6.12)	12	5.84 (3.02-10.20)
*	Renal agenesis or dysgenesis	965	5.28 (4.95-5.61)	13	6.33 (3.37-10.82)
	Stenosis/atresia of lg intestine, rectum, anus	956	5.23 (4.90-5.56)	8	3.89 (1.68-7.67)
*	Transposition of the great vessels	890	4.87 (4.55-5.19)	12	5.84 (3.02-10.20)
*	Coarctation of the aorta	839	4.59 (4.28-4.90)	13	6.33 (3.37-10.82)
*	Congenital hip dislocation	835	4.57 (4.26-4.88)	10	4.87 (2.33-8.95)
	Craniosynostosis	773	4.23 (3.93-4.53)	1	0.49 (0.01-2.71)
*	Gastroschisis	764	4.18 (3.88-4.48)	9	4.38 (2.00-8.32)
	Agenesis, aplasia, or hypoplasia of the lung	751	4.11 (3.82-4.40)	6	2.92 (1.07-6.36)

What are the consequences?
Financial Impacts

- Failure to comply with NAAQS, such as ozone
- Costs associated with cancer
- Costs from asthma and respiratory disease
- Cost of the uninsured

Financial Impacts: NAAQS

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[7]

Low Case Scenario[8]	High Case Scenario[9]
$6.3 billion in Total Expenditures	**$13.7 billion** in Total Expenditures
$3.2 billion in Gross Product	**$7.0 billion** in Gross Product
$2.2 billion in Personal Income	**$4.8 billion** in Personal Income
56,356 Permanent Jobs	**123,763** Permanent Jobs
$157.4 million in State Fiscal Revenue	**$345.7 million** in State Fiscal Revenue

Financial Impacts: Cancer

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%[103].

Financial Impacts: Asthma

National Impact

- 20 million Americans have asthma
- Asthma is the 3rd 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