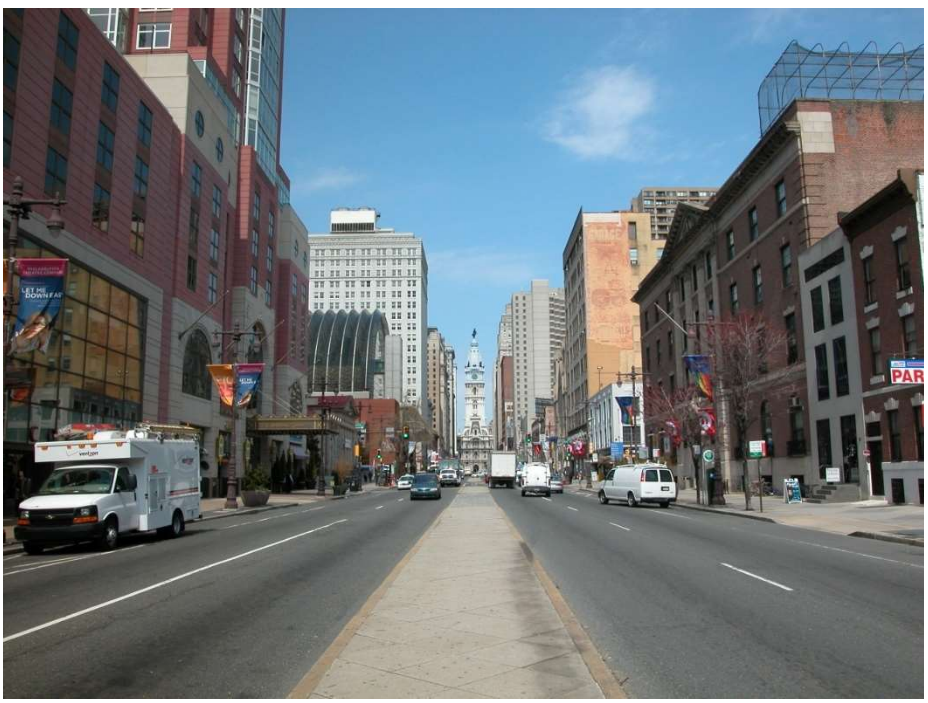
City of Philadelphia
Department of Public Health
Air Management Services

Philadelphia's Air Quality Report 2018



Executive Summary

This report focuses on the air quality of the City of Philadelphia, as presented by the Philadelphia Department of Public Health, Air Management Services (AMS), the local air pollution control agency for the City of Philadelphia. As an urban area, Philadelphia faces many of the same pollution challenges as other densely populated areas, such as emissions from vehicles and industries. The information contained in this report reviews Philadelphia's air quality for the calendar year 2018 and reports how the City's air compared with the National Ambient Air Quality Standards (NAAQS). This report covers the following criteria pollutants: **ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter,** and **lead**. It also provides an overview of **hazardous air pollutants,** also referred to as **air toxics**.

In general, trends show many air pollutants in Philadelphia to be decreasing. In 2018, Philadelphia attained the NAAQS for all pollutants, except for ozone. There were 217 good days, 138 moderate days, and 10 unhealthy days (10 from ozone and 0 from $PM_{2.5}$) in Philadelphia.

In 2018, AMS began a new project called the Philadelphia Air Quality Survey (PAQS). This project aims to set up 50 street level, neighborhood-oriented air sampling sites throughout the City to sample the ambient air for $PM_{2.5}$, $PM_{2.5}$ speciation, NO_2, SO_2, and O_3.

For further information, please visit the Air Management Services website at:
https://www.phila.gov/departments/department-of-public-health/about-us/divisions/

or contact us at:
215-685-7580

James Kenney, Mayor
Thomas A. Farley, Health Commissioner

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Introduction

AMS is responsible for the prevention, abatement, and control of air pollution and air pollution nuisances, achieving and maintain the National Ambient Air Quality Standards (NAAQS) in Philadelphia, and protecting the health and quality of life of the Philadelphia community from the adverse effects of air contaminants and noise.

AMS implements the environmental protection mandates that is contained in city, state, and federal regulations; reviews construction and operating permits for compliance with air regulations, standards, and guidelines; operates and maintains a citywide air sampling network to continuously monitor Philadelphia's air; routinely inspects pollution sources; services citywide complaints of air pollution, asbestos, and noise; issues violations; conducts enforcement actions; and advances voluntary emissions reductions.

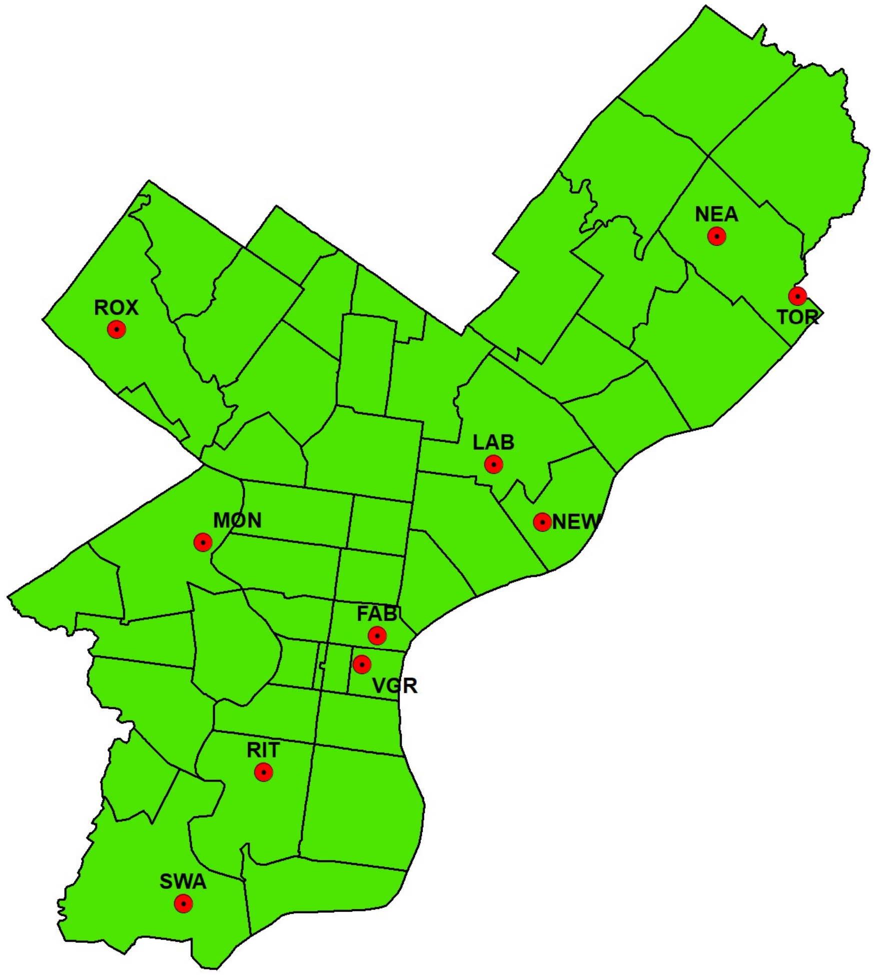
Air Monitoring Network

The City of Philadelphia is served by a network of ten air monitoring sites located throughout the City that measure the criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). Four of the sites also measure toxics, such as 1,3-butadiene, benzene, and carbon tetrachloride. Many of the measurements are made in "real time", meaning that the measurements show pollution levels as they occur, instead of after the fact. The map on page 6 shows the location of air monitors and the pollutants measured at each monitoring location. AMS measures air quality for several reasons:

- To ensure that long-term goals and targets to reduce levels of air pollution are being met.
- To provide information to the public as to how good or bad the air quality is in Philadelphia.
- To ensure attainment with standards set forth by the United States Environmental Protection Agency (EPA).

An air monitoring network plan (AMNP) has been made available to the public annually starting in the year 2007. The most recent AMNP is located on the AMS website: https://www.phila.gov/documents/air-management-reports-and-documents/.

Figure 1 - 2018 Philadelphia Air Monitoring Network



			Parameter																	
AQS Site Code	**AMS Site**	**Address**	**CO**	**SO_2**	**Ozone**	**NO_2**	**NOy/NO**	**PM_{10}**	**$PM_{2.5}$**	**Speciated $PM_{2.5}$**	**PM Coarse**	**Black Carbon / Ultrafine PM**	**Carbonyls**	**PAMS VOC**	**BaP**	**TSP Metals** (Be, Cr, Mn, Ni, As, Cd, Pb)	**Toxics TO15**	**MET**	**Comm. Air Toxics** OPEN PATH	**AMS Site**
421010004	**LAB**	1501 E. Lycoming St			X															**LAB**
421010014	**ROX**	Eva & Dearnley Sts											X				X			**ROX**
421010024	**NEA**	Grant Ave & Ashton Rd			X															**NEA**
421010048	**NEW**	2861 Lewis St	X	X	X	X	X	X	X	X	X		X	X			X	X		**NEW**
421010055	**RIT**	24th & Ritner Sts		X					X	X			X			X	X			**RIT**
421010057	**FAB**	3rd & Spring Garden Sts							X											**FAB**
421010063	**SWA**	8200 Enterprise Ave											X				X			**SWA**
421010075	**TOR**	4901 Grant Ave & James St	X			X			X									X		**TOR**
421010076	**MON**	I-76 & Montgomery Drive	X			X			X			X			X	X		X		**MON**
	VGR	6th & Arch Sts			X				X									X		**VGR**

Table 1 - Site Summary Table

AMS Site	Address	Statement of Purpose
LAB	1501 E. Lycoming St	Built in 1964, this monitor assesses the City's impact on ozone precursors and is a designated Photochemical Assessment Monitoring Station (PAMS) site. New monitoring methods are often evaluated on this site.
ROX	Eva St & Dearnley St	As a periphery site, this site is used for measuring Air Toxics and Carbonyls.
NEA	Grant Ave & Ashton Rd	As a periphery site, this site is best for measuring ozone in the City, because as a secondary pollutant, ozone requires some time to form (longer time periods allow precursor emissions to distribute more uniformly across a region, and thus allow ozone concentrations to develop more uniformly across subregions and even large-scale regions). We tend to see fewer "hot spots" as ozone is not directly emitted from combustion activities as other pollutants are.
NEW	2861 Lewis St	This site was one few sites that was originally established to measure the impact of specific industrial facilities which are now closed. Today, the monitors conduct continuous particulate monitoring and provide information about the nearby wastewater treatment plant. As of October 2, 2013, the NCore site has been moved to this site from Baxter water treatment plant (BAX).
RIT	24th St & Ritner St	This site was selected to help assess the impact of the petroleum refinery on the local community. The area was identified by air quality modeling.
FAB	3rd St & Spring Garden St	This site was established to monitor high levels of fine particulates in the City based on EPA Region III's air quality modeling of air toxics in Philadelphia. It shows high levels of fine particulate created by vehicle traffic.
SWA	8200 Enterprise Ave	This site was established to measure toxics, carbonyls, and metals. Fine particulates may also be monitored. EPA Region III modeling analysis has shown that areas near the airport have high levels of aldehydes.
TOR	4901 Grant Ave & James St.	This site was established as the 1st near-road NO_2 monitor in the Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Metropolitan Statistical Area .
MON	I-76 & Montgomery Drive	This site was established as the 2nd near-road monitor in the Philadelphia-Camden-Wilmington, PA-NJ-DE-MD Metropolitan Statistical Area.
VGR	6th St & Arch St	EPA's Village Green Air Monitoring Station. Utilizes solar and wind turbine power as energy sources. Sited to increase community awareness of environmental conditions.

Quality Assurance

The AMS Air Monitoring Laboratory's main responsibility is to provide accurate data on the quality of the City's air. Pollutants in the atmosphere are measured to answer a number of questions such as:

- Are the NAAQS being met in Philadelphia?
- How close or far away are we from meeting these standards?
- Which pollutants are getting worse (increasing in concentration) or improving?

Many of our measurements require detecting very small amounts of a pollutant, often expressed as parts per million (ppm) or parts per billion (ppb). An illustration: imagine a million yellow balls all the same size with several red balls in the middle of them; we would need to find those red balls and then be able to count them. The instruments used to measure air pollutants need to be reliable in identifying the pollutant and accurate in making the measurement every time. The main way we check to see if our instruments are giving accurate measurements is to send a sample of air which has a known amount (concentration) of a pollutant and compare what the instrument says is the concentration to what we know is the right concentration. Then adjustments (calibration) to an instrument can be made to give a better measurement. If the equipment is off by a significant margin, the instrument needs to be repaired or replaced. The EPA and our Laboratory have standard operating procedures on how accurate and reliable measurements need to be to answer the questions being asked. The instruments being used now are much more reliable than those available years ago. Steps to assure good data quality include:

- Automated calibration.
- Manual calibration conducted by chemists.
- Review of the data by an experienced engineer or scientist.

The system is geared towards public safety; for example, a few measurements can be enough to identify a problem in meeting the NAAQS, but many good measurements over a period of time (often three years) as well as additional types of analysis are needed to "demonstrate compliance" with the corresponding pollutant's standard on the NAAQS.

Air Quality Index

The Air Quality Index (AQI) is a color coding system for air quality used by government agencies across the United States. Media outlets disseminate air quality reports using the AQI to help warn the public about day-to-day pollution problems. Air quality alerts are issued when pollution is rated as Orange (Unhealthy for Sensitive Groups), Red (Unhealthy) or Purple (Very Unhealthy). Alerts are more likely to occur in the summer months, but can happen any time of the year.

The AQI is used to report pollutant levels based on five criteria air pollutants: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. Using formulas created by the EPA, daily pollution levels for each pollutant are converted into a score ranging from 1 to 500. A level of 100 generally corresponds to the National Ambient Air Quality Standard for each pollutant, and an “Action Day” occurs when the AQI for any pollutant exceeds 100. On these days, the public is advised to do their part to reduce pollution and take precautions to protect themselves and their families from health effects. For example, on an Orange day, or Unhealthy for Sensitive Groups day, children, seniors, and those with respiratory ailments are advised to minimize prolonged outdoor exposure. On a Red/Purple day, or Unhealthy day, all residents are advised to limit outdoor activity. Red and purple days are uncommon. The highest of the five pollutant scores is reported as the overall air quality rating for Philadelphia for a given day. That is, any individual pollutant can, on its own, trigger an Action Day. Action Days are reported through print, radio and television media, online, via apps, and by local and regional air agencies.

Philadelphia's real-time air quality website, located at https://www.phila.gov/services/mental-physical-health/environmental-health-hazards/air-quality/ provides the most up-to-date information about the air quality in Philadelphia. It lets you know what you should do to protect your health if the air quality is unhealthy.

Figure 2 shows the AQI summaries, as used by media outlets. The recommended actions that individuals should take to protect their health and plan their daily activities are described below the index.

Figure 2 - Color Coded Air Quality Index (AQI)

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range …	... air quality conditions are …	... as symbolized by this color.
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Good – The AQI value is between 0 and 50. Air quality is considered satisfactory, and air pollution poses little or no risk.

Moderate – The AQI is between 51 and 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.

Unhealthy for Sensitive Groups – When AQI values are between 101 and 150, members of sensitive groups may experience health effects. This means they are likely to be affected at lower levels than the general public. For example, people with lung disease are at greater risk from exposure to ozone, while people with either lung disease or heart disease are at greater risk from exposure to particle pollution. The general public is not likely to be affected when the AQI is in this range.

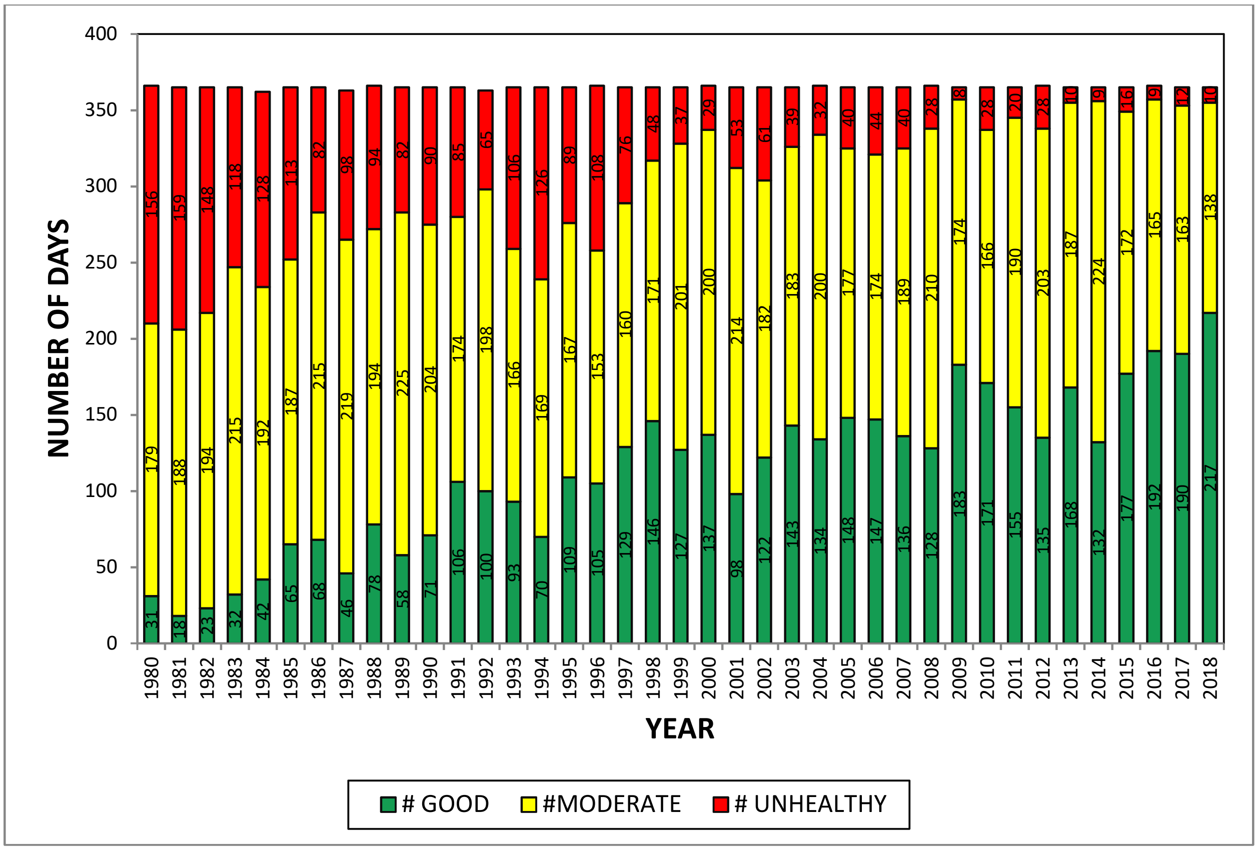
Unhealthy – Everyone may begin to experience health effects when AQI values are between 151 and 200. Members of sensitive groups may experience more serious health effects.

Very Unhealthy – AQI values between 201 and 300 trigger a health alert, meaning everyone may experience more serious health effects.

Hazardous – AQI values over 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected.

Figure 3 shows the annual summary of the number of good, moderate, and unhealthy air quality days in Philadelphia based on monitoring conducted by AMS since 1980[1]. The chart has been standardized with the current EPA AQI breakpoints or pollutant concentration cut-offs and are consistent with the 2015 ozone standards.

Figure 3 - Philadelphia Annual AQI Summary



[1] Data downloaded on August 1, 2019 from EPA's Air Data website (https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report).

National Ambient Air Quality Standards

The Clean Air Act (CAA), which was last amended in 1990, requires EPA to set NAAQS for pollutants considered harmful to public health and the environment. The CAA identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA has set NAAQS for six criteria air pollutants: carbon monoxide, sulfur dioxide, nitrogen dioxide, lead, particulate matter ("dust" or "soot"), and ozone. Periodically, the standards are reviewed and may be revised. The current standards are listed here: https://www.epa.gov/criteria-air-pollutants/naaqs-table. A history of the standard for each criteria pollutant is shown in Appendix H. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air ($\mu g/m^3$).

In 2018, Philadelphia was in attainment for all pollutants, except for ozone.

The Pollutants We Measure

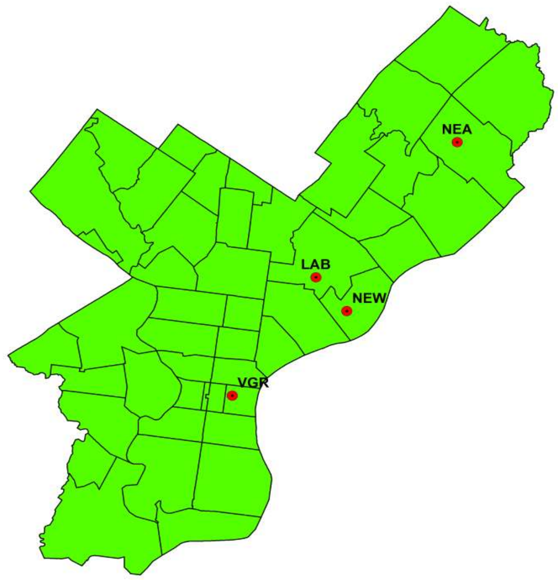
The following pages provide information on the health effects, sources, and trends of pollutants measured in Philadelphia. Included are the six pollutants, commonly called criteria pollutants, for which EPA has established NAAQS, as well as pollutants identified as being toxic or hazardous. Each of the criteria pollutants are graphed to show the historical trends compared with national standards. The graphs identify the sites of the "worst" (maximum) levels, the "best" (minimum) levels, and with a solid circle, the mean of all recorded levels. It is important to note the mean, as it factors out extreme levels, and thereby provides a better indication of general air quality levels. In addition, Appendix G provides tables of historical information downloaded from EPA's Air Quality System data mart.

Ozone (O_3)

NAAQS:

- The 3-year average of the annual fourth-highest daily maximum 8-hour average O_3 concentration is less than or equal to 0.070 ppm

Figure 4.1 - Ozone Monitoring Map



Ground level ozone (the primary constituent of smog) is the pollutant most often responsible for unhealthy air quality in the Philadelphia region. Ozone is not emitted into the atmosphere directly but is formed by chemical reactions between other pollutants. Specifically, Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NO_x) react to create ozone in the presence of heat and sunlight. Ozone levels are consistently higher during the summer months.

There are four categories of emission sources from human activity that produce VOC and NO_x:

- **Point sources** – The largest utilities, industries, and other operations.
- **Area Sources** – Commercial, solvent use, waste disposal, and other smaller categories.
- **Non-road Engine Sources** – Construction and agricultural equipment, recreational boats, lawnmowers and other sources.
- **Highway Vehicle Sources** – Cars, trucks, buses, and motorcycles.

Emissions of VOC and NO_x may be carried by wind currents while reacting to produce high ozone levels hundreds of miles from their sources. In the eastern United States during the summer months, ground level ozone is frequently high over wide areas containing several states. This phenomenon is caused by ozone and its precursors traveling via wind currents across great distances.

Unlike the oxygen that we breathe, which has only two atoms of oxygen (O_2), ozone (O_3) has an additional unstable oxygen atom, making it very reactive. This is why ozone is said to burn or irritate the lungs. People who are very young or very old, or who have chronic lung problems such as asthma are particularly sensitive to ground level ozone. In the lower atmosphere, free radicals (molecules with unpaired electrons) are produced by the chemical reaction of nitrogen dioxide (NO_2) to give an oxygen (O_2) atom and nitric oxide (NO), which contributes to ozone formation.

In any discussion of ozone, it is important to distinguish between the effects of ozone at the ground and ozone high in the atmosphere, several miles above our heads. An advertisement might use the slogan “good up high, bad nearby,” to describe ozone.

Regardless of where it is, no one would want to breathe it. However, up high in what’s called the ozone layer, ozone is essential to the health of nearly every living thing, since it protects the Earth from harmful ultraviolet (UV) light. If not for this natural layer, UV light would sterilize the Earth’s surface, and life as we know it would cease to exist.

Near the ground, ozone reacts with buildings, plants, animals, and people, and is one of the most irritating, harmful components of smog. Smog refers to the whole mixture of air pollution in an area, and may include ozone, a whole host of other gases, as well as fine particles and the hazy conditions they cause.

VOCs are organic (i.e. carbon-containing) compounds that evaporate readily, such as gasoline vapors and paint fumes. NO_x stands for two compounds, nitric oxide (NO) and nitrogen dioxide (NO_2). VOCs that come from human activities are called anthropogenic VOCs. Some anthropogenic VOCs, such as benzene, are themselves toxic and may increase risks of cancer or lead to other adverse health effects in addition to helping form ozone. Some VOCs are considerably more reactive in the atmosphere than others, and the reactivity of a VOC influences how quickly ozone forms. A compound that reacts in a few minutes to produce ozone will have a much greater impact near its source than one that reacts more slowly. Thus, ozone can form at various distances downwind of a VOC source due to the speed of these chemical reactions.

In 2018, as seen in Figure 4.1, there were four ozone monitoring sites: LAB, NEA, NEW, and VGR. The ozone monitor at VGR is part of EPA’s Village Green Project to demonstrate the capabilities of new real-time monitoring technology using solar power for residents and citizen scientists to learn about local air quality. The real-time data is available here: https://www.airnow.gov/index.cfm?action=airnow.villagegreen. Data from the VGR monitor is not used for comparison to the NAAQS / AQI.

Figures 4.2 and 4.3 show the trends for the 2015 ozone 8-hour concentration in Philadelphia and the 3-year design value at Northeast Airport (NEA), respectively.

Figure 4.2 - Ozone Trends for the 4th Highest Daily Maximum 8-Hour Concentration From All Sites

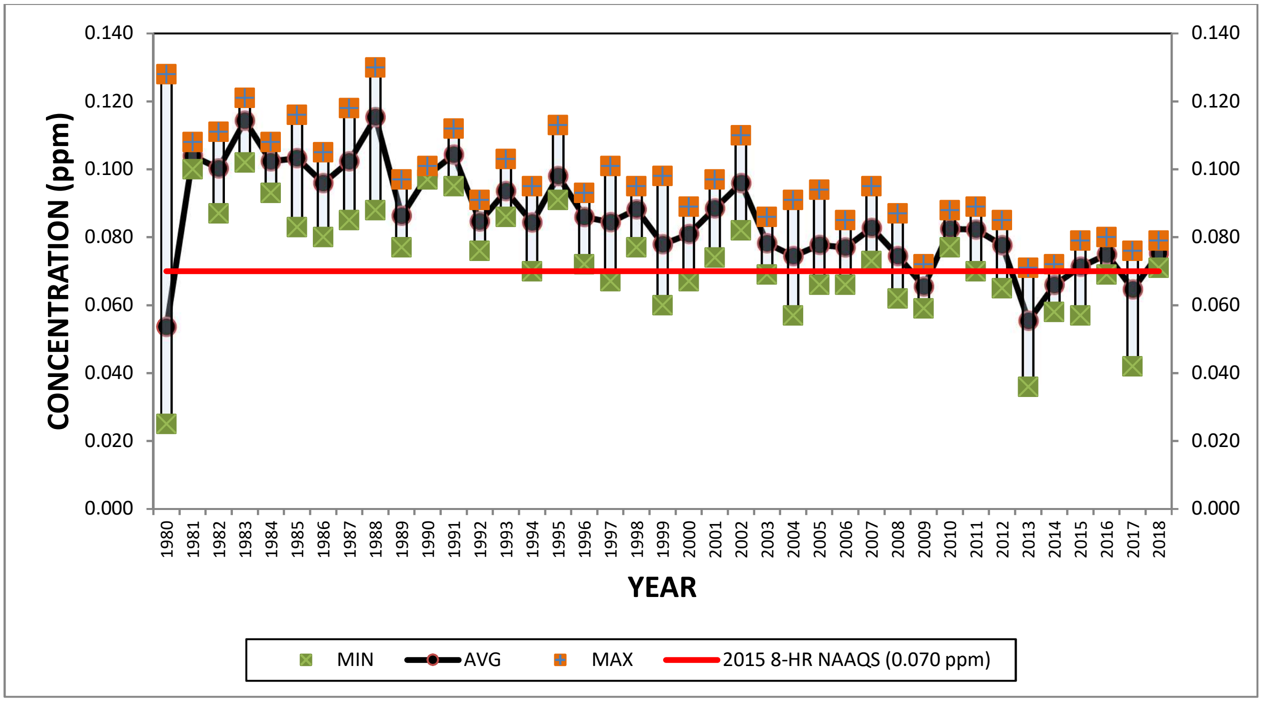
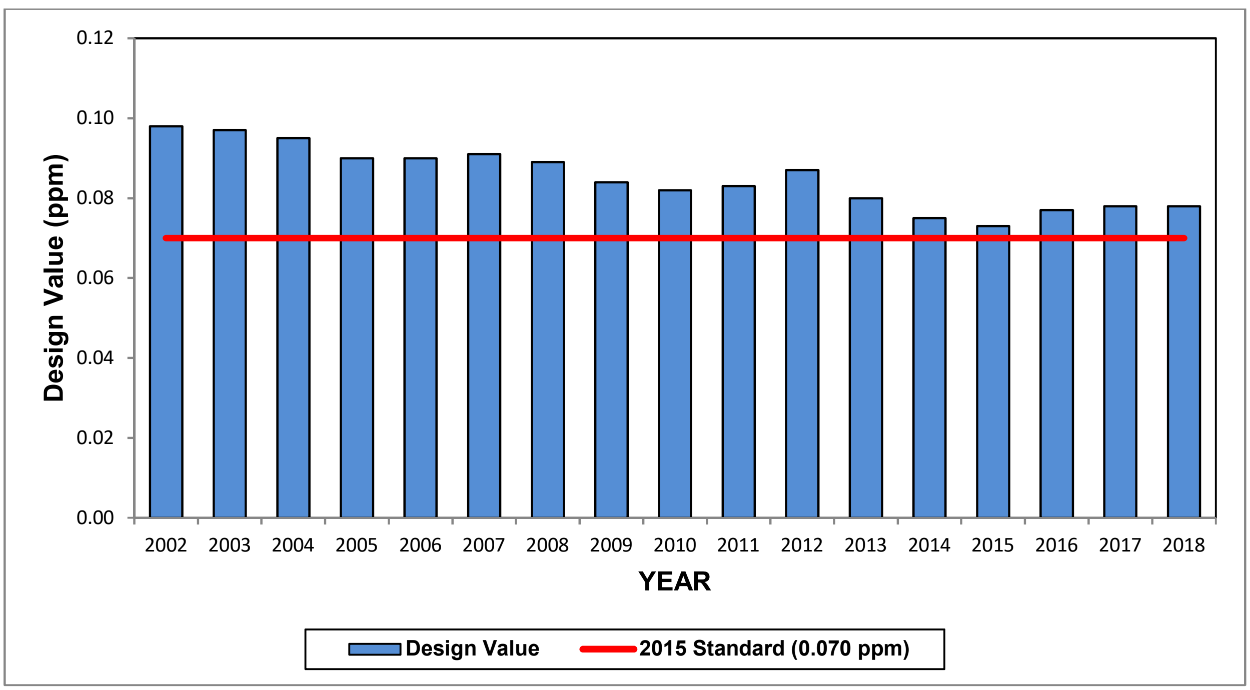


Figure 4.3 - 3-Year Design Value at NEA Monitoring Site (AQS ID 421010024)

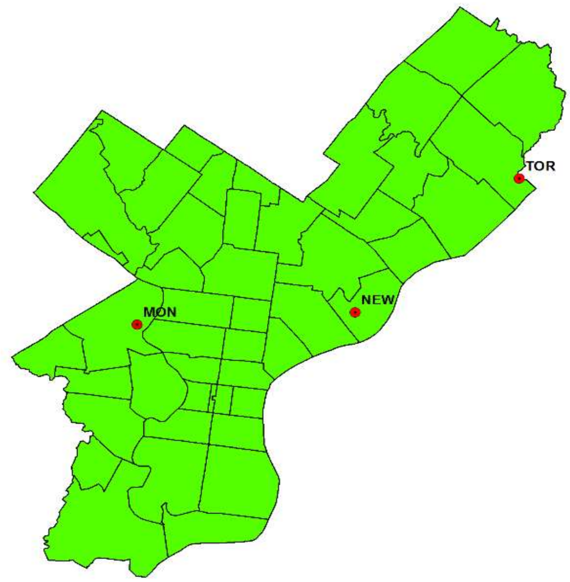


Carbon Monoxide (CO)

NAAQS:

- 9 parts per million for an 8-hour average concentration (2nd highest) not to be exceeded more than once per year.
- 35 parts per million for a 1-hour average concentration not to be exceeded more than once per year.

Figure 5.1 - CO Monitoring Map



Carbon monoxide (CO) is colorless, odorless, and at high concentrations a poisonous gas. It is formed when carbon in fuels are not burned completely. The major source of CO is motor vehicle emissions. Other sources of CO include residential, industrial, and natural processes. Weather greatly affects CO levels, and peak CO concentrations typically occur during the colder months of the year.

Carbon monoxide enters the bloodstream and reduces oxygen delivery to the body's organs and tissues. The health threat from carbon monoxide is most serious for those who suffer from cardiovascular disease. Exposure to elevated CO levels is associated with impairment of vision, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks. At very high levels, carbon monoxide can be fatal.

Over a thirty year period, there has been a continued reduction in carbon monoxide levels. This is mainly the result of federal requirements for cleaner automobiles and fuel and state inspection/maintenance programs.

Figures 5.2 and 5.3 on the following page show the trends for the CO 8-hour concentration and 1-hour concentration, respectively, in Philadelphia.

Figure 5.2 - CO Trends for the 2nd Highest 8-Hour Average Concentration

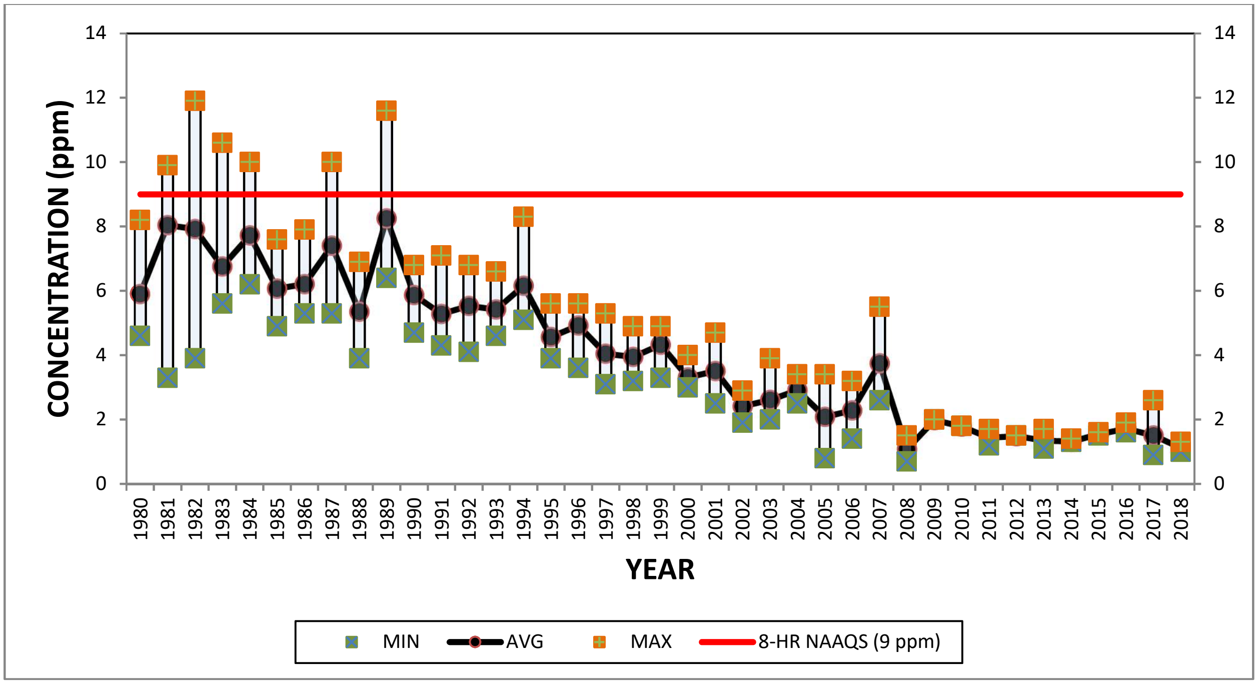
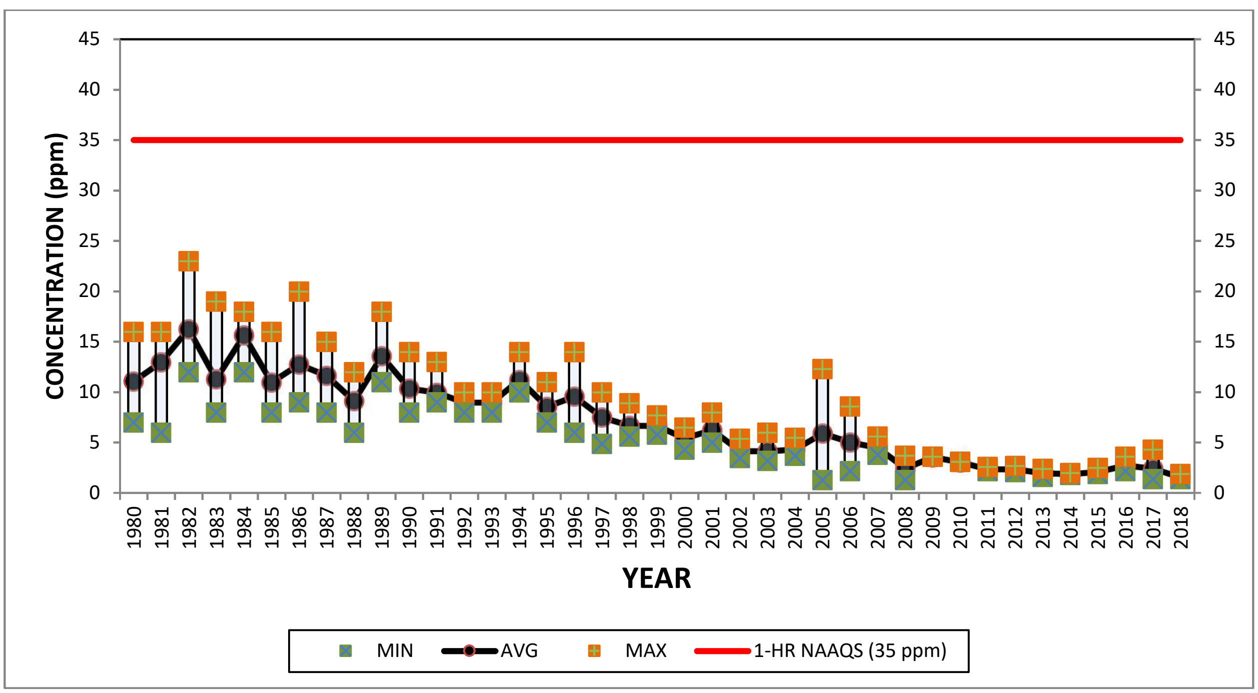


Figure 5.3 - CO Trends for the Highest 1-Hour Average Concentration

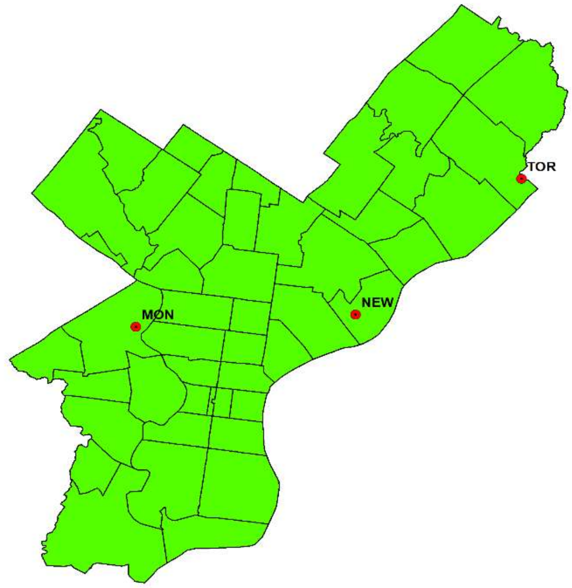


Nitrogen Dioxide (NO_2)

NAAQS:

- The annual average concentration is less than or equal to 53 ppb.
- The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentration is less than or equal to 100 ppb.

Figure 6.1 - NO_2 Monitoring Map



Nitrogen dioxide is a light brown gas that is an important component of urban haze. The compound is created primarily from fuel combustion in motor vehicles, utilities, and industrial sources.

Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza. Nitrogen oxides (NO_X) are an important precursor to both ozone and acid rain and can affect both land and water ecosystems. They contribute to the formation of fine particulate matter, haze and reductions in visibility.

Ambient levels of nitrogen dioxide in Philadelphia are better than the NAAQS, showing a sustained downward trend over time.

Figures 6.2 and 6.3 show the NO_2 trends for annual average and daily maximum of one-hour concentrations, respectively.

Figure 6.2 - NO_2 Trends for Annual Average Concentration

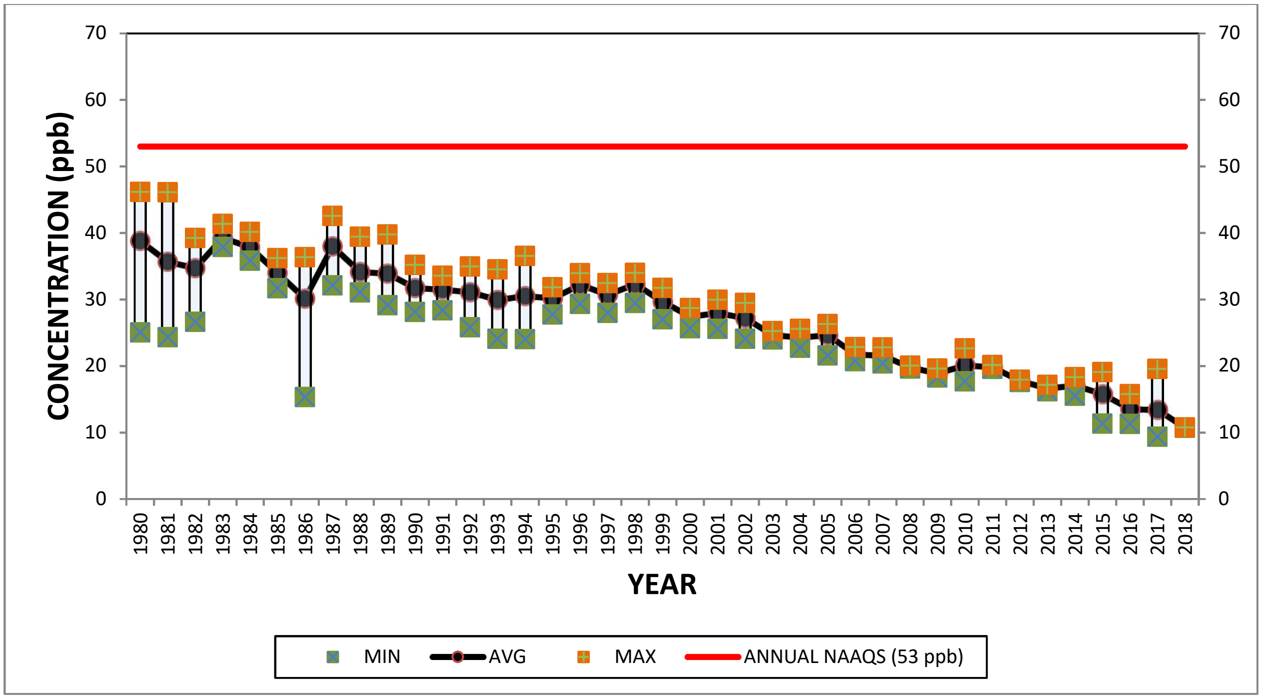
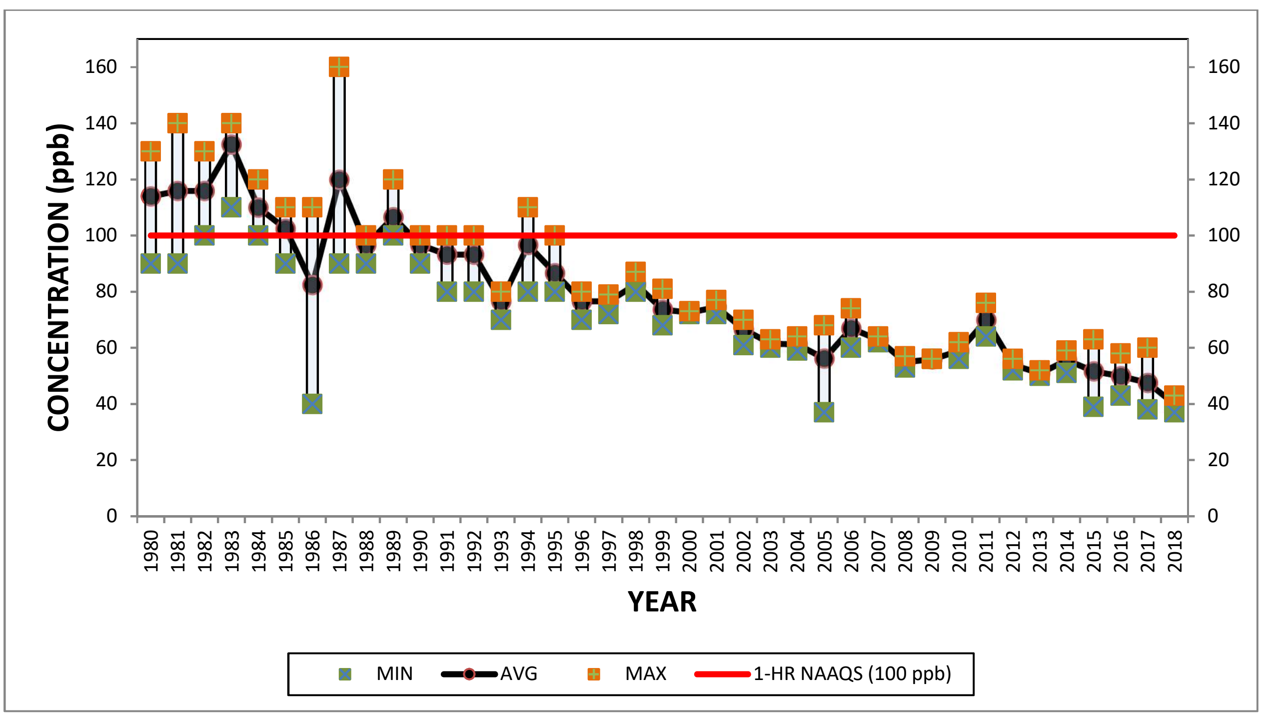


Figure 6.3 - NO_2 Trends for 98th Percentile Daily Maximum 1-Hour Concentration

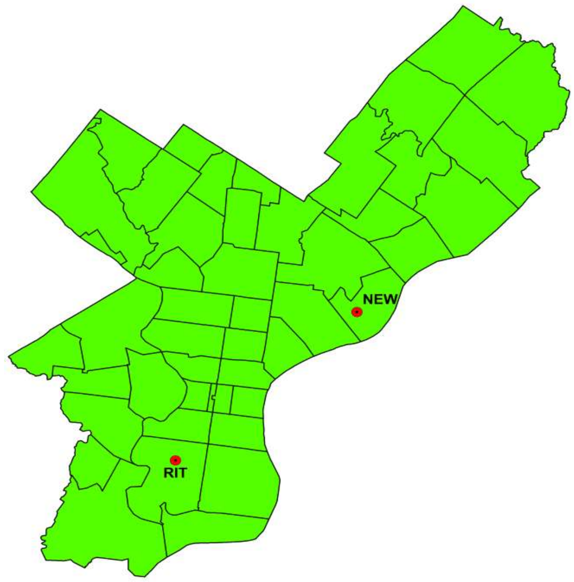


Sulfur Dioxide (SO_2)

NAAQS:

- The 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentrations is less than or equal to 75 ppb.

Figure 7.1 - SO_2 Monitoring Map



Sulfur dioxide is emitted from the burning of fuels that contain sulfur. Industrial grade fuel oils are the primary source in Philadelphia.

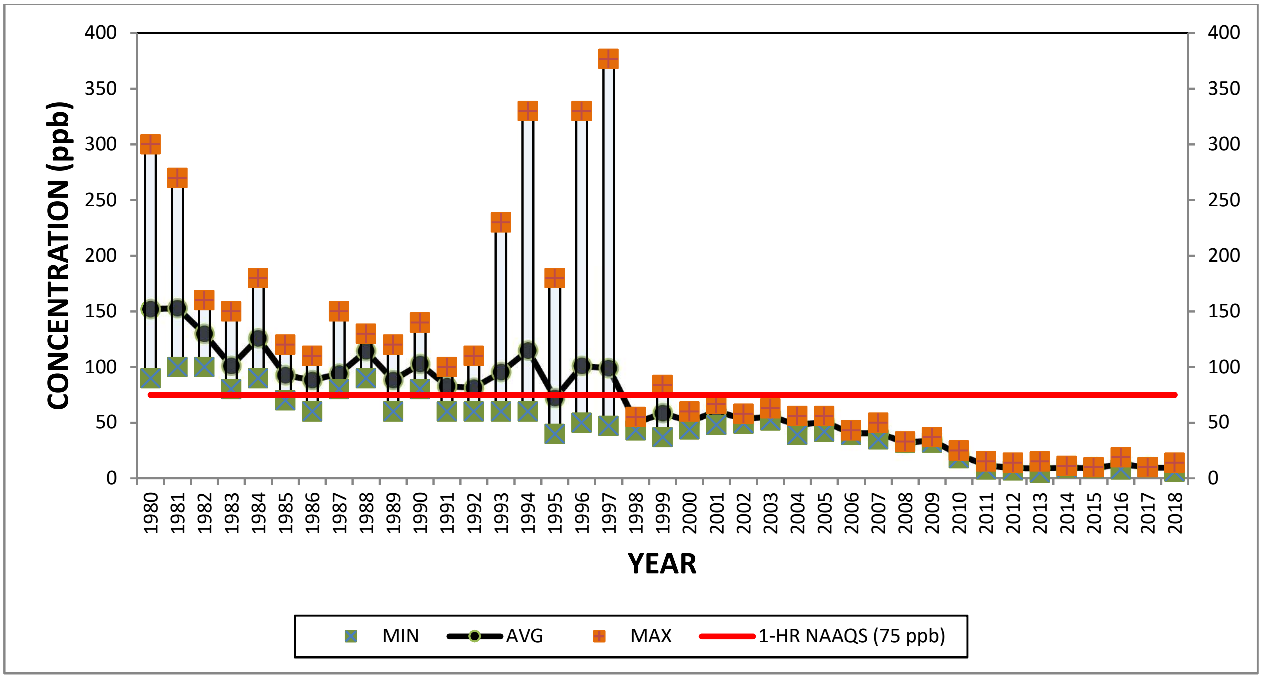
The major health concerns associated with exposure to high concentrations of SO_2 include effects on breathing, respiratory illness, alterations in the lungs' defenses, and aggravation of existing respiratory and cardiovascular disease. Together, SO_2 and NO_X are the major ingredients of acid rain. SO_2 also plays a significant role in the formation of fine particulate matter.

SO_2 levels are well within air quality standards and show a slow, continued improvement over time. This is mainly due to industry, businesses, and homes changing to fuels with lower sulfur content such as natural gas.

In 2018, the NEW and RIT sites were operating as the monitoring sites for SO_2 as seen in Figure 7.1.

The following graph, Figure 7.2, shows the trends for the one-hour SO_2 concentration for Philadelphia.

Figure 7.2 - SO_2 Trends for 99th Percentile Daily Maximum 1-Hour Average Concentration



Lead (Pb)

NAAQS:

- The maximum arithmetic rolling 3-month mean concentration for a 3-year period is less than or equal to 0.15 µg/m3 micrograms per cubic meter.

The processing of metals is the major source of lead emissions to the atmosphere. Lead does not travel over great distances in the air and so concentrations vary, with the highest levels near specific industrial sites.

Lead is a metal that is highly toxic when inhaled or ingested. Lead accumulates in the blood, bone, and soft tissue and may affect the kidneys, liver, nervous system and other organs. It also can cause learning difficulties in children.

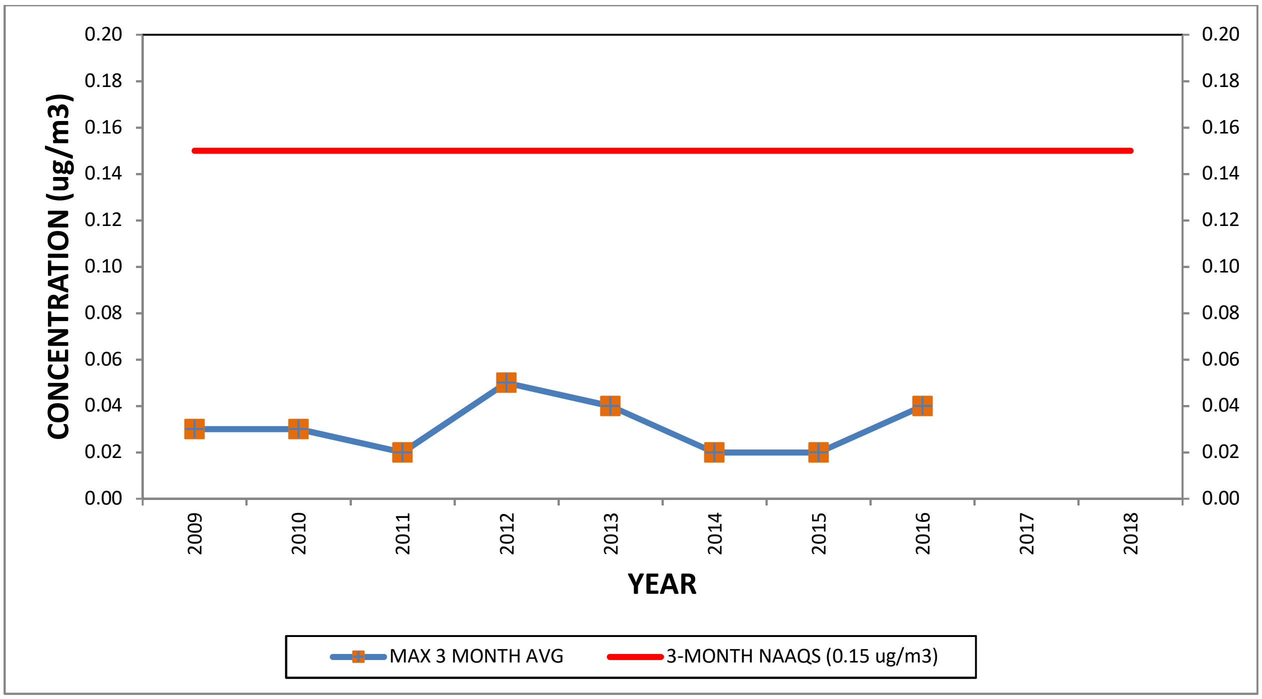
Ambient lead levels have been decreasing throughout the city due to the elimination of leaded gasoline and greater control of emissions from companies that produce or process lead compounds.

Prior to 1998, lead levels in certain parts of the city were once extremely high due to the concentration of particular industries in the areas near Castor and Delaware Avenues. The levels of lead in these areas have drastically improved, and are now comparable to the rest of the city.

On October 15, 2008, the EPA strengthened its regulation for lead. The standard was revised from the 1978 standard of 1.5 $\mu g/m^3$ to a level that is 10 times more stringent, 0.15 $\mu g/m^3$, with a different averaging time. For the previous standard, the averaging time used a quarterly average while the new standard uses a rolling 3-month average. The revision is based on more than 6000 studies performed since 1990 on the health effects of high lead concentrations in the bloodstream. The studies show that adverse effects from lead in the blood occur at a much lower level than previously thought. Figure 8.3 shows the trends for the 2008 lead standard.

As of January 1, 2017, Total Suspended Particulate Lead monitor was shutdown at NEW site. Philadelphia has no sources that emit 0.5 or more tons of Pb per year. On 4/28/17, EPA approved Philadelphia AMS' waiver of the requirement for a source oriented Lead-TSP monitor in Philadelphia effective 1/1/17.

Figure 8.1 - Lead Trends (Maximum) Rolling 3-Month Average



Particulate Matter (PM_{10}, $PM_{2.5}$)

Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. These particles come in a wide range of sizes and originate from stationary, mobile, and natural sources.

PM_{10} and $PM_{2.5}$ refer to small particulates that measure less than 10 micrometers (0.00001 meters) and 2.5 micrometers (0.0000025 meters) in diameter, respectively. In addition to health problems, particulate matter can cause reduced visibility, soiling, and damage to materials such as buildings. Particles of this size remain airborne for long periods of time and disperse in uniform concentrations across wide areas, crossing geographic boundaries.

In 1997, the EPA set a separate standard for $PM_{2.5}$. Particles in the $PM_{2.5}$ size range are able to travel deeply into the respiratory tract, reaching the lungs. Exposure to fine particles can cause short-term health effects such as eye, nose, throat and lung irritation, coughing, sneezing, runny nose and shortness of breath. Exposure to fine particles can also affect lung function and worsen medical conditions such as asthma and heart disease. Scientific studies have linked increases in daily $PM_{2.5}$ exposure with increased respiratory and cardiovascular hospital admissions, emergency department visits and deaths. Recent studies suggest that long term exposure to particulate matter may be associated with increased rates of bronchitis and reduced lung function.

Particles come in a wide variety of shapes and sizes, which affect their impacts on the environment and human health. Bigger particles, such as dust, are easier to see and can cause problems, but smaller particles are likely to be worse for our health.

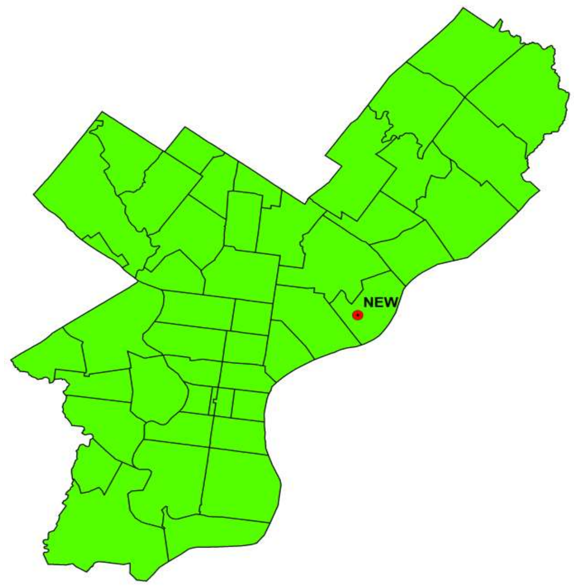
Fine particles are treated as though they are a single pollutant, but fine particles come from many different sources and are composed of thousands of different compounds. Fortunately, these compounds fall into a few dominant categories: sulfates, nitrates, ammonium compounds, soil, organic carbon compounds, and elemental carbon. Water is nearly always an important and variable part of PM, and sea salt is often significant near the coast. Given the complex composition of PM, it is no surprise that its chemistry is also complex. Particles may be dry or wet. When the wind blows hard enough, soil, silt, and sand can be lifted from the surface. Human activities such as mining, construction, plowing, and driving on unpaved roads also lift particles into the air. Soot, also referred to as black carbon or elemental carbon, is emitted directly by diesel engines and forest fires, among other sources. Most individual particles are likely mixtures of different substances, the products of growing by collisions with other particles and by taking on gases.

PM_{10}

NAAQS:

- 150 µg/m3 for a daily 24-hour average concentration not to be exceeded more than once per year on average over a 3-year period.

Figure 9.1 - PM_{10} Monitoring Map



Particulate matter levels have been decreasing due to regulations limiting the amount of emissions allowed and the change to cleaner fuels, for example, switching from oil to natural gas by industry, businesses and homes.

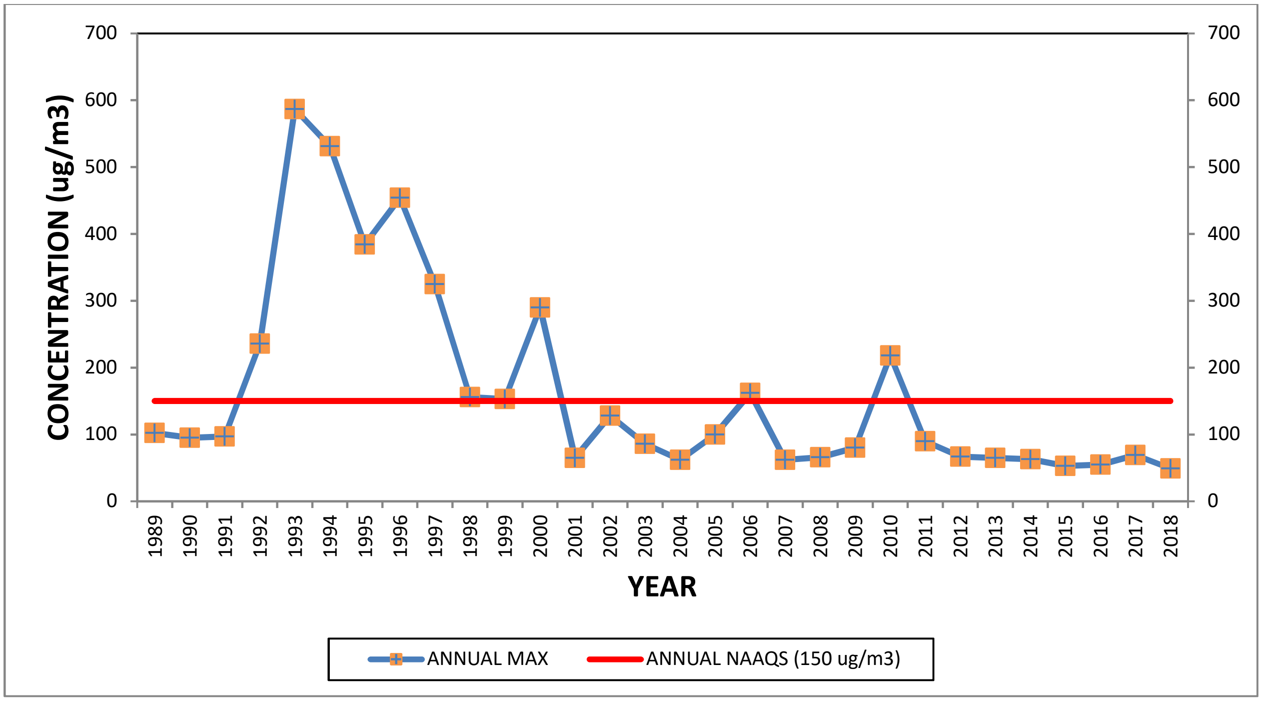
During the mid-1990s, particulate emissions from several sources in the area of Castor and Delaware Avenues caused extremely high-localized measurements and the levels were many times higher than those measured at other city locations. Specific actions to abate these sources have resulted in air quality that now meets the national standards and are now comparable to levels in the rest of the city.

The EPA revoked the annual standard for PM_{10} on December 17, 2006, due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution.

As seen in Figure 9.1, there is one PM_{10} monitoring site, NEW.

Figure 9.2 shows the trends for PM_{10} for the maximum 24-hour average concentration from all monitoring sites.

Figure 9.2 - PM_{10} Trends for the Highest 24-Hour Average Concentration for All Monitoring Sites

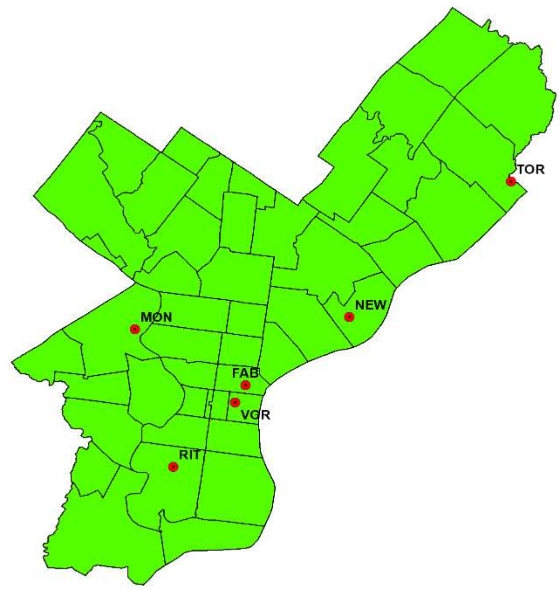


$PM_{2.5}$

NAAQS:

- The 3-year average of the annual arithmetic mean concentration is less than or equal to 12.0 µg/m3.
- The 3-year average of the 98th percentile 24-hour concentration is less than or equal to 35 µg/m3.

Figure 10.1 - $PM_{2.5}$ Monitoring Map



$PM_{2.5}$ consists of those particles that are less than 2.5 micrometers in diameter. They are also referred to as "fine" particles. Fine particles result from fuel combustion from motor vehicles, power generation, and industrial facilities, as well as from residential fireplaces and wood stoves. A significant amount of fine particles are also formed in the atmosphere by the transformation of gaseous emissions such as SO_2, NO_X, VOCs, and ammonia.

Fine particles can accumulate in the respiratory system and are associated with numerous health effects such as premature death, respiratory symptoms and disease, and decreased lung function. Sensitive groups that appear to be at the greatest risk for such effects include children, seniors, and individuals with cardiopulmonary disease or respiratory ailments such as asthma.

In 2018, there were six $PM_{2.5}$ monitoring sites in the network.

Figures 10.2 and 10.3 show the trends for the 24-hour concentration and the annual mean, respectively.

Figure 10.2 - $PM_{2.5}$ Trends for 98th Percentile 24-Hour Concentration

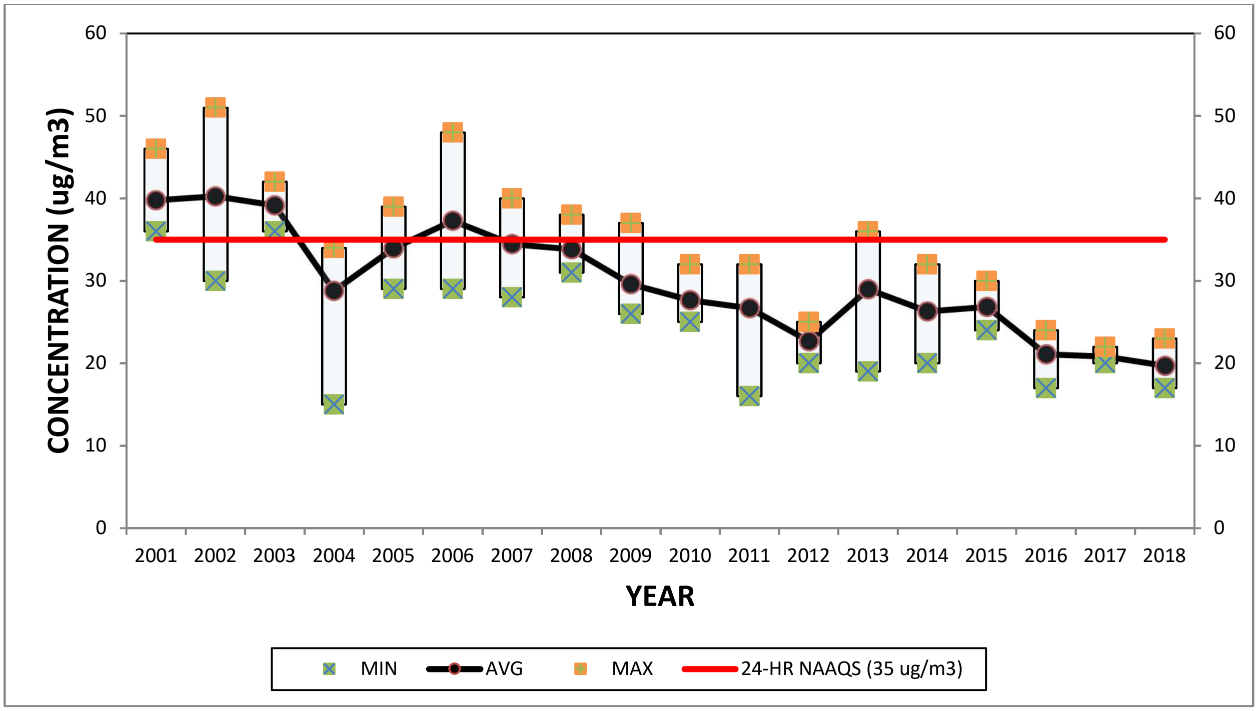
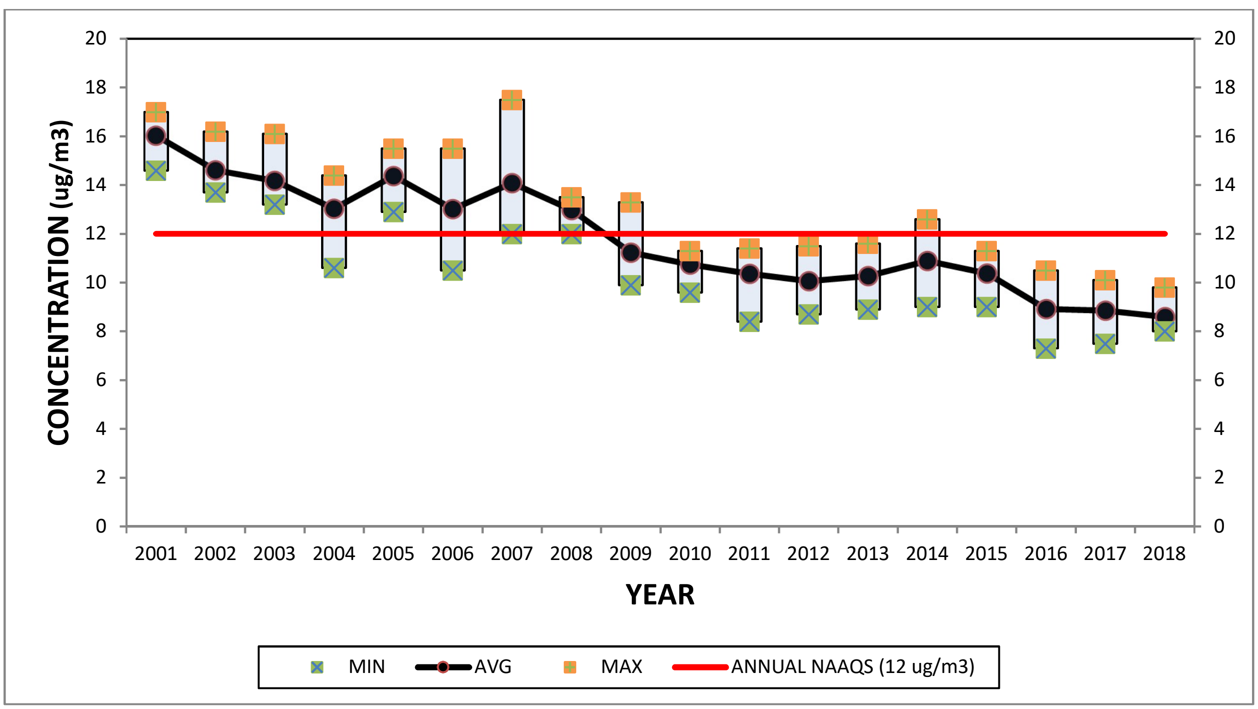


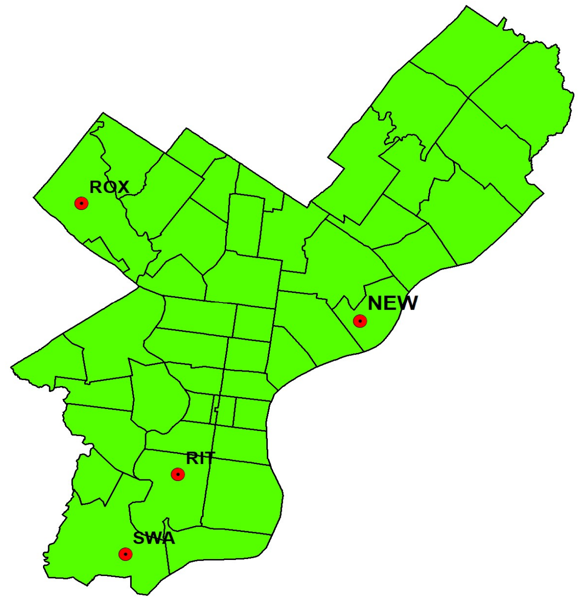
Figure 10.3 - $PM_{2.5}$ Trends for Annual Mean Concentration



Air Toxics

NAAQS:
- None

Figure 11 - Air Toxics Monitoring Map



Air toxics, also referred to as toxic air pollutants or hazardous air pollutants (HAPs), are substances that cause adverse health effects or environmental damage. The Federal Clean Air Act Amendments (CAAA) of 1990 list 187 pollutants or chemical groups as HAPs. Examples of air toxics include heavy metals (such as beryllium), organic chemicals (such as formaldehyde), polycyclic organic matter (POM, which are formed primarily by combustion), benzene (which is found in gasoline), pesticides, fine mineral fibers, and asbestos. HAPs are emitted from stationary sources (large industrial facilities), area sources (dry cleaners and household uses), as well as mobile sources (trucks and buses).

There is less information known about the health impact from the 187 HAPs than there are for criteria pollutants, and no national standards exist for them. However, a number of these pollutants are known or suspected to be carcinogenic, and there is no known “safe concentration.” The danger posed by toxics is often referred to in terms of risk. Risk is defined as the likelihood of a negative outcome from a certain level of a specific chemical, or the measure of a chance that health problems will occur. For example, many toxics cause cancer, while others cause respiratory problems, birth defects, neurological or immune response problems, and other health concerns. Toxics have varying degrees of danger, and some will cause harm with a very small amount of the substance while others require large amounts to have a negative effect. A cancer risk level of one in a million implies a likelihood that up to one person out of one million equally exposed people would contract cancer if exposed continuously (24 hours per day) to the specific concentration over 70 years (an assumed lifetime). This risk is calculated as additional to those cancer cases that would normally occur in an unexposed population of one million people.

AMS is helping to reduce HAPs in Philadelphia by enforcing Federal, State, and locally mandated programs that limit emissions from stationary and area sources. Many toxic emissions have been reduced by regulations designed to bring Philadelphia into compliance with the NAAQS for Ozone. In addition, Philadelphia enforces the National Emission Standards for Hazardous Air Pollutants (NESHAPs), a program designed to reduce emissions from existing major and area sources, as well as New Source Performance Standards (NSPS), which limit toxic emissions from new sources. In 2010, Air Management Regulation XIV – Control of Emissions from Dry Cleaning Facilities was promulgated. This regulation restricted the use of perchloroethylene (PERC) in dry cleaning facilities that share a common wall with businesses or residences. Since 2010, ambient concentrations of PERC have been decreasing.

Since diesel emissions are a significant but unquantified contributing factor in determining health risks from toxic emissions, AMS continues working to promote voluntary emissions reductions from diesel vehicles and to bring clean diesel technology to the Philadelphia area. In addition, AMS is currently working with other City departments to enforce Mayor's Executive Order 1-07 which requires all public works and demolition contracts to use clean diesel technology. This program is expected to significantly reduce particulate matter, hydrocarbons and carbon monoxide from diesel vehicles contracted by the City, resulting in $6,000,000 in annual health benefits.

As part of EPA's National Air Toxics Assessment (NATA) activities, 180 air pollutants were assessed for either lifetime cancer risk or non-cancer hazard due to inhalation. NATA is EPA's ongoing comprehensive evaluation of air toxics in the U.S. These activities include: expansion of air toxics monitoring, improving and periodically updating emission inventories, improving national- and local-scale modeling, continued research on health effects and exposures to both ambient and indoor air, and improvement of assessment tools.

The goal of NATA is to identify air toxics which are of greatest potential concern, in terms of contribution to population risk. The results are used to establish strategies, priorities, and programs to reduce air toxics emissions. In 2018, EPA released the results of the NATA for 2014.

The assessment for 2014 includes four steps:

1. Compile a national inventory of air toxics emissions from outdoor sources from emissions year 2014.
2. Estimating ambient concentrations of air toxics across the United States.
3. Estimating population exposures.
4. Characterize potential public health risks due to breathing air toxics (including both cancer and noncancer effects).

Nationwide, the results of the 2014 NATA can be summarized as follows:

- Nationwide, total emissions of air toxics are declining, and air quality monitoring data show that concentrations of many toxics in the air, such as benzene, also are trending downward.
- The 2014 NATA estimates that the nationwide average cancer risk from air toxics exposure is 30 in 1 million. About half of that risk comes from the formation of formaldehyde – produced when other pollutants chemically react in the air. This is known as secondary formation, and comes from emissions from industries, mobile sources, and natural sources. The other half of the nationwide cancer risk comes from pollution that is directly emitted to the air.

Specifically, the results of the 2014 NATA for Philadelphia County are summarized below:

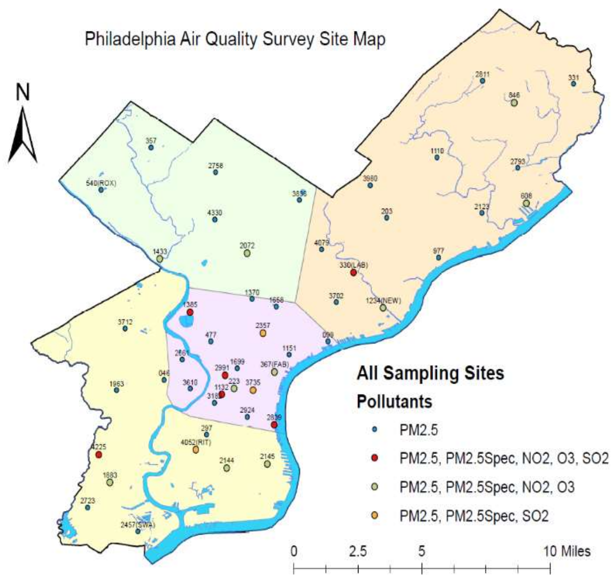
- Total cancer risk was 36.8 in 1 million.
- Secondary formation accounted for 39 percent of cancer risk and on-road mobile sources accounted for 20 percent.
- The pollutants contributing most to cancer risk were formaldehyde (47 percent), benzene (15 percent), and carbon tetrachloride (9 percent).

Addition information for the 2014 NATA can be found here: https://www.epa.gov/national-air-toxics-assessment/2014-nata-assessment-results

Philadelphia Air Quality Survey

NAAQS:
- None. Special purpose monitoring.

Figure 12 – PAQS Survey Map



In 2018, AMS began a new project called the Philadelphia Air Quality Survey (PAQS). This project aims to set up 50 street level, neighborhood-oriented air sampling sites throughout the City to sample the ambient air for $PM_{2.5}$, NO_2, SO_2, and O_3. The sites also contain meteorological sensors as well. PAQS captures the seasonal changes and neighborhood-to-neighborhood spatial variances in air quality. The data results may serve as a basis for future work, including: provide policy recommendations for reducing pollution from congested traffic, diesel vehicles and winter time fuel burning; analyze the relations between air quality and land use characteristics and build a land use regression model to predict air pollution levels in different neighborhoods; and study public health impact of air pollution in the City. Additional information regarding PAQS is provided in the latest version of the Air Monitoring Network Plan (https://www.phila.gov/documents/air-management-reports-and-documents/).

Appendix A: Glossary

1. **1-Hour Standard**: The maximum hourly average concentration of a pollutant in a calendar year not to exceed EPA's National Ambient Air Quality Standards codified at part 50 of 40 CFR (Code of Federal Regulations).

2. **24-Hour Standard**: The maximum 24-hour average concentration of a pollutant (averaged from hourly measurements or measured from midnight to midnight) in a calendar year not to exceed EPA's National Ambient Air Quality Standards codified at part 50 of 40 CFR (Code of Federal Regulations).

3. **75% Data Capture:** When 75 of every 100 possible data measurements are available for a given pollutant. This is the minimum amount of data required to satisfy data completeness.

4. **8-Hour Average:** The rolling average of eight hourly pollutant concentrations.

5. **Action Day**: When the Air Quality Index (AQI) is forecast to be Unhealthy for Sensitive Groups, Unhealthy, or greater, or Code Orange, Red, or greater.

6. **Air Quality Index (AQI)**: EPA's color-coded tool designed to inform the public about daily air pollution levels in their communities and what associated health effects might be a concern.

7. **Ambient Air:** The portion of the atmosphere, external to buildings, to which the general public has access.

8. **Annual Arithmetic Mean Concentration**: The weighted average of four quarterly calendar means.

9. **Annual Standard:** The maximum 365-day average concentration of a pollutant (averaged from daily measurements) in a calendar year not to exceed EPA's National Ambient Air Quality Standards codified at part 50 of 40 CFR (Code of Federal Regulations).

10. **Anthropogenic Volatile Organic Compounds (VOCs):** VOCs that come from human activities.

11. **Area Sources**: Sources that emit less than 10 tons annually of a single hazardous air pollutant or less than 25 tons annually of a combination of hazardous air pollutants. This can include groups of stationary sources (such as dry cleaners and gas stations).

12. **Asbestos:** A mineral fiber that has been used commonly in a variety of building construction materials for insulation and as a fire-retardant. When Asbestos is disturbed, it can release dust into the air. Inhalation can result in asbestosis, lung cancer, or mesothelioma.

13. **Assessment Tools:** The methods of gathering data, performance and understanding, checklists and analyzing scales for projects.

14. **Benzene:** A colorless liquid with a pleasant odor. It is used mainly in making other chemicals and plastics, as a solvent, and is found in trace amounts of gasoline.

15. **Benzo [a] pyrene (BAP):** Part of a class of chemicals called polycyclic aromatic hydrocarbons.

16. **Breakpoints:** Ranges or categories. These are pollutant concentration cut-offs for the Air Quality Index (AQI) to determine the Air Quality Category from Good to Unhealthy.

17. **Carbon Monoxide (CO)**: A colorless, odorless, and (at much higher levels) poisonous gas, formed when carbon in fuels is not burned completely. CO is a criteria pollutant – a substance for which EPA has set health-based standards.

18. **Clean Air Act Amendments (CAAA)**: The law that defines EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer, as amended, 42 U.S.C. §7401 et seq.

19. **Criteria Pollutants:** Substances for which EPA has set health-based standards. There are six "criteria pollutants" of air quality: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

20. **Design Value:** The calculated concentration according to the applicable appendix of part 50 of 40 CFR (Code of Federal Regulations) for the highest site in an attainment or nonattainment area.

21. **Emission Inventories**: A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community during a given time period.

22. **Environmental Protection Agency (EPA)**: A federal agency that was established to consolidate a variety of federal research, monitoring, standard-setting and enforcement activities to ensure environmental protection.

23. **Excess Lifetime Cancer Risk**: The additional or extra risk of developing cancer due to exposure to a toxic substance incurred over the lifetime of an individual (over 70 years).

24. **Federal equivalent method (FEM):** A method for measuring the concentration of an air pollutant in the ambient air that has been designated as an equivalent method in accordance with 40 CFR part 53; it does not include a method for which an equivalent method designation has been canceled in accordance with 40 CFR part 53.11 or 40 CFR part 53.16.

25. **Federal reference method (FRM)**: A method of sampling and analyzing the ambient air for an air pollutant that is specified as a reference method in an appendix to 40 CFR part 50, or a method that has been designated as a reference method in accordance with this part; it does not include a method for which a reference method designation has been canceled in accordance with 40 CFR part 53.11 or 40 CFR part 53.16.

26. **Fine Mineral Fibers**: Glasswool, rockwool, slagwool, glass filaments, and ceramic fibers.

27. **Gaseous Emissions:** Pollutant emissions in gas form.

28. **Ground-level Ozone**: Ozone at ground-level created by a chemical reaction between oxides of nitrogen (NO_x) and Volatile Organic Compounds (VOC) in the presence of sunlight, also known as smog or “bad” ozone.

29. **Hazardous Air Pollutants (HAPs):** A list of 187 pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. These are codified at Section 112 of the Clean Air Act.

30. **Heavy Metals**: Individual metals and metal compounds that negatively affect people's health. In very small amounts, many of these metals are necessary to support life. However, in larger amounts, they become toxic.

31. **Highest 2nd Maximum 24-Hour Concentration:** The second-highest daily maximum 24-hour average concentration of a pollutant (averaged from hourly measurements or measured from midnight to midnight) in a calendar year not to exceed EPA’s National Ambient Air Quality Standards codified at part 50 of 40 CFR (Code of Federal Regulations).

32. **Highest 4th Daily Maximum 8-Hour Concentration:** The fourth highest daily value of a pollutant, calculated rolling 8-hour average, in a calendar year.

33. **Highway Vehicle Sources:** Emissions that originate from a highway vehicle, any self-propelled vehicle, or any trailer or semi-trailer, designed to perform a function of transporting a load over highways, whether or not also designed to perform other functions.

34. **Indoor Air**: Air within a building occupied for at least one hour by people of varying states of health.

35. **Industrial Grade Fuel Oils:** Industrial techniques such as addition of heat and/or chemicals, the evaporation of water content, filtration, sedimentation, centrifuge separation, and vacuum distillation applied to used fuel oil, which is a fraction obtained from petroleum distillation, either as a distillate or a residue, to prepare it for blending with virgin oil.

36. **Lead:** A metal found naturally in the environment as well as in manufactured products. Lead is a criteria pollutant – a substance for which EPA has set health-based standards.

37. **Lifetime Cancer Risk:** The risk of developing cancer due to exposure to a toxic substance incurred over the lifetime of an individual.

38. **Major Source:** A stationary facility that emits a regulated pollutant in an amount exceeding the threshold level depending on the location of the facility and attainment with regard to air quality status. In Philadelphia these levels are: 25 tons of Volatile Organic Compounds (VOC) or Nitrogen Oxides (NO_x) per year, 100 tons of Carbon Monoxide (CO), Sulfur Oxides (SO_x), or Particulate Matter

less than 10 microns (PM_{10}) per year, 10 tons of an individual Hazardous Air Pollutant (HAP) per year, or 25 tons of all HAPs combined per year.

39. **Meteorology (MET)**: Winds, air temperature, atmospheric stability, mixed layer heights, etc.

40. **Microns:** One millionth (10^{-6}) of a meter.

41. **Mobile Sources:** A wide variety of vehicles, engines, and equipment that generate air pollution and that move, or can be moved, from place to place.

42. **Modeling:** The mathematical simulation of how air pollutants disperse in the ambient atmosphere. It is performed with computer programs that solve the mathematical equations and algorithms which simulate the pollutant dispersion. The dispersion models are used to estimate or to predict the downwind concentration of air pollutants or toxins emitted from sources such as industrial plants, vehicular traffic or accidental chemical releases.

43. **National Ambient Air Quality Standards (NAAQS):** Those primary and secondary ambient air quality standards which are promulgated by the Administrator of the United States Environmental Protection Agency.

44. **National Emissions Standards for Hazardous Air Pollutants (NESHAPs):** Emissions standards set by the EPA for an air pollutant not covered by National Ambient Air Quality Standards (NAAQS) that may cause an increase in fatalities or in serious, irreversible, or incapacitating illness.

45. **New Source Performance Standards (NSPS):** Technology based standards set by the EPA which apply to specific categories of stationary sources.

46. **Nitric Oxide (NO):** Precursor of ozone; nitric oxide is usually emitted from combustion processes. Nitric oxide is converted to nitrogen dioxide (NO_2) in the atmosphere, and then becomes involved in the photochemical processes and/or particulate formation.

47. **Nitrogen Dioxide (NO_2):** A light brown gas that is an important component of urban haze. The compound is created primarily from fuel combustion in motor vehicles, utilities, and industrial sources.

48. **Nitrogen Oxides:** A general term pertaining to compounds of nitric oxide (NO), nitrogen dioxide (NO_2) and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition.

49. **Non-Cancer Hazard:** Chemicals that cause non-cancer health effects, which may include birth defects, organ damage, morbidity, and death.

50. **Non-Road Engine Sources:** Sources emitted by internal combustion engines (including the fuel system) that is not used in a motor vehicle or a vehicle used solely for competition.

51. **Non-Road Sources:** A wide variety of sources including industrial, lawn and garden, construction, recreational, and farm equipment.

52. **On-Road Sources:** Sources that emit pollution on road. On-road vehicles include cars, vans, trucks, motorcycles, and buses.

53. **Organic Chemicals:** Chemical compounds of carbon excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbonates, metallic carbides and ammonium carbonates.

54. **Ozone (O_3):** A highly reactive gas composed of three oxygen atoms. Ozone occurs both in the earth's upper atmosphere and at ground level.

55. **Particulate Matter (PM):** A mixture of solid particles and liquid droplets found in air. These solid and liquid particles come in a wide range of sizes.

56. **Parts Per Billion (ppb):** Parts per billion by volume in air or by weight in water.

57. **Parts Per Million (ppm):** Parts per million by volume in air or by weight in water.

58. **Permit:** A document giving permission to do something; a license.

59. **Pesticides:** Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.

60. **Photochemical Assessment Monitoring Stations (PAMS):** Enhanced ambient air monitoring for volatile organic ozone precursors via Gas Chromatograph (GC-FID) analysis.

61. **Point Sources:** A single identifiable localized source.

62. **Polycyclic Organic Matter (POM):** A broad class of compounds that includes the polycyclic aromatic hydrocarbon compounds (PAHs), of which benzo[a]pyrene is a member.

63. **Primary (health-based) National Ambient Air Quality Standards (NAAQS):** Limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly.

64. **Quarterly Average Concentration:** Average concentration for each calendar quarter.

65. **Quartz Filter:** High-purity microfibers for collecting particulates.

66. **Respiratory and Cardiovascular Disease:** Disease affecting the respiratory system, the heart, or blood vessels.

67. **Rolling 3-Month Average Concentration:** Average pollutant concentration in a 3-month rolling fashion.

68. **Sensitive Groups:** People with heart and lung disease, older adults and children that are at a greater risk from exposure to a pollutant.

69. **Size Selective Sampler (SSI):** PM_{10} Quartz Filter Measurement.

70. **Smog:** Air pollution, characterized by low visibility and an assortment of human health problems. Smog occurs when emissions from industry, motor vehicles, incinerators, open burning and other sources accumulate under certain climatic conditions.

71. **Speciated $PM_{2.5}$**: Fine particulate components including elements, radicals, elemental carbon, and organic carbon.

72. **State Implementation Plan (SIP):** A federally approved and enforceable plan by which each state identifies how it will attain and/or maintain the health-related primary and welfare-related secondary NAAQS.

73. **Stationary Sources:** Any building, structure, facility, or installation which is fixed in a certain place or position which emits or may emit any air contaminants.

74. **Sulfur Content:** The quantity of sulfur in a substance to meet EPA requirements in a substance.

75. **Sulfur Dioxide (SO_2):** A colorless toxic gas that occurs in the gases from volcanoes; used in many manufacturing processes and present in industrial emissions; causes acid rain.

76. **Total Suspended Particles (TSP)**: Particles of solid or liquid matter such as soot, dust, aerosols, fumes, and mist – up to approximately 30 micrometers in size.

77. **Toxics:** Substances that cause adverse health effects or environmental damage.

78. **Ultraviolet (UV) Light:** Electromagnetic radiation with a wavelength shorter than that of visible light, but longer than x-rays, in the range 10 nm to 400 nm, and energies from 3 eV to 124 eV.

79. **Unit Risk Factors (URFs):** Toxicity values used for carcinogens that estimate the increased risk of getting cancer that is associated with the concentration of the chemical in air that you are breathing. A cancer risk of less than one in a million is usually considered to be negligible.

80. **Vapor Recovery**: The process of recovering the vapors of gasoline or other fuels, so that they do not escape into the atmosphere.

81. **Volatile Organic Compounds (VOCs):** Any compound of carbon, other than those organic compounds that the Administrator has excluded in 40 CFR (Code of Federal Regulations) Part 51, Section 51.100.

82. **Weighted Annual Average:** A yearly average in which each quantity to be averaged is assigned a weight. These weightings determine the relative

importance of each quantity on the average. Weightings are the equivalent of having that many like items with the same value involved in the average.

83. **μg/m^3:** The concentration of an air pollutant in one-millionth of a gram per cubic meter air.

Appendix B: Consequences of Air Pollution

Health Effects
Air pollution contributes to health problems such as asthma, lung disease, and respiratory tract infections. It also can aggravate cardiovascular disease. This concern is greatest in sensitive populations, especially those with lung disorders, young children, and the elderly.

Acid Rain
Acid rain occurs when sulfur dioxide and nitrogen oxides are released into the air, and combine with rain, snow or fog. Acid rain's effects include harm to fish, plants, animals, and crops, and eroding building surfaces and national monuments. The effects of acid rain can be offset by reducing the amount of sulfur dioxide released into the air.

Visibility
Haze is caused when particles and gases in the atmosphere scatter or absorb light. The same particles that affect our health also limit our ability to see our surroundings. This affects our quality of living and the beauty of the City of Philadelphia by obscuring many of the national treasures and landmarks that we value.

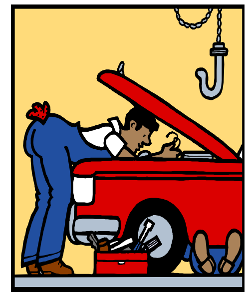
Climate Change
Global warming refers to an increase in the Earth's temperature, which has the effect of causing climate change. The emission of certain pollutants into the atmosphere which absorb heat energy have sped this process along. Some of the expected long-term changes are a rise in sea level, damage to coastal areas, a variation in precipitation, and other local climate changes. These changes have the potential for altering forests, crop yields, wild life, and water supplies. In 2009, the Mayor’s Office of Sustainability, was charged with improving energy efficiency and reducing operating costs in City-owned facilities.

Appendix C: What AMS is Doing to Reduce Air Pollution

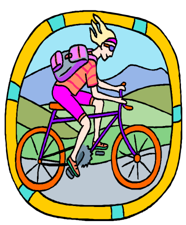
- AMS monitors the air for pollutants at many stations throughout the City.
- AMS requires operators of facilities that install or modify sources of air pollution to obtain an air permit from AMS prior to installation. A permit is a list of requirements that includes emission limits and work practice standards as well as testing, monitoring, recordkeeping, and reporting requirements. Sometimes AMS will perform modeling as part of the permit review to assess the impact of new equipment on air quality. Permits are available to the public. You may contact AMS for information on access to these documents.
- AMS inventories stationary sources of emissions such as factories and other businesses to obtain a current, comprehensive listing of air pollutant emissions for a specific time interval.
- AMS inspects facilities that may cause air pollution or create an air pollution nuisance, meets with and assists facility personnel to achieve compliance, investigates noise and vibration nuisance sources, and responds to citizen complaints and requests for information.
- AMS issues Notices of Violation (NOVs) for sources that are not in compliance, assesses and collects penalties in response to NOVs, initiates orders to abate sources of air pollution, negotiates compliance schedules and agreements to achieve compliance, and refers cases to the Law Department for additional legal remedies including injunctive actions, court orders and consent decrees.
- AMS provides information on economic incentives for cleaning up pollution.
- AMS conducts industry workshops on permitting and emission inventory submittals, provides assistance and training to owners and operators of auto body shops on reducing emissions, and trains asbestos contractors on workplace standards. AMS also provides outreach to educate the public about air quality. Staff members attend community fairs, speak at meetings, and visit schools throughout the City.

Appendix D: Protecting Yourself and the Environment

If you care about your health, and the health of your neighbors and loved ones, you should also care about the health of the environment. What you do everyday can have a significant impact on the air.



- Avoid overfilling, or "topping off" your car's gas tank.
- Keep your car's engine tuned up and maintain proper tire pressure.
- When you need to drive, plan ahead so you don't make extra trips.
- Avoid high speeds - fuel efficiency decreases significantly at speeds over 55 mph.
- Drive smoothly to save gas and reduce vehicle emissions.
- Avoid lengthy idling - idling wastes gas.
- Don't rev the engine - this also wastes gas.
- Minimize drag - heavy tow loads, and even driving with the windows open, can create "drag'" which reduces fuel efficiency.
- Keep tires properly inflated - under inflated tires decrease gas mileage and shorten tire life. Check the tire pressure in all four tires every two weeks.
- Avoid rough roads and potholes. They are hard on tire and wheel alignment and can also reduce fuel efficiency.



- Use alternative forms of transportation whenever possible, such as carpooling, biking, mass transit, or walking.
- Avoid oil-based paints. Latex paints are much friendlier to the environment, and usually work just as well.

- Conserve energy.
- Don't overheat or overcool your home.
- Turn off lights and appliances when not in use.
- Wash clothes and dishes in full loads.
- Choose Energy Star appliances whenever possible.
- Recycle – Glass, Metals, and Plastics, and other items.
- Report air pollution violations when you become aware of them.
- Take part/respond to hearings/public notices for cleaning up air pollution.
- Learn about local air quality efforts and issues and consider becoming involved in a group that addresses these issues.
- Let your government representatives know that you care about the quality of our City's air.
- Consider switching to wind power or using green building technologies like high-efficiency lighting.

Appendix E: Frequently Asked Questions About Air Quality

What is a criteria pollutant?

A criteria pollutant is one of the six pollutants that are regulated under standards provided by the US Environmental Protection Agency (EPA) to protect the public health and welfare. The criteria pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

Where and how is air quality measured?

The city's air is sampled at stations located throughout Philadelphia. Every minute, monitoring instruments at these stations record the air quality. The data is uploaded to the department's computer system at the AMS Laboratory located at 1501 E. Lycoming Street every 15 minutes. This is called a "real time" system, because the measurements show pollution levels as they are occurring, not after the fact. It allows AMS to evaluate air quality almost continuously.

What does nonattainment mean?

Nonattainment is a designation given to an area that persistently exceeds the ambient air quality standards set for a criteria pollutant. The final designation for nonattainment is given by the EPA after it reviews the recommendations of the State’s governor and looks at air quality data for an area. A designation of nonattainment obligates the state or local air agency to identify the causes of pollution, create and implement a strategy that will improve air quality to the point that it meets the standard.

What is an air toxic?

Air toxics or toxic air pollutants, commonly referred to as Hazardous Air Pollutants (HAPs), are air pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. The Federal Clean Air Act Amendments of 1990 list 187 pollutants or chemical groups as HAPs.

How do I report an air pollution problem?

For Philadelphia, call 215-685-7580 during AMS office hours from 8 AM to 4:30 PM on weekdays. At all other times, call 311. By calling immediately at the time of the problem, AMS will have a better chance of observing the problem directly and developing an appropriate and timely response.

What information should I report for air pollution problems?

The date, time, location, responsible party (if known) and a description of the problem is requested. A callback name and telephone number is helpful in the event that we are unable to identify the problem. Anonymous calls are also accepted.

What do I do if there's carbon monoxide in my house?

Seek fresh air and dial 911 for rescue if someone is unconscious or needs help. Otherwise, contact 311. The operator will assist in contacting AMS and other responders as needed.

What should I do if there is unhealthy air quality?

Consider limiting strenuous activity outdoors, especially if you are a member of a sensitive group (the elderly, children, and those with heart or lung problems). Limit the use of your car during daylight hours, and avoid using lawn or garden equipment that requires gasoline.

Why is the ozone layer in the atmosphere considered good, and ozone at ground level considered a health risk?

High in the atmosphere, ozone provides a protective covering for the earth from the sun's ultraviolet (UV) rays, which are harmful. However, ozone low to the ground is formed when certain chemicals and sunlight interact, and is the chief ingredient in smog. It is a strong irritant to the upper respiratory system and eyes, and can cause damage to crops.

Has the air quality in Philadelphia been improving over the years?

Overall Philadelphia's air quality is good and improving. Since 1979, while fluctuating from year to year, the trend of unhealthy and very unhealthy days has steadily declined, especially since 1988. Currently, the Philadelphia region is in attainment for all pollutants, with the exception of ozone.

How was Philadelphia's air quality in 2018?

In 2018, Philadelphia's air quality was rated "good" on 217 days, "moderate" on 138 days, and "unhealthy" on 10 days. These ratings are based on the Air Quality Index (AQI), a system used by cities throughout the country to describe the quality of the air.

How do I find out more about the air quality in Philadelphia?

The Air Quality Index (AQI) tells you how clean the air is and whether it will affect your health. Philadelphia's Real-Time Air Quality Website is located at https://www.phila.gov/services/mental-physical-health/environmental-health-hazards/air-quality/ and provides the most up-to-date information about the air quality in Philadelphia. It lets you know what you should do to protect your health if the air quality is unhealthy. To obtain general air quality information for Philadelphia, arrange for a school or group based presentation or to request a speaker or information booth for a health or environmental fair, contact Air Management Services at 215-685-7586.

Appendix F: Websites

www.aafa.org – Asthma and Allergy Foundation of America.
www.airnow.gov – The AQI (Air Quality Index) tells you how clean the air is and whether it will affect your health. Through AIRNow, EPA, NOAA, NPS, state, and local agencies work together to report current and forecast conditions for ozone and particle pollution.
www.airqualitypartnership.org – Ground level ozone and particle pollution forecasts.
www.atsdr.cdc.gov – Agency for Toxic Substances and Disease Registry: public health statements on specific toxics and the effects of exposure.
www.cleanair.org – Clean Air Council.
www.delawarevalley.enviroflash.info/about.cfm – Sign up for air quality forecasts.
www.depweb.state.pa.us – Pennsylvania Department of Environmental Protection.
www.dieselforum.org – Diesel Technology Forum.
www.dvgbc.org – Delaware Valley Green Building Council.
www.ecasavesenergy.org – Energy Coordinating Agency.
www.epa.gov – U.S. Environmental Protection Agency.
www.epa.gov/outdoor-air-quality-data – EPA's AQS (Air Quality System) database for air monitoring data.
www.epa.gov/echo – EPA's ECHO (Enforcement & Compliance History Online) database for compliance inspections conducted by EPA or state/local government, violations, enforcement actions, and penalties assessments in response to environmental law violations.
www.howstuffworks.com – For simple to read answers to a wide variety of science questions, including air pollution, acid rain, and ozone.
www.ipcc.ch – Intergovernmental Panel on Climate Change.
www.lungusa.org - American Lung Association website: Information on lung health, air pollution, and related matters.
www.pennfuture.org – For Pennsylvanians to breathe easier.
www.phila.gov/departments/department-of-public-health/about-us/divisions/ – Philadelphia Department of Public Health, Air Management Services.
www.phila.gov/services/mental-physical-health/environmental-health-hazards/air-quality/ – Philadelphia's Air Quality Website, provides the most up-to-date information about the air quality in Philadelphia and lets you know what you should do to protect your health if the air quality is unhealthy.
www.scorecard.org – Detailed information on toxics.

Appendix G: Air Quality Data Tables[2]

[2] All data (including exceptional events data) in this appendix downloaded on 8/1/19 from EPA's AirData website (https://www.epa.gov/outdoor-air-quality-data/monitor-values-report).

Table 2 – Ozone 4th Highest Daily Maximum 8-Hour Concentrations (ppm)

	AQS SITE ID - POC												
Year	**421010004-1**	**421010004-2**	**421010014-1**	**421010019-1**	**421010021-1**	**421010023-1**	**421010024-1**	**421010026-1**	**421010027-1**	**421010029-1**	**421010048-1**	**421010136-1**	**421011002-1**
1980	0.032		0.113	0.037	0.032	0.062	0.128	0.025	0.026	0.028			
1981			0.1				0.108						
1982			0.111			0.087	0.103						
1983			0.12			0.102	0.121						
1984			0.106			0.093	0.108						
1985			0.111			0.083	0.116						
1986			0.103			0.08	0.105						
1987			0.104			0.085	0.118						
1988			0.13			0.088	0.128						
1989			0.085			0.097	0.077						
1990			0.097			0.097	0.101						
1991			0.106			0.095	0.112						
1992			0.087			0.076	0.091						
1993	0.086		0.092			0.09	0.097					0.103	
1994	0.08		0.095			0.07	0.092					0.085	
1995	0.091		0.096				0.113					0.092	
1996	0.087		0.093				0.092					0.072	
1997	0.067		0.096				0.101					0.074	
1998	0.077		0.095				0.093					0.088	
1999	0.073		0.081				0.06					0.098	
2000	0.067		0.086				0.089					0.082	
2001	0.074		0.097				0.097					0.086	
2002	0.082		0.098				0.11					0.094	
2003	0.069		0.084				0.086					0.074	
2004	0.057		0.077				0.091					0.073	
2005	0.066		0.083				0.094					0.068	
2006	0.066		0.076				0.085					0.081	
2007	0.073		0.081				0.095					0.082	
2008	0.062						0.087						
2009	0.059						0.072						
2010	0.077						0.088						
2011	0.07						0.089						0.088
2012	0.065						0.085						0.083
2013	0.047						0.068				0.036		0.071
2014	0.058						0.072				0.068		
2015	0.057						0.079				0.078		
2016	0.069						0.08				0.076		
2017	0.042						0.076				0.076		
2018		0.071					0.079				0.076		

Table 3 – Carbon Monoxide 2nd Highest 8-Hour Average Concentrations (ppm)

	AQS SITE ID - POC																		
Year	421010004-1	421010004-2	421010014-1	421010019-1	421010021-1	421010024-1	421010026-1	421010026-2	421010027-1	421010029-1	421010029-2	421010045-1	421010046-1	421010047-1	421010048-1	421010051-1	421010075-1	421010076-1	421011002-1
1980	7.1	4.6		4.9	6.8	5.5		5.3	5.8		5	8.2							
1981	9.9		3.3				7.4		9.3	9.4		9.5	7.6						
1982	9.9		3.9						11.9	7		7.9	7.6	7.3					
1983	6.6								10.6	6.1		6.1	5.6	5.6					
1984	9.5								10	6.3		7.8	6.6	6.2					
1985	6.8								7.6	5.1		6.3	4.9	5.8					
1986	6.3								7.9	5.3			5.3	6.3					
1987	7.8								10	7.3			5.3	5.4		8.7			
1988	5.9								6.3	4.9			3.9	4.3		6.9			
1989	11.6								6.4	6.9				6.9		9.5			
1990	6.8								6.4	4.7				5.4		6.1			
1991	5.6								7.1	4.4				4.3		5.1			
1992	6.4								6.8	5				4.1		5.4			
1993	6.6								4.6	5.6				5		5.4			
1994	8.3									5.1				5.4		5.9			
1995	4.5								4.8	4.1				3.9		5.6			
1996	5.6								5.4	4.5				3.6		5.6			
1997	5.3								5	3.3				3.1		3.6			
1998	4.6								4.9	3.2				3.3		3.8			
1999	4.9								4.9	4.4				3.3		4.2			
2000	3.3								4	3				3					
2001	4								4.7	2.9				2.5					
2002	2.9								2.9	2				1.9					
2003	2.4								3.9	2.2				2					
2004	3.1								3.4	2.5				2.7					
2005	2.1								3.4	0.8				2.1					
2006	2.3								3.2					1.4					
2007	2.6								3.2					5.5					
2008	1.5													0.7					
2009	2																		
2010	1.8																		
2011	1.7																		1.2
2012	1.5																		1.5
2013	1.7														1.1				1.3
2014	1.3														1.3		1.4		
2015	1.6														1.5		1.6		
2016	1.9														1.7		1.6		
2017	0.9														1.4		1.2	2.6	
2018															1		1.3	1.1	

Table 4 – Carbon Monoxide Highest 1-Hour Average Concentrations (ppm)

	AQS SITE ID - POC																		
Year	421010004-1	421010004-2	421010014-1	421010019-1	421010021-1	421010024-1	421010026-1	421010026-2	421010027-1	421010029-1	421010029-2	421010045-1	421010046-1	421010047-1	421010048-1	421010051-1	421010075-1	421010076-1	421011002-1
1980	14	8		7	11	8		11	15		10	16							
1981	14		6				12		16	15		16	12						
1982	18		12						23	14		15	13	19					
1983	10								19	11		11	9	8					
1984	17								17	18		18	12	12					
1985	12								16	11		10	8	9					
1986	10								12	13			9	20					
1987	12								15	13			8	9		13			
1988	9								12	8			6	9		11			
1989	18								11	12				11		16			
1990	10								11	8				9		14			
1991	10								13	9				9		9			
1992	9								10	8				8		10			
1993	9								9	10				8		9			
1994	14									11				10		10			
1995	8								7	8				9		11			
1996	10								10	8				6		14			
1997	10								10	6.4				4.9		6.4			
1998	7.6								8.9	5.8				5.8		5.6			
1999	7.7								6.9	6				5.8		7			
2000	6.5								6.5	4.3				4.7					
2001	5.7								8	6.4				5					
2002	5.4								4.5	3.5				3.5					
2003	3.7								6	3.8				3.2					
2004	4.6								5.5	3.7				3.7					
2005	3.8								6.5	1.3				12.3					
2006	4.4								8.6					2.2					
2007	3.8								4.2					5.6					
2008	3.7													1.3					
2009	3.6																		
2010	3.1																		
2011	2.6																		2.2
2012	2.7																		2.1
2013	2.4														2.1				1.6
2014	2														1.8		2		
2015	2.1														2.5		1.9		
2016	3.6														2.6		2.2		
2017	1.4														2.3		1.9	4.3	
2018															1.4		1.9	1.5	

Table 5 – Nitrogen Dioxide Annual Average Concentrations (ppb)

	AQS SITE ID - POC									
Year	421010004-3	421010022-1	421010023-2	421010024-1	421010026-2	421010027-1	421010029-2	421010047-1	421010075-1	421010076-1
1980	40.89			25.02	46.18	45.82	36.19			
1981	37.4	34.24		24.32	46.12		36.19			
1982	33.05	37.1		26.62			39.23	37.64		
1983	38.15	41.34					39.7	37.87		
1984	38.1	35.82					37.34	40.16		
1985	33.71	31.67					34.34	36.21		
1986	33.28		15.32				36.34	35.67		
1987	32.12						39.28	42.55		
1988	31.06						31.93	39.41		
1989	29.11						32.86	39.74		
1990	28.14						31.91	35.19		
1991	28.35						32.59	33.55		
1992	25.82						32.55	34.93		
1993	24.06						31.22	34.51		
1994	24.01						31.06	36.56		
1995	27.73						31.01	31.81		
1996	29.34						33.35	33.92		
1997	27.99						32.44	31.76		
1998	29.47						33.37	34		
1999	26.99						30.23	31.75		
2000	25.66						27.94	28.69		
2001	25.59						28.32	29.95		
2002	24.09						28.1	29.48		
2003	23.97						24.69	25.23		
2004	22.73						24.69	25.58		
2005	21.57						26.11	26.29		
2006	20.72							22.81		
2007	20.35							22.8		
2008	19.6							20.03		
2009	18.25							19.59		
2010	17.66							22.61		
2011	20.12							19.56		
2012	17.91							17.6		
2013	16.18							17.17		
2014	17.45							18.31	15.51	
2015	18.15							19.07	14.69	11.32
2016	15.73								13.55	11.28
2017	19.55								11.35	9.36
2018									10.69	10.76

Table 6 – Nitrogen Dioxide 98th Percentile Daily Maximum 1-Hour Concentrations (ppb)

	AQS SITE ID - POC									
Year	421010004-3	421010022-1	421010023-2	421010024-1	421010026-2	421010027-1	421010029-2	421010047-1	421010075-1	421010076-1
1980	130			90	120	130	100			
1981	110	140		90	130		110			
1982	110	120		100			130	120		
1983	140	140					140	110		
1984	120	100					100	120		
1985	100	110					110	90		
1986	90		40				110	90		
1987	90						160	110		
1988	100						90	100		
1989	100						100	120		
1990	100						90	100		
1991	100						80	100		
1992	80						100	100		
1993	70						80	80		
1994	80						100	110		
1995	80						80	100		
1996	70						80	80		
1997	72						79	79		
1998	80						87	81		
1999	68						81	72		
2000	73						72	73		
2001	72						77	75		
2002	61						70	69		
2003	62						63	60		
2004	64						59	61		
2005	64						37	68		
2006	74							60		
2007	62							64		
2008	57							53		
2009	56							56		
2010	62							56		
2011	76							64		
2012	56							52		
2013	52							50		
2014	59							57	51	
2015	63							56	49	39
2016	58								49	43
2017	60								45	38
2018									37	43

Table 7 – Sulfur Dioxide 99th Percentile Daily Maximum 1-Hour Average Concentrations (ppb)

	AQS SITE ID - POC																					
Year	421010004-4	421010004-5	421010014-1	421010019-1	421010020-1	421010021-1	421010022-1	421010022-2	421010023-2	421010023-3	421010024-1	421010026-2	421010026-3	421010027-1	421010029-2	421010029-3	421010047-1	421010048-1	421010048-2	421010055-1	421010136-1	421011002-1
1980	160		120	150	120	90	300	180	160	140	110	170	110	150	170							
1981	140	120					270		100				140	130	170							
1982	120						130		100					120	160		150					
1983	90						130		80		80			80	150	100	100					
1984	120						180		90		100			130	140		120					
1985	100						100		70		70			100	90		120					
1986	80						110		80		60			100	90		100					
1987	90						150		80		80			90	90		80					
1988	100						130		110		90			110	130		130					
1989	80						100		80		60			80	100		120					
1990	90						110		90		80			100	110		140					
1991	70						100		90		60			70	100		90					
1992	80						100		60		60			80	110		80					
1993	80						110		60		70			60	90		80	230			80	
1994	80						90		80		60				100		90	330			90	
1995	60						80				50			50	60		60	180			40	
1996	60						100				50			60	70		90	330			50	
1997	54						87				56			47	65		54	377			52	
1998	53						53				48			48	55		52	43			50	
1999	58						73				37			51	54		84	53			60	
2000	44						56								60						45	
2001	48						60								67						67	
2002	49														58						53	
2003	52														63						53	
2004	47														56					39	51	
2005	51														55					42	56	
2006	40																			43	39	
2007	38																			35	50	
2008	33																			32		
2009	37																			32		
2010	18																			25		
2011	13																			15		8
2012	7																			14		8
2013	8																		15	9		5
2014	11																		9	10		
2015																			9	10		
2016																			19	8		
2017																			10	10		
2018																			14	6		

Table 8 – Lead (Maximum) Rolling 3-Month Averages (µg/m^3)

	AQS SITE ID - POC									
Year	**421010004-5**	**421010014-1**	**421010047-1**	**421010048-1**	**421010055-1**	**421010063-1**	**421010076-1**	**421010136-1**	**421010449-1**	**421011002-1**
2009									0.03	
2010									0.03	
2011									0.02	0.02
2012										0.05
2013				0.02						0.04
2014				0.02						
2015				0.02						
2016				0.04						
2017										
2018										

Table 9 – PM_{10} Highest 24-Hour Average Concentrations ($\mu g/m^3$)

	AQS SITE ID - POC													
Year	421010003-1	421010004-1	421010004-2	421010037-1	421010038-1	421010047-1	421010048-1	421010049-1	421010136-1	421010149-1	421010449-1	421010449-2	421010649-1	421010649-2
1988	65	83		76	92	91								
1989		96		97	102	96								
1990		72		79	95	87								
1991		85	87	76	97	84								
1992		54		59	101	129				236				
1993		81		59	105	116		103		587	162			
1994		95		83	94	84		143	83	531	186			
1995		64		68		82		90	107	384	233			
1996		87		54		86		129	63	454	247			
1997		76		117		136		78	113	308	325		288	
1998		60		130		82		63	104	73	130		156	
1999		73		57		24		36	45	111	153		56	
2000		43		73					36	165	290		44	
2001		61		62					61	65	61	64	61	
2002		66		128					72	122	68	99	106	
2003		82		86					63		86		77	
2004		62		55					52		58		52	
2005		57		67					48		79		100	
2006		132							37		93		162	161
2007		44									37		61	62
2008		53									43		64	66
2009		49									41		80	78
2010		57									67		218	151
2011		46									59		64	90
2012		67									61			
2013		29					65				36			
2014							63				30			
2015							53							
2016							55							
2017							69							
2018							49							

Table 10 – $PM_{2.5}$ 98th Percentile 24-Hour Concentrations (µg/m³)

	AQS SITE ID - POC																							
Year	421010003-1	421010004-1	421010004-2	421010014-1	421010020-1	421010024-1	421010027-1	421010047-1	421010047-3	421010047-4	421010048-1	421010048-3	421010052-1	421010055-1	421010055-3	421010056-1	421010057-1	421010057-3	421010057-4	421010075-1	421010076-1	421010136-1	421011002-1	421011002-3
1999		39			30	33		33														34		
2000		41			32	38	57	39														39		
2001		40			36	37		40														46		
2002		41		30	40	38		39					51									43		
2003		40		39	39	39		42														36		
2004		34		15	29	33		32														30		
2005	29	36			33	36		39														31		
2006	29	38	36			35		48								0						38		
2007		35	36			34		40		38							33		28			32		
2008		35	33			31		38		33				35			33		33					
2009		26	34			26		37		29				29			28		28					
2010		28	25			25		32		27				29			28							
2011			24					32		28				31			31						25	16
2012			21					24		22				25			23						20	24
2013			35					26	22	34	36	35		35	25		19	33					24	24
2014		20	25					28	26		26	28			31			32		21				
2015		25	27						24		26	26			30			27		27	30			
2016		17	24								19	22			22			22		22	21			
2017		22	21								22	20			20			20		22	20			
2018		19	21								17	20			21			18		23	19			

Table 11 – $PM_{2.5}$ Annual Mean Concentrations ($\mu g/m^3$)

	AQS SITE ID - POC																							
Year	421010003-1	421010004-1	421010004-2	421010014-1	421010020-1	421010024-1	421010027-1	421010047-1	421010047-3	421010047-4	421010048-1	421010048-3	421010052-1	421010055-1	421010055-3	421010056-1	421010057-1	421010057-3	421010057-4	421010075-1	421010076-1	421010136-1	421011002-1	421011002-3
1999		14.6			13.3	13		15.5														14.5		
2000		14.9			14.7	14.7	23.4	17.1														14.8		
2001		16.5			15.4	14.6		17														16.7		
2002		14.8		14.5	14.4	14.3		16.2					13.7									14.4		
2003		14.8		13.3	13.7	13.2		16.1														14		
2004		13.9		10.6	13.9	12.8		14.4														12.7		
2005	14.4	14.2			15.5	12.9		15.1														14.2		
2006	10.5	13.5	13.2			12.4		15.5														13.1		
2007		13.7	14.1			12.9		14.4		14.9							12		17.5			13.3		
2008		13	12.5			12		13.5		13.2				13.5			13.3		12.9					
2009		10.9	11.3			9.9		11.1		11.1				11.3			11.1		13.3					
2010		10.7	11			9.6		10.9		10.9				11.3			10.9							
2011			8.9					11.3		11.4				11.4			11.4						9.9	8.4
2012			9.7					10.2		10.1				10.3			10.1						8.7	11.5
2013			9.2					10	8.9	11	10.4	11		11	11.1		10.2	11.6					9.4	9.7
2014		9	9.8					11.3	11.3		10.3	11.1			12.6			12.1		10.7				
2015		9.7	10.3						11.3		10.3	10.1			11.2			11		10.7	9			
2016		7.3	8								8.9	9.8			10.5			9.4		9.4	8.2			
2017		7.5	8.2								9.1	9			10			10.1		8.5	8.6			
2018		8.1	8								8	8.6			9.8			8		9.7	8.7			

Table 12 – AQS Site ID information

AQS Site ID	Address
421010003	Comm Health Services 500 S Broad Street
421010004	1501 E. Lycoming Ave.
421010014	Roxy Water Pump Sta Eva-Dearnley Sts
421010019	Fire Boat Sta Allegheny Ave & Del River
421010020	Ford Rd-Belmont Ave Water Treat Plant
421010021	Island Rd E Of Airport Circle Phl Int
421010022	Defense Support Center 20th & Oregon Ave
421010023	Se Sewage Plant Front-Packer Strts
421010024	Grant-Ashton Roads Phila Ne Airport
421010026	Broad Spruce Sts Mobile Trailer
421010027	S W Corner Broad And Butler
421010029	20th And Race Streets
421010037	13th Street And Montgomery Avenue
421010038	4415 Almond (Near Orthodox Street)
421010045	1421 Arch Street
421010046	1206 Chestnut Street
421010047	500 South Broad Street-Parking Lot (Chs)
421010048	3000 Lewis St. (Near Bath St.) Philadelphia, Pa. 19137
421010049	Richmond St. And Wheatsheaf Lane
421010051	323 Race Street
421010052	1439 East Passyunk Avenue
421010055	24th & Ritner Streets
421010056	2851 Island Ave, Eastwick Free Library
421010057	240 Spring Garden Street
421010075	4901 Grant Avenue And James Street Philadelphia, Pa. 19114
421010076	4100 Montgomery Drive
421010136	Amtrak, 5917 Elmwood Avenue
421010149	Castor And Carbon Sts On Pgw Property
421010449	Castor And Delaware Avenues
421010649	Water Dept. Newpcp Lagoon Area (Nel)
421011002	5200 Pennypack Park Philadelphia, Pa. 19136

Appendix H: History of the National Ambient Air Quality Standards

Table 13 – History of the National Ambient Air Quality Standards for Carbon Monoxide[3]

Final Rule/Decision	Primary/ Secondary	Indicator	Averaging Time	Level	Form
1971 36 FR 8186 Apr 30, 1971	Primary and Secondary	CO	1-Hour period	35 ppm	Maximum, not to be exceeded more than once in a year[4]
			8-hour period	9 ppm	Maximum, not to be exceeded more than once in a year
1985 50 FR 37484 Sept 13, 1985	Primary standards retained, without revision; secondary standards revoked.				
1994 59 FR 38906 Aug 1, 1994	Primary standards retained, without revision.				
2011 76 FR 54294 Aug 31, 2011	Primary standards retained, without revision.				

[3] https://www.epa.gov/co-pollution/table-historical-carbon-monoxide-co-national-ambient-air-quality-standards-naaqs
[4] Second highest, non-overlapping 8-hour average concentration.

Table 14 – History of the NAAQS for Pb-TSP (Lead in total suspended particles)[5]

Final Rule/Decision	Primary/ Secondary	Indicator	Averaging Time	Level	Form
1978 43 FR 46246 Oct 5, 1978	Primary and Secondary	Pb-TSP	Calendar Quarter	1.5 μg/m^3	Not to be exceeded
1991	Agency released multimedia "Strategy for Reducing Lead Exposures"				
2008 73 FR 66964 Nov 12, 2008	Primary and Secondary	Pb-TSP	3-month period	0.15 μg/m^3	Not to be exceeded
2016 81 FR 71906 Oct 18, 2016	Primary and secondary standards retained, without revision.				

[5] https://www.epa.gov/lead-air-pollution/table-historical-lead-pb-national-ambient-air-quality-standards-naaqs

Table 15 – History of the NAAQS for Nitrogen Dioxide[6]

Final Rule/Decision	Primary/ Secondary	Indicator	Averaging Time	Level	Form
1971 36 FR 8186 Apr 30, 1971	Primary and Secondary	NO_2	Annual	53 ppb[7]	Annual arithmetic average
1985 50 FR 25532 Jun 19, 1985	Primary and secondary NO_2 standards retained, without revision.				
1996 61 FR 52852 Oct 8, 1996	Primary and secondary NO_2 standards retained, without revision.				
2010 75 FR 6474 Feb 9, 2010	Primary	NO_2	1 hour	100 ppb	98th percentile, 1-hour daily maximum, averaged over 3 years[8]
		Primary annual NO_2 standard retained, without revision.			
2012 77 FR 20218 April 3, 2012	Secondary	Existing secondary NO_2 standard (annual) retained, without revision.			

[6] https://www.epa.gov/no2-pollution/table-historical-nitrogen-dioxide-national-ambient-air-quality-standards-naaqs

[7] The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

[8] The form of the 1-hour standard is the 3-year average of the 98th percentile of the yearly distribution of 1-hour daily maximum NO2 concentrations.

Table 16 – History of the NAAQS for Ozone[9]

Final Rule/Decision	Primary/ Secondary	Indicator	Averaging Time	Level	Form
1971 36 FR 8186 Apr 30, 1971	Primary and Secondary	Total photochemical oxidants	1 hour	0.08 ppm	Not to be exceeded more than one hour per year
1979 44 FR 8202 Feb 8, 1979	Primary and Secondary	O_3	1 hour	0.12 ppm	Attainment is defined when the expected number of days per calendar year, with maximum hourly average concentration greater than 0.12 ppm, is equal to or less than 1
1993 58 FR 13008 Mar 9, 1993	EPA decided that revisions to the standards were not warranted at the time				
1997 62 FR 38856 Jul 18, 1997	Primary and Secondary	O_3	8 hours	0.08 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
2008 73 FR 16483 Mar 27, 2008	Primary and Secondary	O_3	8 hours	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
2015 80 FR 65292 Oct 26, 2015	Primary and Secondary	O_3	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8 hour average concentration, averaged over 3 years

[9] https://www.epa.gov/ozone-pollution/table-historical-ozone-national-ambient-air-quality-standards-naaqs

Table 17 – History of the NAAQS for Particulate Matter[10]

Final Rule/Decision	Primary/ Secondary	Indicator[11]	Averaging Time	Level	Form
1971 36 FR 8186 Apr 30, 1971	Primary	TSP	24 hour	260 µg/m³	Not to be exceeded more than once per year
1971 36 FR 8186 Apr 30, 1971	Primary	TSP	Annual	75 µg/m³	Annual geometric mean
1971 36 FR 8186 Apr 30, 1971	Secondary	TSP	24 hour	150 µg/m³	Not to be exceeded more than once per year
1971 36 FR 8186 Apr 30, 1971	Secondary	TSP	Annual	60 µg/m³	Annual geometric mean
1987 52 FR 24634 Jul 1, 1987	Primary and Secondary	PM_{10}	24 hour	150 µg/m³	Not to be exceeded more than once per year on average over a 3-year period
1987 52 FR 24634 Jul 1, 1987	Primary and Secondary	PM_{10}	Annual	50 µg/m³	Annual arithmetic mean, averaged over 3 years
1997 62 FR 38652 Jul 18, 1997	Primary and Secondary	$PM_{2.5}$	24 hour	65 µg/m³	98th percentile, averaged over 3 years
1997 62 FR 38652 Jul 18, 1997	Primary and Secondary	$PM_{2.5}$	Annual	15.0 µg/m³	Annual arithmetic mean, averaged over 3 years [3, 4]
1997 62 FR 38652 Jul 18, 1997	Primary and Secondary	PM_{10}	24 hour	150 µg/m³	Initially promulgated 99th percentile, averaged over 3 years; when 1997 standards for PM10 were vacated, the form of 1987 standards remained in place (not to be exceeded more than once per year

[10] https://www.epa.gov/pm-pollution/table-historical-particulate-matter-pm-national-ambient-air-quality-standards-naaqs
[11] TSP = Total Suspended Particles

					on average over a 3-year period) [5]
1997 62 FR 38652 Jul 18, 1997	Primary and Secondary	PM_{10}	Annual	50 µg/m^3	Annual arithmetic mean, averaged over 3 years
2006 71 FR 61144 Oct 17, 2006	Primary and Secondary	$PM_{2.5}$	24 hour	35 µg/m^3	98th percentile, averaged over 3 years [6]
2006 71 FR 61144 Oct 17, 2006	Primary and Secondary	$PM_{2.5}$	Annual	15.0 µg/m^3	Annual arithmetic mean, averaged over 3 years [2, 7]
2006 71 FR 61144 Oct 17, 2006	Primary and Secondary	PM_{10}	24 hour	150 µg/m^3	Not to be exceeded more than once per year on average over a 3-year period
2012 78 FR 3085 Jan 15, 2013	Primary	$PM_{2.5}$	Annual	12.0 µg/m^3	Annual arithmetic mean, averaged over 3 years [2, 7]
2012 78 FR 3085 Jan 15, 2013	Secondary	$PM_{2.5}$	Annual	15.0 µg/m^3	Annual arithmetic mean, averaged over 3 years [2, 7]
2012 78 FR 3085 Jan 15, 2013	Primary and Secondary	$PM_{2.5}$	24 hour	35 µg/m^3	98th percentile, averaged over 3 years [6]
2012 78 FR 3085 Jan 15, 2013	Primary and Secondary	PM_{10}	24 hour [8]	150 µg/m^3	Not to be exceeded more than once per year on average over a 3-year period