

With Houston's growth,

# WHAT'S HAPPENING TO OUR AIR QUALITY?

2021

HOUSTON AIR QUALITY TRENDS



Monitoring by Houston Regional Monitoring (HRM), state and federal organizations in 2021 confirmed that air quality continues to improve throughout the greater Houston area.

To determine air quality, measurements are taken of the six major air pollutants for which the federal government sets National Ambient Air Quality Standards (NAAQS):

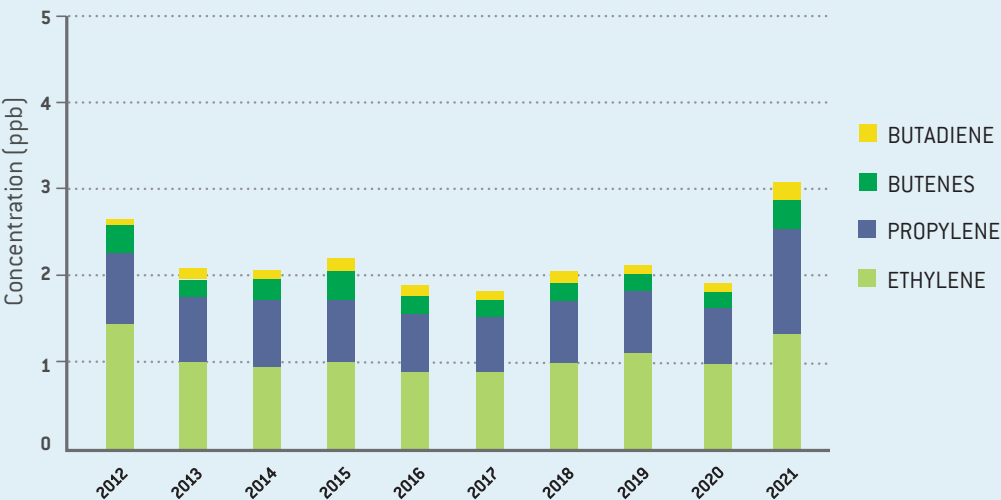
- Ozone
- Carbon monoxide
- Particulate matter
- Sulfur dioxide
- Nitrogen dioxide
- Lead

Greater Houston’s air quality currently meets five of the six standards—all except the ozone standard. There were two 1-hour ozone exceedance days in 2021. In 1987, there were 66 days when the 1-hour ozone standard was exceeded.

*From 2012 – 2021 the greater Houston area has experienced a 15% increase in HRVOCs, highly reactive compounds that contribute to ozone formation.*

## Highly Reactive Volatile Organic Compounds (HRVOCs)

Based on TCEQ and industry (or HRM) continuous automatic gas chromatography data



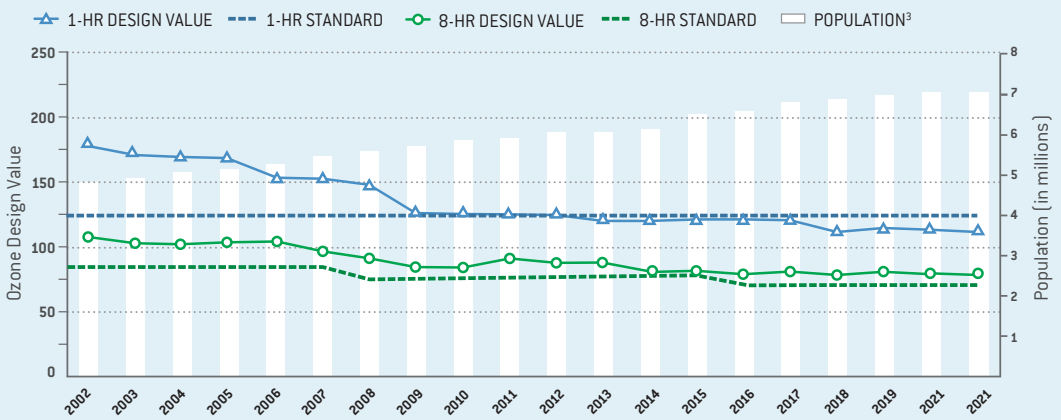
# HOUSTON'S AIR QUALITY CONTINUES TO IMPROVE.

Air quality in the greater Houston area has improved significantly and continues to get better.

*Even with the greater Houston area's growth in population, transportation and manufacturing, we have fewer days in 2021, when ozone levels exceeded federal standards, than we had in earlier decades.*

## Ozone Levels and Population<sup>1</sup>

There are two federal standards<sup>2</sup> by which ozone is measured in the greater Houston area. In 2021, the greater Houston ozone nonattainment area continued to meet the former EPA 1-hour standard for ozone and is progressing toward attaining the 8-hour standard.



Source: TCEQ

22 ozone monitors in 1990

25 ozone monitors in 2000

49 ozone monitors in 2021

1. Population data before 2007 from US Census Bureau. Population data after 2007 from Texas Department of State Health Services. Ozone data from TCEQ.

2. 1-Hour NAAQS 124 ppb. 1997 8-Hour NAAQS 84 ppb. 2008 8-Hour NAAQS 75 ppb. 2015 8-hour NAAQS 70 ppb.

3. Population data can be found in the Q&A section of this brochure.

## Houston Regional Monitoring Network

The HRM network is an important part of the greater Houston area's air monitoring system. We are committed to the scientific monitoring and understanding of air quality in the greater Houston area. HRM's historical commitment supports the greater Houston area's goal of demonstrating attainment with all air quality standards.

Since HRM began in 1980, HRM-member companies have invested nearly \$50 million in HRM's ambient air monitoring network. HRM operates 10 ambient air monitoring sites in the region and has an annual operating budget of \$2.5 million.

HRM provides its members with the best scientific air quality data available so it can be used to make the best decisions about ways to effectively reduce air emissions.

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## HRM's Measurement Process

HRM collects air samples throughout the year to measure the concentration of individual compounds in the ambient air. Together with the monitoring conducted by state and federal agencies, the HRM monitoring data provides an ongoing comprehensive understanding of the state of air quality in the greater Houston area.

Air samples are collected at all 10 HRM monitoring sites, in full compliance with EPA approved methods.

In addition to measuring the six major air pollutants, HRM monitors 156 volatile organic compounds (VOCs) emitted by vegetation, utilities, industrial sources, small businesses, motor vehicles and household sources. Over the past 36 years, more than 14,580 VOC samples from monitoring sites have been collected. We have compiled and reported more than 2.2 million individual VOC measurement values.

We also monitor weather conditions that affect ozone concentrations. These include temperature, wind speed, wind direction, rainfall and net solar radiation (solar energy).

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## Analyzing the Monitoring Data

HRM data is analyzed and the results are compared to:

- EPA's National Ambient Air Quality Standards (NAAQS)
- Known benchmark concentrations, including Texas Commission on Environmental Quality (TCEQ) Air Monitoring Comparison Values (AMCVs)
- Computer modeling results
- Data from other cities

HRM member companies meet several times per year to review the data and to identify trends for potential action. Representatives from TCEQ, Harris County and the City of Houston are invited to participate in these meetings. HRM also shares summary air monitoring results with the general public and participates in educational outreach activities and in numerous studies and committees that have a common goal of understanding and improving air quality in the greater Houston area.

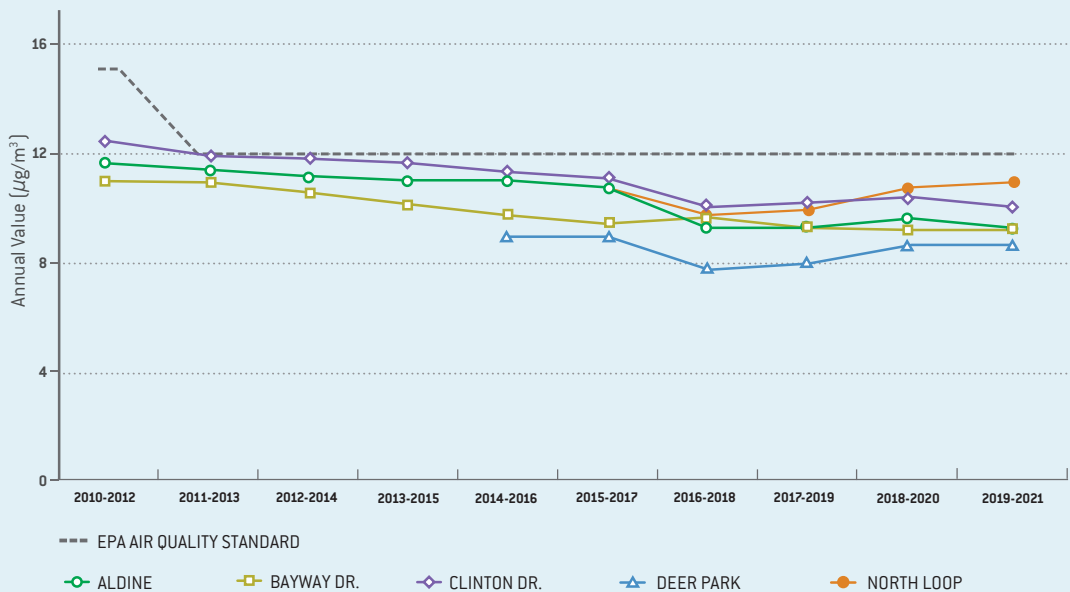
# Reductions in Fine Particulate Matter Equals Easier Breathing

Ozone is the main air pollutant of concern in the greater Houston area, but “fine” particulate matter is another form of pollution. These tiny particles can pass through the throat and nose when inhaled and enter deep into the lungs where they can potentially cause serious health effects.

In late 2012, EPA lowered the acceptable air quality standard for fine particulate matter to be even more protective of public health. Results from TCEQ monitoring sites show that the greater Houston area continued to meet this more protective standard in 2021.

*Since 2012, results have shown that the greater Houston area continues to meet the more protective EPA standard for fine particulates.*

## Fine Particulate Levels



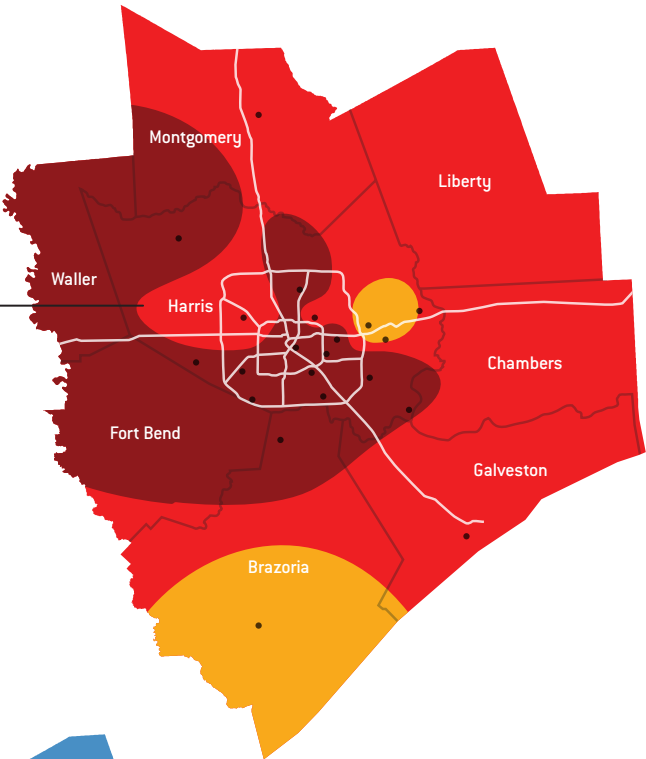
The design value for the PM<sub>2.5</sub> is calculated based on the annual arithmetic mean measured over 3 consecutive years. The primary standard is achieved if the design value is equal to or less than 12 ug/m3.

# 8-Hour Ozone Design Values

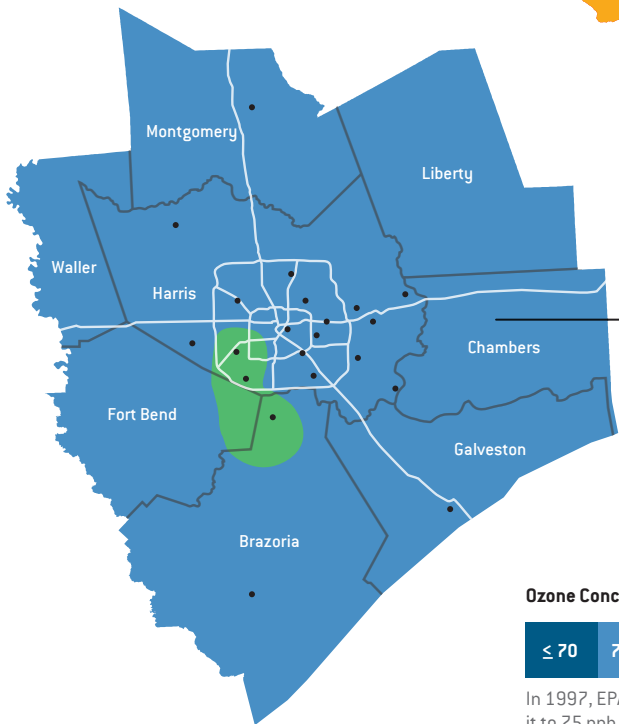
Based on TCEQ and City of Houston regulatory monitoring sites (denoted by • on the maps)

1985

A large part of the greater Houston area experienced high levels of ozone.



GREATER HOUSTON OZONE  
NONATTAINMENT AREA



2021

In 2021, ozone levels continued to show improvement.

Ozone Concentration (ppb)

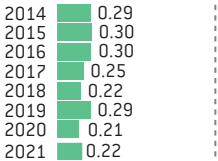


In 1997, EPA set the 8-hour ozone standard at 84 ppb, lowered it to 75 ppb in 2008, and lowered it, again, to 70 ppb in 2015.

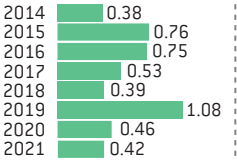
# Benzene Levels (ppb)

Based on continuous automatic gas chromatograph samples, the 2021 annual average benzene concentration for the Houston area network was 0.28 ppb.  
= TCEQ Annual Air Monitoring Comparison Value (AMCV) = 1.40 ppb

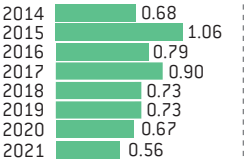
## Cesar Chavez (TCEQ)



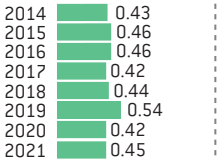
## Deer Park (HRM 16)



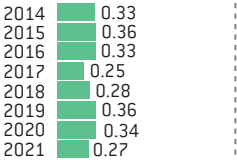
## Lynchburg Ferry (HRM)



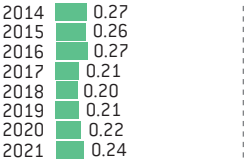
## Channelview (TCEQ)



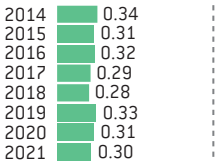
## Deer Park (TCEQ)



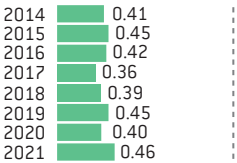
## Milby Park (TCEQ)



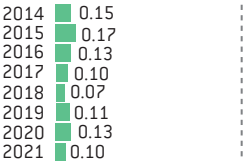
## Clinton Drive (TCEQ)



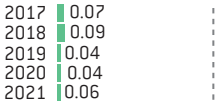
## Haden Road (HRM)



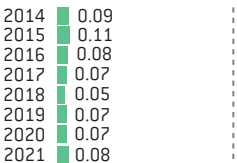
## Texas City (AECOM)



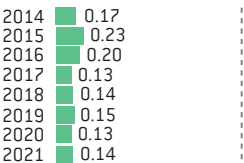
## Oyster Creek (AECOM)



## Lake Jackson (AECOM)



## Wallisville Road (HRM)



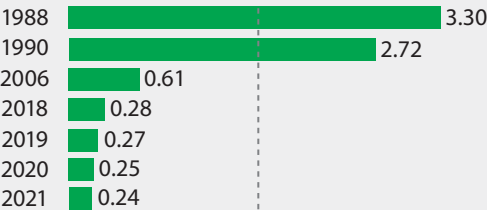
## Baker Road (HRM 7)



Benzene and butadiene are air toxics that contribute to ozone formation and are among the VOCs that HRM and governmental agencies monitor.

## Benzene Annual Average Across Canister Monitoring Network

A significant reduction in benzene levels has occurred since measurements began in 1988. Measurements are based on 24-hour canister samples at 7 HRM monitoring sites.

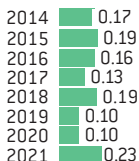




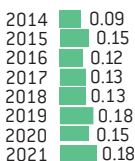
# Butadiene Levels (ppb)

Based on continuous automatic gas chromatograph samples, the 2021 annual average butadiene concentration for the Houston area network was 0.29 ppb. TCEQ Annual Air Monitoring Comparison Value (AMCV) = 9.10 ppb

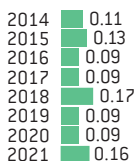
## Cesar Chavez (TCEQ)



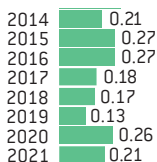
## Deer Park (HRM 16)



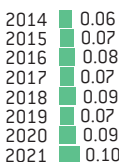
## Lynchburg Ferry (HRM)



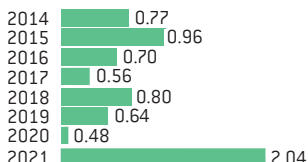
## Channelview (TCEQ)



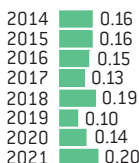
## Deer Park (TCEQ)



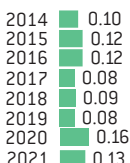
## Milby Park (TCEQ)



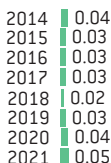
## Clinton Drive (TCEQ)



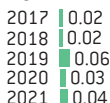
## Haden Road (HRM)



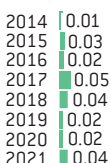
## Texas City (AECOM)



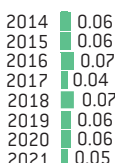
## Oyster Creek (AECOM)



## Lake Jackson (AECOM)



## Wallisville Road (HRM)



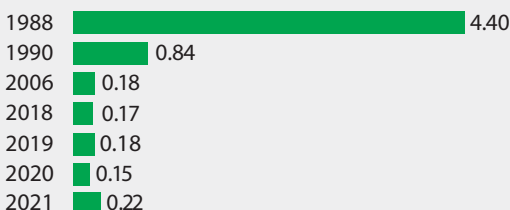
## Baker Road (HRM 7)



TCEQ and industry operated 12 VOC monitoring sites with continuous automatic gas chromatographs in 2021, each one monitoring for benzene, butadiene and about 40 additional compounds.

## Butadiene Annual Average Across Canister Monitoring Network

Butadiene levels have remained below the Air Monitoring Comparison Value of 9.1 ppb since measurements began in 1988. Measurement is based on 24-hour canister samples.





# GLOSSARY

## **Ambient Air**

The outside air all around us.

## **Air Monitoring Comparison Values**

AMCVs are chemical-specific air concentrations set to protect human health and welfare.

Exposure to an air concentration at or below the AMCV is not likely to cause adverse health effects. AMCVs are a collective term that refers to all values used by TCEQ to review ambient air monitoring data.

## **Benzene**

Benzene is an organic chemical compound, a natural constituent of crude oil and a constituent in gasoline. Benzene is classified as a human carcinogen. Long-term exposure to excessive levels of benzene in the air may cause leukemia.

## **Butadiene**

This industrial chemical is used in the production of synthetic rubber. Typically, butadiene refers to 1,3-butadiene, which is listed as a known carcinogen by the EPA.

## **Design Value for the 1-Hour Ozone Standard**

A value calculated according to a formula from the EPA, based on three-year averages of the fourth-highest value at each monitor. To attain the 1-hour ozone standard, the average number of exceedances of the standard over a three-year period must not exceed 1.0.

## **Design Value for the 8-Hour Ozone Standard**

A value calculated according to an EPA formula, based on three-year averages of the fourth-highest value at each monitor.

## **Design Value for Fine Particulate**

A value calculated according to an EPA formula, based on the annual arithmetic mean of the measurements averaged over three years.

## **EPA**

Environmental Protection Agency, the federal government agency that regulates environmental matters in the United States.

## **Fine Particulate Matter**

Often referred to as PM<sub>2.5</sub>, it is a complex mixture of small particles and liquid droplets smaller than 2.5 microns in diameter, composed of acids (such as nitrates and sulfates), organic chemicals, metals, and soil and dust particles. A micron is one millionth of a meter. For comparison, a human hair is about 40 - 70 microns in diameter.

## **Ozone**

Ground-level ozone is an air pollutant that can harm lung function and irritate the respiratory system. It is formed by the reaction of hydrocarbons and nitrogen oxides in the ambient air in the presence of sunlight.

## **ppm**

Parts per million. One ppm has the time equivalent of 32 seconds in a year.

## **ppb**

Parts per billion. One ppb has the time equivalent of 3 seconds in 100 years.

## **Regulatory Monitors**

Monitors operated by the TCEQ that meet stringent EPA data quality and location requirements.

## **TCEQ**

Texas Commission on Environmental Quality, the state government agency that regulates environmental matters in Texas.

## **Volatile Organic Compounds**

VOCs are emitted as gases to the air. They include a variety of chemicals, some of which may have short- and long-term adverse health effects.

# Q&A

## HOW EXTENSIVE IS THE AIR MONITORING SYSTEM IN THE HOUSTON AREA?

Houston has more air monitors than any other area of the United States. Air monitoring in the region is performed by the EPA, TCEQ, HRM and others.

## IS ALL AIR QUALITY MONITORING DATA IN AGREEMENT ABOUT HOUSTON'S PROGRESS IN AIR QUALITY IMPROVEMENTS?

While individual monitors may differ in the year- to-year results they report, collectively they demonstrate the substantial, long-term progress Houston has made in meeting air quality standards, including ozone standards.

## HOW DOES HOUSTON'S AIR QUALITY COMPARE WITH THE AIR QUALITY OF OTHER LARGE U.S. CITIES?

Favorably, Houston meets five of six air quality standards set by the EPA. Los Angeles meets four of six and other large cities such as New York, Phoenix, Baltimore, Washington DC, and Detroit meet five of six current NAAQS.

## IS THERE AN AIR QUALITY FORECAST FOR WHERE I LIVE?

Yes. For today's air quality and a forecast for the next three days, click the "Today's Texas Air Quality Forecast" section of the TCEQ website: [tceq.texas.gov/airquality/monops/forecast\\_today.html](https://tceq.texas.gov/airquality/monops/forecast_today.html).

## WHERE CAN I FIND MORE INFORMATION ABOUT HOUSTON AIR QUALITY?

For more Information about Houston Air Quality issues, visit [houstonairquality.com](https://houstonairquality.com).

<sup>1</sup> Population data for the years 1990–2007 are for the eight-county Houston-Galveston-Brazoria ozone nonattainment area. Population data after 2007 is for the Houston-Sugar Land-Baytown Metropolitan Statistical Area, consisting of Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, San Jacinto and Waller counties.

Note: "Greater Houston area" refers to the eight-county Houston-Galveston- Brazoria ozone nonattainment area consisting of Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller counties.

Note: 2021 TCEQ data was not validated at the time of publication.

## Contact Us

To learn more about Houston Regional Monitoring go to [hrm.aecom.com](https://hrm.aecom.com).

For more information about HRM contact Cheryl Adkins at AECOM [cheryl.adkins@aecom.com](mailto:cheryl.adkins@aecom.com).



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