

Ozone.....

- Ozone is an odorless, colorless gas and a key component of smog
- Ozone is regulated under the Federal Clean Air Act
- Ozone is associated with many health effects
 - Ozone can irritate the respiratory system
 - Ozone can reduce lung function
 - Ozone can aggravate asthma
 - Ozone can inflame and damage the lining of the lungs
- Ozone formation is influenced by the Gulf Coast meteorology
 - Wind patterns along the Gulf tend to push and pull
 - The push/pull effect allows for greater ozone cloud formation
- Ozone scientific data is currently being assessed under the 2000 Texas Air Quality Study or Tex AQS
 - High ozone concentrations related back to industrial source regions
 - The rate of ozone production in industrial areas very high
 - Ozone production in urban areas found to be slower and less efficient
- Ozone emissions are inventoried in the Houston-Galveston Area in five major categories
 - Point Source Emission Data – petrochemical industries, power plants, etc.
 - On-road Mobile Source Emission Data – cars and trucks
 - Biogenic Emission Data – trees and shrubs
 - Area and Nonroad Mobile Source Emission Data – drycleaners, construction equipment
- Ozone Emission Inventory Data for Galveston County (calendar year 2000)
 - Mobile Sources
 - Volatile Organic Compounds – 2,314.1 tons per year
 - Nitrogen Dioxide – 4,175.6 tons per year
 - Point Sources
 - Volatile Organic Compounds – 10,102.06 tons per year
 - Nitrogen Dioxide – 24,684.98 tons per year
- Ozone monitoring occurs at two (2) Continuous Air Monitoring stations located in Galveston County.
 - Galveston County has exceeded the National Air Quality standard for ozone on one occasion in Calendar Year 2003
- Ozone control strategies are identified in an enforceable document entitled the State Implementation Plan or SIP
 - SIPs protect our air
 - SIPs are required by law
 - Failure to produce SIPs has consequences

For more details concerning ozone pollution, please continue to read the attached Ozone information

Ozone.....

Ozone.....Regulatory Background

In Texas and across the Houston-Galveston area, air pollution caused by ozone has become a major concern because of the harmful effects on our health, our property and our crops. Nearly 50 percent of our state's population lives in four urban areas that currently do not meet the federal standard for ozone.

The Houston-Galveston (HG) area currently violates the National Air Quality Standard for ozone, and has been classified as a severe nonattainment area under the Federal Clean Air Act Amendments of 1990 (1990 FCAA). For areas that are designated severe, the 1990 FCAA requires that ozone or photochemical grid models be used to assess the air quality benefits of emission reductions listed in the State Implementation Plan (SIP). The SIP is the "roadmap" leading the way to get the area into compliance with the federal standard.



Ozone.....The Basics

Ozone is an odorless, colorless gas composed of three atoms of oxygen. Ozone occurs both in the Earth's upper atmosphere and at ground level. Ozone can be good or bad, depending on where it is found.

Ozone pollution is a key component of smog. It is mainly a daytime problem during the summer months. Strong sunlight and hot weather causes ground level ozone to form in harmful concentrations in the air.

Ozone is not emitted directly into the air. Instead it is formed in sunlight, which initiates a series of complex atmospheric chemical reactions. These reactions primarily involve nitrogen oxide (NO_x) and volatile organic compound (VOC) emissions, called precursors.

VOC + NO_x + Heat + Sunlight = Ozone

For more information on ozone facts go to:

www.tnrcc.state.tx/air/monops/ozonefacts.html

Ozone.....The Health Effects

Should I be concerned about exposure to ground-level ozone? That depends on who you are and how much ozone is in the air. Most people only have to worry about ozone exposure when ground-level concentrations reach high levels. In general, as ground level ozone concentrations increase, more and more people experience health effects, the effects become more and more serious and more and more people are admitted to the hospital. Scientist have found that about one in every three people in the United States is at a higher risk of experiencing ozone-related health effects.

- **Ozone can irritate the respiratory system.** When this happens, individuals begin to cough, feel an irritation in their throat and/or experience an uncomfortable sensation in their chest.
- **Ozone can reduce lung function.** Ozone can make it more difficult to breathe as deeply and vigorously as an individual normally would.
- **Ozone can aggravate asthma.** When ozone levels are high, more asthmatics have asthma attacks. One reason this happens is that ozone makes people more sensitive to allergens, which are the most common triggers for asthma attacks.
- **Ozone can inflame and damage the lining of the lungs.** Ozone damages the cells that line the air spaces in the lung. Within a few days, the damaged cells are replaced and the old cells are shed. If this kind of damage occurs repeatedly, the lung may change permanently in a way that could cause long-term health effects.

Most of these effects are considered to be short-term effects because they eventually cease once the individual is no longer exposed to the elevated levels of ozone. However, scientists and the medical community are concerned that the repeated short-term damage from ozone may injure the lungs permanently.

Who is at most risk from ozone?

- Children. Active children spend a large amount of their summer vacation outdoors, engaged in vigorous activities. Children are also most likely to have asthma or other respiratory illnesses.
- Adults who are active outdoors. Healthy adults of all ages who exercise or work outdoors are considered a sensitive group.
- People with respiratory diseases. There is no evidence that ozone causes asthma or other chronic respiratory disease, but these diseases do make the lungs more vulnerable to the effects of ozone.

For more information on ozone and ozone related health effects, go to:

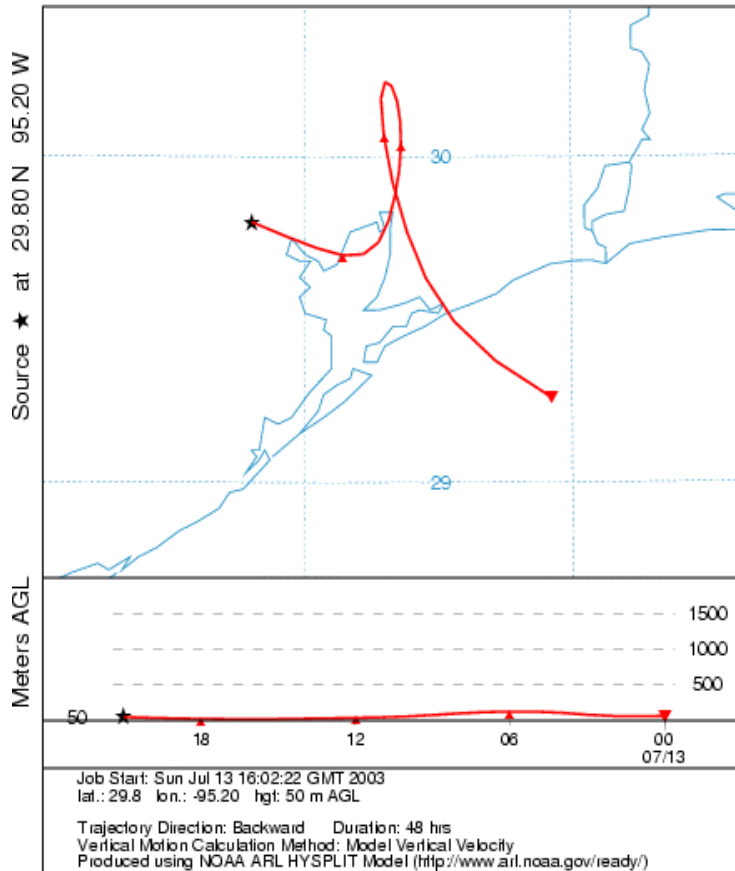
www.epa.gov/airnow/health/smog1.html

Ozone.....The Meteorology

Along the Gulf Coast, wind patterns are somewhat controlled by the push/pull effect created by the warming and cooling of the land and sea. As the land mass begins to warm, the gulf coast area experiences an onshore flow. As the land mass begins to cool, the area experiences an offshore flow.

Figure 1: Backward trajectory for July 13, 2003. Trajectory shows the movement of an air mass identified in the Houston area to its point of origin. Shows that wind currents along the gulf coast with the push/pull effect

Backward trajectory ending at 21 UTC 13 Jul 03
ETA Meteorological Data



For more information about air pollution and weather, go to:

www.tnrc.state.tx.us/air/monops/pollwx.html

Ozone.....The Science

The Texas Commission on Environmental Quality, the scientific community, the environmental community and the business community are jointly assessing scientific data on ozone formation in the Houston-Galveston area emerging from one of the largest and most successful air quality studies undertaken. This field program, referred to as the Texas Air Quality Study, was conducted during the summer of 2000(Tex AQS-2000).

During the TexAQS-2000 study, a number of episodes of high ozone concentrations occurred. Measurements made during the episodes have led to the some of the following findings regarding ozone formation in the Houston-Galveston area:

Finding 1: Almost without exception, air parcels with very high ozone concentrations, observed by aircraft during the Texas Air Quality Study, had back trajectories that indicated a substantial contribution of emissions from industrial source regions.

Finding 2: The rate of ozone production in and around the industrial source dominated areas of Houston-Galveston can be very high.

Finding 3: Ozone production in the urban plume was found to be slower and less efficient than in the industrial plume.

Urban Airshed Model

The TCEQ uses powerful computer models to simulate the photochemical reactions or ozone reactions and the meteorological conditions that contribute to the formation of ground-level ozone. The ozone model helps the TCEQ estimate future air quality in Texas communities that have ozone problems and it assists staff in deciding on the appropriate air pollution control measures. Computer ozone formation models are necessary to predict how air quality in a region such as the Houston-Galveston area will be affected by economic and population growth, and by the efforts to reduce pollution emissions.

The Urban Airshed Model is used to:

- Assess how sensitive ozone concentrations are to changes in pollution emissions, meteorological conditions and geographical boundary conditions.
- Assess the sensitivity of the model to various control scenarios.
- Determine if the control strategy will actually achieve attainment with the federal standard.

Ozone.....Emission Inventories

Emissions are inventoried in the Houston-Galveston area under five major source categories. These categories include point sources (petrochemical industries, power plants), area sources (drycleaners, gasoline stations), non-road mobile (construction site equipment), on-road mobile (cars and trucks), and biogenics (natural emissions example: trees).

Point Source Emission Data: TCEQ collects point source emission's estimates for major sources in the region. Because transport of pollutants from areas outside of the

region can potentially affect the area of Texas being studied, point sources beyond the Houston-Galveston region may be included in the study.

On-Road Mobile Source Emission Data: mobile sources are estimated using a travel demand model that distributes traffic along a digital road network. Congestion is calculated and used to estimate vehicle speeds.

Biogenic Emission Data: TCEQ staff use a computer model to estimate the biogenic or natural emissions. In estimating the biogenic emissions, several variables are considered:

Species composition – the type of trees in the area.

Leaf biomass density – emissions are directly proportional to the leaf biomass.

Land Use/Land Cover – identifies how the land is used.

Meteorological Variables – dependent on temperature and solar radiation to which the leaves are exposed.

Area and Nonroad Mobile Source Emission Data: Area and non-road mobile are combined for processing because they are modeled in a similar way. Lawn mowers, construction activities, boating, printers, gasoline stations, etc.

The Houston-Galveston Emission Inventory for Calendar Year 2000 is divided into Volatile Organic Compounds (VOC) Emissions and Nitrogen Dioxide (NO_x)

TOTAL VOLATILE ORGANIC COMPOUNDS INCLUDING BIOGENICS

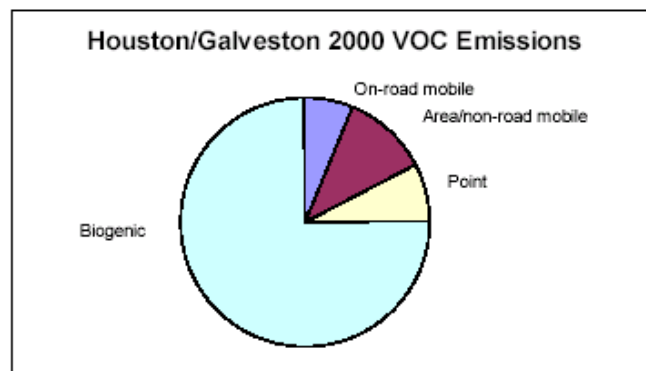


Figure 1. Total VOC Emissions, Houston/Galveston nonattainment area, 2000 Emissions Inventory (TNRCC, 2002).

TOTAL VOLATILE ORGANIC COMPOUNDS MINUS BIOGENICS

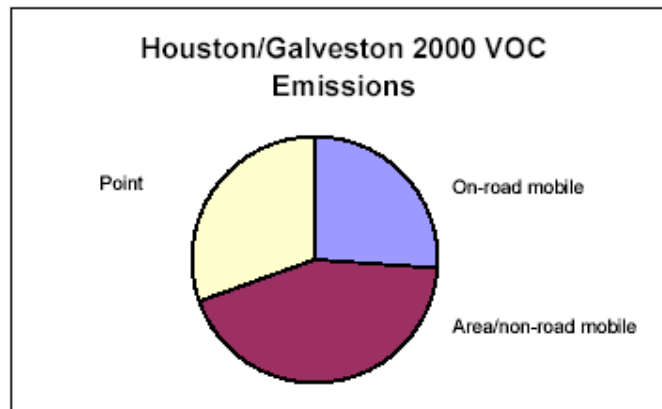


Figure 2. Total VOC Emissions without biogenics, Houston/Galveston nonattainment area, 2000 Emissions Inventory.

TOTAL NITROGEN DIOXIDE EMISSIONS

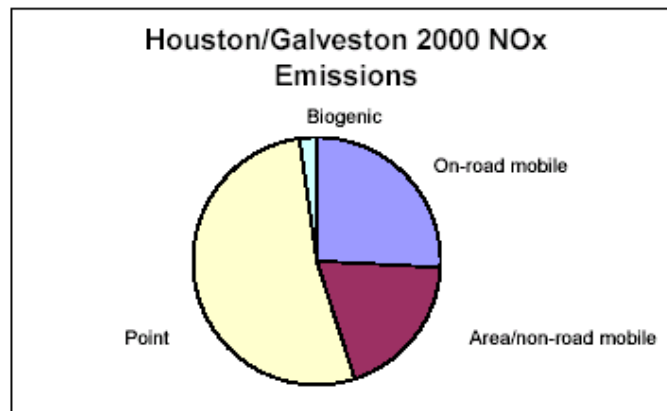


Figure 3. Total NO_x Emissions, Houston/Galveston nonattainment area, 2000 Emissions Inventory (TNRCC, 2002).

2000 Galveston County Data Point Sources and Mobile Sources

Point Sources: Data presented below is for 31 facilities (chemical plants, refineries, electric utility plants and other industrial sites) in Galveston County required to report inventory data in accordance with Texas Commission on Environmental Quality Rules.

Volatile Organic Compound: 10,102.06 tons per year
20,204,120.00 pounds per year

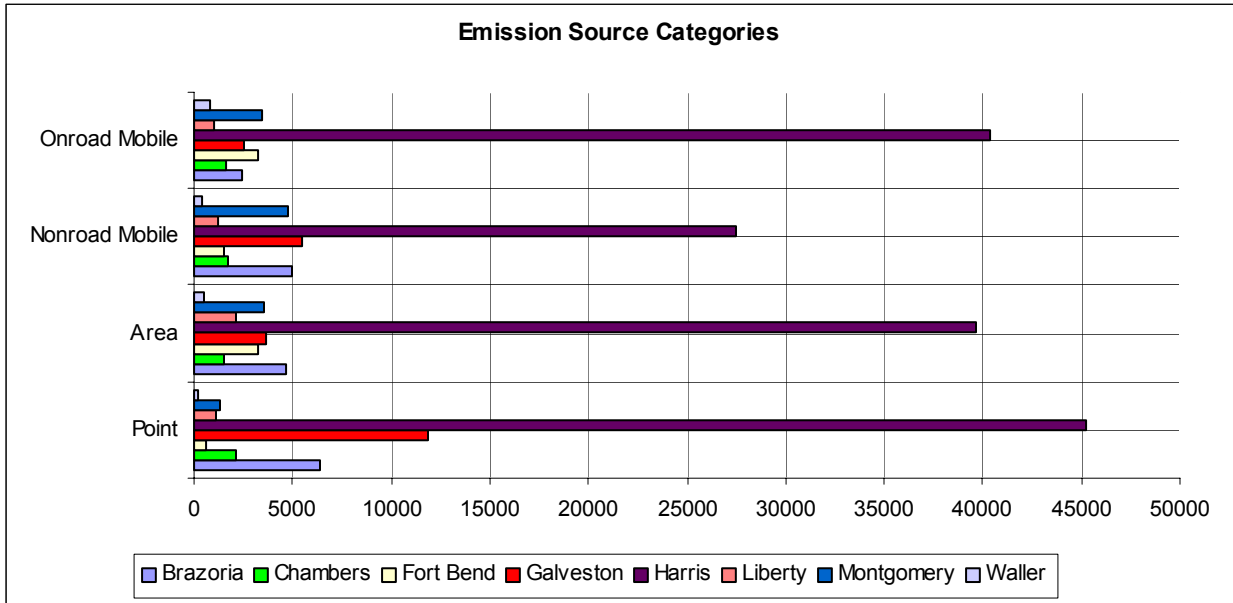
Nitrogen Dioxide: 24,684.98 tons per year
49,369,960 pounds per year

Mobile Sources: Mobile Sources 2000 Annual Average Daily Traffic (AADT) Vehicle Miles Traveled (VMT)*

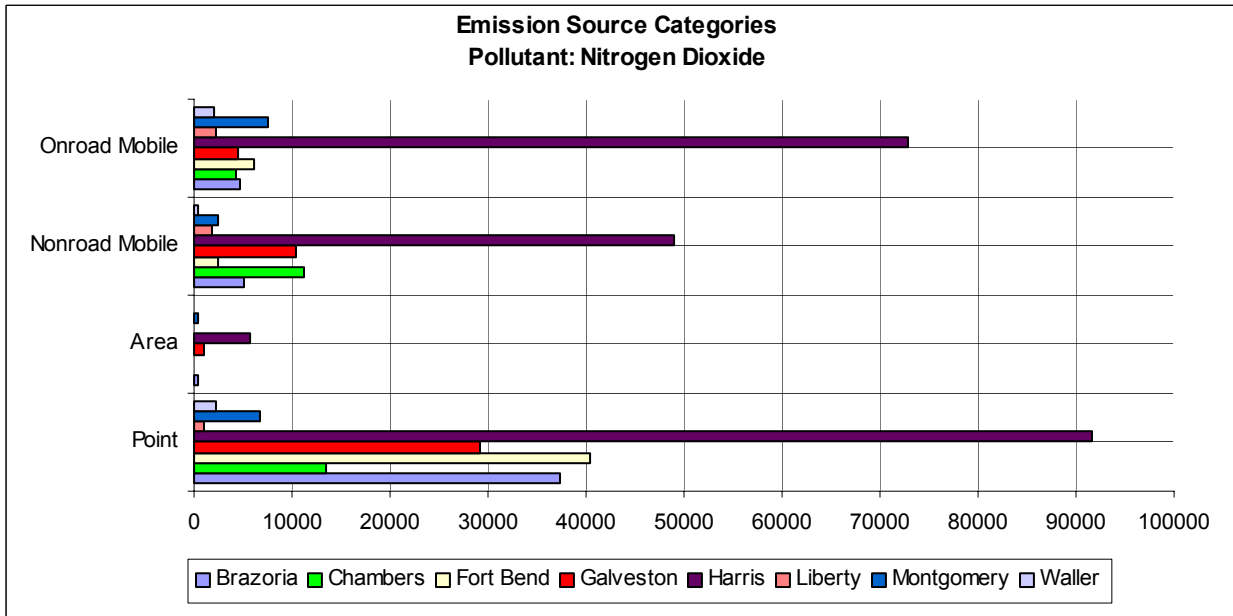
*The mobile source 2000 AADT estimates are based on traffic count data collected according to a statistical sampling procedure specified by the Federal Highway Administration (FHA) designed to estimate the vehicle miles traveled on a daily basis. Vehicle classification data was used to apportion a fleet-wide link of VMT using 28 U.S. Environmental Protection Agency vehicle types. The outputs of the model estimating emissions from mobile sources within a county identify the Volatile Organic Compounds and Nitrogen Dioxide released during a typical day in each of the counties as tons per day.

County	AADT	VOC (tons per day)	NO _x (tons per day)
Brazoria	5,284,407	5.86	10.4
Chambers	2,081,471	2.31	4.09
Fort Bend	6,418,376	7.12	12.62
Galveston	5,820,799	6.34	11.44
Harris	85,667,980	95.0	168.42
Liberty	1,923,087	2.12	3.78
Montgomery	6,856,031	7.60	13.48
Waller	1,626,312	1.8	3.2
HGA Region	115,678,465		

Emission Data All Sources 1996 Inventory: The emission source categories for each of the counties listed in the Houston-Galveston Non-attainment area is contained in the graphical representation below. The data used in this graph is from the 1996 Emission Inventory. The numbers listed on the graph are tons/year of volatile organic compounds.



The emission source categories for each of the counties listed in the Houston-Galveston Non-attainment area is contained in the graphical representation below. The data used in this graph is from the 1996 Emission Inventory. The numbers listed on the graph are tons/year of Nitrogen Dioxide.



Ozone.....The Monitoring

Continuous Air Monitoring Stations or CAMS are located across the Houston-Galveston region and as the name implies monitors the air on a continuous basis. Many pollutants are monitored at each of the 26 CAMS sites in the area. Ozone is not a primary pollutant released in the atmosphere. Therefore, ozone is generated using an ozone generator at the CAMS station.

In Galveston County, two CAMS stations are actively monitoring the air that we breathe for many pollutants including ozone. To date in FY 2003, Galveston County has experienced one(1) ozone exceedance at the CAMS station located in Galveston, Texas. The monitored level was recorded at 129 ppm exceeding the one (1) hour standard of 125 ppm.

For more information on air monitoring in the State of Texas including Galveston County, go to: www.tnrcc.state.tx.us/air/monops/index.htm

Ozone.....Reducing the Pollution

The Houston-Galveston area is classified as non-attainment for the pollutant ozone. This classification of non-attainment requires that the State of Texas draft a plan or a “road map” of sorts to address the sources of pollution contributing to the formation of ozone. The road map’s official name is entitled the Houston-Galveston State Implementation Plan of SIP. The SIP is an enforceable plan developed at the state level that explains how the state will comply with the air quality standards according to the Federal Clean Air Act. SIPs contain fourteen (14) sections with the most important section being the Control Strategy section.

The Control Strategy section identifies all of the strategies used to control the precursors to ozone formation. Each strategy targets pollution from point, area, and mobile sources. Each and everyone is affected by these control strategies from large petrochemical complexes to individual consumers.

With any plan, revisions are an integral part. Only one (1) SIP exists for each state. For Texas, this document was initially approved in 1972. Rather than re-write the plan, parts of the SIP are simply revised as needed. Revisions are typically prepared for a specific area. SIP revisions go through an intense period of research in which data is collected and modeled, control strategies are selected and tested, and the revision is drafted. Eventually, the revision is published for public comment and finally adopted by the TCEQ Commissioners.

There are numerous reasons why we need SIPs.

- SIPs protect our air
- SIPs are required by law
- Failure to produce SIPs has consequences

For more details on the Texas SIP including the Houston-Galveston area, go to:

www.tnrcc.state.tx.us/oprd/sips/index.htm