PROCEDURE - BLOWING IN THE WIND

National Air Quality Standards

Every day, at more than 1,000 locations across the U.S., instruments record the concentrations of several major air pollutants. The readings for each pollutant, e.g., carbon monoxide, are compared to the National Ambient Air Quality Standard for that pollutant. These standards are limits set under the federal Clean Air Act and monitored by individual states. When the levels measured in an area exceed the standard, the area is classified as "nonattainment" for that pollutant.

States are required to develop state implementation plans (SIPs) that explain how they plan to meet the national standards in each nonattainment area. The federal Environmental Protection Agency (EPA) must approve each plan. If a SIP is not acceptable, EPA can take over enforcement of the Clean Air Act in that state.

National standards have been established for the six major (so-called "criteria") pollutants listed below. The standards are of two types. Primary standards establish limits that EPA thinks are needed to protect public health. Secondary standards set limits to protect the environment. Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

Smoking Out Air Pollution

In this activity you will go online to find and analyze the actual measurements that Texas reported to the EPA on three occasions in three different parts of the state where pollutant levels exceeded national standards.

To prepare for these case studies, first familiarize yourself with the pollutants and standards in this table:

Air Pollution Concentrations Required To Exceed the National Ambient Air Quality Standard (NAAQS)

Pollutant	Averaging Period	Primary NAAQS	Secondary NAAQS
Ozone	1 hour	125 ppb	125 ppb
	8 hours	85 ppb	85 ppb
Carbon monoxide	1 hour	35.5 ppm	35.5 ppm
	8 hours	9.5 ppm	9.5 ppm
Sulfur dioxide	3 hours	–	550 ppb
	24 hours	145 ppb	–
	Annual	35 ppb	–
Nitrogen dioxide	Annual	54 ppb	54 ppb
Particulate matter (10 microns or less) (PM_{10})	24 hours	155 $\mu g/m^3$	155 $\mu g/m^3$
	Annual	51 $\mu g/m^3$	51 $\mu g/m^3$
Particulate matter (2.5 microns or less) ($PM_{2.5}$)	24 hours	66 $\mu g/m^3$	66 $\mu g/m^3$
	Annual	15.1 $\mu g/m^3$	15.1 $\mu g/m^3$
Lead	Quarterly	1.55 $\mu g/m^3$	1.55 $\mu g/m^3$

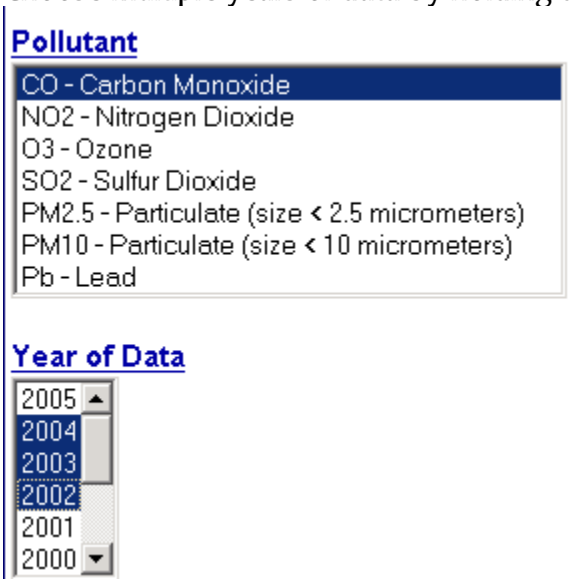
Now familiarize yourself with the way these data are reported and displayed online. Choose a county from one of the nonattainment areas listed below:

Beaumont-Port Arthur nonattainment area
Jefferson County
Orange County
Dallas-Fort Worth nonattainment area
Collin County
Dallas County
Denton County
Tarrant County

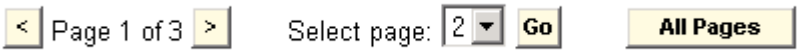
El Paso nonattainment area
El Paso County
Houston-Galveston-Brazoria area
Brazoria County
Fort Bend County
Galveston County
Harris County
Montgomery County

Nonattainment county selected: _____

Click on this link to see how air-pollution levels are reported to the EPA: EPA Air Data. Highlight the first pollutant listed--in this case, carbon monoxide--and highlight the most recent three years of complete data. Choose multiple years of data by holding down the shift key and clicking on each year, like this:



Now scroll down to the bottom of the screen and click on the box that lets you view all pages.



County names are listed in alphabetical order on the far right side of the data table. Find the county you chose to study and count the number of times carbon monoxide levels exceeded the national standard. (NOTE: Your chosen county may have more than one monitoring station).

Check "no" if the monitoring stations in your county measured levels that did not meet the national standard and "yes" if the levels met the standard.

Now go back to the EPA Air Data screen and repeat this process for each criteria pollutant.

Air Pollution Check List

Pollutant	Averaging Period	Standard	Yes	No
Ozone	1 hour	May not equal or exceed 125 ppb on more than three days over three years.		
	8 hours	The average of the annual fourth-highest daily maximum over a three-year period may not equal or exceed 85 ppb.		
Carbon monoxide	1 hour	May not equal or exceed 35.5 ppm more than once a calendar year.		
	8 hours	May not equal or exceed 9.5 ppm more than once a calendar year.		
Sulfur dioxide	24 hours	May not equal or exceed 145 ppb more than once a calendar year.		
	Annual	May not equal or exceed 35 ppb.		
	Annual	May not equal or exceed 54 ppb.		
Nitrogen dioxide	24 hours	May not equal or exceed 155 µg/ml^3 on more than three days over three years with daily sampling.		
Particulate matter (10 microns or less) (PM_{10})	Annual	The three-year average of annual arithmetic mean concentrations at each monitor within an area may not equal or exceed 51 µg/ml^3.		
	24 hours	The three-year average of the annual 98th percentile for each population-oriented monitor within an area may not equal or exceed 66 µg/ml^3.		
Particulate matter (2.5 microns or less) ($PM_{2.5}$)	Annual	The three-year average of annual arithmetic mean concentrations from single or multiple community-oriented monitors may not equal or exceed 15.1 µg/ml^3.		
Lead	Quarterly	May not equal or exceed 1.55 µg/ml^3.		

1. Which pollutant(s) in the county you selected were in violation of the NAAQS?

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2. Click on the link below for the nonattainment area for the county you selected. What plans are being made in the county you selected to reduce air pollution?

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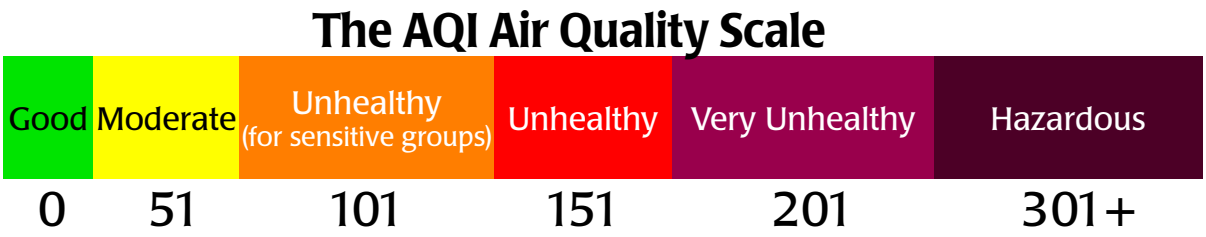
HOUSTON/GALVESTON brochure (pdf)
EL PASO pdf document
DALLAS-FORT WORTH brochure (pdf)
BEAUMONT-PORT ARTHUR brochure (pdf)

The Air Quality Index (AQI)

Pollution levels measured at air monitoring stations are converted by the Texas Commission on Environmental Quality (TCEQ) into an overall Air Quality Index that is reported to the public. The AQI is like a weather report--an easy way to summarize each day's pollution measurements. The index focuses on health effects people may experience within a few hours or days after breathing polluted air.

The AQI for ozone on any given day is based on either the peak eight-hour running average since midnight or the peak one-hour measurement since midnight. The AQIs for sulfur dioxide, PM-10, and PM-2.5 are based on a 24-hour average sampled from midnight to midnight, and the AQI for carbon monoxide is based on the peak eight-hour running average since midnight. An AQI value is calculated for each pollutant, and the highest value is the AQI value for that day. For example, if on July 12 a certain area had AQI values of 90 for ozone and 88 for sulfur dioxide, the AQI value would be 90 for the pollutant ozone on that day.



Now let's put your knowledge of air-quality standards and monitoring data to use.

Case Study No. 1. Houston, September 27-October 2, 2004

Houston experienced high ozone at the end of September. Look at the data for this event by going to this link: TCEQ Air Monitoring Data. Look for the data that matches dates in the data table below and record your findings.

Date	Monitoring Sites in Metro Area	Color	Air Quality Description	Critical Pollutant
9/29/2004	Houston			
9/30/2004	Houston			
10/3/2004	Houston			
10/4/2004	Houston			

Weather is an important factor in the formation of ground-level ozone. Go to September NOAA weather information and find the weather conditions for Houston during the September 2004 ozone event. Record the information below. Then go to October NOAA weather information to find the weather information for Houston during the first couple of days in October and record that information as well.

Date	Monitoring Sites in Metro Area	Temperature Column 2	Wind Speed Column 11	Wind Direction Column 12	Rain Column 7
9/29/2004	Houston				
9/30/2004	Houston				
10/4/2004	Houston				
10/5/2004	Houston				

4. Using what you know about the role of weather in the formation of ground-level ozone, explain how weather conditions contributed to the September-October 2004 ozone event in Houston.

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5. What weather condition helped end the ozone event? _____

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6. Topography also affects ozone. Houston lies largely in the northern portion of the Gulf coastal plain, a 40- to 50-mile-wide swath along the Texas Gulf Coast. The land rises about one foot per mile inland. The northern and eastern portions of the area are largely forested; the southern and western portions are predominantly prairie grassland; coastal areas are prairie and sand. How could these topographical features affect ozone formation in Houston?

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7. Convection currents in the troposphere mix warm and cold air, which helps dilute pollutants. Sometimes a layer of warmer, lighter air overlies cooler, denser air. This is called a temperature inversion. Temperature inversions produce stable atmospheric conditions that inhibit mixing and keep upward-flowing air currents from developing. Explain how a temperature inversion could affect ozone formation.

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Case Study No. 2: Mission, May 18-21, 2003

Find the data for this event by going to TCEQ Air Monitoring Data. A box at the top of the screen displays the date. Change the date to match the dates in the data table below. Select the monitoring station for Mission (CAMS 43). Click on generate a report. Scroll to the bottom of the screen to see the AQI rating and record findings in the data table.

Date	Monitoring Sites in Metro Area	Color	Air Quality Description	Critical Pollutant
5/19/2003	Mission			
5/19/2003	Mission			
5/19/2003	Mission			

Particulate matter (PM) means smoke particles, liquid droplets, hydrocarbons, soot, dust, pollen, acids and aerosols that are smaller than 10 microns in diameter (1 micron = 1 millionth of a meter). Particles that are even smaller--2.5 microns or less--are mostly formed from chemical reactions in the atmosphere and from burning fuels (e.g., motor vehicles, power plants, industrial facilities, fireplaces, wood stoves and agricultural burning).

Go to TCEQ Air Pollution Events and read about the May 2003 event that affected areas across Texas. Explain in your own words what caused this event and where it originated.

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Case Study No. 3: El Paso, March 23-25, 2002

Find the data for this event by going to TCEQ Air Monitoring Data. A box at the top of the screen displays the date. Change the date to match the dates in the data table below. Select the monitoring station for El Paso (CAMS 12). Click on generate a report. Scroll to the bottom of the screen to see the AQI rating and record findings in the data table.

Date	Monitoring Sites in Metro Area	Color	Air Quality Description	Critical Pollutant
3/23/2002	El Paso			
3/23/2002	El Paso			
3/23/2002	El Paso			

Coarse particulate matter can come from natural sources, such as wind-blown dust, sea salt spray and vegetation. It can also come from human-produced sources, including road dust, various grinding activities and industrial combustion processes such as incinerating trash. Go to TCEQ Air Pollution Events and read about the March 2002 event in El Paso. Explain in your own words what caused this event and where it originated.

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